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Dynamic Load Balancing Approach For Grid Environment

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ABSTRACT
Next generation computing involves the sharing and aggregation of geographically distributed resources which results in large-scale load balancing problems. In a grid system, Load Balancing has been an increasingly important issue for handling computational intensive jobs. By developing methodologies that can allocate such jobs to resources in a way that balance out the load, the total processing time will be reduced. In this paper, an algorithm based on the queue length of each resource and waiting time of each task, is proposed for achieving job allocation with load balancing. The simulation results show that proposed algorithm yields better performance when compared with other traditional approach.
Keywords - Grid System, Job allocation, Load Balancing.

I. INTRODUCTION

The availability of low cost powerful computers coupled with the popularity of the Internet and high-speed networks have led the computing environment to be mapped from classical distributed to grid environments. To improve the global throughput of these environments, effective and efficient load balancing algorithms are fundamentally important. Emerging as new distributed computing environments, computational grids [1] provide an opportunity to share a large number of resources among different organizations. Grid computing involves coupled and coordinated use of geographically distributed resources for purposes such as large-scale computation and distributed data analysis [2] [3]. Performance enhancement is one of the most important issues in such grid systems. However, in many situations, poor performance is due to uneven load distribution among the nodes in the system. Therefore, to fully exploit the computing power of such grid systems, it is crucial to employ a judicious load balancing strategy for proper allocation and sequencing of tasks on the computing nodes. A lot of research has already been done in the field of load balancing.

II. RELATED WORK

In [4], authors proposed a dynamic load balancing algorithm which considers CPU length, CPU and memory utilization, network traffic as load metric. In [5], authors presented a load metric "Tendensive Weight" and this metric consider both CPU and Input-Output utilization including memory access rate. An algorithm is developed for calculation of the Tendensive Weight of each task to be distributed to the node. The workload estimation of each device for LB using fuzzy system is implemented in [6]. It used run-queue length and CPU utilization as the input variables for fuzzy sets and a set of membership function is defined. This scheme focuses only on run queue length and CPU utilization factors, other factors such as cost of migration, reliability etc. are not considered. In [7], authors proposed a decentralized load-balancing algorithm for a Grid environment. The presented method does not consider the actual cost for a job transfer. In [8], authors addresses several issues that are imperative to Grid environments such as handling resource heterogeneity and sharing, communication latency, job migration from one site to other, and load balancing. Two job migration algorithms, which are MELISA (Modified ELISA) and LBA (Load Balancing on Arrival) are proposed. The algorithms differ in the way load balancing is carried out and is shown to be efficient in minimizing the response time on large and small-scale heterogeneous Grid environments, however, no provision is provided for fault tolerance. In [9], authors presented an algorithm for dynamic load balancing in distributed systems with multiple supporting nodes by exploiting the interrupt service.

III. SYSTEM MODEL

The main objective is to propose a dynamic load balancing algorithm that can handle load in efficient way.

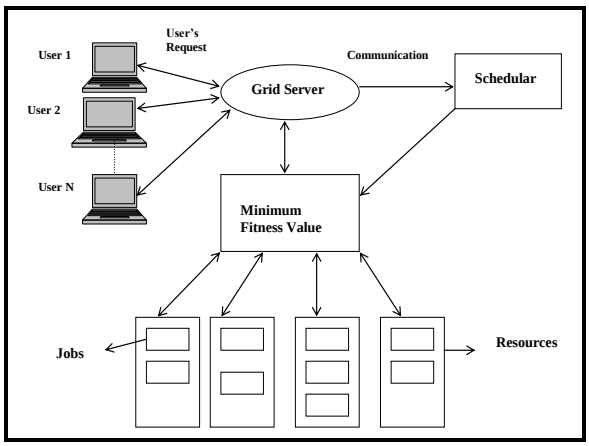

Figure 1: Computational Grid Model

Presented model make use of a centralized server called Grid server, in order to dynamically allocate and balance the load to different servers available or registered in the Grid environment as shown in Fig. 1. In this computational Grid model, the main role factors and performers are Grid Server, Users, Resources and Scheduler. Each resource is a computational unit with different processing power. All the resources and users register their information and update their status time to time to the Grid Server. Scheduler schedules the tasks to the resources according to the load divided by the grid server.

IV. PROPOSED METHODOLOGY

The proposed algorithm will balance the load based on the queue length of each resource and waiting time of each task. It transfers the job to the resource having minimum computation value of queue length and waiting time. The proposed algorithm for dynamic load balancing in grid environment is as follows:

i) Input the value of number of Users (NU) and Resources (NR).
ii) Create the Expected Time For Computation [ETC] Matrix for each Resource.
iii) Get the availability of all registered Resources.
iv) Request for the queue length and waiting time of each resource.
v) Initialize the NextUser = 0 and QueueLength of each resource= 0.
vi) Find the resource ' R ' with minimum computed Queue Length (ql) and Waiting time(wt).
vii) Allocate the job of NextUser to R which is having minimum fitness value (F) given by :

$$F=0.5\ (ql) + 0.5\ (wt)\ .$$

viii) NextUser = NextUser + 1.
ix) QueueLength_R = QueueLength_R + 1.
x) Check for the arrival of any job ' J ' from Resource R' after completing the execution.
xi) If no resource arrival exist then goto step xiv).
xii) QueueLength_R' = QueueLength_R' – 1.
xiii) Make Span= max time computed from the available resources.
xiv) If NextUser <= NU then goto step vi).
xv) Print ExecutionTime_J of all jobs.
xvi) Print which resource has been allocated to which User.

V. SIMULATION RESULTS

Table 1 show the parameters used during simulation of Proposed Methodology (PM).

Table 1: Parameters Used

No. Resources	3 – 40
No. of Users	10 – 50
Type of Resources	Heterogeneous

The execution time of jobs corresponding to different users using PM and queue based algorithm is shown in Table 2, Table 3, Table 4 and Fig. 2, Fig. 3, Fig. 4 respectively. The graph shows that the execution time of jobs under random queue length based algorithm is more than that of execution time of jobs proposed.

Table 2: Make span value of various users when number of resources = 8

Make Span Value		
Users	Proposed Method (PM)	Queue Based Method (QBM)
15	132.6	136.3
25	252.3	257.3
35	321	327.3
40	330	335
50	446.6	456.6

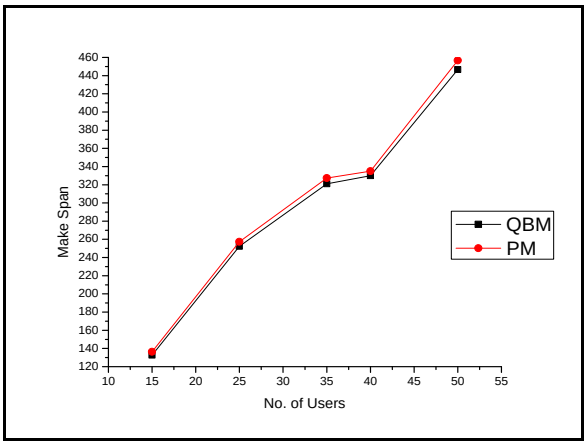

Figure 2: Make span value of various users when number of resources = 8

Table 3: Make span value of various resources when number of users =100

Make Span Value		
Resources	Proposed Method (PM)	Queue Based Method (QBM)
10	657	662.3
15	455.3	465.3
20	332	336.3
30	259.3	268
40	196.6	204

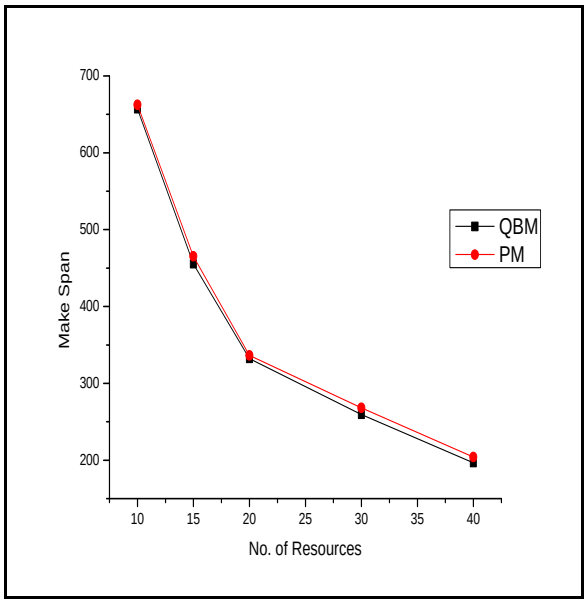

Figure 3: Make span value of various resources when number of users=100

Table 4: Make span value at various stages when sers and resources both vary.

Make Span Value		
Resources, Users	Proposed Method (PM)	Queue Based Method (QBM)
3,10	253	261
10,35	260	267
15,45	196	203
18,50	197	201

The results show that our Proposed Method (PM) is better than the Queue Based Method (QBM) algorithm in all scenarios.

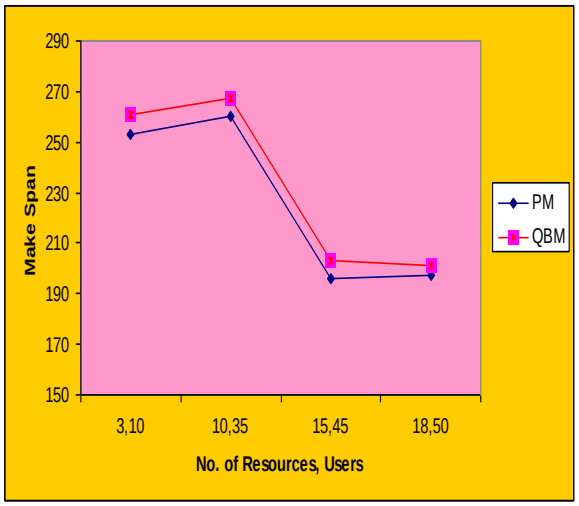

Figure 4: Make span value of various resources and users when both vary.

VI. CONCLUSION

Main objective of the grid environment is to achieve high performance computing by optimal usage of geographically distributed and heterogeneous resources. Grid application performance remains a challenge in dynamic grid environment. Resources can be submitted and can be withdrawn from at any moment. This characteristic makes Load Balancing one of the critical features.

There are a number of factors, which can affect the grid performance like load balancing, heterogeneity of resources and resource sharing in the Grid environment. In this paper author focused on Load Balancing and proposed an efficient load balancing approach for grid environment and also analyzed existing (QBM) method as well as proposed a new method (DLBA) which more efficiently balances load as illustrated by simulation results.

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A Comprehensive Review of Overlapping Community Detection Algorithms for Social Networks

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Abstract—
Community structure is an interesting feature found in many social networks which signifies that there is intense interaction between some individuals. These communities have a tendency to overlap with each other as there are nodes that can belong to multiple communities simultaneously. Detection of such overlapping communities is a challenging task; it still remains a topic of interest for the researchers as it answers many questions about the behavior of the network and its operation as a function of its structure. This paper reviews overlapping community detection techniques proposed so far and points out their strengths and weaknesses. The paper also presents insightful characteristics and limitations of the existing state of art algorithms to solve the problem of overlapping community detection.
***Keywords*—**Overlapping Community detection, Online Social Networks, Complex Networks, Community Structure.

I. INTRODUCTION

Online social networks have become a primary means of communication nowadays; they attract a wide variety of audience. Nearly every person has a profile on Facebook, Google plus, Orkut, Twitter etc which are collectively termed as *Social Networking Sites (SNS).* People usually communicate to others via these SNS and this communication has attracted a lot of research focus in recent years under the domain named *Social Network Analysis.* A *social network* is a graphical representation of the communication among people, where people are represented as nodes and the edges between a pair of nodes represent some kind of communication between them. A very interesting feature in social networks is the formation of *Communities.* A *community* is a group of individuals in a social network who communicate more frequently with each other than with others outside the group. When a the social network is represented as a graph G (V, E), where V representing the individuals and E representing the connections among them, then a community $C \subset G$ such that the number of edges going outside from the vertices in C is far less than the number of edges with both vertices inside C. The detection of such communities is not trivial and is quite challenging as it is completely different from two similar and well studied problems in computer science namely *Clustering* and *Graph Partitioning.* The first most challenge in the domain of community detection is that there is no generally accepted definition of a community; still there are a large number of community detection algorithms available which produce effective results. Most of the community detection algorithms do not take in to account the *overlapping* between communities, which is a serious case in SNSs. Communities in social networks, tends to *overlap* with each other which means that a vertex which is a member of one community can also be a member of another community as shown in Fig 1. The idea of overlapping communities makes the problem of community detection tougher as the result of the algorithms would now be a *Cover*, a set of communities of which a vertex is a member. Most of the community detection algorithms start resulting in bad assignments of communities to vertices in the overlapping case as they generally merge two communities with dense overlaps into a single community.

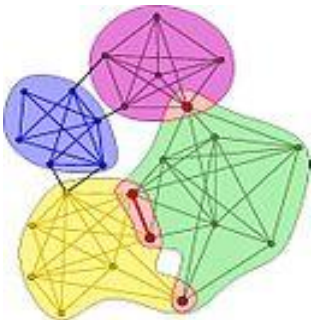

Fig 1: Illustration of overlapping communities, nodes shown in red color

This paper presents a systematic and organized study of overlapping community detection techniques. The strengths and weaknesses of each technique is also a matter of focus in this paper. The major contributions of this paper will be:

- To serve as a base for those starting research in this direction.
- To provide them with the existing state of art algorithms for the research problem.
- To make them aware of the challenges in the direction and the solutions proposed so far.

The paper is organized in to sections namely *Problem Formulation* which clearly states the problem of overlapping community detection, *Techniques* which explains the techniques used so far to solve the problem and their corresponding strengths and weaknesses, and at last Conclusion which sums up the work conducted and the future directions for work.

II. PROBLEM FORMULATION

Given a graph G (V, E), where V is the set of Vertices and E is the set of edges assign to each vertex $v \in V$ a cover C where C represents the set of communities of which v is a member.

$|V|$ =n, $|E|$ =m

For dense graphs m= O (n^2) and for sparse graphs m=O (n).

III. TECHNIQUES

The algorithms for overlapping community detection can be broadly classified into following categories:

a) Link Partitioning Algorithms
b) Clique Based Algorithms
c) Agent Based and Dynamic Algorithms
d) Fuzzy Algorithms
e) Local Expansion and Optimization Algorithms

We will explore each of them one by one, and will point out their relative strengths and weaknesses.

a) Link Partitioning Algorithms

The basic idea of link partitioning algorithms is to partition links to discover the communities. Two steps of every link partitioning algorithms are:

Step 1: Construct the Dendrogram.

Step 2: Partition the Dendrogram at some threshold.

A node will be identified as overlapping if the links to the node are present in more than one cluster. Links are partitioned by hierarchical clustering in [1] on the basis of edge similarity. If we are given a pair of links e_{ik} and e_{jk}, the edge similarity between these two links is calculated by Jaccard index as:

$$S(e_{jk}, e_{ik}) = |N_i \cap N_j| \,/\, |N_i \cup N_j|$$

N_i is the set of nodes which are in the neighborhood of node i including node i. After calculating edge similarities linkage clustering is done to find hierarchical communities. Generally single linkage hierarchical clustering is done because of its simplicity and efficiency which enables us to apply it on large networks. Other clustering methods include average and complete hierarchical clustering. Initially every node belongs to its own community, and then links with highest similarities are merged into a single community, this process is repeated until all the links belong to a single community. This whole merging process is stored in a *Dendrogram* which records the hierarchical community organization.

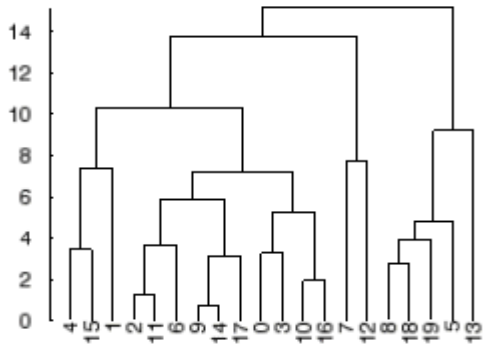

Fig 2: Illustration of a Dendrogram; y axis represents similarity (linkage distance) and x axis denotes node indices.

This Dendrogram is then cut at a threshold value of *partition density* to reveal communities as shown in Fig 2. Partition density attains a global maximum at some level in the Dendrogram; it is average at the top of Dendrogram and attains the lowest value at the leaves of the Dendrogram. The idea of link partitioning is quite natural and intuitive but it can't guarantee better results than node partitioning algorithms as it is also based on the ambiguous definition of community [2]. The complexity is O (nk^2_{max}), where k_{max} is the maximum degree of any node in the network.

b) Clique Based Algorithms

A clique is a maximal subgraph in which all nodes are adjacent to each other. The input to Clique based algorithms is a network graph G and an integer k. Clique based algorithms have following steps in general:

Step 1: Find all cliques of size k in the given network.

Step 2: Construct a clique graph. Any two k-cliques are adjacent if they share k-1 nodes.

Step 3: Each connected components in the clique graph form a community.

CPM (Clique Percolation Method) is based on the assumption that a network is composed of cliques which overlap with each other. CPM finds overlapping

communities by searching for adjacent cliques. As a vertex can be a member of more than one clique, so overlap is possible between communities. The parameter k is of utmost importance in finding communities via CPM, Empirically small values of k have shown effective results [3] [4]. An efficient implementation of the CPM method is *CFinder*. CPM is suitable for dense graphs where cliques are present. In case there are few cliques only CPM fails to produce meaningful covers.

Example 1: showing the working of clique percolation as shown in Fig 3.

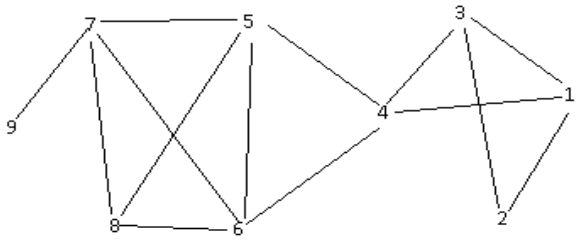

Fig 3: A network with 6 k-cliques where k=3

Clearly the network has 6 cliques of size 3, first of all these are identified by the CPM as {1, 2, 3}, {1,3,4}, {4,5,6}, {5,6,7}, {5,6,8}, {6,7,8}. After finding the cliques, a clique graph is formed in which two cliques are adjacent if they share k-1 nodes as shown in Fig 4.

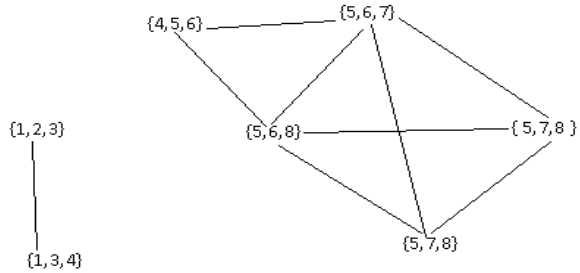

Fig 4: showing the clique graph for the network in Fig 3

Two communities will be shown as result and they are: {1,2,3,4} and {4,5,6,7,8}

The major disadvantage of CPM is that it fails to terminate for large networks. Some argue that CPM is more like a pattern matching algorithm as it searches for a particular pattern in the given network on the basis of input parameter k. Two other Clique based algorithms are CPMw [5] and SCPM[6]. CPMw is for weighted networks, it introduces the concept of intensity threshold. Only the cliques with subgraph intensity greater than the threshold are included in the community. CPMw produces communities with smoother contours as compared to CPM. SCPM is faster than CPM as it doesn't process the network for all values of k, instead it processes only for a given value of k. SCPM suits for weighted networks having hierarchical community structure.

c) *Agent Based and Dynamic Algorithms*

Three famous algorithms that come under this category are SLPA [7], COPRA [8], and Label Propagation algorithm [9].

SLPA is Speaker-Listener label propagation algorithm, in which a node is called *speaker* if it is spreading information and is called a *listener* if it is consuming information. Labels are spread according to pair wise interaction rules. In SLPA a node can have many labels depending upon the underlying information it has learned from the network. The time complexity of SLPA is O(tm) where t is the number of iterations and m is number of edges. The best part of SLPA is that it doesn't require any prior knowledge about the number of communities in the network. In other two algorithms the node forgets the information it has learned in previous iterations but in SLPA each node has a stored memory in which it stores all the information it has learned about the network in form of labels. Whenever a node observes more labels in surrounding, it is more likely that it will spread those labels to other nodes. The Label Propagation algorithm described in [9] is extended to overlapping case by allowing a node to have multiple labels. Initially all nodes have their own unique label, labels are updated upon iterations depending upon the labels occupied by the maximum neighbors. Nodes with same labels form a community. LPA was modified by Gregory [8], he introduced Community Overlap Propagation Algorithm (COPRA). In COPRA each label consists of a *belonging coefficient* and a *community identifier*. The sum of belonging coefficients of communities over all neighbors is normalized. A node updates its belonging coefficient in a synchronous fashion by averaging the belonging coefficients of all its neighbors at each step. The parameter v controls the number of communities of which a node can be a member. The time complexity of COPRA is O (vmlog(vm/n)). According to benchmarks in [10] COPRA provides the best results for overlapping communities. An important optimization in LPA can be to avoid unnecessary updates, which will reduce the execution time.

d) Fuzzy Algorithms

The overlap between communities can be of two types, one is the crisp overlap in which each node either belongs to a community or doesn't, the belonging factor is 1 for all the communities a node is a member. The other type of overlap is the fuzzy overlap in which each node can be a member of communities with belonging factor in the range 0 to 1.The membership strength of a node to a community is denoted by b_{nc} and if we sum the belonging coefficients

of a vertex for all the communities of which it is a member the result will be 1.

$$\sum_{C} b_{nc} = 1 \text{ where } c \in C$$

The major drawback of fuzzy based overlapping community detection methods is the need to calculate the dimensionality k of the membership vector; this value is generally passed as a parameter to the algorithms, while some algorithms calculate it from the data. Only a few fuzzy methods have shown good results. In [10], authors proposed an algorithm with the combination of spectral clustering, fuzzy c means and optimization of a quality function. They propose a method to detect up to k communities by using the fuzzy c means clustering algorithm after converting the input network to a k- dimensional Euclidean space. The accuracy and computational efficiency of the algorithm is heavily dependent upon the parameter k. Nepsuz [11] model the problem of overlapping community detection as an optimization problem constrained nonlinearly which can be solved by simulated annealing methods. The objective function required to be minimized in this method is:

$$f = \sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij}(\ddot{x}_{ij} - x_{ij})^2$$

Where w_{ij} denotes a predefined weight and $\ddot{x}_{ij}$ denotes prior similarity between nodes i and j. Similarity x_{ij} is defined as:

$$x_{ij} = \sum_{c} a_{ic} a_{jc}$$

Where a_{ic} is the fuzzy membership of node i in community c, subjected to constraints of total membership and non empty community. To determine the value of k, it is increased repeatedly until the value of community structure doesn't improve as measured by modified fuzzy modularity function, Q defined as:

$$Q = \frac{1}{2m} \sum_{c} \sum_{i,j \in c} [A_{ij} - \frac{k_i k_j}{2m}] a_{ic} a_{jc}$$

A hybrid approach [18] based on Bayesian Non-negative Matrix Factorization to achieve soft partitioning of the network in computationally effective manner is proposed. The advantage of this approach is that it doesn't suffer from the problem of resolution limit. This approach is a mix of dimensionality reduction and feature extraction in machine learning. The problem with NMF approach is that it is computationally inefficient because of large matrix multiplications.

e) Local Expansion and Optimization Algorithms

These algorithms rely on a local benefit function which encodes the quality of densely connected subgraphs. The goal of these algorithms is to expand partial or natural communities so as to maximize the local benefit function. The quality of discovered communities heavily depends upon the quality of seed communities. A clique serves as a better seed than a single node. EAGLE [12] creates a Dendrogram by using agglomerative framework. First of all maximal cliques are identified, and initialized as seed communities, then similarity values are computed and communities with maximum similarity are merged. The optimal cut of the Dendrogram is calculated using extended modularity function defined in [13]. EAGLE is computationally expensive even without taking into account the time required for finding maximal cliques. GCE [14] also uses cliques as seed communities and expands them using a local fitness function. Communities are merged if they are found similar to previously detected communities. The similarity is computed using the distance function defined as:

$$1 - \frac{|c_1 \cap c_2|}{\min(|c_1|, |c_2|)}$$

If the distance is smaller than the value specified by parameter $\in$ then communities' c1 and c2 are merged. The time complexity of GCE is O (mh) where m is number of edges and h is the number of cliques. In [15], author proposed another two step technique in which nodes are first of all ranked according to some criterion, and then highly ranked nodes are removed until small disjoint cluster cores are formed. In the second step i.e Iterative Scan (IS) these cores act as seed communities which are expanded by adding or removing nodes until a local density function cannot be improved further. The density function used is given as:

$$f(c) = \frac{w_{in}^{c}}{w_{in}^{c} + w_{out}^{c}}$$

w_{in}^{c} is total internal weight and w_{out}^{c} is the total external weight of community c. The worst case complexity of this technique is $O(n^2)$. IS sometimes results in disconnected components as the algorithm allows removal of nodes during expansion, so CIS [16] was introduced in which connectedness is checked after each iteration. OSLOM [17] works by comparing the statistical significance of a cluster with the global null model (i.e. the random graph configuration model) during the expansion phase. To grow the community r value is computed for each neighbor, which is the cumulative probability of having more internal edges in the community than the number of edges from neighbors in the null model. If the cumulative distribution of smallest r value is lesser than a tolerance value, the node is considered significant and is added to the community otherwise second smallest r value is considered. The average time complexity is $O(n^{2})$, it is dependent upon the underlying community structure of the input network. The main problem with OSLOM is

that it results in significant number of *singleton communities* or *outliers*. To detect both static and temporal communities iLCD [18] intrinsic longitudinal community detection was proposed which updates communities by adding nodes depending upon whether the number of their first, second robust neighbors is greater than an expected value or not. The algorithm depends upon two parameters one for adding nodes to the community and another for merging two communities. Recently there have been many improvements in the local optimization and expansion algorithms.

