

Number of research papers published per teacher in the Journals notified on UGC care list during the last five years

3.3.1.1. Number of research papers in the Journals notified on UGC CARE list year wise during the last five years

HEI Input:

2021	2020	2019	2018	2017
7	8	2	3	0

3.3.1 Number of research papers published per teacher in the Journals notified on UGC website during the last five years

Title of paper	Name of the author/s	Department of the teacher	Name of journal	Year of publication	ISSN number	Link to the recognition in UGC enlistment of the Journal /Digital Object Identifier (doi) number		
						Link to website of the Journal	Link to article / paper / abstract of the article	Is it listed in UGC Care list/Scopus/Web of Science/other, mention
An Energy-Balanced Routing Algorithm Based On Forward Aware Factor for Machine-To-Machine Communication Networks	Challa.Prasad	Computer Science	Indian Journal of Computer Science and Engineering (IJCE)	2021	e-ISSN-0976-5166 p-ISSN:2231-3850	https://web.archive.org/web/20210715042148id_/http://www.ijcse.com/docs/INDJCSE21-12-01-241.pdf	https://web.archive.org/web/20210715042148id_/http://www.ijcse.com/docs/INDJCSE21-12-01-241.pdf	Scopus- Indexed
Vadali Radha Krishna Rachanallo Kdha Kdhanam - Samagika Spruha	Dr.L.Jyotheeswara Naidu	Telugu	International Journal of Academic Reasearch	2021	ISSN:2348-7666	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://ijar.org.in/stuff/issues/v8-i2(2)/v8-i2(2)-a001.pdf	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://ijar.org.in/stuff/issues/v8-i2(2)/v8-i2(2)-a001.pdf	Peer Reviewed Journal
ILLINDILAVARI MALLIKA SAMAJIKA CHAITANYAM	Dr.L.Jyotheeswara Naidu	Telugu	International Journal of Academic Reasearch	2021	ISSN:2348-7666	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://ijar.org.in/stuff/issues/v8-i3(1)/v8-i3(1)-a001.pdf	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://ijar.org.in/stuff/issues/v8-i3(1)/v8-i3(1)-a001.pdf	Peer Reviewed Journal
Vadali Radha Krishna Kadhalu- Grameena Jeevanam	Dr.L.Jyotheeswara Naidu	Telugu	International Journal of Academic Reasearch	2021	ISSN:2348-7666	http://ijar.org.in/#gsc.tab=0	http://ijar.org.in/#gsc.tab=0	Peer Reviewed Journal
JANAPADHA GEETHALU-SRUNGARA GEETHALU	Dr.L.Jyotheeswara Naidu	Telugu	BAVAVEENA A	2021	ISSN:2456-4702	BHAVAVEENA -బావవీణ (telugujournalbhavaveena.blogspot.com)	BHAVAVEENA -బావవీణ (telugujournalbhavaveena.blogspot.com)	Yes - UGC CARE
Vadali Radhakrishna Antharnethram Kadha Samputi Paathra Chitrana	Dr.L.Jyotheeswara Naidu	Telugu	International Journal of Academic Reasearch	2021	ISSN:2348-7666	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://ijar.org.in/stuff/issues/v8-i8/v8-i8.pdf	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://ijar.org.in/stuff/issues/v8-i8/v8-i8.pdf	Peer Reviewed Journal
Open Access Source and Information Services in the Academic Colleges,	Dr. P.Anuradha	Library & Information Science	Journal of Resource Management	2021	0745-6999	http://www.jrmat.com	http://www.jrmat.com	Peer Reviewed Journal

Issues Challenges and Opportunities			and Technology. Volume 12, Issue 4					
Spectraql change and far-red emission of Mn+2 ions co-dopted NaSrB5Og:Dy3+ luminescence material for plant growth LEDs	Dr. R.Vijaya	Physics	Rare Earths	2020	ISSN:1002-0721 CODEN JREAE 6	https://doi.org/10.1016/j.jre.2020.12.014	https://doi.org/10.1016/j.jre.2020.12.014	Scopus- Indexed
Construction of multi-level data aggregation trees for energy efficiency and delivery delay in machine-to-machine communications	Challa.Prasad	Computer Science	Peer to Peer Network Application	2020	ISSN 1936-6442	https://doi.org/10.1007/s12083-020-01016-y	https://doi.org/10.1007/s12083-020-01016-y	Scopus- Indexed
Leader sub-ordinate comparison of organizational commitment of lower level police personnel in guntur district of andhra pradesh	A. Lavanya	Commerce	SELP Journal of Social Science - A Blind Review & Refereed Quarterly Journal	2020	ISSN: 0975-9999 (P) 2349-1655 (O)	https://iaraindia.com/selp-journal-of-social-science-2-2/	 A.Lavanya paper 2 ,SELP-43-FULL-PAPE	UGC APPROVED JOURNAL
Leader-Subordinate Comparison of Job Satisfaction of lower level Police Personnel in Guntur District of Andhra Pradesh	A. Lavanya	Commerce	Studies in Indian Place Names	2020	ISSN: 2394-3114	https://www.tpnsindia.org/index.php/sipn/search/search	https://www.tpnsindia.org/index.php/sipn/article/view/3718	UGC-CARE
Tourism in India - Impact and Intiatives	P.Revathi Reddy	History	International Journal of Multi disciplinary Educational	2020	ISSN:2277-7881	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://s3-ap-southeast-1.amazonaws.com/ijmer/pdf/volume9/volume9-issue11(6)-2020.pdf	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://s3-ap-southeast-1.amazonaws.com/ijmer/pdf/volume9/volume9-issue11(6)-2020.pdf	Peer Reviewed Journal

			Reasearch					
Dynamics of GIG-Economy with Special Reference to Digital Platforms in India	Dr.M.Sriram ulu	Commerce	International Journal of Reaserach in Commerce, Economics & Management	2020	ISSN: 2231-4245	https://ijrcm.org.in/article_info.php?article_id=9439	https://ijrcm.org.in/article_info.php?article_id=9439	Peer Reviewed Journal
An Analysis of Trends in Venture Capital Funds in India and the Impact of COVID-19	Dr.M.Sriram ulu	Commerce	International Journal of Reaserach in Computer Application & Management	2020	ISSN:2231-1009	https://ijrcm.org.in/article_info.php?article_id=9376	https://ijrcm.org.in/article_info.php?article_id=9376	Peer Reviewed Journal
A Study on efficiency of working capital management with special reference to Micro and small Enterprises a Chittor District of Andhra Pradesh	Dr.M.Sriram ulu	Commerce	Journal of Inter Disciplinary Cycle Reasearch	2020	ISSN:0022-1945	DOI:18.0002.JICR.2020.V12I8.008301.317122000	DOI:18.0002.JICR.2020.V12I8.008301.317122000	An UGC-CARE Approved Group – II Journal
A Brief Review on Thin Film Deposition and Characterization Techniques	N. Nagaraju	Physics	International Journal of Pharmaceutic al Research	2019	ISSN 0975-2366	DOI:https://doi.org/10.31838/ijpr/2019.11.01.307	DOI:https://doi.org/10.31838/ijpr/2019.11.01.307	Scopus - Indexed
Tunable emission and energytransfer mechanism of singlephase Na3Y (PO4)2:Ce3 , Mn2phosphors for white LEDs	Dr R Vijaya	Physics	Journal of Luminescence	2019	ISSN : 0022-2313	https://doi.org/10.1016/j.jlumin.2019.116651	https://doi.org/10.1016/j.jlumin.2019.116651	Scopus - Indexed

Socio Economic Condition of Beedi Industry in Chittoor District	Dr. U. Narasimhulu	Commerce	International Journal of Academic Research	2018	ISSN:2348-7666	IJAR Volume 5 Issue 3 March, 2018	IJAR Volume 5 Issue 3 March, 2018	Peer Reviewed Journal
Effect of concentration on spectral properties of lanthanide ions doped fluorophosphate Glasses,	Dr R Vijaya	Physics	Materials Today: Proceedings	2018	2214-7853	https://doi.org/10.1016/j.matpr.2018.04.042	https://doi.org/10.1016/j.matpr.2018.04.042	Scopus - Indexed
Problems of Beedi Industry in Chittoor District	Dr. U. Narasimhulu	Commerce	International Journal of Academic Research	2018	ISSN:2348-7666	v5-i2-a021.pdf (ijar.org.in)	v5-i2-a021.pdf (ijar.org.in)	Peer Reviewed Journal

An Energy-Balanced Routing Algorithm Based On Forward Aware Factor for Machine-To-Machine Communication Networks

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Abstract - Machine-to-Machine Communication (M2M), sometimes also entitled as Machine-to-Machine Communication Area Networks which has been a dynamic research area above the past few years and it is an essential ingredient of Engineering and Industrial Applications (EIA). The sensor nodes in the network are limited in energy, therefore, communication ability also restricted. So, in this case, this appears particularly significant for the development and designs direction finding the protocol for the broadcasting of the sensing data successfully. For the conservation of energy, a novel approach is preferred that is an Energy-Balanced Routing Algorithm based on the Forward-Aware Factor (FAF-EBRA). The new concept is introduced in FAF-EBRA is hop is a segment of the path between starting place and target. The hop count refers to the number of intermediate devices through which data must pass between source and destination. In the method of FAF, the next-hop node chosen as per the perception of communication link weight and the forward energy density and additionally local topology reconstruction mechanism is designed for load-balance among the nodes. The FAF-EBRA is evaluated with LEACH & EEUC and the results obtained through the experiments that FAF-EBRA better performance in terms of the consumption of the energy, which prolongs the network lifetime and gives assurance to maintain high Quality of Service of M2M Communication area networks.

Keywords: Energy Balanced, Forward-Aware Factor, Engineering and Industrial Application, Machine-to-Machine Communications.

1. Introduction

The Machine-to-Machine communication is an autonomous network system of wireless and it is organized with a vast number of micro sensors with limited energy in the stream of a lot of Engineering and industrial applications (EIA). Now, M2M is extensive acts as a useful communication technology to put together both the home applications and communication in the field applications of engineering and as well as industry. A power supply is a limited one in the sensor networks. Consequently, the design of the shape of a local-area network or other communications system, a direction-finding algorithm is vital and a key to work to study an extensive level M2M communication system. In M2M controlling of topology and routing design, it needs to balance the utilizing of energy, connectivity, and multiple mechanisms are applied. The majority of the networks of EIA are independent of time role, and scope, converge to a similar architecture and so pollsters tried to make a unified replica for complex networks in the last decades. It is outstanding that remote feeler systems are a self- alliance framework with a remote system composed of the sum of strength constrained the miniaturized degree of feelers under the flag of Engineering and Industrial Application (EIA) [1], [2].

At present days, M2M network is a successful medium that is largely utilized to coordinate the data universe of EIA [3]–[6]. Each sensor center consisting of a sensor and a switch, and its capacity to register, accumulation of stockpile is in the limit, correspondence capability, and the supply of the power is restricted. In this way, it delineates of the topology of the system, steering calculation, and convention is the most vital and key work to examine the extensive scale M2M correspondence framework [7]–[12].

As of late, it is outstanding that remote feeler systems are a self- alliance framework with a remote system composed by the sum of strength constrained miniaturized degree of feelers under the flag of Engineering and Industrial Application (EIA) [13] [14]. A huge segment of the actual systems of EIA is autonomous of their age, capability, and also, it unites to designs [15], [16], therefore analysts attempted to construct a brought together an innovative replica in the complicated systems.

In [17], Erdős, as well as Rényi, suggest ER arbitrary diagram show given great chart hypothesis and measurable material science.

In [18], the global property of the complex structure of the system is set up by Watts and Strogatz. In [18], the worldwide things of the multifaceted system are set up by Watts and Strogatz, set up WS world organization. In [19], Barabási and Albert build the BA show, uncovers the without a level of scale. In [20], the BBV model is manufactured by Barrat, et al., this model explains the quality of associations and modifications of accumulation of quality into the novel thought. In the present scenario, the model of BBV is mainly utilized to investigate the genuinely complicated systems, for example, a joint effort of the researcher put in order (SCN) and overall airplane fatal point of the system (WWAN) [21]– [23]. Like SCN and WWAN are dissimilar nodes and its structures of their group (bunches) in M2M communication, critical nodes (group heads) have a huge number of organizations than normal nodes.

Many nodes look into "energy opening" which explains that the stream of information on every association fluctuates broadly in WSN in light of these assorted separations to the sink node.

Therefore, it is not a proper reasonable one to speak to an association as associated ("1") or connectionless ("0"). Besides, global data controlled in M2M of EIA sensors deal data their "neighborhood world". By and large, the weighted system and neighborhood hypothesis are fitting to show M2M of EIA. When compared to the LEACH and EEUC the proposed system FAF-EBRA gives the best results to increase the lifetime of the M2M communication network.

2. Related Work

2.1 Low Energy Adaptive Cluster Head (LEACH) Procedure

LEACH procedure is a well-known WSN tree based routing algorithm in which nodes are having the capability for reorganization of local topology. In the LEACH routing protocol, the nodes sort out themselves into local cluster, the routing process divided into set up stage and steady state stage, in the setup stage the clusters are formed and in steady state stage data is transferred from the nodes to the sink node under [1]–[3]. In the set up stage, every node pick a random number in the between 0 and 1, if this number is not up to the threshold value $T(n)$, the node will broad cast as the cluster leader the non-cluster leader chooses the cluster leader with higher signal strength and joins the group, and the cluster leader node receives the data from all the nodes and sends the data to the remote sink node [4]– [7]. The threshold value is denoted with $T(n)$ is given as

$$T(n) = \begin{cases} \left\{ \frac{p}{\left(1 - p * r \bmod \left(\frac{1}{p}\right)\right)} \right\}, & n \in G \\ 0, & \text{else} \end{cases} \quad (1)$$

Where p is the rate of the cluster leader account for entire sensor node, present figure of the round, and r represents the current number of communication round G denotes the set of nodes that have not part of the cluster group.

In the steady stage state, data is sending from the sensor nodes to the cluster leader and on to the sink node. The new cluster leader is elected for each communication round by this way the load is balanced among the sensor nodes present in the M2M communication area network.

2.2 Energy-Efficient Uneven Clustering (EEUC) Procedure

EEUC is an cluster routing procedure in which tentative cluster leaders use uneven competition ranges R_c to construct clusters of the sizes of uneven [8]–[11].

$$R_c = \left(1 - c \frac{d_{max} - d(i, Sink)}{d_{max} - d_{min}}\right) R_c^0 \quad (2)$$

Where d_{max} and d_{min} are the furthest distance and the nearest distance between sensor nodes the to the sink node, $d(i, Sink)$ is the distance between and node i and the sink, and R_c^0 is the maximum of the competition ranges (which is a fixed value, but R_c is a variable value), the value of c is between 0 and 1 which depend on the competition ranges, in other works it indicates that the node have smaller value closure to the sink node and larger value far to the sink node. Therefore the cluster leader selected based the closure to the sink node.

3. BBV Weighted-Network Model and Local-World Theory

Based on our work relating to research, developing the topology of BBV replica could be separated into the stages of four [20].

1. Initialization: In the early of the network consists of nodes and a smaller number of edges($w = w_0$). Here, w_0 is the original weight, and changeable limitation weight w is w_0 .
2. Topology Growth: At each case in point step, a join through the edges at the access network.
3. Preferential count: Nodes are giving an advantage to close-by edges in step 2) with probability $p_{n \rightarrow i}$ as follows

$$p_{n \rightarrow i} = \frac{S_i}{\sum_j S_j} \quad (3)$$

Wherever $n \rightarrow i$ denotes node n to node i , the strength of the apex S_j define as the summary of edge masses related to it: $s_i = \sum_{j \in n(i)} w_{ij}$, w_{ij} Is the heaviness between node and Node j , $n(i)$ is a set of neighbored nodules (directly connect to node). The node strength S_j is similar.

4. Update effectiveness as well as masses (as obtainable in Fig.1). The totaling of the edge(n, i) not vary the strong idea of the node, besides, it also alters the weights between and its neighbors

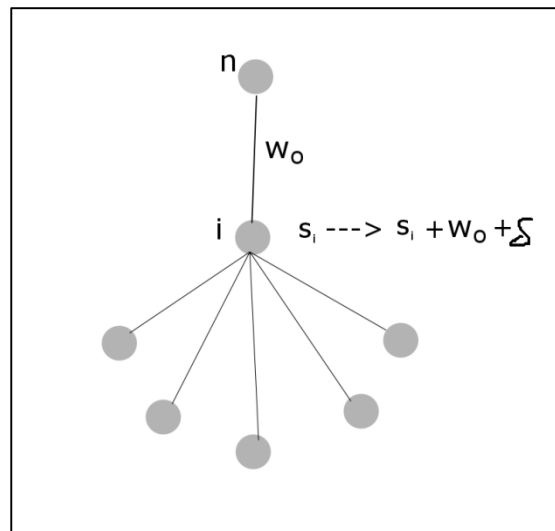


Fig.1. Change the node strength

$$W_{ij} \rightarrow W_{ij} + \Delta W_{ij} \quad (4)$$

$$\text{where } \Delta W_{ij} = \delta \frac{W_{ij}}{S_j} \quad (5)$$

Here, δ is an increment of either positive or negative. Subsequent updated repeating the steps 2)–4), until the developing is completed. As an assumption, let $\ln w_0 = 1$, when $t \rightarrow \infty$, the distribution of edge weight is

Distribution of node degree

$$P(w) \sim w^{-\alpha} \quad (6)$$

$$P(k) \sim k^{-\gamma} \quad (7)$$

$$P(s) \sim s^{-\gamma} \quad (8)$$

At this point δ is an increment of either an optimistic or bad. The developing model of the system is scheduled by Li and Chen [10]. These instructions show that whereas in the definite system, a nodule could hardly attach to the singular collection of the nodules rather than whichever nodule in the whole system. M nodes are designated as arbitrarily among the current bulges as the limited biosphere of the original nodule and the preferred connection prospects are clear as

Here, $M(M \leq N_0)$ nodes among the existing arrange as the neighborhood universe of new device node collected with original edges and is a historical factor. In the BBV demonstration, current centers from the entire arrangement are elected to limit with the new center, which is not feasible in a Wireless Sensor Actuator Networks (WSAN) of EIA because of the restricted communication transmission range and energy of sensors.

$$P_{local}(n \rightarrow i) = p^1(1\epsilon local - world) \frac{k_i}{\sum_j k_j} \quad (9)$$

$$where \quad p^1(1\epsilon local - world) = \frac{M}{(N_0+t)} \quad (10)$$

Thus the local world theory is required, that is to state, n can only connect with the sensors within a particular range. In SCN, the similar approach is used among scientists to cooperate with other persons who effort in a similar state or intercity. Also in the WWAN, the flight distance is often shorter than the greatest rage of a plane, which can be observed as the examples of the local world topology. [10–13].

4. Forward-Aware Factor Energy Balanced Routing Algorithm(FAF -EBRA)

In the proposed FAF-EBRA we study the details analysis of the data capturing in M2M communication area network and quantify the forward transmission area and forward energy density which are factors for the edge weights. In this way the load among the nodes adjusted and thus improves the network lifetime of the communication network.

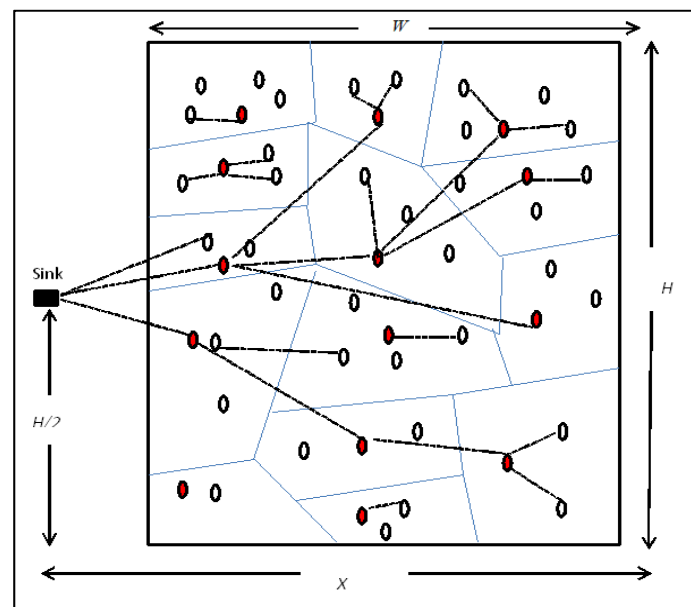


Fig.2. Allocation plan of sink and sensor node

4.1 Network Model

As seemed in Fig. 2, assume device nodes are randomly distributed in a $W \times H$ rectangular sensing field. The communication network is divided into several clusters and all the nodes present in the cluster should transfer the data packets to the cluster leader node. The cluster leader is the native dominant node and consequently sends the data packets to the sink node. The descriptions and definitions are as follows.

- 1) All the sensor nodes are isomorphic, and they have constrained abilities to compute and communicate and store the captured data. The sensors are defined as $V = \{V_1, V_2, \dots, V_n\}$ where n is the total number of sensors. The nodes are identified by their index number $i \in \{1, 2, \dots, n\}$, here i indicates the identifier of the node.
- 2) The initial energy of the sensor nodes is same for all nodes and it is denoted by E_0 , and the nodes stop communicating if the energy is exhausted completely. The sink node is having continuous power supply. We assumed that all the nodes in the network are stationary.
- 3) Nodes can have the ability to adjust the transmission range. The sink node can broadcast the messages to all the sensor nodes in the communication are network. The receiver signal strength indicates the distance between signal source and the destination. The cluster leader nodes nodes are not chosen at the beginning of the commutation, despite they spring up during the topology evolution.

The energy model of the network is free space model [8]. The energy consumed for transmitting a l -bit data packet over the distance d is given as

$$E_{Tx}(l, d) = E_{Tx-elec}(l) + E_{Tx-amp}(l, d) = \begin{cases} lE_{elec} + l\epsilon_{fs} d^2, & d < d_0 \\ lE_{elec} + l\epsilon_{mp}d^4, & d > d_0 \end{cases} \quad (10)$$

Where
$$d_0 = \sqrt{\frac{\epsilon_{fs}^2}{\epsilon_{mp}}} \quad (111)$$

Where ϵ_{fs} , ϵ_{mp} represent the energy coefficients. The energy consumption of sensor nodes while receiving the data packets is

$$E_{Rx}(l) = E_{Rx-elec}(l) = lE_{elec} \quad (122)$$

Where E_{elec} value is energy consumed for receiving the 1-bit data. When the distance to transmit the data is more than the threshold value d_0 , the energy consumption increases sharply, therefore the maximum communication range of the sensor nodes is set to d_0 .

As shown in the Fig.2, the distance of the Sink is $d(i, sink)$, is given as

$$d(i, Sink) \in (X, \sqrt{((H/2)^2 + (X + W)^2)}) \quad (13)$$

In the same Fig.2., the range of communication can be measured to shape a topology so with jagged bunches, when the collection head, the range of the bunch is $R_{opt}(i)$:

$$R_{opt}(i) = f_1(d(i, Sink)) \quad (14)$$

where $f_1(d(i, Sink))$ is a function for $d(i, Sink)$

$$f_1(d(i, Sink)) \in (0, d_0) \quad (15)$$

Definition 3: At a time t , The edge weight between i and j sensor nodes is given by

$$w_{ij}(t) = \frac{\zeta(E_i(t)E_j(t))^\psi}{(d(i, j)^2)^\eta (T_{ij}(t))^\xi} \quad (16)$$

Where ζ, ψ, η and ξ are non-negative coefficients, $E_i(t)$ and $E_j(t)$ are the residual energies of node i and j at the time t , $d(i, j)$ is the distance between two nodes, and $T_{ij}(t)$ is the data movement of the control link of the communication. Set the distance from i to Sink farther than j and then

$$T_{ij}(t) \sim f_2(d(i, Sink), t) = \frac{t}{(d(i, Sink))^2} \quad (17)$$

Where $f_2(d(i, sink), t)$ is a function of lessening of $d(i, sink)$ and with a cumulative function of time t . The sum of data is minor when the edge-finish node is outside away from the nodule of the sink.

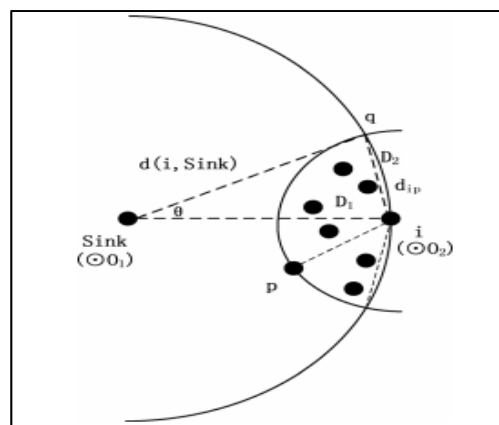


Fig.3. Forward Transmission Area of node i

As the time goes on the number of communication rounds increases by this the quantity of data present in the network grows simultaneously. In this explanation, the weight of the edge w_{ij} represents the capacity of the communication which is present in the eq. (18), when, $d(i, j)$ is long, the data transmission tends to selects a link of short-distance. Similarly, when $T_{ij}(t)$ is larger, the communication link is busy shows busy, the data transmission chooses the low-load link. Here the energy plays a key role in edge weight, when the residual energy of nodes i and j is adequate, (the edge from i to j) is stronger for the transfer of data packets.

The nodes forward energy density is denoted as $FED(i, t)$ and defined as the

$$FED(i, t) = \frac{\sum_{j \in FTA(i)} E_j(t)}{S_{FTA(i)}} \quad (18)$$

Where $E_j(t)$ is the energy value of node j at time t and $\sum_{j \in FTA(i)} E_j(t)$ denotes the all of the neighbors energy combined in $FTA(i)$.

The Forward Aware Factor for the communication is defined as the link between the nodes i and j given as

$$FAF(ij) = \alpha \frac{FED(j)}{\sum_{j \in FTA(i)} FED(j)} + \beta \frac{w_{ij}}{\sum_{j \in FTA(i)} w_{ij}} \quad (19)$$

Where $\sum_{j \in FTA(i)} FED(j)$ is all the neighbors FAF combined in $FTA(i)$. The weight of edge (w_{ij}) is defined in (16), $\sum_{j \in FTA(i)} w_{ij}$ is all of the edge weights combined that i has in FTA . α and β are the positive harmonic constants and

$$\alpha + \beta = 1 \quad (20)$$

4.2 Design of the FAF-EBRA

FAF-EBRA is used for the large-scale M2M Communication networks where the nodes are stationary and captures the data from all the sensors to the sink node. In (18), he first term denotes the FED of the possible next-hop neighbors into consideration, which means the means the ability to transmit the data packets. The second term considers the weight of the transmit link, which can be used to select the next hop directly. The edge weight includes key parameters such as the energy, distance and load of sensor nodes which are listed in the Table-1.

Table-1: Routing Parameter of nodes

Field Name	Significance
Neighbor_id	Unique identifier of each neighbor
Energy_id	Energy identifier of each neighbor
FED_id	FED identifier of each neighbor
Distance_id	Distance identifier of each neighbor

The FAF-EBRA is designed in seven stages as follows

1. Define $FTA(i)$ all of the probable next-hop nodes of node i . First, take d_0 as transmitting radius, find the set of all of the nodes that have neighbors of node i , and denoted by the $N^1(i)$. Choose the nodes that are closure to the sink node than node i which constitutes all the set of possible nest hop nodes and the furthest node determined by $FTA(i)$.
2. Define $FTA(j)$ and $SFTA(j)$ of each possible next-hop node. Determine the $FTA(j)$ as we defined in $FTA(i)$. Plug and the furthest distance between j and sink in FTA and the distance between j and Sink and get $SFTA(j)$.
3. Calculate $FED(j)$ of each possible next-hop node. Plug the nodes' energy into (19) and get $FED(j)$.
4. Calculate the weight of edges between i and every node as indicated by (16).
5. Substitute the values of 3) and 4) into (16) and compute FAF of every possible transmit link. Select the next-hop node according to

$$j = \max_j [FAF(ij)] \quad (21)$$

6. If there is no node closure to the sink I in $N^1(i)$, directly compare FAF of all of the nodes in $N^1(i)$, and choose the nest-hop node according to (20). If there is no node in $N^1(i)$, I will be increases the transmitting power of the node to get the longer radius than d_0 until connected with another node or I will be abandon the data packet.

7. If Sink is among the forward transmitting nodes, i will be transmitting the data directly to Sink. And accomplish the procedure.

In FAF-EBRA, the routing list structure of nodes is showing as the in Table-1. The information of the table can guarantee all the parameters FAF-EBRA needed. The communication launch node can calculate the weight of edge between neighbors. Neighbors can get their own FED. It avoids the communication launch node doing all of the algorithms. Thus, each node's memory should storage its own ID, real time energy, distance to the Sink, and FED at any moment, which could be feedback to launch node quickly.

4.3 Local Topology Reorganization

In the actual routing process the nodes with greater signal strength will have the more communication link and results in faster energy utilization. The whole communication system cannot work under the same topology routing structure. A topology reorganization mechanism of the cluster leader rotation of LEACH algorithm is required.

The whole M2M area network information is limited, and global topology change may influence the information perception, the global change caused by energy unbalanced area is waste of energy to energy balanced area, so the only local topology reorganization mechanism is needed. This paper proposed an additional procedure for the local topology reorganization.

The different steps in the local topology modifications given below,

1. In FAF-EBRA, every time node i completes its data transmission, checks the point strength of the next-hop node j . If it is less than the average value of all the nodes strengths in FTA then the local topology reorganization mechanism is launched in node i ' FTA.
2. Before going to the reconfiguration of the local topology, remove the link between i and j , remove j , from FTA(i), and get a new set $FTA^1(i)$ then reconnect in $FTA^1(i)$. and the function of reconnect possibility is given as

$$p_{i \rightarrow j} = \frac{S_j}{\sum_{j \in FTA^1(i)} S_j} \quad (22)$$

3. The nodule detached in 2) can be possible next-hop node when the next transmission is finished, and the revocation of the edge does not affect the possible reorganization. The nodes real-time strength is needed to calculate the sum of strength.

5. Results

The real M2M Communication networks are mostly complex systems that contain lots of nodes and connections. If a complex network is weighted, the weight not only represents existence of the link between nodes, but also describes the property and intensity of the connection. In Scientific Collaboration Networks (SCN), weights represent the frequency of cooperation between scientists, and in WWAN, weights represent the number of available seats in flights between two airports. Based on our research work, an energy-balanced routing algorithm FAF-EBRM based on forward aware factor is tested. In FAF-EBRA, the next-hop node is selected according to the awareness of link-weight and forward energy density, furthermore, a spontaneous reconstruction mechanism for local topology is designed additionally

In SCN, masses represent to the reappearance of teamwork amongst investigators, and in WWAN, masses represent the number of nearby seats in airlifts between binary air terminals. In light of our job assessment, energy is adjusted according to the directing the relevant technique FAF-PBRM in light of forwarding aware element is endeavor. In FAF-EBRA, the subsequent jump node is selected as per the awareness of the weight of the link and the density of forwarding energy; also, a spontaneous renovation of the native topology device is intended. Before testing many imitations [4], [5], [22], the two purposes in (17) and (19) will be quantized $R_c(i)$. Is intended as:

$$R_c(i) - f_1(d(i, Sink)) = \left(1 - c \frac{d(i, Sink) - X}{\sqrt{((H/2)^2 + (X + W)^2) - X}} \right) d_0 \quad (23)$$

Where $c = 0.5$, $d_0 = 87m$, $X = 50m$, $W = H = 200m$ which is verified arbitrarily from folder use as fresh information. Edge weight is stated as in (18)

$$w_{ij}(t) = \frac{\zeta(E_i(t)E_j(t))^\psi}{(d(i, j)^2)^\eta (T_{ij}(t))^\xi} \quad (24)$$

Assumed and is become from topology construction utilizing truthful apparatus. How would we select centers from amongst the nodes? It is as indicated by arbitrary choice has given the possibility of the hypothesis. A related guideline is also identified from that. The transference of node degree, quality and weight of the edge comes into sight in

Furthermore, the information in the hypothetical from the investigation by the mathematical vision of the concern hypothesis is dissimilarity and the information test commencing practice situations in the figures and after taking one of the practices in the situations.

M2M Communication networks could be deliberated as gauge free biased schemes which reproduce their current information and active character beneath the excellent of Broadband Internet of Cars (BIOC). Now the arrangement of BIOV and WSANs are broadly utilized as a division through online well-being read-through and safety measurements and alarming movement of the vehicles, delightful run of the carrying, and point improvement in the crossing point. By making use of the sensors of the vehicles with vast implementation, for instance, heat devices and ultraviolet devices are breaking down the pounding took from the radar and additionally its recurrence changes to maintain a strategic distance from impact mischance's and give security cautioning.

The specialized types of gear utilized by us are Crossbow, MicaZ, Iris, and the examination schemes use via us are NS-3, OMNeT++, and ATEMU. These specialized types of gear and the test systems specified above are regularly utilized by our examination gathering. As appeared in Fig. 6, trial dissemination of IA is steady with hypothetical appropriations, take after control rule and prove a "tail", which are the important qualities of sans gauge schemes. As seemed in Fig. 6, the likelihood of $p(k)=1$.

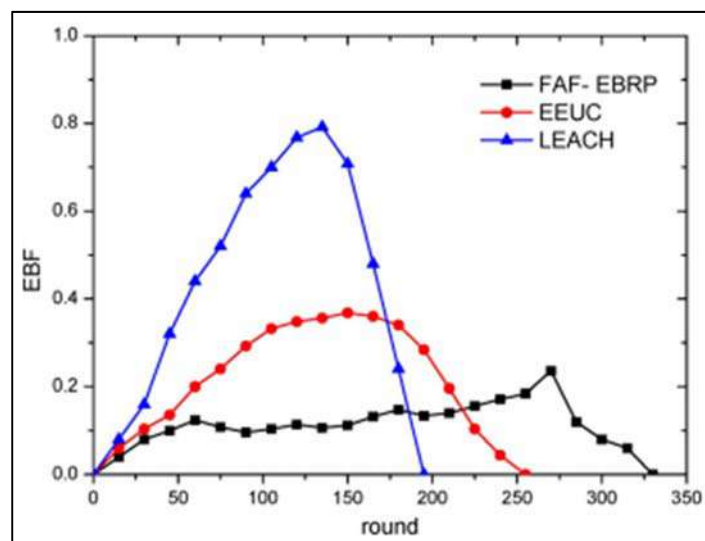


Fig.4. Comparison of EBF

Is 0.5, represents that about part of the sensors has one interface for correspondence, which moves forward the information to the subsequent bounce node of EIA. The chance that a scheme has a wide amount of nationals (grade is bigger than 100) is small, watching that dominant centers are in the underground bounded by all devices, then the number of correspondence connections associated with one focal node is restricted.

Truth is told, similarly, as we specified over, the quantity of neighbors relies on upon taking after parameters: number of nodes, arrangement region, methodology, and radio connection run. For instance, if we convey routinely 400 devices on 200 m four-sided part and result in the radio connecting up to 39 m, the number of neighbors will be equal to 8. The association of theoretical review is alike as Fig. 6, consequently it is ignored. Each arrangement of exploratory information has their errors, and the grade of their mistake is howl 5% in light of our many dimension work as well as examination.

We think about LEACH, EEUC, and FAF-EBRA by three parameters: energy adjusted element (EBF), number of last-surviving nodes (NLN) and network lifetime, packet reception relation (PRR). To count the adjust of energy utilization of direction-finding conventions, EBF remains characterized as the standard deviation of the considerable number of nodes' remaining energy

$$EBF = \sqrt{\frac{1}{N} \sum_{i=1}^N [E_i(t) - E_{avg}(t)]^2} \quad (25)$$

Where N is an integer of nodes of the whole network, $E_i(t)$ is the node i residual energy at time t and $E_{avg}(t)$ is the average value of remaining energy of all the nodes. FL is uncomplicatedly recognized with NLN; the FL description and requirement of is varied under different circumstances, as a few need not required passing node.

