A HANDOVER ALGORITHM OVER QUERY DRIVEN COMMUNICATION MODEL FOR BETTER QOS

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***Abstract*—** *Any type of computer network that uses wireless data connections for connecting network nodes is referred as wireless network. While the set of challenges in wireless networks are diverse we focus on fundamental networking challenges in this review. Development of new microelectronics applications for wireless sensor network requires a low end-to-end delay and high reliability for various communication models. Handover algorithm is performed over Query Driven communication model to improve reduced performance and quality of service in a congested network by means of multi-channel redundancy.*

Keywords*—Wireless sensor network, nodes, query driven communication, quality of service, Round trip time, Packet Delivery Ratio*

I. INTRODUCTION

Wireless network is a type of network that uses wireless communication between the corresponding nodes within the network[1]. Wireless provides increase in the ability to move, improved response to the user request, easier to expand the network, better access to required info and increased guest user experience but it also suffers from various challenging areas that need to be focused while working on a wireless system[1]. These challenging areas can be security of confidential data, coverage area of the nodes within the network, networking issues, power consumption and energy required by the nodes[1].

The networking problem includes mobility[1], traffic[2], performance, data rate, signal fading and quality of service[4]. Development of microelectronics presents various new applications requiring low end to end connection delay and high reliability within wireless sensor networks which interact the various researchers of the scientific community. To fulfill these conditions for the applications a query driven communication model is used where each nodes sends a query to the network sink and wait for the response for that particular query[4]. Providing quality of support becomes necessary specially for medium and high traffic load because the applications depending on this model has become very popular within last few years.

There are various network issues within wireless network and the most frequently occurring issue within WSN is congestion which will cause packet loss and thereby reduces throughput and energy efficiency[4]. A handover algorithm is used over query driven communication model which will recover the deficiency within the performance and QoS by dealing with the redundancy for multiple channels.

WSN attracts researchers due to its potential use within wide variety of applications[5]. The major issue occurring within WSN is congestion at the network sink which causes packet loss and reduce the energy efficiency and throughput. Hence there is a need to control congestion in order to improve quality of service, increase battery lifetime and higher energy efficiency.

Wireless sensor network are utilised within various applications like tracking of some target located at some distance and automatically monitoring the present environmental conditions which require availability of sensors that are smaller, cheaper and intelligent. These sensors are equipped with wireless interfaces in order to communicate with each other forming a network[5]. This work aims to present an inclusive review for various network problems and to reduce the congestion problem in order to improve QoS within the system[4].

The main concept within a query driven model is the communication within the nodes and the network sink were communication takes place through queries and respective responses[4]. Nodes sends some queries to the network sink and waits for the respective response for that particular query within smallest time frame. Round trip time and packet delivery ratio[6] are the two main parameters for analyzing the performance of the algorithm besides that average delay and message drop is also taken into consideration. Handover is performed to improve QoS by reducing congestion at network sink.

Wireless sensor networks are made of tiny nodes having inbuilt memory, batteries, processor and wireless transceiver. These nodes can be deployed either according to a proper infrastructure model or randomly within an area and then automatically adjust themselves to form a network that support queries from an end user outside of the networking area[7].

Nodes are having fixed processing power, memory space, capacity of battery and speed for the communication. Preserving capacity of the battery is more necessary than upgrading performance metrics due to which most wired network algorithms becomes infeasible for WSN. Designing WSN completely depends on the requirement of the application but it should also consider some general but yet important factors like objective of the application design, cost for designing, hardware and other system limitations[5].

Various medium access algorithms enables nodes to share common wireless medium in order to transfer data more efficiently. Since hardware evolvement in WSN and applications are also growing there is a need to develop algorithms providing higher data rate[9]. Quality of service provisioning in WSN interacts various researchers within scientific community as the new applications of microelectronics require less end to end delay within communication link and higher reliability[4].

II. QUERY DRIVEN APPROACH WITH HANDOVER IN EXISTING SYSTEM

The major issue occurring within WSN is congested network problem which leads to the loss of the packets during transmission and thereby reduces the overall performance of the network[7]. Hence congestion within wireless sensor networks requires proper attention in order to improve the network performance and QoS. The scenario of query driven model is like that every node within the network will send query to the network sink and waits for some response regarding that particular query that must arrive within the possible smallest time frame[4]. The main parameters to consider within the designing of system is RTT and PDR which ensures the reliability of the system[6].

