International Research Journal of Advanced Engineering and Science
ISSN: 2455-9024

Achievement of Energy Proficient Procedure Using Wireless Network

A. Ruby Priyadharshini
Assistant Professor, Department of Computer Science, Voorhees College, Vellore, TamilNadu, India

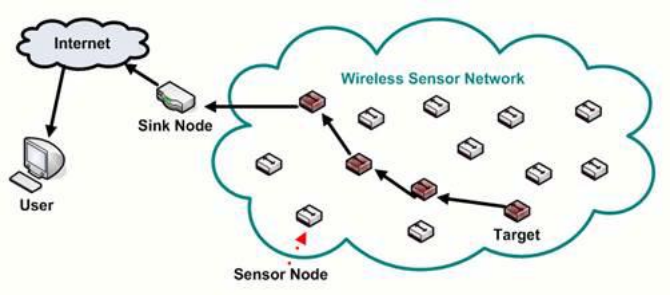
Abstract**—** *A multi-hop wire-less network is composed of large number of nodes and continuous links between them so that when a packet is transmitted from one node to another it goes through several path. Wireless sensor network normally Consists of large number of distributed nodes that organizes them into a multi- hop wireless network. In wireless sensor network one of the main problems is related to energy issue because every node is operated by battery. In ad-hoc network each and every node communicate with each other without any fixed infrastructure's communication overhead will be less. Ad-hoc is infrastructure less network. To have large Network life time all nodes need to minimize their energy consumption. Node is composed of small battery so that the energy associated with this node is very less. So replacing and refilling of battery is not possible which is very costly. Hence some techniques are applied through which the energy associated with each node can be conserved. Energy conservation can be done by controlling the transmission power of each node. Ad-hoc and wireless sensor network, cellular network are some example of wireless network. In this thesis we have tried to implement a protocol in the literature and the performance of the protocol in sensor network.*

Keywords**—** *Ad-hoc, fraud detection, location awareness mobility, multi-hoping, adaptability, adaptability.*

I. INTRODUCTION

The term "wireless" has become a generic and all-encompassing word used to describe communications in which electromagnetic waves to carry a signal over part or the entire communication path. Wireless technology can able to reach virtually every location on the surface of the earth. Due to tremendous success of wireless voice and messaging services, it is hardly surprising that wireless communication is beginning to be applied to the domain of personal and business computing [1]. Ad- hoc and Sensor Networks are one of the parts of the wireless communication.

In ad-hoc network each and every nodes are allow to communicate with each other without any fixed infrastructure. This is actually one of the features that differentiate between ad-hoc and other wireless technology like cellular networks and wireless LAN which actually required infrastructure based communication like through some base station. [2]. Wireless sensor network are one of the category belongs to ad-hoc networks. Sensor network are also composed of nodes. Here actually the node has a specific name that is "Sensor" because these nodes are equipped with smart sensors [2]. A sensor node is a device that converts a sensed characteristic like temperature, vibrations, pressure into a form recognize by the users. Wireless sensor networks nodes are less mobile than ad-hoc networks. So mobility in case of ad-hoc is more. In wireless sensor network data are requested despending upon certain physical quantity. So wireless sensor network is data centric. A sensor consists of a transducer, an embedded processor, small memory unit and a wireless transceiver and all these devices run on the power supplied by an attached battery [1].



A. Wireless Communication

Now in recent scenario the growth of wireless communication is vast. Because the wireless technology can be applied in any kind of situation it has a capability of reaching in any part of the earth surface. Now considering the recent market scenario in which there are a lot of wireless products are available. There are so many wireless network are there some are infrastructure based and some are infrastructure less. Ad-hoc and wireless sensor network, cellular network are some example of wireless network Infrastructure less in ad-hoc network each and every node communicate with each other without any fixed infrastructure's communication overhead will be less. Ad-hoc is infrastructure less network.

Mobilit Mobility of nodes in ad-hoc networks more. The nodes are able to organize themselves in such a manner by exploring the area without the presence of infrastructure they can communicate with each other [3]. Multi-Hoping Ad-hoc Networks composed of several nodes and they are communicating with each other to describe several paths to several node. Here actually the packet traverses from one node to another node to reach the destination. Due to this Multi-hop features energy Associated with each node can be conserved [3].Openness Ad-hoc network access information and services without geographic position. Adaptability can freely adaptable to any situation and dynamically self-organize into arbitrary and temporary network topologies. Heterogeneous Network Ad-hoc network composed of heterogeneous devices like laptop, walkie-talkies etc. The different type of devices are able to communicate with each other [2].

