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Title of Project : **Design and Implementation of a communicating method for WSN**

Abstract

The sensor nodes present in the wireless sensor networks are constrained of energy as they are powered with the help of battery. Deployment of the sensor nodes in the hostile environment makes it unfavorable for the people to change the battery of the senor nodes when it is expired. Due to the energy limitations there is a great need of providing any energy efficient way of communication for the wireless sensor networks. Several techniques of offering communications in a sensor network use the classical layered method that results in great overhead of the network and high energy consumption. It will be very better when a unified technique is present for converting the functions of common protocol to the cross layer method. A cross layer protocol is been implemented in this project to provide congestion control, better routing over the cross layers. This cross layer protocol is designed based on the initiative determination present in cross layer module. This method offers congestion control forwarding based on initiatives contention based on receivers and better communication between the sensor nodes of a wireless sensor network. The implementation of this initiative determination is very easy as it just involves the comparison with the threshold values. Through this cross layer protocol the functions of each layer can be combined very easily .The performance of this cross layer protocol is also identified in this project. Through this cross layer protocol better communications can be provided between the sensor nodes of a wireless sensor networks and also is far better than the classic layered protocols with respect to the energy consumption and network performance.

Acknowledgement

I would like to express my special thanks of gratitude to my supervisor and the management who gave me this golden opportunity to do this wonderful project on the topic "Design and implementation of a communication method for WSN", which also helped me in doing a lot of research and I came to know about so many new things . I am really thankful to them. **Dr. Vitaly Schetinin** who has given me great support in order to learn, organise, understand and bring out the best in me. 'Without great guru's there are never great students!', similarly **Dr. Vitaly Schetinin** has shown interest on me to make me establish myself on a strong basis. On closure of this course in the **University of Bedfordshire**, I would want to convey my hearty thanks to this person who has guided me through this to the right track and has made me come out with flying colours.

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My best wishes and thank you all once again.
Nazeer Basha Shaik Khadar Basha.
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Chapter 1 Introduction

1.1 Introduction

The wireless sensor networks which have gained huge importance these days are actually event based networks which continuously sense the surroundings in order to collect the required information. The main aim of this network is to extract the event features based on the information that is collected by the sensor nodes with less energy and storage abilities. On the other hand huge research has been taking place to develop several networking protocols in order to provide better communication in energy efficiency manner. Most of the protocols that are developed are based on a particular layer like network layer, physical layer, transport layer and medium access layer. Even though these protocols can offer higher performance matrix with respect to that particular layer, they are not better to improve the overall performance of the network and also to minimize the energy consumption. Based on these energy restrictions and processing capabilities of these sensor networks cross layer design that combines all the layers is considered as the best solution for the wireless sensor networks. Research also specifies that the protocol design based on this cross layer approach can provide an energy efficient way of communication in a wireless sensor network. This research also resulted in providing various solutions based on the interactions present in the cross layer approach (Lalit and Mohan, 2009). However there is a lack of particle implementation of this communication protocol in a wireless sensor network and the performance of this cross layer protocol is not partially verified. Hence it can be stated that there is a need of an efficient way of unifying the functions of all the protocol layers so as to offer efficient communication between the nodes of a wireless sensor network.

Huge research is been taking place in this field in order to develop an better networking protocol for providing better communication in the sensor networks through high energy efficiency. In this project a concept called initiative determination is considered and it is applied for the cross layer operations in order to provide congestion control, distributed routing, medium access control etc. Using this initiative determination method any node present in the wireless sensor network can decide whether to take part in the communication depending on several aspects like energy level, link quality, buffer level, location and the traffic load. All these parameters are

integrated and provided in a particular decision that a node has to provide weather is willing or not willing to participant in a particular communication. Based on this concept cross layer protocol is implemented in this project to provide a better communication between the sensor nodes of a wireless sensor networks in an energy efficient manner. This simulation for this cross layer protocol is done on a wireless sensor network that is simulated using a real simulator which is also known as a network simulator. From the simulation it can be known that cross layer protocol provides better communication methods and also improves the network performance when compared to the other existing protocols. The implementation of this initiative determination is very easy as it doesn't involve any complex operations and also provides an energy efficient way of communication (Jiang and Yang, 2012).

1.2 Problem Statement

The wireless sensor networks are regarded as a collection of various sensor nodes. These sensor nodes are aimed in collecting the information from the surrounding environment. The main aim of these networks is to detect the accurate events from the group of information given by the sensor nodes with respect to their restrictions in memory, processing and energy. Providing an efficient communication method has become challenging issues because of these constraints of the sensor nodes. A traditional layered protocol approach is being used in the existing system for providing communication in sensor networks. This exiting system suffers from several limitations related to overhead and the congestion of traffic.

1.3 Proposed System

- In the proposed system cross layer protocol (XLP) is being used which combines the functions all the layers into a single cross layer protocol.

- The advantages of this cross layer protocol are routing, congestion control and the medium access control.

1.4 Aim and Objectives

The aim of the project is to provide reliable communication method for the wireless sensor networks through cross layer protocol (XLP).

Objectives:

1. To perform research and to gather all the requirements of the project in a better manner.
2. To complete the literature review of the project based on the research conducted.
3. To design this cross layer protocol for the sensor networks.
4. To implement this cross layer protocol in the sensor networks java language.
5. To check the performance of the system using network simulator 2.0 software.

Chapter 2: Literature Review

2.1 Introduction

The wireless sensor networks have been clearly characterized as one of the best event based systems in the present scenario. The primary intention of these said networks is to perfectly identity the precise events from the group of data or information that is largely given through the sensor nodes with respect to their own limitation in energy, processing and memory. In this particular field, several research studies are conducted in order to perfectly develop an efficient and better protocol of networking for largely providing communication that is very better in the sensor networks that is very close to high energy efficiency. In the existing system, an approach of conventional layered protocol is being utilized for offering better communication in sensor networks. Currently in existence system be subjected to many limitation associated to the congestion of traffic and to overhead.

In the suggested system cross layer protocol (XLP), the state or fact of existing utilized this perfectly combines all types of functions plus all the given layers into a single cross layer protocol. It is to be highly noted that the demerits of this cross layer protocol are the medium access control, congestion control and routing control. The main goal of this particular project is to perfectly offer better and energy efficient communication method, through cross layer protocol (XLP) for the wireless sensor networks. Using network simulator software, steps are taken to perfectly implement the said cross layer protocol in the given sensor networks. On the other hand, the cross protocol for the sensor networks layer is perfectly well-designed for right kind of implementation. All the necessary information or data are gathered in a better manner in order to make the communication network in the given platform in a better nature for over all development and improvement. Moreover, there is a need for several measures to be taken in this particular field.