A handover algorithm is used to improve the performance of the system by dealing with the congested network specially at the network sink[4]. Congested network causes loss of the packets being transmitted and thereby reduces the overall performance of the system in terms of throughput and energy required during the transmission. To maintain and improve the performance of the system some protocols must be used to prevent a highly congested scenario within the network[4].

System uses a handover algorithm is used to improve the decreased performance of the network by providing redundancy at multiple channels[4]. Flow charts in figure 1 and figure 2 shows the working of query driven communication (QDC) model ideally as well as using two way communication.

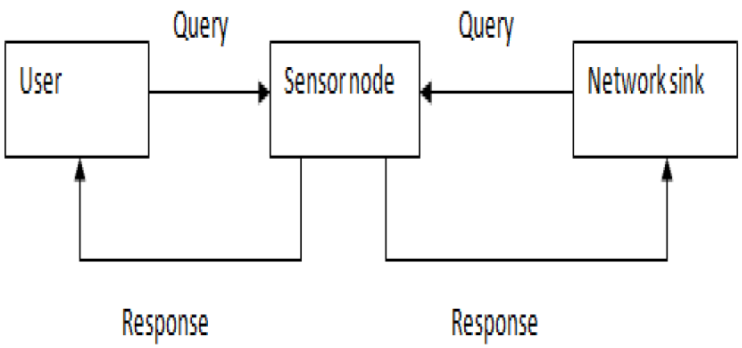


figure 1. ideal query driven model

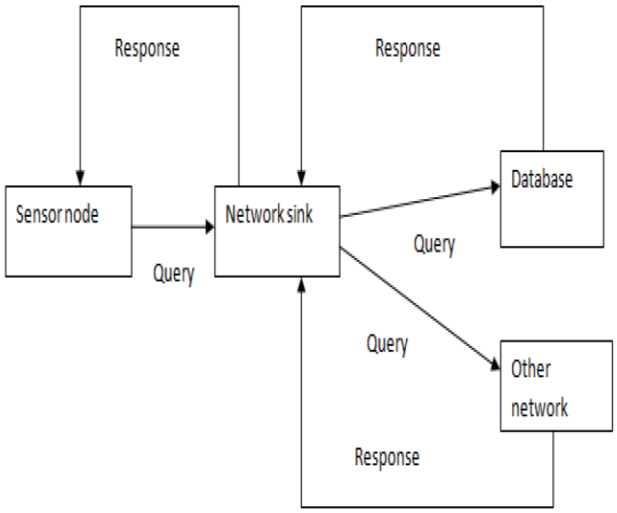
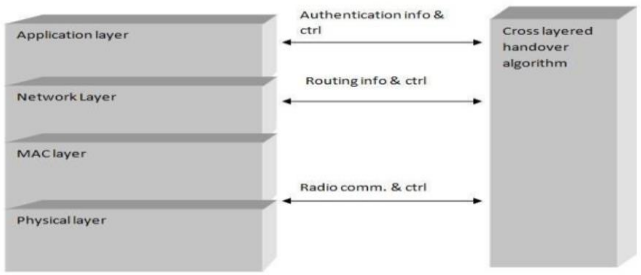


figure 2. two way qdc model

Figure 3 shows the cross layered handover approach being used at various layers of a wireless system. As the figure 3 shows this handover algorithm works jointly on physical as well as on the MAC layer to deal with congestion hence it is called as cross layered handover algorithm. At the physical layer a shared medium is used by various access points that can result into congestion. MAC layer deals with the congestion at the network sink as all the nodes within network transmits there query to network sink and accept a response from the sink which can result to a bottleneck at the sink.



f igure 3. handover scenario at various layer

Figure 4 below shows the flow of Query driven approach with handover at physical and MAC layer. Here the coordinator will send some query to the wireless node and waits for the response. If the confirmation in response of the query is received by the coordinator then there is no need to perform handover in this scenario else a dynamic search of the neighboring node is done to accomplish the task if that node is found connected then data will be send otherwise the dynamic search will be continued for the neighboring nodes.