In our examination point of view, it required considering FL of two states, one is time from the system starts to the principal passing of the nodes, and the other is time from the system start to a large portion of the nodes dead. PRR implies the proportion of the information that sinks gotten to the information that the sink should be gotten. PRR can quantify M2M network circumstance naturally.

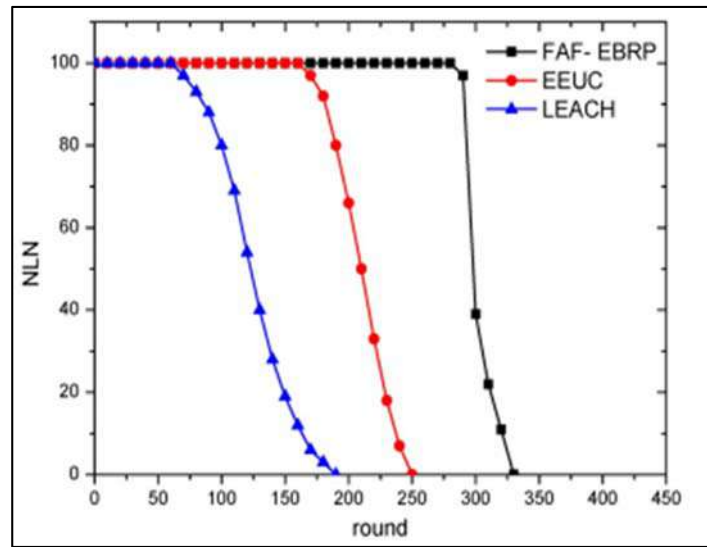


Fig.5. Contrast of NLN

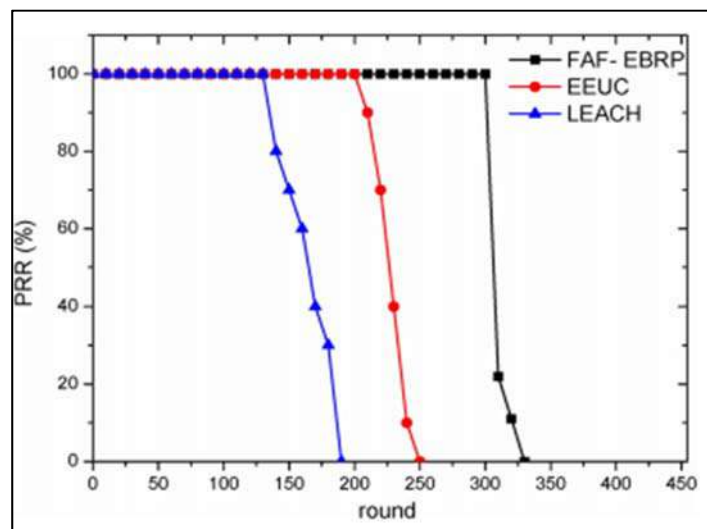


Fig.6. Comparison of PRR

In this particular article of the research paper, we set to make easy information is uneven, and the normal parcels developing rate is given to test the implementation of every conference. To think about three conventions helpfully and naturally, FAF-EBRA likewise utilizes the time round level.

Fig. 4, Fig.5 and Fig.6 make obvious that the EBF, NLN and PRR of three conventions in the test of 350 rounds respectively. In Fig.4, the EBF of FAF-EBRA increases very marginally at the initial instant and keep ups a constant condition before encircling 250, then amplify a little time and move toward reverse to 0 as the energy of the entire system is utilizing up.

In Figure 3, the prime passing of FAF-EBRA center go roundup in anticipation of Round 300, and the technique of the nodes' termination of either quick or late. In Fig. 6 the PRR of FAF-EBRA keeps 100% proportion for 300 rounds and the decrease arrange representing a little extent. From the outcomes of the above, we can observe that FAF-EBRA execution rate is higher than LEACH and EEUC, which adjusts the energy utilization, drags out the capacity of life span and make certain high level of QoS, (for example, Energy-Balanced, Long-Surviving, Packets Reception Radio of M2M communication networks.

6. Conclusion

In this paper we proposed energy balanced routing algorithm FAF-EBRA, in this protocol the next-hop node is chosen according to the link weight and forward energy density. Furthermore we designed a local topology reconstruction mechanism. In the Simulation, FAF-EBRA is having better performance in terms of energy consumption and network lifetime against LEACH and EEUC, and test come about demonstrate that FAF-EBRA outflanks LEACH and EEUC, which adjusts the energy utilization, delays the capacity lifetime, and ensures high QoS of M2M communication area network. In addition, they demonstrate that the disseminations of node degree, quality, and edge weight take after power law and speak to "tail," so the topology has strength and adaptation to internal failure, lessens the likelihood collapse and the synchronization is upgraded of use of EIA failure, and promotions the synchronization of M2M communication of industrial applications.

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Open Access Source and Information Services in the Academic Colleges, Issues Challenges and Opportunities

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ABSTRACT

"Open access" is a new vocabulary, to solve the contradiction between the price rise of academic journals and the relatively tight of school library funding, a internet freedom communication campaign arose in international academic community, information media and the publishing industry. As a new mode of academic information exchange, the "open access" has drawn wide attention.

The idea of open access to scientific information resources promotes use of mostly free of charge scientific information resources thus substituting use of fee based access to scientific information resources. It has good opportunity as well challenging also in academic libraries.

The study provides the review about open access resources, information, opportunities and challenges.

1. INTRODUCTION

The professionals of a discipline should have continuing education throughout their life for learning and survival. Though there are many formal methods for learning and acquiring knowledge, many informal channels, invisible colleges, corridor meets, video and web conferencing tools have come handy for the researchers to know, discuss, share, debate and get solutions for their professional problems, technological issues and administrative encounters. Conferences and Seminars are the best platforms for the professionals to learn new things, to correct the wrongly conceived ideas, to know new practices and to get chances for sharing one's ideas. Of late, Conferences and Seminars in the field of Library and Information Science (LIS) are brought to forefront to let the LIS Community to reveal, share, collaborate and improve their knowledge and Skills.

The ongoing technological and information revolution will solve the problems and supports well

to improve the skills in LIS community, and it provides challenges too. Two such fronts are educational process and research at higher education institutions. It is generally expected that higher education institutions benefit from the implementation of information and communication technology (ICT) in all their activities, especially in teaching and research and that ICT will help us all build a new information society. To achieve this goal, higher education institutions and academic community in general need support in form of quality information resources accessible without limitations i.e. open access information resources. The concept of open access to scientific information resources is related to modern science and its public, collective character as well as its commitment to cooperative inquiry and free sharing of knowledge [1]. Since part of the modern science is publicly funded, the results of the publicly funded research should also be freely available. As universities around the world are currently facing financial problems, they are changing their orientation from use of fee (subscription) based information resources towards open access information resources to provide the desired levels of availability and access of information resources to its users [2] thus helping the idea of open access to scientific information resources to become widely accepted. Without open access, new research would become more difficult to begin.

2. LITERATURE SURVEY

The term Open Access (OA) alludes to the free and unhindered admittance to insightful material accessible on the web, which can be downloaded, perused, replicated, or utilized by the specialists and researchers. This can likewise be characterized as data assets accessible in an open access area which gives the freedoms to clients to get to the ideal material from anyplace, whenever with practically no charges. Budapest Open Access Initiative recognized

two methodologies for open access; self-filing where writers will put their refereed articles in an open, unreservedly available web-based chronicle, and open access diaries where writers distribute their articles in open-access diaries that don't charge membership/access expenses from perusers nor apply copyright limitations (Schmidt, Sennyey, & Carstens, 2005)¹. The two classes, self-documenting, and open access are likewise characterized as Gold and Green in an investigation of Lewis (2012)². Willinsky (2003)³ recognized nine kinds of open access, that incorporates: 1) e-print archive, 2) unqualified (immediate and fully open access publication of a journal), 3) dual-mode, 4) delayed open access, 5) author fee, 6) partial open access, 7) per-capita, 8) abstract, and 9) cooperative-approach (institutional members support open access journals). Open Access includes a few highlights that help the OA development. As indicated by Velmurugan (2010)⁴, coming up next are the striking highlights of OA assets; Scholarly and logical writing openly accessible on the web. Anybody can utilize it with practically no segregation of geographical limits.

- It provides the facility of full-text availability. It can be accessed anywhere and anytime.
- It is free from licensing restrictions.
- It gives a range of formats such as scholarly articles and their preprints, texts, images, sound, videos and dataset to software.
- In many cases it is freely available for users but there is a fee for authors or producers.

Authors invest with the expectation of return in a high research profile rather than payments. Literature has highlighted the use of open access resources by researchers in different contexts. Nagaraj and Bhandi, (2016)⁵ studied the use, awareness, and utilization of open access resources by the researchers from Physics. Vlachaki and Urquhart (2010)⁶ highlighted a low awareness with open access resources among the researchers from biomedicine in Greece. Singh (2016)⁷ studied the use of electronic resources by the Postgraduate students of Doaba College Jalandhar as they use e-resources for their study, research, and consultancy. Nicholas, Jamali, Huntington, and Rowlands (2005)⁸ revealed that out of 3,787

respondents one-third (34%) knew nothing about open access. Kaba and Said (2015)⁹ reported that faculty members of Al Ain University of Science and Technology, United Arab Emirates have positive perception of OA. Fullard (2007)¹⁰ reported little interest in publishing by South African faculty members in OA journals. Academic libraries are at the forefront of the open-access revolution and considered to be greatly benefited from open access resources. Bailey (2006)¹¹ mentioned that open access has significant implications for libraries, especially academic libraries. Okamoto (2013)¹² highlighted libraries as key advocates for Open Access Textbooks (OATs) and Open Access Educational Resources (OERs). Jain (2012)¹³ summarizes a list of benefits for researchers, readers, libraries, society, journals, publishers, funding agencies, universities, and even governments. Giarlo (2005)¹⁴ highlighted that due to the less involvement of parent institutes towards libraries, yearly budget cuts and high cost of books and journals affect the library's performance. To cater to the user in such situations, the availability of open-source highly affects the efficiency of libraries and helps them to support the institutional research activities by providing information at the right time in the right format with low cost and minimum time.

3. COMPLETE STUDY

1. Necessity of open access services in academic Colleges:

Over the years, college libraries are facing the problem of financial constraints, journal publishers continue to raise prices, so that the construction of the library literature resources is affected. Open Access is another distributing model, the client free, limitless use, and full open access asset sharing are the main highlights, concerning school library, the rise of open access assets, without a doubt carries new freedoms to development of the library's data assets, making part of the games diaries can be straightforwardly gotten to without request, which somewhat facilitate the monetary limitations of college library. Lately, quick advancement of open access assets, open access diary has become stronger scale, the number has been rising, and present more establishments all over the world have open access

institutional archives. College and university libraries can play their own advantages, and actively collect and collate the online open access resources, enrich own information resources.

College libraries are able to comprehend several advantages by using open source software. One of the most obvious advantages is the initial cost. Open source is generally available for free or at a minimal cost and it is not necessary to purchase additional to access many.

The two primary paths towards open access for delivering to research article are:

Open Access Journals: Free, immediate, permanent, full-text, online access, for any user, who has access to the Internet, may link, read, download, store, print-off, and use the content of that article. It is also referred to as “gold” open access

Open Access Archives: Institutional repositories is a electronic prints of journal articles which comprise theses and dissertations, course materials etc., It is also referred to as “green” open access

The open access is generally significant because of distributed research results and thoughts are the establishment for future advancement in science and medication. Open Access distributing accordingly prompts more extensive dispersal of data. Open access assists with guaranteeing long haul admittance to insightful articles. Not at all like articles that are authorized in conventional article data sets, libraries and others are able to generate local copies and repositories of these resources. Libraries, by working together to formulate repositories of open access literature, know how to ensure continued access to these scholarly publications into the distant future off future.

2. Opportunities through Open access services

The opportunities of open access resources including access to information resources at no cost, getting informed to stay current in the field, and satisfying the urge to contribute to knowledge, and the open access has straitened the way for the researchers who belong to developing countries and have limited access to scholarly material because of the high costs

of journals. Open Access resources provide numerous benefits to different segments, specially for college student/ researchers, some of that are:

a. Access Benefits for Library Users

Provides scholarly material without any discrimination. Students and teachers can use these OA resources for teaching and learning, OA facilitates the researchers/students to access freely available literature without any restrictions. It also provides the opportunity to publish and have wider visibility, discoverability, and usage of research findings. Access to scholarly and scientific literature is a common problem of all developing countries due to limited resources. OA resources increase the availability of open resources for students, teachers, researchers, and common people. Libraries can also provide their services by creating awareness of OA resources and their associated benefits.

b. Financial Benefits

Lower cost, greater accessibility, and better prospects for long term preservation of scholarly works as three major benefits of open access. Open access ensures long-term access as compared to licensed journals because open access allows libraries to create local copies and repositories of these resources. Libraries of economically disadvantaged areas can get a greater benefit from material available through open access, and is great opportunity to researchers / students to have open and unrestricted access to scholarly material.

Also college libraries can pay for low cost licensed journals/materials and make it available in library to many students/ researchers instead of individual purchase from student side, it reduces the cost to student, college can provide students good OA of information and it makes to attract student to college, and it makes college popular too.

c. Benefits for Colleges Research Visibility

The open-access model provides great opportunities not only for libraries, students, teachers, and researchers but also for universities to use and support the OA movement and have wider visibility of their research and researchers’ profiles.

Colleges/Universities can invest in this model by supporting financially their researchers to publish through the OA model and creation library research repositories based on OA research

d. quality of students' education

Students can directly benefit from open access because it facilitates unrestricted access to educational material and enables enriched education. Furthermore, open access can ensure students getting the best possible education and these students are not artificially limited by the selection of information resources (they get access to the latest research findings throughout the world. Open access is used by students for writing their term papers and final theses and they can access open access information resources regardless of their social status.

3. Challenges of Open Access Services

The common challenges associated with OA resources in college libraries are

- Lack of additional resources (staff, time, effort) for integration of OA resources in library collection
- Inadequate tools, infrastructure to integrate OA information resources in library.
- Difficult to track change in dynamic OA information resources
- Low speed of internet causes the inaccessibility of OA resources
- Unreliability of OA information resources
- Incomplete/Inaccurate metadata of OA information resources
- Difficult to monitor the availability of OA resources as library has no specific relationship with suppliers or published
- Lack of skills that are required for the integration of OA information resources to library collection

Suggestion to overcome problems

Open source of information is majority through computer over the internet, so that must appoint computer skilled staff to maintain good information in libraries and need to develop latest infrastructure

and acquire latest tools that can help them in managing OA information resources effectively and efficiently.

4. CONCLUSION

For libraries, universities, governments, and research institutions, one major benefit of lowering the cost of knowledge is the availability of extra budget that can be reallocated for other purposes. For researchers themselves, OA can increase their audience and impact by delivering wider and easier access for readers. For publishers, promoting OA is an answer to the desires and the needs of their research communities. Furthermore, subscription-based publishers have (partly) answered the call of the increasing global demand for OA, by giving their green light to author self-archiving, as well as by establishing numerous 'hybrid' OA options. It is now the responsibility of researchers to ensure OA to their publications either by choosing the Green or the Gold road, or for public research funders to employ policies that are in the best interests of the wider public while considering the financial sustainability of the scholarly publishing ecosystem.

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భావవీణ

కళలు, సాహిత్య సాంస్కృతిక భావధ్యమన పత్రిక

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జానపద సాహిత్యం - శృంగార గేయాలు

- జా. లంకేశులై జ్యోతిశ్వర నాయుడు, ఆంధ్రోపన్యాసకులు, ఎ.ఆర్.ఎస్. & వై.ఆర్.ఎస్. కాలేజి, చీరాల, ప్రకాశం జిల్లా.

జానపదుడు కల్లా కపటం లేనివాడు. మనసులోని మాట మరుగు లేకుండా బయట పెట్టే స్వభావం కలవాడు. అతనిలో ఏర్పడే విభావమైనా ఆవేశంతో కలిసి అందమైన పాటగా ఆవిర్భవించి అలరింపజేస్తుంది. స్పష్టికి హేతుభావమైన కోరిక మానవుని వయసుతోపాటే పెరుగుతుంది. యవ్వనపు పొంగుతో కలిసి ఉబికి ఉద్రూతలూగుతుంది. ఇది స్పష్టి కంఠటికి సమాన ధర్మమే. యవ్వనంలోనే వలపు మొగ్గ తోడుగుతుంది. స్త్రీ, పురుషులు పరస్పర ఆకర్షణకు లోనవుతారు. చూపులు కోరికల్ని రేపుతాయి. మనసులో మదన సంగీతం మొదలవుతుంది. అప్పటిపాట్లు అనుభవక వేద్యం. తమ మానసిక స్థితిని బహిర్గతం చేసి మనోభారాన్ని దించుకొంటాడు జానపదుడు. దానికువయోగవడే చక్కని సాధనలే స్వచ్ఛమైన జానపద శృంగార గేయాలు లేదా వలపు పాటలు. ఇవి స్త్రీ, పురుషులు తమ వలపును తెలుసుకోడానికి ఉపకరిస్తాయి. కష్టాలు, కడగండ్లు చుట్టు ముట్టినపుడు ఆ మానసిక స్థితి నుంచి తాత్కాలికంగానైనా తప్పకొనేందుకు జానపదుడు వీటిని ఆశ్రయిస్తాడు. నాగరికులు వీటిని విన్నవ్వడం మానసికంగా ఆ వాతారవణంలో ప్రవేశించి తాదాత్మ్యం పొందగలుగుతాడు. ఈ శృంగార గేయాల్ని వాలుగు విధాలుగా పర్గీకరించడమైంది. అవి-

1) ప్రేయసీ ప్రయుల శృంగారం 2) భార్యాభర్తల శృంగారం 3) ప్రలోభ శృంగారం 4) వంచక శృంగారం
ప్రేయసీ ప్రయుల శృంగారం :

ప్రేమికుల ప్రేమకు వరాకాశ శృంగారం. శిష్టసాహిత్యంలో పురుషులే మొట్టమొదట స్త్రీలను వలచి వలకరించినట్లుగా పెక్కు కావ్యాల్లో కన్పిస్తుంది. కాని జానపద సాహిత్యంలో అలాగాక స్త్రీ పురుషులిరువురూ

పరస్పరం వలకరించుకొనే శృంగార గేయాలు ఎన్నో కన్పిస్తాయి. భావ వ్యక్తీకరణ, కలయిక విషయాల్లో పల్లియులకు, పట్టణ వాసులకు ఎంతో తేడా వుంది. సాధారణంగా పట్టణవాసులైన ప్రేమికులు తమ ప్రేమ కలాపాల్ని ఉత్తర ప్రత్యుత్తరాల ద్వారా తెల్పుకుంటూ, సినిమా హాళ్ళలోను, పార్కుల్లోను కలుపుకుంటుంటారు. పల్లెల్లో అలాకాదు. మాటల ద్వారానో, పాటల ద్వారానో తమ అనురాగాన్ని పరస్పరం తెలియజేసుకుంటూ పొలాల్లోనో, బావుల దగ్గరనో, తోపుల దగ్గరనో కలుసుకుంటుంటారు.

ఒక చిన్నది బావి దగ్గర పొలంలో వరినాట్లు వేస్తుంటుంది. ఆ పొలం ప్రక్కన పొరుగు గ్రామానికి చెందిన ఒక చిన్నవాడు గొర్రెలు మేపుతుంటాడు. వాడికి ఆ చిన్నదానిపై మనసు పడుతుంది. పాట ద్వారా తన ప్రేమ భావాన్ని వ్యక్తంచేస్తాడు. ఆమె కూడా అలాగే తన భావాన్ని తెలియజేస్తుంది. వాళ్ళిద్దరి మనోభావాల వ్యక్తీకరణే క్రింది గేయం.

చిన్నోడు : జడనీకు ఎవరల్లీరో చిన్నదానా
జడనీకు ఎవరల్లీరో
జడనా జాజికాయ మెడనా కుచ్చుల దండా
జడనీకు ఎవరల్లీరో

చిన్నది : మానిలో పండుందాదీ చిన్నవాడా
మాటలకు మడిరాలునా ||చిన్నావాడా||

చిన్నోడు : దోటివేసి లాగితే పడుసుదానా
దోసిట్లో పడదూకునా

చిన్నది : బాయిలో చేపుండాది చిన్నవాడా
బాధా పాడితే దొరుకునా ||చిన్నావాడా||

చిన్నోడు : గాలమేసి లాగితే పాడుసుదానా
గెడ్డానా పడదూకునా

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ఇల్లిందల వారి మల్లిక - సామాజిక చైతన్యం

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మానవుని మనస్సుకు ఆనందాన్ని కలిగించి, ఆలోచింపజేసి, అతనిని సన్మార్గంలో నడిపించేది సాహిత్యం. అట్టి సాహిత్యం ఆనంతమైంది. ప్రబంధం - శతక - వద్యం - గద్యం. యక్షగానం - ఉదాహరణ - నాటకం-నవల-కథ ఇత్యాదిగా తెలుగు సాహిత్యం వివిధ ప్రక్రియాయుతమై విరాజిల్లుతోంది. వీటలో 'నవల' అనే ప్రక్రియ 19వ శతాబ్దంలో కందుకూరి వీరేశలింగం పంతులుగారి పుణ్యమాయని తెలుగు నేలలో మెలకలెత్తింది. నవాన్ విశేషాన్ లాతి గృహ్యతి ఇతి నవలా' అని వ్యుత్పత్తి. ఆంగ్లములోని 'నావెలో' తెలుగులో నవలగా మారింది. "మానవ జీవిత యధార్థ చిత్రణాన్ని కల్పనకతో మేళవించి సమకాలీన సంఘ స్వరూపాన్ని సముచితంగా ప్రతిబింబిస్తూ పాఠకుణ్ణి పట్టి చదివించే మనోరంజక సరళశైలీ సముపేత గద్యరచన నవల. ఉదాత్త వర్ణన - నాటకీయత - పాత్ర చిత్రణ కథా కథన శిల్పం నవలాకారుని ప్రతిభకు గీటురాళ్లు" అని అంటారు శ్రీ పుల్ల వొట్ల వెంకటేశ్వర్లు (తెలుగు నవలా సాహిత్య వికాసము - పుట -48) సమకాలీన సంఘ స్వరూప నిరూపణకు ఆయా వ్యక్తులు ఎదుర్కొంటున్న సమస్యల్ని అనుభవిస్తున్న కష్ట సుఖాల్ని తెలియజెప్పడానికి మానవ జీవిత వాస్తవ చిత్రణానికి, సామాజిక చైతన్యానికి నవల ఎంతగానో తోడ్పడుతుంది.

మల్లిక:-

1920 ప్రాంతంలో దేశంలో స్వాతంత్రోద్యమం తారాస్థాయికి చేరుకున్న రోజుల్లో జాతీయోద్యమ ప్రభావితులై కొందరు రచయితలు నవలల్ని వ్రాయగా మరికొందరు ఆంగ్ల భాషా పరిజ్ఞానంతో పాశ్చాత్యుల నాగరికతను, ఆచార వ్యవహారాల్ని గ్రహించి నవలలను వ్రాశారు. స్వాతంత్ర్యానంతరం సంఘ వ్యవస్థలో, ప్రజా జీవన విధానంలో ఎన్నో మార్పులు చోటుచేసుకున్నాయి. ముఖ్యంగా అస్పృశ్యతా నివారణకై, హరిజనోద్ధరణకై ఎందరో బద్ధకంకణులయ్యారు. వారి సమస్యలపై ఎన్నో నవలలు వెలువడ్డాయి. అలా వచ్చిన నవలల్లో 'మల్లిక' అనే నవల ఒకటి. ఇది శ్రీ.త. 1949లో వ్రాయబడిన నవల సాంఘిక సమస్యను ఆధారంగా తీసుకొని సంఘ చైతన్యానికి నడుంబిగించిన ఒక ఉచితాశయంతో ఇల్లిందల రంగనాయకులు గారు ఈ నవలను వ్రాశారు. వీరు సరసరావుపేటలోని సుబ్బారాయ అండ్ నారాయణ కళాశాలకు ప్రాచార్యులుగా పని చేశారు. సంఘ సంస్కార దృష్టితో వ్రాయబడ్డ నవల ఇది. దీనిలో అంటరానితనం గూర్చి విస్తారంగా చెప్పబడింది. అస్పృశ్యతా నివారణ గూర్చి ఉద్యమిస్తున్న రోజుల్లో యుగధర్మాన్ని జీర్ణించుకొని తత్ సంస్కృతికి గుర్తుగా ఈ నవల రాయడం విశేషం. మతాలు - కులాలు - వర్గాలు - వర్గాలు - అనేవి మానవుల కల్పితాలు. మానవులందరూ అన్నదమ్ములే అని చాటడానికి ప్రేమ అనే ములసూత్రం ఉందని గ్రహిస్తే మానవ సౌందర్యానికి ఈ కులమత భేదాలు అడ్డుకోడలు కావు. అయితే సంఘంలో స్వార్థపరత్వం - అహంకారము - అధికారం - అభిజాత్యం భేదాలు అడ్డుకోడలు కావు. అయితే సంఘంలో స్వార్థపరత్వం - అహంకారము - అధికారం - అభిజాత్యం - మూర్ఖత్వం పలుకుబడి మున్నగునవి కులమత విద్వేషాల్ని



శక్తిస్తున్నాయి. మానవ మనోగత సంకుచితత్వం కులమత భేదాన్ని అడ్డుపెట్టుకుని లోకంలో మానవ సమాజ ఔన్నత్యానికి అడ్డుగా నిలబడుతోంది. దాని నుండి సమాజాన్ని జాగృత పరచడానికి ఈ 'మల్లిక' నవల వ్రాయబడింది. కాలానుగుణంగా వ్రాయబడ్డ నవల ఇది. దీనిలోని కథ క్లుప్తంగా ఇలా.

మల్లికలోని వస్తువు :-

అదొక పట్టణం అమరావతి. దానిలో ఒక ఆశ్రమం. ఆ ఆశ్రమంలో వికటానందుడనే ఒక సన్యాసి. పేరుకు సన్యాసి అయినా మంచి భోగపురుషుడు, మోసగాడున్ను ఊళ్ళో వాళ్ళందర్ని మాయ మాటలతో తన నైపు త్రిపుకొని ఇష్టం వచ్చినట్లు ప్రవర్తిస్తుంటాడు. ఆ ఊళ్ళోనే లక్ష్మీనాథ శాస్త్రి అనే పేరొందిన మంచి బ్రాహ్మణుడొకడున్నాడు. సంఘసంస్కార పరాయణుడు. ప్రజలందరూ ఒకటే అంటూ పంచముల్ని సైతం ఆదరిస్తూ, వికటానందుని వంటి కుసంస్కారుల్ని ఎదిరించి నిలిచిన ధైర్యశాలి. ఆ నవలకు ముఖ్యపాత్ర ఆనందగిన మల్లిక పంచముకులంలో పుట్టిన స్త్రీ. తల్లిదండ్రులు పార్వతీ శంభుదాసులు. వారికి మల్లిక ఒక్కతే బిడ్డ. చిన్నపిల్ల, ఎనిదేళ్ళ వయసు. ఆమె ఒక రోజు పూలపై కోరికతో ఆశ్రమంలో పూలు కోసుకుంటూ ఉంటుంది. అది గమనించిన వికటానందుని శిష్యులు ఆ పాపను రాళ్ళతో కొడుతూ తరుముతూ ఉండగా లక్ష్మీనాథ శాస్త్రి పాపను కాపాడి తన ఇంటికి తీసుకుపోతాడు. ఆ రోజునుంచి శాస్త్రి అన్నా ఆయన కుటుంబమన్నా మల్లికకు ఎనలేని గౌరవం. అయితే పంచముల పిల్లను తాకి శాస్త్రి కుటుంబం మైల పడిందని వికటానందుని శిష్యులు ఆయనను అవమానిస్తారు. ఇదే విషయం తమ గురువు వికటానందునితో అంటారు. లక్ష్మీనాథ శాస్త్రికి కుడిభుజం లాంటి శిష్యుడొకడున్నాడు. అతని పేరు కేశవుడు. అలాగే శాస్త్రి తమ్ముడు మాధవుడు. శాస్త్రికి మాధవునికి హస్తీమశకాంతరం. అన్నగారికి పూర్తి వ్యతిరేక భావం మాధవునిది. అన్నగారు పంచముల్ని చేరదీయడం మాధవునికి నచ్చదు. దాంతో వాడు వికటానందుని పంచ జేరి వాని లోధనలకు లోనవుతాడు.

ఇలా ఉండగా ఒకసారి లక్ష్మీనాథ శాస్త్రి తండ్రి గారి తద్దినం వస్తుంది. దానికాయన పంచముల్ని కూడా భోజనానికి పిలుస్తాడు. అది నచ్చని మాధవుడు ఇంట్లోనుంచి వెళ్ళిపోయి వికటానందుని ఆశ్రమంలో తద్దినం పెట్ట నిర్ణయిస్తాడు. లక్ష్మీనాథ శాస్త్రి తాను మాత్రమే పితృకార్యం చేసి పంచములతో సహా అందరికీ భోజనాలు పెడతాడు. వారంతా శాస్త్రిని దేవునిగా భావించి ప్రశంసిస్తారు. శాస్త్రిది అంకా మోసమంటాడు వికటానందుడు. శాస్త్రిని మీ ఇళ్ళకు భోజనానికి పిలిచి అన్నం పెట్టమని వికటానందుడు పంచములతో అంటాడు. వారలు పాపమంటారు. కాని మల్లిక శాస్త్రిని భోజనానికి పిలుస్తుంది. ఆయన ఆమె ఇంటికి వెళ్ళి భుజిస్తాడు. వారందరూ చదువుకొని చైతన్యవంతులు కావాలని నిర్ణయించి వారికొక పాఠశాలను ఏర్పాటు చేసి దానికి ఉపాధ్యాయునిగా తన శిష్యుడైన కేశవుని నియోగిస్తాడు శాస్త్రి.

ఆ అమరావతిలోనే ధనగుప్తుడనే వైశ్యశిఖామణి ఒకడున్నాడు. నౌకావ్యాపారం సాగించి సార్థక నాముడయ్యాడు. వాని మెదటి భార్య పిల్లల్ని కనకుండానే కన్ను మూసింది. వాడు హైమావతి అనే ఆమెను రెండవ భార్యగా పెళ్ళాడాడు. పదేళ్ళు గడచినా ఆమెకు కూడా పిల్లలు కలుగలేదు. అందుకు మిక్కిలిగా విచారించిన ధనగుప్తుడు తనకు సన్యాసుపై నమ్మకం ఉన్నందువల్ల భార్యతో కలిసి వికటానందుని దర్శిస్తాడు.

ఈ కాపటికుడు ఆమె అందానికి ముగ్ధుడై ఎలాగైనా ఆమెను పొందాలనుకొని పిల్లలకొరకని ఒక పింఠ వ్రతాన్ని ఉపదేశించాడు. ఆమె ఆ వ్రతాన్ని ఏకాంతంగా అనగా భర్తగాని, ఇతరులు ఎవ్వరూగాని దగ్గరలో లేకుండా చేయాలంటాడు. వాని ప్రవర్తనను గమనించిన హైమావతి అందుకు ఒప్పుకోలేదు.



దాంతో ఆమెపై పగను పూనాడు. ఆమె శీలం మందిది కాదని ప్రచారం చేస్తాడు. ధనగుప్పుని తన వైపు త్రొప్పుకొని ఆమె చేత ఎలాగైనా ప్రకం చేయించాలని, అలా కానిచో నిన్ను కూడా నాశనం చేస్తానని వైకున్యని బెదిరిస్తాడు. పంచముల ఇందినుండి వస్తుండగా ఆమె శాస్త్రిని చూసి తన మనసులోని కోరిక చెప్పింది. తన పరిస్థితిని తెలుపుతుంది. ఆయన ఆమెను గూర్చి ధనగుప్పునితో మాట్లాడతానంటాడు. ఈ సంగతి వికటానందునికి తెలుస్తుంది. వాడు లక్ష్మీనాథ శాస్త్రికి హైమావతికి అక్రమ సంబంధం అంటగట్టి ధనగుప్పుడు ఆమెను అవమానించేటట్లు చేస్తాడు. వారిరువురిని నిందిస్తాడు. కోమటికి నిజం తెలియాలనే ఆశతో వారిన్ని అన్నా లక్ష్మీనాథ శాస్త్రి ఏమీ అనడు.

అమరావతిలో రైతుల పొలాల్ని వికటానందుని ప్రోద్బలంతో ధనగుప్పుడు లాక్కుంటాడు. వారందరూ లక్ష్మీనాథ శాస్త్రిని ఆశ్రయిస్తారు. అప్పుడు రైతులకు ధనగుప్పునకు పోరాటం జరుగగా శాస్త్రి రైతు పక్షాన ఉంటాడు. ఆ పోరాటంలో శాస్త్రి శిష్యుడు కేశవుడు మరణిస్తాడు. ప్రజలు శాస్త్రికి సానుభూతి చూపించి వికటానందుని నిందిస్తారు. దీనికంతటికీ తన భార్య కారణం అని వైక్యుడు ఆమెను తిడతాడు. దాంతో మనసు వికలమై ఆమె అర్ధరాత్రి ఊరి చెరువులో పడి ఆత్మహత్య చేసుకొంటుంది. భార్య మరణంతో కళ్ళు తెరుచుకున్న వైక్యుడు లక్ష్మీనాథ శాస్త్రిని శరణం అని తన ధనం మొత్తం పంచముల అధ్యున్నతికి ధారపోస్తాడు. ఏభైవేల రూపాయలతో ఒక పెద్ద భవనం నిర్మించి దానికి పంచముల కోరికపై 'కేశవ మందిరం' అనే పేరు పెడతాడు. ప్రజా వ్యతిరేకతతో పారిపోవాలని ప్రయత్నించిన వికటానందుని లక్ష్మీనాథ శాస్త్రి ఆ మందిరంలోనే బంధించి, విచారణానంతరం కారాగారానికి అప్పగిస్తాడు. కథ సుఖాంతం. సామాజిక వైతన్యం:-

అస్పృశ్యతా నిరసనం ఈ నవలలో చెప్పబడింది. లక్ష్మీనాథ శాస్త్రి తాను బ్రాహ్మణుడయినా పంచముల ఉద్ధరణకు పాటుపడ్డాడు. కులమత భేద భావాలు లేవని ప్రజలంతా ఒక్కటేనని నిరూపించాడు. తరువాత వారికి మార్గ నిర్దేశం చేసాడు. ముఖ్యంగా దొంగ స్వాముల్ని ప్రజలు నమ్మరాదనే విషయం నవలలో రచయిత తెలిపారు. మనం నిత్యం ఇట్టి దొంగ స్వాముల్ని చూస్తున్నాం. మూఢవిశ్వాసాలతో ఇలాంటి స్వాముల్ని నమ్మితే నశిస్తాం. ఇది గుర్తుంచుకోవాలి అందరూ మరియు సొంత వారితో పాటు అన్య స్త్రీ పురుషుల్ని అనుమానించడం, అవమానించడం కూడ మంచిదికాదు. సర్వమానవ సౌత్రాత్మత్వంను అందరూ అలవరచుకోవాలని ఈ నవల ద్వారా రచయిత చాటారు.