2.2 Wireless Sensor Networks

One of the best inventions in the present scenario is wireless sensor networks. It consists of small size, low power and light-weight of sensor nodes. During the initial phase of the utilization of wireless sensor network, it was given prime importance in the military department. It was used for the exchange of confidential information or data from the base stations to the soldiers deployed in the battleground, for the administration and control of the military department, for passing the information to a base station that is located in the remote area etc. Later, wireless sensor networks were slowly and steadily used in the various areas of applications in the commercial sector, environmental sector, healthcare and civil department (Lee, Keshavarziaa, Venkatraman, 2006). The best example of applications includes energy management, forest fire detection, surveillance, inventory control, reconnaissance and so on. It is to be noted that mainly due to these nodes are available in the low-cost, the deployment can be successful in order of perfect magnitude of thousands to ten million nodes in a given situation or environment. The said nodes can be successfully deployed either in a pre-engineered way or in random fashion way. Over a wireless channel, the sensor nodes performs successfully as per the desired measurements, perfectly process the measured information or data and then correctly transmit it a given base station, usually referred to as the sink node. The base station gathers the information or data from all the given nodes and then successfully analyzes this given information or data in order to draw the desired conclusion regarding the functions and activities in the given area of interest. It is to be remembered that sinks can also acts as a perfect gateways to other given networks, access points for human interface or a powerful data process. They are frequently utilized in order to extract information or data from the network or to disseminate control information or data (Iyengar et al, 2004).

2.2.1 Quality of service (QoS) parameters in WSN

It is to be noted that for low power wireless communication, in the present scenario, one of the cutting edge technology is wireless sensor network. It is to be highly remembered that a new vision for WSN has collectively set the pervasive computing technique or method, adhoc network protocols, the perfect development of distributed signal processing and the fast paced advancement and development of low power wireless communication devices. In order to gather information or data that is based on application domains, several number of sensor nodes are perfectly deployed successfully in majority of WSN applications. On the other hand, this particular data or information collection activity can be query based, event driven and continuous too. WSN can be successfully deployed in many applications and domains like security, home automation, industrial control, military surveillance, healthcare, wild life monitoring, agriculture and environmental sensing, etc (Erosy, Demirkol and Alagoz, 2006).

Quality of Service (QoS) in general largely refers to perfect quality as perceived by the application and the user. It is to be highly noted that from various perspectives, Qos assistance in WSNs is an open area of research studies. On the other hand, QoS is largely understood by several technical communities through different manners. Among the community of networking, QoS is well understood as a measure or step of service quality which said network provides to the given application or to the end user. According to the experts in this particular field, QoS has been perfectly well-defined as a unit of different types of service requirements in order to be fulfilled when successfully transmitting a given stream of packets from the said source to the given destination. It is to be highly noted that QoS cites certain parameters in the traditional data network like bandwidth, jitter, delay, packet loss, etc. The other requirements of QoS in WSNs like network lifetime, fault tolerance, coverage, aggregation delay, data accuracy, etc. On the other hand, the said network is totally different from the given traditional end-to-end QoS immediate requirements mainly due to the differences in network properties and in the application domains (Melodia, Akyldiz and Chowdhury, 2007).

QoS solutions are well-developed for the said traditional networks; these can be ported successfully in WSNs mainly due to several reasons such as data-centric and application specific

communication protocols in wireless sensor networks, random and large scale deployment of sensor nodes and constraints of severe resource in sensor nodes. It is to be highly noted that researchers and experts in this particular field are working with committed and dedication to find means for QoS perfect support in wireless sensor networks. The most important kinds of approaches for QoS support in WSNs are Middleware layer based QoS support; Cross Layer based QoS support and Network Layer that is largely based on QoS support in terms of routing (Langendeon, 2008).

2.3 Routing protocols in WSN

It is to be highly remembered that the routing algorithms design space for wireless sensor networks is really quite large. In many different ways, the classification of the routing algorithms for WSNs can be successfully done. They are QoS based routing protocols and location-aware (geo-centric) or data-centric and node centric. It is to be highly noted that most of the Ad-hoc network routing protocols are basically node-centric protocols in any given situation or environment where destination are clearly defined based on the identifiers or numerical addresses of nodes. On the other hand, In WSNs, in any given situation or environment, node-centric communication isn't a usually anticipated communication type. So the routing protocols that are perfectly designed for WSNs are geo- centric or data-centric to a large extent (Sivalingam and Naik, 2004).

The sinks perfectly send all types of queries to certain specified area and largely wait for information or data from the sensors that are rightly located in the chosen in preference to other regions. On account of data or information being rightly requested through the method of queries, impute that is based naming is required in order to specify the correct properties of information or data. In any given situation or environment, data or information is commonly transmitted from each and every sensor node that is largely within the deployment area with significant superfluousness. In certain given location or area aware routing nodes perfectly know where they are in a said geographical area or region. On the other hand, location data or information can be rightly utilized in order to improve the better performance of routing and to rightly offer advanced kinds of services (Deshpande and Kanagal, 2008).

In QoS based routing protocols primarily considers energy consumption, latency and data delivery ratio. In order to get a better Quality of Service, the said routing protocols should largely posses less energy consumption, less latency and more delivery ratio. It is to be also noted that Routing protocols also can be perfectly classified largely based on whether they are proactive or reactive. A proactive protocol establishes routing paths and cites much before that there is a great demand for routing traffic (Petrioli et al, 2005). It is to be remembered that certain paths are perfectly maintained even in a given situation or environment where there isn't any traffic flow at that particular time. On the other hand, in reactive routing protocol, actions of routing are put in motion when there is information or data that need to be successfully sent and later circularized to other given nodes. It is to be highly remembered that in this routing method, paths are established on demand in a given situation and environment hen all types of queries are perfectly initiated.

The classification of routing protocols can also be done based on whether they are source-initiated (Src-initiated) or destination-initiated (Dst-initiated). Other classification of routing protocols is Flat routing protocols and hierarchical routing protocol (Heidemann and Ye, 2004).

2.4 Importance of better communication method in WSN

Wireless sensor networks play an essential role in the modern methods of communication. It is one of the most better and efficient technique or method of perfect communication in any given situation or environment to a large extent. In this fast paced life style of personal and professional situation or environment, WSNs plays a significant role in the perfect development and advancement of better communication standards. It is to be highly noted that all the tools and implemented techniques should perfectly co-ordinate and co-operate for the exchange of all types of information or data. In case if any of the tools and implemented techniques doesn't function properly or are inactive in a given situation or environment then the exchange of information will be hampered to a large extent and may cause several difficulties of temporary or permanent nature to a great extent. There are many situations in the personal and professional life that WSNs are used for several reasons, if there isn't any better communication method

adopted in the WSNs then it will prove to be a total failure for the exchange of information or data to large extent (Madden and Tulone, 2006).

For example, WSNs is utilized in the military department usually for their daily administration and control and largely utilized in serious situation in the war front or battle fields. A lot of confidential or secretive information or data are exchanged among the troops and between the base stations and troops on the ground, air or water in the entire given situation or environment. Better communication is part and parcel of all types of activities and function in the military department. There is a large need to improve and advance the tools and techniques implemented in the methods of better communication in WSNs. There is also a greater need to find the loopholes and negative aspects in the better communication in WSNs so that steps or measures can be taken to improve or advance the areas that really need to be looked upon for improvement and advancement with perfection. On the other hand, WSNs is utilized in various other fields like healthcare, civil administration, media and entertainment sector etc. A better communication in WSNs is the need of the hour because exchange of information or data is directly or indirectly depended on WSNs. Several functions and activities also directly or indirectly are depended on the better communication in WSNs that is perfectly implemented. There is an immediate need for finding the best means to be perfectly implemented in WSN for better and better communication methods or techniques. Many departments of the government sectors, private sectors and commercial sectors are actively utilizing WSN in all the functions and activities within their given sector for better exchange of information or data that are confidential or secretive in nature (Mehrotra, Han and Venkatasubramanin, 2004).