A. Ruby Priyadharshini, "Achievement of energy proficient procedure using wireless network," *International Research Journal of Advanced Engineering and Science*, Volume 1, Issue 4, pp. 104-110, 2016.

B. Challenges in Wireless Sensor Network

Challenges in wireless sensor network arise in implementation of several services. There are so many controllable and uncontrollable parameter [4] by which the implementation of wireless sensor network affected such as. Energy conservation in wireless sensor network every node is equipped with sensor and the sensor devices are in working condition depending upon the power supplied by attached battery.

To have better performance the network should operated for large time. As we know that the sensor node has small size due this small size the battery has low capacity and the available energy is very less. And in that situation the refilling or replacing of battery is impossible. It is a costly attempt. In order to avoid this problem some more energy efficient protocol are design so that the sensor node communicate efficiently by increasing both throughput and network capacity.

Operation in antagonistic environment Sensor network can be operating in antagonistic environmental condition. So design issues of sensor node are carefully considered. Protocol for the sensor network should be robust one. It silent about any fault occurs in system. Communication quality Sensor network have very low quality communication depending upon different situation like when it operated in some unpleasant environment then communication quality is very poor. It is environment specific.

Availability of resources When the resources required by sensor network are unavailable then the sensor networks try hard to provide the desired QoS.Data processing: Data collected by many sensors may contain redundant data. So data aggregation required in network processing so that redundant data can't be transmitted more number of time. It will help to conserve some amount of energy for further transmission.

Scalability Wireless sensor node are composed of large number of sensor node and many more nodes can be added in design stage [2].Commercialization In recent scenario the production of sensor node started by many electronics based company. But commercialization very poor especially in case of sensor network. Profit issue is very less [2]. Application specific Sensor network changes with change in application. For different type of application we have to design different sensor network [1].

C. Applications in Wireless Sensor Network

Intrusion Detection Due to presence of less mobility and stationary property of wireless sensor network can be used to track object event. It can be used for security purposes that are for surveillance purposes. Generally high resolution camera is equipped with sensors that can be used to form a network that monitor a restricted area access. If any outsider enter into this region without any proper authentication then some sort of signalling event occur it may be an alarm message quickly propagate to a handling authority [2], [8]. Avalanche prediction:

Movement of large snow masses can be predicted by device equipped with sensor .GPS one of the detecting devices use for this purposes [2].

Environment Observation and Forecasting System The Environment Observation and Forecasting System (EOFS) is a distributed system that spans large geographic areas and monitors, models and forecasts physical processes such as environmental pollution, flooding, among others. It consists of three

Components: sensor stations, a distribution network, and a centralized processing farm [1].

II. Related Work

In the previous chapters we discussed briefly about the basics and classification of Topology control in Wireless sensor network. Among that we realized that power consumption of a node is the most important factor to be noticed. So we have made a detailed literature review about the different Topology control protocol in order to minimize energy consumption that already exists. As we discussed earlier that the topology control mechanism are applied to increase the Network capacity and decrease the energy consumption. There are three scheme are there to control the topology

a. Location based Topology control
b. Direction based topology control
c. Location free topology control

A. Location Based Topology Control

LMST protocol (Local minimum spanning tree):LMST protocol [2] is one of the protocols based on the location based topology control approach. In this protocol symmetric wireless medium is consider. The node have same maximum transmit power. LMST protocol first involves Information Exchange in which each node makes a data structure it may be a table that composed of both Node id and location transmit this beacon message to all neighbours at maximum transmit power.