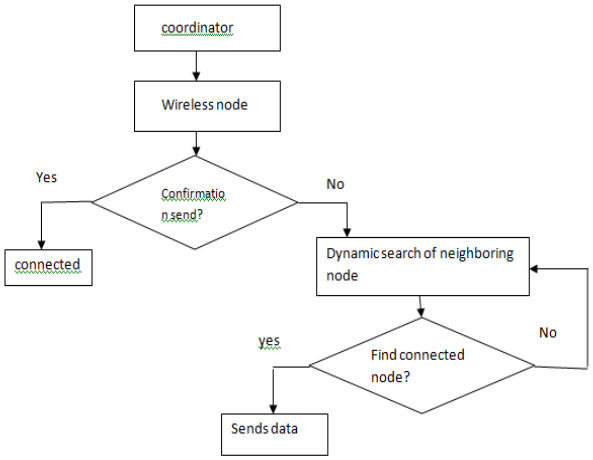


figure 4. physical and mac layer flow diagram

Figure 5 shows the flow of the algorithm at application layer where a coordinator sends some query to the database and waits for the response of respective query. If the response came within a particular time frame then there is no need to perform handover else the data will be retransmitted. This retransmission will occur N times were N is the number of nodes within the network and even after completion of N retransmissions coordinator not able to get any response then handover will be performed. A dynamic search is performed within the neighboring network descending to the lowest layer of the system.

The main limitation of this system is that under very high load this algorithm[4] won't perform well in comparison with the conventional wireless sensor network as the value of Round trip time is increased slightly under that scenario. The increased value of RTT will also increase the energy consumption and the execution cost of the algorithm within very high load scenario hence this problem cant ne ignored if dealing with the highly loaded network. This problem is taken as the basis for the proposed work were the solution is searched to decrease the increased slight increase in RTT at high traffic load. The work is done to reduce the number of retransmissions within existing algorithm by providing some conditions for the retransmissions so that the algorithm don't perform retransmission to all the nodes but only to a specified number of nodes which fulfill the condition hence the extra time consumed can be controlled to some extent using this proposal.

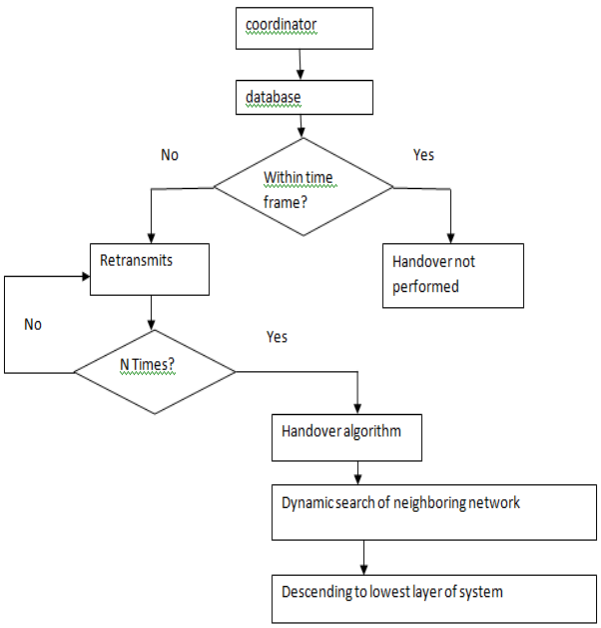


figure 5. application layer flow diagram

III. QUERY DRIVEN APPROACH WITH HANDOVER IN PROPOSED SYSTEM

In proposed work we are dealing with the inefficiency of the algorithm in a high load scenario and to overcome this inefficiency we are working to reduce the extra time consumed in retransmission of data to each node within the network if the first trial to send query to particular node gets failed.

Before performing handover the existing algorithm retransmit the data to all the existing nodes within coverage at that particular time which requires extra time to compute and thereby result in delay and increased computational cost.A query driven WSN is used where each node sends a query to the network sink and waits for the response regarding that particular query within a fixed smallest possible time frame.

Then handover is performed to improve the decreased performance and QoS it will consider the problem of congestion on MAC layer as well as on the physical layer because there also a single medium is shared by various nodes and hence can make the scenario of congested transmission environment. This proposal aims to provide better QoS even when the load on network is high and it will also share the load on several nodes within the coverage area at that particular point of time.