IV. CONCLUSION

Overlapping community detection approaches have attracted a lot of attention of researchers in recent years and there is a considerable increase in the number of algorithms published for solving the issue as it has applications in various domains like microbiology, social science and physics. Analyzing community structure in social network has emerged as a topic of growing interest as it shows the interplay between the structures of the network and its functioning. This paper tries to review all popular algorithms for overlapping community detection with their strengths and weaknesses. We have tried our best to review all popular algorithms, but the study is by no means complete as there are newer algorithms discovered at a fast rate because of the growing interest of researchers in this domain.

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RESEARCH ARTICLE OPEN ACCESS

A Three Dimensional Design for Underwater Wireless Sensor Network

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ABSTRACT
A hierarchical Underwater Sensor Network architecture in which the sensors and the collector station operate in different layers is proposed. Underwater environments are very different from terrestrial environments if we consider communication and operating circumstances. As the sensor nodes are deployed in harsh underwater conditions, there is high probability of node failure. This paper presents an efficient approach for cluster based underwater sensor networks in order to prolong network lifetime and reducing the energy consumption.
Keywords - Cluster Head (CH), Super Head (SH), Underwater Wireless Sensor Networks (UWSNs)

I. INTRODUCTION

The Earth is covering about 70 percent of water in form of undefined oceans and large water bodies. From the ancient era, water links provide great means of sharing the information and as the technology grows wireless information transmission through the ocean is the most significant technology for exploring the aqueous environment and monitoring various disaster prevention activities [1]. In this new technobabble world, there is a great need to monitor the aquatic environment not only for safety and military reasons but also for scientific, commercial and environmental reasons. Underwater Wireless Sensor Networks (UWSNs) are built up of sensor nodes that are deployed in an underwater environment and are capable of monitoring their nearby. Sensor node is a small device having limited energy stored in form of battery and has limited memory. The main work of sensor node is to sense the data from its surroundings and process that data with the help of sensing unit and processing unit respectively and to manage the energy dissipated for all such processes and units with the help of power unit. Underwater Acoustic Sensor Networks (UW-ASN) is defined as the collection of large number of sensors that are deployed underwater and on surface water to perform the collaborative monitoring and tracking tasks over the specified or target area. The communication underwater is also known as hydro-acoustics.

As the Underwater Wireless Sensor Networks are very vulnerable to the hard underwater conditions, a crucial issue for the efficient UWSN is to maximize the network lifetime [4]. Consequently, a new concept of low-cost easier deployable underwater networks having less constraints should be developed. This type of network should be mobile/dynamic, scalable and capable of self-build. UWSNs are a new research paradigm that poses exciting challenges due to the intrinsic properties of the underwater environments. Cabled framework is eliminated here and acoustic waves are used for propagation [2]. Major challenges in the design of underwater acoustic networks are [3]:

Battery: Battery power is limited and difficult to recharge as solar energy cannot be exploited.

Node deployment: It is application dependent and affects the performance of system. Deployment can be deterministic i.e. sensors are placed manually and data is routed through pre-determined paths, or randomized in which the sensors are scattered randomly creating an infrastructure in an ad hoc manner.

Bandwidth: The available bandwidth is severely limited.

Large propagation delays: In water the propagation speed of acoustic signals is about 1.5 x 10^3 m/s. The channel suffers from long and variable propagation delays.

Node mobility: Due to turbulence in water current underwater sensor networks are movable.

High error probability: Underwater acoustic channel has limited bandwidth capacity, variable delays suffers high bit error rates.

Environment: Underwater sensors are prone to frequent failures because of fouling, corrosion, etc.

Energy saving is a major concern in UWSNs as sensor nodes are powered by batteries which are difficult to replace or recharge in aquatic environments.

Clustering is a valuable technique to improve the network lifetime in UWSNs with sensor nodes that are densely deployed over a large area [5][6][[7]. Each cluster consist several cluster members like normal nodes and the Cluster Head (CH). After forming a cluster, a CH is responsible for collecting data from its cluster members and for transmitting the data to the Super Head (SH).

II. DESIGN MODEL

UWSNs have significant amount of drawbacks like high mobility, limited bandwidth, large propagation delays, weird environmental conditions, etc. Therefore, a technique is needed to improve energy utilization, scalability and the lifetime of the network. Network is deployed with the assumption that nodes are heterogeneous in term of energy. A node can perform dual role of being a normal sensor node or a cluster head which can be decided on the basis of energy level. A hierarchical arrangement is used because it is more energy efficient and easy to collect data. Data security is better as information is not disseminated through a path that goes through many nodes in the system. Instead of that, path is quite simple and comprising of cluster head and super head. Also flooding is avoided which was a major disturbance. To achieve energy efficiency, a hierarchical model is proposed where sensors are simple nodes and their task is to sense data only. If an intrusion or an event occurs in the field then sensors sense this and report to the cluster head. The role of cluster head is to control the sensor nodes under it. Whenever a report comes to cluster head it directly sends that report to super head. Super head is an energy rich device capable of processing the data send by the cluster head and route it to the desired direction. The architecture of underwater wireless sensor networks is presented in Figure 1.

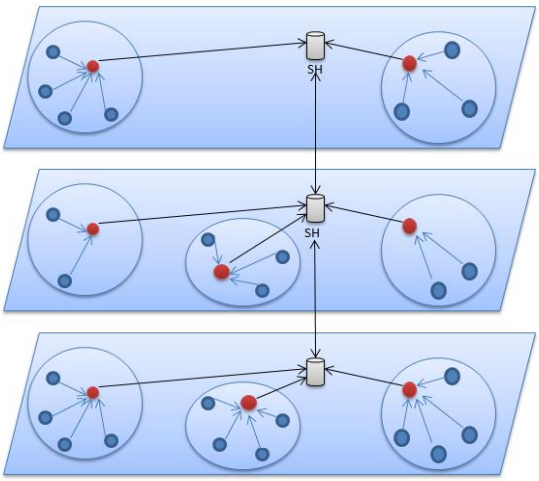

Fig 1: System Structure

2.1 Network deployment

How to deploy the nodes is the first task in design of any network? Our network is heterogeneous. In the initial stage, sensors can be dropped from an aircraft in a random fashion. The node having high energy acts as a cluster head when compared to other nodes. Each layer has a high powered device known as super head (SH). In our proposed model, three layers are designed: at the bottom bed level (layer 1), at the middle level (layer 2), at the top surface level (layer 3). Sensors at the bottom layer are relatively less mobile then the middle layer as middle layer sensors are more prone to the underwater current and other activities. We use the concept of clustering at each level.

2.1.1 Cluster Formation

Cluster formation and the cluster head selection is the very crucial phase. To form the clusters, cluster head sends the hello message in the network. Normal sensor nodes which have received hello message from cluster heads joins the clusters based on RSS (Received Signal Strength) value of the hello message. If a node receive hello message from more than one CHs then it will join the cluster having high RSS value.

2.1.2 Isolated node trying to ping Cluster Head

If due to some circumstances any sensor node is not able to join any cluster, then the isolated node will increases its transmission range and try to ping cluster heads. The ping message is send to the CHs around it and it keeps on increasing its power until it reach its maximum limit or some CHs replies back as shown in the Figure 2.

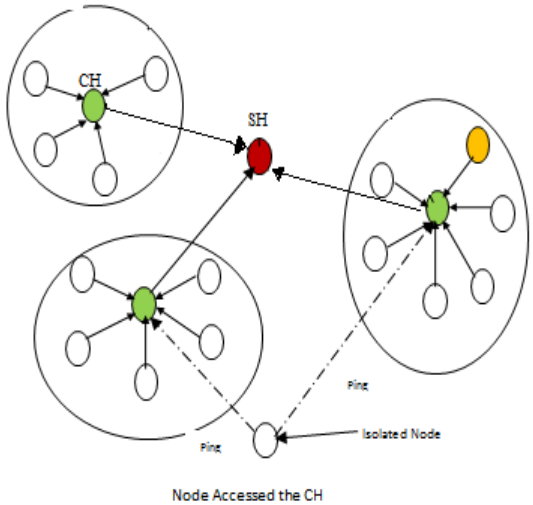

Fig 2: Isolated Node Ping Mechanism

2.1.3 Isolated node as cluster member

After an isolated node sends join message to any of the cluster head then that CH also increases its

transmission range to accommodate that node. If more than one CHs are accessed by the isolated node then the cluster head having more energy and better node count will be selected. Energy level and the member count are the two parameters of the reply message of CHs on the basis of which the isolated node will take decision to join one of them. CH also increases its transmission range equals to that node's transmission range so that CH can provide accommodation to that node. Thus isolated node becomes active member of that cluster as shown in Figure 3.

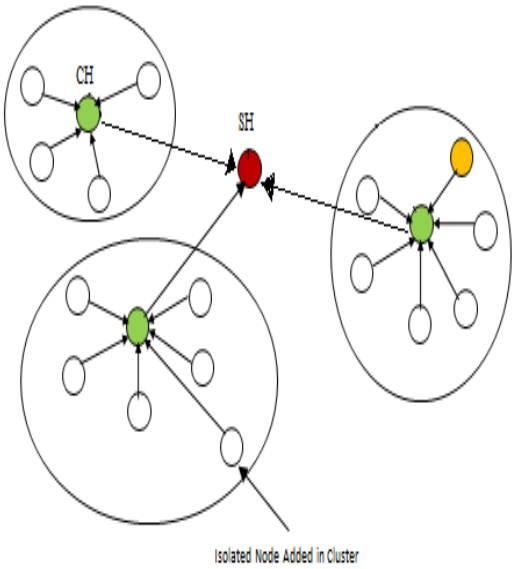

Fig. 3: Isolated Node as Cluster Member

2.1.4 Cluster Head Failure

As we know that energy is the major issue and due to dissipation of energy cluster head fails after sometime and another high energy node will take charge of being a cluster head. If cluster head goes down and it does not have any heterogeneous node as a member then it will try to find another node in the cluster as its descendent to be the next cluster head. If it has energy next best in the cluster and also more than the threshold energy then it will be appointed as the cluster head and the previous CH will become a normal member node. If there is not any node in the cluster whose energy is greater than the threshold energy then re-clustering is done.

2.2 Data Aggregation

In a typical sensor networks, different nodes collect data from its surroundings and then send it to some central node for processing and analysis of data and then send it to the application main center. The main goal of data aggregation here is to gather and aggregate data in an energy efficient manner so that network lifetime can be enhanced [3]. Data gathering is defined as the systematic collection of sensed data from multiple sensors to be eventually transmitted to the super head for processing. Since sensor nodes are energy constrained and data collected is often redundant and correlated so we require such mechanism that can output quality information. This can be accomplished by data aggregation.

2.3 Energy saving through sleep/active mode

As UWSN is divided into layers and further divided into clusters for better performance [8]. But it is not necessary that all the clusters are doing their task all the time. In such cases keeping the nodes in the active mode is the wastage of energy. Hence nodes may be put into sleep mode during idle time to save energy. Whenever any event takes place CH send wakeup call to nodes and after completing the required task it again goes into sleeping mode.

III. LIFECYCLE

In our protocol methodology there are four phases in each layer.

Phase 1: Cluster Head Selection

1. Energy level of each node is checked.
2. Energy levels are compared to the threshold value.
3. Node having energy level equal to or more then the threshold level value is assigned as cluster head.

Phase 2: Cluster Formation

1. CH broadcast JOIN-REQ message to from the cluster.
2. After receiving the message, the neighboring nodes within the range respond by sending JOIN-REPLY message.
3. If any node remains isolated, it may be a member of any cluster according the process explained in design model.

Phase 3: Data Reporting

1. All the nodes report to CH on TDM basis.
2. CH received the sensed data from the cluster member nodes.
3. CH forwards the data to the super head where the data aggregation is achieved.
4. Then the aggregated data is processed and routed to the other layer's SH towards the destination BS.

Phase 4: CH Alteration

1. CH regularly checks its residual power and compares it with the threshold power.
2. If finds energy below threshold level, new CH search takes place.
3. Now CH selects its descendent having the highest residual energy.
4. Nodes update their CH information and start reporting to new CH.
5. Old CH works as the normal node.

IV. APPLICATIONS

This field possesses a wide area of applications. Ones of the main places where it can be used are:

Environment Monitoring: Pollution is now days one of the greatest problems, oil spills or broken underwater oil tubes can make lot of harm to marine biological activity [4]. Monitoring ecosystem can help understanding and predicting the human and climate effect in underwater environment.

Prevention of natural disaster: By measuring the seismic activity from different remote location the sensors could alert about tsunami or submarine earthquakes alarms.

Underwater navigation: The sensors can be placed to identify hazards on the sea floor, rocks or shoals in shallow water.

Assisted Navigation: Sensors can be used to identify hazards, discover new locations or seeking lost areas and drawing the bathymetry profile of the area [5].

Underwater Autonomous Vehicles: Distributed sensors in movement can help in monitoring area for surveillance, recognition and intrusion detection.

V. FUTURE TRENDS

A lot of advantages can be achieved by using underwater sensor networks, but lot of research must be done in next years. It is necessary to improve the physical layer performance in terms of efficiency, building low power acoustic modem that are able to make best use of bandwidth and reducing error rate. The development of new strategies and research in this open field can be able to provide more reliable and efficient way to communicate in the network.

VI. CONCLUSION

In this paper, a layered clustering hierarchical strategy for the deployment of sensors in underwater scenario is proposed for longevity of the network. A clustering or hierarchical strategy can improve scalability, energy efficiency and the life time of the network. To achieve energy efficiency hierarchical model is used. Less amount of energy is consumed in transmitting the data from underwater to the upper station as the data is routed only through CH and SH. Moreover to save energy during the idle state i.e. when the sensor nodes are not doing any activity, sensor nodes goes into sleep mode and whenever any event occurs it goes into active state to perform its task. Hence, this approach will save energy and improves lifetime of the network.

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RESEARCH ARTICLE OPEN ACCESS

Hypertension Diagnosis Using Fuzzy Expert System

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ABSTRACT
Hypertension, also referred to as high blood pressure, is a condition in which the arteries have persistently elevated blood pressure. Blood pressure is the force of blood pushing up against the blood vessel walls. The higher the pressure the harder the heart has to pump. Hypertension can lead to damaged organs, as well as several illnesses, such as kidney failure, heart failure, stroke, or heart attack. High blood pressure during middle age may raise the risk of cognitive decline later in life. So for the better diagnosis and treatment of hypertension patients, an intelligent and accurate system is needed. In this study, we design fuzzy expert system to diagnose hypertension for different patients. Fuzzy expert system is based on set of symptoms and rules. The input parameters for this system are age, body mass index, blood pressure, heart rate, diabetes, physical activity, genetics and the output parameter is risk of hypertension. It is expected that this proposed Fuzzy Expert System can provide a faster, cheaper and more accurate result.
Keywords- Diabetes, fuzzy expert system, genetics, hypertension

I. INTRODUCTION

Fuzzy logic is used to model nonlinear systems which are difficult to model mathematically. It is a system of logic and is based on set theory and continuous variables. Conclusions that are based on vague, imprecise, missing input information are simply provided by fuzzy logic (FL). Fuzzy logic uses different words, i.e. fuzzification, defuzzification, membership function, linguistic variables, domain, rules etc. In Boolean algebra or Boolean logic crisp sets are used, which has only two values 0 and 1, but in fuzzy logic, sets have infinite logic values between 0 and 1. In Boolean logic completely inclusive, exclusive membership is used, but in FL completely inclusive, exclusive or between these two memberships is used. Fuzzy logic control systems are used to handle difficult processes on the bases of human knowledge. FLC controller uses linguistic rules that show the strategy of the user.

The basic advantage of this method is that it does not require the model. Knowledge based systems in which fuzzy logic controllers are explained with the help of IF-THEN rules are based on professional's knowledge about system controllers, performance and established. The reason for designing and application of FLCS is to handle the ambiguous, unclear and difficult processes which are not easily handled by old techniques of the control systems. Also the fuzzy expert system is a system in which fuzzy rules are used with MF to find the conclusion or result.

Fuzzy logic has been applied to many areas or fields, for example fuzzy logic has played an important role in the field of medicine [1] [2]. They are used in control, automobiles, household appliances and decision making systems.

Hypertension or high blood pressure, sometimes called arterial hypertension, is a chronic medical condition in which the blood pressure in the arteries is elevated. The normal level for blood pressure is below 120/80, where 120 represent the systolic measurement (peak pressure in the arteries) and 80 represents the diastolic measurement (minimum pressure in the arteries). Blood pressure between 120/80 and 139/89 is called prehypertension (to denote increased risk of hypertension), and a blood pressure of 140/90 or above is considered hypertension.

Hypertension may be classified as essential or secondary. Essential hypertension is the term for high blood pressure with unknown cause. It accounts for about 95% of cases. Secondary hypertension is the term for high blood pressure with a known direct cause, such as kidney disease, tumours, or birth control pills.

In this study, we present a Fuzzy Expert System for the diagnosis hypertension. As laboratory data, blood pressure, Body Mass Index (BMI), age, heart rate, diabetes, genetics and life-style of the patient are used. Using this data and help from an expert doctor,

the fuzzy rules to determine the risk factor of having high blood pressure are developed.

II. METHODOLOGY

1.1 DATA COLLECTION

The process for the clinical diagnosis of hypertension starts when an individual consults a physician (doctor) and presents a set of complaints (symptoms). The physician then requests further information from the patient or from others close to him. Data collected include patient's previous state of health, living condition and other medical conditions [3] [4] [5].

Many patients were selected to get the parameters like age, BMI level, blood pressure, heart rate, diabetes, physical activity, and genetics. In addition to medical tests, questions such as working background, medical history and life style were asked from patients for obtaining an additional knowledge.

First parameter age is divided into three categories: age of 0 to 25 years is considered as young, 20 to 60 as middle age and above 55 as old.

To get the BMI, the scales for weight and height gain is used. Body mass index is defined as the individual's body weight divided by the square of his or her height. BMI is measured in kg/m2. The BMI can be divided to three categories of BMI range. First category range 15 to 25 is having a healthy weight. The second category in range 5 to 15 is an underweight. The third category is ranged 25 to 35 are considered to be overweight.

To measure the blood pressure, Non invasive blood pressures (NIBP) are used to get the reading. The Non-invasive blood pressure measurement uses the oscillometric method to produce numeric values for systolic, diastolic, and mean blood pressure. The normal blood pressure is 120/80mmHg where the 120mmHg is a Systolic (maximum) and 80mmHg is a Diastolic (minimum). When the blood pressure more than 139/89mmHg, the hypertension can occur.
Heart rate is monitored to get heart rate readings. It can also be divided into three categories: low (50-95), normal (85-135), high (130-185).
Diabetes is a disease in which blood glucose, or blood sugar, levels are too high Over time, having too much glucose in blood can cause serious problems. It can damage eyes, kidneys, and nerves. Diabetes can also cause hypertension. To measure diabetes, blood test is performed and readings are taken. Diabetes is divided into three categories: normal, early diabetes, established diabetes. It is measured in mg/dl. Range of Normal diabetes is (70-110), early diabetes is (100-140), established diabetes is(>140).
Physical activity is estimated by asking the questions to patients about their life style. Persons are less active if they work for only 0-2 hours a day, normal active if work for 2-7 hours and very active if they work for more than 7 hours.
Patients are also asked about their parents if they had suffered from hypertension in the past [6] [7] [8].
The output parameter is risk of hypertension. It is divided into low, medium and high categories.

1.2 DESIGN AND DEVELOPMENT OF FES

A fuzzy expert system is a collection of membership functions and rules that are used to reason about data [9] [10] [11] [12] [13]. The part of the rule between the "if" and "then" is the rule's _premise_ or _antecedent. This is a fuzzy logic expression that describes to what degree the rule is applicable. This design has been divided into several steps. Steps are fuzzification, rule evaluation and finally defuzzification. To design the system, the FIS tool in MATLAB R2010a is used.

In this study, the analysis focused on how to design an expert system to diagnosis hypertension is performed by range of age participants. First, the linguistic values and corresponding membership functions have been determined. Samples of values and corresponding membership functions for the input age, BMI, BP, heart rate, diabetes, physical activity, genetics are shown in Fig 1, Fig 2, Fig 3, Fig 4, Fig 4, Fig 5, Fig 6 and Fig 7 respectively. Fig 8 shows the membership function and linguistic variables for the output risk of hypertension (%).