Then it constructs topology by creating local minimum spanning tree for each node. Which can be done when the beacon message is received by the neighbours within the corresponding range each node try to construct its local minimum spanning tree by the help of prims algorithm. The link weight is same as the Euclidian distance between two nodes. From this distance the power can be calculated by using the following formula:

$$Puv= (D (u, v))\beta *c$$

Where, C=path loss component
ß=Distance power gradient and ß>=1

After the formation minimum spanning tree then define the set of neighbours in the final topology depending upon the distance that is at one-hop distance from source. Then it determine the transmit power of each node by comparing the received energy of the beacon message and the maximum transmit power of node that is received the message. Every node can estimate minimum power level needed to reach the destination node by comparing with the maximum transmit power with the receiving power of beacon message. Broadcast power is also compute by nodes, this power required to reach

A. Ruby Priyadharshini, "Achievement of energy proficient procedure using wireless network," *International Research Journal of Advanced Engineering and Science*, Volume 1, Issue 4, pp. 104-110, 2016.

to the farthest node in the network. The topology produced by the LMST protocol can be preserves in worst case.

B. Direction Based Topology Control

CBTC protocol (Cone-based topology control): In cone-based topology control [2] the transmit power of every node is set to some minimum power .Power is function of width so that when this minimum power i given to the respective node let say u and minimum power given to the node u be P such that u, node u can reach at least one node in every cone of width centred at the respective node. A node must retain connection to at least one neighbour in every direction where determine direction.

In this protocol each node determines the minimum power required to reach the neighbour in every direction then identified the energy inefficient edge and remove it from final topology. Every node can communicate with other node within its range by transmitting beacon message to these node which contain the node Id and power used to send the message and the receiving node also send acknowledgement message in response to beacon message. The ack message contains the Id of sender, receiver and power used to transmit the message.

C. Location Free Topology Control

XTC protocol (extreme topology control).In XTC protocol [2] every node in the network maintains an order relation with its neighbour set. The ordering relation can be explaining in terms of strength of received signal or by packet delivery ratio. Here the link quality is measured in terms of received signal strength. Neighbour order can be found out by sending a beacon message at maximum power. Then the receiver node measures the received signal strength and order accordingly. This process repeated for some time to find out the proper order then form neighbour list. Then broadcast the neighbour list with maximum power. Then network topology is constructed at each node locally. The XTC protocol computes the topology for bidirectional links. It also preserves connectivity at worse case.

III. PREVIOUS IMPLEMENTATIONS

A. Topology Controls

The topology of a multi-hop wireless network is a collection links by which various nodes in the network communicate with each other. It is just like a structure of a network. This topology is used by various mechanisms to select path in a network to send traffic so that the transmission of data from source to destination can be done efficiently. Topology affected by various factors like transmit power, antenna direction that can be controlled by proper implementation but there some factor like mobility, noise can't be controlled [4].

B. Topology Control

Topology control is the mechanism by which nodes are arrange in such a way based upon their transmission range to increase network capacity and reduce node energy consumption [2]. So main goal of Topology control are

• Maximize network capacity

• Minimize Energy consumption

Classification based on critical transmission range it broadly divided into two categories [2] Homogeneous critical transmission range Heterogeneous critical transmission range Homogeneous critical transmission range:

- Every node in the sensor network uses the same transmitting range. Heterogeneous critical transmission range.
- Every node in the sensor network uses different transmitting range.

Topology control can be classified according to the critical transmitting range [2].Depending upon type of data available during computation of topology Non homogeneous topology control classified as:

a. Location based Topology control
b. Direction based Topology control
c. Location free Topology control

C. Location Based Topology Control

Location based approach can be applied when the node location are known to compute the corresponding topology. This topology control scheme can be applied to both centralized and distributed network. In case of centralize schemes the information about node location is used by centralized authority to calculate set of transmitting range. And in case of distributed network information is transformed between various nodes to find out the optimal transmission range. In sensor network the nodes are equipped with low power GPS receiver to find out the appropriate position. As it is a new hardware attached to node it increases the cost factor which is a disadvantage in this scheme. By this way the cost factor increases [2]. Let u and v are two nodes having coordinates (x1,y1) and (x2,y2).

$$D(u, v) = ((x1-x2)^2 + (y1-y2)^2)1/2$$

D be the Euclidian distance between two nodes u and v. Transmission power P can be uv calculated as:

$$Puv = (D(u, v))\beta * c$$

Where,ß = Distance power gradient C = path loss component For free propagation model value of β=2.

Free propagation model [2].In this model the path between the sender and the receiver is clear and unobstructed.The value of received power can be expressed by the following formula:

$$Pr(d) = Pt*Gt*Gr*\lambda^2 / ((4\Pi)^2 * d^2 * L)$$

Where,λ= Wavelength in meters. L= System loss factor.

pr(d) = power of the radio signal received by the node located at distance d from the transmitter.