నవలకు మల్లిక అనే పేరు పెట్టారు. నవలలో ముఖ్య పాత్రగా భావించబడ్డ ఆమె కథలో కొంత వరకే ఉంటుంది. మల్లిక తన అంటరానితనాన్ని ఆలోచించక శాస్త్రిగారి ఇంటికి వెళ్ళడం, ఆయనకు భోజనం పెట్టడం జరుగుతుంది. ఈ సంఘటనలకు మూలకారణం ఆమె. ఆమె లేనిచో అస్పృశ్యతా నిరసనం జరగదు. అందువల్ల హరిజనాభ్యుదయాన్ని దృష్టిలో ఉంచుకొని రచయిత ఆమె పేరుతోనే నవల వ్రాసి ఉండవచ్చు ఇలా సామాజిక వైతన్యానికి, లోకోపకారానికి ఈ నవల దోహదం అవుతుంది.

ఆధార గ్రంథము :-

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వదలి రాధాకృష్ణ కథలు-గ్రామీణ జీవనం

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రేణుకాకృష్ణులకి గ్రామాల్లో పట్టుకొమ్మలు. ప్రకాంత బాలాపరణానికి, తీరదానికి నిలవాలి ఆ గ్రామాలు. అసలు గ్రామము అంటే జనపదాలని, పల్లెలని అంటారు. జనాలు నివసించే ప్రాంతాన్ని అంటారు అంటారు. పూర్వం జనపదాలు అనేవారు. ఇప్పుడు గ్రామము అంటున్నారు. దేశం సాగిపోతే పదాలు ఎంత అభ్యున్నతి పొందినా, ఎంత దిక్పాలకే పెరిగినా, ఎన్ని కృత్రిమ వసతులు మూడవుడు సమగ్రం ఎంత రూపాన్ని అర్జించినా ప్రకృతి ధర్మాన్ని అవన్నీ తీర్చలేవు. మనిషికి ఆకలి, నిద్ర, ఆనందం, పీడలు లాంటి వన్నీ ప్రకృతి ధర్మాల్లో. అయితే వీటిలో ఆకలిని తీర్చే ఒకే ఒక దారి అహారం తీసుకోవడం. ఆ అహారం అనేది ఒక ఊరికి, ఒక పట్టణానికి, ఒక రేణుకానికి అని పరిమితం కాకుండా పుట్టిన ప్రతి కీర్తి అవనరం ఈ ఆకలి తీరడం. ఇంతటి అవసరాన్ని తీర్చే ప్రకృతి అందాలతో అలరారే 'గ్రామాలు'. ఆ పల్లెటూళ్ళు వచ్చని పంటపొలాల్లో పంట పండించక పోతే ఈ ప్రకృతి ధర్మమే నెరవేరదు. అందుకే రేణుకా ప్రాంతం గ్రామాలు. గ్రామాల్లో నివసించే వల్లి ప్రజలు వెన్నెముక వంటి వారని నానుడి.

ఇలా అహారాన్నందించే పంటపొలాలు వల్లిలోనే తప్ప పెద్ద పెద్ద నగరాలు, పట్టణాల్లో సాధ్యమయ్యే విషయం కాదు. ఒక వ్యవసాయం అనే కాకుండా, మానవ విలువలకు, ఇంధాలకు, ఆదార వ్యవసాయాన్ని మన సంస్కృతి సాంప్రదాయాలకు, ప్రేమాభిమానాలకు, గౌరవ మర్యాదలకు, ప్రకృతిలోని సహజ అందాలకు ఇలా ఎన్నెన్నో విలువల నెలవులు ఈ గ్రామాలు. ఇప్పటికీ, ఇంత నగరీకణ ఆరుగుతున్నా కూడా మన వల్లిలోని విలువల వల్ల ప్రపంచంలోని రేణుకాల్లో మనదేశం వల్ల ఒక గౌరవ అభిప్రాయం ఉంది. ఇది కేవల మన గ్రామాల వల్ల అంటే అతిశయంగా ఉన్నప్పటికీ వాస్తవ విషయం ఇది అని మనందరిలో ఎవరిని అడిగినా చెప్తారు. ప్రకృతి విలువలతో, మానవ విలువలతో వర్ణిల్లుతున్న గ్రామాలు రేణుకాకి ఎంతటి ప్రయోజనాన్ని చేకూరుస్తున్నాయో, విలువలను ఎలా కాపాడుతున్నాయో రచయిత వదలి రాధాకృష్ణ గారు అయిన రచనలో అరుగరుగునా ప్రస్తావించారు.

రచయిత వదలి రాధాకృష్ణకు తన బాల్య స్మృతుల్లో నిలిచిన గ్రామీణ జీవితం పట్ల ప్రత్యేకమైన అభిమానం ఉంది. "పల్లి ప్రజల అదరాభిమానాల పట్ల చెరిగిపోని నమ్మకం ఉంది. వారి అమాలుకళ్ళు మీద ఆపారమైన సాగుభూతి ఉంది. అధునిక నగరీకణ వల్ల కనుమరుగైపోతున్న గ్రామీణ సంస్కృతి పట్ల బాధ ఉంది. ప్రపంచీకరణ నేపథ్యంలో ఉప్పెనలా నొచ్చుకువస్తున్న విపరీత పోకడలపై ఆరోకం ఉంది. పంటనేలా, పద్ధికబయత్కూ, ప్రకాంతమైన అప్రోదకర అరుణయలు ప్రకృతి దృశ్యాల పట్ల ఎలకీతం ఉంది. ఈ కథల్ని చదువుతున్నప్పుడు అయో ప్రోత్సల వెనుక రచయిత అంతరంగం మనకి స్పష్టమవుతుంది. ఈయన కథల్లో గ్రామీణ విలువలు ఎలా కనుమరుగవుతున్నాయో, వాటిని మనం ఎలా కాపాడుకోవాలి, ఈ విలువలను, అనుబంధాలను మనం ఎలా దూరం చేసుకుంటున్నామో తన ప్రతి రచనలోనూ వదలి రాధాకృష్ణ పాఠకులకు అందించారు. ఈయన రచనల్లో గ్రామీణ ప్రజల జీవనం ఎలా కొనసాగుతుందో,



వారి వారి జీవనంలో ఎన్ని సమస్యలు ఉంటాయో ప్రతి అంశాన్ని తీసుకొని ఒక కథగా మార్చి మన కనుల ముందుంచారు రాధాకృష్ణ. ప్రకృతి అందాలతో బయటకు అహోదంగా కనిపించే వల్లెల్లో ఎన్ని అసౌకర్యాలు ఉన్నాయో, వల్లె ప్రజల జీవనం ఎంత కష్టమో వారికి మనం పెద్ద మనసుతో ఎంత సహాయం చేయవచ్చో వివిధ అంశాలను అయన రచించారు. గ్రామీణ జీవనం ఎంత ప్రశాంతమైనదో, ఎంత అందమైనదో వర్ణిస్తూ వాటిని మనం ఎలా కాపాడుకోవాలో సూచించారు.

నగరాలనీ, నాగరికతలనీ అందని ద్రాక్షవళ్ళకోసం వరుగులు తీస్తున్న మనం వదలి వారి రచనలు చదివితే మనం మరిచిపోతున్న విలువల విలువ అవగతమవుతుంది. ప్రపంచీకరణ నేపథ్యంలో గ్రామీణ జీవనం అంటే ఏదో బ్రతకలేనివారు గ్రామాల్లో జీవిస్తున్నారని ఇప్పటి వారు చులకన చేసే పరిస్థితులు వచ్చాయి. బ్రతకలేని వారు గ్రామాల్లో ఉంటున్నారో, మనం బ్రతకాలంటే వల్లెల్లో జీవనాన్ని కొనసాగించేవారు లేకపోతే మన పరిస్థితి ఏంటి అన్న బేరీజు వేసుకోవాలి. ఇలా తారతమ్యాలు తెలుసుకోవాలని వారి కోసం వదలి రాధాకృష్ణ ఈ రచనలు చేశారనిపిస్తుంది. గ్రామీణ విలువలను, అందాలను, జీవన విధానాలను, అనుబంధాలను తన కథలతో మనకు అందించారు.

'అంతర్వేతం' కథాసంపుటిలోని గ్రామీణ జీవనం

అంతర్వేతం కథాసంపుటిలో 'నేనున్నాను' కథలో గ్రామీణ జీవన విధానంలో ప్రకృతి అందాలకన్నా వల్లె ప్రజల జీవనం ఎలాంటి మలుపులు తిరుగుతుందో స్పష్టమవుతుంది. ఈ కథలో అగ్రహారం గురించి చెప్పారు రచయిత. అగ్రహారం అంటే పూర్వం రాజులుగానీ, రాజవంశీకులుగానీ, పెద్దవారు కానీ, ఆచార సాంప్రదాయాలు పాటించే బ్రాహ్మణ కుటుంబీకులకు గానీ, వృత్తి కళల వారికి గానీ, వారు ఉండడానికి కొంత ఊరిని ఇచ్చేవారు. ఆ ప్రాంతాన్ని అగ్రహారం అనేవారు. ఇలా పూర్వం అగ్రహారంలో ఏయే కట్టుబాట్లు, ఆచారాలు, పద్ధతులు ఉండేవో ఈ కథలో అవివృతం చేశారు. ఇప్పటి జీవన సరళిలో సామాన్యమైన విషయాలు ఒకప్పటి గ్రామీణ జీవనంలో ఎంతో విశిష్టత కలిగి ఉండేవి. గ్రామంలో ఏ చిన్న విషయం జరిగినా, మందైనా, చెడైనా కూడా ప్రతి ఒక్కరికీ తెలుస్తుంది. అది అందరికీ అమోదమై ఉండాలనేది గ్రామీణ అగ్రహారం కట్టుబాటు. దీనిని అతిక్రమించినవారి గురించి పలురకాలుగా మాట్లాడుకోవటం గ్రామీణ జీవన లక్షణం. గ్రామీణ ప్రజల్లో ఈ లక్షణం 'నేనున్నాను' కథలో చాలా బాగా వ్యక్తం చేశారు. సంప్రదాయమైన ఇల్లాలిరి ఏమీ తెలియదని అపోహపడ్డ భర్త, చాటుమాటుగా భర్త చేసే పనులు అనోటా ఈనోటా విన్నా బయటపడి అల్లరి చేయకుండా భర్తని మార్పుకోవాలన్న సంకల్పం ఉన్న భార్య. వీరి కట్టుబాట్లలో వీరు ఉండగా వీరి గురించే మాట్లాడుకునే అగ్రహారీకులు, చెడు ప్రవర్తన కలిగిన భర్తను గురించి అందరూ మాట్లాడుకుంటుంటే విన్న తమ్ముడు, కొడుకూ కూడా తనను నిలదీసి అడిగినా నోరువిప్పని స్త్రీ హృదయం ఒక పల్లెటూరి ఆడవాళ్ళలోనే ఆ నిగ్రహం ఉంటుందని రచయిత భావం వ్యక్తం చేశారు. ఇదే విషయం నగరంలో అయితే ఎవరూ పట్టించుకోరు. కానీ గ్రామంలో ఒక తప్పు విషయంగా భావిస్తారు. వేళ్ళ దగ్గరికి వెళ్ళే భర్తని మార్చాలన్న తపన చదువుకోని ఒక స్త్రీ చేయగలుగుతుందా! ఈ రోజుల్లో చాలామంది మగాళ్ళి అదేయావ! పండుల్లా కుక్కల్లా తిరుగుతూ సాయంత్రం అయ్యేసరికి 'టీ' సెంటర్లో ఏ ఇద్దరు చేరినా ఆడదాని తరీరం గురించే, జీవితంలో అంతకుమించి ఏమీ లేనట్లు కళ్ళూరి పడి చస్తారు.



సుకుమారమైన శృంగారాన్ని బహుపాటు చేస్తున్నారు. విచ్చలవిడి ప్రవర్తనతో రచ్చకీడుస్తున్నారు. పెళ్లాం పిల్లలు, ఇంటి అవసరాల కంటే కూడా అలాంటి చౌకబారు ఆలోచనలకి అలవాటు పడిపోయి అందమైన జీవితాలను ధీరం చేసుకుంటున్నారు. ఇలాంటి విషయాలను సమాజ విరుద్ధమైన విషయాలగా భావించి తప్పుగా మాట్లాడుకొని ఖండిస్తారు గ్రామ ప్రజలు. ఎవరితో పడితే వారితో సంబంధాలు కొనసాగించే వేశ్య ఆమెకేదైనా ఇబ్బంది వస్తే, అప్పటిదాకా వాడుకొని అప్పటికప్పుడు వెలివేయాలన్న గ్రామీణ కట్టుబాటు. పంచాయితీలు అందరి మధ్యన దోషులు, తీర్పులు, వాటి ఆచరణ వల్లైలో కనిపించే విధానం. ఈ విధానం ఈ కథలో వదలి రాధాకృష్ణ స్పష్టంగా రాశారు. అప్పటి దాకా వాడుకొని ఆమెకు ఎయిడ్స్ సోకిందన్న నెపంతో, కాపురాలు కూలుస్తోంది ఊరి నుంచి వెలివేయందన్న ప్రజల పంచాయితీ వారందరి ముందు తలవంచుకు నిలబడ్డ ఆమె. అప్పటి దాకా భర్త తనని మోసగించి ఆమె వెనుక తిరిగాడు. ఇప్పుడు ఆమెను దోషిగా చూస్తున్నాడు. తనను తాను కాపాడుకోవాలన్న స్వార్థం. భర్త మనిషిగా మారినందుకు ఒక ప్రకృ సంతోషం, మానవత్వం లేదన్న బాధ. కానీ సాటి స్త్రీని అవదలో ఆడుకోవాలన్న ఔదార్యం ఇవన్నీ ఒక వల్ల జీవన సరళిలో కనిపిస్తాయని వదలి రాధాకృష్ణ గ్రామీణ జీవనంలో స్త్రీ జీవన విధానాన్ని తెలిపారు.

'అంతర్వేతం' కథలో కూడా గ్రామీణ జీవనం చేసే ప్రజల నాడిని పట్టి చెప్పారు. ఒక వ్యక్తి మరణించాడంటే ఎవరో ఎక్కడోలే మనకెందుకు అని గ్రామ ప్రజలు అనుకోరు. మరణించిన వ్యక్తి ఇంటికి గుంపులు గుంపులుగా అందరూ చేరతారు. ఎవరికి చేతనైన సహాయం వారు చేస్తారు. కొందరు మాటల ద్వారా ఊరట కలిగిస్తారు. కొందరు పనులకు సహాయం చేస్తారు. మానవ విలువలకు అద్దం పట్టే గ్రామీణ జీవనం కనపడుతుంది అంతర్వేతం కథలో. భర్తను కోల్పోయి ఒంటరిగా ఉన్న స్త్రీకి దూరాన వున్న కొడుకులు వచ్చి ఓదార్చక పోయినా అక్కడకు వచ్చిన ఊరి ప్రజలందరూ చూపించే సానుభూతి గ్రామీణ ప్రజల అదరాభిమానాలను తెలుపుతుంది. ఎక్కడో పల్లెటూళ్ళో ఉన్న నాన్న అప్పులు చేసి వుంటాడు. వెళితే వెంబడి మనకు చుట్టుకుంటాయి అన్న కుసంస్కారంతో పట్నంలో ఉన్న కొడుకులు, కోడళ్ళు తండ్రి చనిపోయినారారు. ఆ సమయంలో సహచరి అయిన భార్య, సమాజ కట్టుబాట్ల ప్రకారం కొడుకులు తలకొరివి పెట్టాల్సిన సమయంలో వారు రాకపోవడంతో అందరూ తలా ఒక మాట అంటుంటే, ఆమెకు ఏమీ చేయాలో తోచక ఆలోచిస్తుంది. ఇక్కడ కొడుకులు దూరమైన పల్లెల్లోని తల్లిదండ్రుల పరిస్థితిని రచయిత ఎంతో వ్యూహంగా రచించారు. చివరకు ఆమె నేనే నా భర్తకి తలకొరికి పెద్దాను అని నిర్ణయం చెప్పింది. గ్రామంలో ఇలాంటి సమాజ వ్యతిరేక నిర్ణయాలు విద్వేదంగా అనిపిస్తాయి. ఆమె తలకొరివి పెట్టి కొడుకులకు బుద్ధి చెప్పింది. ప్రేమ, అనురాగం వంచి పెద్ద చేసినా, నగర వాతావరణంలో నేర్చుకొన్న కుసంస్కారం వారి చేత ఆ పని చేయిస్తే, మానవత్వంతో పెంచి పెద్ద చేయాలన్న నిర్ణయంతో ఆమె చివరి దశలో కూడా ఒక అనాధని మంచి సంస్కారంతో పెంచాలన్న నిర్ణయానికి దారితీస్తుంది. "మనుషులు మర యంత్రాల్లా కాకుండా మానవత్వమున్న మహనీయుల్లా మెలగక జీవన వరుగువందెంలో యంత్రాలై పోతున్నారు. అమనవీయత-నిర్ణయ, విచ్యుకత్తుల్లా కదిలే మనుషులు హృదయాలతో గాక మెదళ్ళతో మావత్వాన్ని దేరీఅ వేసి అత్యీయతల్ని కూడా వాణిజ్య వస్తువులుగా చేస్తున్న దయనీయ పరిస్థితి. ఇలాంటి విపరీత పోకడలకు అతీతంగా, అత్యీయతకు అర్ధంగా గ్రామీణ జీవనం ఉంటుందని 'అంతర్వేతం' కథలో కవి గ్రామీణ జీవనాన్ని చూపించారు.



'మనిషై వుట్టిన వాడు కారాడు మట్టి బొమ్మ' అన్న చందాన మనం వుట్టి పెరిగిన పల్లెటూరి వాతావరణాన్ని మరువద్దని, అసలు మరువలేమని వదలి రాధాకృష్ణ తన కథల్లో ముఖ్యంగా ప్రస్తావించిన అంశం. మన జీవితంలో ఎంత ఉన్నత శిఖరాలు అధిరోపించినా, జీవన పోరాటంలో తమ బాధ్యతల్లో తలమునకలౌతున్నా వయసు పై బడినా కూడా తమ జ్ఞాపకాల్లో గ్రామంలో వుట్టి పెరిగిన వారు మాత్రం గ్రామీణ జీవనాన్ని మరచిపోరు. ఎప్పటికైనా, జీవిత చరమాంక దశలోనైనా మరల గ్రామీణ వాతావరణంలో ఉండాలన్న తపన ప్రతి ఒక్కరిలో కనపడుతుంది.

ఈ విధంగా వదలి రాధాకృష్ణ తన కథల్లో గ్రామీణ జీవన విధానాన్ని, జీవనశైలిని, జీవన సరళిని ప్రజలు మరచిపోలేని విధంగా మనం కూడా ఒక్కసారి వెనక్కి తిరిగి చూసుకునేలా రచన సాగించారు.

ఆధార గ్రంథములు :-

- 1) అంతర్వేతనం కథా సంపుటి - వదలి రాధాకృష్ణ
- 2) మనసు మూలాల్లోకి కథా సంపుటి - వదలి రాధాకృష్ణ



వదలి రాధాకృష్ణ 'అంతర్వేతనం' కథా సంపుటి - పాత్ర చిత్రణ

డా॥ అంతిపల్లె జ్యోతి-శ్రీర నాయుడు,
ఆంధ్రోపన్యాసకులు,
ఐ.ఎ.ఐ.సి.టి. కె. వై.సి.ఐ.సి. కాలేజి,
బీరాల, ప్రకాశంజిల్లా

కథను వదిపించేవి పాత్రలు. రచయిత తన సృజనాత్మక కృతిలో పాత్రల్ని సృష్టించాడు. పాత్రలు సహజంగా వుండాలి. సమాజంలోని వ్యక్తుల్ని ప్రతిబింబించాలి. పాత్రల ద్వారా రచయిత చెప్పదలచుకున్న విషయం నేరుగా పాఠకుణ్ణి చేరుకుంది. ప్రభావితం చేస్తుంది. వారి ఆలోచనల్లో మార్పు తెచ్చింది. మానవ నైజాన్ని, అందుకు గల కారణాలను అర్థం చేసుకొనే ప్రయత్నంలో కథలను రచించిన వదలి రాధాకృష్ణ పాత్రల్ని అదే దృష్టితో ముందుకు.

కథ వదవడం అయిపోయిన తర్వాత కూడా మన కళ్ళ ముందు ప్రత్యక్షం అయ్యేవి అయిన పాత్రలు. పాత్రలకు ఉన్న పేర్లు మన మనసుని ప్రభావితం చేస్తాయి. అంత వక్రి ఈ కథలోని పాత్రలకు ఉంది. అవీయంగా కథలో పాత్రల్ని ప్రవేశపెట్టడం వదలి వారి పాత్ర చిత్రణా నైపుణ్యం.

కథలో అమిడి పోయే పాత్రలు, తగు పాత్రలు బలయినంత హృద్యంగా, సమానంగా, కథను పాఠకుల చేత ఆసాంతం చదివించేంతగా పాత్రలు ఇందరికీ రిథా బెదిల్పము. ఈ బెదిల్ప భోజనలో పాత్రలు ప్రవేశపెట్టడం వదలి వారి పాత్ర చిత్రణా బెదిల్పము.

ఈయన కథా సంపుటాలన్నింటిలోని పాత్రలు సమాజంలో నిష్ఠుర జరిగే, కుటుంబాల్లో జరిగే పాత్రల వంటివే. ప్రతి సంపుటిలోని ప్రతి కథా చదువుతున్నప్పుడు అన్ని రకాల పాత్రలు మన కుటుంబంలో బెదిల్పొయినప్పుటికీ, మిగతా కుటుంబాల్లో, సమాజంలో మనం చాలాపు యాసిన పాత్రలలాగే వున్నాయి. అయితే వాటిని కొత్త కోణంలో రకరకాల సమస్యలతో, రకరకాల పరిష్కారాలతో మనముందు ఇందారు వదలి రాధాకృష్ణ.

కథలోని ప్రధాన పాత్ర ద్వారా మొత్తం వదవడం మొదలు, చివర ఆ పాత్ర ప్రాధాన్యత ఉండటం ఆ కథ యొక్క ఆయువు పట్టు.

జోగారావు :

అంతర్వేతనం కథా సంపుటిలోని 'శ్లేషసౌభం' కథలోని ప్రధాన పాత్ర జోగారావు. ఒకమాట మనం మాట్లాడినా, సలహా ఇచ్చినా ఎదుటి వారి జీవితాన్ని మంచిగా ప్రభావితం చేసే చిధంగా ఉండాలి. మంచి స్నేహితుడిగా, మంచి సలహాదారుగా తన స్నేహితులకి మంచి, చెయ్య చెప్పు వారిలో రదిసిపోయే పాత్ర జోగారావు. ఏదైనా ఒక మంచి పని చేస్తే అది స్వాక్షరపూరితంగా చేపటం మనకు మాత్రమే ఉపయోగపడటం కాక సమాజ హితానికీ ఉపయోగపడాలనేది జోగారావు మనస్తత్వం.

జోగారావుతో సమానంగా ఉద్యోగం చేసే శౌరికి ఒక మంచి సలహా అస్తాడు జోగారావు. జోగారావు అర్థికంగా వెనుకబడినవాడు. కానీ శౌరి మాత్రం అర్థికంగా ఒక స్థితిలో వున్నవాడు. అయితే ఎప్పుడూ



మంచి సలహాల్నిచ్చే జోగారావుతో 'రెయ్ జోగీ నేను ఒక మంచి పని చేయాలనుకుంటున్నాను దానికి నీ సలహా కావాలంటారు. జోగారావు వెంటనే అందరూ దేవాలయాలని అదనీ ఇదనీ పరిగెత్తుతారు. కానీ నీవు మాత్రం మానవసేవా మందిరం నిర్మించి నలుగురి పేద వృద్ధులకి ఆశ్రయం కల్పమంటారు శారితో.

పెద్దమనసు ఉన్నా అర్థికంగా పెద్దకాటీని జోగారావు తన స్నేహితుని ద్వారా సమాజానికి మేలు చేసే రార్హకమం చేయమనటం ఆ పాత్ర యెప్పు టెదిత్యాన్ని తెలుపుతున్నది. అదిదే శ్లేశ సాధంగా వెలిగి ఓశ్లేజోహోమగా రూపుదిద్దుకుంది.

మీనాక్షి :

అంతర్జీవ సంప్రదించి 'నేనున్నాను' కథ ద్వారా మీనాక్షి పాత్రను పరిచయం చేశారు రచయిత. సంస్కృతి సంప్రదాయాలు అతరబిసిన క్రోత్రియ కుటుంబం మంచి వచ్చిన కాన్సానుగు గృహిణి. వరుపు తప్పవే అయినా బోకణ్ణానం తెలిసిన పిల్ల. పట్టాల్ని పెన్సివేసుకొని భార్యగా అత్తగారింట్లో కాలుపెడుతుంది మీనాక్షి

మీనాక్షి సంస్కారవంతమైన పిల్ల. కానీ పట్టాల్ని అంత సంస్కారవంతుడు కాదు. భర్త చేసే అనంబర్ల చర్చలను సహనంగా భరిస్తూ కాలం కలిసిరానాఅనే జలోచన కళ్లన అమ్మాయి, తొందరపాటు లేని మీనాక్షి సమయం కోసం, మనుషుల్లో మార్పుకోసం చూస్తుంటుంది. భర్త ఆక్రమ సంబంధం పెట్టుకున్నాడని తెలిసినా భర్తలో మార్పుకోసం ఎదురు చూసే సహనమూర్తి మీనాక్షి

భర్త వెళ్తున్న వేళ్ళకి ఎయిడ్స్ ఉందని తెలియడంతో భర్త వేళ్ళకు చూరచుయ్యి ఇంటి పట్టున ఉంటున్నాడని సంతోషిస్తుంది. కానీ సామాజిక స్పృహ ఉన్న మీనాక్షి వేళ్ళని ఎయిడ్స్ కారణం చేత ఊరి నుండి వెలివేస్తున్నాడని తెలిసి, సాటి స్త్రీగా ఆమె మీద జాలి కలుగుతుంది.

నిన్నటి వరకు ఆమె చూపులకు పరితపించే వారంతా, ఆమెను ఆ పరిస్థితికి తీసుకువచ్చిన వారంతా అంటే ఇఖరికి ఆమె భర్తతో సహా ఆమెను అదుకోకపోవడం చూసి చలించిపోతుంది. వేళ్ళకు తనవంతు అర్థిక సహాయం చేసి అడుకుంటుంది. గృహిణి అంటే ఎంత సహనంగా ఉండి నమస్కలను ఎదుర్కోవాలో తెలిపే పాత్ర మీనాక్షిది.

విరజ :

'మనసైన మగువ' కథలో నాయిక పాత్ర. విరజ లీడింగ్ లాయర్ విశ్వనాథం గారి అమ్మాయి. డిగ్రీ పూర్తి చేసి కమనీయమైన కిలలు కంటున్న కుందనపు బొమ్మ కడిగిన ముక్కం. అందానికి తోచు చలాకీతనం, చురుకుకనంతో చాలా అందంగా ఉంటుంది విరజ.

విరజ వాళ్ళింటికి వంకీ అన్న ఇతను అద్దెకు వస్తారు. కుటుంబ కల్లబాల్లతో, సమాజంలో తన తండ్రి పరవతి వలన పర్ధతిగా పెరిగిన పిల్ల విరజ. కానీ వంకీ వారించితి ఆద్దెకు వచ్చిన దగ్గర నుండి కూతురిలో మార్పు గమనిస్తుంది విరజ తల్లి.

వంకీ కూడా చాలా చుంచువాడు. వృద్ధివృద్ధం ఉన్నవాడు. అయితే తొలిచూపులోనే విరజ, వంకీ మనసులు కలుస్తాయి. కానీ సంస్కారం, విజ్ఞత వున్న, బాధ్యత కలిగిన యువకుడిగా తొందరపడని



వదలి రాధాకృష్ణ రచనల్లో కథాకథనం - సామాజిక స్పృహ

డా|| లంకివల్లె జ్యోతీశ్వర నాయుడు,
ఆంధ్రోపన్యాసకులు,
బి.ఆర్.యస్. & జై.ఆర్.ఎస్. కాలేజి,
చీరాల, ప్రకాశంజిల్లా,
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తెలుగు సాహితీ క్షేత్రంలో ప్రాచీన కాలం నుండి అనేకానేక సాహితీ సృజనాత్మక ప్రక్రియలు వెలువడ్డాయి. అందులో కథానిక ఒకటి. విషయ ప్రధాన క్షుప్తత కలిగి పాఠకుల హృదయాంతరాలను కదిలించగల భావేళం వీటి ప్రత్యేకత. ఆ విలక్షణమైన శైలితో రచించబడినవే వదలి రాధాకృష్ణ కథలు.

వదలి రాధాకృష్ణ మంచి సాహితీ వ్యక్తిత్వం కలవారు. కథకుడిగా, కవిగా నటుడిగా చిన్నరీతులలో ప్రతిభ కలవారు. అతను చేపట్టిన అన్ని ప్రక్రియలలో పాఠకులకు ఆలోచన కలిగించే విధంగా సామాజిక చైతన్యం తేవాలన్నదే తాను రచనల్లో కనిపిస్తుంది.

ఇలిపృత పరిచయం :- ఉమ్మడి అవగాహన, కట్టుబాట్లు సంప్రదాయం, గౌరవం పట్ల అందరికీ అవగాహన ఉన్న గ్రామాన్ని దత్తత తీసుకొని ఉద్ధరిద్దామనుకున్న లండన్ డాక్టరు గారు తానే ఆ ఊరికి దత్తుడైన వైనం చెప్పిన 'మనసు మూలాల్లోకి' కథ. విదేశీ వ్యామోహం నుండి విముక్తులై గాంధీ గారి గ్రామ స్వరాజ్య బాటలోకి రావాల్సిన ఆవశ్యకతను ఈ తరానికి తెలియజేస్తుంది.

కులం, మతం, భాష, ప్రాంతం అంటూ గిరిగిసి కూర్చున్నప్పుడు మనసు విశాలం కాదు. వీటిని అధిగమించినప్పుడు మనిషి మనిషిగా మారగలడు అన్న సత్యాన్ని హృద్యంగా చెప్పిన మంచి కథ 'జీవిత సతేషం'. 'జీవనది' కథలో తాను కోరుకున్న వ్యక్తి తనకు దక్కనప్పుడు దక్కిన వ్యక్తిని గురించి హీనంగా హేళనగా మాట్లాడడం, అతగాడు నీచంగా ఉండాలని కోరుకోవడం మానవ బలహీనత. కానీ ఆ వ్యక్తి సంస్కారం చూశాక తన చిన్నతనం ఆర్థమౌతుంది ఇందులో.

భార్యను, కుమార్తెను కోల్పోయిన రాఘవేంద్రరావు తన తల్లిని చూసుకోవడానికి ఆడదిక్కుండాలని అందరి ఒత్తిడితో పెళ్లికి ఒప్పుకుంటాడు. రూపవతి అయిన ఆమె భైస్యస్థితిని ఆసరా చేసుకొని పెళ్లాడడం ఇష్టం లేక తన కొడుకీచ్చి వివాహం జరిపిస్తాడు. అతనిని ఎంతో సంస్కారవంతునిగా చెప్పిన కథ 'పూలవాన'. ప్రపంచీకరణ ప్రభావంతో కోస్తా తీరప్రాంతాల్లో పచ్చగా కలకల్లాడే పంట పొలాలు కనుమరుగై పోయి రొయ్యల కయ్యలు విస్తరించి, మధ్య దళారీలు లక్షాధికారులై ఉత్పత్తిదారులు బికారీలుగా మారిపోతున్న విధానాన్ని తెలియజేసే కథ 'తొలిపొద్దు కల'. ఇంట్లోని ఖాళీ పోర్షన్ అద్దెకిచ్చినట్లు తన గర్భనంచిన పది నెలల పాటు కిరాయి పందాన్ని పోషించి, బిడ్డను కనిపెట్టేందుకు మాతృత్వపు మమకారాన్ని పణంగా పెట్టిన కథ 'సింగి నీడలు'.

తల్లిదండ్రుల మాటకాదని ప్రేమించిన యువతిని పెళ్లాడి విధివంచితుడైన కొడుకు, అతని పిల్లలు.



అతని ఓదార్పు కోసం, పసిపిల్లల రక్షణ కోసం పరిస్థితుల ప్రభావాన గడ్డ కట్టిన రాయిగా మారినా తరువాత పెద్దలు బాధ్యత గురైరిగి ప్రపల్లించిన తీరు తెలిపిన కథ 'చలువరాయి'. 'ముసుగు'లో తండ్రి నిరంకుశ, నిర్లక్ష్య ప్రవర్తన పట్ల విలక్షిత పెంచుకున్న కొడుకు కన్పిస్తాడు. పెద్దల బాధ్యతారాహిత్యం కుటుంబ వ్యవస్థని ఎంత ప్రమాదకర పరిస్థితిలోకి తోస్తుందో వివరించే ప్రబోధాత్మకమైన కథ. అభిప్రాయాలు కలపక విడిపోయిన దంపతులు తిరిగి ఒకటవ్వాలన్న ఆలోచన వచ్చినా, మంచి స్నేహితులుగానే మిగిలి పోవాలనుకునే ఇతివృత్తం గల కథ 'ఇలానే బాగుంది'. ఇంట్లో ఏదిపోయినా పని పనిపిసి అనుమానించడం మామూలు. అది ఇంటి దొంగ పని అని తెలిసినా పైకి చెప్పుకోలేక మానసిక క్షోభకు గురౌతామని తెలిపే కథ 'దొంగ'.

ఇదేగాక ఇంకా అనేకమైన ఇతివృత్తాలు మనకు వదలి రాధాకృష్ణ కథల్లో కన్పిస్తాయి.

కథను ప్రసన్నంగా నలుగురుకు అర్థమయ్యే రీతిలో వ్రాయడంలో ఆయనకు ఆయనే సాటి. 'అల్పాక్షరాల్లో అనల్పార్థ రచన' అన్నట్లు వదలి రాధాకృష్ణ కథలలో క్లుప్తత చోటు చేసుకొని పాఠకుల మన్ననలను పొందింది. వదలి రాధాకృష్ణకు కవిగా, కథకుడిగా ప్రత్యేక గుర్తింపు ఉంది. ఈయన కథలు రాశిలో తక్కువైనా వానిలో గొప్పవి, ప్రముఖమైనవి. దానికి కారణం రాధాకృష్ణ కథలలోని వాస్తవ జీవిత చిత్రణమే. ఈయన తన కథలలో సమాజంలో ఉన్న అన్ని రకాలైన సమస్యలను ఎత్తి చూపించే ప్రయత్నం చేశారు. ఈ ప్రయత్నంలో భాగంగా కొన్ని సమస్యలకు పరిష్కార మార్గాలను కూడా చూపించారు. వదలి రాధాకృష్ణ కథలలో మరో గొప్ప లక్షణం సామాజిక స్పృహ కలిగి ఉండటం. వాస్తవికతను విస్మరించిన వాళ్ళ స్థితిని గ్రహించి వదలి రాధాకృష్ణ మధ్య తరగతి జీవన స్థితి గతులను వివరిస్తూనే, వ్యవస్థలోని లోపాలను ఎత్తి చూపించారు. ఈయన కథలలో పాత్రలు చాలా భాగం సమాజానికి మన వంతు సాయం ఎంతో కొంత చేద్దామనే భావనకు లోనయ్యేవి.

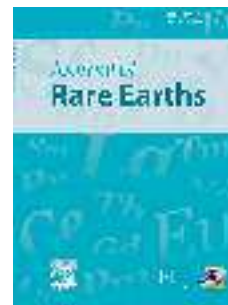
ఈ విధంగా సమాజంలో సభ్యునిగానే గాక కథకుడిగా తమ వంతు బాధ్యతను నిర్వహించి ఉత్తమ కథకుల కోసలోకి చేరారు వదలి రాధాకృష్ణ.