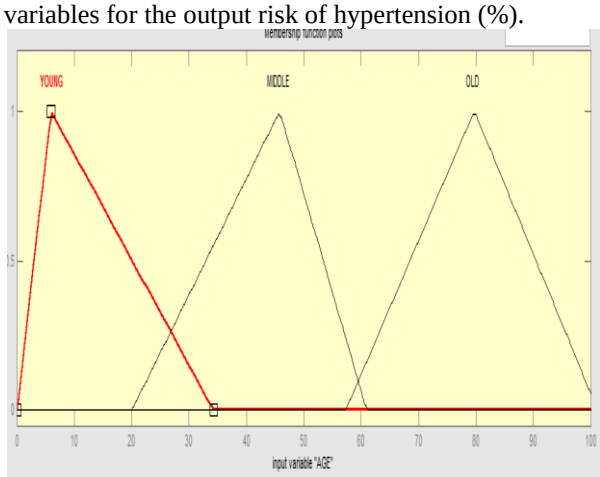

Fig 1: Linguistic variable and membership function of 'Age'

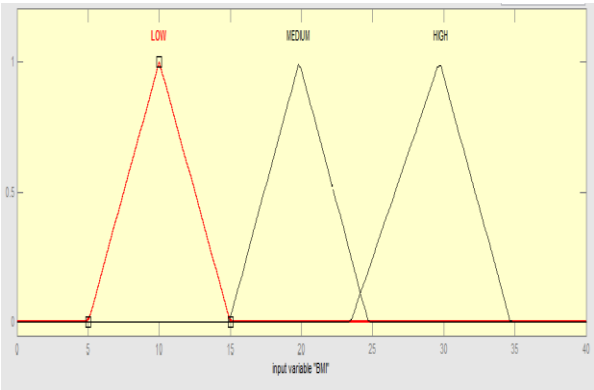

Fig 2: Linguistic variable and membership function of 'BMI'

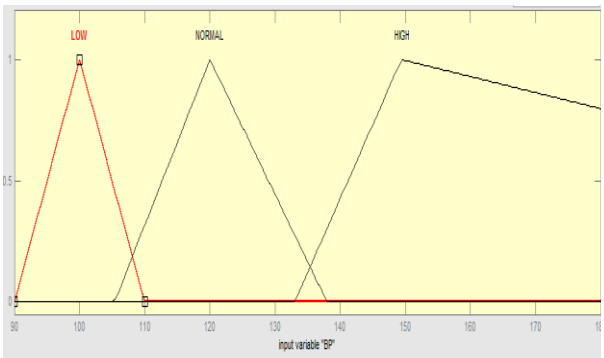

Fig 3: Linguistic variable and membership function of 'BP'

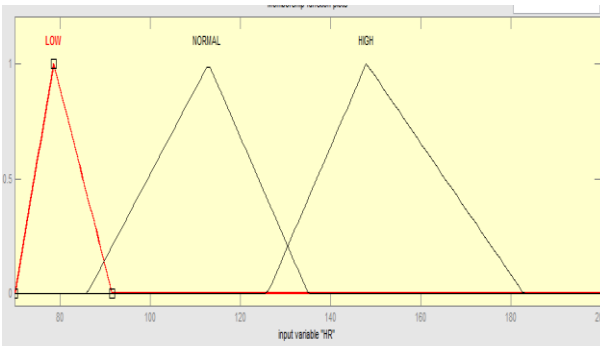

Fig 4: Linguistic variable and membership function of 'HR'

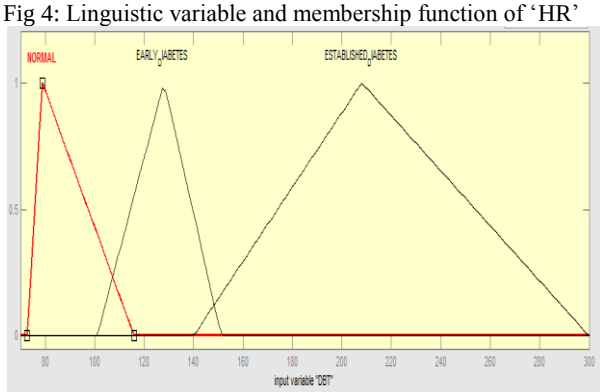

Fig 5: Linguistic variable and membership function of 'DBT'

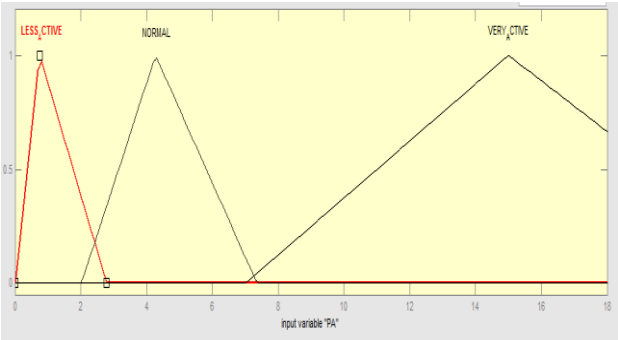

Fig 6: Linguistic variable and membership function of 'PA'

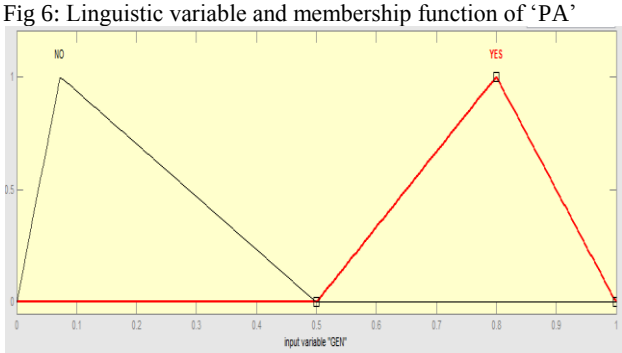

Fig 7: Linguistic variable and membership function of 'GEN'

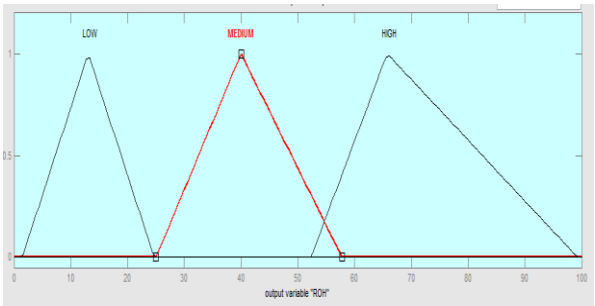

Fig 8: Linguistic variable and membership function of 'ROH'

III. RESULTS AND DISCUSSION

Table 1 shows the data collected from various patients. Fuzzy expert system is used to determine risk of hypertension. This design consists of 7 inputs and 1 output. The inputs consist of age, blood pressure, BMI, heart rate, diabetes, physical activity and genetics while the output is the risk of hypertension (%). The variables are used like low, normal, medium and high for input and low, medium and high for output. The outline of our proposed fuzzy expert system can be shown in Fig. 9 and in this system, Mamdani method is used for fuzzification.

Table 1: Data Collection

Age	BMI Kg/m2	BP mmHg	HR Bmp	DBT mg/dl	PA h/d	GEN
23	20.3	112/68	82	95	12	0.3
24	20.3	120/79	104	95	12	0.3
22	18.6	107/79	90	150	5	0.5
23	25	111/68	67	220	13	0.8
23	25.7	115/76	75	95	3	0.1
26	24.7	123/74	66	106	4	0.3
30	22.1	121/81	81	107	9	0.1
33	23.9	122/73	79	84	14	0.1
30	23.1	126/91	81	95	10	0.2
45	23.7	114/73	70	95	13	0.8

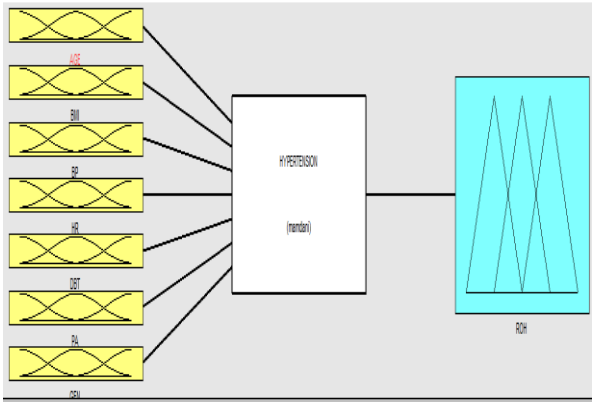

Fig 9: Fuzzy expert system

Rule base is shown in Fig 10. Eleven rules are used in this system and the rules have been developed using *if-then* method. Using these rules, the result risk in term of percentage (%) has been computed. Fig 11 shows the result for the ROH at the age of 50 years old, BMI is 20 kg/m², blood pressure is 135/68 mmHg and heart rate is 135 bpm, diabetes is 185mg/dl, physical activity is 9 hours and geneticly no i.e 0.5 . Hence, the output risk is of hypertension 65.2%. For the surface result, we can see the output for BMI versus Age, PA versus HR in three dimensions as shown in Fig 12 and Fig 13.

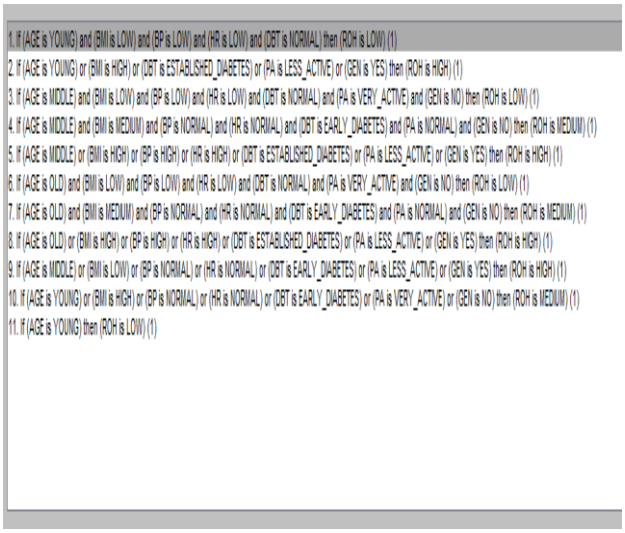

Fig 10: Fuzzy Rules

Fig 11: The result rules of fuzzy expert system

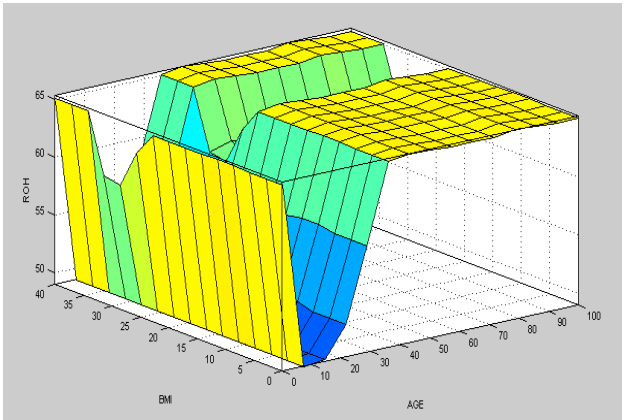

Fig 12: Surface view of fuzzy expert system

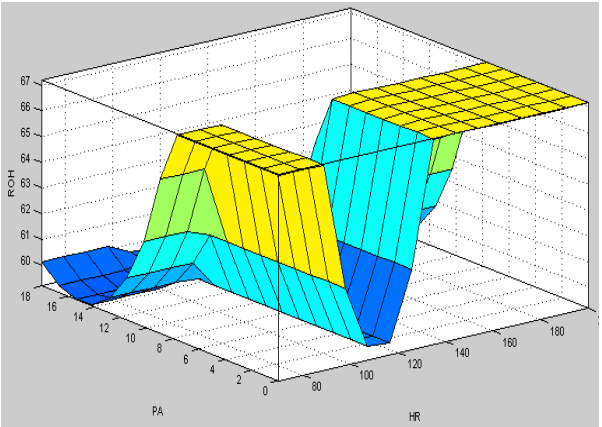

Fig 13: Surface view of fuzzy expert system

The overall result for the risk of hypertension can be shown in Table 2.

Table 2: Hypertension Using Fuzzy Expert System

Age	BMI Kg/ m2	BP mmHg	HR Bmp	DBT mg/ dl	PA h/ d	GEN	ROH (%)
23	20.3	112/68	82	95	12	0.3	55.5
24	20.3	120/79	104	95	12	0.3	58.2
22	18.6	107/79	90	150	5	0.5	50.2
23	25	111/68	67	220	13	0.8	57.4
23	25.7	115/76	75	95	3	0.1	56.2
26	24.7	123/74	66	106	4	0.3	59.7
30	22.1	121/81	81	107	9	0.1	59.6
33	23.9	122/73	79	84	14	0.1	59.6
30	23.1	126/91	81	95	10	0.2	59.8
45	23.7	114/73	70	95	13	0.8	60.1

IV. CONCLUSION

In this paper, a fuzzy expert system is presented for diagnosis of hypertension. Seven input variables age, BMI, heart rate, blood pressure, diabetes, physical activity and genetics are used for the fuzzification method while risk of hypertension (%) is used as output. This is a very efficient, less time consuming and more accurate method to calculate the risk of hypertension.

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RESEARCH ARTICLE OPEN ACCESS

Free Space Optical Link Performance Evaluationusing AODV and DYMO

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ABSTRACT
Free space optical network gained increasing visibly as a broadband communication network over traditional wireless networks because of their high bandwidth (up to Gbps), low cost easy installation and also license free long range spectrum. Existence of line of site and alignment between the nodes is one of the key requirements for free space optical communication. In this paper the free space optical (FSO) communication is briefly elaborated and performance of optical link is evaluated for reactive routing protocols. The protocols used for simulation are AODV and DYMO. The results are compared for the aggregate received packets in the network and signals received with error. A good routing mechanism enhances the performance of the network. The protocol performing better in the simulation scenario is suggested for the free space optical communication.
Keywords–Free space optical communication, routing protocol, AODV, DYMO

I. INTRODUCTION

Optical wireless technology has emerged as a viable technology for next generation indoor and outdoor broadband wireless applications. These applications range from short range wireless communication link providing network access to portable computers to bridging the last mile links between the end uses and existing fiber optic communication backbones and even laser communication for outer space links[1]. The indoor wireless communication often referred to infrared communication and outdoor is commonly known as the free space optical communication. FSO communication offers several advantages over the RF and microwave systems such as greater information capacity (upto 300 THz, for wavelength of 1 µm compared to 300 GHz of RF and 300 GHz of microwave), easyinstallation, improved security due to narrow laser beam and most importantly the nonexistence of spectrum licensing for frequencies above 300 GHz [2].

A recent trend in wireless communications has been the desire to leverage directional forms of communications e.g. directional smart antennas, FSO transceivers for more efficient medium usage and scalability [3]. Directional communication for example, using directional antenna for free space optics has a potential to increase the capacity inmultihop wireless mesh and ad hoc network. There are different reactive and proactive routing protocols which can be utilized to route the traffic in the network. With various routing methodologies the link performance varies. The performance for same parameters is evaluated for AODV and DYMO. The results justify that while using the same simulation parameters AODV performs better than DYMO.

We have conducted an extensive performance evaluation of free space optical link for reactive routing protocols. Results indicate that AODV surpasses the other protocols. The rest of the paper is organized as follows. In section 2, we discuss the FSO communication followed by description of routing protocols used for the simulation in section 3. Next section 4 represents the simulation model. The results are compared in section 5. Finally this paper is concluded in section 6 highlighting the most efficient routing solution for free space optical link.

II. FREE SPACE OPTIC COMMUNICATION

FSO communication is a line of sight technology that uses laser beam for sending high bandwidth digital data for one point to another using the free space. This can be achieved by using a modulated narrow laser beam lunched from a transmitter at one node and subsequently received at the receiver side. The system typically consists of transmitter, FSO channel and a receiver.

A block diagram of an FSO communication link is presented in Fig 1. The transmitter modulates the data onto the instantaneous intensity of an optical beam.

The optical beam travels in line of sight to the receiver and the data is recovered using the photo diode and the de modulator [4].

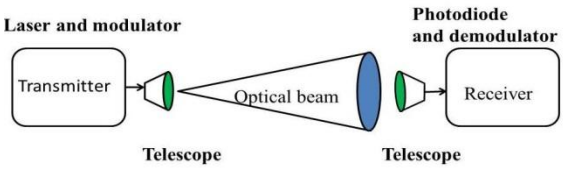

Fig 1: Block diagram of an FSO link

2.1 PARAMETERS OF OPTICAL LINK PERFORMANCE

The FSO link performances can be determined by several parameters including geometrical loss, link margin, received power and BER. There are two parameters to evaluate the FSO link performances- the received power and BER. Theoretically, the basic communication principle states that received power must be less than transmitted power, PR ≤ PT, according to [5]:

= -Total losses (1)

Where (dBm) is the received power, (dBm) is the transmitted power. According to [5], total losses in a FSO communication system would cover all the losses caused by the atmospheric phenomena, (dB) which can be calculated as in Eq. (5), geometrical loss, (dB) and system loss, (dB). Therefore, the new equation for FSO received power is as in Eq. (2):

= - - - (2)

The total transmitted power can be obtained in Eq. (3):

= +10 ( ) (3)

Where, is the number of transmitter lenses on a single FSO unit. Geometrical loss and system loss are the internal losses occurred within theFSO transceiver. Both losses are fixed on all FSO link and cannot be neglected. Is manufacturer defined; meanwhile in [5] can be calculated as in Eq. (4):

=-10 ——— (4)

ℓ (km) is the distance of the optical path where the laser beams travel and θ (mrad) is the divergence angle which is the angle of the cone of light emitted from the transmitter. Meanwhile, ( ) ( ) is the total area of the receiver apertures on a single FSO unit.

According to Beers-Lambert Law, the atmospheric losses for any laser power is in a form of exponential equation of:

= (5)

Where ℓ (km) is the transmittance range of the laser and σ is the typical attenuation coefficients (0.1 for clear air) [6].

The robustness of the design of any optical communication system can be effectively verified by critically applying performance checks on the system. The evaluation criteria should provide a precise determination and separation of dominant system limitations, making them crucial for the suppression of propagation disturbances and performance improvement. The Bit Error Rate (BER) of an optical link is the most important measure of the faithfulness of the link in transporting the binary data from transmitter to receiver. The BER quantifies the rate of errors and is defined as the probability of an error occurring per transported bit. The bit error rate takes the simple form

BER=–erfc(—=) (6)

Where Q is quality factor and 'erfc' denotes the complementary error function.

III. ROUTING PROTOCOLS

In the wireless communication the nodes may be placed randomly in the whole network. Each node follows a certain set of rules during the data transmission in the network known as the routing protocols.Routing protocols arecategorized in two subclasses reactive and proactive routing protocol.In this section, we summaries the various key features of AODV and DYMO.

3.1 Proactive Routing Protocol

Each node in the network has routing table for the broadcast of the data packets and want to establish connection to other nodes in the network. These nodes record for all the presented destinations, number of hops required to arrive at each destination in the routing table. The routing entry is tagged with a sequence number which is created by the destination node. To retain the stability, each station broadcasts and modifies its routing table from time to time. Example of proactive routing protocol is destination sequenced distance vector (DSDV).

3.2 Reactive routing protocol

It employs flooding (global search) concept by constantly updatingroutetables of individual nodes. Reactive protocol searches for the route in an on-demand manner and sets the link in order to send out and accept the packet from a source node to destination node. Reactive Protocol has lower overhead since routes are determined on demand Route discovery process is used in on demand routing by flooding the route request (RREQ) packets throughout the network. Examples of reactive routing protocols are the dynamic source Routing (DSR), ad hoc on-demand distance vector routing

(AODV) and Dynamic MANET On-Demand Routing Protocol (DYMO).

3.2.1 AODV

AODV is a modification of the DSDV algorithm. When a source node desires to establish a communication session, it initiates a path-discovery process to locate the other node. The source node broadcasts a RREQ packet with its IP address, Broadcast ID (BrID), and the sequence number of the source and destination . While, the BrID and the IP address is used to uniquely identify each request, the sequence numbers are used to determine the timeliness of each packet.

3.2.3 DYMO

DYMO is not a new protocol but an improvement of basic AODV routing protocol and easier to implement. Typically, all reactive routing protocols rely on the quick propagation of route request packets throughout the MANET to find routes between source and destination,while this process relies on broadcasting route reply messages that are returned to the source. DYMO [7] [8] determines unicast between DYMO routers within the network in an on-demand fashion, offering improved convergence in dynamic topologies. The basic operations of the DYMO protocol are route discovery (by route request and route reply) and route maintenance. In networks with a large number of routers, it is best suited for sparse traffic scenarios. In each DYMO router, minimal state routing is maintained and therefore it is applicable to memory constrained devices. In this protocol only routing information relative to active sources and destinations is maintained. The routing algorithm in DYMO may be operated at layers other than the network layer, using layer-appropriate addresses. For operation at other layers only modification of the packet/message format is required. To ensure predictable control overhead, DYMO router's rate of packet/message generation should be limited.

IV. SIMULATION ENVIRONMENT

Qualnet 5.0 is used for the simulation of protocols. The free space model is simulated for 15 nodes. The simulation area is 1800X1800 . The nodes are placed randomly in the given simulation area. The other specifications used for the simulation are as follows:

Radio type: abstract
Data rate:1.5 Gbps
Transmission power: 15 dBm
Antenna model: steerable antenna
Laser beam angle: 10 degrees
Simulation time: 30 minutes

V. RESULTS

The simulation results are compared for the total number of packets received in the network along with the signals received with error. Fig 2 shows the aggregate number of packets received in the network using AODV as the routing protocol and Fig 3 shows the same using DYMO. The performance comparison of both protocols in terms of signal received with error is shown in Fig 4.

Fig 2: Aggregate number of packets received in the network with AODV

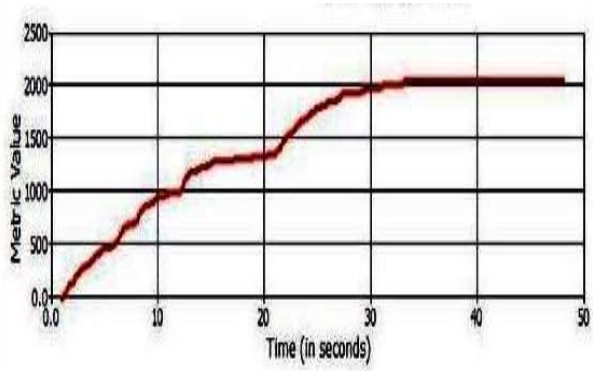

Fig 3: Aggregate number of packets received in the network with DYMO.

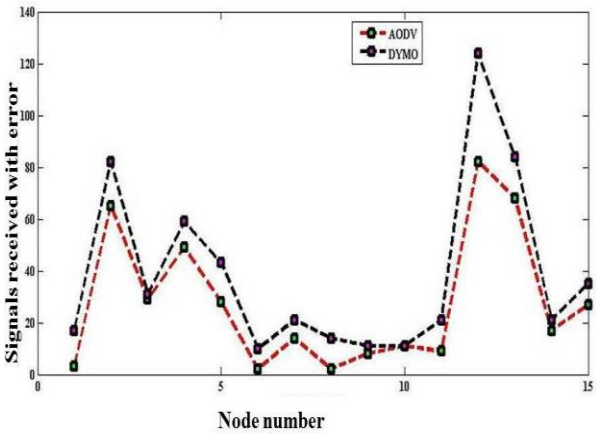

Fig 4: Comparison of signals received with error for AODV and DYMO

VI CONCLUSION

As the results are compared for AODV and DYMO the aggregate number of packets received are more for AODV then DYMO also the network stabilizes faster for AODV with gradual increase in the total number of packets in the network. When comparing the signals which are received with error the error rate is higher in DYMO. The error rate increases gradually when DYMO is used as the routing protocol. For the overall simulation of the optical link, AODV performs better than the DYMO as the network efficiency would be more for AODV.