2.5 Cross Layer Protocol (XLP) in WSN

In Wireless Sensor Networks (WSNs), many energy level constraints of sensors that are battery-powered sensor nodes largely demands better communication methods that need to be successfully implemented in the said networks. It is to be highly remembered that the majority of the presently existing best solutions are largely based on classical layered protocols approach that perfectly leads to important overhead. On the other hand, it is really efficient to have a perfectly unified scheme in the said network in order to blend all the usual protocol layer's practicalities into a cross-layer module. It is to be highly noted that a cross layer protocol (XLP)

is successfully introduced that perfectly achieves medium access control, congestion control and routing in a cross-layer fashion. It is to be remembered that on the cross-layer concept of initiative determination, the design principle of XLP is largely based that rightly enables all types of local congestion control, initiative-based forwarding, receiver-based contention and distributed duty cycle operation in order to realize reliable and efficient communication in WSNs. A simple comparison against thresholds is largely required for the initiative determination in the said networks and this is so easy to implement plus on the devices that are computationally impaired (Aghajan, Bahai and Skraba, 2004).

A cross layer protocol (XLP) is the initial protocol which perfectly integrates all type of functionalities of all the given layers from transport to PHY into a cross-layer protocol. In order to investigate the best performance of the cross layer protocol (XLP), a cross-layer analytical framework is appropriately developed. On the other hand, for performance evaluations, in a cross-layer simulation platform, cross-layer protocols and the state-of-the- art layered have been successfully implemented along with the cross layer protocol (XLP). In terms of both implementation complexity and network performance, XLP significantly improves the out performs the traditional layered protocol architectures and communication performance is a better manner.

In order to achieve reliable, better and efficient event communication in wireless sensor networks with just expenditure of minimum energy levels, a cross-layer protocol (XLP) is developed with much perfection to a large extent. On the other hand, in a cross-layer simulation platform, cross-layer protocol configurations and the state-of-the-art layered have been successfully implemented for all types of major and minor success in the mode of better and efficient communication methods and techniques (Shroff and Lin, 2006).

2.6 Cross Layer Protocol (XLP) Vs other protocols in WSN

In wireless sensor networks, the successful implementation of cross layer protocol (XLP) has given the status of safe and secured technique or method to the users to a large extent. It comes with all the steps and measures that are required for a perfect protocol in this particular field. This particular protocol comes with its best features or characteristic that is really unique and

best in this particular field. There are many advantages and certain disadvantages to the said protocol. The users take the best advantages of the positive aspects and don't bother much to the negative aspects of the said network and its protocol. On the other hand, other protocols in the WSN are QoS based routing protocols, reactive routing protocol, proactive routing protocol, flat routing protocols and hierarchical routing protocol. Each and every other said protocol in WSN has their identity. These protocols also have their own special features and characteristics that make them unique in this particular field to a great extent. On the other hand, Each and every other said protocol comes with certain advantages and disadvantages in this particular field (Akyildiz and Vuran, 2006).

In the initial phase of the wireless sensor network and its utilization, many research studies were carried out in order to make the exchange of communication in a better manner. In this effort, in the initial stage, many protocols were successfully implemented with lot of dedication and commitment in order to get the best results in the exchange of communication in a better and efficient manner. It is to be remembered that each and every other said protocol in WSN looked better only in their initial implementation phase only because later experts and technicians in this particular field felt directly or indirectly it's certain limitation. So they began to develop a protocol that can overcome the limitations and disadvantages of the other in the short run or long run in any given situation or environment. In the present scenario, experts and technicians in this particular field are realizing the comfort of better and efficient exchange of communication with the successful implementation of cross layer protocol (XLP). There are lot of advantages related to cross layer protocol (XLP) in this particular field and only certain limitation or disadvantages. According to the experts and technicians in this particular field, cross layer protocol (XLP) has been able to cover the expected level of satisfaction in this particular field to a great extent. Many research studies conducted based on the various aspects of cross layer protocol (XLP) has given desired results and feedbacks. The research studies also pointed out the short comings in the cross layer protocol (XLP) and suggested the areas of improvements in order to make this particular protocol as one of the best protocols in this particular field. There are also efforts made by the experts and technicians to understand and study regarding the various aspects of other types of protocols in the WSN to a great extent. These efforts are put together to find the rate of

advantages and certain limitations in each and every routing protocols that has been used from the past to the present phase (Vuran, Melodia and Pompili, 2006).

2.7 Summary

The technological improvement and advancement in the wireless communications and micro-electro-mechanical systems have largely motivated the perfect development of wireless sensor networks in the present scenario. A distinctive WSN is a perfect system that is event-driven that largely exploits the joint efforts of all the densely and successfully deployed sensor nodes in order to regularly notice all types of physical phenomenon and to reliably get sensory data or information to a great extent. In WSNs, one of the key challenges is regarding how to successfully achieve better or high transmission reliability even under certain level of constraints of given or limited hardware resources. It is to be noted that in WSN, transmission reliability is primarily influenced through multiple concurrent factors like energy exhaust, network congestion, link failure, channel error and so on.

At an acceptable level, it is largely required that all the different types of reliability mechanisms must perfectly maintain information or data with lot of perfection. In an intuitive manner, it is a multifaceted issue that largely corresponds to the different types of functionalities usually perfectly designed in order to be provided by different protocol layers such as even application layers, transport, network, medium access control (MAC), and physical. According to the experts and technicians in this particular field, the conventional layered protocols are perfectly developed individually and rightly optimized in order to obtain high performance in the appropriate terms of the metrics that is largely related to a certain networking layer. In this given situation or environment, it is quite impossible to directly or simply bring together the protocols that are belonging to different layers combined in order to maximize network performance overall while minimizing the expenditure on node energy.

Taking into consideration the different types of constraints related to hardware resources of sensor nodes, the cross-layer design was perfectly developed which largely exploits interactions and dependencies across layers in order to perfectly integrate multiple layers' functionalities into

a given unified communication framework to a great extent. It perfectly stands in order to achieve efficient and reliable communication method or technique in WSNs. Because of all these reasons, experts and technicians in this particular field focused their attention towards the cross-layer improvement and development of network protocols for WSNs. According to the experts and technicians in this particular field, the cross-layer design techniques result revealed that energy efficiency and significant improvements on network performance was achieved successfully in WSNs at the expected level of satisfaction without any type of limitations.

The main aim of a cross layer protocol (XLP) is to provide a better platform for the perfect exchange of information or data among the users to a large extent. The shortcomings or disadvantages of other protocols in the WSN were over come through the perfect implementation of a cross layer protocol (XLP). The experts and technicians in this particular field were quite happy on the results or feedbacks of the successful implementation of a cross layer protocol (XLP) in the WSNs mainly because its implementation really improved the rate of efficiency in the exchange of information or data in the wireless sensor network to a large extent with perfection and positive results or feedbacks in this particular field. There is also a need for making lot of improvement and advancement in this particular field.

Chapter 3 Software Requirements and Research Methodologies

3.1 Software Requirements

It is to be highly noted that in the information technology sector, tremendous fame is earned by Java from the day of its initial launch in the open market. It is to be highly remembered that it has the perfect features in order to successfully write a particular program immediately and it can be perfectly run it anywhere. The distinctiveness of this particular language is that it is perfectly well-designed and the programming characteristics have rapid ascension and wide acceptance.