- Gt=Transmitter antenna gain.
- Gr=Receiver antenna gain.

In this above parameter λ , L, Gt, Gr are all constants and the above formula can be replaced by

$$Pr(d) = Pt^2 / (d^2) * C$$

Where C = Constants depends upon the Characteristic of transceiver. There are two schemes those are used this location based topology control.

D. Range Assignment Schemes

Range assignment schemes is one of the location based topology control schemes that is used to decide the power

A. Ruby Priyadharshini, "Achievement of energy proficient procedure using wireless network," *International Research Journal of Advanced Engineering and Science*, Volume 1, Issue 4, pp. 104-110, 2016.

level assignments that generate a connected communication graph and also minimize the energy consumption.

Let N be a set of nodes in the n- dimensional space, with n=1, 2, 3.The range assignment function R for which corresponding communication network is strongly connected and Cost associated with this R can be expressed .Cost is minimum over all connecting range assignment function, where ß is the distance
power gradient. Energy – efficient communication Scheme

$$Cost(R) = \Sigma u \in N (R(u))\ \beta$$

Energy – efficient scheme based on either the end to end communication scheme between various node or it depends upon communication to all node simultaneously. The first scheme known as unicast schemes and the later one is known as broadcast schemes.

Energy – Efficient unicast

When the entire node transmits at maximum power a communication graph is created known as max power graph denoted by G (N, E). The power cost between any two nodes is defined as the sum of the power cost of the single edges.

$$PCost(Puv) = \Sigma (D(u, v))\ \beta$$

Where, PCost=effective power cost of summation of power cost of single edges.D (u, v) =Euclidian distance between two nodes u and v.ß= Distance power gradient. The minimum-power path between nodes can be found out by above formulation and if the minimum-power path is not unique then we can take any path as the minimum power
path.

Energy – Efficient Broadcast

Here the main goal is to find the sparser graph of the broadcast graph broadcasting is
more energy efficient. The main cause of using sparser graph to solve the problem that occurs when many nodes in a neighbourhood try to relay the broadcast message at the same time, resulting in serious redundancy, collision and bandwidth contention.

E. Direction Based Topology Control

This topology control schemes depend upon the ability of node to find the relative direction of their neighbours. It is actually less accurate information than location. If the direction is given then we can find out the location. IEEE antenna and propagation community proposed various mechanisms for estimation of direction in which the node transmit. This problem is known as Angle - of- arrival problem. This can be solved by equipping nodes with one directional antenna. Advantage of using Angle-of-arrival technique rather than location based techniques is that it can be use in case of indoors application [2].

F. Location Free Topology Control

Location or direction information nothing is given, here the node should explore knowledge about their neighbour by some message passing schemes. So that each and every node should know some minimal amount of information about their neighbour it the information may be node id, location and order them according to certain criteria. Every node requires some minimum amount of information to build network topology it may be number of node or node id. If the node not able to find out information about the neighbour it is very difficult to build topology [2].

G. Layer Concepts

Routing layer: When one node sends some message to another node then the route discovery and maintenance part is done by the routing layer. This work is done by the routing protocol present in routing layer. Firstly the routing protocol checks whether the route is already known or not. If not then it starts the routes discovery phase. This layer is responsible for sending packets from sender to destination through intermediates node. When no routes found the communication is delayed [2].

Topology control layer: Topology control layer presents in between the routing layer and MAC layer. The main work of topology control protocol to create and maintain the list of immediate neighbour node. When some node fails or some modification is done to the list then this protocol trigger a route update phase .This modification is mainly done by many leave and join operation of node in the neighbour list. To minimize delay without waiting for routing layer the topology control layer triggered route update phases that the response time became faster leading to reduce packet loss rate [2].

MAC layer: This layer is responsible for regulating access to shared channel, wireless. The main issue associated with this layer is to reduce the conflicts. This layer is also responsible for maintaining the network capacity to reasonable level .Collision detection, avoidance is done at this layer. So that no conflict occurs in communication between various node of network [2].