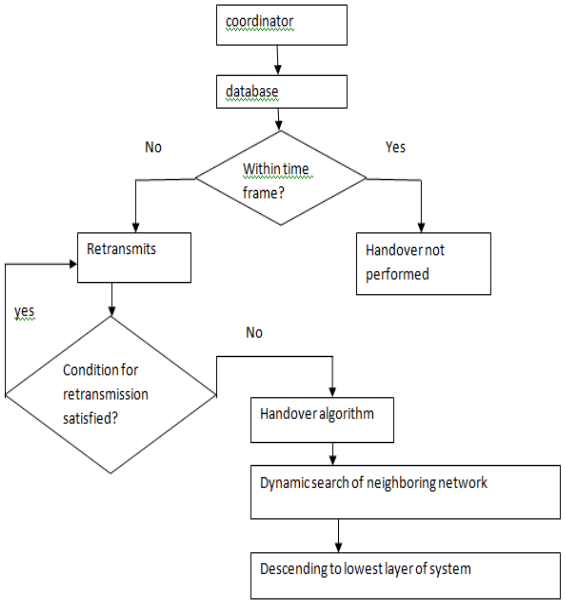


figure 6. flow diagram for the proposed approach

Figure 6 here shows the flow for the proposed system where the condition is provided regarding retransmission of the data when the response for the query of coordinator from the database is not received within the time frame. If the condition is not satisfied then directly handover will be performed with no further retransmissions. This approach will reduce the number of retransmissions which will thereby reduce the traffic load over the system and the time consumed to run the algorithm.

IV. IMPLEMENTATION ENVIRONMENT

Network simulator is an event simulator which aims at networking research. Network simulator provides support for the simulation within wired and wireless networks for TCP, routing and various multicast protocols. In 1989 Ns start as a variant of REAL network simulator and improved considerably over last few years. Network simulator always includes contributions from other researchers.

Similar functionalities within ns1 and ns2:

- One way TCP without synchronization packet.

- Two way TCP including synchronization packet and transmission from

  both ends.

- Techniques for managing storage and retrieval of data from Queue
- Self motivated routing algorithms.
- Manger for managing the flow of data from source to destination.

Advance functionalities of ns2:

- Routing through multiple paths from source to destination.
- Protocols for real time scenario.
- Algorithm to schedule the process for execution.
- " Centralized multicast " to speedup large scale simulations.
- Supporting mobile hosts within a network.
- Some casual bug fixing like TCP transmit timer behavior.

Running ns1 modules on ns2 :

Ns1 modules can run on ns2 without any fault but the vice versa have some constraints[14]:

- Use of ns-1 flow manager.
- Global changes required to override the default parameters.
- Order of sending packets at same virtual time may be different

Languages used:

- C++

C++ languages are free form, general purpose, compiled and platform independent language. It is an intermediate language because it contains both high level and low level language. C++ is based on object oriented programming where the key element to work with is object. It deals with the element to be processed not the procedure to be followed for execution of the code.

- OTcl

OTcl is the extension of tool command language with object oriented features. It is the language used in network simulator2 and mostly it runs under UNIX environment. OTcL also referred to the unrelated IXI object Tcl extension by Dean Shenaan. It is then further referred as the XOTcl which is an object oriented scripting language.

V. IMPLEMENTATION MODULES

Module1: Create a wireless sensor network topology

Create a simulation environment on WSN topology with more no. of nodes to implement DSR(Dynamic Source Routing) protocol to transmit message from source to destination.

Implementation : TCL, C++

Module2: Implementation of Query driven communication model

Create a simulation environment on WSN topology with more no. of nodes and implement QDC model, QoS decreases when the load on the network get increased because of the congested network. PDR, RTT, Average delay, Message drops are measured for QDC model and outputs are shown using graphs

Implementation : TCL, C++, AWK, Xgraph

Module3: Implementation of handover algorithm

Create a simulation environment on WSN topology with more no. of nodes and implement handover algorithm over QDC model based on

a) Service differentiation

b) Routing (we need to focus only on congestion)

c) congestion to transmit message from source to destination

PDR, RTT, Average delay, Message drops are measured for handover algorithm over QDC model and outputs are shown using graphs.
Implementation : TCL, C++, AWK, Xgraph

Module4: Result analysis

Compare QDC model with and without handover algorithm using the measured parameter and outputs are shown using graph

Implementation : Xgraph

Module5: Proposed work

Extra time can be reduced by reducing the no. of retransmissions to all the nodes within network by providing some conditions such that it should check only limited number of nodes and thereby consume less time for overall computation. Comparison of QDC without handover, QDC with handover and performance after reduced retransmission is done through RTT, PDR, Average Delay and Message Drops.