Java has been at the beginning comprehended as a universal front end for the enterprise database. On the other hand, Java was chosen in preference to another as the programming language for network computers (NC). As per the white paper drafted by Sun Microsystems on Java language, cited that "Java is an object-oriented, very simple, distributed, robust, interpreted, architecture neutral, secure, dynamic, portable and multi threaded." In any given situation and environment, Java (TM) has merits of implication over other types of languages in this particular platform that really makes it apt perfectly for any kind of assignment concerned to programming.

On the other hand, there are several merits and only certain limitation associated with Java. The advantages related to this particular programming language are that it is really very easy to learn and much user friendly too. It largely allows for reusable code and perfectly develops programs of modular nature. At both the source level and binary level, it is a platform-independent. It is to be noted that Java is rightly designed to make simple the method of distributed computing with said capabilities of networking that are perfectly inherently within it. Moreover, it is absolutely secure in nature. It is to be remembered that within its design, the aspects of security is rightly bonded. It is reliable to large extent.

3.2 Artefact of the project

The main functionality of the sensor nodes present in the sensor network is to sense the information from surroundings and to communicate it with the other nodes. My artifact in this project is to design and implement a communication method for the sensor nodes of the sensor network. Through this designed communication method, the sensor nodes will be

communicating very easily with the other sensor nodes and can also minimize the data loss in the network.

3.3 Research Approach

Research is defined as the procedural way of investigating so as to collect the required data from various sources. The research should also be performed in a very systematic and sequential approach in order to minimize the time for collecting the data. Therefore the main aim of conducting the research is to gather the data itself and to acquire more knowledge. The approaches to conduct the research are two types. The first approach is the qualitative approach and the second approach is the quantitative approach. In this project the qualitative research methodology is used in order to collect the subjective and descriptive type of information. On the other hand collection of the data through this qualitative research approach is very easy when compared to the quantitative research approach. In this qualitative approach data collection can be done using different methods like interviews, focus groups, surveys etc. In this qualitative research method, a theoretical problem will be considered and the data regarding this theoretical problem will be gathered. This methodology also offers a high volume of information. Structured or semi-structured responses can be obtained from this qualitative research methodology (Kuada, 2012).

As theoretical data is collected in this approach, non-statistical methods are used for analyzing the data that is collected in the research. The reliability and the validity of the data that is collected in this research method are also very high when compared to the other methods. Data analysis and the data generalization will be done very easily using this theoretical data. As data collection and data generalization is easy using this qualitative approach, this approach is being selected for the project. Under the qualitative research the various qualities that are considered for this project are the type of communication, type of information transmitted over the communication and the energy efficient nature of the communication etc. Based on all these qualities the design of the communication method will be done for the wireless sensor network.

3.4 Methodology Used

A particular methodology has to be followed in order to develop particular software. The methodology that is used in this project is the agile methodology. This methodology specifies a list of steps that can be used for developing the project. Agile methodology is the technique that is selected in most of the projects. In contrast to the sequential execution, this agile methodology helps in executing all the stages in acyclic manner. This agile methodology came into existence in the year 1970 where the development of software is found to be difficult by using the other exiting methods like waterfall and spiral methodology. The different stages of the project life cycle are described as follows: (Rugg and Petre, 2009)

1. **Requirements gathering**

In this first stage requirements will be collected for developing particular software from the end users. These requirements will be identified based on the software functionality and the software structure. The collected requirements will then be analyzed.

2. **System design**

When the requirements are analyzed, the design of the system will be carried out. The system design will be presented using the unified modeling language diagrams.

3. **System implementation**

After designing the project, the coding part of the project will be carried out. In this coding part the programs will be written using the required software.

4. **Testing**

When the implementation is completed, the testing of the system will be carried out in this testing phase. Each implemented component will be tested and then will be integrated and finally tested. The main aim of the testing is to check if the developed system is according to the requirements.

5. **Risk analysis**

Risk analysis is another important part of the spiral methodology. In this risk analysis phase the risks that can occur in the project will be identified very easily and thereby the risks can be avoided very easily in the project. In this project the risk analysis will be used to identify the possible risks that can take place during the stage in implementing the better communication method for the wireless sensor networks.

3.5 Market Survey

An essential part of market research is market survey. In the open market, it enables to measure the preferences and feeling of the esteemed customers. Market survey largely varies in size, purpose and design. The piece of information or data derived from market survey is utilized by the organizations and companies in perfectly determining what type of products and services to be offered to the existing customers and potential customers in the open market plus how to successfully market them. There are some basic steps for market survey which largely helps in order to optimize the results. A market researcher should determine and perfectly define the nature, size and extent of the given market. Should largely determine what aspects of the given market will be investigated. Reach the customers who are ready to participate in the market survey. Choose a sample size from the given open market for market survey. Prepare a list of questions for the market survey and find the answers from the esteemed customers. Gather all the information and data from the esteemed customers and from all other available sources for getting a final feedback or results through the market survey. The derived results and feedback is treated like a valuable piece of information for all types of future decision making and future course of actions.

Chapter 4 Design of Artefact

4.1 Introduction

A better communication method is offered for the wireless sensor networks in this project. This communication method is based on the cross layer protocol. This protocol is been designed such that it contains four main modules like source node, destination node, coloring method and the convergent MAC. The functions of each of this module are explained clearly in this chapter. These operations are explained with the help of the relevant diagram called the unified modeling language diagrams.

4.2 Use Case diagram

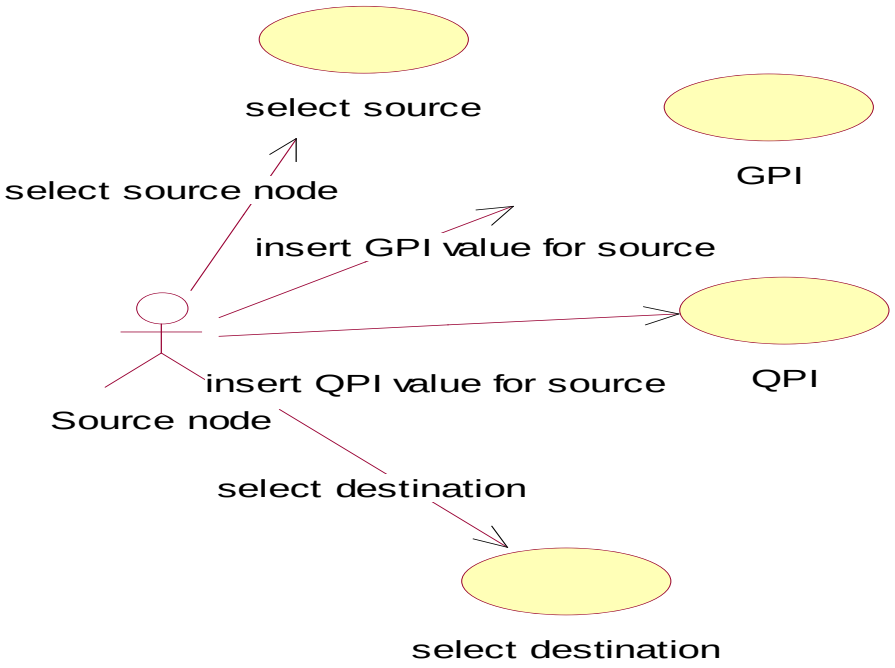


Figure 1. Use case Diagram for the Source Code

In the above Figure 1, the use case diagram for the source node is been displayed. Hence the only actor in this use case diagram is the source node. This source node consist of several functions like selecting destination, inserting the values of GPI and QPI for that selected node and all these functions are shown above.