IV. SYSTEM IMPLEMETNATION

A. Algorithm

The work is an implementation of a proposed protocol present in paper" Topology control of Multi-Hop wireless Networks using transmit power adjustment" [4].input N=number of Nodes in a wireless sensor network G be the MAXPOWER graph. L (Xx, Yx) =Location of each node x in the WSN G.pmin= minimum power required to communicate through a distance d, it is a function of instance. C=number of possible nodes pairs, NC=number of cluster, R=sorted pair list
OUTPUT: Transmit power level of each node P to form a connected topology

{

Begin
1. Initialization:
1.1 d(x,y)=0
1.2 pmin=a*d(x,y) // 0≤a<1
1.3 N=0
1.4 Create Cluster per node depending upon N
1.5 C=0
1.6 NC=0
2. Enter the Number of Nodes N
3. Calculate the Euclidian distance d(x, y).

A. Ruby Priyadharshini, "Achievement of energy proficient procedure using wireless network," *International Research Journal of Advanced Engineering and Science*, Volume 1, Issue 4, pp. 104-110, 2016.

4. Arrange the (x, y) on the basis of d(x,y) in ascending order and store in R and
return C
5. NC=N
6. For i=1 to C
7. Select nodepair(C)
8. If cluster of both node pair are different then
9. Assign P(x) and P(y) to the d(x,y)
10. Merge Both node pair cluster to form new cluster
11. NC=NC-1
12. If NC is equal to 1
then stop
13. Minimum_ power (G,pmin,P,k,R)
End
}

Procedure minimum_ power (G, pmin, P, k, R)

{
1. For i=N to 1
2. Select(node)
3. Create a set S of node pairs in which the selected node is the source or destination
node.
4. Arrange the set S in descending order of d(x,y)
5. Calculate pmin for each node and compare with the power level of each node
6. If pmin(d)>P(u) then Remove that node pair from T
7. Search node pairs in T and check if P(u)=pmin(d) then the graph is not K connected
stop
8. Else assign P(u) to pmin(d)
}

We have reproduced here the proposed protocol for the sake of completeness. The detailed protocol found in a paper [Topology Control of multi-hop wireless networks using transmit power adjustment [4].

B. Parameter Description

1. G represent the multi-hop-wireless network. Which is represented as G (N, L).
2. N=number of nodes
3. L=location of each node
4. P is the transmit power associated with each node.
5. p is least power function is the minimum power needed for transmission min between nodes.
6. K is the connectivity parameter e.g. k=1 for one-connectivity [4].

C. Algorithm Analysis

I have implemented a polynomial time algorithm CONNECTIONCHECK [4] for a connected STATIC network [4].The multi-hop wireless network contain several nodes. A packet must be successfully sent to destination through several nodes. The communications possible if there is a link exist between source nodes to destination whether direct or indirect through several intermediate nodes. Here actually the multi-hop wireless network is represented as a graph. Ever vertices are represented as nodes and communication links as edges. So the two nodes are communicated as if there exist an edge between corresponding vertices.

Multi-hop wireless network is represented as G= (N, L) [4] where N represents the number of nodes and L represent their location with respect to the node. This algorithm is a simple greedy based algorithm. The greedy method suggests that one can devise an algorithm that works in stages, considering one input at one time. At each stage, a decision is made regarding whether the solution is an optimal solution or not. Every greedy approach has some constraint function and objective function.

Any subsets that satisfy the constraint are called feasible solution. We have to find the feasible solution that maximizes or minimizes the objective function. Here this algorithm is a minimization problem. Here the main objective of the algorithm is to minimize the maximum transmit power of each node rather than the overall nodes. Here the constraint are simply the network connectivity between node and the transmission power of nodes must be less that the maximum possible transmit power. While The CONNECTIONCHECK [4] algorithm can found out the transmit power of each and every node but it may not be per-node minimal due presence of some side-effect edges and this node may have some negative effect on the transmit power of every node.

It may involve lowering of power level or elimination some edges. So another procedure that is applied to have per node minimum transmit power that is minimum power [4][7].It uses the presence of side effect edges and found out the per node minimal power. This procedure simply decrease the transmit power of node to a certain level so that the induced graph can't be disconnected.

V. COMPUTATIONAL RESULT

I have implemented the above algorithm using C#.Net programming language. First I create each node that is present in the (node.cs) file and specify the attribute of each node that is the node location in term of x-coordinate and y-coordinate, Node id, power associated with each node, receiver sensitivity and the Euclidian distance from node considered to the all other node. Each and every node has some region of communication that is known as node boundary. We here assign node boundary to each and every node[8].