సామాజిక స్పృహ: సర్వ సాధారణంగా రచయితలు తాము తీసుకునే ఇతివృత్తం ఎప్పుడూ సంఘ సంబంధమైనవే ఉంటాయి. అంటే తన చుట్టూ ఉన్న సమాజ సంబంధమైన, వాస్తవమైన గాథలకు కొందంత కల్పన జోడించి రచించే ఇతివృత్తమే సస్సువు కావటం జరుగుతుంది. కాబట్టి సామాజిక స్పృహ అనేది రచయిత వాస్తవికమైనపరిధిలో సుంచే ఇతివృత్తాన్ని స్వీకరించినట్లు ధృవీకరించవచ్చు. అయితే వాస్తవంతోపాటు అయా రకాలయిన ప్రక్రియల్లో పరిశోధనా పరిధి మేర వినిపించడమే ఒక ప్రత్యేకత ఇది. పరిశోధకుల పరిణతి మేర జరిగే విభజన.

సామాజిక స్పృహ అంటే సంఘ సంబంధమైన జ్ఞప్తి, ఇచ్చి, గాఢమైన కోరిక అనేది నిఘంటువులోని అర్థాలు. 'రియలిజమ్' అనే ఆంగ్ల పదానికి తెలుగు వాస్తవికత అంటే స్థూలంగా జీవితాన్ని ఉన్నదున్నట్లుగా చిత్రించడం అనవచ్చు. ఇందులో కనిపించే సాహిత్యం లో కళ్ళకు కట్టేటట్లు వ్రాయడం అనవచ్చు.

అంటే రచయిత తాను అహరహం సామాజిక జీవితాన్ని, సమాజం లేనిదే తాను లేనని తన ఉ నికిని, తన భద్రత, తన అభ్యుదయం, సర్వస్వ సమాజ శ్రేయస్సు మీదనే ఆధారపడి ఉంటాయని అలాంటి శ్రేయస్సును చేకూర్చడానికి తాను ఒక సమీధను సమర్పించాలని నిరంతరం సమాజ సంబంధ చైతన్యంతో

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Spectral change and far-red emission of Mn^{2+} ions co-doped $\text{NaSrB}_5\text{O}_9:\text{Dy}^{3+}$ luminescence material for plant growth LEDs

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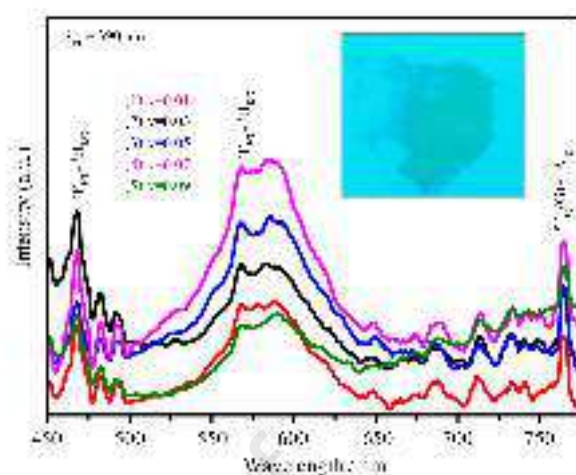
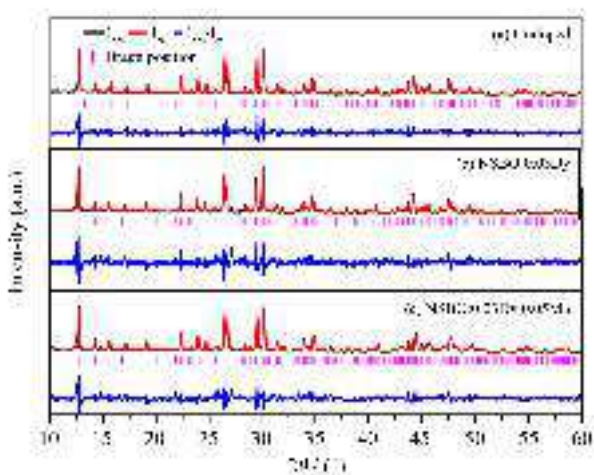
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Spectral change and far-red emission of Mn^{2+} ions co-doped $NaSrB_5O_9:Dy^{3+}$ luminescence material for plant growth LEDs

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ABSTRACT

Due to the characteristic emission of phosphors, phosphor-converted LEDs have been employed to provide the requisite light sources for indoor plant growth in the optical agricultural industry. Here in, we prepared a series of Mn^{2+} co-doped $NaSrB_5O_9:Dy^{3+}$ phosphors via a solid-state reaction method. These phosphors have significant three-band emissions at 467 nm (blue region), 606 nm (orange region), and 765 nm (far-red region), ascribed to the $4F_{9/2}-6H_{15/2}$ and $4F_{9/2}-6H_{13/2}$ transitions of the Dy^{3+} ions and the ${}^4T_{1g}(G)-{}^6A_{1g}(S)$ spin-forbidden transition of the Mn^{2+} ions, respectively, when excited by light of 376 nm (near-UV region). The co-dopant in the host material facilitated tunable photoluminescence (PL) due to energy transfer from the Dy^{3+} ions to the Mn^{2+} ions. The three emission peaks from the prepared phosphors were well matched with the absorption spectra of the photosynthesis pigments of plants, chlorophyll and phytochrome, can absorb blue (400–500 nm), orange-red (550–700 nm), and infrared (IR) radiation, indicating that these phosphors have potential applications in the fabrication of plant-growth LEDs. Prior to the PL studies, the structure of the phosphors was determined by X-ray diffraction, refined by Rietveld method and chemically quantified by X-ray photoelectron spectroscopy.

KEYWORDS: Phosphors; refinement; X-ray photoelectron spectroscopy; energy transfer; plant growth LEDs.

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1. Introduction

In recent years, increasing attention has been paid to indoor plant growth that provides a stable growing environment and prevents from damages due to the natural calamities including droughts, foggy weather, and floods [1]. Naturally, the light is indispensable to indoor plant growth and research reports on plant cultivation revealed that the photosynthesis pigments of plants, chlorophyll and phytochrome, can absorb blue (400–500 nm), orange-red (550–700 nm), and infrared (IR) radiation, respectively [2,3]. Light that matches the absorption spectra of plant photosynthesis and photomorphogenesis can be obtained by light emitting diodes (LEDs) using various phosphors. The LEDs with blue and orange-red emissions that serve as light sources for plant growth in the absence of sunlight are called plant growth LEDs. Additionally, LEDs are distinctive in energy consumption, highly efficient, long-lasting, and eco-friendly from the conventional lamps [4, 5]. Basically, plant growth LEDs can be fabricated by two methods. The first method is the combination of a blue LED chip and a red LED chip. The promising second method is the coating of phosphors on the LED chip, known as phosphor-converted light-emitting diodes (pc-LEDs). The former method has several limitations such as the requirement of different drive circuits for both semiconductor LED chips to maintain a constant ratio of blue and red emission, aging time, and the halo effect due to different characteristics of LEDs. Using the latter method, the desired emission could be obtained by two approaches. The first is to combine the blue light emitting chip with the red emission phosphor, and the other is to fabricate blue and red emission phosphors coated on the near-UV chip/single phosphor with both emissions [6,7]. The pc-LEDs are designed with near-UV LED chips and single emission phosphors have more efficiency as compared to the multiple phosphors. Thus, the LEDs with dual-emission and single-phase phosphors are considered as prospective light sources for plant growth, in which the phosphors play a vital role of spectral convertors. The critical part of the fabrication of plant growth LEDs is the selection of the phosphor, whereby the spectra, luminous efficacy, and lifetime are determined. For instance, the photoluminescence of dual emission of single-phased phosphors depends on the various parameters such as doping of rare earth and/or transition metal ions, the structure and crystal fields around the activator, and co-activator ions in the host materials.

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Construction of multi-level data aggregation trees for energy efficiency and delivery delay in machine-to-machine communications

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Abstract

Machine-to-Machine (M2M) communications have gone forth as the newest technology for succeeding in communication generations. The M2M connections use the sensor nodes to capture an event into data packets and relayed through a network. The sensor nodes consume more energy whenever the increase in data packets transmitted from the sensor nodes in the system. To reduce the energy utilization applying the data aggregation is essential. We proposed a comprehensive model for calculating energy utilization and delay-tolerance by using Multi-Level Data Aggregation Trees (MLDAT). In the proposed scheme, the first stage is about the construction of Multi-Level Data Aggregation Tree, which aggregates the data originated from various wireless sensor nodes in the communication network. In the second stage, a delay-tolerant scheduling algorithm for controlling the delivery delay for user queries presented. Ultimately, the simulation results of the proposed scheme show that the suggested algorithms have better performance than the existing state-of-the-art approaches significantly.

Keywords Sensors · Machine-to-machine(M2M) communication · DAT · Energy consumption · Network delay

1 Introduction

The Machine-to-Machine(M2M) communication network involves thousands of sensors connected to the core network via a select node called *Sink node or gateway node*. The battery-operated devices monitor the environmental conditions corresponding to their position, transfer the collected data to the *gateway node*, process this data, and deliver information to Application Server. The sensor nodes can organize by themselves, providing access outside and watchdog environments. In this way, the M2M communications are getting attractively for several application areas such as health-monitoring, farming, aviation, water contamination- monitoring, crowd-monitoring and Building Monitoring Systems (BMS), etc.,

However, thousands of devices, combined with sensors, result in multiple target analysis or unnecessary data transmissions in the communication network. Therefore, the more nodes

squander energy very quickly. The approaches, such as dynamic routing, medium access control, and resource allocation of communications, reduce the energy consumption of sensor nodes [1, 2]. The scheduling algorithms of the wireless sensor nodes can efficiently manage the power consumption of the communication network [3–7]. The information collecting mechanism can utilize data aggregation functions to reduce unnecessary communications. The data sensed by multiple wireless sensor devices have temporal and spatial interactions [8, 9] due to only a few sensor devices are scheduled to transmit the data packets. The other sensor nodes are in the sleep state.

Several empirical studies stated that hierarchical network topology is efficient for sensor nodes to collect data and transmit to the *gateway node* [10]. A tree-based topology is expensive for storing routing tables at each node with limited resources compared to an arbitrary network topology [11]. The data aggregation tree structure's saving ability to implement aggregation functions is likewise referred to as data aggregation trees (DATs). DATs have *gateway node* as root, these are directed trees and receive a distinct route from every sensor device to the *gateway node*. Furthermore, in data aggregation trees (DAT), the sensor nodes gather data from various wireless sensors that are fused at intermediate wireless sensor nodes, as stated by the data aggregation functions such as MAX, MIN, SUM, AVERAGE, COUNT, etc. [12].

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Data Aggregation technique is applied to lower total energy consumption in the communication networks. Mottola et al. described an energy-saving routing algorithm, which states that the data aggregation becomes better up to 70% of network life for the entire wireless network the real-world experiment results. But there is a significant effect of data aggregation, where the delays for processing the user queries with data aggregation increase about four times. Shin-Yeh Tsai et al. studied timing control, in which time is taken to buffer packets. The maximal number of buffered data packets is to take into account data aggregation [13].

The rest of the paper is structured as follows. Section 2 specifies the literature survey on data collection and data aggregation in the M2M Communication networks. Section 3 presents the details of the problem statement and the system environment. Section 4 presents the aggregation tree construction algorithm and delay tolerance model and examine development issues. The simulation environment and results are analyzed in Section 5. The conclusion and future directions are given in Section 6.

The primary contributions of this article are pruned as follows:

- We distinguish the problems when constructing the Multi-level data aggregation tree (MLDAT) for the M2M communication network. Furthermore, we proposed two algorithms to measure minimum data transmissions and also minimal latency for user queries.
- Construction of the Multi-level Data Aggregation Tree problem, it is a well-known NP-Complete. We work out this problem in two stages. On the stage1, we compute aggregating nodes obtained by the combination of Maximal Independent Set with minimal load, LBMIS(I), and set connectors denoted as CMIS(C). Next, in stage2, Load Balanced Parent Node Assignment LBPNA, which is NP-Complete, we provide an approximation solution.
- In addition to this, we proposed a Delay Tolerant Scheduling Algorithm based on the periodic per-hop method.

2 Related work

In the Data Aggregation Trees (DAT), most research studies focus on scheduling algorithms to transfer the data packets from sensors to the *gateway node*. The Data Aggregation Tree construction problem is NP-Complete Problem only fewer approaches are available for constructing the Optimistic Data Aggregation Trees. By this motivation, we try to study the construction of Data Aggregation Tree for the objective of energy efficiency and delivery latency in the wireless communications network.

The energy consumption of sensor nodes is cut by the dynamic nature of the wireless channel consuming energy due to loss of packets and retransmissions [14]. Cognitive Radio sensors may be efficient in adapting varying channel situations, which would surge transmission efficiency and lower the power consumption used to transmit and receipt [15, 16].

Many researchers have conducted several experiments on node scheduling approaches in the M2M communications, and all those schemes work based on the assumption that sensor nodes are stationary. So, these systems cannot be applied to the M2M applications in which there is a requirement of mobility in wireless communication devices, for example, health control. In [17–20], the studies are illustrated cluster-based scheduling algorithms for the need for movement.

In [4], a cluster-based energy-efficient, mobility-centric node scheduling scheme is (CENM) proposed to network coverage by keeping minimal node inactive and minimizing the total failures by selecting different cluster gateway nodes. Several Data Aggregation Models have aimed for the development of Data Aggregation Trees (DAT) for WSNs. Ding, Min et al. recommended energy-aware distributed heuristic to generate the aggregation tree (EADAT) [21]. It makes use of neighboring broadcast scheduling and distributed competition with neighbors. Kumar Padmanabh et al. introduced an algorithm that is flexible to opt one of the aggregations depends on the scheme and degree of data aggregation based on network traffic [22].

Yao Lu et al. proposed a spanning tree called Multi-Objective Steiner Tree (MOST) based on some standard metrics. A heuristic method Jumping particle swarm optimization is suitable for a static objective, but in practice, if the targets are frequently changed, then it incurs more overhead [23]. Randhawa et al. also suggested analyzing the results of tiny aggregation to reduce energy consumption and increase the network lifetime. It is only suitable for fixed connections in small networks. In the case of lossy link radio connections, it results in poor performance [24].

Mohsenifard et al. proposed a data aggregation tree (DAT) using a cuckoo optimization algorithm that did not consider the load–balance factor [25]. In [26], monitoring hierarchical trees became easy. Still, when moving out from the cluster head, the number of nodes increased enhanced relay routing in which the data packets relayed among sensor nodes, taking too much delay for user queries. In the case of duty-cycled WSN, Le et al. [27] proposed a level order tree-based scheduling scheme for delay tolerance, which having more computations overhead for scheduling.

Zhaohui et al. [28] and Lu, Yao, et al. [29] proposed a data aggregation scheme for heterogeneous wireless sensor networks concentrating on local tree topology and maintenance. Also, in [30] Kale et al., proposed scheduling technique with local heuristics approach both are having improvements in the centralized and static network topology. Still, in practice,

WSN links are dynamic, and connections are lossy link nature.

Compressive Sensing is an advanced signal processing technique, in which data sets process efficiently and accurately by acquiring, storing, fusing, and processing slowly. This method, which links data gathering, compression, dimensionality reduction, and optimization, has drawn significant attention from researchers and applied scientists in several fields. The CS-based aggregation solution improves energy efficiency [31]. The energy consumption models are summarized in Table 1.

3 System model and problem definitions

In this section, we depict the overall construction of the MLDAT under the lossy link network model. First, we listed the assumptions commonly present in the network model, followed by the formal definition of the problem and some remarks on the issue.

3.1 Assumptions

We assume the M2M Communication network as a connected graph $G(V, E)$, where $V = \text{Error ! Bookmark not defined.}$ are the set of sensor nodes, and E denotes the lossy wireless connections among the nodes. In the sensor nodes, v_0 indicates the gateway node, unlike the other nodes, the gateway node has a continuous power supply. Every node except the gateway node (v_0) powered by a non-removable battery.

All the nodes at any point in time they can determine their residual energy. We assume every node in the network has the same transmission range \mathbb{R} . If there is an edge between any two nodes $i, j \in V$ then the distance between them is denoted by $l_{ij} \leq \mathbb{R}$. In addition to this, we assume no node failure and also no duty-cycles.

The n nodes monitor the environment in the deployed area and periodically send the gathered data to gateway node v_0 along with the MLDAT routing structure. Every node prepares a data packet of size B -bits during each report. Non-leaf sensors aggregate different incoming data packets, along with its data packet into a single outgoing data packet. Also, we assume the data gathering rate of any node v_i is γ_i . Also, \mathbb{R} represents the maximum data receiving rate of all the sensors.

3.2 The network model

In a lossy-link network model, we denote the communication network as connected undirected graph $G(V, E, P(E))$, where $V = V_s \cup \{v_0\}$ and $V_s = \{v_1, v_2, \dots, v_n\}$ is a collection of $n + 1$ nodes, any sensor node is denoted by v_i , where $0 \leq i \leq 1$. The communication links indicated as E is the set of lossy links $\forall v_i, v_j \in V_s$, there exists a link (v_i, v_j) in G iff:

1) Both v_i and v_j stay within wireless radio transmission range, also.

2) $l_{ij} > 0$, as every link $(v_i, v_j) \in E$, l_{ij} denotes the probability that v_i can straightly transfer a data packet towards v_j successfully; as well as

$$P(E) = \{ l_{ij} \mid (v_i, v_j) \in E, 0 \leq l_{ij} \leq 1 \} \tag{1}$$

In the network all the sensor nodes can send data packets by forwarding through the intermediate nodes, in that case, we define 1-hop neighborhood $\{N_1(v_i)\}$ as the data packets can reach by one-step to the destination also k-hop neighborhood $\{N_k(v_i)\}$ set as the data packets can reach by k-steps to the target in the wireless sensor network.

3.3 Problem definition

The primary goal of the proposed Multi-Level Data AggregationTree (MLDAT) construction problem is to reduce energy consumption and prolong the network lifetime to accomplish this measurement of every node's traffic pattern and

Table 1 Summary of the Related Work

S. No	Approach	Energy consumption	Delivery Delay	Network lifetime	Scalability
1	Cognitive radio	✓	×	×	×
2	Sleep node scheduling	✓	×	×	×
3	Relay nodes	✓	✓	✓	×
4	Deterministic Network Model	✓	×	✓	✓
5	Periodic simple and Periodic Per-Hop	✓	✓	×	×
6	MAC: EER-ACK	✓	×	×	×
7	Approximation or Heuristics Algorithms	×	✓	✓	✓
8	Clusters Hierarchical Aggregation	✓	×	×	×
9	Compressive Sensing (CS)	✓	×	×	✓

workload network. We can distinguish the network traffic load for internal nodes and leaf nodes. Compared to the leaf nodes, Internodes have more workload on them. We can measure the potential traffic load of every node by using the *potential load* factor of that node.

As earlier stated in Section 1, based on the number of neighboring nodes connected to a node is an indicator of its traffic load. However, in the lossy-link wireless sensor network, some other components also there to cause *potential load* on sensor nodes. Consider the example, if $l_{ij} = 0.25$, then the expected number of transmissions is $\frac{1}{0.25} = 4$ to guarantee v_i to transfer one data packet to v_j . If l_{ij} valueless, then potential traffic load on v_j from v_i is more. Thus, a more admissible as well as formal definition of the *potential load* presented as follows:

Definition 3.1: Potential Load (ρ_i). $\forall v_i \in V_s$, the potential load of v_i defined as:

$$\rho_i = \sum_{v_j \in N_1(v_i)} \left[\frac{B}{\gamma_i} \right] \frac{1}{l_{ij}} \quad (2)$$

The construction of the MLDAT problem solved in two stages; in stage1, we find out the internal nodes of the given M2M communication network. To achieve this, first compute the Maximal Independent Set with minimum *potential load* LBMIS(I), but finding the LBMIS is well known NP-Hard. We can map LBMIS problem just like integer Linear Program LP_{LBMIS}^* As follows:

Definition 3.2.

Let $\omega_i, \forall i \in V$ is a binary decision variable set to 1 if the node is independent; the other is 0.

$$\text{Max } v = \min \{ \rho_i \mid \forall v_i \in I \} \quad (3)$$

$$\text{s.t } \omega_0 = 1;$$

$$\omega_i + \sum_{v_j \in N_1(v_i)} \omega_j \geq 1;$$

$$\sum_{v_j \in N_1(v_i)} \omega_{ij} = 0;$$

$$\omega_i \geq \omega_{ij}; \omega_j \geq \omega_{ij};$$

$$\omega_i + \omega_j - 1 \leq \omega_{ij};$$

$$\omega_i, \omega_j, \omega_{ij} \in \{0, 1\}, \quad \forall v_i, v_j \in V_s$$

In Eq. (3), the objective function for selecting the set of nodes such that the nodes having minimal potential load with the specified constraints represented as relaxed Integer Linear Problem.

Next, we can arrange the LBMIS(I) into several partitions as disjoint sets. Those connected by selecting some other nodes as connectors, which are denoted by C. Finally, the combination of both I and C are called internal nodes or dominating set or Connected Maximal Independent Set CMIS of

the network. In the second phase, we can assign the parent nodes to the internal nodes and the parent nodes to the leaf nodes denoted with A_I and A_L .

Definition 3.3: Parent Node Assignment (PNA) for internal nodes (A_I),

$$A_I = \{I(v_i) \mid \forall v_i \in D, 1 \leq i \leq m\} \quad (4)$$

In Eq. (4), the internal nodes are assigned with parents from the dominant set(D) towards the root node. Also, assigning the parent links for the leaf nodes is a well known NP-Complete. The assignment of leaf nodes to their parent node is done by considering the minimum *actual load* of that particular node.

Let formally define the *actual load* among the *dominating set(D)* of nodes.

Definition 3.4: Actual Load (α_i). The actual load of an internal node v_i is:

$$\forall v_i \in D, \quad \alpha_i = \sum_{v_j \in \{L(v_i) \cup I(v_i) \mid i \neq j\}} \left[\frac{B}{\gamma_i} \right] \frac{1}{l_{ij}} \quad (5)$$

Definition 3.5: Assignment Parent Nodes to leaf nodes (A_L) of lossy-link wireless sensor network denoted by the graph $G(V, E, P(E))$ along with CMIS, $D = \{v_1, v_2, \dots, v_m\}$.

It is required to obtain m disjoint sets from V , denoted by $L(v_1), L(v_2), \dots, L(v_m)$, so that:

1) Each set $L(v_i)$ ($1 \leq i \leq m$) contains exactly one non-leaf node v_i .

2) $\bigcup_{i=1}^m L(v_i) = V$, and $L(v_i) \cap L(v_j) = \emptyset$, ($1 \leq i \neq j \leq m$).

3) $\forall v_u \in L(v_i)$ ($1 \leq i \leq m$) and $v_u \neq v_i$, such that $(v_i, v_u) \in E$.

4) Assign v_1 ($1 \leq i \leq m$) as the parent node of the nodes in $L(v_i) \setminus \{v_1\}$.

Therefore formally we can denote Parent Node Assignment (PNA) for leaf nodes as,

$$A_L = \{L(v_i) \mid \forall v_i \in D, 1 \leq i \leq m\}.$$

We define a decision variable β_i to denote whether the sensor v_i is an internal node or a leaf node. β_i sets to be 1 iff the sensor v_i is an internal node. For remaining nodes, β_i assigned as 0. Moreover, Let select a random variable ξ_{ij} to every edge connecting an *internal node* v_i , a *leaf node* v_j in graph G formed with the lossy-link wireless communication network.

We can define the parent node assignment as standard linear programming LP_{LBPNA}^*

$$\text{Max } v = \min \{ \alpha_i \mid \forall v_i \in D \} \quad (6)$$

$$\text{such that } \sum_{v_i \in N_1(v_j)} (\beta_i \xi_{ij} = 1) \forall \# D$$

$$\xi_{ij} \in \{0, 1\}$$

Table 2 Notations

ρ_i	Potential load of node i
α_i	The actual load of node i
β_i	The decision variable associated with the node i
P(E)	Probability of lossy-link connectivity
A_I	Parent node assignment for Internal nodes
A_L	Parent node assignment for leaf node
I	Maximal Independent Set
C	Connected maximal Indent Set
D	Dominating Set
$N_2(v)$	Two-hop neighbors of node v
B	The size of the data packet (bits)
ξ_{ij}	The random variable associated to the edge between i and j
$L(v)$	Level of vertex v
ω_i	Decision Variable of node i
γ_i	The rate of data packets generated by node i

Therefore, the overall Parent Node Assignment with minimum *actual load* (LBPNA- A^*) is a combination of both A_I and A_L . i.e., $A^* = \{A_I, A_L\}$. After LBPNA is decided, by assigning a direction of each link in the constructed tree structure, we obtain an MLDAT.

In the next section, the solutions for solving the load-balanced MIS(I), connected MIS(C), load-balanced PNA(A^*), and finally, we build the MLDAT.

4 Construction of multi-level data aggregation trees

The construction of MLDAT is designed in two stages. In the first stage, we obtain the *dominating set* (D) of the given Lossy-link wireless communication network graph $G(V, E, P(E))$. In other words, the *dominating set* (D) contains the internal nodes of the MLDAT, including the root node. We can find out the *dominating set* (D) by solving the problem of LBMIS (I) and selecting the *connectors* (C) of set I. We can

represent the LBMIS(I) problem as an Integer Linear Program (ILP) and solve by using the Linear relaxation technique. After that, we can choose some connectors (C) to form the *dominating set* (D). i.e., $D = \{I \cup C\}$.

In the second stage, we have to form parent-child links by keeping the load balance among the nodes. First, we assign the parent nodes among the internal nodes (D) as A_I next, we assign the parent nodes for leaf nodes as A_L . The problem of Parent Node Assignment with minimum *actual load* (LBPNA) of leaf nodes A_L is formally defined as an Integer Linear Program, and it solved by using the random rounding technique.

Table 2 shows the notations used in this paper.

4.1 Approximation algorithm for MIS with minimum traffic load LBMIS(I)

The basic idea of the solution in Algorithm 1 described as given below:

Let solve the linear program of LP^*_{LBMIS} to obtain an optimal solution, which is denoted by

(ω^*, v^*) , (where)

$\omega^* = \langle \omega_1^*, \omega_2^* \dots \omega_n^* \rangle$, also round-off ω_i^* values into integers ω_i render to the six steps.

presented through lines 3–14 of Algorithm 1, also.

v^* denotes the corresponding node.

- 1) Sort sensor nodes by the ω_i^* value (where $1 \leq i \leq n$) in the decreasing order.
- 2) Set the sink node to be the independent node, i.e., $\omega_0 = 1$.
- 3) Fix for all ω_i with 0's.
- 4) Begin with the first node in sorted array P. If no node selected as an independent node in v_i 's 1-hop neighborhood, then set $\hat{\omega}_i = 1$ with probability $p_i = \omega_i^*$.
- 5) Repeat step (4) until the end of array A.
- 6) Again repeat steps 4) and 5) as $\frac{8 \ln(n)}{\min\{\omega_i^* \mid v_i \in \mathbb{V}, \omega_i^* > 0\}}$ many times.

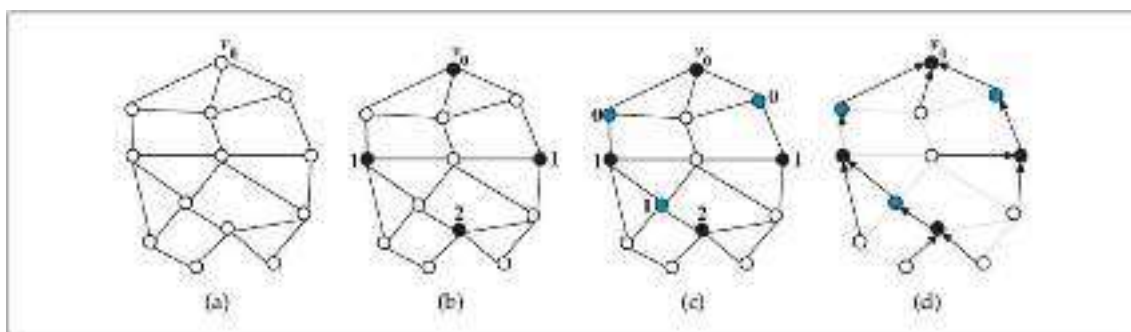


Fig. 1 Illustration of (b) LBMIS, (c) CMIS, and (d) MLDAT construction process

Algorithm 1: Approximation Algorithm to obtain load-balanced MIS(I)

```

1  Solve  $LP_{LBMIS}^*$ , Let  $(\omega^*, v^*)$  be the optimal solution, Where  $\omega^* = \langle \omega_1^*, \omega_2^*, \dots, \omega_n^* \rangle$ ,  $v^* = \min\{\rho_i \mid \forall v_i \in V\}$ ;
2  Sort all  $\omega^*$  values in a non-increasing array. The arranged ids put into an array denoted by  $P[n]$ .
3   $\widehat{\omega}_0 = 1$ ;
4  for  $i = 1$  through  $n$  do
5     $\widehat{\omega}_i = 1$ ;
6     $counter = 0$ ;
7    while  $counter \leq \tau$  where  $\tau = \frac{8 \ln(n)}{\min\{\omega_i^* \mid v_i \in V, \omega_i^* > 0\}}$ 
8     $k = 0$ ;
9      while  $k < n$  do
10      $i = P[k]$ ;
11     if  $\forall v_j \in N_1(v_i), \widehat{\omega}_j = 0$  then
12        $\widehat{\omega}_i = 1$  with probability  $p_i = \omega_i$ ;
13      $k = k + 1$ 
14    $counter = counter + 1$ ;
15 return  $(\widehat{\omega}_i, \widehat{v}_i = \min\left\{\sum_{j: \widehat{\omega}_j l_{ij} > 0} \left\lfloor \frac{\beta}{\gamma_i} \right\rfloor \frac{1}{l_{ij}} \mid \forall v_i \in V\right\})$ 

```

4.2 Connecting load-balanced MIS(C)

After finding the LBMIS(I) one more step is required to obtain the dominating set (D). We have to select the connectors(C). To do this by a similar procedure as in [32], to obtain a minimum set of connected MIS (C) to connect the load-balanced MIS(I).

Partition the LBMIS(I) into disjoint node sets by using the following criterion:

$$I_0 = \{v_0\}(\text{and})$$

$$I_l = \left\{ v_i \mid v_i \in I, \exists v_j \in I_{l-1}, v_i \in N_2(v_j, v_i \notin \cup_{k=1}^{l-1} I_k) \right\} \quad (7)$$

The gateway node is put into I_0 . It acts like the root of the MLDAT, i.e., $|I_0| = 1$. All of the other nodes present in I in a 2-hop neighborhood out from nodes in I_{l-1} are placed in I_l . So, l is termed as the level of the independent node. I_l Represent collection of separate nodes in level l of G corresponding to a node in I_0 . In addition to this, L denotes the maximum allowed levels of independent nodes.

For each level i , where $i \in [0, L - 1]$, assume S_i is a set of neighboring nodes to at least one node in I_i also at least one node in I_{i+1} . Next, find a minimum-sized set of nodes $C_i \subseteq S_i$ to cover all nodes in I_{i+1} .

$$\text{Let } C = \cup_{i=0}^{L-1} C_i \text{ and.}$$

Therefore, finally, $D = \{I \cup C\}$ is the CMIS of the original graph G .

We use the M2M communication network shown in Fig. 1a to illustrate the construction process of a Dominating Set (D). In Fig. 1a, all circles denote the sensor nodes as we specified previously, the construction of MLDAT T having two steps. In the step1, we solve the LBMIS(I) problem using Algorithm 1, which is represented in Fig. 1b as black circles. In step2, we choose appropriate LBMIS connectors (C), expressed as grey nodes in Fig. 1c, for connecting every node in I to form a dominating set (or) Internal nodes of G , denoted as CMIS (D).

$$\text{i.e., } D = \{I \cup C\}.$$

4.3 Load balanced PNA for internal nodes(A_l)

After dominating set (D) finds out, in the next stage, we dedicate to find a load balance PNA for Internal nodes A_l . The following procedure is given:

- $\forall v_i \in C_0$, their parent is to be the gateway node v_0 .
- As per the index non-decreasing order, all $v_i \in C_l$, and $l > 0$, their parent connected to the neighboring node $v_j \in I_{l-1}$, which is having the minimum load.
- As per the index non-decreasing order, all $v_i \in I_l$, and $l > 0$ their parent connected to the neighboring node $v_j \in C_{l-1}$, which is having the minimum load.

4.4 Integer linear program formulation of load-balanced PNA of leaf nodes(A_L)

As we know that, finding an arbitrary data aggregation tree having maximum network lifetime is NP-Complete [27]. Similarly, we can prove that PNA with minimal load for leaf nodes A_L is also an NP-complete. The following randomized

algorithm used to solve the load-balanced PNA for Leaf Nodes, A_L . The formal definition of the load-balanced PNA for Leaf Nodes A_L is explained in definition 3.4. The problem can solve by using the following randomized algorithm.

Algorithm 2: Randomized Approximation Algorithm for load-balanced PNA for Leaf Nodes A_L .

```

1  Solve  $LP_{LBPNA}^*$ . Let  $(\xi^*, v^*)$  be the optimal solution.
   Sort the  $\xi_{ij}^*$  values in each row (for every node) of  $\xi^*$  in the non-increasing
   order and next to keep the corresponding  $j$  ( $v_j$ 's IDs) in two-dimensional array
   denoted by  $P[n][m]$ 
2   $\widehat{\xi}_{ij} = 0$ 
3  while  $k \leq \kappa = \frac{7 \log(n)}{\delta^2 \min\{\xi_i^* | 1 < i < n, 1 \leq j \leq m, \xi_{ij}^* > 0\}}$  do
4   $k = 0, l = 0;$ 
5  while  $k < n$  do
6   $i = k;$ 
7  while  $l < m$  do
8   $j = P[k][l]$ 
9  if  $v_j \in N_1(v_i)$  and  $\widehat{\xi} = 0$  then
10  $\widehat{\xi}_{ij} = 1$  with probability  $\xi_{ij}^*$ ;
11 break;
12  $k = k + 1$ 
13 return  $(\widehat{\xi}, \widehat{v}) = \min\{\alpha_i | \forall_i \in D\}$ 

```

5 Delay-tolerant scheduling model

Once the Multi-level Data Aggregation Tree (MLDAT) is constructed, the aggregation time control mechanism is applied by the Delay-Tolerance function. Consider the following M2M Communication network shown in Fig. 2. Every node gathers information in its location and sent it to the gateway node (Fig. 2b), which further transmits the data to Application Server, as shown in Fig. 2c.

The source node is $N(i)$, $0 \leq i \leq k-1$ relays data m_i , and sends to the gateway node $N(k)$. The data m_i collected by $N(i)$ to be sent to the user by application server by following the Multi-level DAT structure. We present a periodic per-hop aggregation time scheduling algorithm present at each node $N(i)$. The time control for the aggregation scheduling algorithm and delay tolerance process consisting of the following steps:

Algorithm 3: Delay-Tolerant Scheduling Algorithm

1. When $N(i)$ receives the data from its child node $N(i - 1)$ else prepares a data packet to have the data m_i , gathered by $N(i)$ by its own, it keeps the data packets in its buffer.
2. $N(i)$ checks its buffered packets, if the buffered packets are empty, $N(i)$ begins a refresh timer with count T.
3. Suppose the packets present in the buffer is extended to the maximal number of buffered data packets. In that case, $N(i)$ extracts the buffered data packets and aggregates the gathered information into a new data packet (or) If the refresh time reaches 0, then $N(i)$ stops the buffering timer to count T and save the original parcel to its next parent node $N(i + 1)$.