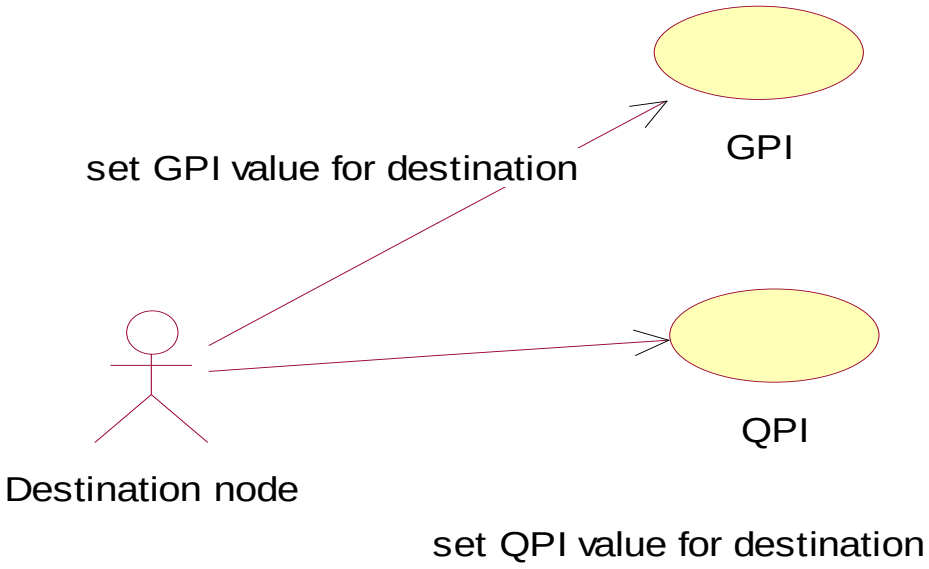


Figure 2. Use case Diagram for the destination Code

The use case diagrams of the destination node are shown clearly in the above Figure 2. This destination node which is the actor is having two main activities that are marked clearly in the above Figure 2.

Use Case Diagram for the Coloring Schema

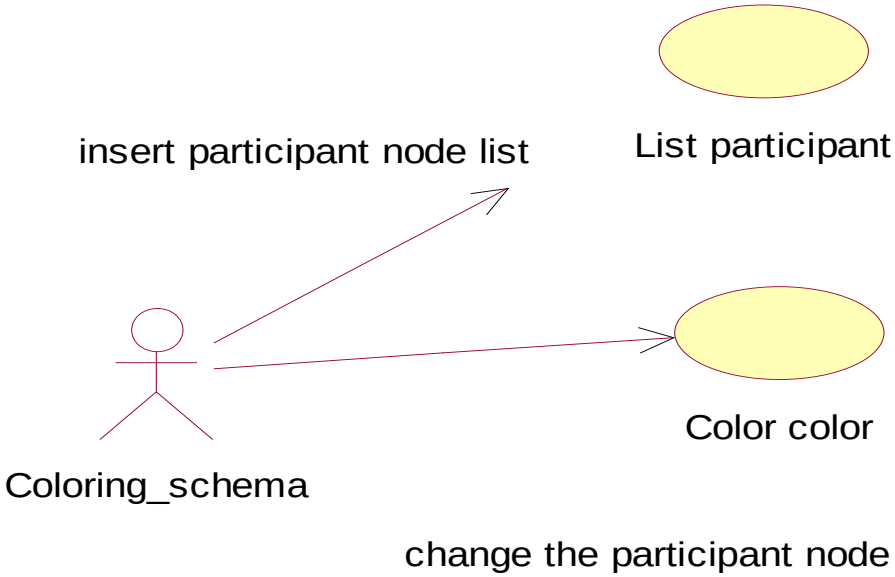


Figure 3. Use case Diagram for the coloring schema

The use case diagram for the coloring scheme is shown clearly in the above Figure 3. In this use case diagram the coloring schema has two main functions namely participant list, changing the color of eth participant node etc.

Use case diagram related to CMAC

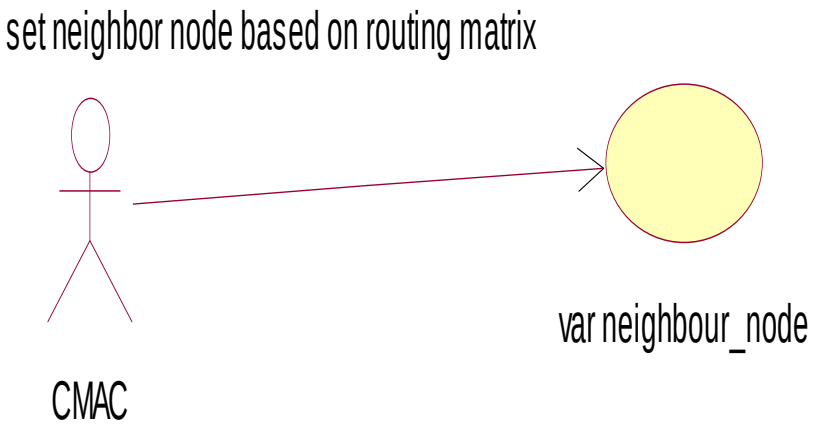


Figure 4. Use case Diagram related to CMAC

The use case diagram of the CMAC is shown clearly in the above use case diagram. This CMAC actor is consisting of only one use case that is shown clearly in the above Figure 4.

4.3 Sequence diagram for the source node

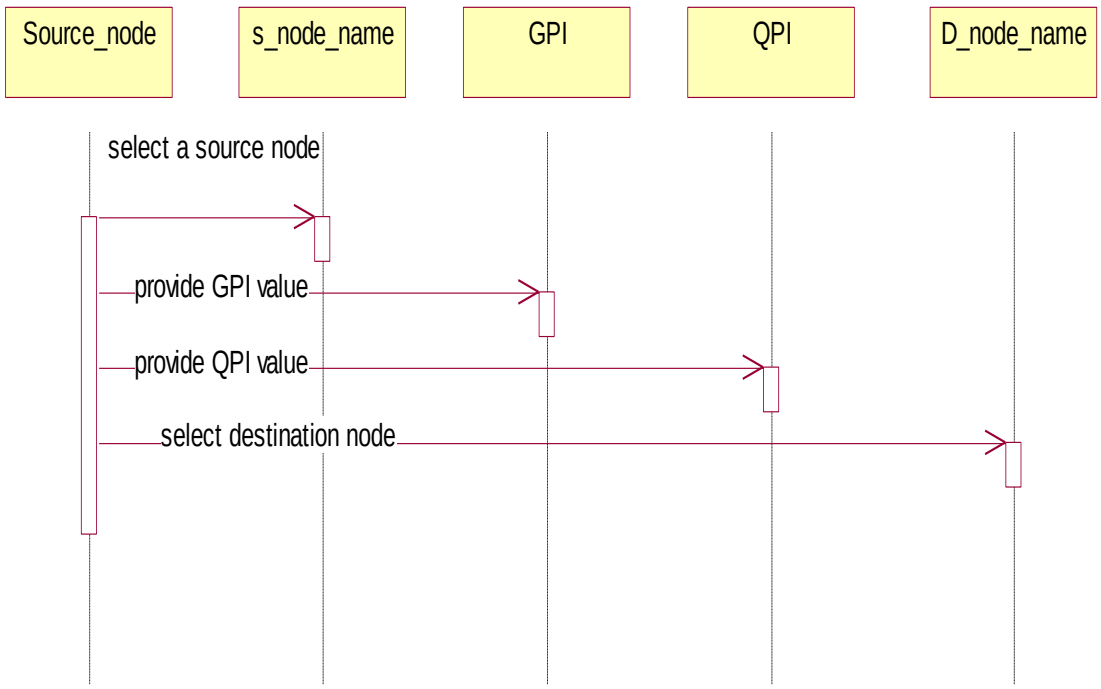


Figure 5. Sequence Diagram of the Source Code

The sequence diagram of the source node that is related in adding the values of GPI and CPI to the destination node is shown clearly in the above Figure 5. All the functions are explained in sequence in the above sequence diagram.