Location of each and every node are randomly assigned and the node location are checked with the boundary condition whether the node present inside the boundary or not. If it is present inside the boundary then considered otherwise discarded. Another node attribute is the node id of the destination node to which the current node can communicate. We first made cluster for each and every node by specifying the node boundary .In which the node can able to communicate. The cluster can be created by the help of generic collection class present in the System. Collections. Generic namespace.

- List<node> li=new List<node> ()
- For n is greater than 0

A. Ruby Priyadharshini, "Achievement of energy proficient procedure using wireless network," *International Research Journal of Advanced Engineering and Science*, Volume 1, Issue 4, pp. 104-110, 2016.

- li.Add(new node())

Here List is a collection which can contain object of type node. All the node property including the node id, power, boundry condition etc is encapsulate in the respective list object. List object are nothing but nodes. And every List object can be access by the helpof indexer e.g. li[i] where i represent node no.After that from each location the Euclidian distance can be found out. And from this distance we can found out the power associated with each node by applying the following formula:

$$Puv= (D (u, v))\beta *c$$

Where C=path loss component, ß=Distance power gradient

Here we consider the free space propagation model so for this model the value of ß be 2 and c=1, So the generalized formula is:

$$Puv= (D (u, v))^2$$

Initially all the calculated power assign to each node and all nodes transmit with this maximum power. Then by applying the above algorithm we can calculate the pernode minimal transmit power. Here I take k=1 that is for one – connectivity only. Here one thing I took pas constant multiple of x let say a and the value of 0=a<1.With p we min min check the connectivity issue in the minimum power procedure. Here I write the program for 20 nodes. Then the average transmits power of the entire node for a particular number of nodes calculated. And a graph is plotted between the density and the average transmits power of node.

Here we plot a graph between density and average energy of node in a wireless sensor Network. From this result we found that with increase in density the average power decreases because suppose a area of radii 2 contain two nodes then the Euclidian distance between node are larger as comparison to ten nodes in the same area because their mutual distance decreases. As the power is calculated directly from distance and with increase in distance the power increases and vice-versa. Here the density plotted on x- axis and average power on y-axis.

VI. CONCLUSION

In this thesis, Energy efficient techniques play a significant role in saving the energy. One of the techniques is the topology control mechanism. There are many existing Topology control protocols, each one is having its own advantages as well as disadvantages. After looking through this existing protocol, we decided to implement the protocol [4] which reduces the total energy consumption in the network and thus maximize the life time of the network.

We have studied wireless sensor network, its features and challenges. We also studied the different types of topology control techniques and its properties. We studied and analysed the algorithm that is proposed in the paper and implement it show the simulation result.