Aggregation Timing Control Scheduling Algorithm considers both the number of buffered packets and the refresh timer for transmitting fresh data packet at a node to overcome long delays for user queries. After collecting data from all nodes, the gateway node $N(k)$, restores the gathering data present in the application server. The gateway node resets the Application Server to minimize the signal overhead in the core network after a new refresh time value denoted by T_{ref} .

6 Performance evaluation

In the construction of Data Aggregation Trees, most of the earlier research works focus on the classical Shortest Path Tree, Minimal Spanning Tree, and Load Balanced Cluster Head Approaches. In this paper, we selected the most dominating tree-based routing models, such as Load-Balanced Data Aggregation Trees (LBDAT) [33], Two-Tier Adaptive

Model Aggregation (TTAMA) [34] and Energy Efficient Spanning tRee (EESR) [35]. The Proposed MLDAT approach is suitable to compare with the selected routing tree structures. We compare all the four algorithms in terms of energy consumption and delay tolerance.

The Simulation environment is having all sensors having the same transmission range of 40 m. Every sensor device randomly distributed in a rectangular area of $200m \times 400m$.

Fig. 2 The Architecture of Machine-to-Machine(M 2 M) Communication Network

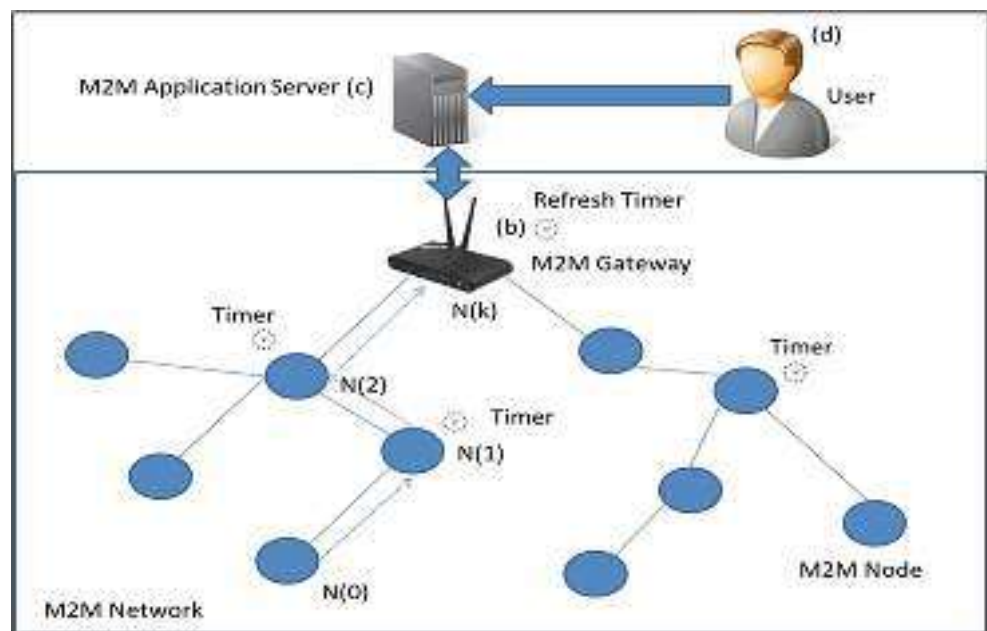


Table 3 Configuration parameters

Parameter	Value
Random value for Wireless Links	[0.5–1.0]
Gateway Position	Top Left
Topology (Grid)	200m × 400m
Network Size	150
Transmission Range	40 m
Energy for receiving	1Unit
Energy for Transmitting	2Units

The results are getting for every different setting, 50 instances obtained, and rounded to integer values. In addition to this, a random value function is taken to assign links among the nodes. If a node is within the transmission range, then the transmission value is [0.5, 1] else it is [0, 0.5]. All the configuration parameters have listed Table 3.

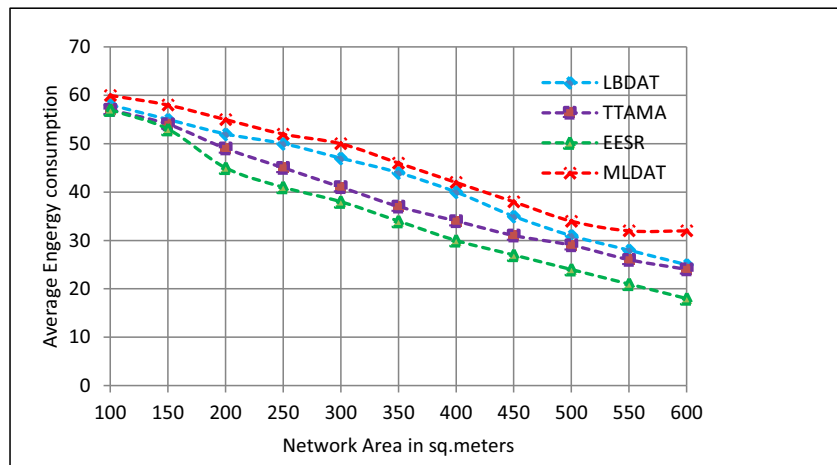
Among all the parameters network Area, number of nodes, and transmission range are tunable parameters. The implementation of the proposed MLDAT model is evaluated using NS-3 tools and Python programming language, and the configuration parameters parsed by using an XML File.

We evaluate the performance of MLDAT with the state-of-art DAT models such as LBDAT, Energy Efficient Spanning Tree (EEST), Two-Tier Aggregation Multi-target application Trees (TTAMA). The proposed MLDAT Model has better performance for energy consumption and delivery delay than the existing algorithms.

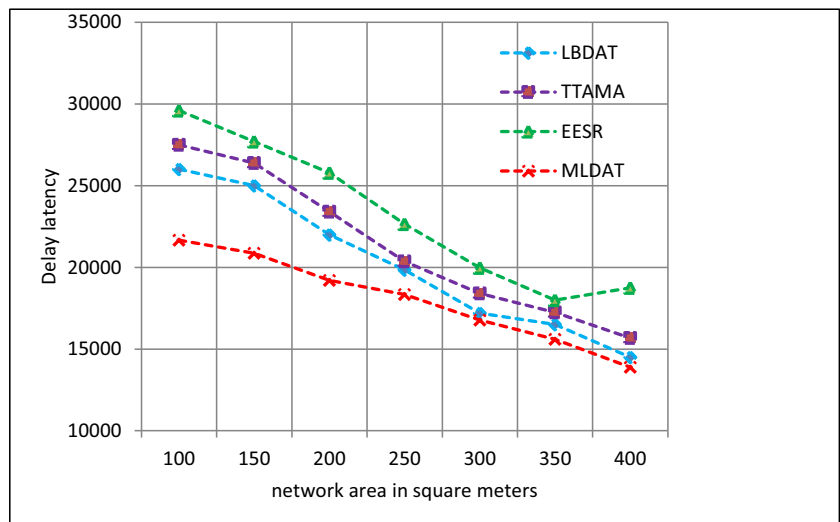
Scenario 1: Network Coverage Area

In this case, 150 sensors are distributed randomly and evenly in the rectangular network area. Each node has a transmission range of 30 m. The side length of the rectangle area is varied from 100 m to 400 m by increasing by step of 50 m. As increasing the length of the side, the network turned into thinner, and higher internal nodes are required to support the connectivity. The number of transmissions reduced in each

Fig. 3 a. Average Energy consumption. b. The average Delay latency against the network area

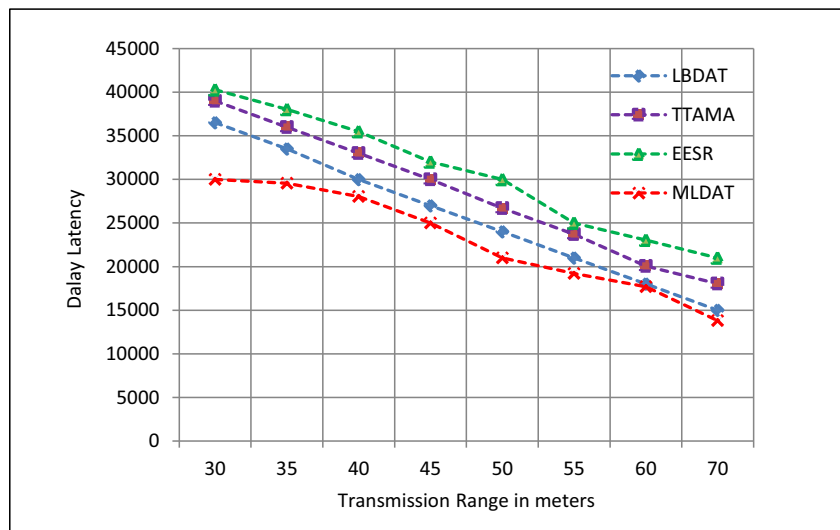


(a)

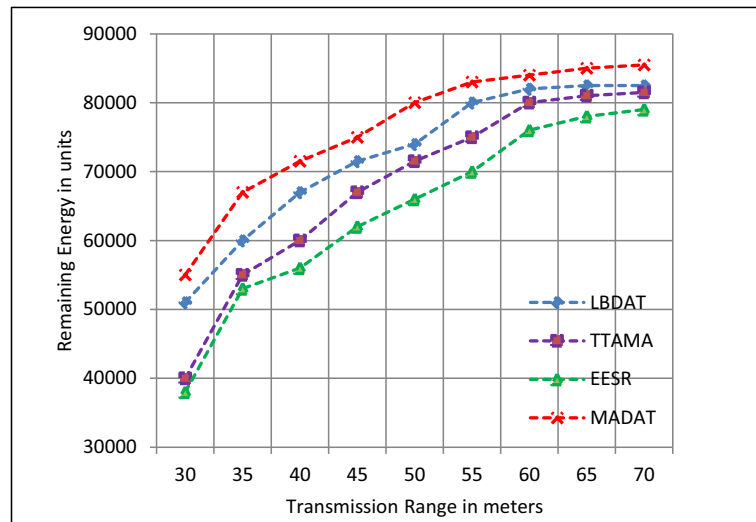


(b)

Fig. 4 **a** Residual energy for different transmission ranges. **b** Delay latency for different transmission ranges



(a)



(b)

communication round the energy consumption is also reduced, as shown in Fig. 3a. In the other models, also it is the same trend happens.

In Fig. 3b, the average delay latency for user queries is shown. When the network becomes thinner, the nodes choose available buffers packets to transmit to the gateway node. In MLDAT, we use the periodic per-hop scheduling mechanism, which improves the average delay due to the availability of buffered packets.

Scenario 2: Transmitting Range

In this scenario, the transmitting range is tuned from 30 m to 70 m by increasing a step of 5 m. The 100 nodes are deployed randomly uniformly in the network area.

We consider the 140m × 300m rectangular area of grid topology. In Fig. 4a, the Residual energy for different transmission ranges is shown. In Fig. 4a, we can observe the decrease in the residual energy because the network becomes denser, which means more nodes are present within the circles of node transmissions. So even the connectivity of internal nodes is maintained although with less number of internal nodes. For the other EESR and TTAMA algorithms is very close to both use Minimal Spanning tree method to maintain aggregating node connectivity.

In Fig. 4b, the delay is measured for all the algorithms. As the network becomes denser, the delay occurred for MLDAT is better than the other models due to *periodic per-hop scheduling* which is used tunable parameter refresher timer,

due to updating the refresher timer it can achieve shorter delay. In contrast, the other models use minimum latency scheduling algorithms (MLSA) that are suffering from their static time slots.

Scenario 3: Number of Sensor Nodes

In this scenario, In a rectangular area size of $200m \times 400m$, the number of sensors that are deployed randomly as 50 to 500 with unevenly. Each node transmission range as 50 m.

In Fig. 5a, it is shown that the residual energy is proportional to the number of nodes becoming more and more. It is because the redundant nodes are available for connecting CMIS. We have to perform the data aggregation in a dense area, the Parent Node Assignment (PNA) can improve the energy consumption significantly due to a lot of redundant sensors.

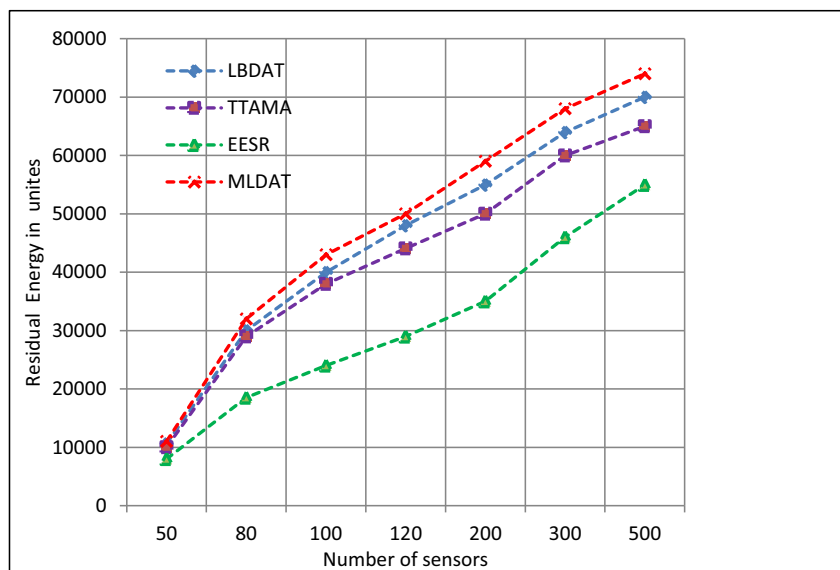
In Fig. 5b, as the number of nodes increasing the delay is also increased for all the traditional algorithms (LBDAT,

TTAMA, and EESR) due to the dense network, the number of aggregation points are more and more, but it is different for MLDAT because the constraints on the Parent Node Assignments MLDAT selects the optimistic aggregation points with more leaf nodes.

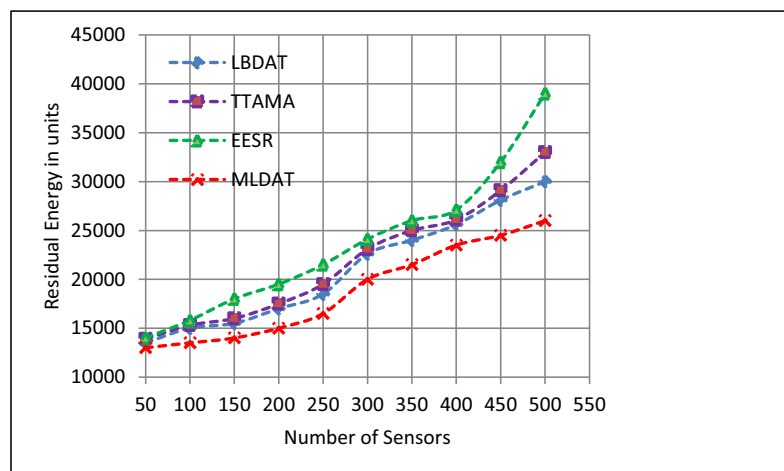
Scenario 4: Observation of Network Lifetime

The number of sensor nodes is deployed randomly in a 200×200 sq. m area, ranging from 10 to 100 with step value ten and the number of sensors 100–1000 with step value 100 and the transmission range, $R = 30m$ fixed. The observation is that the number of nodes increasing from up to 100 the network lifetime of MLDAT is having a similar report with other approaches which is shown in Fig. 6a. In contrast, the number of nodes increasing from 100 to 1000 shows a significant improvement in the network lifetime of MLDAT compared to the LBDAT, TTAMA, and EESR. The reason is that the actual load in Eq. (5) of nodes increased in EESR and

Fig. 5 a. Energy Consumption w.r.t the number of nodes. b. Network delay concerning the number of nodes

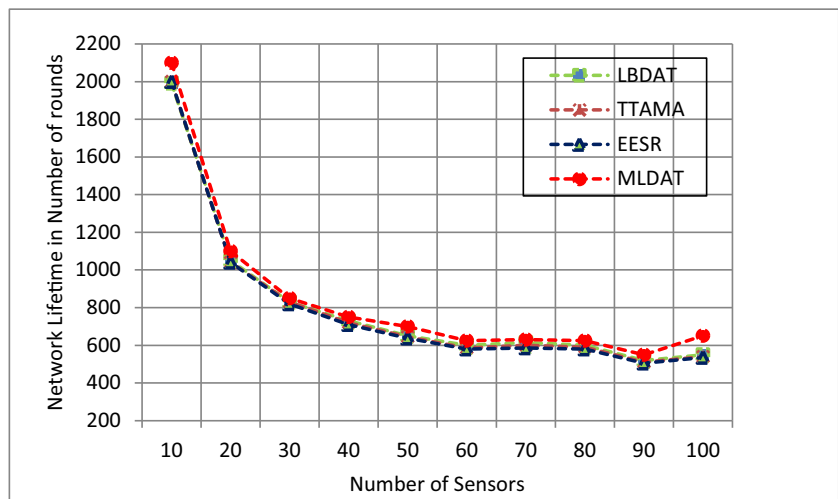


(a)

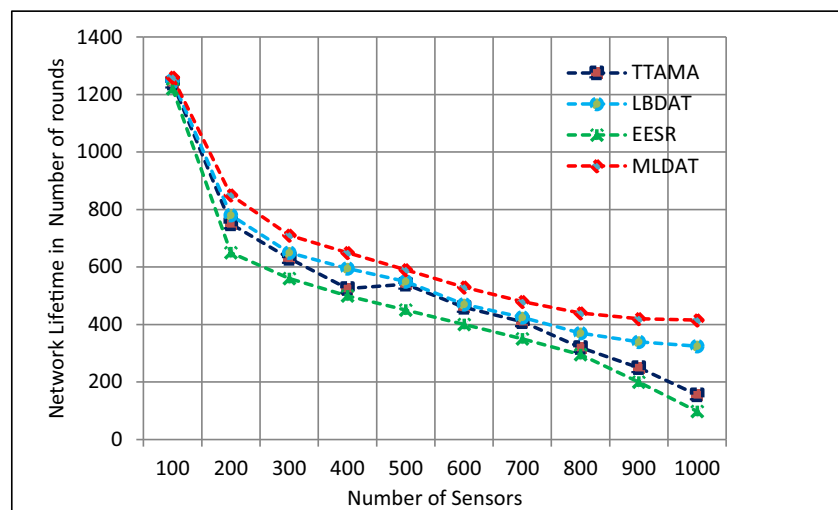


(b)

Fig. 6 a. Network Life Time for Number of nodes. b. Network Life Time concerning Number of nodes



(a)



(b)

TTAMA compared to MLDAT and LBDAT as the number of nodes increasing the overall network is shown in Fig. 6b.

7 Conclusion

In this article, we address the fundamental problem of modeling the Data Aggregation Trees in Machine-to-Machine(M2M) communication Networks. We Proposed a solution for CMIS and PNA Problems. In addition to this, Aggregation Time control Scheduling appropriately schedules the nodes to reduce the redundant transmissions. However, the proposed Multi-Level Data Aggregation Tree model with the Delay-Tolerant Scheduling algorithm for the Machine-to-Machine(M2M) communication shows better performance than the existing state-of-art solutions. Distributed algorithms can improve the solution for collecting data from sensor nodes and compressed sensing techniques to improve energy efficiency.

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Leader-Subordinate Comparison of Job Satisfaction of lower level Police Personnel in Guntur District of Andhra Pradesh

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Abstract

Job Satisfaction is one of the significant reflectors that can reveal about the way the employees feel regarding their occupations and it indicates the behaviour related to the work like - the rate at which employees leave an organization, organizational belongingness, frequency of absenteeism. Besides, the concept of job satisfaction partly influences the association of personality related variables with deviated behaviours of work. One of the usual research results is job satisfaction is proportional to satisfaction in the life. This association is can also be reciprocal, meaning individuals who are happy with the personal life are usually happy with their professional life and individuals who are happy with the professional life are likely to be happy with personal life as well. The current research study is accomplished with the main objective of measuring job satisfaction among police personnel in Guntur district of Andhra Pradesh. The findings revealed that the officers feel more professional than the lower level police staff.

Keywords: *Job Satisfaction, cadre and ANOVA*

Introduction:

In earlier days an individual had no other choice but to take up parent's occupation. Job satisfaction is a word generally utilized in order to explain to what level an employee is happy with respect to the job. Job Satisfaction indicates the kind of attitude possessed by an individual towards the job. It reflects the level of contentment experienced by an employee when all his wants because of a job are met with. A satisfied employee is an asset to the organization. He can be very productive and also be a part in successfully branding the organization. The word job satisfaction has been defined as a positive feeling about one's job. (Robbins, 2007)¹.

Employee is basically an individual who has a lot of needs and desires. Some of the needs are explicit and some are implicit. At times these needs become stronger and when the individual is unable to meet the needs, it creates dissatisfaction and stress. This can influence the behaviour of an employee and it can cause changes in his attitude and priorities. The extent of satisfaction is based on the individual mind-set. A resource, that gives satisfaction to certain employees, may or may not give contentment to other employees. There are many determinants that can influence job satisfaction like the psychological conditions, physiological features, social factors and also environmental situations.

There are several definitions about job satisfaction. It is about how people usually feel about their jobs. It is a combination of set of positive and negative feelings towards a job role. Job satisfaction has a direct connection with the organizational productivity and individual's wellbeing. This adds to industrial morale. So, job satisfaction is an important factor in industrial environment. The sum of positive feelings and favourable attitudes bring job satisfaction and negative feelings and negative feelings and attitudes bring job dissatisfaction. High levels of job satisfaction can reflect the emotional state of an employee. The better satisfied employees usually produce more and more; if the industrial environment is relatively supportive, the satisfied employees become innovative and productive.

Review of literature

The concept job satisfaction remains an extensively researched topic in the organizational areas. Ever since the growth of the movement in human relations right from early thirties, this has attracted a lot of interest. Several researchers have carried out research on job satisfaction after the Hawthorne studies. The current study is focussed at studying job satisfaction of police personnel in Andhra Pradesh, all the relevant literature available has been reviewed and presented.

Mira Singh and Pestonjee (1990)², regarded that the concept of job satisfaction is impacted by the factors of kind of occupation, extent of job involvement and participation. The sample for the study consisted of 250 officers and 250 clerical cadres belonging to a Nationalised bank in Western India. The study confirmed the hypothesis and it was found that job satisfaction of the bank employees was positively affected by the occupational level, job involvement and participation.

Mathew (1991)³ tested the relationship between satisfaction and organisational commitment with a non-recursive model that permitted the simultaneous examination of the influence of satisfaction on commitment and the influence of commitment on satisfaction. The study highlighted that the two variables were reciprocally related but that the influence of satisfaction on commitment was stronger.

Syeed (1992)⁴ made an endeavour to determine the relationship between employee job satisfaction and organisational effectiveness. The main objective of the study was to relate satisfaction with organisational effectiveness along with personal attributes such as age, education, pay, length of service etc. The study revealed that job satisfaction facets had more explanatory power than the personal attributes of respondents. It was clear from the study that the Organisation through its human resource development policies and practices created better environment for employees, resulting in greater satisfaction which in turn enhanced organisational effectiveness.

Rama Devi (1997)⁵ conducted a study on faculty job satisfaction and their views on management of the two universities in Andhra Pradesh. The sample consisting of 200 teaching faculty and 100 members were selected randomly from each university and the attempt was made to measure job satisfaction of the faculty in universities of Andhra Pradesh. The study found that the factors such as freedom in job, scope for self-improvement, income and job security were causing satisfaction while bureaucratic rules, no recognition for work and routine work were causing dissatisfaction to them.

Sarri and Judges' (2004)⁶ Article provided greater understanding of the research on employee's attitudes and job satisfaction. The article identified three gaps between Human resource practice and the scientific research in the area of employee attitudes in general and the most focal employee attitude in particular –Job satisfaction: the causes of employee attitudes, the result of positive or negative job satisfaction and how to measure and influence employee attitudes. Suggestions for practitioners are provided on how to close the gaps in knowledge and for evaluating implemented practices.

Objective of the Study:

The objective of the present study is to assess the Job Satisfaction levels of leaders and subordinates at lower level of police hierarchy.

Hypothesis Formulated:

The following hypothesis has been formulated and tested:

There is no significant difference between the cadre in job satisfaction of police personnel.

Methodology:

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LEADER SUB-ORDINATE COMPARISON OF ORGANIZATIONAL COMMITMENT OF LOWER LEVEL POLICE PERSONNEL IN GUNTUR DISTRICT OF ANDHRA PRADESH

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Abstract

Employees are bound to their organization due to organizational commitment. The extent of commitment is an important factor that contributes to the effectiveness of an organization. Many research studies brought out that the employees who are highly committed usually tend to work more efficiently than the less committed employees. Highly committed employees have good self-confidence, strong self-esteem. They can balance between what they want and what they are capable of. The present study aims at assessing the difference in the organizational commitment of leaders and subordinates at lower level of police personnel in Guntur district of Andhra Pradesh. The findings revealed that the leaders have more affection towards the department than the subordinates at lower level of police personnel.

Keywords: *cadre, Organisational commitment and police personnel*

Introduction

Organizational Commitment is usually measured by aspects such as employees “willingness to work hard to develop their organization, the match or correlation between the organization’s and the employee’s values, how reluctant they are to leave the organization, and their faithfulness towards their organization or how proudly people work for their

employers”. In recent days, the aspect of organizational commitment has gained considerable momentum. Much research is done to understand and analyse the extent of intensity and stability of an employee’s commitment towards the organization.

Organizational commitment is defined as the extent to which an employee relates himself or herself to a specific organization and its objectives, and desires

to maintain relation with the organization. According to the **Meyer & Allen (1997)**¹ organizational commitment “is a psychological condition by which the employee relationship is characterized with the organization and has considerable extent of influence for the choice to prolong organizational membership.” From the above definition it can be understood that commitment is completely different from motivation or general attitude. Commitment can drive employees to behave in a specific way. From the point of view of neutral observer it may appear distinctly to their own self-interest. The researchers have the opinion the definition given by Allen and Meyer for the study Employee commitment is important because high levels of determination lead to several favourable organizational results. It clearly indicates to what level the employees identify with the organization and how committed are they to organizational goals.

In the area of organizational behaviour, studies of relationship with the organization, particularly those of Organizational Commitment, are given special emphasis due to their role in enabling a wider knowledge of the relationships established between employees and their organizations. From these organizational factors' points of view, commitment is anticipated due to its influence on required variables, such as performance and organizational citizenship behaviour, among others. Ranging from this premise, several studies have been conducted in recent times so as to ascertain the variables that contribute to the development of this relationship or association, and also the consequences anticipated with its establishment.

Review of literature on job commitment

The thought of organizational commitment has gained much attention in the literature on industrial and organizational psychology. Earlier research on organizational commitment considered the ideas as one aspect,

based on attitude point of view, bringing out identification, loyalty and involvement. As far as **Porter et al (1974)**² is concerned the attitudinal aspect relates to the psychological attachment or affective commitment formed by an employee is in relation to identification and involvement with the respective organization. He further explains that organizational commitment is “how employees relate themselves to the organization, how they characterise intentionally to be attached to it; how they identify with the values and goals of the organization; and how willing are they to put in extra efforts on its behalf”. Employees usually consider the extent to which their own values and goals relate to that of the organization as part of organizational commitment, therefore it is considered to be the main link between an individual employee and the organization.

Yet another aspect on organizational commitment is the “exchanged-based definition” or “side-bet” theory by **Alluto, Hrebimak & Alonso, (1973)**³. This theory holds that people get committed to the organization as long as the individuals hold their portfolios, no matter how stressful situations they undergo. In spite of these things, if they get alternative advantages, they will voluntarily resign and leave the organization.

Mowday, Porter and Steers (1979)⁴ added to the the “side-bet” theory by explaining organizational commitment as organizational behaviour “relating to the method how individuals become attached within a specific organization and the way how they tackle with this issue”. This behavioural point of view related to organizational commitment is better through calculative and normative commitments.

Wiener and Vardi (1980)⁵ explained organizational commitment as “someone’s intention of behaviour or how an employee reacts to influenced as per

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DYNAMICS OF GIG-ECONOMY WITH SPECIAL REFERENCE TO DIGITAL PLATFORMS IN INDIA

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ABSTRACT

Our country is emerging as the third largest on-line labour market according to On-line Labour Index Survey and India-based employers represented 5.9 per cent of all projects/tasks posting for online labour of which 45.0 per cent were for software development and technology projects. The highly informal and micro nature of our economy provides impetus to digitally-enabled independent employment opportunities. These forms of work have gained momentum in recent years with the emergence of native and international freelancing platforms. These trends show that the nature and structure of employment in our economy has been undergoing a reformative change towards more independent, freelance on-line jobs. "Gig Economy" is such a new trend in the employment models in these days of digital influences. The present paper deals with this concept of "Gig Economy" with special reference to our economy. The gig economy can be defined as "a free market system where organizations and independent workers engage in short-term work arrangements. Technology has lowered the barriers to entry so much that "gigs" have become easily accessible to an unprecedented number of people. Based on secondary sources of information and statistics, this paper briefly discusses about the traditional job market and the job necessities in the context of the present 4th Industrial Revolution. An attempt is made to discuss about gig and freelance work in India and gig workers' earnings in Top-10 countries along with India. Types of gig work rise of gig economy with its broad segmentation and subsectors. Discussion was also presented about the converging factors responsible for thriving the gig economy in our country, the motivational factors acting as growth drivers of gig economy. The high paying tech-savvy gig jobs in advanced countries and in our country is also present to provide a comparative picture of gig works. The paper concludes with a remark for the necessity of encouragement to be provided for the development of gig economy, keeping in view the unemployment rates both in urban and rural areas with specific reference to women.

KEYWORDS

GIG economy, on-line employment, freelancers, independent work, growth drivers, motivational factors, unemployment rates.

JEL CODES

O32, J22, Q55.

INTRODUCTION

In recent years, the traditional job market and the work-dynamics have been changing allowing greater autonomy and flexibility. The technological disruption has been potentially reshaping the employment landscape by generating opportunities to earn income on-line and better matching of workers with opportunities through digital platforms. The demographic shift and technological developments that are taking place today are demanding rapid job creation to be matched with workers and employers. These shifts are acting as potential drivers of creating opportunities for generating new, relevant and decent jobs for the future of our country. It is argued that the present demand for jobs should be accompanied by the need to create high quality employment opportunities in general and for aspiring youth and women specifically. Digitalization and technological adoption are sound supporting the growth of decent jobs and greater economic inclusion, since employment-generation strategy of our country aims at inclusion of women in the labor market, to erase the gender-bias, which is both a social and economic imperative.

Keeping the approach to strategy of economic development in our country, today, most of the companies are adopting industrial technology and machinery to improve the quality of their output, to maintain their current market position, associated with qualitative improvements in supply-chain management as well as are planning to introduce digital tools and services to attract new customers.

In the context of fast changing business environment and rapid developments in technology, it is necessary for employers to prepare for changes at the workplace. The experts have been observing that there are 10 important workplace trends that are taking place in our country and the companies are found preparing the work force for the future by embracing new developments in labor-market like "Gig-Economy". Gig-Economy consists the gig workers or freelance workers, who work without the frills and collars of traditional jobs, who are called as "Blue Collar Workers". Defined as "Gig Economy", this recent trend presents a distinct strategic opportunity for the organizations of the future, with a specific focus on "Digital Skills" and also on "Digital Platforms". In other words, the "Gig Economy" refers to "labor market activities that are coordinated via digital platforms". Workers take on particular "gigs" without any guarantee of further employment, and the persons who mediate in between these workers and employers, are called as intermediaries, independent contractors and not employers. Generally, the companies operating these platforms are intermediaries, who enable purchasers to order a timed and monetized task from an available worker, by taking a commission, whenever the service is paid for or completer. The Gig Economy operates through two kinds of platforms – "Crowd Work" and "On-demand Work" (Hunt et.al.2017). Crowd Work refers to jobs which are commissioned and carried out virtually, via internet. On-demand work refers to activities which are generally organized through mobile platforms and the jobs are carried out locally with the purchaser and the provider in physical proximity. These jobs are also carried out by text messages or phone calls instead of a mobile platform. Increasing access to internet, increasing number of mobile and smart phone usage and improvements in digital infrastructure have significantly influenced the proliferation of on-line market places and transactions, facilitating a forward movement towards physical world to the digital world. Social networks and cloud computing are found supporting the access to e-commerce transforming cross-border trade in merchandise and services.

As a positive sign being driven by these transformations, "independent work" (flexible work) has gained momentum, both in advanced and developing countries. Independent work is not new to our country since we have the tradition of self-employment- the other term used for independent work, is deeply engrained in our economy and this is reflected in micro-nature of organizations of our country. In this sense, we can use the term "self-employment" as alternative term for "independent work" or gig-based "freelance work".

THE IMPACT OF 4th INDUSTRIAL REVOLUTION

The present century has been witnessing and experiencing the 4th Industrial revolution being propelled by the convergence of a cluster of technologies representing physical, digital and biological impact factors. Machine learning, artificial intelligence, advanced robotics, cloud computing, the IoTs, and block chain etc., are

evolved and employed for profoundly transforming the future and nature of work in developing and developed economies. Many traditional employment opportunities are found outdated and many are created newly influenced by these modern technologies, embracing and influencing the production processes, business models, service delivery mechanisms, establishing a relationship between generation of employment, flexible working environment, autonomy in working opportunities and decent remuneration to meet the increasing cost of living. Under these transformative conditions, experts, economists, entrepreneurs, employment-model strategists and technocrats are striving to analyze the impact of 4th industrial revolution and are arriving at different arguments and observations, with a specific focus on employment conditions, job displacement and inequalities in labor market in the economies around the globe.

The technology-led employment models that were designed and evolved to suit the requirements of 4th industrial revolution, as they have thought, provide solutions to improve the low productivity and output in the key economic sectors. A variety of strategies were designed for shaping the emerging technologies to play out in the complex socio-economic and cultural contexts of work, among which digital literacy and ICT were recognized as the basic skills required in the current environment of work and to access the public goods and services.

Use of technology has become the major driving force for the present 4th industrial revolution to displace as well as replace the traditional employment opportunities, particularly in India. Of late, the concepts like "Uberization", "Gig-workers" "Independent work", "Freelance Industry", "On-demand Jobs", "Flexible Staffing", "Leased work" and "On-call Workers" are gaining currency in advanced as well as advancing economies. Independent work is on the rise in many advanced economies of Asian, European, North America, Africa, South America and Oceania economies. Asian economies are providing gig work to the estimated tune of 62.0 per cent, 18.0 per cent in European economies, and 16.0 per cent in North American economies (On-line labour Index Worker Supplementary-2017). These gig workers are found engaged in software development and technology, creative and multimedia, sales and marketing support, writing and translation, critical and data entry and professional services. According to the On-line Labour Index-2017, India is the largest supplier of online labour and also traditional outsourcing destination. It is estimated that 24.0 per cent of workers are gig workers in India, followed by Bangladesh (16.0 per cent), United States (12.0 per cent), Pakistan (8.0 per cent), Philippines (6.0 per cent) and UK (5.5 per cent). There are four largest online labour outsourcing platforms namely Fiverr, Freelancer, Guru and People Per Hour, which are English language platforms, covering 40.0 per cent of the global gig labor market for platform-based online work. Research efforts were also made to understand the "Gender-dynamics" of Gig Economy for identifying the existing critical knowledge gaps, which are useful of policy makers (Abigail Hunt and Emma Samman, 2019). The research findings indicate that a smaller proportion of women than men are involved in gig work; less regularly work than men and are more likely exit the gig economy. Van Dorn (2017) has analyzed that the gender, racial and class inequalities were acting as dragging forces in the low-wage gig workers. It was estimated that the proportion of women in the gig economy of US accounts to 33.0 per cent to 55.0 per cent, in UK this proportion works out to 31.0 per cent to 52.0 per cent, Germany (39.0 percent), Sweden (39.0 percent) Austria (41.0 per cent) Switzerland (43.0 per cent) and Netherlands (44.0 per cent). The evidence suggests that in many of the economies, women earn less than men through gig work.