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Routing Policies & Strategies in Delay Tolerant Network

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Abstract-
Delay Tolerant Networks (DTNs) represent a class of wireless networks that experience frequent and long lasting partitions due to sparse distribution of nodes in the topology. A traditional network assumes the definite existence of a contemporaneous end-to-end path between a source and destination. But this assumption is unrealistic in many real life applications. Therefore, DTN comes into existence to deal with the networks that assumes partitions among the network. Numerous studies have tackled the challenging problem of routing in DTNs. Routing proposals include stochastic approaches such as random, spray-and-wait and epidemic routing, or deterministic approach such as history-based, model-based, coding - based and variations of these approaches. The number of routing schemes in the literature is increasing rapidly without a clear mapping of which is more suitable for any of the vast array of potential DTN application. This document surveys the main routing schemes in the DTN literature. It provides a detailed insight to the DTN approach and describes in some depth the policies and strategies proposed to manage buffers and queues in DTN nodes. Then, the predominant DTN real-life applications are presented and discussed. The aim of this document is to create a classification basis for the most prominent DTN applications and to map major DTN routing schemes to these categories according to some influential network attributes and characteristics that are related particularly to the type of application.

I. INTRODUCTION

Delay tolerant networking [1] has received considerable attention from the research Community in recent years. Advances in wireless and mobile technologies have enabled new networked systems where intermittent disconnections are not exceptional. Examples include sparse mobile ad hoc networks. The traditional Internet model assumes low error rates, low propagation delays and, most importantly, a steady end-to-end connection between any source/destination pair of nodes.

Delay tolerant networks (DTNs) represent a class of infrastructure-less wireless systems that support the functionality of networks experiencing frequent and long lasting partitions. DTNs are intended to deal with scenarios involving heterogeneity of standards, intermittent connectivity between adjacent nodes. The key issue of routing for DTN is to find an opportunistic connectivity between the nodes and transmit data to the nodes when they meet with each other if possible [2] [3]. Some methods have been proposed to achieve opportunistic communication in such challenged networks, trying to achieve the higher delivery ratio with the shorter delivery delay. Each of them has its own pros and cons.

1.1 Issues in DTN

In Delay Tolerant Networks, the network may not be connected at any given point of time. The packets are delivered in a store – carry – forward

model. Each node along the path receives the packets from the previous node as it comes in contact with that particular node. After that this node stores the packet locally until it encounters next intermediate node. And when encounter occurs the packet is sent to next intermediate node. This procedure is followed until the destination is reached.

When two nodes come in contact with each other, they may exchange the packets and such an opportunity is known as encounter. In case of traditional networks, the network is connected at any given point of time. Therefore there are no partitions in such a network. But the traditional network fails to consider several real life applications like wildlife and habitat monitoring, deep space communication, underwater infrastructure etc. That's why the delay tolerant network comes into existence, to take into account the above applications [4] [5].

There are several issues in delay tolerant network that needs to be addressed. Some of them are described as per below:

1.1.1 Encounter Schedule

In order to send the data from source to destination, the node can wait till it encounters the destination node and after that directly deliver the packet to the destination. However, this approach may take a long time and may not even happen. But the encounter schedule is very crucial factor, because the delivery of messages depends upon the schedule of the encounter.

1.1.2 Network Capacity

Generally, the duration of an encounter as well as the bandwidth of the network, are the main factors that tells the amount of packets that can be transferred from one node to another node. But the capacity of underlying network is also a vital factor for determining the amount of data that can be delivered. If during an encounter multiple nodes tries to forward data, the network may become congested. Thus, this factor determines whether a message needs to be fragmented or not in order to send it from source to the destination.

1.1.3 Energy

The transmission of packets as well as the computation carried out at nodes, consumes a significant amount of energy. In some cases, such as battery operated wireless sensor networks, the resources may be highly constrained where it is important to take into account the residual energy of a node while determining whether to exchange data during an encounter. So the energy is an important issue in delay tolerant networks that needs to be considered. However, in case of vehicular ad-hoc networks, the constraint on power may not be as severe as in case of delay tolerant network.

1.1.4 Storage Capacity

The storage capacity of nodes is limited. Whenever an encounter occurs, the nodes try to exchange all the data they currently carry with them. Therefore, if the nodes are storage constrained, the node buffers will overflow and it will result into packet loss.

Therefore, the approach of exchanging all the data during an encounter may not be applicable in all the applications. Certain intelligent schemes are needed that restrict the number of copies of the packets, as well as the schemes that delete the data that has already been delivered to the destination.

1.2 Architecture of DTN

The DTNRG has developed architecture for Delay-tolerant networking that has emerged from the efforts on Interplanetary Internet (IPI). There are many Bundle Protocol implementations, but the most famous protocol is DTN2, that is developed by Intel and at present it is maintained by Dublin Trinity College, and ION (Interplanetary Overlay Network) [6] [7]. The DTN architecture and its protocol stack are shown in Fig 1.

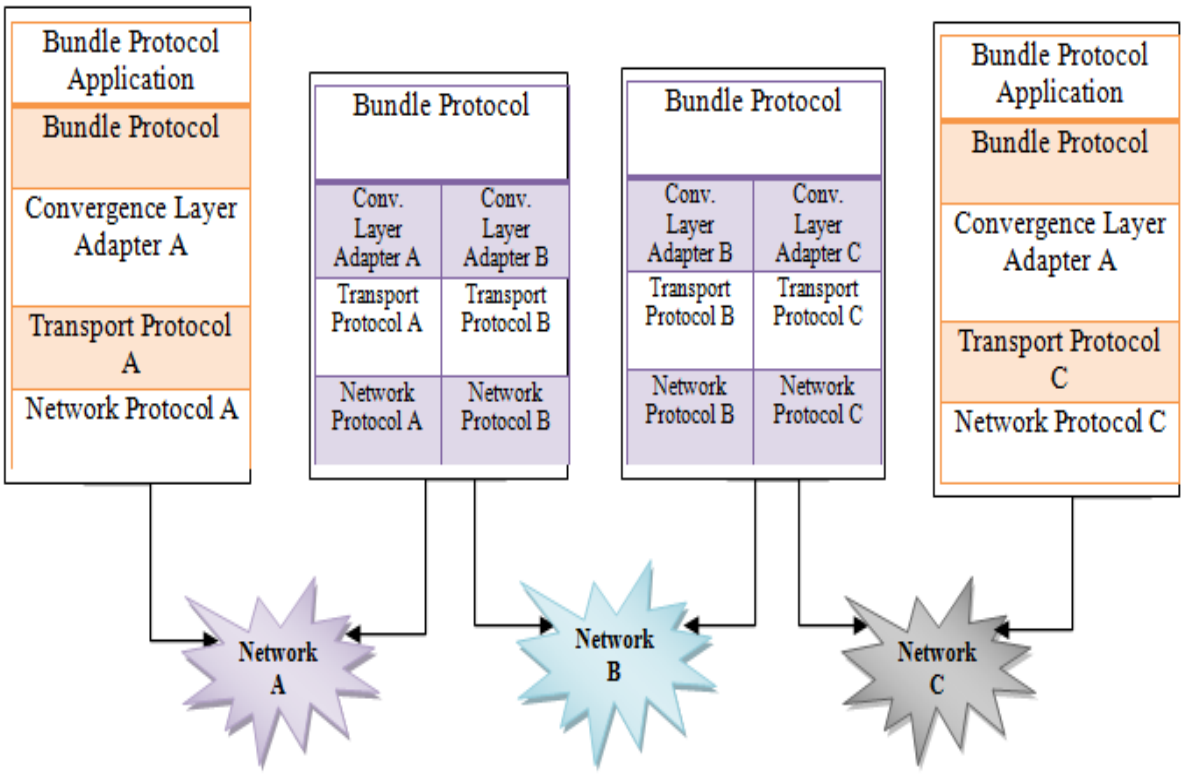

Fig 1: DTN architecture and protocol stack.

1.3 Characteristics of DTN

Delay Tolerant networks may be characterized by the combination of the following characteristics:

- **Intermittent Connectivity:** If there is no consistent end-to-end path between the source and destination -a phenomenon known as network partitioning, end-to-end communication using the TCP/IP protocols does not work. Other protocols are required.
- **Asymmetric data rates:** The Internet does support some forms of asymmetric bi-directional data, as in cable TV or asymmetric DSL access. But if asymmetries increase then they will hinder traditional interactive protocols such as TCP.
- **High error rates**: The delay tolerant networks have high error rates. Ambiguous mobility patterns: Unlike the case with public bus services that maintain fixed routes or planetary trajectories, future behavior of a node is not fully known for many DTN applications. It is widely assumed, however, that node mobility patterns (while random) are generally recurrent.
- **Long or variable delay**: Long propagation delays between nodes, in addition to variable queuing delays at node buffers, all create end-to-end path delays that far exceed the threshold levels usually tolerated by Internet protocols and applications that rely on quick return of acknowledgements.

II. ROUTING STRATEGIES

Data is delivered in a DTN using a store-carry-forward model. The main categories of routing schemes for delay tolerant networks are given below:

2.1 Epidemic routing

The epidemic routing is one of the simplest and earliest routing schemes for DTN [8]. In this routing strategy, whenever two nodes come in

contact with each other, they exchange all the messages they currently carry at that point of time. In other words, the packets are spread like a viral epidemic. So this routing strategy is fastest possible routing scheme.

In [9], authors improved the basic epidemic scheme by introducing the adaptive dropping policies like Drop-Random (DRA), Drop-Least-Recently-Received (DLR), Drop-Oldest (DOA) and Drop-Least-Encountered (DLE).

In[10], authors proposed a set of strategies for controlled flooding in Delay Tolerant Networks. These schemes have a Time-To-Live (TTL) field to control message flooding. In epidemic routing, the data delivery results in inefficient use of the network resources such as power, bandwidth, and buffer at each node. Moreover, messages may continue to exist in the network even after they have been delivered to the destination.

2.2 Probability-based Routing

If network resources are unlimited, Epidemic Routing is likely to be good at message delivery. But in reality, the network resources like bandwidth, buffer space are constrained. Therefore, in order to leverage mobility and use scarce resources efficiently, the Probabilistic Routing Protocol using History of Encounters and Transitivity (PRoPHET) has been proposed [11] [12].

The sender forwards the message to the node having the highest probability of successful message delivery. This mechanism relies on the implicit assumption that all the nodes cooperate to message forwarding.

2.3 Spray and Wait Routing

A novel way to achieve efficient routing in DTNs is presented [13]. This protocol consists of two phases:

a.) Spray phase (only once): L message copies are initially spread to L distinct "relays".
b.) Wait phase: If the destination is not reached in the spray phase, the L nodes carrying a message copy perform direct transmission. The forwarding technique is a mix of always (Spray) and direct delivery (Wait). The replication is limited (the bound is L) and the queue management is FIFO.

2.4 Location Based Routing

In some cases, the location of the nodes may be known, that can be used in case of opportunistic forwarding of messages in DTN. The location information of the nodes may be known in either a physical (for example, from GPS devices attached to nodes or through a location service) or a virtual coordinate space (designed to represent network topology taking obstacles into account) [4]. When an encounter occurs, the node forwards data to another node only if it is closer to the destination. Hence, location-based routing is a form of greedy, geographical-based routing.

2.5 Context-aware Adaptive Routing (CAR)

CAR routing scheme does not require any previous knowledge of the routes of the hosts like other approaches. This protocol is based on a single copy of message in the system, instead of multiple replicas. According to this routing scheme, if a host wants to send a message to another host, it uses Kalman Filter prediction and multi criteria decision theory [14].

III. QUEUING POLICIES AND FORWARDING STRATEGIES

Nodes may have to buffer messages for a long time and in case of congestion these needs to decide which messages to drop from its queue. The queuing policies are responsible for deciding which message should be dropped whenever there is overflow or congestion in the network. They also have to decide which messages to forward to another node that is encountered [15] [16].

3.1 Queuing Polices

The queuing polices defines which message should be dropped when the buffer is full. There are many queuing polices that has been proposed for selecting the most vulnerable message. Some of them are described below:

a.) **FIFO -First in first out:** In this queuing policy, the message that was firstly entered into the queue is the first message to be dropped.

b.) **MOFO -Evict most forwarded first**: In this scheme, the message that has been forwarded the most number of times is the first to be dropped.

c.) **MOPR -Evict most favourably forwarded first:** In this, every node maintains a value FP (initialized to zero) for each message in its queue. Each time the message is forwarded, FP is updated according to the equation:

$$FP = FPold + P \quad (2)$$

The message with the highest FP value is the first to be dropped.

d.) **SHLI -Evict shortest life time first**: In the DTN architecture, each message has a timeout value which specifies when it is no longer useful and should be deleted. If this policy is used, the message with the shortest remaining life time is the first to be dropped.

e.) **LEPR -Evict least probable first:** Since the node is least likely to deliver a message for which it has a low P-value, drop the message for which the node has the lowest P-value.

More than one queuing policies can be combined together to provide a more efficient queuing policy.

3.2 Forwarding Strategies

The forwarding strategies decide which message should be forwarded from the queue whenever an encounter occurs. Let A and B are the nodes that meet. Destination node is D and all other nodes are followed by node A. P (x,y) is the delivery predictability that node x has for destination y. Now, the forwarding strategies are described as per below:

a.) **GRTR** - Forward the message only if :

$$P(B,D) > P(A,D)$$

b.) **GRTRSort** - Select messages in descending order of the value of **P(B,D) and P(A,D).** Forward the message only if :

$$P(B, D) > P(A,D)$$

c.) **GRTRMax** - Select messages in descending order of P(B,D). Forward the message only if :

$$P(B,D) > P(A,D).$$

d.) **COIN -** Forward the message only if :

$$X > 0.5$$

- where X ε U(0, 1) is a random variable.

IV. DTN APPLICATIONS

There are many real-life applications where wireless nodes, mobile or stationary, are forced to undergo extreme operational conditions and/or wait for extended intervals of time that exceed traditional IP forwarding times (that are usually measured in milliseconds) before being able to forward their data to next hops.

Some of these applications are listed below:

- **Wildlife Monitoring:** This application is concerned with gathering data about wild faunae species and their habitats. Monitoring is conducted by attaching a sensing device to each animal (i.e. mobile node). These devices may contain microcontrollers, global positioning systems (GPS), and orientation and temperature sensors.
- **Forestry and Underwater Sensors:** Using forestry and underwater sensors Measurements regarding temperature, air pressure, intensity of natural lighting, chemical contamination in the soil or the water, fire hazards, radiation levels and other measurements can be gathered.
- **Village Networks:** Village networks represent a very promising public application for DTNs, especially in secluded areas lacking communication infrastructure.
- **Inter-planetary Networks:** The massive distances separating terrestrial artificial objects and the need for these objects to exchange data among each other or with base-stations on earth –or perhaps other planets-represent an extreme case of DTN communication [17].
- **Military Applications:** In military, as in the case of wildlife monitoring, there is a need to monitor extended geographical planes their objects and inhabitants – i.e. soldiers-who would be equipped with wireless sensors in order to indicate their locations.

V. COMPARATIVE ANALYSIS

In this section different real life applications are mapped on different network characteristics. The Table 1 shows this mapping.

Table 1: Mapping DTN fields of application to network characteristics.

	Higher Node-Loss Ratio	**Higher Level of Partitioning**	**Delay is Significant**	**Buffer Constraints**	**Energy Constraints**
Wildlife Monitoring	✓	✓			✓
Underwater Sensing		✓		✓	✓
Inter-Planetary Networks		✓	✓	✓	
Village Networks		✓			
Military applications	✓	✓	✓	✓	✓

Now, the table showing the mapping of different routing protocols on different parameters is shown with the help of Table 2:

Table 2: Mapping routing schemes to network parameters [18].

	Delivery ratio	**Routing delay**	**Vulnerability to Malicious nodes attack**	**Number of messages sent**
Epidemic routing	High	High	High	Highest
PRoPHET	Medium	Medium	High	Medium
C.A.R.	Low	Low	Very low	Low

VI. CONCLUSION

In this paper, various routing protocols for delay tolerant networks, the queuing and forwarding strategies for DTN has been covered. Choosing the correct buffer management policy and forwarding strategy, and combining them to the suitable routing method, represent the best recipe for improving performance of DTN. And also various real life applications are mapped on major DTN routing schemes according to some influential network attributes and characteristics that are related particularly to the type of application.

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RESEARCH ARTICLE OPEN ACCESS

Social Networking Security: Awareness among Indian Users

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ABSTRACT
Social networking has become a very popular activity these days among all categories of people. Billions of people use it to meet old friends, make new friends, share and view information and fulfill their social needs to interact with people. But with these attractions, come the risks of exposing personal information to unknown people. This paper aims at studying the awareness about the importance and ways of having security and privacy checks while on these social networking sites. Respondents to this study belonged to different educational backgrounds, age and gender. Data was collected and then analysed based on the category of the questions related to basic awareness, technical awareness, advocacy and responsiveness towards the proper usage of social networking sites.
Key words - Cyber crimes, Internet Security, Social Networking

I. INTRODUCTION

Social Networking is a platform that is used to build social relations among people who are linked to each other in some way like having common interests, likes for similar activities, similar backgrounds or real life connections. In a typical social network service, each user has a profile, social links and various additional services. Users of social networking sites create their public profiles, add list of other users with whom they want to interact and view and share information with these set of users. These users can also interact with each other through instant messaging, e-mails etc.

Because of its ease to use and availability of cheap technology, social networking has become a popular medium of finding and interacting with new and old friends. For this purpose, many users of these social networking sites tend to disclose their personal information like name, gender, pictures, phone numbers, address and sexual preferences etc. [1]. What they do not realize is that providing personal information on the public platforms will not only put them in danger of opening up to total strangers who can misuse their personal information for purposes like identity thefts, applying for credit cards etc. but can also cause them physical harm. An empirical research in this field has shown that many of the people either do not have awareness regarding privacy or security issues associated with these social networking sites or they are not aware of the risks they are posing themselves to, in disclosing this information on public platforms [2].

One more important factor to be considered is that social networking is attracting people from all walks of life including teenagers and children as well. These people do not understand the importance of security and privacy. Many of them post their real life pictures, addresses, mobile numbers name of their schools and other confidential information without adequate security settings. Parents too are sometimes too busy to monitor their children's online activities and hence with easy accessibility of gadgets and such platforms, teenagers and children fall prey to security and privacy attacks.

II. RELATED WORKS

One of the problems of social networking usage is that these sites are also being used for sexual crime offenders, in which youth are their main target [3]. This means that university and college students are within the target group of the offenders since they are usually aged between 17 to 30 years old. In terms of gender-based awareness, [4] found out that young women are more concern and being more protective towards their privacy in Facebook than their men counterpart. But that does not mean that women users are safer than their men counterpart. Based on a media report, women are more addicted to the usage of social networking sites than men [5]. It means that there will be more opportunity for women to be at risk when using the social networking sites since they are more likely to spend more time using the sites. Although in [3], authors clearly mentioned about the youth as being the target of crime offenders, however, youth in the literature is defined as between 7-17 years old, which is different than the target group of this paper. Other related literatures reviewed are focused on the students from other countries like Australia [6] the United States [4] [1] and Canada [7]. This paper however will focus on social

networking usage awareness in Internet users in India specifically in the region of tricity (Chandigarh, Panchkula, Mohali).

III. MATERIALS AND METHODS

The data of the study is based on a survey distributed to a total of 90 respondents in which it was distributed randomly in January 2014. All of them were returned, yielding 100% response rate. There were 14 questions focusing on the respondents' awareness of computer security from the perspective of social networking usage [8]. All surveys responses were recorded and used for statistical analysis. Descriptive cross tabulation method was used to conduct the data analysis and SPSS v20 is used. The respondents came from different academic background, age groups and gender background with the minimum education graduation and highest education level was PhD holder. In terms of age, the respondents were aged between 18 to 65 years old. 62% of the respondents were female, and the rest were male respondents. Figure 1, Figure 2 and Figure3 describe the composition of the respondents in details.

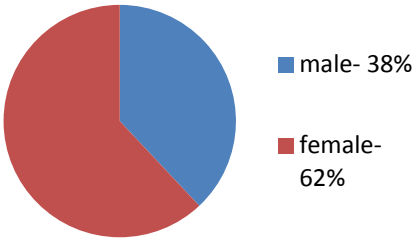

Fig 1: Respondents composition based on gender.

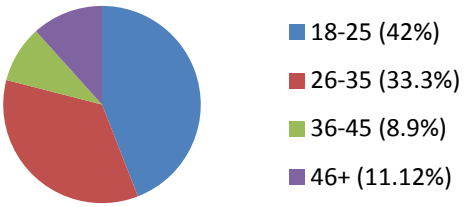

Fig 2: Respondents composition based on academic background.

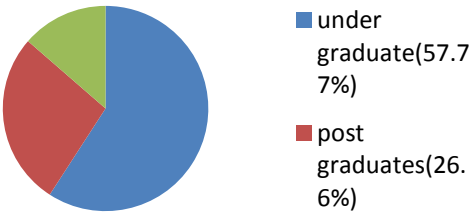

Fig 3: Respondents composition based on age.

IV. RESULTS AND DISCUSSION

The results are categorized based on several groups; basic knowledge on social networking usage awareness; technical awareness for secure social networking; social networking awareness advocacy and responsiveness towards incidents and suspicious profile over such sites. The findings are analyzed based on gender and also academic background of the respondents. The following sub-sections discussed the results obtained for each category.

Table 1: Social Networking Basic Awareness Survey Questions.

Code	Questions
Q1	Aware of pretenders and are very vigilant (in adding them as your friend)
Q2	Share or post your personal information such as your phone numbers, home/work address in your profile
Q3	Do you think before posting your photos (to avoid it from being exploited)
Q4	Share your password with anyone
Q5	Add people as friends to your site only if you know them
Q6	Meet someone whom you have first 'met' on social networking site

Table 2: Social Networking Basic Awareness Based on Gender.

	Male		Female	
Q.N.	Yes (%)	No(%)	Yes(%)	No(%)
Q1	70.58	29.41	85.71	14.28
Q2	58.82	41.17	25.00	75.00
Q3	64.70	35.29	78.57	21.42
Q4	29.41	70.58	25.00	78.57
Q5	88.23	11.76	85.71	7.14
Q6	11.76	88.23	10.71	89.28

Table 3: Social Networking Basic Awareness Based on Education Level.

	Graduates		Post Graduates and Ph.D.	
Q.N.	Yes(%)	No(%)	Yes(%)	No(%)
Q1	66.66	33.33	95.23	4.76
Q2	41.66	50.00	33.33	66.00
Q3	75.00	25.00	71.42	28.57
Q4	16.66	83.33	38.09	61.90
Q5	75.00	14.28	100.00	0.00
Q6	12.5	87.5	9.52	90.476

4.1 Basic Awareness

The survey has six questions that measures the basic awareness of the respondents (Table 1); Q1, Q2, Q3, Q4, Q5, and Q6. Questions Q2, Q4, and Q6

are questions which were asking whether the users will do negative actions on the social networking sites. These types of questions were expecting respondents to answer "No", while other questions; Q1, Q3, and Q5 are questions that were expecting "Yes" answers. Table3 shows the responds on the survey questions that measure the basic awareness on social networking usage.