Sequence diagram for the destination node

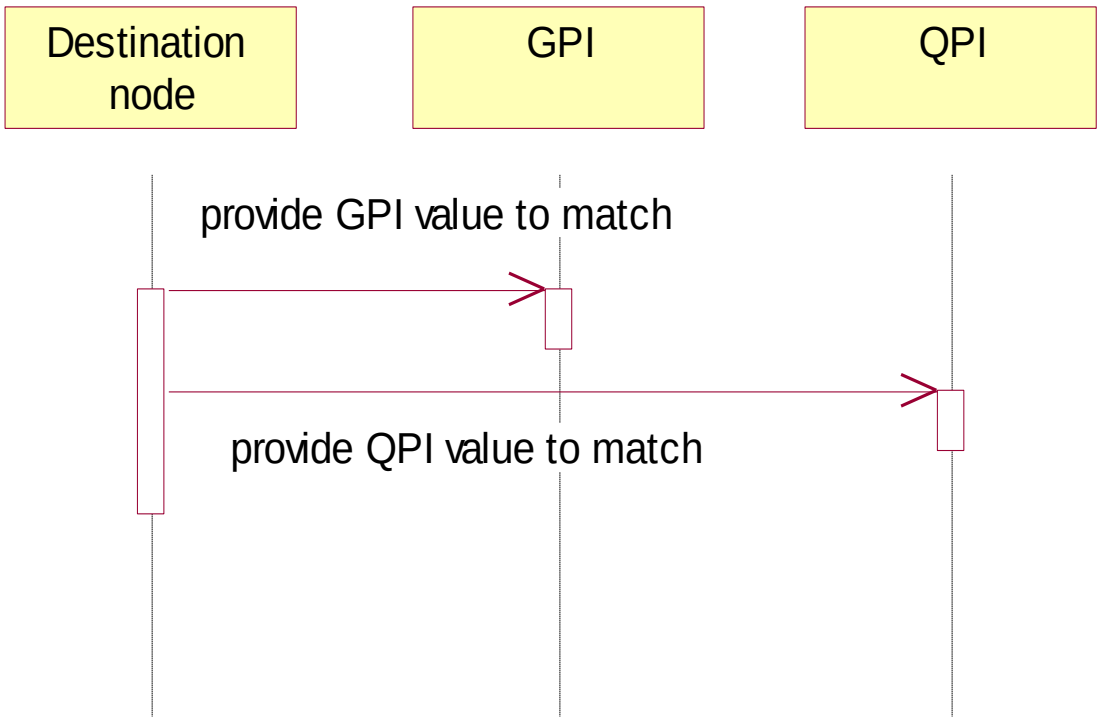


Figure 6. Sequence Diagram for the destination Code

The sequence diagram that is related to the destination node is shown clearly in the above Figure 6. Here the destination node has only two main functionalities which are the providing of GPI and the QPI to the destination nodes.

Sequence diagram in varying the node color

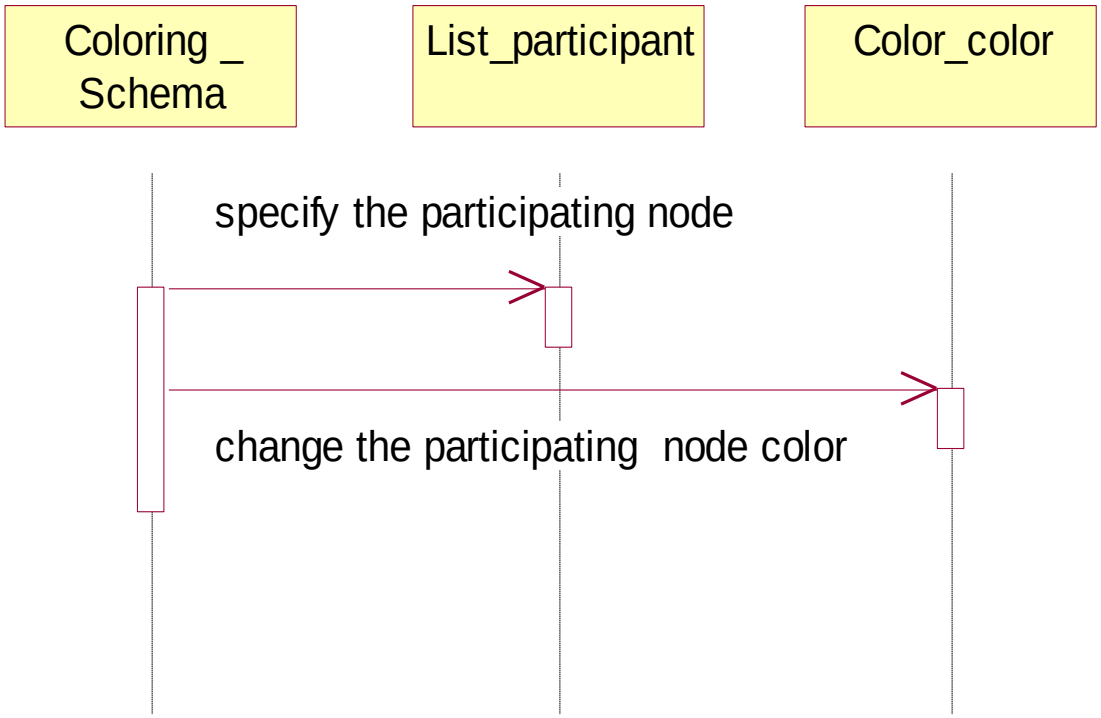


Figure 7. Sequence Diagram in varying the node color

The sequence diagram in changing the color of the node is shown in the above Figure 7. The changing of the node color is only the functionality of the coloring schema.