MATERIALS AND METHODS

The present paper is exclusively based on secondary sources of information collected from different national and international published reports, research papers and newspapers. The primary purpose of this analytical paper is to explain the concept "Gig-Economy", its features, segmentation, nature of jobs and income offered in general and in our country in particular. The paper focuses on the following objectives:

1. To define and explain the concept "Gig-Economy", its types and segmentation.
2. To introduce the rise of Gig-Economy in India.
3. To analyze the Motivational Factors that drive the performance of Gig-Economy in India.
4. To present the estimates of income offered for the Gig Jobs in India.

RESULTS AND DISCUSSION

GIG-ECONOMY AND FREELANCE WORKERS IN INDIA

The term "Gig" refers to the concept of 'engagement' coined during the financial crisis-2009., when the unemployed made a living by "gigging" or working in several part-time jobs wherever they were available and they could. It was observed that "Gig-Economy" was a sharing economy, open talent economy, freelance economy and also on-demand economy, representing the new paradigm of work. Gig work is characterized by the prevalence of short-term contracts or freelance work as contrary to the permanent jobs in the organized sectors. Technology has been playing an important role in gig-economy as a new business and employment model. The current cutting edge digital on-line platforms along with the proliferation of mobile and smart-phone penetration and application are treated as the important influencing factors for thriving of this gig-economy. By these digital aids, the work assigned to a professional can be completed within the scheduled time and has the flexibility to choose location of the assignments and areas.

Gig economy which is also called as "Flex-economy" or "Mobile Economy" is among the fastest growing employment trends in India along with advanced countries during the recent years. The Global Gig Economy Index-2019 published by "Payoneer" observed that among Top-10 countries, India is emerging as the 3rd largest on-line labor market and the "On-line Labor Index Survey-2016" estimated that India-based employers represented 5.9 per cent of all projects/tasks posting for on-line labor of which 45.0 per cent were for software development and technology projects. The Global Gig Economy Index-2019 also shows that India occupies 7th rank in the year over year revenue growth of gig workers engaged in the economy, as shown in Table. 1.

TABLE 1: TOP-10 COUNTRIES WITH HIGH GIG-WORKER EARNINGS AND REVENUE GROWTH

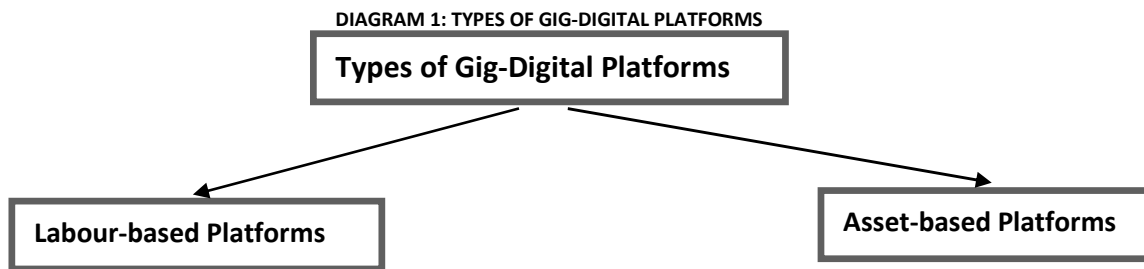
Rank	Country	% of YoY Growth in Revenue of Gig worker earnings
1	United States of America	78.0
2	United Kingdom	59.0
3	Brazil	48.0
4	Pakistan	47.0
5	Ukraine	36.0
6	Philippines	35.0
7	India	29.0
8	Bangladesh	27.0
9	Russia	20.0
10	Serbia	19.0

Source: Payoneer (2019) Report on The Global Gig Economy Index-2019, p.3

It is evident from the data presented in Table.1 that technology has made easier than ever for individuals to get increased earnings by engaged themselves in profitable gig-work and received favourable rewards. The data shows that India got the 7th rank in terms YoY growth in gig-earnings, accounting for 29.0 per cent among the top-10 countries. However, it is to be noted that India has to make sincere digital efforts to touch the revenue growth of Pakistan (47.0 per cent) as well as the rank of USA (78.0 per cent). As an effort to improve the earnings from gig work in India, it is to be noted that gig economy is churning out of a large number of solopreneurs, micropreneurs and our country has to provide the congenial business and technological environment for the development of gig work.

GIG-DIGITAL PLATFORMS

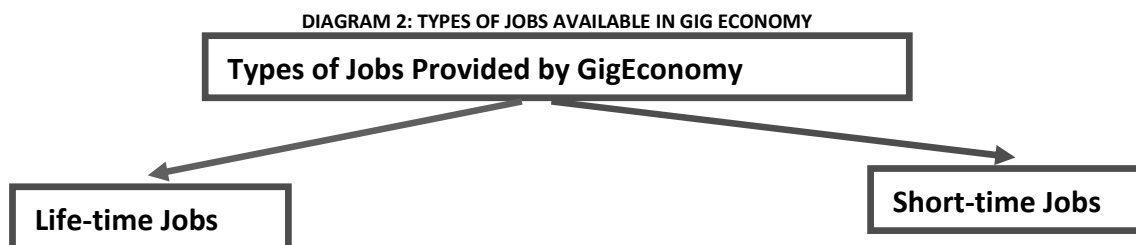
It is to be observed that gig-digital platform can be categorized into two main types in India as shown in the following diagram-1.



The labour-based platforms enable workers to provide activities and completing tasks assigned (Uber, Ola etc., The asset-based platforms allows people to rent or sell their unused asset (Airbnb, eBay etc., These two platforms have enabled the transformation of the gig economy from a C2C market to B2C market with new models of work and employment. These two kinds of platforms represent gig economy as a broad umbrella term originating from the digital universe of the "Sharing Economy". It is an economy and a novel organization of digital workers, distributed across the economy and organized through task markets and network connections. It is beyond doubt that the rise and advancement of technology has given people more options in the kinds of work they can do in the gig economy. A variety of mobile apps and E-commerce websites like Amazon, Flipkart, Alibaba and Shop clue etc., have proved that anyone can become a merchant and portals like Flexiorg.com, Getmeexperts.com etc., are providing work opportunities for any one with specialized knowledge and skills by connecting them with companies that have such needs.

SEGMENTATION OF GIG ECONOMY

An observation of jobs that are provided by the gig economy can be classified into two types, as shown below in diagram 2.



Gig economy provides both lifetime jobs as well as short-time jobs. Life-time jobs mean short-term projects and which give provide jobs with independence and work flexibility, pay very well and offer future opportunities. Work with only 1 or 2 hours of working represent short-term jobs with good remuneration. The gig job options comprise a variety of digitally-skilled jobs like creative services, content writing, virtual assistance, engineering and architecture, accounting and consulting, software development, automation, artificial intelligence, IoT, ML, IT infrastructure, management, sales and marketing, civil BIM, automobile connected vehicles, PR and Branding, project management and data assembling etc.,

All the modern gig business offers on-line applications to connect individuals seeking jobs/services with those providing jobs and services, fueled by internet startups and a majority of talent managers are found leveraging gig workers in their teams and departments, to drive efficiency, innovation and competitive advantage.

RISE OF GIG ECONOMY IN INDIA

The incentives, schemes and financial assistance provided by Government of India and the creation of SEZ culture, start-ups have flourished in India and 70.0 per cent of the corporate were found using gig workers for solving organizational issues. It was reported by HR professionals and independent consultants interviewed that gig workers were found very useful for supplementing the skills of the existing workforce, reduce the cost of production and fill the temporary vacancies in the firms/organizations/enterprises. The gig workers containing self-employed, freelancers, independent contributors and part-time workers, though represent very much fragmented, got recognition across the globe in general and in India in particular and emerged as a modern workers'-economy, wherein workers come, gig and leave.

In India during the last five years, a large segment-- about 81.0 per cent--has joined the gig economy. Delhi accounts for 43.0 per cent of gig workers, recognized as the biggest hum followed by Mumbai with 19.0 per cent and Bengaluru with 18.0 per cent.

Besides the above mentioned two types (as shown in Dig:2), the gig economy can be segmented into the following 4 important categories and with a broad description of each segment is presented in Table. 2

TABLE 2: BROAD SEGMENTATION OF GIG ECONOMY WITH ITS SUB-SECTORS IN INDIA

S. No.	Sector	Description	Subsectors included
1	Asset-Sharing Services	Digital Platforms that facilitate short term P2P rentals of one owner's (or freelancer) property to another individual	Home-sharing Car-sharing Boat-sharing Parking space-sharing P2P Equipment-sharing etc.,
2	Transport-based Services	Digital Platforms that require a freelance driver to complete the requested transport service	Ride-sharing Car pooling Restaurant Delivery Coupled with guiding skills
3	Professional Services	Digital Platforms that connect freelancers directly with business to complete projects	Management skills, Business work, Designing, Coding, Writing/ Translating, Artificial intelligence, ICT, Cloud computing, Robotics etc.
4	Handmade Goods, Household and Miscellaneous Services (HGHM)	Digital Platforms for freelancers to sell homemade goods/crafts or offer on-demand services for household related jobs.	Home services Baby sitting Handicrafts Tutoring Pet Services and Miscellaneous services etc.,

Source: Master Card and Kaiser Associates: (2019) Report of The Global Gig Economy: Capitalizing on a \$500 B Opportunity.

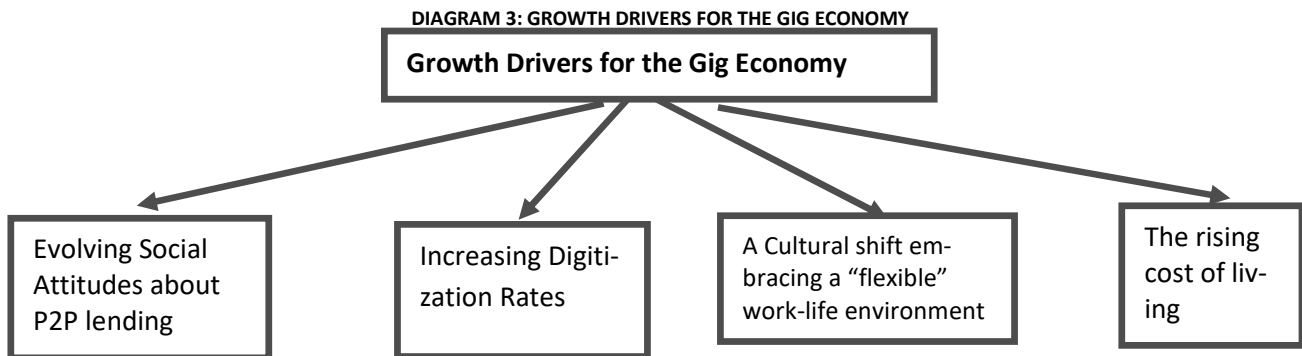
THE CONVERGING FACTORS

According to the report produced recently by BCG Henderson Group, the following are the factors that are pulling the gig workers towards gig economic activities:

1. Contrary to the mature economies, (1 to 4 per cent), a high proportion of more than 30.0 per cent of workers were found preferring the use of gig work platforms.
2. Job-seekers are entering into gig economy in each and every industry as freelancers.
3. There is a shift in the priorities among workers towards full-time employment as only 20.0 per cent of the freelancers preferred the fulltime employment.
4. The gig work platforms are targeting at workers with a specific level of expertise as well as management consultants, software developers and wellness workers with sophisticated modern skills.
5. 40.0 per cent of the companies, which have absorbed gig workers who have satisfied the characteristics of gig work reported that the gig workers have acted as a complementary source to their regular workforce and the labour productivity in their firms has improved.

THE MOTIVATING FACTORS

According to the recent reports on Gig Economy, the following factors can be listed as “growth drivers” for gig economy in India as shown in Diagram



With the advent of gig economic activities, major portion of gross volume of gig economy has been estimated coming from platforms that were relatively new to market, offering a greater diversity of services to customers, thus enabling the digital industry to expand and mature. The above flow-chart explains the important motivating factors, which acted as the growth drivers for the gig economy and for its expansion. In recent years sharing personal items has been accepted and there is a shift in social attitudes that are encouraging and facilitating of sharing underutilized as well as unutilized assets for profit.

Many digital lending and P2P lending platforms like Lendbox (New Delhi), Faircent (Gurugram), Lending Kart (Ahmedabad), Finzy (Bengaluru), i2i Funding (Noida), i-Lend (Hyderabad), LenDen Club (Mumbai), Paisa Dukan (Mumbai), Rupee Circle (Mumbai), Monexo (Mumbai), CashKumar (Bengaluru) etc., have been attracting the customers by providing an online marketplace to facilitate peer-to-peer lending by bringing together borrowers and lenders. The consumers are also actively engaged in this lending activity.

The recent trends in rapid smart phone adoption and increased access to internet are found expanding the numbers of eligible gig freelancers. The number of smart phone users is estimated to reach 442.5 million in 2022, which was 199.48 million in 2015. There are 1026.37 million active mobile phone users in our country as on 2018 with 2G,3G and 4G networks. It is also estimated that our country occupies 22nd rank, after China in the number of internet users which was estimated as 560 million and on an average 310 million people in India are spending time with social media accounting for an average of 17 hours per week. It is found that 80.0 per cent of the adults in our country are having at least one digital financial account and according to IMD World Digital Competitiveness Ranking for the year 2019, our country occupied 44th place with the improvement in terms of knowledge and future readiness to adopt and explore digital technologies.

It is also observed that work-life adjustments have been considered as important and a cultural shift has been taking place towards embracing a flexible environment altering the workers expectations of a typical 9 to 5 work day. It is also true that in recent times, the cost of living has been increasing alarmingly clubbed with a shrinking share of middleclass families, which is compelling the employed lower to middle class to pursue the sources of supplementary income by engaged in part-time jobs to earn income through gig work to satisfy the needs and demands of the family members.

It is beyond doubt the all the above discussed facts are motivating the people with skills and expertise to pursue the gig economic activities as the best option.

NOT SIDE-HUSTLING WORK

Many workers feel that gig work is a part- time work which offers low income and they are not lucrative. It is a wrong notion and a mistake. The tech-savvy attitude and the skills and expertise fetches high amounts of income by serving a freelancer’s option. The study of “FitSmallBusiness.com” observed that the following are the most lucrative options for gig tech-savvy workers. The following Table-3 presents the jobs, their description and the income that can be earned

TABLE 3: TECH-SAVVY GIG JOBS AND THE INCOME OFFERED

S. No.	Name of the Tech-Savvy Gig Job	Income offered per Hour	Description of the Job
1	Deep Learning/ Artificial Intelligence	\$ 115.06	Self-Teaching systems, Machine learning, data scientists, software engineers etc.
2	Block Chain Architecture	\$ 87.05	Technology used to power, cryptocurrencies, digital currencies etc., It is also known as cloud computing, in which users share data on third-party servers via Google and Microsoft.
3	Robotics	\$ 77.46	Includes mechanical and electrical engineering and companies are expanding to develop devices in the medical and surgical fields.
4	Ethical Hacking/ Penetration Testing	\$ 66.33	Skills in coding and programming systems-security professionals and Penetration testing.
5	Bit Coin /Cryptocurrency	\$ 65.37	Ability to build automated payment tools using altcoins are sought after, including to integrate bitcoin payment technology into existing websites and apps.
6	Amazon Web Services/ Lambada Jobs	\$ 51.0	Specialization in AWS Lambada writing and load code for lambada
7	Virtual Reality	\$ 50.18	App designing to create digital content that combines visual and audio to create an interactive world in a user’s environment, including Development of Algorithms and 3D modeling and Scanning languages.
8	ReactJS Developers	\$ 40.75	Companies like Yahoo, Airbnb, and American Express rely on React to allow consumers to make multiple selections on a page (the number of bedrooms in a rental, for example) without needing to reload it.
9	Final Cut Pro Editor	\$ 37.12	This professional-grade software allows cutting video clips, altering pace, integrating music, editing scenes, inserting transitions, and more. As an editing freelancer, a gif worker can find work in almost every professional field.
10	Instagram Marketing	\$ 31.23	As a marketer and influencer, a Gig worker connects the brands and advertises their products through photos for an agreed-upon fee.

However, there are some gig works which offer and pay a small amount per hour. Particularly in Data Entry jobs which converts the paper-based books into e-books, in the typing projects and Captcha solving the payment is very low which ranges from Rs. 7 to Rs. 48 in gig platforms like Kolotibablo, Megatypers, Captcha solving websites and MTurk etc.

CONCLUSION

In our country the unemployment rate is estimated at 7.9 per cent on 29th February, 2020 according to the data released by CMIE. Urban unemployment rate was estimated as 8.6 per cent it was 7.6 per cent for rural areas. After going through this unemployment rates, it is to be noted that our economy is not able to generate the jobs for the people entering into labour market. Besides, it is to be observed that people in the age group of 15-24 years constitute nearly a fifth of India's total population (2011) and by 2020, they are predicted to make up a third of the country's population. The youth population with the age group of 20-24 years constitute around 40 per cent of India's labor force, have an unemployment rate of 32 per cent and the unemployment rate among the educated is even worse. The World Bank recently estimated that our country needs to create 8.1 million jobs a year to maintain the employment rate. With our demographic dividend and urgency to generate jobs in different sectors of our economy needs immediate attention in the present era of digitalization, which demands high skilled, well-educated and experts in modern technological literacy. The participation of women in the work force in our country is lowest in the world at around 21 percent, as absence of suitable jobs is observed as one of the reasons for this low rate of participation. The report on "Employment Outlook", women gig workers accounted for about 68,000 jobs in the country in 2019 and gig economy has to be resorted for generation of jobs in future. Keeping these unemployment rates, there is every need to support the gig works, which offer not only part-time jobs as well as full-time highly remunerative jobs for tech-savvy freelancers. Referring to the future of jobs in India, EY, FICCI and NASSCOM teams suggested that the jobs in future could be a combination of employee arrangements interspersed with gig working models. The jobs seekers should understand the importance and evaluate the benefits of contractual labor/project-based work arrangements. Gig work should be considered as relevant as any other type of employment and as the primary source of income and have its impact on society, which values stability in work. The Government, while designing the employment generation strategy should keep in mind the requirements of the present digitally-driven technological-dominant labor market to create employment opportunities for the future of India.

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**A STUDY ON EFFICIENCY OF WORKING CAPITAL MANAGEMENT
WITH SPECIAL REFERENCE TO MICRO AND SMALL ENTERPRISES
IN CHITTOOR DISTRICT OF ANDHRA PRADESH**

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ABSTRACT

Working capital employed in MSMEs is financial metric which tells about the liquidity available and also indicates the financial health of an enterprise. Working capital has two major components – current assets and current liabilities. The efficiency with which an enterprise operates depends exclusively on how that enterprise utilizes the working capital and manages its different sub-components. The research carried out so far did not deal with the each of these components of these two major components and explain that inefficient management of working capital was responsible for their losses and closing up the enterprises with high amount of NPAs. Though a number of studies that dealt with management of working capital have focused on macro picture at state or national levels. The specific field-based studies that have evaluated the efficiency of managing the working capital in MSMEs at district level are scanty.

Keeping this research gap in view, the present study focuses on the evaluation of management of working capital in Micro and Small Enterprises (MSEs) in Chittoor district. Exclusively based on primary data collected by canvassing a structured and pre-tested questionnaire and the financial statements prepared by the enterprises selected, the present paper deals with an analysis of working capital employed and how it is utilized, in sample Agro, food and allied enterprises(36), Textile-based enterprises (34) and Mineral-based (30) enterprises operating in Chittoor district.

Primary data for these 100 sample enterprises was collected for a period of 6 years i.e. from 2011-12 to 2016-17 and assessment was carried out with the help of Ratio Analysis and Liquidity Index .The primary objective is to evaluate how efficiently the sample enterprises were able to manage the working capital invested with each of their respective enterprises. By this evaluation, the present paper satisfies the objective of district level research studies on

management of working capital, with all its sub-components , which are absent particularly with reference to Chittoor district and represents a bench mark attempt to carry out further research embracing the other dimensions of working capital management.

Key Words: Micro and Small Enterprises, Working Capital, Current Assets, Current Liabilities, Inventories, Trade Receivables, Liquidity Index.

INTRODUCTION:

Capital, the vital financial propeller that activates the production activity by establishing a symbiotic relationship among all the factors of production, specifically for an economic activity. Capital is the factor production necessary for the employment of labor, particularly in industrial sector, in association with land, ignites the production process with its suitable structure. It is so important for micro, small and medium enterprises for their efficient operation in the present complex production-environment and also to stay as competitive enterprises in the global market conditions. Getting adequate profits are the primary objective of any enterprise, adoption of a suitable capital structure assumes much importance in any economy, where in MSMEs are considered as a strategic option for income and employment generation with less amount of capital. Today, much research was carried out to prove the fact that MSMEs serve as a suitable development strategy for providing sustainable development opportunities in the available locally, which results into acceleration of regional industrial development. It was also argued that MSMEs are the activities that facilitated the development of entrepreneurship by reaping the external benefits, innovation and labour productivity.

Working Capital and MSMEs

The capital structure of MSMEs basically includes two broad and major components- Fixed capital and Financial (Working) Capital. The first component includes physical capital and the latter component includes current assets and current liabilities, which is generally called as Working Capital. Working Capital a vital component of capital employed, which helps to convert raw material into finished goods up to the cash realization. The concept of present “Working Capital” is nothing but the concept of “Variable Capital” used by classical economists.

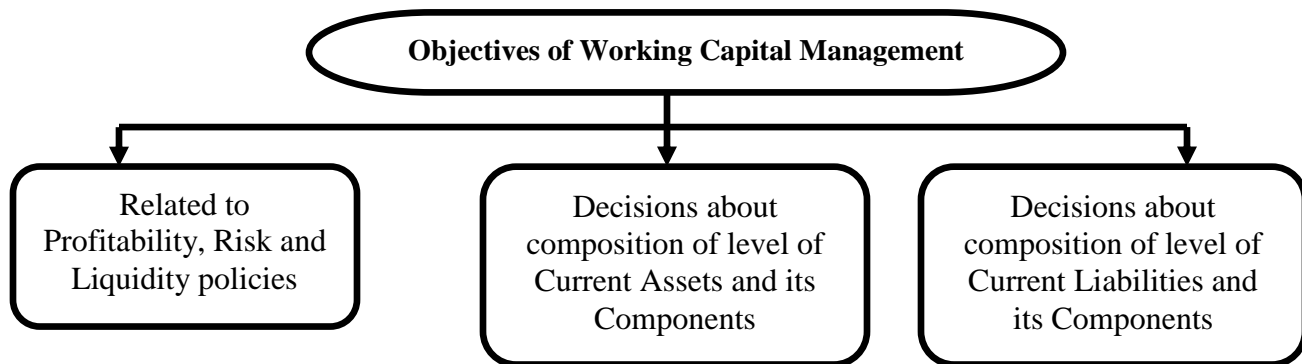
Working capital employed in MSMEs is called as a financial metric, representing the operating liquidity available to an enterprise and represent a portion of operating capital. The

amount of working capital is treated as an index of financial health of an enterprise. Keeping in view the general methods of calculations, working capital consists two major components-current assets and current liabilities. Based on these components working capital is defined as “the current assets over current liabilities. A balanced approach is required between these two major components. In the modern days a financial manager of any enterprise strives to find out a cheapest and convenient source of financing these components and also to keep an optimum mix of current assets and current liabilities. Hence, MSMEs consider the working capital, the singular source, to meet the short term financial requirements and refer to it as “trading capital”. For an enterprise, working Capital is equal to the blood in circulation for a human being and if it becomes weak, there is a room forgetting lower or nil profits and the enterprise many not survive. The enterprise must be capable of generation of cash receipts in excess of its payments, then only it will have adequate liquidity to meet the day to financial requirements. All these inter relationships makes it clear that an efficient working capital administration assumes a critical process of the financial management of an enterprise. This process of administration / management deals with the management of ingredients of current assets and current liabilities in an enterprise, because there is a positive link between efficient management of working Capital and profitability (Eyelly A MA(2004) Pedro, J.G and Pedro M (2007), karaduman, H, (2011). An enterprise has to manage its inventories, receivables and payables for its success and to eliminate the risk of inability to meet short term obligations also to avoid excess investment in assets for maintaining a balance between risk and efficiency.

Need for efficient Working Capital

The research put forth on the system of efficient management of working capital and operational success of MSMEs makes it clear that working capital management is one of the most vital segments of financing decisions and a dynamic stimulus for its good performance managing the problems that arise towards the maintenance of current assets and liabilities at optimum level is the important purpose of management of working capital. The interrelation that exists in between current assets and liabilities is to be carefully observed so that working capital is neither inadequate nor excess of what is required. Maintenance of this equitable balance in between the components of Working Capital exerts a telling effect on profitability liquidity and financial health of an enterprise. An efficient management of working capital in an enterprise

specifically serves the following three important objectives of working capital. Three objectives of Working capital Management



When we go through these objectives, we can understand that holding too much of current assets (liquidity) leads to reduction in risk at cost of decreased profitability. An enterprise must operate on the principles of speeding up collections (Trade Receivables) as quickly as possible to pay the disbursements (current Liabilities) to minimize the risk. This is the trade off that exists between profitability and risk, which is the main purpose of management of working capital. If an enterprise fails to pay its obligations results into loss of its reputation and it is also true that inadequate inventories leads to held up of production and may lead to purchase of raw materials at higher prices. Working capital available with an enterprise should provide a cushion in bad days and avoid interruption in the process of production and generate sufficient funds to finance inventories and payments to be made. Hence, it was said that proper management of working capital is the driving seat of a financial manager or owner of an enterprise.

Review of Literature

The foregoing discussion makes it clear that the management of working occupies an important place in the business finance, particularly for MSMEs in any economy. In the present study an attempt is made to an insightful analysis of working capital management in MSMEs, with specific reference to total current assets and liabilities and with reference to their sub-components by using Ratio Analysis. It is to be accepted that a number of research was carried out based on the subject of management of working capital in developed and developing countries and in India also.

A field survey conducted by Hemanth Saikia (2012) in Assam with a sample of 220 small scale industries, dealt with the measurement of financial performance of SSIs. Her research

observed that mobility of inputs was small; management of quality of the labour input was not good. There was shortage of funds as the native investors have faced difficulties in raising the funds. Siddarapu Haribabu and prof. M. Venkatewarlu (2019) have discussed the socio-economic conditions of MSMEs in YSR Kadapa district and Chittoor district of Andhra Pradesh. Dr. Nallabala Kalyan (2017) made an attempt to analyze the performance of MSMEs in Chittoor District. He analyzed the capital –output-ratio input output ratio of MSMEs in Chittoor district tested by ANOVA and T-test techniques the problems and prospects of MSMEs in chittoor district was presented by Dr. Nallabala Kalyan and Hareesh babu(2017) and suggested some measures for smooth and accelerated growth of MSMEs in chittoor district. N. Venkataramana et.al (2013) have made an attempt to find out the efficiency of receivables management and its impact on working capital management and also to assess the impact on Working Capital Management on profitability in the selected cement companies in India. They have used financial tools like ratio Receivables to current ratio, Receivables to total assets ratio and receivables to sales ratio. They have come to a conclusion that receivables management was not satisfactory and the average collection period across industry was less than the suggested norms. P. Seshagiri Rao (2014) aimed at a study of need for promoting SSIs and its role in development and on examination of the problems of small and medium enterprises in Chittoor district. D. Sudarsana Murthy (2016) published a research paper on the analysis of performance evaluation of MSMEs in Chittoor District of Andhra Pradesh. He has observed that entrepreneurs were found facing the problems related to production, finance, marketing and other related areas of management.

The Need for present Study

The analysis of references presented above related to MSMEs in Andhra Pradesh and in Chittoor District proves the fact that the studies that have dealt with the total current assets and liabilities comprising their respective sub-components of MSMEs were not available. Keeping this research gap in view, and to present a district-specific study on working capital management in Micro and Small Enterprises, an attempt is made to analyze the management of working capital in MSMEs in Chittoor District.

Chittoor District: The Study Area:

Constituted on 1st April, Chittoor is the southernmost district of Andhra Pradesh. It is one of the drought prone districts of Rayalaseema region. Chittoor district receives an inadequate rainfall and of the 66 revenue mandals, most of the mandals are announced as drought prone mandals every year. Since there are no perennial rivers in the district, 1,16,239 wells form the major source of irrigation. 70.5 per cent of the total population resides in rural areas and the urban population accounts for 29.5 per cent (2011 Census). The literacy rate worked out to 71.5 per cent. The district has a good bank-branch network, since 580 bank branches are operating in the district, serving 7197 persons per bank branch.

Agriculture is the primary occupation in the district, as 61.2 per cent of the total workers are dependent on agriculture sector as cultivators and agricultural labor. 38.8 per cent of the workers are engaged in household industries and other household industries (MSMEs). The industrial structure of the district comprises a combination of both large and mega industries and MSMEs. As on 2015-16, 113 large and mega industries were enlisted providing employment to 37090 persons with a capital investment of Rs.778077.2 lakhs. As a supplementary structure, it was estimated that 3588 MSMEs are operating in the district, providing employment to 50,421 persons with a capital investment of Rs.2,30,373 lakhs. (General Manager, DIC). These statistics reveal that with a capital investment of Rs.4.61 lakhs on an average per enterprise, MSMEs are capable of providing employment to 14.1 persons. On the contrary, the large and mega industries need Rs.21 lakhs on an average to provide employment to one person, which works out to Rs.32, 929 for MSMEs for generating employment to one person. Hence, it is evident that MSMEs in the district are capital-light in nature with comparative high employment-potentiality and forms the important source of income and employment, after agriculture sector.

Methodology and Tools of Analysis:

The present study is based on primary data collected from 100 micro and small enterprises in Chittoor district. The data was collected by canvassing a structured schedule designed to collect the relevant information covering working employed in total assets and liabilities for 6 years period i.e. from 2011-12 to 2016-17. The data was collected during the months of July to August, 2019 by visiting the sample enterprises selected.

Sample Size:

The selected 100 micro and small enterprises selected represent three major categories of enterprises viz.. Agro, food and allied enterprises (36), Textile-based enterprises (34) and Mineral-based enterprises (30). Stratified Random sampling technique was adopted to select the sample enterprises.

Tools of Analysis:

The primary data collected was processed and analyzed with the help of Ratio Analysis. Current Ratio, Quick Ratio, Working Capital Turnover Ratio, Debtors Turnover Ratio and Cash Position Ratio were measurement metrics used for the analysis. Ratio analysis assumes much importance to evaluate the financial performance of sample micro and small enterprises to get clues of efficient management of working capital over a period of time. This method of analysis helps to make a qualitative judgment about the liquidity, profitability and to present a comparative inter-category of sample enterprises. The types of ratios used, their formulae and the purpose of the ratios used is briefly presented in Table.1

Table. 1. Types of Ratios Used for the Analysis

S. No	Measurement Metrics Used	Formula	Objective of the Measurement
1	Current Ratio	$\frac{\text{Current Assets}}{\text{Current Liabilities}}$	Measures Short term financial strength
2	Quick Ratio	$\frac{\text{Quick Assets}}{\text{Current Liabilities}}$	Measures the ability of the enterprises to meet shot term obligations
3	Working Capital Turnover Ratio	$\frac{\text{Sales}}{\text{Working Capital}} \text{ (times)}$	Determines the efficiency with which working capital is utilized
4	Debtors Turnover Ratio	$\frac{\text{Sales}}{\text{Debtors}}$	Determines the efficient management of Trade Receivables.
5	Cash Position Ratio	$\frac{\text{Cash and Cash equivalents}}{\text{Total Current Liabilities}}$	Determines the ability to pay debt obligations

Besides, the use of above mentioned ratios, an attempt is also made to calculate the “Liquidity Index” by using the following formula:

$(\text{Trade Receivables} \times \text{Days to Liquidate}) + (\text{Inventory} \times \text{Days to Liquidate}) / (\text{Trade Receivables} + \text{Inventory})$.

Objectives of the Study:

Analyzing the efficient management of working capital employed in sample enterprises is the basic objectives of the present paper. In addition, the present paper makes a modest attempt to satisfy the following primary objectives also:

- 1) To analyze the Liquidity Position of the sample enterprises
- 2) To estimate the turnover ratios to assess the performance of sample enterprises
- 3) To calculate Liquidity Index to determine how the sample enterprises are able to quickly raise cash to pay its liabilities.

Results and Discussion:

Socio-economic Features of Owners of Sample Enterprises:

The data collected reveal that majority of the owners of the sample enterprises belong to Chittoor district (72.6 per cent) and others to YSR Kadapa and Anantapur districts of Andhra Pradesh. Majority of the owners belonged to backward classes, (47.8 percent), Other social groups (29.4 per cent) and socially disadvantaged sections (22.8 per cent). 79.0 per cent of the enterprises were proprietary in nature and 54.8 per cent of the owners had technical education as their qualifications and 22.9 per cent of the owners were commerce and economics graduates. A proportion of 44.8 per cent of the enterprises had own premises and others were found operated in rented premises. Majority of the owners (55.6 per cent) belonged to the age group of 33- 48 years and 34.6 percent belong the age group of less than 33 years. Most of the owners (67.9 per cent) had previous experience in the same category of enterprises and 27.8 per cent of the owners ventured to start the sample enterprises to prove their entrepreneurial skills and capabilities.

Working Capital and its Management:

It is quite evident that the important objective of management of working capital is nothing but ensure liquidity and inadequate attention towards this purpose makes the enterprises unable to meet the obligations, which results into the lack of loyalty. Besides, if the funds are tied up in working capital, earnings or returns are negatively influenced for an enterprise. Therefore determining an optimum level of amount of Working capital assumes much importance for the maintenance of financial health of the enterprises. To understand all these

effects, an attempt is made to estimate the following important ratios, to find out the financial health of the sample enterprises.

Ratio Analysis:

1. Current Ratio:

The proportion of current assets to current liabilities measures the working capital available during the reference period of 6 years i.e. from 2011-12 to 2016-17. The details of ratios calculated for sample agro-food and allied enterprises are presented in Table.2

Table. 2. The Calculations of Ratios for Agro, Food and Allied Enterprises

Reference Period	Ratios Calculated				
	Current Ratio	Quick Ratio	Working Capital Turnover Ratio	Debtors Turnover Ratio	Cash Position Ratio
2012	1.19:1	0.70:1	9.17	5.1	0.30
2013	1.21:1	0.65:1	8.99	5.4	0.24
2014	1.19:1	0.65:1	8.16	4.9	0.27
2015	1.25:1	0.72:1	6.75	4.9	0.29
2016	1.25:1	0.73:1	6.75	4.9	0.30
2017	1.41:1	0.85:1	3.93	3.8	0.34

Source: Field Survey and Preparation of Financial statements of selected enterprises.

It is evident from the calculations of current ratio that the proportion of current assets in agro, food and allied enterprises to current liabilities has been increasing. It is well known that 2:1 is considered as satisfactory ratio; however the current ratio worked out to 1.19:1 to 1.41:1 during the reference period. This position of current ratio indicates some difficulty of the sample enterprises to meet the current obligations. However, it is also evident that the sample enterprises did not keep high level of current assets (> 2), which did not result in the idle funds.

The quick ratio represents a standard of liquidity as the ratio does not include inventories. . It is well known that 1:1 is considered as satisfactory ratio; however the quick ratio worked out to 0.65:1 to 0.85:1 during the reference period. This position of quick ratio indicates the unsatisfactory level of liquidity for the selected agro, food and allied enterprises.

The data on calculated Working capital turnover ratio reveals that the ratio shows a declining trend during the reference period from 9.17 times to 3.93 times. This ratio shows ability of an enterprise to generate income per rupee of working capital employed. The calculated ratio for the study period reveals the inefficiency of the sample enterprises to utilize the working capital, as the values for the ratio is found declining during the study period.