Based on the result shown in Table 2, most of the respondents or more than 60% respondents for both gender answered "Yes" for questions Q1, Q3, and Q5. This shows that most of the respondents have good knowledge in basic awareness. However, male respondents produced 64.70% of "Yes" answers for Q3 compared to female's 78.57%. This shows that male respondents were lacking in thinking before they post their status than the female respondents. Q2 shows a very significant difference in the opinions of males and females. As about 60% males share their phone numbers, home/work address in their profile but only 25% of females feel comfortable in sharing such information in their profile. In terms of questions Q4, and Q6, respondents from both gender gave over 70% of "No" answers. This shows that they are aware of the danger of sharing their personal information in the social networking sites. Female respondents again dominate the results by giving 78.57% and 89.28% for "No" answers respectively for all the questions while male respondents gave slightly lower percentage of "No" in all questions. Although most of the respondents gave high percentage of awareness regardless of their gender, based on the findings, female respondents showed higher awareness than the male respondents.

Based on the respondent's educational background, the result shows that, respondents with higher educational background are more aware on social networking security than respondents with lower educational background.

Based on Table 3, it shows that post-graduates and Ph.D. respondents gave more than 70% of "Yes" answers to questions Q3 and more than 95% yes for Q1 and Q5. While there were only 66.66%, 75% and 75% of "Yes" answered by respondents with graduation degree and below for the same set of questions. In terms of questions Q2, Q4, and Q6, similar trend repeated when respondents with higher educational background recorded higher percentage of basic awareness. Ph.D. Degree holders and post graduates responded 66.6%, 61. 90% and 90.47% of "No" answers for this set of questions. While respondents with the lower educational background recorded 50%, 83.33% and 87.5% which are slight lower than the other group. It can be concluded that respondents with higher educational background have basic awareness of using social networking sites. However, in general, regardless of educational background, most of the respondents have basic awareness in social networking sites usage.

Table 4: Social Networking Technical Awareness Survey Questions.

Code	Questions
Q8	Use privacy setting of the social networking site
Q9	Install monitoring software to monitor online activities
Q13	Enable privacy setting to restrict who can post and access information on your children websites

4.2 Technical Awareness

Technical awareness of the respondents has also measured. Technical awareness refers to the settings that have been changed and used by the respondents to have a secure social networking site. In this study, the technical changes are the privacy setting of the social networking sites to make its page or status can only be viewed by users who are connected to them. Another technical mean that have been measured in this study is the use of 3rd party monitoring software to monitor the usage in the social networking sites. Table 4 describes the questions used in the survey for measuring technical awareness for social networking users. Based on the acquired data about the technical usage on their social networking sites, the technical awareness of the users is then measured.

Table 5: Social Networking Technical Awareness Survey Response based on Gender.

	Male		Female	
Q.N.	Yes(%)	No(%)	Yes(%)	No(%)
Q8	88.23	11.76	82.14	17.85
Q9	11.76	88.23	10.71	89.28
Q13	58.82	41.17	78.57	21.42

Table 6: Social Networking Technical Awareness Survey Response based on Educational Background.

	Graduates		Post Graduates and Ph.D.	
Q.N.	Yes(%)	No(%)	Yes(%)	No(%)
Q8	95.83	4.16	71.42	28.57
Q9	12.5	87.5	9.52	90.47
Q13	58.33	41.66	85.71	14.28

Table 5 shows the percentage of the awareness survey based on gender. Based on the table, respondents of both gender showed majority of them uses some technical measures that include networking settings, but maximum people do not install software for secure social networking activities. Majority the respondents are also aware of

the privacy settings of the social networking sites. This is shown in the result where more than 50% of the respondent, answered "yes" to Q8 and Q 13, regardless of the gender. The result also showed that the percentage of awareness in terms of more advance approach as described in Q8 and Q13 are higher than in Q9. This reflects that most of the users are not keen to explore further the security mechanism in social networking sites. Table 6 shows the percentage of the technical awareness survey based on academic background. In general the results showed that for each questions, majority of the respondents from all education category aware of technical awareness for social networking sites except the case of installing monitoring software

Table 7: Social Networking Awareness Advocacy Survey Questions.

Code	Question
Q10	Educate them on what information should be kept private and not shared
Q11	Tell them to inform you if someone asks or talks about sensitive issues that makes them uncomfortable
Q12	Tell them that information posted online cannot be taken back

Table 8: Social Networking Security Awareness Advocacy Survey Response based on Gender.

	Male		Female	
Q.N.	Yes(%)	No(%)	Yes(%)	No(%)
Q10	82.35	17.64	78.57	21.42
Q11	64.70	35.29	53.57	46.42
Q12	58.82	41.17	35.75	64.28

Table 9: Social Networking Security Awareness Advocacy based on Educational Background.

	Graduates		Post Graduates and Ph.D.	
Q.N.	Yes(%)	No(%)	Yes(%)	No(%)
Q10	62.5	37.5	100.00	0.00
Q11	58.33	41.66	57.14	42.85
Q12	41.66	58.33	47.61	52.38

4.3 Advocacy

In the survey, questions regarding security advocacy on social networking sites usage have also been asked. The advocacy of security for social networking is regarding the effort of the users to teach, educate and advocating people around them especially their siblings, family members or their children on security measures and issues for social networking usage. The questions for this category are shown in Table 7.

Table 8 shows the results for technical awareness among the respondents based on gender. It shows that more than half of the respondents answered yes for all questions asked regardless of their gender. Male respondents showed better percentage in terms of advocacy where they responded 82.35%, 64.70% and 58.82% percents to all three questions respectively. Women respondents recorded lesser percentage of advocacies with 78.57%, 53.57% and 35.75% respectively. It shows that men are more aware of advocating security in social networking sites usage.

In terms of educational background, survey results showed in Table 9 showed that, 100% of post graduate and Ph.D. holders educate people around them about what information should be kept private and not shared. More than 50% respondents tell to others to talk to them if they (others) feel uncomfortable due to sharing information on sensitive issues. But only less than 50% people (irrespective of education level) tell others that information posted online cannot be taken back.

Table 10: Social networking responsiveness.

Code	Question
Q7	Do you respond to harassing or threatening comments posted on your profile?
Q14	Do you respond if you have reasonable belief that someone is a scam artist or sexual predator on the social networking site?

Table 11: Social Networking Responsiveness based on Gender.

	Male		Female	
Q.N.	Yes(%)	No(%)	Yes(%)	No(%)
Q7	23.52	76.47	32.14	60.71
Q14	47.05	52.94	46.42	53.57

Table 12: Social Networking Responsiveness based on Educational Background.

	Graduates		Post Graduates and Ph.D.	
Q.N.	Yes(%)	No(%)	Yes(%)	No(%)
Q7	37.5	62.5	28.57	71.42
Q14	29.16	70.83	66.6	33.33

4.4 Responsiveness

Responsiveness describes the action of the social networking sites users towards any incidents or suspicious profile account on the sites. Question Q7 refers to the respond of the users, positive or negative in any approach (comment, message) to the person who are writing harassing or threatening comments on their profile (Table 10). Question Q14 refers to the respond by users through reporting to the authority

(police, MMC) on suspicious account that may be administered by scam artist or sexual predators.

Table 11 describes the responds by the respondent on the given survey questions based on gender. Based on the result, majority of the respondents from both gender are not responsive towards harassment and threats that are happening in the social networking sites with the men are the least responsive. Female users recorded higher responsive percentage towards such incident on the sites with 32.14% while men respondents only obtained 23.52%. In terms of reporting on suspiciously scam profile on the social networking sites, majority of the users responded negatively with 47.05 % responded by male users while 46.42% female users will report for the scam profile incident.

Table 12 describes the responsiveness percentage in terms of incidents on social networking sites based on educational background. More than 60% respondents irrespective of their education background are negative in terms of responsiveness towards harassment and threat over social networking sites with only 37.5% (graduates and below) and 28.57%(post graduates and above) respondents answered "Yes" for question Q7. But more people (66.6%) with higher education background report if they believe that someone is a scam artist or sexual predator on social networking site.

V. CONCLUSION

The primary motivation of this paper was to measure the security awareness on social networking sites usage. The awareness is divided into three categories; basic, technical, advocacy. The results of the present study can be categorized based on gender and education level. In terms of gender-based user category, women respondent are more aware of social networking usage than the men users. These results are congruent with the work by [4] that has also found that women are more aware than their men counterpart in terms of using the social networking sites.

Most of the respondents regardless of their education background are reluctant to meet new friend that they engaged in their networking sites. However, the respondents with higher academic qualification are aware of pretenders and are vigilant. They also educate their children on proper use of social networking sites. As a conclusion, this study gives an outlook upon the need for social networking users in India high awareness when dealing with the usage of the sites in order to combat the increase of cyber security incidents.

Limitations of this study were that the respondents belonged to the urban India and of the limited demographic area. Also, it is seen that social networking usage is increasing in the children as young as 7 years. These children were not included as respondents. Future work may include large number of respondents including wider range of age groups, demographic location and academic qualifications

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Survey of Adaptive and Dynamic Management of Cloud Datacenters

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ABSTRACT
As cloud computing has emerged as an enabling technology that allows the Information Technology world to use the computer resources more efficiently and effectively such that the users have unlimited computing power at their disposals whenever required, so the cloud services has made it the best Information Technology solution. Additionally, it has increased the computational and storage capacity without investing in new infrastructure, training new personnel's or licensing new software. The concepts of virtualization, energy efficiency and resource provisioning have been recognized as the key techniques to enhance the scheduling services provided by the cloud. In this paper, we presented a summary of various research activities carried out for the effective management of cloud resources.
Keywords – Data Centers, virtualization, resource provisioning, energy efficiency, Infrastructure as a Service.

I. INTRODUCTION

Cloud computing is a service oriented paradigm that offers "everything as a service" over internet i.e. platform, infrastructure (server space) and services can be shared [1]. Cloud Computing is a term used to illustrate both a platform and type of application. As a platform it provides, configures and reconfigures servers, where the servers can be physical machines or virtual machines. On the other hand, Cloud Computing [2] describes applications that are extended to be accessible through the internet and for this purpose large data centers and powerful servers are used to host the web applications and web services.

It utilizes the techniques of virtualization and load balancing for increasing the cloud performance and complete utilization of resources. Other than these, it also makes use of technologies like distributed computing, networking, web services etc. Cloud computing is called 'cloud' since a cloud server can have any configuration and can be located anywhere in the world. Cloud services allow individuals and businesses to use software and hardware resources that are managed by third parties at the remote locations e.g. online file storage, social networking sites, operating webmail and online business applications [3].

Clouds are basically virtualized data centers and applications offered as service on a subscription basis. Web based companies (Amazon, eBay), hardware vendors (HP, IBM), telecom providers (AT&T, Verizon), and software firms (Oracle/Sun) are investing huge amount of capital in establishing huge data centers. Cloud computing emphasizes on pay per use economic model means customers pay for services on pay-per-use (or pay as you go) basis as per their requirement [4].

In a cloud computing environment, users can access the operational capability faster within internet application. The internet platform of cloud computing provides many applications for users like video, music etc.

Although cloud computing has been widely used, the research on resource management in cloud environment is still an early stage. The main objective of the research work is to investigate the relevant efficient and enhanced resource utilization approaches for cloud based system. Another focus of the work is to study the existing energy management techniques.

An overview of cloud environment is presented in this section. The rest sections of the paper are organized as follows: in section 2, three methods for improving the efficiency of cloud data centers are presented. Section 3 discusses the related work. Section 4 concludes with a summary of the research work.

II. SERVICES OF CLOUD COMPUTING

Cloud computing service models are Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) [5]

- ***Software as a Service (SaaS)***

In this model, the service user only needs to access the service itself as a web application, and not the platform or the infrastructure the service is running on. Applications such as social media sites, office software's, and online games enrich the family of SaaS-based services.

- ***Platform as a Service (PaaS)***

Platform as a service (PaaS) is an entire infrastructure packaged that can be used to design and implement the applications and deploy them in a public or private cloud environment. Typical examples of PaaS are Google App Engine, Windows Azure, Engine Yard and Force.com.

- ***Infrastructure as a Service (IaaS)***

The Infrastructure as a Service is a provision model in which an organization outsources the equipment used to support operations, such as-storage, hardware resources, servers and networking components. The service provider himself owns the equipment and is responsible for housing and maintaining it. The client pays on a per-use basis. Infrastructure services are built on top of a standardized, secure, and scalable infrastructure. Some level of redundancy is required to be built into the infrastructure to ensure the high availability and elasticity of resources and it must be virtualized. Virtualized environments make use of server virtualization, typically from VMware [6], XEN as the basis of running services.

III. CHALLENGES OF CLOUD COMPUTING

The following are the challenges faced by cloud computing environment[7]:

- ***Security and Privacy***

It deals with securing the stored data and to monitor the use of the cloud by the service providers. This challenge can be addressed by storing the data into the organization itself and allowing it to be used in the cloud.

- ***Service Delivery and Billing***

The service level agreements (SLAs) of the provider are not adequate to guarantee the availability and scalability as it is difficult to assess the cost involved due to dynamic nature of services.

- ***Interoperability and Portability***

As the cloud environment is highly dynamic to user requests and due to the concept of virtualization, the leverage of migrating in and out of the resources and applications should be allowed.

- ***Reliability and Availability***

Cloud providers still lack in round-the-clock service which results in frequent outages. Therefore, it becomes important to monitor the service being provided using internal or third party tools.

- ***Automated service provisioning***

A key feature of cloud computing is elasticity; resources can be allocated or released automatically. So a strategy is required to use or release the resources of the cloud, by keeping the same performance as traditional systems and using optimal resources.

- ***Performance and Bandwidth Cost***

Businesses can save money on hardware but they have to spend more for the bandwidth. This can be low cost for smaller applications but can be significantly high for the data-intensive applications.

- ***Energy Cost***

Cloud infrastructure consumes enormous amounts of electrical energy resulting in high operating costs and carbon dioxide emissions [8].

- ***Virtual Machines Migration***

With virtualization technology, an entire machine can be taken as a file or set of files. To unload a heavily loaded physical machine, it is required to move a virtual machine between physical machines. The main objective is to distribute the load in a datacenter or set of datacenters. Then a strategy is required to dynamically distribute load when moving virtual machine to avoid bottlenecks in Cloud computing system.

IV. CLOUD DATACENTER RESOURCE MANAGEMENT

In order to improve the efficiency of cloud resources, most service providers are going to consolidate existing systems through virtualization [9]. Virtualization technology increases the energy efficiency by creating multiple virtual machine instances on a physical server thus improving the utilization of resources and increasing Return on Investment (ROI).The Virtual machines in a cloud infrastructure can be live migrated to another host in case user application needs more resources. The service providers of cloud monitor and predict the demand and thus allocate resources according to the demand. Those applications that require less number of resources can be consolidated on the same server. Datacenter always maintains the active servers according to the current demand which results in low

energy consumption than the conservative approach of over-provisioning [10].

Resource provisioning [11] plays an important role in ensuring that the service provider adequately accomplishes their obligations to customers in terms of Service Level Agreements (SLAs) while maximizing the utilization of underlying resources, and it requires two steps. In the first step, static planning is done in which the initial grouping of Virtual Machines (VM) takes place, then the classification of VMs is done and finally these are deployed onto a set of physical hosts. Second is dynamic resource provisioning in which allocation of additional resources, creation and migration of VMs takes place dynamically according to the varying workloads.

Energy efficiency is one of the main challenges that datacenters are facing nowadays. The rising energy cost is a highly potential threat as it increases the Total Cost of Ownership (TCO) and reduces the Return on Investment (ROI) of Cloud infrastructures. In cloud environment, the resource management should be energy-efficient as it reduces the cost of energy consumption of data center and the carbon dioxide footprint of a data center and increases the power efficiency at the architecture level [12]. Energy consumption at a data center is equal to total amount of energy consumed over a period of time. Energy management techniques employed at data centers can be static or dynamic. The static data management techniques are not suitable for responding to requests when workload changes abruptly. Dynamic energy management techniques configure the data centre at both hardware and software levels dynamically depending upon changing workload conditions [13].

V. RELATED WORK

A new scheduling policy has been proposed in [14] which aim at managing data centers to optimize the provider's profit. Modeling virtualized data centers offers a lot of advantages such as resource management, reduced power consumption, heterogeneity management, and efficient utilization of under used nodes. The work also takes into account the outsourcing capabilities which make it possible to outsource the resources to third party IaaS (Infrastructure as a Service) service providers. A model is developed for describing a virtualized data centers and all decisions are taken from an economic point of view.

In [15], authors demonstrated that utilizing low power idle nodes is an immediate remedy to reduce data center power consumption. To quantify the difference in energy consumption caused exclusively by virtual machine schedulers, simulation are carried out. Besides demonstrating the inefficiency of wide-spread default schedulers, an optimized scheduler (Optsched) is developed and its performance is analyzed in terms of cumulative machine uptime.

A multivariate probabilistic model for improving resource utilization for cloud providers is presented [16]. The proposed algorithm selects suitable Physical Machines (PM) for VM re-allocation which is then used to generate a reconfiguration plan. Two heuristics metrics are also described which can be used in the algorithm to capture the multi-dimensional characteristics of VMs and PMs.

The major pitfalls in cloud computing is related to optimizing the resources being allocated. Due of the uniqueness of the model, the task of resource allocation is performed with the objective of minimizing the total cost. Its other challenges are meeting customer demands and application requirements. In [17], authors discussed various resource allocation strategies and their challenges in detail.

Most data center workload demands are very spiky in nature and often vary significantly in a day. As the resource availability in a data center is generally unpredictable due to the shared feature of the cloud resources and because of the stochastic nature of the workload, severe service level agreement (SLA) violations may occur frequently. To overcome this problem, anautonomic resource controller is proposed that dynamically controls the resource allocation for data center's virtual containers [18]. The controller has two parts: A resource modeler that models the non-linearity of the system by employing different Machine Learning techniques allowing the datacenter to allocate the appropriate resources and a resource fuzzy tuner that dynamically tunes the allocated resources using fuzzy logic to sustain the desired performance taking into consideration the enforcing of service differentiation among clients.

In [19], author provides an introduction to the technique of resource provisioning and power or thermal management problems in datacenters, and a review of strategies that maximize the datacenter energy efficiency subject to peak or total power consumption and thermal constraints, along with meeting service level agreements in terms of task throughput and/or response time.

A brief introduction of state-of-the art techniques and research related to power saving in the IaaS of a cloud computing system, which consumes a large part of total energy in a cloud computing environment is presented [20]. At the end, some feasible solutions for building green cloud

computing are proposed. The aim is to provide a better understanding of the design challenges of energy management in the IaaS of a cloud computing system.

Many market-based resource management strategies are been brought out to implement resource scheduling in cloud computing environment. A large number of consumers rely on cloud providers to supply computing service, so economic effectiveness is a crucial decisive factor for scheduling policy. An economic scheduling model with business parameters and a dynamic scheduling algorithm is presented [21], which makes a trade-off between economic effectiveness and performance. Based on the model and algorithm, market-oriented workflow management architecture for cloud is presented, in which QoS based resource allocation mechanism is introduced to meet different consumer's demands and improve scheduling efficiency.

The research work presented in [22] focuses on optimization of cloud system by lowering operation costs by maximizing energy efficiency while satisfying user deadlines that were defined in service level agreements. It has been discussed that the total energy consumption can be minimized by shutting down the servers which are not presently being used and balancing the resource utilization for all the active servers.

A Hierarchical Scheduling Algorithm (HAS) which aims at minimizing energy consumption of servers and a network device is proposed [23]. A DMNS (Dynamic Maximum Node Sorting) method is developed for optimizing the placement of applications on servers that are connected to a common switch. Then, in order to reduce the number of running servers, hierarchical crossing switch adjustment is done. This results in reduced data transfer and reduced number of servers that are required for processing.

The research work of [24] presents a novel management algorithm to perform the task of VM migration. It has been presented that for moving live sessions between servers; dynamic management of virtualized machines is done as it exploits the computing resources without considering the allocation of resources on local or remote servers. Innovative algorithms are presented for deciding when a physical host should migrate part of its loads, which part of load should be moved and where it should be moved. The focus in this work has also been on deciding when a dynamic redistribution of load is necessary.

The research work presented in [25] explores the approaches for modeling, simulation or prototype implementation to help researchers to develop and evaluate their technical solutions. A comparison of various cloud simulation software's is presented. The research work also presents a survey of various cloud testbeds (Amazon EC2, Amazon S3, Google App Engine, Google Apps and Windows Azure) and the services that they offer.

The research work investigated the process of allocating virtual machines to the requesting jobs in a way that maximizes the resource utilization [26]. An improved genetic algorithm is used for automated scheduling policy.

A Pre-emptive online task scheduling algorithm [27] is presented which aims to provide a solution for online scheduling problems being faced by real-time tasks in an IaaS model. The ultimate goal is to maximize the total resource utility and efficiency. The generated results presented in the work shows an improvement over the existing Earliest Deadline First scheduling algorithm.

In virtual desktop cloud computing, client applications are executed in virtual desktops on remote servers. Its advantage can be measured in terms of usability and resource utilization; however, handling a large amount of users in the most efficient manner poses important challenges. In [28], authors introduced an optimization to increase the average utilization on a single host. It has been shown that the proposed overbooking approach together with an advanced scheduler can increase the average utilization of the resources. A cost-based allocation algorithm has been presented that aims to maximize the quality of the service both for the customers and the service provider. To further optimize the quality of the service, a reallocation algorithm has been proposed to rebalance the virtual desktops among the available hosts after a busy period. The last optimization presented in this paper concern on optimization of the energy consumption by dynamically adapting the amount of powered-on hosts to the actual system load.

VI. CONCLUSION

This paper discusses the mechanisms through which the efficiency of cloud data centers can be enhanced. The techniques of virtualization, energy consumption and resource management are discussed in detail. Several algorithms have been discussed in order to improve the total energy consumption in a data center. Additionally, many other authors proposed several algorithms to implement the techniques of virtualization in an efficient manner in order to increase the number of tasks executed by a cloud environment while increasing resource consumption i.e. overall goal is to allocate resources while minimizing energy consumption in a dynamic cloud environment.

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Optimization of Drilling Program Using Intelligent Oil Fields: A Preliminary Study

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ABSTRACT
The upstream oil and gas sector is a very competitive sector and to succeed in this marketplace, companies must leverage a diverse set of capabilities involving people, process and technology. In addition, competition for natural resources has driven companies to explore for and produce oil and gas in remote and hostile locations. And as the environment grows more diverse, the locations more unforgiving, and the business challenges more complex, skilled technical personnel are becoming scarce. The convergence of forces, threats and technologies creates a ripe environment for the intelligent oilfield—a solution that integrates people, process and technology to improve oilfield performance and optimize drilling programs by leveraging frequently captured data that is delivered, converted to usable knowledge and acted upon in real time. Successfully implementing the intelligent oilfield to take full advantage of all available data requires a sophisticated program of projects designed to integrate key human and technology resources.
This paper discusses the preliminary and basic study of intelligence technologies for oil and gas industries for data assimilation. Making the transformation to an Intelligent Oil Field is dependent on data management and integration. Without it, key insights are lost and analysis is not producing the best interpretations. A modern drilling rig or offshore platform uses a diverse array of specialist contractors, each of whom need to communicate data to the oil company operating the rig, and to each other. Historically this was done with serial transfer of ASCII data, but as the volume of information grows, a new technology is needed.This was provided by WITSML, an example of a standardisation effort for real-time drilling data which facilitates integration of disparate computer systems.
Keywords–Intelligent Oilfield, Data Integration, WITSML.