REFERENCES

[1] C. de Morais Cordeiro and D. P. Agrawal, *Ad-Hoc and Sensor Networks Theory and Application*, World Scientific publication, 2006.
[2] P. Santi, *Topology control in wireless Ad-hoc and Sensor networks*, Jhon Wiley and son's publication, 2005.
[3] P. Mohapatra and S. V. Krishnamurthy, *Ad-Hoc Networks Technologies and Protocols*, Springer Science + Business Media, 2005.
[4] R. Ramanathan and R. Rosales-Hain, "Topology control of multi hop wireless networks using transmit power adjustment," Internetwork Research Department, BBN Technologies Cambridge, Massachusetts, (IEEE Infocom2000)2000; 404-413.
[5] J. P. Sheu, S. C. Tu, and C. H. Hsu, "Location-free topology control protocol in wireless ad hoc networks," *Computer Communication*, vol. 31, issue 14, pp. 3410-3419, 2008.
[6] P. K. Sahoo, J. P. Sheu, and K. Y. Hsieh, "Power control based topology construction for the distributed wireless sensor networks," *Computer Communication*, vol. 30, issue 14-15, pp. 2774-2785, 2007.
[7] N. Haripriya, G. Sangeethalakshmi, and A. Sivasankari, "A detailed study on quality of service in computer networks," *International Journal of Research in Computer Application & Management*, vol. 5, issue 02, pp. 48-51, 2015.
[8] T. Deepiga, A. Sivasankari, and S. A. Shoba, "Border guards systems using hybrid wireless sensor networks," *International Journal of Research in Computer Application & Management*, vol. 5, issue 06, 2015.
[9] Ms T. Deepiga and Ms A. Sivasankari, "Smart water monitoring system using wireless sensor network at home/office," *International Research Journal of Engineering and Technology (IRJET)*, vol. 02, issue 04, pp. 1305-1314, 2015.
[10] Ms. A. Sivasankari, Mrs. S. Sudarvizhi, and L. Sarala, "A comparative study of wireless technologies based on home automation bluetooth low energy, zigbee, insteon and enocean," *International Journal of Computer Science and Information Technology Research*, vol. 2, issue 3, pp. 255-259, 2014.
[11] M. Beneish, "Detecting GAAP violation: Implications for assessing earnings management among firms with extreme financial performance," *Journal of Accounting and Public Policy*, vol. 16, pp. 271-309, 1997.
[12] B. Green and J. Choi, "Assessing the Risk of Management Fraud through Neural Network Technology," Auditing, vol. 16, issue 1, pp. 14-28, 1997.
[13] P. J. Bentley, "Evolutionary, my dear Watson: Investigating committee-based evolution of fuzzy rules for the detection of suspicious insurance claims," *GECCO'00 Proceedings of the 2nd Annual Conference on Genetic and Evolutionary Computation*, pp. 702-709, 2000.
[14] C. Von Altrock, *Fuzzy Logic and Neurofuzzy Applications in Business and Finance*, Prentice Hall, pp. 286-294, 1997.
[15] B. B. Little, W. L. Johnston, A. C. Lovell, R. M. Rejesus, and S. A. Steed, "Collusion in the US crop insurance program: Applied data mining," *Proceedings of the 2002 SIAM International Conference on Data Mining*, pp. 594-598, 2002.
[16] C. Phua, D. Alahakoon, and V. Lee, "Minority Report in Fraud Detection: Classification of Skewed Data," *SIGKDD Explorations*, vol. 6, issue 1, pp. 50-59, 2004.
[17] S. Viaene, R. Derrig, and G. Dedene, "A case study of applying boosting naive bayes to claim fraud diagnosis," *IEEE Transactions on Knowledge and Data Engineering*, vol. 16, issue 5, pp. 612- 620, 2004.
[18] P. Brockett, R. Derrig, L. Golden, A. Levine, & M. Alpert, "Fraud classification using principal component analysis of RIDITs," *Journal of Risk and Insurance*, vol. 69, issue 3, pp. 341-371, 2002.
[19] B. Stefano and F. Gisella, "Insurance fraud evaluation: A fuzzy expert system," *Proceeding of IEEE International Fuzzy Systems Conference*, pp. 1491-1494, 2001.
[20] E. Belhadji, G. Dionne, and F. Tarkhani, "A model for the detection of insurance fraud," *The Geneva Papers on Risk and Insurance*, vol. 25, issue 4, pp. 517-538, 2000.
[21] M. Artis, M. Ayuso, and M. Guillen, "Modelling different types of automobile insurance fraud behavior behaviour in the Spanish market," *Insurance: Mathematics and Economics*, vol. 24, issue 1-2, pp. 67-81, 1999.
[22] C. Phua, V. Lee, K. Smith, and R. Gayler, "Comprehensive survey of data mining-based fraud detection research," *Artificial Intelligence Review*, 2005.
[23] C. Elkan, "Magical thinking in data mining: lessons from CoIL Challenge 2000," *KDD '01 Proceedings of the Seventh ACM SIGKDD*

A. Ruby Priyadharshini, "Achievement of energy proficient procedure using wireless network," *International Research Journal of Advanced Engineering and Science*, Volume 1, Issue 4, pp. 104-110, 2016.

International Conference on Knowledge Discovery and Data Mining, pp. 426-431, 2001.

[24] T. Fawcett, ""In Vivo" Spam filtering: A challenge problem for KDD", *SIGKDD Explorations*, vol. 5, issue 2, pp. 140-148, 2003.

[25] N. Lavrac, H. Motoda, T. Fawcett, R. Holte, P. Langley, and P. Adriaans, "Introduction: Lessons Learned from Data Mining Applications and Collaborative Problem Solving," Machine Learning, vol. 57, issue 1, pp. 13-34, 2004.