The Debtors turnover Ratio is calculated by dividing the revenues from sales by average trade receivables. The calculated debtors Turnover ratios indicate a declining trend. This ratio was 5.10 times during the year 2012 and has declined to 3.80 times during the year 2017. This declining trend reveals that the quality of trade receivables and the credit collection efforts of the sample enterprises are not at satisfactory level.

The cash position ratio shows the amount of cash and cash equivalents available with the enterprises to meet immediate payments. The calculated values for this ratio indicate an increasing trend during the reference period from 0.30 to 0.34. In spite of this trend the calculated values are found below 1, even the recommended values of 0.5, it can be said that the enterprises need more than just its cash reserves to pay its current liabilities.

Ratio Analysis for Textile Based Enterprises

As mentioned in methodology adopted 34 textile based micro and small enterprises were visited and the financial statements were collected for analyzing the ratios to assess their level of working capital management. The selected ratio were calculated and presented in Table.3.

Table. 3. The Calculations of Ratios for Textile-based Enterprises

Reference Period	Ratios Calculated				
	Current Ratio	Quick Ratio	Working Capital Turnover Ratio	Debtors Turnover Ratio	Cash Position Ratio
2012	1.38:1	0.90:1	4.32	2.66	0.21
2013	1.34:1	0.89:1	4.58	2.58	0.23
2014	1.58:1	1.04:1	3.02	2.59	0.28
2015	1.68:1	1.10:1	2.42	2.34	0.30
2016	1.76:1	1.15:1	2.35	2.42	0.35
2017	1.88:1	1.27:1	1.94	2.36	0.44

Source: Field Survey and Preparation of Financial statements of selected enterprises.

It is evident from the calculations of ratios, as presented in table.3, that both current ratios was less than the standard ratio i.e. 2:1 though it shows increasing trend during the reference period. Though Quick ratio was below the satisfactory ratio i.e. 2:1, though it shows increasing trend during the reference period. Though quick ratio was below the satisfactory level (1:1), during the initial years from 2014 inwards it has exceeded the ideal ratio (1:1) for the

succeeding years and found high at 1.27:1 for the year 2017. The increasing trend of quick ratio indicates the ability of sample enterprises to meet current obligations without relying on the sale and collection of inventories.

The calculated working capital ratios are found decreasing during the reference period from 4.32 to 1.94 which indicates that the sample enterprises are not efficient to generate revenues from the sales. The debtors turnover ratio, which is an accounting measure the effectiveness of sample enterprises in extending credit and the collection of debt. These calculating ratios ranged from 2.66 to 2.36 times, which indicates a slow process of effective use of their assets. However, the calculated of cash position ratios which ranged from 0.21 to 0.44 with an increasing trend. The stable cash position is not satisfactory to cover the liabilities of the sample enterprises during the reference period. This stable /low ratio might be an indication of liberal and inefficient credit and collection efforts of the sample enterprises.

Ratio Analysis for Mineral Based Enterprises

The data related to financial statements were collected from 30 mineral based enterprises for the calculations of ratios to assess the efficiency in the working capital management of these enterprises. The calculated ratios are presented in Table 4.

Table :4 Calculations of Ratios for sample Mineral-based Enterprises

Reference Period	Ratios Calculated				
	Current Ratio	Quick Ratio	Working Capital Turnover Ratio	Debtors Turnover Ratio	Cash Position Ratio
2012	1.25:1	0.76:1	7.06	5.54	0.15
2013	1.18:1	0.72:1	9.16	5.44	0.14
2014	1.17:1	0.70:1	7.85	4.67	0.14
2015	1.37:1	0.82:1	4.95	6	0.17
2016	1.48:1	0.88:1	3.59	5.44	0.16
2017	1.51:1	0.92:1	3.46	5.64	0.16

Source: Field Survey and Preparation of Financial statements of selected enterprises

The calculated current ratios for sample mineral based enterprises as presented in Table 4 are found below the ideal ratio of 2:1, though the ratio gradually increased from 1.25:1 in 2012 to 1.51:1 in 2017. These ratios indicate the inability of the sample enterprises to meet their current liabilities. Similarly the quick ratio increased from 0.7:1 in 2014 to 0.92:1 in 2017

which indicates the enterprises are unable to pay the liquid liabilities. The calculated of working capital turnover ratios, show a declining trend during the reference years from 9.16:1 in 2013 to 3.46:1 in 2017 indicating the inability of the sample enterprises to generate income from sales by turnover ratio, as calculated, show the quality of trade receivables and the efforts of credit collection are not satisfactory, since the ratios were found fluctuating ranging from 4.67 in 2014 to 6.00 in 2015. The calculations of cash position ratios, exhibit the financial strength and liquidity of the sample enterprises. These ratios ranged from 0.14 to 0.16 during the reference period, and were found below the satisfactory level. Similarly, the cash position ratio were found very low, which indicates that the cash flows generated by the sample enterprises were insufficient to pay off their current liabilities.

Calculation of Liquidity Index:

An overview of the ratio analysis presented in the foregoing analysis amply reveals the fact that the sample enterprises have to pay much greater attention towards enterprises have to pay much greater attention towards the efficient management of working capital invested in their respective enterprises. It is evident from their financial statements that a large portion of their Gross Working Capital was fastened in inventories and trade receivables, as their proportion was estimated ranging from 68.5% to 74.7% if the gross working capital (Total Current Assets). It seems this proportion of these two components cautions that a major proportion of gross working capital is tied up, which represents a low qualitative management of working capital as well as the liquidity of the sample enterprises. Keeping this attitude towards utilization of working capital an attempt is made to work out the “Liquidity Index” by using the following formula:

$$\text{Liquidity Index} = (\text{AR} \times \text{ARCP}) + (\text{I} \times \text{DL}) \div (\text{AR} \times \text{I})$$

Where: AR= Accounts Receivables

ARCP = Average Receivables Collection Period (in no of days)

I = Inventories

DL = Number of days to liquidate.

Liquidity Index is a financial indicator which is used to estimate the number of days required to convert the trade receivables and inventory into cash. This index measures the ability of an

enterprise to generate cash necessary to meet the current liabilities in its business. It shows the capacity of an enterprise to convert accounts receivables and inventories and how quickly the cash is raised to meet the expenses of day-to-day operations.

By using the above said formula, an attempt is made to estimate the values of liquidity index for the three categories of sample enterprises, selected for the present study. The values are presented in Table-5 to provide inter-category capacity of liquidity which explains the assessment of efficient utilization of working capital in general and gross working capital in particular.

Table: 5 Liquidity Index for Sample Enterprises

Reference Period	Category of Sample Enterprises			Mean values for All Sample Enterprises
	Agro, food and allied based	Textile based	Mineral based	
2011-12	37.88	31.86	51.34	40.36
2012-13	37.07	32.08	47.66	38.94
2013-14	39.08	29.19	51.97	40.08
2014-15	38.07	27.36	46.60	37.34
2015-16	38.36	28.53	42.56	36.48
2016-17	39.41	30.07	47.42	38.55
Mean	38.15	30.07	47.42	38.55

Source: Calculated from the financial statements of the sample enterprises.

It is observed from the liquidity index values presented in Table. 5 that textile-based enterprises have the lowest values (30.07), compared to mineral-based enterprises (47.42) and agro-based enterprises (38.15). The mean values for all the sample enterprises ranged from a low of 36.48 (2015-16) to a high of 40.36 (2011.-12). However, the index values are found decreasing during the years of reference, which cautions about the inability of sample enterprises to maintain a stable and /or a satisfactory level of liquidity.

Conclusion:

If we go through the ability of sample enterprises as measured by current and quick ratios, it is found that they are suffering from inefficient management of working capital, except textile-based enterprises from 2013-14 onwards during the reference period. The result of working capital turnover ratio reveals the failure of sample enterprises to generate revenue from the working capital invested during the study period. It is noticed that the quality of trade receivables and the credit collection efforts were not found satisfactory and the cash position ratio was also below the recommended values and unable to pay the current liabilities. The liquidity index values calculated for the study period also revealed that the sample enterprises

could not able to maintain satisfactory level of liquidity levels and were found unable to raise cash to meet even the short term obligations. The analysis of the above said indicators leads to an inference that the sample enterprises have to pay an increased attention towards inventory, trade receivables management for effective utilization of working capital. It is so important that they have to carefully attentive towards payables, as the average period of collection of payables was found below the satisfactory levels. Above all, they have to use the potential financial assistance schemes introduced by the Government to meet the working capital needs and manage them efficiently to generate required revenue from their business.

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AN ANALYSIS OF TRENDS IN VENTURE CAPITAL FUNDS IN INDIA AND THE IMPACT OF COVID 19

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ABSTRACT

It is a proved fact that entrepreneurship facilitates the creation of innovative enterprises, which in turn influences the improvement in competitiveness of the economy, particularly in India, where Start Ups are playing an important role in the development of innovative entrepreneurship. Venture Capital plays a significant role by providing risk capital and handholds the development of enterprises, thereby bridges the gap where traditional sources of funds cannot participate actively in funding new ventures, brings in smart advice, hand-on management support and other skills that help the entrepreneurial vision to be converted to marketable products. It was these inputs that made India to open its doors to private venture capital and the Venture Capital has made a significant contribution to development of entrepreneurship as well as improving competitiveness. The present paper primarily deals with the role of venture capital in the development of entrepreneurship in general and Start Ups in particular. Exclusively relying on secondary sources of data collected from international and national level reports prepared by reputed corporate institutes, research papers and reports of the Ministry of MSMEs, Government of India, this paper makes a modest attempt to analyze the role of Venture Capital in India. The analysis in this paper is focused on different aspects of venture capital investments in India. Special mention was made to the role of venture capital towards the contribution of capital and broad types of venture capital as an introduction to the present analysis. In the light of this introduction, a critical analysis is presented on introduction of venture capital in India, financing the investments to entrepreneurs, trends in venture capital investments in India during 2010-17, and to the recent trends influenced by COVID 19 with reference to the deals and their values, sector-wise venture capital attracted in India. A comparative analysis is provided highlighting the impact of COVID 19 for the period of January 2019 to June 2020. An attempt is also made to analyze the significance of the role of venture capital in generation of income and employment, as a financial mechanism for achieving the sustainable development and economic growth in India, the paper focuses the need for modifying the venture capital funds to play an active role for the industrial development in India, particularly for start-up enterprises.

KEYWORDS

COVID 19, venture capital investments, start ups, deals and investments.

JEL CODES

G10, G11, G19.

INTRODUCTION

During the post-financial crisis period, a new financing eco-system for new ventures has emerged particularly in recent years which have exerted significant implications both for investors and entrepreneurs. A variety of discussions took place and debates were made on the role of alternative funding channels. As a complementary effort there was a heavy pressure from seed and later stage Companies for alternative source of financing have arrived at a conclusion that the traditional closed-end venture capital funds be made as an unique investment process. However, investors have to be cautious for identifying successful investments and the identification must depend on skills and capabilities of the investors. A special focus was laid on financing entrepreneurial companies, especially start-ups and early stage ventures as start-up scene around the world was exploding and disrupting the existing business models. It was observed that investing in entrepreneurial ventures was characterized by very high degree of uncertainty and venture capitalists can create value despite high degree of uncertainty. Much attention was laid on understanding the venture capitalists own incentives and constraints which were found linked to the fund-raising cycle and the way in which the venture capital funds were structured. Being influenced by these experiences, entrepreneurial finance was explored by the following three perspectives:

- 1) The founder's perspective
- 2) The venture capitalists perspective, and
- 3) The investors backing the venture capital.

As a result of these explorations of perspectives, venture capital has emerged as an important source of funding, which had a significant effect on reshaping the start up ecosystem. Then onwards, the corporate entities have used a common approach to identify the funding options based upon the positioning of the company in its life cycle and decomposition of capital market industry into different segments, which were suitable for their maturity stage of development, size, typical investment needs, and availability of information on corporate ownership and governance models.

Attempts were made to identify the potential funding gaps, which was to be filled through appropriate funding strategies aimed at funding the most suitable type of financial investor. It was also identical that each financial system would be affected by a certain amount of allocative efficiency resulting in a gap, referred as the "primary funding gap" between the demand for financial resources for start-up companies and the supply of early stage equity capital, particularly for young and newly created small and medium sized enterprises. Consequent to this development thinking, the domain of venture capital was identified as the only source of external financing after the choices available for internal financing referred as "insider seed money". Consequently, venture capital has emerged as one of the major alternatives over the last two decades in the form of "information venture capital market"- such as "Business angels" and "Business Angel Organization".

OBJECTIVES

A critical examination of the performance of venture capital is the primary aim of the present paper, particularly in case of start ups in India. Besides this primary objective, the present paper aims at the following supplementary objectives also:

1. To assess the contribution of venture capital and financing the start ups in India
2. To analyse the trends in private equity /venture capital during the 3 stages of investment covering the period of 11 years i.e. 2010 to 2020.
3. To present the recent trends in venture capital in India with reference to pre and post -COVID -19 periods (before 2019 and during 2019 and 2020.)
4. To examine the reasons for slow growth of venture capital funds in India, and
5. To explain the implications of COVID-19 for venture capital funds in India.

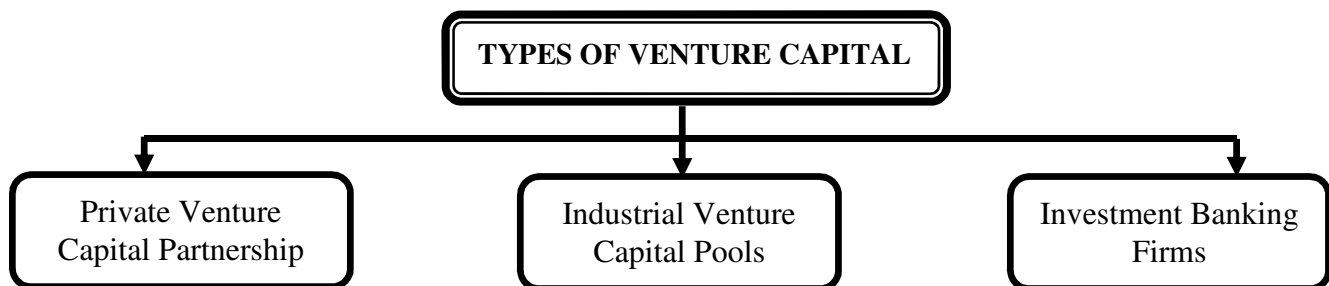
RESEARCH METHODOLOGY

The present analytical study is exclusively based on secondary data sources, focusing on a critical analysis of role of venture capital in financing start ups in India. An attempt is made to examine the recent trends in the performance of venture capital in India. Attention was paid on to present the role of venture capital investments in top sectors and specifically to present the impact of COVID-19 on venture capital investments. To satisfy the objectives mentioned above, relevant secondary data was collected for 11 years i.e. from 2010 to 2020, covering three important kinds of investments, appropriate for three stages of firms/companies in India. Relevant data and insights were gathered from International and National research reports as well as the research papers published in peer reviewed reputed journals like Bain and Company, Venture Intelligence, KPMG, EY, PREQIN PRO etc.

DISCUSSION AND RESULTS**VENTURE CAPITAL AND CONTRIBUTION TO CAPITAL**

Venture capital is a form of financing used by start-up and young companies at different stages of growth. Funds flowing into a company in the form of an investment rather than a loan, controlled by an individual or small group known as 'venture capitalists'. Venture capitalists provide large sums of money, advice and prestige by their presence. By obtaining the venture capital backing means that the business would be in the venture capitalist eyes with potential and rapid and profitable growth. Generally, venture capitalists define their investments by the business life cycle-seed financing, start-up financing, second stage financing, bridge financing and leverage buyout. If classified by life-cycle of a business, some venture capitalists prefer to invest in start-up companies, featured by high risk and potential for return, same deal with second-stage financing for expansion purposes and same venture capitalists concentrate solely on supplying funds for management-led buyouts.

The following three are the broad types of Venture Capital:



The first type of venture capital is a largest source of risk capital, aims at business which has the capability to generate a 30% return in investment each year. The capitalist like to participate in the planning and management of the business for which funds were invested.

The second type of venture capital focuses on high tech firms or companies that use state of the art technology in a unique manner, which are expected to achieve a high rate of success.

The third type of venture capital provides risk-capital for expansion and early stage financing. In general, venture capital fills the void between sources of funds for innovation-chiefly corporations, government bodies and the entrepreneurs) and traditional lower-cost sources of capital available to ongoing concerns and expects to earn a consistently superior return on investments in inherently risky business ventures.

VENTURES CAPITAL IN INDIA

In India, SEBI has laid down the activities which constitute eligible business activities qualifying for the concessions available to a recognized. Venture Capital Fund. SEBI (VC funds) Regulation -1996 defined venture capital fund as "a fund established in the form of or trust a company having a dedicated pool of capital which raises money through loan, donations, issue of securities or units as the case may be and makes or proposes to make investment in accordance with these regulations." In India, the venture capital funds are playing an important role in supplying management and marketing expertise to unlisted, new and small private business especially in technology-oriented and knowledge-intensive business or industries which might have long development cycles and which usually do not have access to conventional sources of capital. In India the activities of venture capital funds include the provision of:

- 1) Seed capital for industrial start-ups.
- 2) Additional capital to new business at various stages of their growth.
- 3) Equity financing or leverage buy-out financing to management groups for taking over other companies.
- 4) Bridge Finance
- 5) Capital to mature enterprises for expansion, diversification and restructuring.

VENTURE CAPITAL IN INDIA

Though in India, a large sophisticated financial system is in operation, in addition to formal institutions, informal financial institutions are playing a dominant role as sources of capital. Venture capital industry in India was introduced through the budget speech for the year 1988. In collaboration with ICICI, the UTI set up a venture capital fund of Rs.20 Crore for fostering industrial development during the year 1988-89. The UTI has launched Venture Capital Unit Scheme (VECAUS-I) to raise resources and with Rs.100 Crore, the second venture capital unit was set up for financing Greenfield ventures.

In 1985, the Risks Capital Funding (RCF) was sponsored by IFCI to provide positive encouragement to new entrepreneurs. It has provided risk capital and technology finance under is roof to innovative entrepreneurs and technocrats for their ventures.

The first private sector venture capital fund was set up by ANZ Grindlays Bank in India with an initial capital of Rs 10cr. In Banking Industry, the subsidiaries of SBI and Canara Bank have started the provision of venture capital funds for the development of industries such as watches, seamless metal, cement and ceramics.

In addition to the regulatory mechanism of SEBI, the government regulations and policy are very congenial for the development of venture capital industry. by sanctioning tax breaks and concessions to the venture capital funds and tax exemptions under section 10(23FB) of IT Act. However, such privileges are not allowed to shareholders of a venture capital company.

FINANCING THE INVESTMENTS TO ENTREPRENEURS

Generally, the venture capital provides funds for long-term under the following three modes of financing:

- 1) Equity
- 2) Conditional Loan and
- 3) Convertible Loans

Under the above three modes, the venture capitalists provide finance for investment to entrepreneurial ventures, particularly related to the sectors like biotechnology, medical services, communications, electronic components, and software companies. To maintain a balance between risk and profitability, venture capital firms finance the following stages of investment requirement.

STAGES OF INVESTMENT FINANCING

- 1) Seed capital and Research and Development Projects
- 2) Start-ups
- 3) Second Round Finance

- 1) Development Capital
- 2) Expansion Finance
- 3) Replacement Capital
- 4) Turn Arounds
- 5) Buyouts

Early stage financing stage need seed capital and the financial risk increases progressively as the research phase moves into the development phase. Venture capital is provided to undertake these risks and make investments in R&D projects which promise higher returns in future. Venture Capital is necessary for start-ups with inadequate finance to commercialize new technology and resultant products. Second round finance meets the financial needs for a company at the stage when the product was launched in the market and has not earned. Adequate profits to attract new investors.

Later stage financing includes development capital to purchase of new equipment plant, expansion of market and launching of product into new regions and loan. Expansion finance focuses on low risk ventures. Buy out refers to the management control by creating a separate business by separating it from their existing owners. These buyouts include management buyout (MBOs) and management buy ins (MBI). Replacement capital is another aspect of financing is to provide funds for the purchase of existing shares of owners. "Turn arounds" is a form of venture capital financing which involves medium to high risks and buying the control of a sick company.

The venture capitalists evaluate technology and study potential markets besides considering the capability of the promoter to implement the project related to early stage investments. They examine new markets and track record of the business in the later stage investments.

TRENDS OF VENTURE CAPITAL FINANCING IN INDIA

An attempt is made to analyze the trends in Venture Capital Investments made in India during the period 2010 to 2017, based on secondary sources of information. The trends are presented in Table 1:

TABLE 1: TRENDS IN PRIVATE EQUITY/ VENTURE CAPITAL DURING THE PERIOD 2010 TO 2017

Year	Value of Deals (US \$ million)	Volume of Deals (No. of Deals)
2010	8430	372
2011	9641	446
2012	7546	416
2013	9116	392
2014	11683	470
2015	19635	767
2016	16203	588
2017	26458	595

Source: EY (2018) PE/VC Agenda, India Trend Book-2018, p.13

The data presented in Table. 1. reveals that during the period 2010 to 2017, there was a significant increase in the flow of Venture Capital investments as well as in the no. of deals. The value of deals which was US \$ 8430 in 2010 has remarkably increased to US \$ 26458, with a simultaneous increase in no. of deals from 372 to 595. The year 2017 was treated as the best year in terms of the value of PE/VC investments, as the overall underlying trends of deals becoming larger and more complex.

However, it was observed that the impressive growth in absolute terms was due to the large deals by Softbank from its gigantic US\$ 100 billion Vision Investment Fund. In 2017, Softbank made investments worth of US\$ 5 billion in the Indian market and most of these investments have flown from Vision Fund, particularly for e-commerce Company, Flipkart and also US \$ 1.4 billion investments in Paytm and the US \$ 1.1 billion investments in Ola Cabs along with Tencent.

A BIRD'S EYE-VIEW OF OTHER DEALS

An analysis is also made to present the other deals and their volume particularly covering start up deals, buyout deals, credit deals, growth deals and PIPE deals and their respective values of deals during the period 2014-2017 in India. Table. 2 presents these details.

TABLE 2: OTHER DEALS AND THEIR RESPECTIVE VALUES IN INDIA DURING 2014-2017

S. No	Investments in	2014		2015		2016		2017	
		No. of Deals	Value (US\$b)	No. of Deals	Value (US\$b)	No. of Deals	Value (US\$b)	No. of Deals	Value (US\$b)
1	Start up Deals	253	1.7	454	4.8	300	2.1	372	3.5
2	Buyout Deals	11	1.3	23	3.0	29	3.9	25	3.2
3	Credit Deals	24	0.6	35	1.1	65	2.9	57	2.5
4	Growth Deals	121	6.6	213	8.5	160	5.7	159	13.5
5	PIPE Deals	61	1.6	42	2.3	34	1.6	42	3.8

Source: EY (2018) PE/VC Agenda, India Trend Book-2018, p.16-18

The following observations can be made from the data presented in Table 2:

- 1) The start-ups deals have recorded highest growth in 2015, with a drop to 300 deals with a value of US \$ 2.1 in 2016 from 454 deals with US \$ 4.8 billion. E-commerce was the sector which has received the largest amount start-up funding at US \$819 million.
- 2) Though the no. of buyout deals was 11 in 2014, picked up momentum from 2015 onwards, registering the highest number of 29 in 2016, with a drop to 25 deals. In terms of value of deals also the buyouts registered the highest value of US \$ 3.9 billion in 2016, though it was only US \$ 1.3 billion in 2014.
- 3) Credit deals, which emerged as a new mode of funding in 2016, proved as a viable means of financing for the real estate sector, as can be seen from the data that with 65 deals and representing the value of US \$ 2.9 billion in 2016, which has increased from deal value of US\$ 0.6 billion in 2014.
- 4) Growth capital account for more than 50.0 per cent share of the total value invested and the year 2017 was proved as the best year for growth deals which has touched the peak no. of deals with value of US \$ 13.5 billion.

5) For PIPE investments also 2017 was proved as the best year as they have registered highest no. of deals (42) which received investment of US \$ 3.8 billion, though an investment of US \$ 1.6 billion was invested across 61 deals.

SECTOR-WISE VENTURE CAPITAL INVESTMENTS IN INDIA

A similar view can be seen with regard to the sectoral distribution of venture capital investments in India during the year 2017, which was considered as the best year compared to the year 2016. The important sectors like financial services, real estate, e-commerce, technology, retail and consumer products, and health care recorded the highest ever investments by Venture Capitalists in India. Except for technology, which recorded a decline of 10%, all the other sectors mentioned above grew by over 50% in terms of value. Apart from these, sectors such as logistics, power and utilities and food and agriculture also witnessed good investment activity in 2017. The sector-wise amounts of venture capital attracted are presented in Table.3.

TABLE 3: GROWTH OF INVESTMENTS ACROSS SELECTED SECTORS IN INDIA DURING 2017

S. No.	Sectors Attracted investments	No. of Deals and Value of Deals (US \$ b)			
		Deal Value	% contribution to overall value	No. of Deals	% contribution to overall Deal volume
1	Financial Services	7.2	27	112	19
2	Real Estate	5.0	18	53	9
3	E-Commerce	4.7	17	60	10
4	Technology	1.8	7	121	20
5	Power and Utilities	1.3	5	NA	NA
6	Health care	1.0	4	37	6
7	Retail and Consumer	0.8	3	37	6
8	Others	4.7	18	128	22

Source: EY (2018) PE/VC Agenda, India Trend Book-2018, p. 18

Among the different major sectors that have attracted venture capital, as presented in Table. 3, reveals that Financial Services with US \$ 7.2 billion across 112 deals has attracted the highest percentage of contribution to overall value of the deals. This was followed by Real Estate sector contributing 18 % of the overall value estimated as US \$ 5.0 billion across 53 deals. E-commerce was the next succeeding sector which has attracted US \$ 4.7 billion across 17 deals during the year 2017. Other sectors also proved more effective in attracting the venture capital to the tune of 18% of the overall value, accounting for US \$ 4.7 billion across 37 deals. The sectors like technology, health care and retail and consumer have attracted investments ranging from US \$1.8 billion to US \$ 0.8 billion during 2017 in India.

SECTOR WISE DEAL SIZE-RECENT TRENDS

The experts have observed that the Indian VC industry has passed through three distinct phases in the last decade. The first phase refers to the period from 2012 to 2015, which was called as “Growth Stage”. The second phase refers to the period of two years, i.e. 2016 and 2017, called as “Maturing and Moderation” period. The third phase refers to the years 2018 and 2019, called as “Renewed Optimism” period buoyed by marquee exits for investors like Flipkart, MakeMyTrip and Oyo, and a strong start-up activity in new sectors such as Fintech and SaaS along with market depth in e-commerce.

An attempt is made to present the average deal size by sectors during the third phase of passage of Venture Capital funds in India. The details are presented in Table 4:

TABLE 4: THE AVERAGE VC DEAL SIZE BY SECTORS DURING THE 3RD PHASE IN INDIA

Sectors	Average Deal Size (\$B)		No. of Deals	
	2018	2019	2018	2019
1. Consumer Tech	11.6	16.9	188	216
2. Fintech	14.3	26.7	71	609
3. Software/SaaS	11.9	12.1	50	88
4. B2B Commerce and Tech	13.2	16.8	38	82

Source: Bain and Company (2020) India Venture Capital Report-2020: Perspectives on the Funding and Start-Up Ecosystem, p.10.

It is evident from the Table.4 that 83.3 per cent of the venture capital investments was concentrated in four sectors like Fintech, Consumer Tech, B2B Commerce and Tech and Software/SaaS. The sector- Fintech was the largest sector accounting for approximately 36.8 per cent of the total investments with 609 deals during the year 2019 followed by Consumer Tech and B2B Commerce and Tech.

GROWTH IN START-UP ECOSYSTEM

It is well known that India has the best start-up ecosystem. A number of initiatives and policy changes like Startup India, Atal Innovation Mission, Digital India and assistance through SIDBI have created a congenial environment for Start-Ups and Venture Capital growth in our country. The estimations revealed that the no. of start-ups have grown at the rate of 17.0 per cent each year from 2015 onwards. The estimated trends in the rapid growth of Start-Up ecosystem in India is presented in Table 5:

TABLE 5: GROWTH IN START-UP ECOSYSTEM IN INDIA (In 100K)

Year	No. of Cumulative Start-Ups	No. of Funded Start-Ups
2015	51	3.6
2016	61	4.6
2017	68	5.4
2018	75	6.0
2019	79	6.4

Source: Bain and Company (2020) India Venture Capital Report- 2020: Perspectives on the Funding and Start-Up Ecosystem, p.22.

The data presented in Table. 5 shows that the no. of cumulative start-ups has increased from 51 to 79 (100K), indicating a percentage increase of 54.9 per cent in 2019 over 2015. Similarly, the no. of funded start-ups has also grown from 3.6 to 6.4 (100K) indicating 77.8 per cent of increase in 2019 over 2015.

IMPLICATIONS OF COVID 19 FOR VC FUNDS

The effect of COVID 19 has also touched the trends in Venture Capital funds. Venture Capital investments in the present financial year are found dropping in terms of no. of deals and value of investments. A comparative picture for the first half of 2019 and 2020 is presented to estimate the impact of COVID 19 on investments by venture capital funds. Table 6 presents the impact of COVID 19.

TABLE 6: VENTURE CAPITAL INVESTMENTS BY TOP SECTORS (In \$ MILLION)

S. No	Top sectors	First Half of 2019	Second Half of 2019	First Half of 2020*
1	Fintech	600	928	547
2	Healthcare	414	471	370
3	Education	108	146	244
4	Food	287	391	243
5	E-commerce	1257	1764	202
6	Artificial Intelligence	134	127	112
7	Consumer Brands	138	104	73
Top 7 Sectors		2938	3931	1791

Note: *Till June, 6, 2020

Source: Report of the Venture Intelligence -2020 and howindialives.com, 23rd June, 2020

The top sectors presented in Table. 6 reveals that the sector drivers have changed with a negligible changes brought about by the COVID 19. E- commerce is the largest loser as this sector has attracted \$1257 million and \$1764 million during the first and second half of 2019, could attract only \$ 202 million in the first half of 2020, losing more than a billion dollars (\$1055 million). This was followed by health care sector by losing \$136 million in the first half of 2020, compared to first half of 2019. The sectors like food (\$ -44 million), artificial intelligence (\$-22 million) and consumer brands (\$ -65 million) were also the losers during the first half of 2020, compared to first half of 2019. The venture capital investments have witnessed a decrease to the extent of 39.0 per cent in firsts half of 2020, as compared to first half of 2019 and a decline of 54.4 per cent compared to second half of 2019.

IMPACT OF COVID 19 ON VENTURE CAPITAL

The first case of corona virus was registered on January, 30th in India and the efforts of the Government to overdrive to contain virus were started during the second half of March, 2020. Though there were more investments in Start-Ups during the months of January and February, 2020, after these two months the Start-Ups have experienced the situation of lack of funds and many companies have announced layoffs. April and May, 2020 have proved more brutal for start-ups and the no. of deals have decreased to an average of 50 a month during January and April, to 20 in May and only one- fourth of the investments were made in May, 2020, as compared to May 2019, though there was a slight increase in the month of June, 2020. The details of the drop in venture capital investments in Indian start-ups are presented in Table 7:

TABLE 7: IMPACT OF COVID ON VENTURE CAPITAL :2019 AND 2020

Months	Venture Capital Investments in Indian Start-Ups (in \$ Million)		Percentage Increase (+)/ Decrease (-) in 2020 over 2019
	2019	2020	
January	1169	709	-- 39.3
February	281	791	+181.5
March	786	392	-- 50.1
April	574	443	-- 22.8
May	788	202	--74.4
June	640	240	--62.5
For all the months	4238	2777	--34.5

Source: Report of the Venture Intelligence -2020 and www.howindialives.com, 23rd June, 2020

The estimations of drop in venture capital investments, as presented in Table.7, reveals that there was a decline of venture capital investments to the tune of \$ 1461 million (34.5 per cent) in the first half of 2020 compared to the first half of 2019. Except for the month of February, for all the 5 months, there was a decline in venture capital investments in Indian Start-Ups and highest decline was registered for the months of May and June.

CONCLUSION

In spite of the availability of vast pool of scientific and technical research abilities, India is still recognized as a low cost developer and service provider. Though India has skilled manpower, advantage of English-speaking human resources and cheap labor, its leadership is on a slipping edge as other countries such as Philippines, China and Vietnam, which are trying to grab the position of India. In recent years, the business activities and operations of the industries are getting more and more technology-oriented. Being attracted by the congenial business environment available in India, many foreign companies are getting located around Delhi, Mumbai, Bangalore, Hyderabad, Visakhapatnam, Tirupati and Sathyavedu, which are offering a good no. of employment opportunities to young, skilled and talented people. It is to be admitted here that there would be a phenomenal increase in start-up industries, which provide employment opportunities, if there would be proper, adequate and effective supply of venture capital funds. This can happen only when the right environment is created to understand the global forces and the operational features of life cycle of borrowing companies and it is sure that we can create a right replica of Silicon Valley in India, a phenomenon for the world to watch. No doubt, the COVID 19 crisis has brought up significant changes in the no. of deals and volume of venture capital investments as well as in start-up investment patterns, there is a shift in their focus from tech-centric start-ups to the ones operating in sectors like FMCG, on-line delivery of essential commodities, entertainment within the house, etc., It is to be noted that start-ups in India like EdTech, FinTech and Cyber Security have been promoting their user demand, forming the important sources of attracting the investors. In addition, the efforts of the Government of India to extend \$ 130K for the development of an encrypted video conferencing solution encourage the development of start-ups in India during the post-COVID 19 crisis. Let us hope that the shifts in focus areas as well as the supporting efforts of the Government to unlock the effect of the present health crisis prove fruitful for the increased flow of venture capital investments for the improvements in productivity of the industrial ventures.

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TOURISM IN INDIA- IMPACT & INITIATIVES

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Abstract

Travel & Tourism creates jobs, drives exports, and generates prosperity across the world. Today tourism is the largest service industry in India, with a contribution of 6.23 per cent to the national Gross Domestic Product and providing 8.78 per cent of the total employment. Foreign Tourist Arrivals (FTA) crossed the 10 million milestone in 2017 and the growth trend is expected to continue over the coming years. The introduction of E-Visa has led to a strong surge in FTAs which extended to citizens from 166 countries for visit to India through 28 international airports. Key initiatives undertaken by Government of India, Ministry of Tourism, which includes launching of 'Incredible India 2.0 campaign' with market specific content and advertising for tourism development in India. The major challenges faced by the Indian tourism industry are deficiencies in infrastructure like sanitation, living facilities, hotels, etc., and inadequate connectivity between cities and tourist locations and security issues etc. According to the World Travel and Tourism Council, India will be a tourism hotspot from 2009-2018, having the highest 10-year growth potential. Moreover, India has been ranked the "best country brand for value-for-money" in the Country Brand Index survey.

Keywords: GDP, FTA, Incredible India 2.0 Campaign, E-Visa.

1. Introduction

Tourism is one of the powerful operators of employment and wealth globally. The activity of tourism in various countries is reflected the most significant than creation concerning to the financial characteristics as well as social impacts. For a growth of economy tourism is an exceptional facilitator that's why it is a vital part in macroeconomic level. This business is imperative to force labour and is essential cause of government's revenues. As one of the world's largest economic sectors, Travel & Tourism creates jobs, drives exports, and generates prosperity across the world. The sector, comprised of a wide range of industries, aims to serve and support domestic, international, business and leisure visitors. Companies, large and small, in industries ranging from accommodation and transportation to food & beverage, retail and culture and sports & recreation, all strive to create products and services that bring people together, support communities and celebrate the wonders that our world can offer.