I. INTRODUCTION

The intelligent oilfield consists of a collaborative environment for communication; data collection, reporting and monitoring; knowledge and information sharing. This environment helps people make informed decisions and take appropriate actions across the enterprise. In addition, it enables alignment, focus and common understanding to help prioritize operations [1].

According to a Cambridge Energy Research Associates (CERA) study, the benefits of the intelligent oilfield can include lower operational costs, earlier and increased production, lower capital investment, increased recovery of oil and gas, and lower abandonment costs. What's more, a significant increase in asset value can be achieved if oil and gas reservoirs are managed on demand and in real time. The CERA study also notes that field operator productivity can increase between 100 and 400 percent, operating costs can decline by 10 to 20 percent and average production rates can increase by 1 to 3 percent. Depending on the oil and gas field size, savings can be generated in the hundreds of millions of dollars. This could result in value creation in the billions of dollars each year. Innovations in various technologies are helping people make the intelligent oilfield a reality. For example, massive amounts of sensor data are being delivered to skilled people who then remotely search the data, convert it to usable knowledge and use it via advanced visualization technology—avoiding cumbersome data stores and transmission by allowing raw data to remain at the source. This helps analysts automatically detect complex data patterns/problems— such as sand production in wells— so the right person can be alerted to initiate a response before a problem occurs. Similarly, for drilling programs, a standardization effort for real-time drilling data was created using WITSML (Wellsite Information Transfer Standard Markup Language) [2].

II. INTERGRATED OPERATIONS (IO)

Integrated operations (IO) refers to new work processes and ways of performing oil and gas exploration and production, which has been facilitated by new information and communication technology. The most striking part of IO has been the use of always-on videoconference rooms between offshore platforms and land-based offices. This includes broadband connections for sharing of data and video-surveillance of the platform. This has made it possible to move some personnel onshore and use the existing human resources more efficiently. Instead of having e.g. an expert in geology on duty at every platform, the expert may be stationed on land and be available for consultation for several offshore platforms. It's also possible for a team at an office in a different time zone to be consulting the night-shift of the platform, so that no land-based workers need work at night [3].

Tools like videoconferencing and 3D-visualization also creates an opportunity for new, more cross-discipline cooperation. For instance, a shared 3D-visualization may be tailored to each member of the group, so that the geologist gets a visualization of the geological structures while the drilling engineer focuses on visualizing the well. Here, real-time measurements from the well are important but the down hole bandwidth has previously been very restricted. Improvements in bandwidth, better measurement devices, better aggregation and visualization of this information and improved models that simulate the rock formations and wellbore currently all feed on each other. An important task where all these improvements play together is real-time production optimization.

In the process industry in general, the term is used to describe the increased cooperation, independent of location, between operators, maintenance personnel, electricians, production management as well as business management and suppliers to provide a more streamlined plant operation [4].

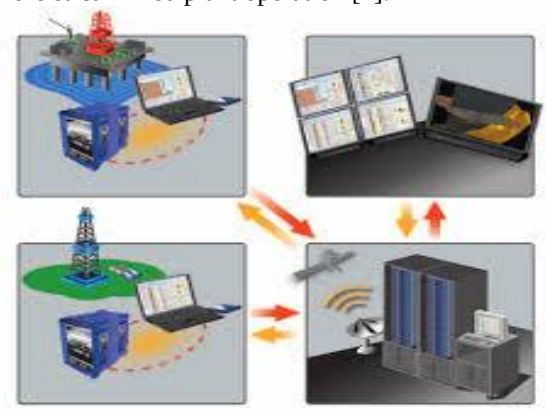

Fig 1: Oil and gas drilling optimization technology

By deploying IO, the petroleum industry draws on lessons from the process industry. This can be seen in a larger focus on the whole production chain and management ideas imported from the production and process industry. A prominent idea in this regard is real-time optimization of the whole value chain, from long term management of the oil reservoir, through capacity allocations in pipe networks and calculations of the net present value of the produced oil as shown in Figure1 [5].

A focus on the whole production chain is also seen in debates about how to organize people in an IO organisation, with frequent calls for breaking down the Information silos in the oil companies. A large oil company is typically organized in functional silos corresponding to disciplines such as drilling, production and reservoir management.

This is regarded as inefficient by the IO movement, pointing out that the activities in any well or field by any of the silos will involve or affect all of the others. While some companies focus on their inhouse management structure, others also emphasize the integration and coordination of outside suppliers and collaborators in offshore-operations. For instance, it is pointed out that the oil and gas industry is lagging behind other industries in terms of Operational intelligence.

Ideas and theories that IO management and work processes build on will be familiar from operations research, knowledge management and continual improvement as well as information systems and business transformation. This is perhaps most evident in the repeated referral to "people, process and technology" in IO discussions.

III. INTEGRATING PEOPLE, PROCESS AND TECHNOLOGY

Intelligent oilfield solution has five key performance- oriented implementation components (see chart below).

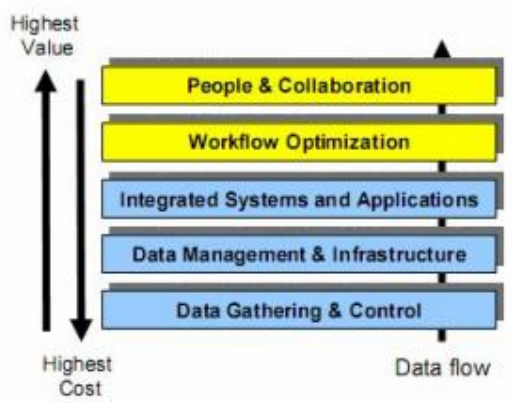

Fig 2: Components of Intelligent Oilfield

These interdependent components can be essential to achieving significant return on investment from an intelligent oilfield. Implementing them facilitates real-time global asset awareness—or access to data from all of the appropriate assets—by enabling proactive asset management using frequently captured data that can be distributed, converted into relevant knowledge, evaluated and acted upon in real time as shown in Figure 2.

IV. INTEGRAL COMPONENTS OF INTELLIGENT OILFIELDS

The most important factor in any intelligent oilfield program is the degree to which people can leverage the latest tools and technologies for improving analysis, alarm capabilities and process management to help them make better-informed, more proactive decisions. New skills and ways of working (including collaboration, knowledge sharing and assistance to those who work in remote locations), change management and new organizational models are at the heart of realizing the intelligent oilfield.

In an intelligent oilfield environment, people must collaborate in innovative ways to enhance their productivity and improve the performance of the organization's oilfield assets. And effective collaboration demands clear and straightforward communication within a simple organizational structure. This mutual effort—among all those responsible for monitoring and maintaining the oilfield assets— gives people more dedicated time for innovation, creativity and continuous improvement. Collaboration can occur at a single location, or it can occur virtually, across many locations. And it can include access to knowledge and expertise outside of a physical asset or business unit.

V. DATA INTEGRATION FOR THE INTELLIGENT OIL FIELD

Exponential data growth is making it essential for the integration of visualization, compute and data resources. Even though much of the infrastructure for oil field operations was built to handle unique requirements, the consolidation of activities necessitates that IT architects rethink it given the processes required today. For example, as scientific disciplines work more closely together, they have needs to access and work with cross-functional data that may have been considered non-essential in the past. Additionally, processing and interpretation are no longer conducted most efficiently as separate operations, but are performed in a continuous loop. The number of processing jobs has also multiplied, making speed to interpretation a high priority.

5.1 Finding the path to an Intelligent Oil Field

Making the transformation to an Intelligent Oil Field is dependent on data management and integration. Without it, key insights are lost and analysis is not producing the best interpretation to improve operational decisions. This is likely the most difficult transition to make due to the silos that are firmly entrenched and the limited access to cross-functional data, but arguably one of the most important.

There are three places to look for making progress:

- Estimate the processes that will benefit from real-time data. Create pilot projects to prove value. Then look for ancillary processes that can be most easily integrated to add incremental values.
- Create standardized data models based on rationalization or consistent interpretations of the data.
- Establish data governance models that guide the use of the data, its storage and management.

Selecting where to start should be based on the drivers that contribute to your company's overall business strategy. Data integration that presents new ways of analyzing information will also require adjustments to business processes and workflows. It may also expose limitations in obtaining the data you need from legacy systems that will need to be addressed. Taking the time to assess these possibilities will help you to formulate a plan that can facilitate much greater results than if these considerations are not made at the start.

VI. WITSML (WELLSITE INFORMATION TRANSFER MARKUP LANGUAGE)

A modern drilling rig or offshore platform uses a diverse array of specialist contractors, each of whom need to communicate data to the oil company operating the rig, and to each other. Historically this was done with serial transfer of ASCII data, but as the volume of information grows, a new technology is needed. This was provided by WITSML. Wellsite information transfer standard markup language (WITSML) is a standard for transmitting technical data between organizations in the petroleum industry. It continues to be developed by an Energistics facilitated Special Interest Group to develop XML standards for drilling, completions, and interventions data exchange.

6.1 Purpose

The drilling, completions, and interventions functions of the upstream oil and natural gas industry needs universally available standards to facilitate the free flow of technical data across networks between oil companies, service companies, drilling contractors, application vendors and regulatory agencies.

The WITSML (Wellsite Information Transfer Standard Markup Language) initiative was started to address this need, and through its success, is now influencing petroleum industry data standards beyond the original scope.

WITSML(tm) Standards support the "right time" seamless flow of drilling and completions data between data producers and data consumers to speed and enhance decision-making in the drilling and completions domain.

The WITSML Special Interest Group (SIG) is open to all industry organizations who wish to contribute to the further development of the WITSML Standards. Energistics has custody of the standards and hosts the SIG. Energistics makes these and other industry standards available for use by all industry companies through a licensing agreement that is free of any fees or charges.

6.2 Standards Used

WITSML Standards are defined using the W3C Internet standards for XML (notably XML Schema) and Web Services (including SOAP and WSDL)). The WITSML Standards define Web Services that define client/server interactions, known as the WITSML Application Programming Interface specifications. The WITSML Standards define more than 20 industry domain specific XML data object schemas to support drilling, completions, and intervention business functions.

6.3 Versions of Intelligent tools

WITSML Version 1.3.1 was released in March 2006. This was superseded by Version 1.3.1.1(bugfix), release in March 2007. WITSML Version 1.4.1 was released in September 2011. It is the current stable version.

VII. INNOVATIVE TECHNOLOGIES

Innovative technology solutions that can help upstream oil and gas companies anticipate problems such as equipment and production impairment or failure before they happen, which can help reduce the costs associated with downtime and repairs. One such technology is a federated early-warning system designed to provide near-real-time data cleansing, calibration and normalization; pattern detection; ontology management, and by implementing other technologies such as middleware, a data warehouse or SOA capabilities. These innovative technologies provide plug- and-play processes and information capabilities in a framework designed to enable an organization and its people to collaborate on a deeper, more efficient, global level.

VIII. CRITIQUE

The security aspect of reducing the offshore workforce has been raised. Will on-site experience be lost and can familiarity with the platform and its processes be attained from an onshore office? The new working environment in any case demands changes to HSE routines. Some of the challenges also include clear role and responsibility definitions and clarifications between the onshore & offshore personnel. Who in a given situation has the authority to take decisions, the onsite or the offshore staff. The increased integration of the offshore facilities with the onshore office environment and outside collaborators also expose work-critical ICT-infrastructure to the internet and the hazards of everyday ICT. As for the efficiency aspect, some criticize the onshore-offshore collaboration for creating a more bureaucratic working environment.

IX. CONCLUSION & FUTURE WORK

Intelligent Oilfields, Digital oilfield of the future, iFields, eFields, Smart fields-These are all names for the industry efforts to use instrumentation and software to optimize operations in all domains for oil and gas exploration and production (E&P).

To achieve this goal, all of these technologies must work together and softwares like WITSML make integration of these technologies possible, enabling near-real-time production optimization and moving closer to realizing the benefits of the digital oilfield at a low-cost, low-risk, and highly innovative environment for the configuration and running of advanced optimization processes. A preliminary studies have been carried out in this paper to understand the knowledge of oil and gas parameters estimation using intelligent techniques and tools.

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RESEARCH ARTICLE OPEN ACCESS

Quality Model For Analysis And Implentation Of CK Metrics Through Neural Networks

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ABSTRACT
Component engineering addresses the issues of component's specification, development, qualification, documentation, cataloguing, and adaptation and selection for reuse. In general, software systems implement functional and non-functional requirements. This implies that component specification methods and qualification techniques should support both functional and non-functional requirements. The paper proposed a model for analyzing CK metric values of component-based software by systematically analyzing a series of metrics using CK metrics analysis and several key inferences are drawn from them. Software component design patterns are used for analyzing various metrics and drawing a number of useful conclusions by evaluating them, which will include inferences on reusability of the underlying components. By using a Self Organizing Map (SOM), empirical evaluation of CK metric component models is done that figure out various matrices which affects the performance of Component based Software Engineering Model and made a try to propose a model that by selecting what metrics of component model gives optimized metric values.
Keywords: Component Based Software Engineering (CBSE); Component Based Development (CBD), Neural Network(NN).

I. INTRODUCTION

Software reuse has long been one of the major issues in the world of software engineering. The reason is obvious. Software reuse can dramatically increase the productivity of the software community, ease maintenance, and improve product reliability. Although most people would agree upon the importance of reuse, it is only today that it has become a main goal in software engineering. As a result, many software reuse technologies have been developed over the past few years. A popular reuse technique in the object-oriented programming community is design patterns. Design patterns represent a recurring solution to a software development problem within a particular context. They have frequently been used to guide the creation of abstractions in the software design phase, necessary to accommodate future changes and yet maintain architectural integrity. These abstractions help us de-couple the major components of the system so that each component may vary independently.

Component-Based Software Engineering (CBSE) is a systematic and structured approach that allows software engineers to maximize reusability.

Fig 1: Concept and Benefits of CBSD

CBSE is also known as Component-based Software Development (CBSD) concept and benefits of CBSD are shown in Fig 1.

In principle, CBSD should provide a software organization with advantages in higher productivity, reduced time to market; reduce the cost of development and higher quality system. The ensuring of quality of a component based system is an important task because unlike tradition software systems, the quality of a component based system depends both on the quality of its components and the framework being used. The development process and the maturity of an organization also influence the quality of component based products. Hence, it is easy to perceive that the quality of its components, directly

or indirectly, influence the quality of the final software. CBSE is an extension of object-oriented concepts such as encapsulation (information hiding), abstraction (what an element is and how it should be implemented), polymorphism (same operation behave differently on different elements), Inheritance (sharing of operation and attributes among elements based on hierarchal relationships). CBSE provides many advantages like:

- Component-based software development can increase the productivity of software developers. Component-based software is constructed by assembling existing reusable components. This process is much faster than writing an application from scratch.
- Component-based software development offers higher quality, more reliable software. The main reason is that reusable components have been tested and therefore their quality can be assured.
- Component technology can ease software maintenance. Component-based software means that a large software application can be made of many small components. A task for maintaining a large software application can be partitioned to many smaller and easier tasks for maintaining components.
- Component technology makes it easier to manage software development. Component partitioning enables parallel development, allowing several organizations to be involved in development of larger and more complex software.
- Because component technology implies some base set of standards for infrastructure service, a large application can depend on these standards thereby saving considerable time and effort.

The fundamental concepts on which CBSE is based are:

1.1 Component

The word "component" is used very broadly and often loosely throughout the software industries. Generically, a component is defined as a computational unit. Components can be things like clients and servers, databases, filters, and layers in a hierarchical system.

"A software component is a unit of composition with contractually specified interfaces and explicit context dependencies only. A software component can be deployed independently and is subject to composition by third party". Main points of this definition indicate that component can be deployed independently and each component interacts with other component(s) by using interfaces [7]. Other definition of component is:

"A component is a coherent package of software that can be independently developed and delivered as a unit, and that offers interfaces by which it can be connected, unchanged, with other components to compose a larger system". Component-based software development means building software by assembling or gluing components together. Fundamental characteristics of components are presented as:

- **Independent:** A component must be independent from its environment and is deployed without needs of other specific components.
- **Standardized:** In CBSE approach a component should follow deployment and composition rule.
- **Deployable:** For a component to be deployable, a component has to be self contained and must be able to perform as a stand-alone entity on some component platform that implements the component model. Usually a component is a binary component and cannot be compiled before its deployment.
- **Documented:** A component should be specified formally.
- **Composable:** A component communicates with others through its public interfaces. Also, it must provide external access to information about itself such as its methods and attributes.

1.2 Interface

"An interface of a component can be defined as a specification of its access point". An interface is a set of functional properties which includes set of actions understandable by both interface provider (component) and user (other components or other software that interact with provider). Clients access the services that are provided by a component through access points. A component may have more than one access point, which contains different services provided by that component. Therefore, a component may have more than one interface. Since components are black box, their implementation detail is not accessible from outside [9].

II. LITERATURE REVIEW

A continuous research is continuing on Component Based Software Engineering model. A brief review of the work done in the past is elaborated here:

In [2], authors presented a survey of component-based development and reuse driven development life cycles. The proposed model contains all the needed activities towards a complete component-based development lifecycle. A comparison between ICBD, normal component-based development, and non-component based development is provided.

In [4], authors discussed the key challenges to the development of standard, complete and

pervasive software quality models, solution to these challenges and their importance. They discussed key issues which need to be considered to develop a widely acceptable standard software quality model. Important issues which are posing obstacles to the development of standard quality models are discussed. They lay down the foundation for the development of a component quality model which is comprehensive and may be used to increase to reusability aspects of components.

In [5], authors proposed explores the five algorithms, Fletcher–Reeves Update Conjugate Gradient (FRUCG) algorithm, Polak–Ribiere Update Conjugate Gradient (PRUCG) algorithm, Powell-Beale Restarts Conjugate Gradient (PBRCG) algorithm, Scaled Conjugate Gradient (SCG) algorithm, Self- Organizing/network algorithms based Neural Network are experimented to develop the reusability evaluation model for function oriented software systems and the results are recorded in terms of Accuracy, Mean Absolute Error (MAE) and Root Mean Square Error (RMSE).

In [6], authors discussed a study of the reuse metrics of three systems i.e. object oriented systems, component based systems and service oriented systems is made and proposed a model to bring out the relationship between them. A template has been designed to study and record how the metrics are categorized and it forms the base for the evolution based model. An evolutionary based model is proposed which states the maturity level of reuse metrics and identifies the gaps to measure complete reusability for service oriented systems.

In [8], an author proposed a model and discusses the main constituents of ontology of quality federating all the aspects of Information System (IS) components quality (software, data, models, etc.). In order to operationalize the proposed ontology, an approach is described that allows using the ontology in order to achieve specific quality goals. QualOnto as a framework is used to link together the IS engineering process and the IS product, which could serve as a basis for statistical studies on the correlation between both process and product qualities.

In [9], authors presented a new methodology of Knowledge Management System (KMS) implementation in a CBSE-oriented organization. A case study of applying this methodology in an existing CBSE organization is also presented. The main objectives of methodology used are an early elimination of risks and misconceptions by ensuring short iterations, continuous integration and intensive customer collaboration. The proposed methodology requires less resources and budget than existing methodologies.

In [10], authors proposed an algorithm in which the inputs can be given to K-Means Clustering system in form of tuned values of the Object Oriented software component. A hybrid K-Means and Decision tree approach is used to predict the reusability value of object oriented software components based on the metric values. The developed reusability model produces high precision results.

In [12], authors made an analysis of the conceptual elements behind Component-Based Software Engineering (CBSE) and proposed a model that support its quality evaluation and integrates the product perspective, a view that includes components and Component-Based Software (CBS), as well as the process perspective, a view that represents the component and CBS development life cycle. Two findings are highlighted that are: 1) a close relationship exists between both identified perspectives: quality of a component directly influences CBS quality; 2) the component models are the backbone of these software systems.

In [13], authors described N-tier architecture as data access architecture in a component based application and is evaluated against the external and internal quality factors. This establishes that an enhanced component model (ECM) is a reliable model. This expresses how data access objects (DAO) in the DAO layer interacts with the business-tier and data source in achieving reliable, reusable, robust and scalable component model by implementing Data Adapter interface.

In [15], authors presented a CBSE approach that involves three contributions. The *first* contribution is a component model that defines the trust worthiness quality attributes as first class structural elements. *Second* contribution is a process model role. The *third* and final contribution is a development framework of comprehensive tool support.

In [17], authors made a survey and analysis of current component models. Based on the analysis, they are classified into a taxonomy based on commonly accepted parameters for Component Based Development. For each category in the taxonomy, its key characteristics are described and evaluated with respect to these parameters.

In [19], authors proposed a component quality model which describes consistent and well-defined characteristics, sub-characteristics, quality attributes and related metrics for the components evaluation. A preliminary evaluation to analyze the results of using the component quality model is also proposed.

III. PROPOSED WORK

Hereby, we are going to propose a model for measuring quality component e.g. reusability of a Component based Software Engineering model through analyzing a series of design patterns which are worldwide accepted as the reuse design terminology for object oriented designing and hence component based designing. Analyzing the entire design pattern values obtained [31].

The object-oriented metrics proposed [19] and later refined by the same authors can be summarized as follows:

a. Weighted Methods per Class (WMC): This is a weighted sum of all the methods defined in a class.

b. Coupling Between Object classes (CBO): It is a count of the number of other classes to which a given class is coupled and, hence, denotes the dependency of one class on other classes in the design.

c. Depth of the Inheritance Tree (DIT): It is the length of the longest path from a given class to the root class in the inheritance hierarchy.

d. Number of Children (NOC): This is a count of the number of immediate child classes that have inherited from a given class.

e. Response for a Class (RFC): This is the count of the methods that can be potentially invoked in response to a message received by an object of a particular class.

f. Lack of Cohesion of Methods (LCOM): A count of the number of method-pairs whose similarity is zero minus the count of method pairs whose similarity is not zero.

Here we will use unsupervised method because we don't know in advance output values for the corresponding design patterns [21] [27]. MatLab will be used for the implementation purpose. Firstly, analysis of Software Design Patterns through CK metrics analysis is made. Then, Implementation of the proposed model is done through Neural Network using MatLab.

3.1 Software Design Pattern Analysis

Design patterns represent a recurring solution to a software development problem within a particular context. They have frequently been used to guide the creation of abstractions in the software design phase, necessary to accommodate future changes and yet maintain architectural integrity. These abstractions help us de-couple the major components of the system so that each component may vary independently. Here we are going to discuss software design patterns in detail. Consider the example of Abstract Factory design pattern as shown in Fig 2.

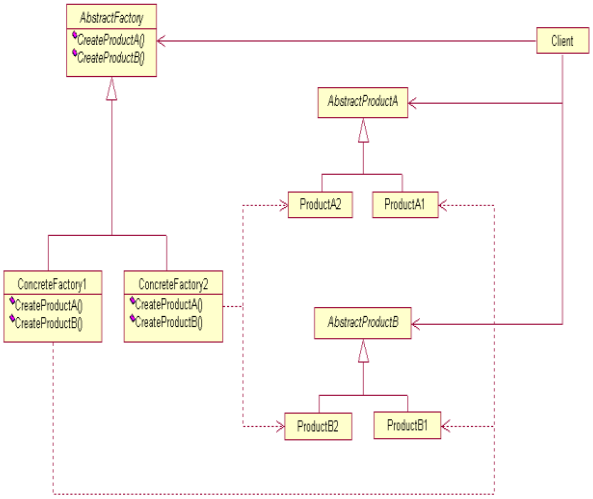

Fig 2: Abstract Factory Design

Class/Matrix	NOM	DIT	NOC	CBO	RFC
Abstract Factory	2	0	2	0	2
Concrete Factory 1	2	1	0	2	2
Concrete Factory 2	2	1	0	2	2
Abstract Product A	0	0	2	0	0
Product A2	0	1	0	0	0
Product A1	0	1	0	0	0
Abstract Product B	0	0	2	0	0
Product B2	0	1	0	0	0
Product B1	0	1	0	0	0

Table 1: CK Matrix Analysis for Abstract Factory Design

In the same way, CK matrix analysis for all the design patterns is done. Table 1 shows the ck matrix analysis for abstract factory design.