Use case diagram in identifying the neighboring node

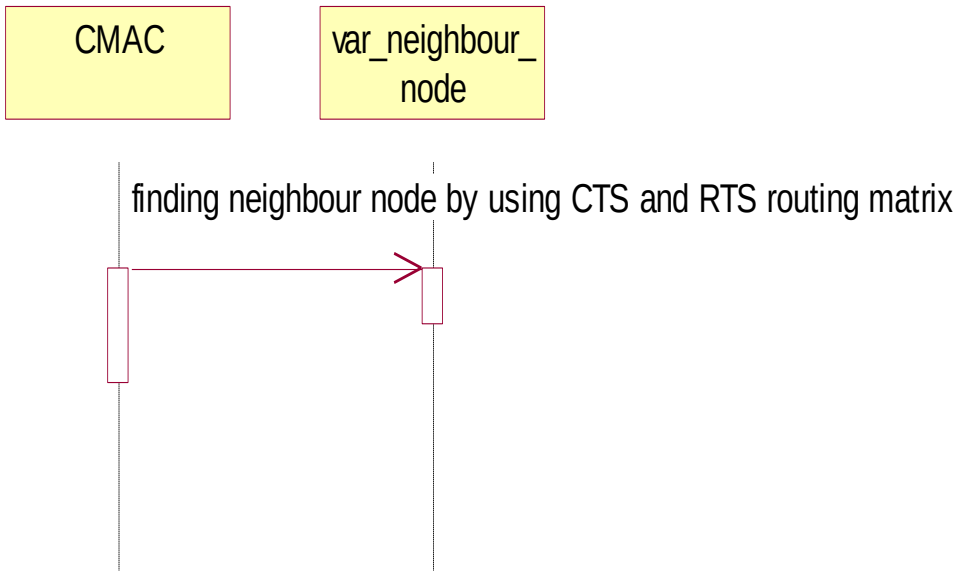


Figure 8. Use case Diagram in identifying the neighboring node

When a node is identified as the source node then it has to find its neighboring nodes. The sequence diagram in finding the neighboring nodes of a particular node is shown clearly in the above Figure 8**.**

4.4 Class diagram of the overall system

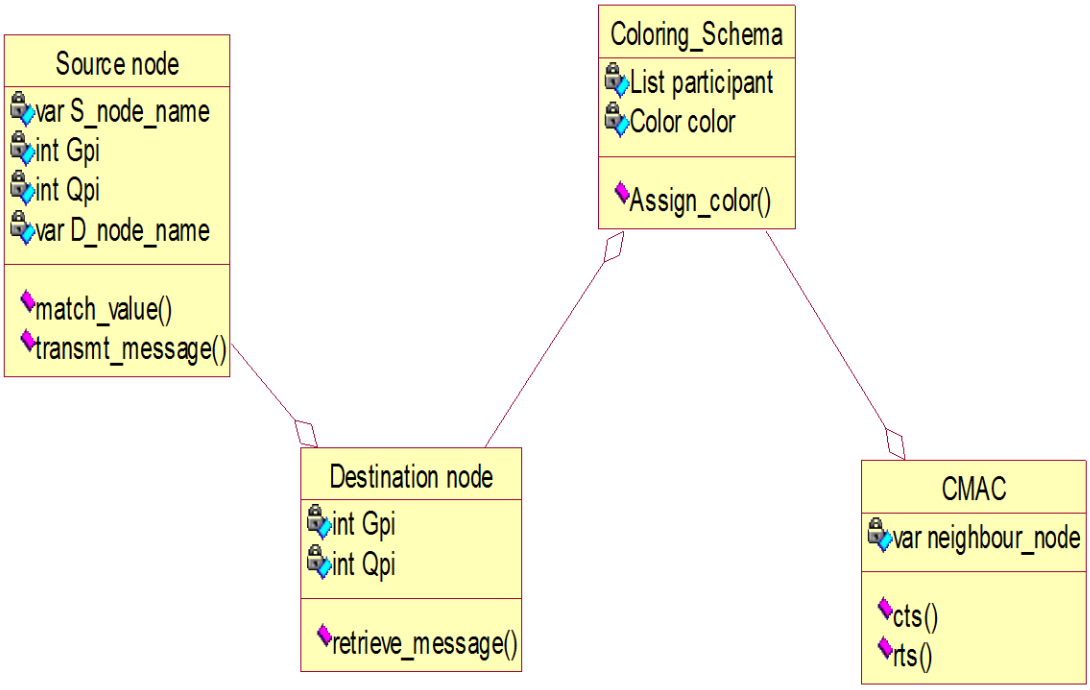


Figure 9. Class diagram of the overall system

The class diagram of the overall system is shown in the above Figure 9. This class diagram shows the different classes that will be involved in the implementation part. The links in between the classes presents the different relations between them.

4.5 Activity diagram of the overall system

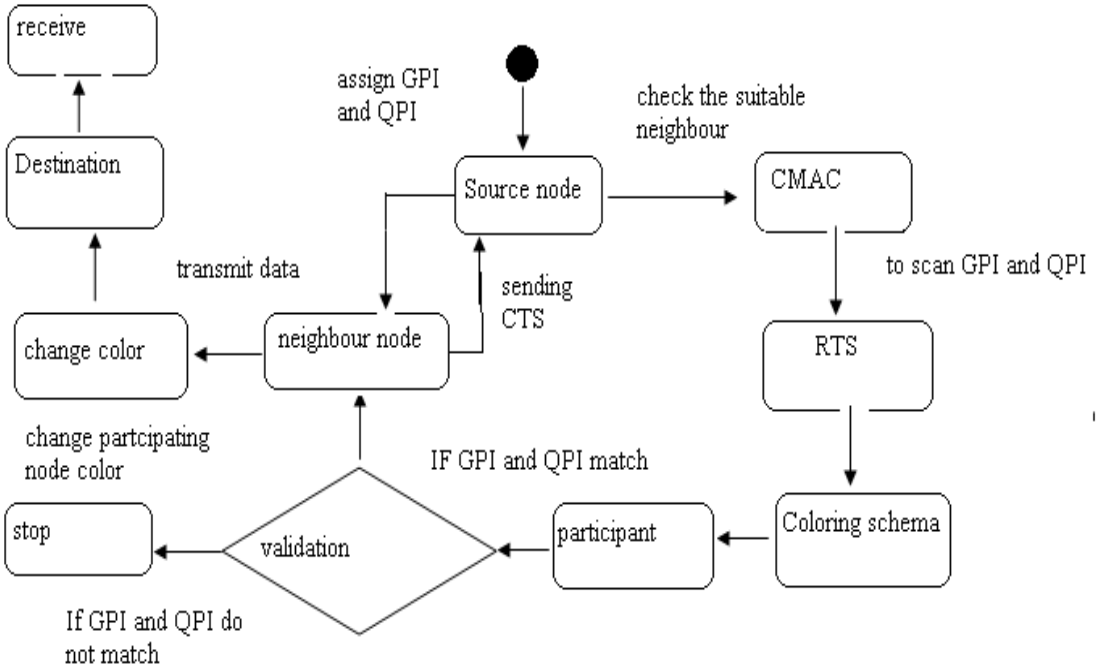


Figure 10. Activity diagram of the overall system

The activity diagram of the overall system that implements the cross layer protocol is shown clearly in the above Figure 10. This activity diagram shows the complete working of this cross layer protocol. Any decisions are indicated in diamond shaped boxes and the rectangles represent the normal function. Initially the process stars from the source node which sends the RTS (Request to Send) packets to all its neighboring nodes. When the neighboring node receives the RTS packets it transmits the CTS (Clear to Send) packets and the data transmission will be done continuously between the source and the destination nodes. QPI is query process identifier and GPI is gross process identifier and when both these value match the only the communication will be done perfectly between the source and destination node.

4.6 Summary

The design of the cross layer protocol is given clearly in this chapter. The design is presented with the help of the several unified modeling language diagram. All the diagrams are clearly given and the explanation of these diagrams is also given in this chapter.