In its annual analysis quantifying the global economic and employment impact of Travel & Tourism in 185 countries and 25 regions, the World Travel & Tourism



Council's (WTTC) research reveals that the sector accounted for 10.4 per cent of global GDP and 319 million jobs, or 10 per cent of total employment in 2018. The division of overall spend is firmly weighted towards the leisure market, which represented 78.5 per cent of the total compared with 21.5 per cent for business spend, and the sector accounted for 6.5 per cent of total global exports and 27.2 per cent of total global service exports. Domestic tourism, which represented 71.2 per cent of all tourism spending in 2018 and had the strongest growth in developing nations, continues to support opportunities by spreading development and regional economic benefits and building national pride.

2. Importance of tourism industry

- **Sources of foreign exchange earnings:** Industry of tourism is the key effective type of business worldwide.
- **Employment Opportunities:** This industry is also one of the significant segments. It creates opportunities related to employment. It offers services to inexperienced, pre-nominal and experienced manpower. Director, labour etc are the individual or efforts necessary in the industry of tourism.
- **Sources of public as well as private income:** Industry of tourism is the main cause of earnings for public along with private sector government sales tax, service tax and charges tax etc. which is recognized as government proceeds is the revenue of community. Handicraft, arts etc are the stuffs that fascinate tourist and majority of them purchase them and the seller make some profit which is called private earnings.
- **Cultural Exchange:** Business of tourism accommodates social interchange tourist bring over several ethnic perceptions of other states wherever they visit. Native individuals can pick up their linguistic, skill, talent, values etc and vice versa.

3. Present scenario of Tourism in India

Today tourism is the largest service industry in India, with a contribution of 6.23 per cent to the national Gross Domestic Product (GDP) and providing 8.78 per cent of the total employment. India witnesses' more than 5 million annual Foreign Tourist Arrivals and 562 million domestic tourism visits. The tourism industry in India generated about US\$100 billion in 2008 and that is expected to increase to US\$275.5 billion by 2018 at a 9.4 per cent annual growth rate. The Ministry of Tourism is the nodal agency for the development and promotion of tourism in India and maintains the "*Incredible India*" campaign.

According to World Travel and Tourism Council, India will be a tourism hotspot from 2009-2018, having the highest 10-year growth potential. As per the Travel and Tourism Competitiveness Report 2017 by the World Economic Forum, India is ranked 11th in the Asia Pacific region and 62nd overall, moving up three places on the list of the world's attractive destinations. It is ranked the 14th best tourist destination for its natural resources and 24th for its cultural resources, with many *World Heritage Sites*,



Tunable emission and energy-transfer mechanism of single-phase $\text{Na}_3\text{Y}(\text{PO}_4)_2:\text{Ce}^{3+}$, Mn^{2+} phosphors for white LEDs



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ABSTRACT

A series of color-tunable single-phase $\text{Na}_3\text{Y}(\text{PO}_4)_2:\text{Ce}^{3+}$, Mn^{2+} (NYPO:Ce,Mn) phosphors were synthesized by means of solid-state reaction method for white light-emitting diodes. First, the concentration of Ce ($x = 0.07$) in the NYPO phosphors was optimized according to the photoluminescence (PL) properties, and then the optimized NYPO:0.07Ce phosphor was selected to study the single-phase phosphor with various concentrations of the Mn ($y = 0.01, 0.03, 0.05, 0.07$) co-dopant. The physicochemical characterization of both the doped and co-doped samples was performed via X-ray powder diffraction, infrared spectroscopy, and X-ray photoelectron spectroscopy. Further, for the investigation of the PL properties, emission spectra of both doped and codoped samples were recorded upon 375 nm excitation, and spectra of NYPO:Ce exhibited two distinct peaks around 424 nm (blue emission) and 527 nm (green emission) due to the $5d_1$ to $4f$ transitions of Ce^{3+} ions, while the co-doped NYPO:Ce, Mn phosphors exhibited three peaks, two of them are at 414 and 515 nm (blue and green emission, respectively) due to the $5d_1-2f_{7/2,5/2}$ transitions of Ce^{3+} ions and third peak is closer to the red range (620 nm) due to the ${}^4\text{T}_1({}^4\text{G})-{}^6\text{A}_1({}^6\text{S})$ transitions of Mn^{2+} in the visible spectrum. NYPO:0.07Ce, 0.05Mn emits the combination of the three emission peaks (blue, green, and red) resulted in bright white light with CIE chromaticity coordinates of (0.322, 0.317), CCT (6036 K), and CRI (93), at a suitable excitation wavelength of 375 nm. The emission due to the addition of rare-earth Ce^{3+} ions and metal activator Mn^{2+} ions to the NYPO proves that it may be potential phosphor for obtaining white-light emission and tunable luminescence.

1. Introduction

In recent years, the fabrication of enhanced white light-emitting diodes (LEDs) with significant advantages such as high luminous efficacy, a long life time, and eco-friendliness has led to developments in solid-state lighting technology, which can consume the less energy that used by conventional lighting bulbs. Thus, formal lamps are being replaced by high-efficiency white LEDs (w-LEDs), and this trend is expected to continue [1–3]. In the solid-state lighting market, the predominant technology for achieving white-light emission is the phosphor-converted w-LED, which is fabricated by coating a blue LED or near-ultraviolet (UV) LED with down-conversion phosphor materials. In 1967, a green-yellow emitting phosphor $(\text{Y,Gd})_3(\text{Al,Ga})_5\text{O}_{12}:\text{Ce}^{3+}$ (YAG:Ce) was proposed for use in displays, and later, when the bright-blue InGaN diode was invented, it was employed for white-light generation. Nichia (Japan) successfully achieved white-light emission by

dispersing YAG:Ce in a transparent polymer matrix and coating the resulting material onto a blue InGaN LED chip [4–6]. Although, the generation of white light with YAG:Ce plus blue LED is nearly ideal, the combination of the blue chip radiation and the yellow phosphor emission yields cool white light that has a deficiency of red emission and shows a high Correlated Color Temperature (CCT) and low color rendering index (CRI) [7–9]. Thus, an alternative approach for generating warm white light with the appropriate CRI is the incorporation of a red component in phosphor emission, which can be excited by a UV-emitting LED. The adding of Ce^{3+} and Mn^{2+} ions to host materials is one of the ways to obtain such a phosphor that emits desire white light. Further, researchers are directing considerable effort and great scientific interest toward the discovering, investigation and developing of new phosphors that can have efficiency of red component to obtain pure white light emission with low CCT and CRI, and also w-LED devices can be fabricated without intellectual property (IP) complications [10].

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Generally, in the synthesis of phosphor materials, rare-earth or/and transition-metal ions are often used as appropriate activators to satisfy the requirements of w-LEDs, displays, and other photonic devices, because of the rich emission colors based on the orbit transitions [11–13]. Among the rare-earth ions, Ce^{3+} ions are widely used as activator ions for yellow/broad blue light-emitting phosphors, which exhibit superior absorption in the region of 200–400 nm and a strong emission peak due to the $5d \rightarrow 4f$ transition [14].

In general, the transition-metal ions (Mn^{2+}) are a promising class of materials for red emission due to the ${}^4\text{T}_1$ to ${}^6\text{A}_1$ transition, as they can improve the color rendering and luminous efficiency of w-LEDs [15]. However, the energy transitions can be affected by the nature of the host materials, through nephelauxetic, crystal field effects. Therefore, the excitation and emission energies are tunable in a wide wavelength range through variation of the host composition and crystal structure [16,17].

In the past decades, many research groups have attempted to develop single-phase white light-emitting phosphors doped rare earths ions and transition metals with various host materials that convert UV radiation into white light, and there have been several reports on the optical properties of Ce^{3+} - and transition-metal ion-doped phosphors, such as borates ($\text{Sr}_5\text{MgLa}_2(\text{BO}_3)_6:\text{Ce}^{3+},\text{Mn}^{2+}$) [18]; phosphates ($\text{KSrY}(\text{PO}_4)_2:\text{Ce}^{3+},\text{Tb}^{3+},\text{Mn}^{2+}$) [19]; and also phosphates as host with different dopants have been studied widely such as $\text{KNaCa}_{2-x-y}(\text{PO}_4)_2:\text{xCe}^{3+},\text{yDy}^{3+}$ [20]; $\text{Ba}_3\text{Ce}(\text{PO}_4)_3:\text{Eu}^{2+}$ [21] and $\text{Na}_3\text{Bi}(\text{PO}_4)_2:\text{Eu}^{3+},\text{Tb}^{3+},\text{Dy}^{3+},\text{Sm}^{3+}$ [22]. In particular, alkali metal lanthanide double phosphates ($\text{M}_3\text{Ln}(\text{PO}_4)_2$, where $\text{M} = \text{Na}, \text{K}, \text{Rb}$) have been studied extensively, such as $\text{K}_3\text{Y}(\text{PO}_4)_2$ [23]; $\text{M}_3\text{Y}(\text{PO}_4)_2:\text{Pr}^{3+},\text{Ce}^{3+}$ ($\text{M} = \text{Na}, \text{Rb}$) [24]; $\text{K}_3\text{R}(\text{PO}_4)_2:\text{Tb}^{3+}$ ($\text{R} = \text{Y}, \text{Gd}$) [25]; $\text{K}_3\text{Dy}(\text{PO}_4)_2$ [26]; and $\text{Na}_3\text{Gd}(\text{PO}_4)_2:\text{Ce}^{3+}$ [27]. These class of phosphate-based phosphors have good chemical and thermal stability; optical efficiency is particularly visible region and could create a variety of applications [28]. However, knowledge on the photoluminescence (PL) properties of $\text{Na}_3\text{Y}(\text{PO}_4)_2$ doped with lanthanide ions remains limited. Hence, in this present work, the PL properties of Ce^{3+} - and Mn^{2+} -ions co-doped alkali metal yttrium double phosphate $\text{Na}_3\text{Y}(\text{PO}_4)_2$ phosphors were studied and prior to the PL studies, the physicochemical properties were examined.

2. Experimental

2.1. Synthesis of phosphors

A series of $\text{Na}_3\text{Y}(\text{PO}_4)_2:\text{xCe}^{3+}$ ($x = 0.01, 0.03, 0.05, 0.07$) (NYPO:Ce) and $\text{Na}_3\text{Y}(\text{PO}_4)_2:0.07\text{Ce}^{3+}, \text{yMn}$ ($y = 0.01, 0.03, 0.05, 0.07$) (NYPO:Ce, Mn) phosphor samples were synthesized via the traditional high-temperature solid-state reaction method in air atmosphere. It is proposed that charge compensation can be achieved via the formation of vacancies in $\text{Na}_3\text{Y}_{1-x}(\text{PO}_4)_2:\text{xCe}^{3+}$ and $\text{Na}_{3-2x}\text{Y}(\text{PO}_4)_2:0.07\text{Ce}^{3+}, \text{yMn}$ through the substitution of Ce^{3+} at Y^{3+} sites and Mn^{2+} at Na^+ sites in the present NYPO matrix. This was verified by X-ray photoelectron spectroscopy (XPS). High-purity analytical-grade precursors— Na_2CO_3 , Y_2O_3 , $\text{NH}_4\text{H}_2\text{PO}_4$, MnCO_3 , and Ce_2O_3 —were purchased (Sigma–Aldrich, India) and used as received. For the synthesis of the phosphors, first, all the precursors were ground homogeneously in an agate mortar and subsequently sintered at 400°C for 4 h in air. After cooling to room temperature, the samples were crushed to fine powder. Then, they were annealed at 900 and 1100°C for 8 h, with intermediate crushing between the heat treatments.

2.2. Characterization

The X-ray diffraction (XRD) profiles of the NYPO:Ce, Mn phosphors were recorded in the 2θ range of 10° – 50° with a step size of 0.02° using a PANalytical X'Pert PRO X-ray diffractometer with Cu-K α radiation ($\lambda = 1.54060 \text{ \AA}$) operating at 40 kV and 30 mA. Attenuated total

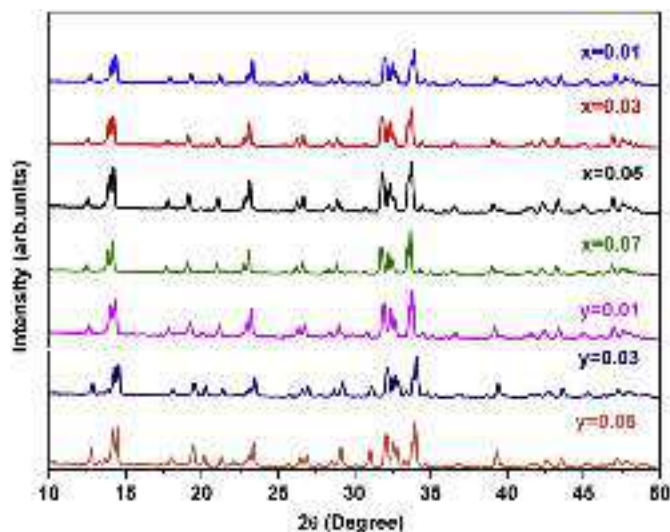


Fig. 1. XRD profiles of NYPO: $x\text{Ce}$ and NYPO:0.07Ce, $y\text{Mn}$ (XRD profile is comparable with the Ref.no:29).

reflectance Fourier transform infrared (FTIR) spectra were recorded in the wavenumber range of 2000 – 400 cm^{-1} using a PerkinElmer (Bruker) infrared (IR) spectrometer. XPS was performed using an X-ray photoelectron spectrometer (K-Alpha, Thermo Scientific, USA) with Al K α X-ray radiation (1486.6 eV). UV–visible diffuse reflectance spectra (DRS) were recorded using a UV–visible–near-IR spectrophotometer (Jobin Varian Cary 5000, USA). The reflectance was measured in the range of 200 – 800 nm using polytetra fluoroethylene as a standard. PL spectra were recorded using a fluorescence spectrophotometer (F-4500, Hitachi, Tokyo, Japan) with a 200-W Xe lamp as an excitation source. All the measurements were performed at room temperature.

3. Results and discussion

3.1. Structural analysis

Fig. 1 shows the powder XRD patterns of the as-prepared NYPO:Ce and NYPO:Ce, Mn phosphors. All the diffraction peaks of the prepared samples are consistent with the reported XRD results by Aleksandra Matraszek et al [29]. The NYPO compound belongs to the $\text{M}_3\text{RE}(\text{PO}_4)_2$ family, which is characterized by polymorphic transitions and a glasserite nature, and has different structures, such as tetragonal, orthorhombic, and monoclinic, depending on the presence of mono- and rare-earth cations in the phosphates, as well as the synthesis temperature [30,31]. However, A. Matraszek et al. reported the formation of orthorhombic NYPO phases at sintering temperatures of 1300°C . In the present study, the samples were synthesized via a solid-state reaction method at 1100°C , and the XRD profile was well matched. Therefore, the prepared phosphors had an orthorhombic structure with the space group Pbc21. Moreover, the XRD peaks exhibited no obvious shifts, owing to the single-phase formation, which can be explained on the basis of the similar effective ionic radii and valences of the cations. Considering the ionic radii of Ce^{3+} ions (1.01 \AA), they prefer to occupy Y^{3+} ion (1.011 \AA) ion sites because of the similar radii and the balancing of the valence of the cations, whereas Mn^{2+} ions (0.67 \AA) may occupy Na^+ ion (1.02 \AA) sites more easily than P^{5+} ions of radius 0.52 \AA (all the ions have a coordination number of 6) [32–34]. Hence, the occupancy of dopant ions $\text{Ce}^{3+}/\text{Mn}^{3+}$ at cation sites of $\text{Y}^{3+}/\text{Na}^+$ is probable in the NYPO-based matrix. This is supported by the XPS analysis results, which are presented later. Further, the substitution of dopant ions at the cation sites can be explained on the basis of the charge-compensation mechanism, as follows.

A Brief Review on Thin Film Deposition and Characterization Techniques

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ABSTRACT

The growing electronic industry needs to adopt new thin technologies for the sake of miniaturization of electronic devices. The performance of the miniaturized thin film-based electronic components depends on various factors such as chemical stability during the deposition (growth parameters), atomic structure, and morphology, optical and electronic properties. Hence choosing a suitable deposition technique plays a crucial role in deciding the performance of thin film-based devices. In addition, various characterization techniques have to be carried out on the prepared thin films to check their quality, and applicability to a specific application. Here in this brief review, we have discussed various thin film deposition techniques such as thermal evaporation, sputtering, electronic beam evaporation, spray pyrolysis etc. We have adopted a few of the aforementioned thin film deposition techniques for our research samples (ZnO, MoO₃, and TiO₂ – MoO₃ thin films) that have been mentioned as examples while elaborating on a particular technique. A few of the thin film characterization techniques have also been discussed.

Keywords: Thin Film Deposition, Characterization Techniques, Flash Evaporation.

INTRODUCTION

In recent years new electronic systems demands new thin-film technologies because of the industrial demand for devices to fulfil the urgent needs of present-day technology. So a large number of physical and chemical vapour deposition technologies were developed to meet the current industrial demand.

The electronic device performance depends on several factors like chemical composition, structure, morphology, and optical and electrical properties of the films prepared, which in turn depend on the deposition technique and the deposition process parameters used for the growth of thin films. Hence there is a lot of demand for techniques which can provide fine control over film deposition and be helpful in essential in the required properties of the films. The important process parameters which can be controlled in physical vapour deposition techniques which affect the film growth and properties are the vacuum, deposition rate, substrate temperature, source temperature, source-to-substrate distance, partial pressure of the residual gases etc. In the present investigation, two techniques were adopted one is r.f. sputtering and another one is d.c. magnetron sputtering.

The detailed description of these two techniques employed in the preparation of porous thin films

of ZnO, MoO₃, and TiO₂ – MoO₃, has been given in section-A of this review. The characterization techniques (experimental procedure and instrument details) employed to characterize the determination of film composition, structure, and optical and electrical properties are presented in section B.

Thin Film Deposition Techniques

In order to explain deposition techniques we will be mentioning a few of our research samples, such as Molybdenum oxide, zinc oxide, as examples which already been published. Different synthesis techniques such as resistive heating [1-16], flash evaporation [17-18], electron beam evaporation [19-20], sputtering [21-26], chemical vapour deposition [27-30], were used to prepare MoO₃-thin films.

Each deposition technique has its merits and demerits. The aim is to have a film with uniform thickness over a large surface area, stoichiometrical and good crystallinity at lower substrate temperatures. To achieve the such qualities, one need to choose a proper deposition technique, which will be discussed in brief in this review.

1. Thermal Evaporation

Among the physical vapour deposition techniques, one of the simplest, though oldest, is

thermal evaporation. A wide variety of materials from varying metals, and semiconductors, to dielectric materials, could be melted using this technique. The basic principle in thermal evaporation is resistive heating or r.f. heating. Upon heating in vacuum chambers, materials get evaporated and transported onto substrates. The necessary vacuum in vacuum chambers is created by employing a diffusion pump backed up by a roughing pump-rotary pump ($\geq 10^{-2}$ Torr).

The main requirements of source material are no reaction with the evaporator and with negligible vapour pressure. To hold materials, the source should have a proper shape (powder, wires etc). A wide variety of sources of different shapes have been employed to evaporate different materials.

2. Flash Evaporation

Thin films of Multicomponent alloys or compounds are difficult to prepare as they have different vapour pressures, hence evaporating all the components become a tedious process. We may end up with a film which could have deviated from its intended stoichiometry. To overcome this difficulty, a new technique had been developed, called flash evaporation. The basic principle of flash evaporation is to evaporate the given material when it is made to fall on the boat in small quantities, which is maintained at high temperatures. The material gets evaporated instantaneously. The powdered materials could be transported onto the heated boats using different arrangements (mechanical, electromagnetic, vibrating, rotating, etc.). This method is widely used for depositing ceramic thin films.

3. Electron Beam Evaporation

When materials are evaporated using resistive heating, there are some drawbacks, such as low evaporation rates and material reactivity with the support crucible. The process of evaporating material with a strong electron beam is known as electron beam evaporation. Upon colliding with the material's surface, the electrons rapidly lose energy and dissipate. By using this method, high-purity films can be created as there will not be any contamination from crucibles. The rate of evaporation ranges from a few nm/sec to $\mu\text{m}/\text{sec}$. The thin film technique is useful for the preparation of wide range of materials and found to provide with high deposition rates.

4. Sputtering

Sputtering is a process of depositing thin films. The basic principle is to eject or remove atoms from the surface of a material-called target, by bombarding with high energetic particles (ions).

The ejected atoms will be deposited on a substrate results in a thin film. Ions of sufficient energy are created by applying a sufficiently high voltage between the target (negatively charged) and the substrate kept in a chamber (grounded) filled with argon gas. A certain breakdown voltage that depends on the pressure of the gas and the distance between electrodes is required for a self-sustaining discharge.

Sputter yield is one of the important parameters that decides sputtering process. This depends on the target material (the materials which get bombarded during the sputtering process) structure, chemical composition, bombarding ions, and also on experimental geometry.

The key benefits of sputtering are its capacity to maintain the stoichiometry of the original target composition, excellent uniformity of film thickness, good adherence to the substrate, higher reproducibility of the films, and relative ease of film thickness management. Sputtering is a flexible method for creating thin films of different substances. Sputtering has been used to deposit thin films using a variety of techniques

DC Sputtering

The glow discharge DC sputtering system is the most straightforward configuration. Reactive sputtering involves sputtering an element, an alloy, or a multi-component target while a diluted reacting gas is present. Generally, oxygen, nitrogen, methane or ethane gases are used as reactive components along with argon in the preparation of oxide, nitride, and carbide films. In the sputtering, the reactive gas is in the activated state and hence highly reactive than in the reactive evaporation.

The problem associated with DC sputtering is that higher voltages are essential to sputter the target. To overcome this problem one can increase the path length of the charged particles by using magnetic assembly. This prolongs the ion's residence time and hence increases the probability of ion collisions. This leads to longer discharge currents and an increase in deposition rates. This technique is known as DC magnetron sputtering.

RF Sputtering

The insulating target is challenging to sputter using DC sputtering. If an insulator target is used instead of a metal target, ion bombardment created a surface positive charge on the insulator's front surface. The charge build up on the insulating target surface could be avoided by the simultaneous bombardment of ions and electrons.



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Effect of concentration on spectral properties of lanthanide ions-doped fluorophosphate glasses

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Abstract

Concentration dependent spectroscopic properties of Ln³⁺ (Ln= Nd, Sm, Dy and Yb) -doped fluorophosphate glasses have been investigated. From the absorption spectra, Judd-Ofelt (JO) intensity parameters have been evaluated which are in turn used to predict radiative properties for the fluorescent levels of the said Ln³⁺ ions. For example, three JO intensity parameters (Ω_2 , Ω_4 and Ω_6) for the Dy³⁺ ions in fluorophosphate glass are found to be $\Omega_2 = 12.34 \times 10^{-20} \text{ cm}^2$, $\Omega_4 = 2.67 \times 10^{-20} \text{ cm}^2$ and $\Omega_6 = 2.30 \times 10^{-20} \text{ cm}^2$. Using FTIR spectra, OH⁻ content in 1.0 mol % Nd₂O₃ -doped samples, responsible for quenching the lifetimes of Nd³⁺ ions, is found to be $2.01 \times 10^{20} \text{ ions/cm}^3$ which is very much less compared to other reported glass systems. The decay profiles for the ⁴G_{5/2} level of Sm³⁺ ions in the fluorophosphate glasses are found to change from single exponential (0.1 mol%) to non-exponential (0.5, 1.0, 2.0, 4.0 and 6.0 mol%) with shortening of lifetimes. The Yb³⁺-doped fluorophosphate glasses possess high absorption (2.55 cm²) and emission (3.44 cm²) cross-sections and high figure of merit (3.33). The analysis of the results confirm that the Ln³⁺-doped fluorophosphate glasses could be useful for the development of photonic devices.

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Keywords: Lanthanides; Fluorophosphate glasses; Judd-Ofelt theory; Luminescence properties; Photonic devices

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1. Introduction

Research on lanthanide ions (Ln^{3+})-doped optical quality transparent glasses are of great interest as they find applications in solid state lasers, optical amplifiers, upconverters, optical sensors, quantum cutters for solar energy harvesting, and phosphors [1-2]. The performance of these devices is limited by fast energy transfer, non-radiative de-excitation probabilities, clustering of Ln^{3+} ions at higher concentrations [3-4]. In order to improve their performance, it is necessary to limit the clustering of Ln ions. In this regard, the selection of chemical composition and concentration of Ln^{3+} ions plays vital role in the formation of clusters in glasses [5].

The optical properties of Ln^{3+} ions in glasses depend on the chemical composition of the glass, which determines the structure and nature of the bonds. Among different host materials, fluorophosphate (FPh) glasses are promising hosts because these glasses can combine the advantages of both fluoride and phosphate glasses such as lower phonon energy, better moisture resistance, physical and chemical stability, lower nonlinear refractive index and higher transparency from near UV to mid IR spectral range [6-8]. It was also found that a relatively higher degree of line broadening and smoother line shapes can be obtained [9] with FPh glass. These properties contribute to the applications of FPh glasses as Ln^{3+} -doped fiber laser. Many researchers have showed that Ln^{3+} -doped FPh glasses have promising features as laser gain media [10–12]. It is well known that the spectroscopic parameters such as absorption cross-section, emission cross-section and fluorescence lifetimes for metastable states of Ln^{3+} ions depend on their local environment in the glass matrix [13,14]. For FPh glasses, the local structure of Ln^{3+} ions can be modified over a large extent by varying P/F ratio and/or introducing other special ions [15,16].

2. Experimental details

Lanthanide (Ln^{3+})-doped transparent fluorophosphate glasses with molar compositions of $\text{P}_2\text{O}_5 + \text{K}_2\text{O} + \text{MF} + \text{SrO} + \text{Al}_2\text{O}_3 + \text{Ln}_2\text{O}_3$ (where MF = $\text{KF}/\text{MgF}_2/\text{SrF}_2/\text{AlF}_3$; Ln = Nd/ Sm Dy/Yb) ($x = 0.1, 0.5, 1.0, 2.0, 4.0$ and 6.0 mol %) were prepared by conventional melt quenching technique. The method of preparation and experimental techniques for spectroscopic measurements [17].

3. Results and discussion

3.1. Absorption spectra

From the absorption spectrum, the experimental oscillator strengths of various absorption transitions are evaluated. A least-square fitting procedure has been used to determine the JO parameters following the procedure described elsewhere [17]. As can be seen from Table 1, the trend of the JO parameters is $\Omega_2 > \Omega_6 > \Omega_4$ for PKMFAN10 glass and $\Omega_6 > \Omega_2 > \Omega_4$ for PKSFAN10 glass. The larger value of Ω_2 is due to the relatively higher value of the oscillator strength of the hypersensitive transition. The parameter Ω_2 is affected by the covalency of the Ln-O bond as well as the asymmetry around the Ln^{3+} ion site. In the present case, the higher value of Ω_2 indicates less centrosymmetric coordination [18] and a strong covalence [19] nature of metal-ligand bond. The condition $\Omega_6 \gg \Omega_4$ favours the intense ${}^4\text{F}_{3/2} \rightarrow {}^4\text{I}_{11/2}$ transition at $1.06 \mu\text{m}$ and $\Omega_6 \ll \Omega_4$ favours the intense ${}^4\text{F}_{3/2} \rightarrow {}^4\text{I}_{9/2}$ transition at $0.89 \mu\text{m}$ [20] compared to other transitions in the emission spectra. For present glass systems, the spectroscopic quality factor ($\chi = \Omega_4/\Omega_6$) values are 0.70 (PKMFAN10) and 0.74 (PKSFAN10) which are presented in Table 1. For the PKFSASm10 glass system, the trend is $\Omega_2 > \Omega_4 > \Omega_6$, the higher value of Ω_2 indicates that PKFSAS10 glass has stronger covalent nature while the other parameters, Ω_4 and Ω_6 are related to the rigidity of the host. It is observed that the ${}^4\text{G}_{5/2} \rightarrow {}^6\text{H}_{9/2}$ transition exhibits higher $\sigma(\lambda_p)$ value for PKFSAS10 glass, which signifies the rate of energy extraction from the laser material. For the PKBAFDy10 glass, the larger value of Ω_2 indicates larger degree of covalency between the Dy^{3+} ion and the surrounding ligands and/or lower symmetry of the coordination structure surrounding the Dy^{3+} ion. As can be seen from Table1, for the PKBAFDy10 glass, the quantum efficiency exceeds 100%. This inconsistent result is attributed to the inherent uncertainty involved in the approximations of the JO theory.

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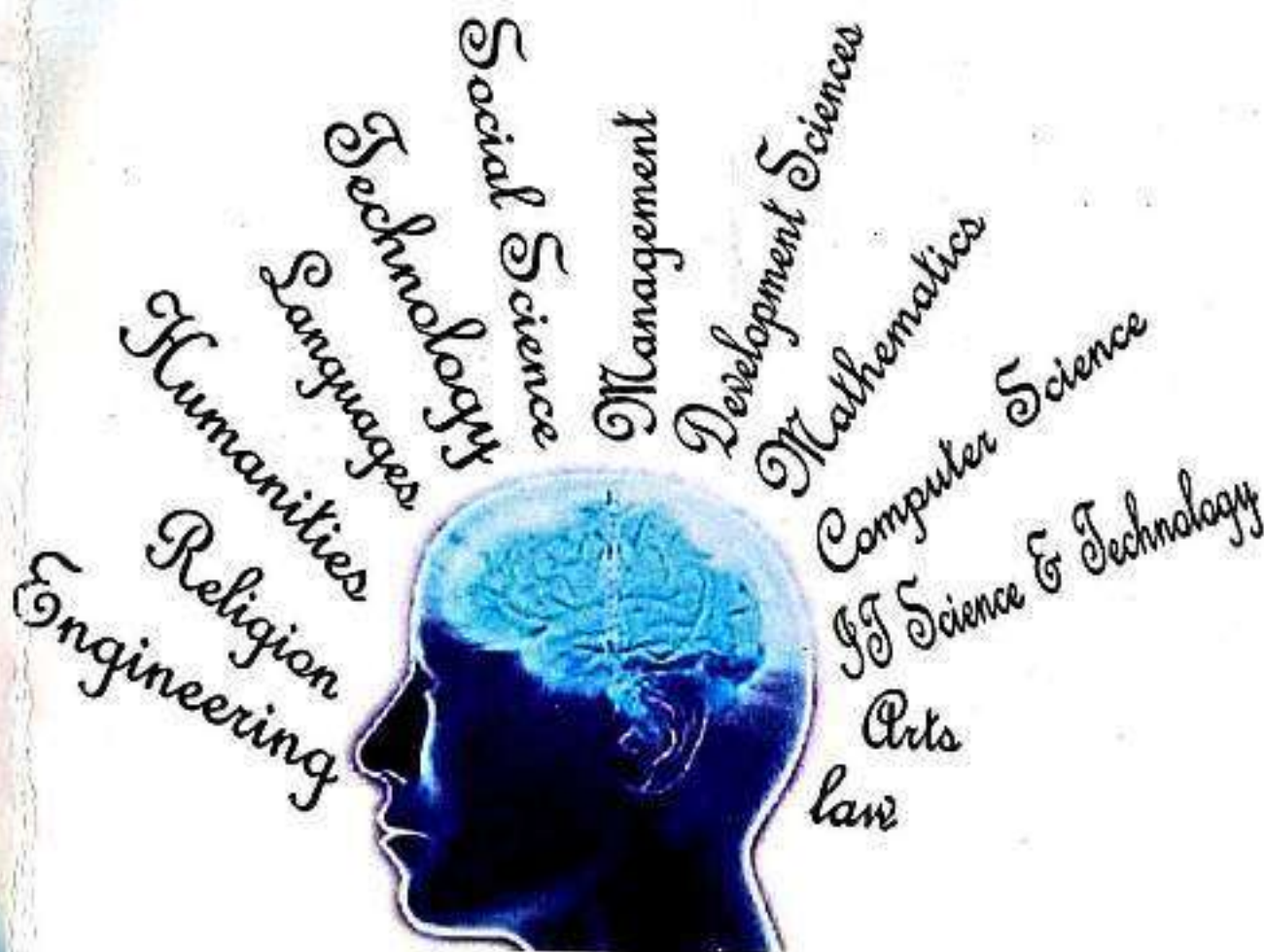
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Socio-Economic Conditions of Beedi Industry in Chittoor District

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1.Introduction

Beedi industry is a labour-oriented industry. The nature of work in this industry is most peculiar in the sense that the majority of workers, working for this industry are not working in the factory premises. The owners of the beedi-making units supply material to the workers who have a minimum experience in that activity for making beedies. While supplying the required material, the owners insist upon the workers to return the finished product within the stipulated period of time. Most of the workers work at their residences. More number of workers in the family are involved in the beedi-making activities. These activities are purely on a contract basis. There is no strong bondage between the workers and the proprietor. There is no legal obligation on the part of the owners to redress for any type of grievances. The worker has also no legal obligation to represent the grievances to his owner / proprietor. No technologies are involved; no amenities and facilities are to be provided to the workers by the proprietor concerned. The workers work only for wages. No incentives are offered to the workers, working within the residential premises with inadequate facilities such as lighting, ventilation, privacy and the like. Beedies are manufactured predominantly in the household sector and as such the information on number of persons involved is often underestimated. Though, one person is

registered in the family for beedi work, the tendency is to take support of as many family members as possible to increase the earnings which are piece rated in the Ministry of Labour, it is clear that the industry, though, spread in all parts, is concentrated in certain States of the country. The following nine States are the major beedi producing States: Madhya Pradesh, Maharashtra, West Bengal, Tamil Nadu, Andhra Pradesh, Karnataka, Kerala, Bihar and Uttar Pradesh.

2.Objectives of the Study

The following objectives have been set specifically for the present study:

- To examine the origin, growth and development of beedi industry in Chittoor District.
- To analyse socio-economic conditions of select beedi making units and beedi rolling workers in Chittoor district

3.Sample Design

The study confines to socio-economic conditions of beedi industry in Chittoor district. The study area includes 95 beedi-making units. A sample size of 20 beedi-making units is taken for the study. As per the official records of the offices concerned the total number of beedi-rolling workers working in the chittoor district is 506. Out of these, a

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Problems of Beedi Industry in Chittoor District: A Study

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Abstract: *The results reveal the slashing of wages for spoiling the beedi leaves and the reactions of the sample respondent beedi-rolling workers. All the respondent beedi rolling workers have unanimously opinioned that the owners of beedi-making units provide the inferior beedi leaves and if at all the beedi rolling workers return the beedies less than the expected number, then the owners of beedi-rolling units slashes the wages out of the wages paid to the beedi rolling workers.*

Key words: *modern technology, employment, bondage*

1.Introduction

Beedi industry is a labour-oriented industry since it requires a large number of labourers for rolling Beedies. Further, this industry is unique in its nature of operation that it does not require much capital and modern technology. It provides sizeable employment to the rural masses since their very much existence is rural in nature. The workers, working for this industry need not work in the factory premises. They can sit in their respective homes and turn out the work. The owners of the beedi making units are not providing any statutory and non-statutory facilities. But without the support of labour, the existence of these units is very much doubtful. Thus, there is moral obligation on the part of the owners of the beedi-making units in extending the needed facilities and to pay remunerative price to the

workers for their well being. Since, there is no legitimate bondage between the owners of the beedi making units and labour working for these units, the problems of beedi making units and the problems of workers working for these units are severe and continuous. Thus, the present study is proposed to identify the problems of beedi-making units and as well as the problems of workers who are working for these units.

2.Objectives of the Study

The following objectives have been set specifically for the present study:

- To identify the functional problems of beedi-making units in study area.
- To identify the problems of select beedi Rolling workers in the study area.