3.2 Neural Network Implementation

Hereby we have developed a Self Organizing Map Neural Network to train the network. Then summing up the computed weights w.r.t. every metrics and dividing the sum by total number of matrices which yields the optimized value among the matrices. Neural Network training and optimum value for the component based software engineering model is shown in Fig 3.

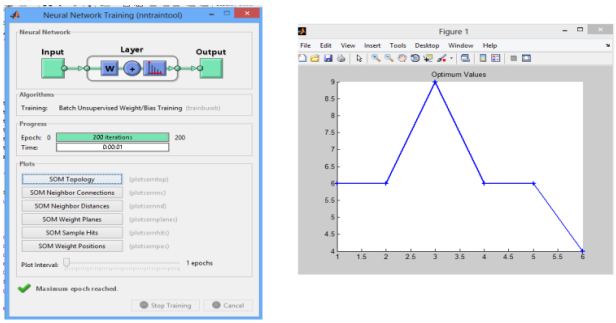

Fig 3: Neural Network Training and Value for the Proposed Model

IV. Result Analysis

The experiment results for training of neural network in the MatLab are shown in Table 2.

Table 2: Neural Network Analysis Values

Experiment	Values
No. of training data	5 x 21 = 105
No. of epoch taken to converge	200
Time taken to execute	2.94093 seconds
No. of outputs	5

The capability of neural network to generalize and insensitive to the missing data would be very beneficial. For training purpose all 21 design patterns and 6 matrices are taken. Number of epochs taken is 2000 to achieve high accuracy.

The results shown using MatLab through execution of Neural Network are:

Performance can be improved by using:

Weighted Method per Classs (WMC): 6
Depth of Inheritance Tree (DIT): 6
Response for Class (RFC): 9
Number of Children (NOC): 6
Coupling Between Objects (CBO): 4
Total time elapsed in entire execution: 2.94093 seconds.

As per the results shown above, the model proposes for the design pattern performance can be improved by using the above values.

V. Conclusion & Future Scope

The model proposed and illustrated here provides an explicit process for adding quality-carrying properties into software. CBSE is a knowledge-intensive activity where collaborators produce and consume knowledge during all the development phases. CBSE is adding a lot of value to rapid application development and is actively contributing to better quality software systems.

In the paper, we proposed a model for enhancing quality with respect to the Component Based Software Engineering (CBSE) methodology. This in total acts as input for the neural network. By using the example of design patterns and unsupervised neural network, we have proposed a model that provides enhancing quality criteria for Software Component Engineering model based on CK metric values. If output may be known from the past values, a supervised neural network may give better results.

Component modeling techniques, with which we have compared our work, do not provide all the tools necessary for rigorous analysis at different stages of system lifecycle. The reason is that these component models are designed and implemented for different specific domains. In order to properly enable the evaluation of software components, supplying the real necessities of the software component markets, a component quality model is strictly necessary. A more elaboration on finding the appropriate size of software with respect to the overhead for preparation of evaluation is required. A full advantage of component-based approach can be achieved when not only the functional parts are reused, but also when this approach leads to easier and more accurate predictability of the system behavior.

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RESEARCH ARTICLE OPEN ACCESS

The Diagnosis Of Some Tweens Childhood Diseases In A Prolog Expert System

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ABSTRACT
An expert system to diagnose the main childhood diseases among the tweens is proposed. The diagnosis is made taking into account the symptoms that can be seen or felt. The childhood diseases have many common symptoms and some of them are very much alike. This creates many difficulties for the doctor to reach at a right decision or diagnosis. The proposed system can remove these difficulties and it is having knowledge of many childhood diseases. The proposed expert system is implemented using SWI-Prolog.
Keywords: Diagnosis, Symptoms, Knowledge Base, Expert System

I. INTRODUCTION

An expert system is a set of programs that manipulate knowledge to solve problems in a specialized domain that requires human expertise.. The main components of expert system are knowledge base and inference engine. Knowledge base contains the domain knowledge needed to solve the problems in the form of rules. The rules are a popular paradigm for representing knowledge. Inference engine is the code at the core of the system which derives conclusions from knowledge base through inference or reasoning. The major features of expert system are user interface, data representation, inference, explanations, coping with uncertainty and advantages of expert system are fast response, increased reliability, reduced cost, reducing errors, multiple expertise, intelligent database, reduced danger. There are also some disadvantages of expert system. Disadvantages are absence of common sense, no response in exceptional cases, and no change with changing environment.

1.1 Medical Expert System

The main aim of any medical expert system is the diagnosis and treatment of diseases. A medical expert system is built up of programs and medical knowledge base. The information obtained from medical expert system is similar to the information given by doctor or expert in that particular area. Our medical expert system has main childhood diseases in its knowledge base. The user or patient is asked to answer with YES or NO, If a particular symptom appears or not. In the end, based on user's or patient's answers, the name of the disease is displayed on the screen. A limitation of this medical expert system is that only symptoms entered by the programmer in the knowledge base are available. It does not think and learn by itself. Therefore the knowledge base needs to be updated any time with new symptoms and new diseases.

1.2 Childhood Diseases

The main childhood diseases are asthma, type 1 diabetes, cystic fibrosis and duchenne muscular dystrophy. Asthma can first appear as a cold or respiratory infection. What is actually happening is an inflammation of the lungs and airways which lead to the symptoms like wheezing, breathlessness, chest tightness, nighttimes or early morning coughing. Type 1 diabetes occurs when a child's pancreas no longer produces insulin, the body must be helped to make and regulate insulin. The symptoms of type 1 diabetes are increased thirst and frequent urination, extreme hunger, weight loss, fatigue, irritability or unusual behaviour, blurred vision and yeast infection. Cystic fibrosis is a life-threatening illness affecting the lungs via thickening mucus. The pancreas is also affected causing problems with the body's digestive system. The symptoms of cystic fibrosis are salty tasting skin, persistent coughing with and without phlegm, frequent lung infections, wheezing or shortness of breath and poor growth or weight gain. Duchenne Muscular Dystrophy is the most common form of muscular dystrophy affecting children, exclusively boys. It causes muscle break down leading to weakness and, eventually, an inability to walk. The main symptoms of duchenne muscular dystrophy are delay in walking, frequent falls, large calf muscles, difficulty in getting up from a lying or sitting position, weakness in lower leg muscles and wadding gait.

II. PROPOSED SYSTEM

A Rule based expert system has the following components-

1) The Knowledge Base contains information about childhood diseases which are represented as a set of if-then production rules. The knowledge base is analogue to the long term human memory. The total ordering of production rules is done in the knowledge base.
   Consider the following example: Asthma is a childhood disease whose symptoms are wheezing, breathlessness, chest tightness, nighttimes or early morning coughing. So it will be stored in knowledge base in the form of a rule which is as follow:-
   Disease (Child, asthma):-
   Symptom (Child, wheezing),
   Symptom (Child, breathlessness),
   Symptom (Child, chest_tightness),
   Symptom(Child,
   night_or_early_times_coughing).

   Another examples are as given below:-
   Type 1 diabetes is a disease whose symptoms are increased thirst and frequent urination, extreme hunger, weight loss, fatigue, irritability or unusual behaviour, blurred vision and yeast infection. So it will be stored in knowledge base as follow:-
   Disease (Child, type_1_diabetes):-
   Symptom (Child, increased_thirst),
   Symptom (Child, extreme_hunger),
   Symptom (Child, weight_loss),
   Symptom (Child, fatigue),
   Symptom (Child, irritability),
   Symptom (Child, blurred_vision),
   Symptom (Child, yeast_infection).
   Cystic fibrosis is a disease whose symptoms are salty tasting skin, persistent coughing with and without phlegm, frequent lung infections, wheezing or shortness of breath and poor growth or weight gain. . So it will be stored in knowledge base as follow:-

   Disease (Child, cystic_fibrosis):-
   Symptom (Child, salty_tasting_skin),
   Symptom (Child, persistent_coughing),
   Symptom (Child, frequent_lung_infections),
   Symptom (Child, wheezing),
   Symptom (Child, weight_gain).

   Duchenne Muscular Dystrophy is a disease whose symptoms are delay in walking, frequent falls, large calf muscles, difficulting in getting up from a lying or sitting position, weakness in lower leg muscles and wadding gait.. So it will be stored in the knowledge base as follow:-

   Disease(Child,
   duchenne_muscular_dystrophy):-
   Symptom(Child, delay_in_walking),
   Symptom(Child, frequent_falls),
   Symptom(Child, large_calf_muscles),
   Symptom(Child, difficulties_in_getting_up),
   Symptom(Child,
   weakness_in_lower_leg_muscles).

2) The Fact Base contains facts which are used to match against the antecedent part of rules stored in the knowledge base. The fact base is analogue to the short term human memory.
3) The main task of Inference Engine is to carry out the reasoning by linking the rules with facts and deducing new facts.
4) The User Interface is used to communicate between user and expert system. It is the method by which the expert system interacts with the user.
5) The Explanation Module enables the user to ask the expert system how a particular conclusion is reached and why a specific fact is needed.
6) The Developer Interface is used to modify the knowledge

III. WORKING OF PROGRAM

In Figure 1, we present the simulation program. S1 D1 denotes the first symptom of first disease. In general Si Dj denotes the “i” symptom of “j” disease. If the program has a positive answer to the symptom, it goes on with the symptoms from that disease. If only one symptom from that disease is negative, it jumps to the first symptom from the next disease.

IV. RESULTS

This Prolog expert system is successfully implemented and results are taken. It is applied on many children and its results are 80% correct. For example Asthma is a disease whose symptoms are wheezing, breathlessness, chest tightness, night or early times coughing. In this Prolog expert system, First the user or child enters his or her name (suppose name is Jimmy) then the user or child is asked to answer with YES (y) or NO (n), If a particular symptom appears or not. (Here user or child will reply YES (y) to the symptoms wheezing, breathlessness, chest tightness, night or early times coughing.) In the end, based on user’s or child’s

answers, the name of the disease is displayed on the screen (Asthma).

V. CONCLUSION

The proposed medical expert system is dealing with child's health and an approximate diagnosis of a certain disease is established. However, the knowledge base needs to be constantly updated with new symptoms and diseases. Symptoms already available in knowledge base are not 100% correct because different doctors have different opinions and there are anomalies in medicines.

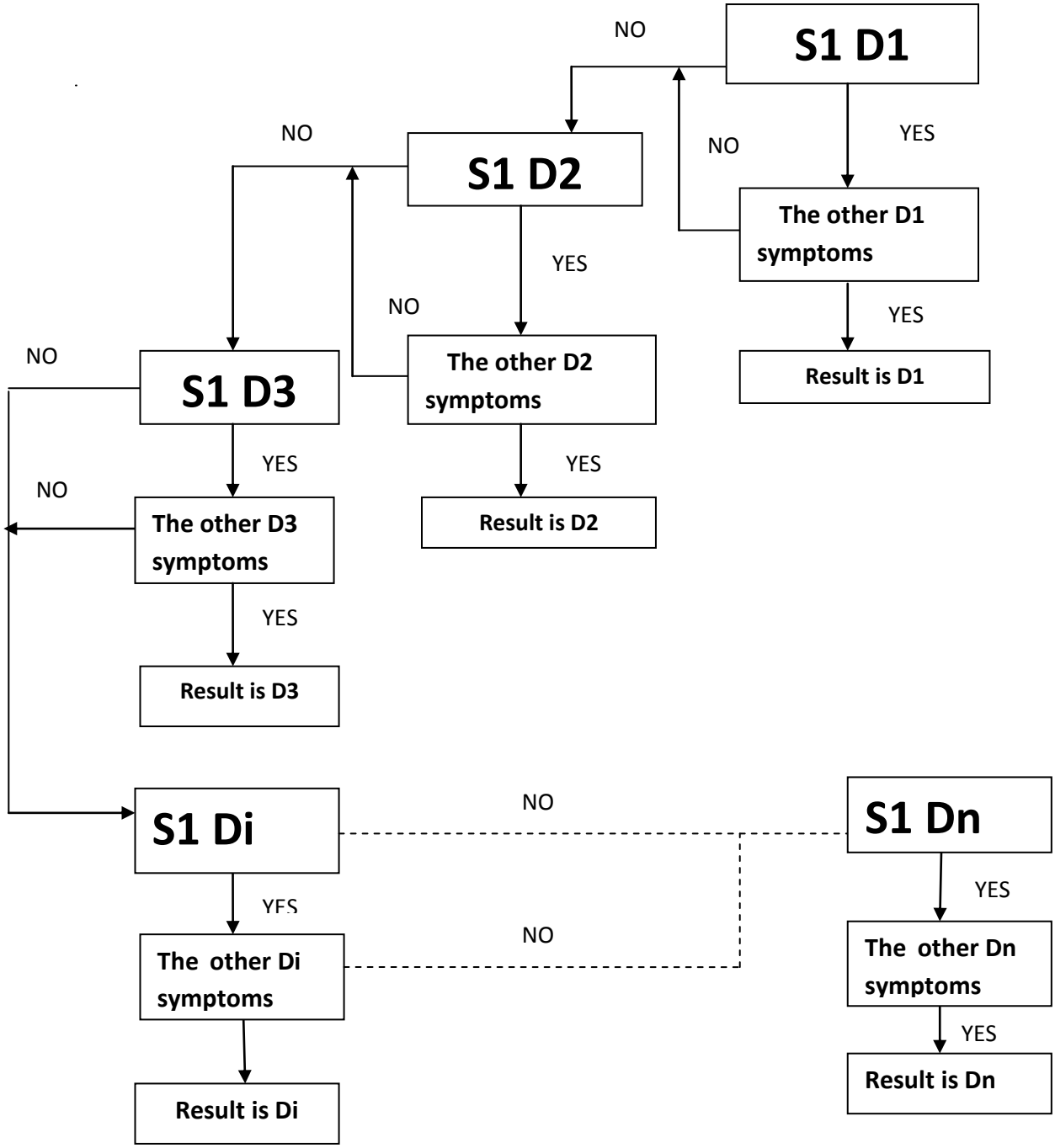

Fig 1: Working of Medical Expert System

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Fuzzy Logic Based Energy Efficient Data Aggregation For Wireless Sensor Network (Fleda)

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ABSTRACT
A sensor network is a network with large number of sensors. Each node in the network is defined with some energy parameters. With each communication over the network some amount of energy is consumed. The proposed work is related to improve the network life by using the concept of prioritization along with the mobile base station over circular path in a clustered network in such a way that maximum connectivity will be there. Prioritization will be done to each communicating node and is performed under parametric factors such as residual energy, distance and connectivity. The first prioritization will be based on residual energy. High energy is considered as one parameter in cluster head selection. In the same way, short distance and maximum connectivity will also be assigned higher priority. All the decision regarding prioritization will be taken by using the fuzzy logic approach. As the base station is defined with specific communication range, each time base station update its location the nodes in its sensing range will activate and perform direct communication with it. The activated area is called hot spot area. Simulation results obtained from this work are satisfactory as it has improved network life as well as reduce the energy consumption in the network.
Keywords –Clustering, Data Aggregation, Energy Efficiency, Fuzzy Logic, Mobile Base Station, WSNs.

I. INTRODUCTION

Wireless Sensor Networks (WSN) is self-organized wireless ad hoc networks comprising of a large number of resource constrained sensor nodes. One of the most important tasks of these sensor nodes is systematic aggregation of data (for reducing the number of data transmissions by eliminating redundant information) and then transmits gathered data to a base station (BS). Optimizing energy consumption for extending the lifetime in wireless sensor networks is of dominant importance. Bandwidth, memory, signal strength, time, battery power etc. have also been utilized to examine the performance of a sensor network. Wireless Sensor Networks have a wide range of applications such as environment monitoring, agricultural monitoring, habitat monitoring, fire detection, wildlife protection, military applications etc.

As this paper is based on clustered network architectures, all nodes firstly sends data to cluster head and then all cluster heads after aggregating the data sends it to base station. Here electing a node as cluster head is based on the prioritization and all the decision regarding prioritization will be taken by using the fuzzy logic approach.

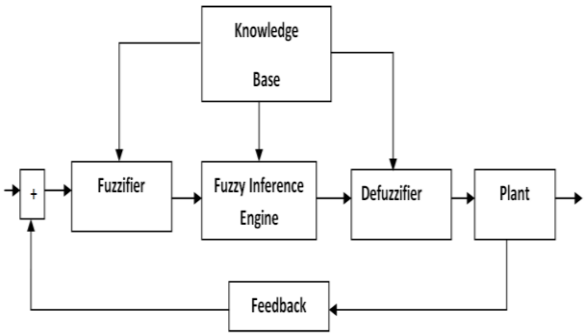

Fig 1: Fuzzy Logic

1.1 INTRODUCTION TO FUZZY LOGIC

Fuzzy Logic (FL) is a problem-solving control system methodology that lends itself to implementation in the system ranging from simple, small, embedded micro-controllers to large, networked, multi-channel PC or workstation-based data acquisition and control systems. It can be implemented in hardware, software, or a combination of both. Working of fuzzy logic is shown in Figure 1.

II. RELATED WORK

Research work in [1] proposed a power-efficient gathering for sensor information systems

(PEGASIS) to transmit the collected data from sensor nodes to the sink node. It is based on the assumption of a relatively static network topology in which each node knows the location of other nodes in the network. The node which was selected as a leader was within the transmission range to the sink node in one hope. A chain is constructed from the utmost nodes to the sink before the data is transmitted. When leader transmit the message to the sink then the message will pass from one node to the next node.

In [2], authors proposed an energy efficient hierarchical clustering scheme to enable nodes transmission within long distance. The sensors are organized into groups and communicate information only to cluster heads and then the cluster heads communicate the accumulated information to the processing center. The processing center determines the final estimates of the parameters in question using the information transmitted by the cluster heads. Since the sensors are now transmitting data over smaller distances in the accumulated environment, the energy spent in the network will be much lesser as compare to the energy.

Local Closest First (LCF) and Global Closest First (GCF) solution given in [3] describes the usage of mobile agent for data fusion in WSNs. In their computing model, data stay at the local site, while the fusion process (code) is moved to the data sites. By transmitting the computation engine instead of data, network bandwidth requirement is largely reduced and the performance of the fusion process is more stable. They presented a method to develop an optimal itinerary for mobile agent to fulfill the integration task while consuming minimum amount of resources, including time and power. For the algorithm Local Closest First (LCF), the MA starts its itinerary from a node and searches for the next destination with the shortest distance to its location. As far as the Global Closest First (GCF) algorithm is concerned, the MA starts its itinerary from a node and selects the next destination with the closest to the center of the surveillance zone.

Mechanism given in [4] is used to generate randomized multipath routes. Under this design, the paths taken by the shares of different packets changes over time. So even if the routing algorithm becomes known to the opponent, the opponent still cannot point out the routes cross over by each packet. Besides irregularities, the generated paths are also highly distributive and energy efficient, making them quite capable of mislead black holes. They tentatively check out the security and energy performance of the proposed schemes. They also formulate an optimization problem to decrease the end-to-end energy consumption under given security compulsions. Wide simulations are conducted to verify the validity of our mechanisms. They propose arbitrary multipath routing algorithm that can overcome the above problems. In their approach, multiple paths are computed in arbitrary way each time an information packet needs to be sent, such that the set of routes taken by various shares of different packets keep changing over time. As a result, a large number of routes can be conceivably generated for each source and destination. To interrupt different packets, the opponent has to accord or jam all possible paths from the source to the destination, which is practically not possible.

Author in [5] proposed the efficient mechanism of energy efficient techniques for data aggregation in WSN using principles like global weight calculation of nodes, data collection for cluster head and data aggregation techniques using data cube aggregation. It is a multidimensional approach for data aggregation. The values are stored in separate cell of a data cube, each phase of cube is divided into separate rows & columns and each value & node such as consumption, bandwidth, MRIC, RSSI etc are represented at the beginning of rows. It provides an accurate usage of battery and low power consumption so that the user can send multiple messages in limited resources. The parameters that are used manage the cluster head generation, and the node selection methods so that the message can be easily transferred under such circumstances with right decision using principles like global weight calculation of nodes, data collection for cluster head and data aggregation techniques using data cube aggregation.

Research in [6] presented an agent migration protocol based on reinforcement learning method to reduce the query delay and improve the total performance. They worked on the subject of access to WSNs over the Internet, in order to integrate WSNs by using mobile agents which are sent over the Internet through a gateway node. The solution at hand provides advantage in energy consumption, by connecting to the Internet only via gateway nodes through which the MA's were sent.

III. SYSTEM MODEL

A sensor network is defined with limited resource because of energy constraint. Each node gives some energy loss with each communication. Because of this it is required to reduce the communication over the network. Clustering is such a technique that is used to save the energy of the network. In sensor network, there are number of available cluster based routing protocols. One of such common protocol is ‘LEACH’. The ‘LEACH’ gives the energy effective communication in a clustered environment. It can perform the communication on a

hierarchical as well as non hierarchical network. The network reduces the energy with each communication over the network. Clustering Process has two phases: the set-up phase and steady-state phase. In the set-up phase, the cluster-heads are chosen "stochastically", which is randomly based on an algorithm. In steady-state phase data is collected.

The proposed research work is the improvement over the existing clustering architecture to increase the network communication and the network life. Fuzzy Logic Based Energy Efficient Data Aggregation in Wireless Sensor Network (FLEDA) is about to reduce the network traffic by inclusion of mobile base station.

As the cluster head is responsible to handle the communication within cluster as well will communicate with base station. The cluster head accepts the information from the cluster nodes and will send it to the base station with direct or with cooperative communication. The proposed research work suggested three important parameters for deciding the cluster head management. These parameters include the connectivity, distance and residual energy based cluster head selection and the management of mobile base station over the network to provide effective communication. The first prioritization will be based on residual energy. High energy is considered as one parameter in cluster head selection. In same way, the short distance node will also be assigned by the higher priority. The proposed work also includes the concept direct communication to the base station. The proposed work is the improvement over the existing clustering architecture to increase the network communication and the network life.

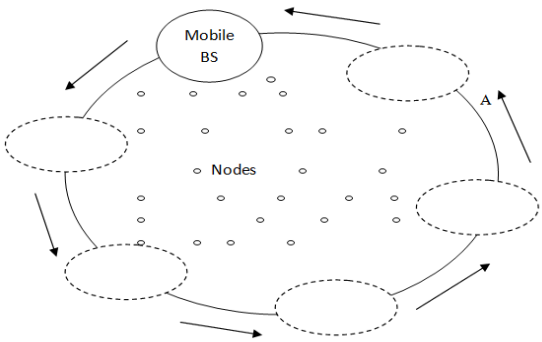

Fig. 2: Movement of Base Station around circumference

In this research work, base station is not stationary. Figure 2 shows the movement of mobile base station around its circumference. The movement of mobile base station helps in efficient utilization of energy as only those nodes which come in range of mobile base station communicate with it and passes data either by direct communication or by multi-hop communication; other nodes are not communicated at this time.