Implementation : TCL, C++, AWK, Xgraph

VI. IMPLEMENTATION RESULTS

Result is measured while using 40 nodes within the network Graph shown in figure 7 compares the average delay while using the 3 methods. Light green color line shows average delay in query driven without handover, red color points average delay using query driven with handover and the last blue color depicts the average delay after reduced retransmission(proposed work).

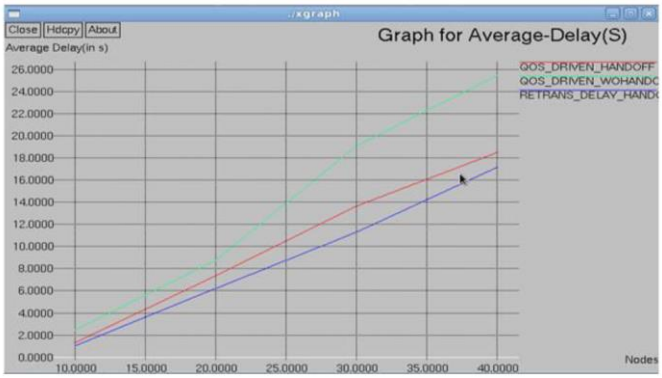


figure 7 comparison graph for average delay

Graph shown in figure8 compares the packet delivery ratio while using the 3 methods. Light green color line shows PDR in query driven without handover, red color points PDR using query driven with handover and the last blue color depicts the PDR after reduced retransmission.

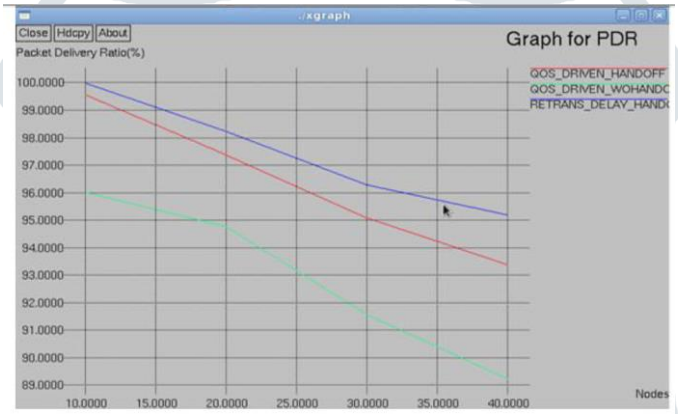


figure 8 comparison graph for pdr

Graph shown in figure9 compares the percentage of message drops occurred while using the 3 methods. Light green color line shows the message drop in query driven without handover, red color points percentage message drop using query driven with handover and the last blue color depicts the message drops after reduced retransmission(proposed work).

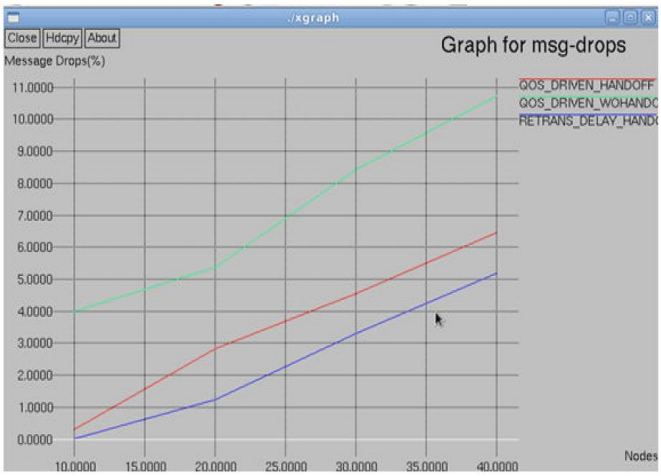


figure 9. comparison graph for message drops

Graph shown in figure 10 compares the round trip time while using the 3 methods. Round trip time is the sum of time required to send a query to the sink, time required to process the query and the time required to send the response back to the source node. Light green color line shows RTT in query driven without handover, red color points RTT using query driven with handover and the last blue color depicts the RTT after reduced retransmission.

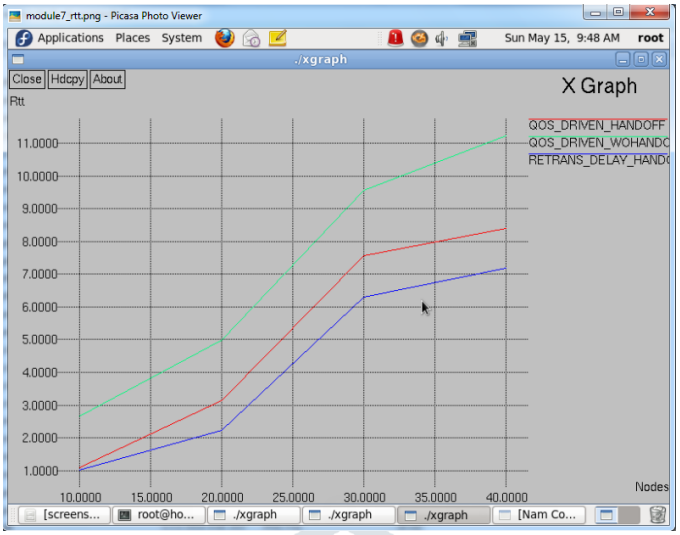


figure 10. comparison graph for rtt

VII. CONCLUSION

A handover algorithm is performed over QDC model to improve the decreased performance the QoS in WSN by dealing with the scenario of congested network specially at the network sink by using redundancy at multiple channel. To deal with the problems occurring with existing algorithm in terms of RTT at high traffic load a criteria is introduced which will reduce the extra time consumed for retransmissions to various nodes and hence thereby improves the QoS and network performance under very high traffic load scenario measured through round trip time, packet delivery ratio, Average delay and message drops.

REFERENCES

[1] Aniruddha , Abhishek , Pankaj Kumar. “Research Issues and Challenges of Wireless Networks. “ International Journal of Advanced Research in Computer Science and Software Engineering (IJARCSSE),2014, IJARCSSE

[2] Azuma, Nobuhiro, et al. "Communication characteristic-aware signaling traffic optimization method for mobile networks." Wireless Communications and Networking Conference (WCNC), 2015 IEEE. IEEE, 2015.

[3] Al Sabbagh, Abdallah, et al. "Optimization of the OpenFlow controller in wireless environments for enhancing mobility." Local Computer Networks Workshops (LCN Workshops), 2013 IEEE 38th Conference on. IEEE, 2013.

[4] Žagar, Drago, and Goran Horvat. "Improving QoS in Query-Driven WSN Using a Cross-Layered Handover Algorithm." 4th Mediterranean Conference on Embedded Computing. MECO 2013/Stojanovic, R. et al (ur.).. Hrvatska znanstvena bibliografija I MZOS-Svibor, 2015.

[5] J. Yick, B. Mukherjee, D. Ghosal, “Wireless sensor network survey”, Computer Networks, Vol. 52, Issue 12, pp. 2292-2330, 22 August 2008.

[6] C. E. M. Aykut Yigitel, O. Durmaz Incel, “Qos-aware mac protocols for wireless sensor networks: A survey,” Computer Networks, vol. 55, no. 8, pp. 1982 – 2004, 2011.

[7] Kaushik, Sunil Kumar, Ruchil Aggarwal, and Rakesh Sharma. "QoS Aware Routing Scheme Based on Traffic Priority for Wireless Sensor Networks." Computing Sciences (ICCS), 2012 International Conference on. IEEE, 2012.

[8] Žagar, Drago, and Goran Horvat. "On the Topic of RTT and Delivery Ratio in Query Driven Wireless Sensor Networks." 2015 IEEE Sensors Applications Symposium. Hrvatska znanstvena bibliografija i MZOS-Svibor, 2015.

[9] Hossain, Md Kowsar, Suprakash Datta, and Jeff Edmonds. "Ad-ATMA: An Efficient MAC protocol for Wireless Sensor and Ad Hoc Networks." Procedia Computer Science 52 (2015): 484-491.

[10] Dagar, Mousam, and Shilpa Mahajan. "Data aggregation in wireless sensor network: a survey." International Journal of Information and Computation Technology. ISSN (2013): 0974-2239.

[11] Tripathi, Ankit, Sanjeev Gupta, and Bharti Chourasiya. "Survey on data aggregation techniques for wireless sensor networks." International Journal of Advanced Research in Computer and Communication Engineering 3.7 (2014).