IV. RESEARCH DESIGN

The presented work includes two main phases. In first phase, a mobile base station over circular path is defined in such a way that maximum connectivity will be there. The center to the circular path will be selected along with the radius specification to that path (Fig. 3). In second phase, prioritization will be done to each communicating node.

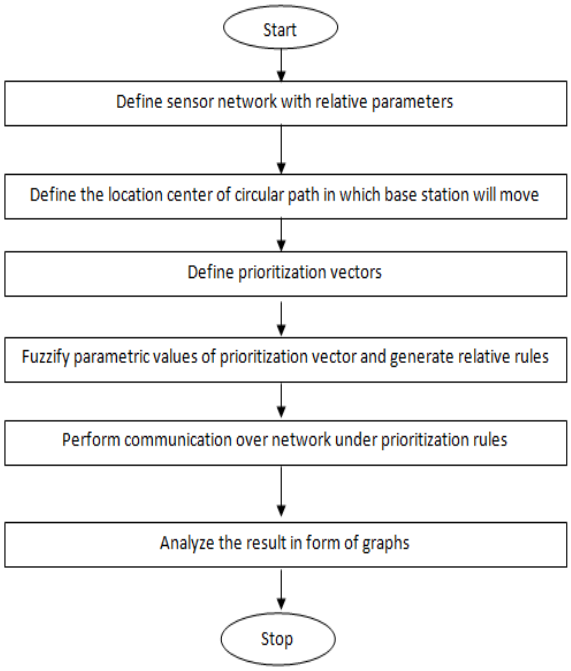

Fig 3: Working of FLEDA

The proposed research work is the improvement over the existing clustering architecture to increase the network communication and the network life. The improvement is defined under two main factors:

a. The base station is moving in a radial path.
b. Selection of the cluster head over the network.

The algorithm defined for the proposed work is given as under

4.1 Algo_FLEDA (Nodes, N)

(i) Distribute N Nodes called node1, node2…..nodeN randomly over the area mxn.
(ii) Set CenterX= m/2 , CenterY=n/2 and Set Radius R for Base station radial path.

(iii) Set BaseStation with parameters (CenterX,CenterY,R,ConstantSpeed,SensingRange)
(iv) Set probability of becoming a clusterhead is p; hence, on average, n/p sensors will become cluster heads
(v) For i = 1 to N
(vi) Neighbor (i , :) = FindNodes (Nodes, SensingRange)
(vii) For inter = 1 to MAXITERATIONS
(viii) For i = 1 to n
(ix) If (Distance(Node(i),bs)<=SensingRange)
a. Perform Direct Communication between the base station and sensor node i
b. Energy(Node(i)) = Energy(Node(i)) - TransmissionEnergy
Else
a. Find the multihop path between basestation and node I with nodes m nodes
End if (ix)
(x) For j=2 to m
(xi) Energy(Node(j))=Energy(Node(j))-ForwardingEnergy;
(xii) Energy(Node(i))=Energy(Node(i))-TransmissionEnergy;
(xiii) Set status=0;
(xiv) For i=1 to n
(xv) ProbabilityVector (Node(i)) = Energy(Node(i)) * ProbabilityVector (Node(i)) + (1-ProbabilityVector(Node(i))) * EnergyConsumed (Node (i))
(xvi) If (ProbabilityVector(Node(i))>.5)
a. If (FuzzyHighDecision (Energy (Node(i))) > Threshold And ResponseTime (Node (i)) < MinResponseTime And ConnectivityVector (Node(i)) > MaxConnectivity)
- Set MaxEnergy=Energy(Node(i))
- Set MinResponseTime = ResponseTime (Node(i)
- Set MaxConnectivity = ConnectivityVector (Node(i))
- Set Status = 1;

Endif (xvi-a)
b. Elseif (FuzzyMediumDecision (Energy (Node (i))) > Threshold and ConnectivityVector (Node (i)) > MaxConnectivity)
- Set MaxEnergy = Energy (Node(i))
- Set MinResponseTime = ResponseTime (Node(i))
- Set MaxConnectivity = ConnectivityVector (Node (i))
- Set Status=1;

Endif (xvi)
(xvii) If (status=0)
a. Set all Alive Nodes as Cluster head so that communication can be performed with base station directly.
b. If (Energy (Node(i) < = 0)
- Dead=Dead+1;

Endif (xvii-b)
Endif (xvii)

V. SIMULATION RESULTS

Simulation result shows comparative analysis of existing and proposed approach.

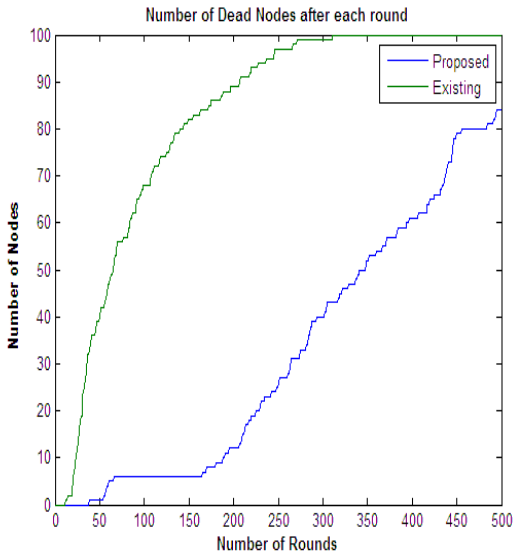

Fig 4: Dead Node after each round

Figure 4 shows in existing approach the nodes starting dead in the starting rounds whereas in proposed approach nodes starting dead after 30 rounds. The complete network dies in existing approach in 380 rounds whereas in proposed work, the network stays after 500 rounds.

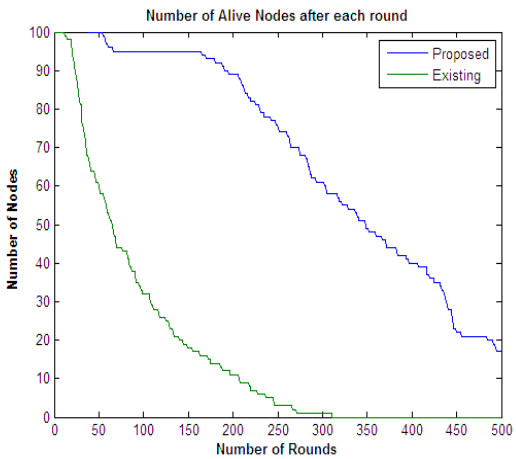

Fig 5: Alive Node after each round

Figure 5 shows in the existing approach the nodes stay alive upto 380 rounds but in proposed approach, the network is alive even after the completion of 500 rounds. This shows the presented approach is far better than existing approach.

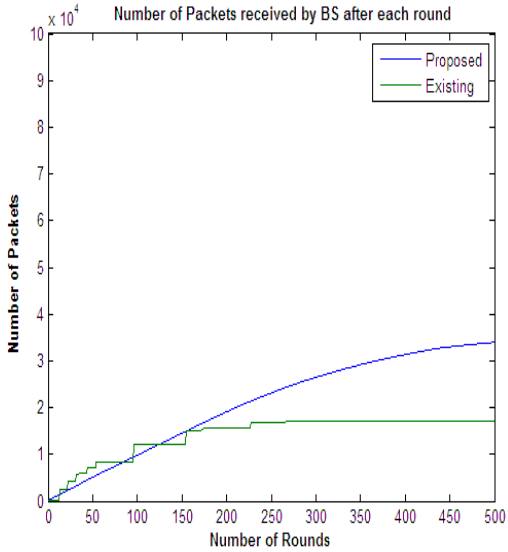

Fig 6: Packet received by BS after each round

Figure 6 shows that packet transmission to the base station is high in proposed approach as compared to existing approach, so network throughput increases.

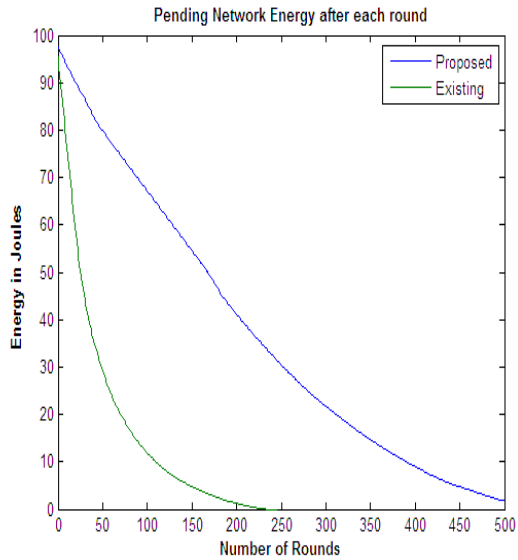

Fig. 7: Pending network Energy after each round

Figure 7 is showing remaining energy in proposed approach is more because of this the energy is still balanced over the network after the completion of 500 rounds.

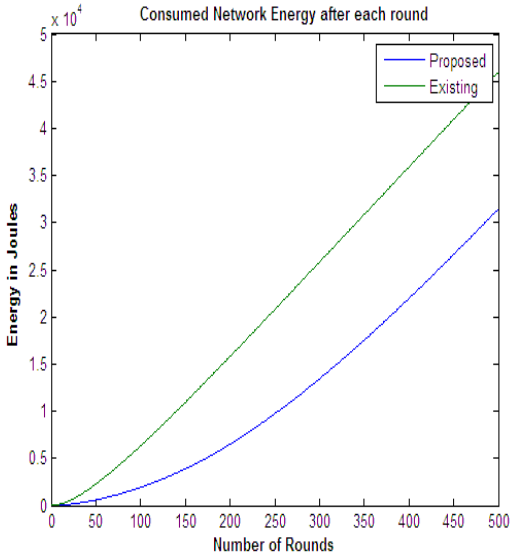

Fig 8: Energy consumed in WSN after each round

Figure 8 shows the energy consumption in the proposed approach is less as compared to energy consumption in existing approach.

VI. CONCLUSION AND FUTURE SCOPE

Energy is one of the critical issues in sensor networks. The main problem with static base station is the multihop communication performed by distance nodes. In proposed approach, base station is non stationary and is defined with specific sensing range. Clusters comes in sensing range can directly communicate with it, whereas other perform a multihop communication. It provides equal chances to all clusters to perform direct communication with base station. Base station will move on a redial surface, for some time instance, a specific group of clusters can directly communicate with base station. The obtained results show that the presented work has improved network life as well as network communication by reducing energy consumption over existing protocols.

The proposed work is focused on a homogenous network in which all sensors are of same type, in future the work can also be improved by considering some heterogeneous network. The proposed work is been performed on a standard wireless network that can be improved with some other sensor network such as underwater sensor network, body area network, personal area network etc. In this work, only one problem of sensor network is considered called the energy consumption or the network life improvement. But there are many other issues along with energy consumption such as security etc. In future the work can also be done in direction to

improve the security aspects in sensor network. The proposed work is implemented on a clustered architecture. In future the same work can be performed on some aggregative communication.

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RESEARCH ARTICLE OPEN ACCESS

Workflow Scheduling In Grid Environment

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ABSTRACT
Task scheduling in heterogeneous computing environment such as grid computing is a critical and challenging problem. Many parallel applications consist of multiple computational components. While the execution of some of these components or tasks depends on the completion of other tasks, others can be executed at the same time, which increases parallelism of the problem. The task scheduling problem is the problem of assigning the tasks in the system in a manner that will optimize the overall performance of the application, while assuring the correctness of the result. Scientific workflows, usually represented as Directed Acyclic Graphs (DAGs), are an important class of applications that lead to challenging problems in resource management on grid and utility computing systems. In this dissertation, a priority scheduling heuristic is developed which maintains a list of all tasks of a given DAG according to their priorities. It firstly prioritizes all tasks and then selects the best resource for the ready task with highest priority.
Keywords- Grid Computing, Work flow, Scheduling, DAG.

I. INTRODUCTION

Grid Computing can be defined as the seamless provision of access to possibly remote, heterogeneous, untrusting, dynamic computing resources [1][2]. Grid applications are usually divided into many interdependent subtasks in real applications. Every single subtask is processed and the subtasks should process concurrently in order to reduce the task running time, which is one of the most important problems in parallel computing. Workflow applications incorporate multiple dependent modules to be executed in a predefined order and may entail the transfer and storage of a huge amount of data. A very important issue in executing a scientific workflow in computational grids is how to map and schedule workflow tasks onto multiple distributed resources and handle task dependencies in a timely manner to deliver users' expected performance [5] [6]. Directed acyclic graph (DAG) is usually used to illustrate the data dependency among subtasks in workflows [3]. In DAG, workflow structure can be categorized into sequence, parallelism, and choice. Sequence is defined as an ordered series of tasks, with one task starting after a previous task has completed. Parallelism represents tasks which are performed concurrently, rather than serially. In choice control pattern, a task is selected to execute at run-time when its associated conditions are true.

The workflow execution time consists mainly of two parts: the task execution time and data transfer time. The task execution time is not simply the sum of times spent carrying out all tasks because some of them are executed concurrently. For a workflow that can be modeled as a DAG, critical tasks are those that must be started on their earliest start times in order to achieve the best performance of the workflow execution [7]. The sum of the execution times of critical tasks is the time spent for workflow task execution. In a workflow, if two tasks having data dependencies, such as intermediate files are allocated on different resources then intermediate files need to be transferred between the two resources. In a grid environment with slow network, the data transfer time may become a significant part of the total workflow execution time. But not all data transfers impact the workflow performance; only those that delay the launching of critical tasks, directly or indirectly, do so.

A workflow scheduler should have two capabilities: first, resource allocation, which distributes tasks onto multiple resources and second, task execution and coordination, which submits tasks to the resource's local schedulers in the right order, and handles task dependencies [4]. In a DAG workflow, the task dependencies determine the order of task submission and file transfer, which is the topological order of the workflow DAG. In this order, the earliest start-time of each task can be calculated easily, as long as we know when the workflow itself should be started. An allocated resource for a task should be available before its

earliest start-time so that no delay is incurred because of the unavailability of resources [8].

In this paper, the grid workflow scheduling problem is formulated and a priority based solution is discussed. A separate module is developed to generate the DAG topology of a workflow. Given the workflow structure and the number of processors with randomly generated processing power, the mapping scheme using both priority based and round-robin strategy is established separately.

II. RELATED WORK

Finding a single best solution for mapping workflows onto Grid resources for all workflow applications is difficult since applications and Grid environments can have different characteristics [9]. Many researchers have studied scheduling strategies for mapping application workflows onto the grid. In [10], authors developed a framework to schedule a DAG in a Grid environment that makes use of advance reservation of resources and also considers the availability knowledge about task execution time, transfer rates, and available processors to generate a schedule. Their simulation results show advantages of unified scheduling of tasks rather than scheduling each task separately. A static scheduling is applied [11] to ensure that the key computational steps are executed on the right resources and large scale data movement is minimized. Authors use performance estimators to schedule workflow applications. In [12], authors mapped the entire workflow to resources at once or portions of it. This mapping can be done before or during the workflow execution. Their algorithm prefers to schedule computation where data already exist. Additionally, users are able to specify their own scheduling algorithm or to choose between a random and a round robin schedule technique. A new grid scheduling algorithm that minimizes the cost of the execution of workflows while ensuring that their associated QoS constraints are satisfied is proposed [13]. The algorithm views a grid environment as a queuing system and schedules tasks within this system. This algorithm is system oriented and considers the execution cost. Hence, it is suitable for economic grids. Since the algorithm is non-linear, as the size of the problem gets large the time it takes to obtain a suitable scheduling becomes very long and unacceptable.

III. SYSTEM FRAMEWORK & IMPLEMENTATION

3.1 Directed Acyclic Graph (DAG)

Task scheduling problem in computational grid can be represented as DAG, a directed graph with no directed cycles. In a DAG, a node is an individual task and an edge represents the inter-job dependency. A child task cannot be executed before all its parent task finish successfully and its required data inputs in place. Nodes and edges are weighed for computation cost and communication cost respectively.

```
Decide the levels of the graph.
For each level do
    Begin
        Allocate tasks to the level.
    End
For each intermediate level do
    Begin
        For each task do
            Begin
                Make at least one dependency of the task(t_i) with the tasks of
                its previous and next level each.
                Assign weight to the dependencies.
            End
End
```

In above algorithm, there are certain numbers of levels. On each level, some number of tasks is assigned not necessarily to be different. There is at least one dependency of each task with the tasks of its previous and next level each, such that each and every task has its predecessor and successor.

3.2 Round Robin Scheduling Algorithm

It is a static scheduling strategy which maps resources to each individual task before workflow execution. In this approach, resources are assigned in round robin manner. In the round- robin scheduling algorithm, initially processors are allocated to the tasks of workflow application. After allocation of processors, EST(Earliest Start Time) and EFT (Earliest Finish time) for each task is calculated. For EST, communication cost between task and its parent is considered if both are on different processors. There may be more than one parent of a single task. Corresponding to each parent, EST is to be calculated and then maximum value among those will be EST for the task. EFT can be calculated as sum of EST and computation time of task on the allocated processor. Finally the EFT for the last task also known as exit task is makespan for the workflow application. The algorithm is as follows:

1. **For** each task do
2. **Begin**
3. Allocate processor to the task(t_i) in the round robin manner.
4. **End**
5. **For** each task do
6. **Begin**
7. Calculate EST for the task(t_i) corresponding to each parent and then choose the maximum of those which will be EST(t_i) for the task(t_i).
8. Calculate EFT(t_i) = EST(t_i) + Computation Time of task(t_i) on the allocated Processor.
9. **End**
10. Makespan = EFT(t_{exit}).

3.3 Priority Based Scheduling Algorithm

It is a list scheduling strategy, where a resource mapping is done only when a task is ready to execute without requiring any prior application and environment knowledge. Here, tasks are prioritized and executed in the order of their priorities.

In this algorithm, initially priority is assigned to the tasks at each level. Priority can be assigned in the decreasing order of their linkcost which is the sum of the uplink and downlink cost where uplinkcost is the maximum of the communication cost among its successor and downlink cost is the maximum of the communication cost among its predecessors. Higher prioritised task is executed first. Now, EST for the task with respect to each processor corresponding to all parents is calculated and among those maximum value of EST is chosen for that processor. Then EFT is calculated corresponding to each EST and minimum EFT is selected and hence the processor with minimum EFT is allocated to the task. Finally, the EFT for the last task also known as exit task is makespan for the workflow application. Algorithm is as follows:

1. **For** each level do
2. **Begin**
3. **For** each task do
4. **Begin**
5. Calculate Downlinkcost(t_i) of task(t_i).
6. Calculate Uplinkcost(t_i) of task(t_i).
7. Calculate Linkcost(t_i)=Downlinkcost(t_i)+Uplinkcost(t_i)+ max{linkcost of its Predecessor}.
8. **End**
9. Sort the tasks in decreasing order of their linked cost and assign priority to them.
10. **End**
11. **For** each level do
12. **Begin**
13. **For** each task according to their priority do
14. **Begin**
15. **For** each processor do
16. **Begin**
17. Calculate EST for task(t_i) corresponding to each parent for processor p_k and then choose maximum of those which will be EST($t_{i,k}$).
18. Calculate EFT($t_{i,k}$) = EST($t_{i,k}$) + Computation Time of task(t_i) on processor k.
19. **End**
20. Choose the processor with minimum EFT of task(t_i) and allocate it to task(t_i).
21. **End**
22. **End**
23. Makespan = EFT(t_{exit}).

IV. RESULTS & DISCUSSION

This section contains a description of experiments carried out during simulation in Java along with relevant parameters as shown in Table 1.

Table 1: Simulation Parameters

Parameter	Value
Simulation Runs	10
Number of Levels	7-20
Number of Tasks	25-100
Number of Processors	5-30

Table 2: Makespan of Workflow Applications with variation in No. of Tasks

Number of Tasks	Number of Levels	Makespan (Round Robin)	Makespan(Priority)
25	7	520	332
50	10	835	592
75	12	1024	757
100	20	1810	1087

Table 3: Makespan of Workflow Applications with variation in No. of Processors

Number of Processors	Makespan(Round Robin)	Makespan(Priority)
5	1638	1073
10	1793	1030
15	1864	1001
20	1773	1020
25	1771	1048
30	2023	1009

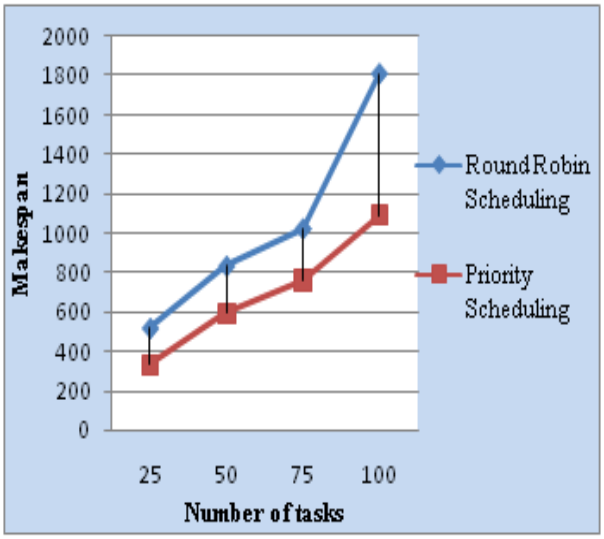

Figure 1: Comparison of Makespan for Different Number of Tasks

The performance of these algorithms is tested under two scenarios. In scenario 1 with a simulation run of 10 times, DAG is randomly generated with 4 different numbers of tasks, i.e. 25, 50, 75 and 100 and the execution environment comprises of 5 processors as shown in Figure 1 and Table 2. In scenario 2 with a simulation run of 10 times, DAG is randomly generated comprising of 100 tasks and executed in a system with processing capability of 5, 10, 15, 20 and 25 processors as shown in Figure 2 and Table 3. Simulation results confirmed that priority based workflow scheduling has significant performance improvement over round-robin approach.

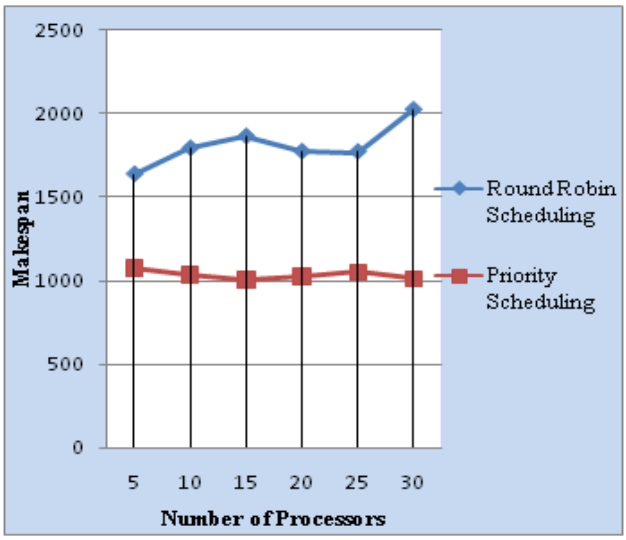

Figure 2: Comparison of Makespan for Different Number of Processors

V. Conclusion

Tasks with DAG dependencies are frequent in case of Grid applications and they require advanced scheduling procedures. In this research work, the grid workflow scheduling problem is formulated and a priority based solution is discussed. Simulation results show that priority based workflow scheduling outperforms the traditional round-robin policy commonly used in real systems.

Future work will include, among other things: the analysis of a wider set of scheduling algorithms currently used in Grid systems and the establishment of relevant performance measures.

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