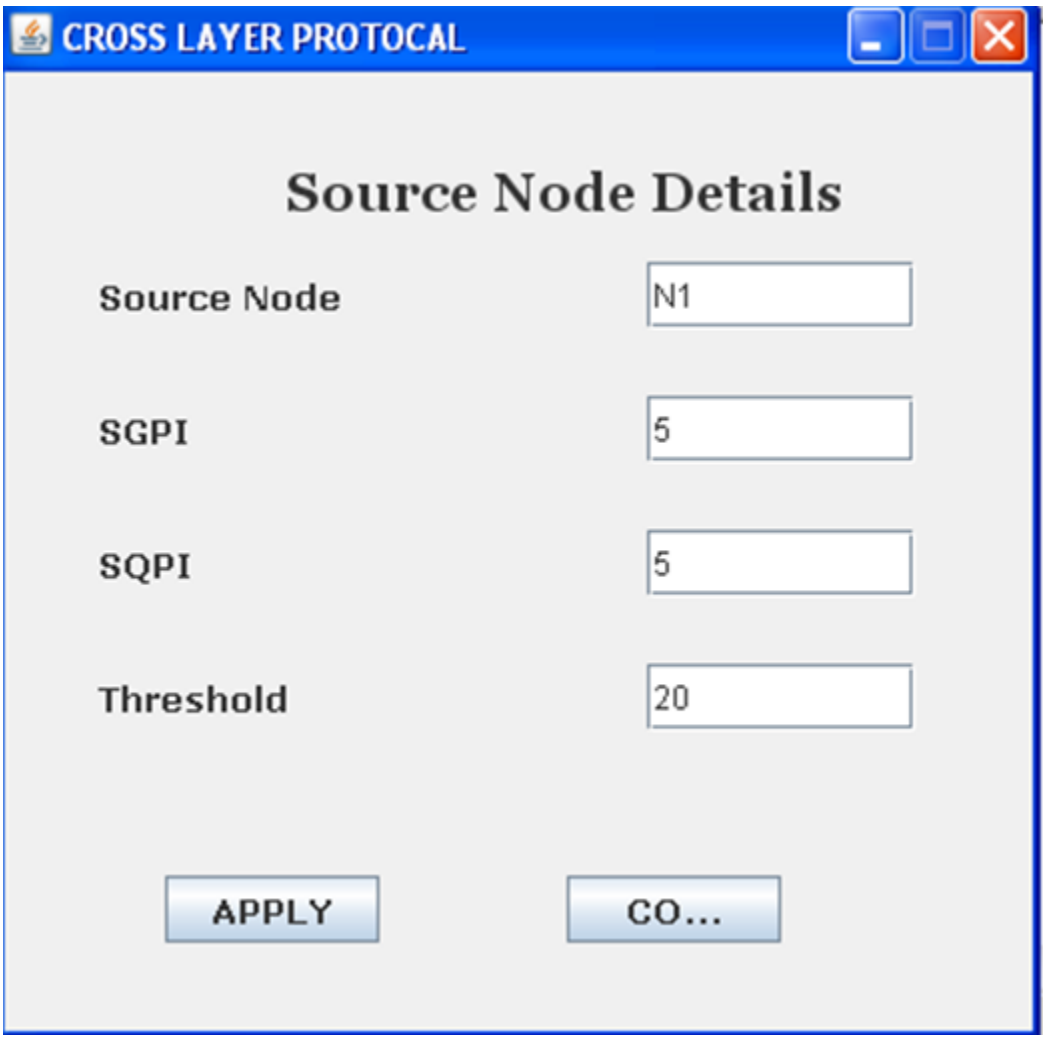
Chapter 5 Implementation, Testing and Evaluation of the System

5.1 Overview

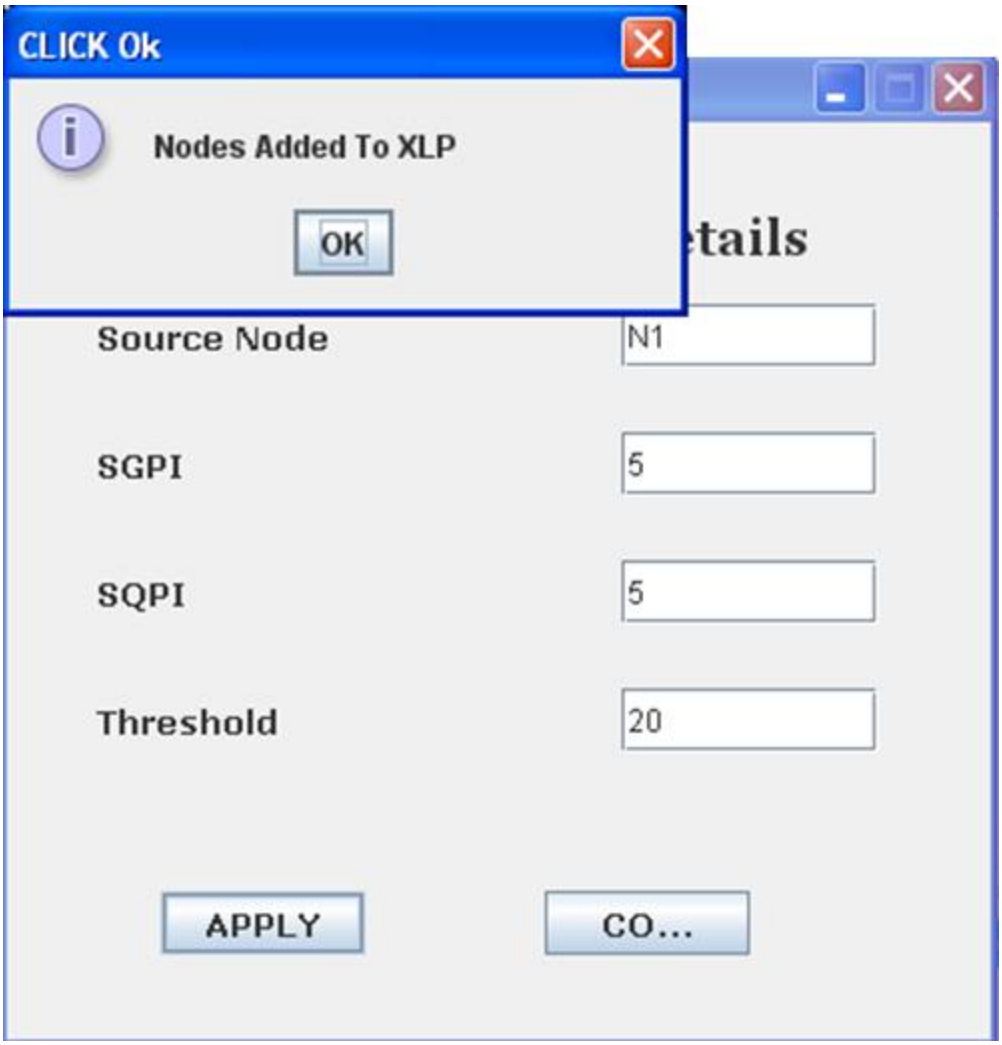
The cross layer protocol that is designed will be later implemented in this project. The implementation will be carried out based on the design itself. On the other hand the implementation details are explained clearly in this chapter. All the details of these screen shots are also given in this chapter.

5.2 Implementation Results

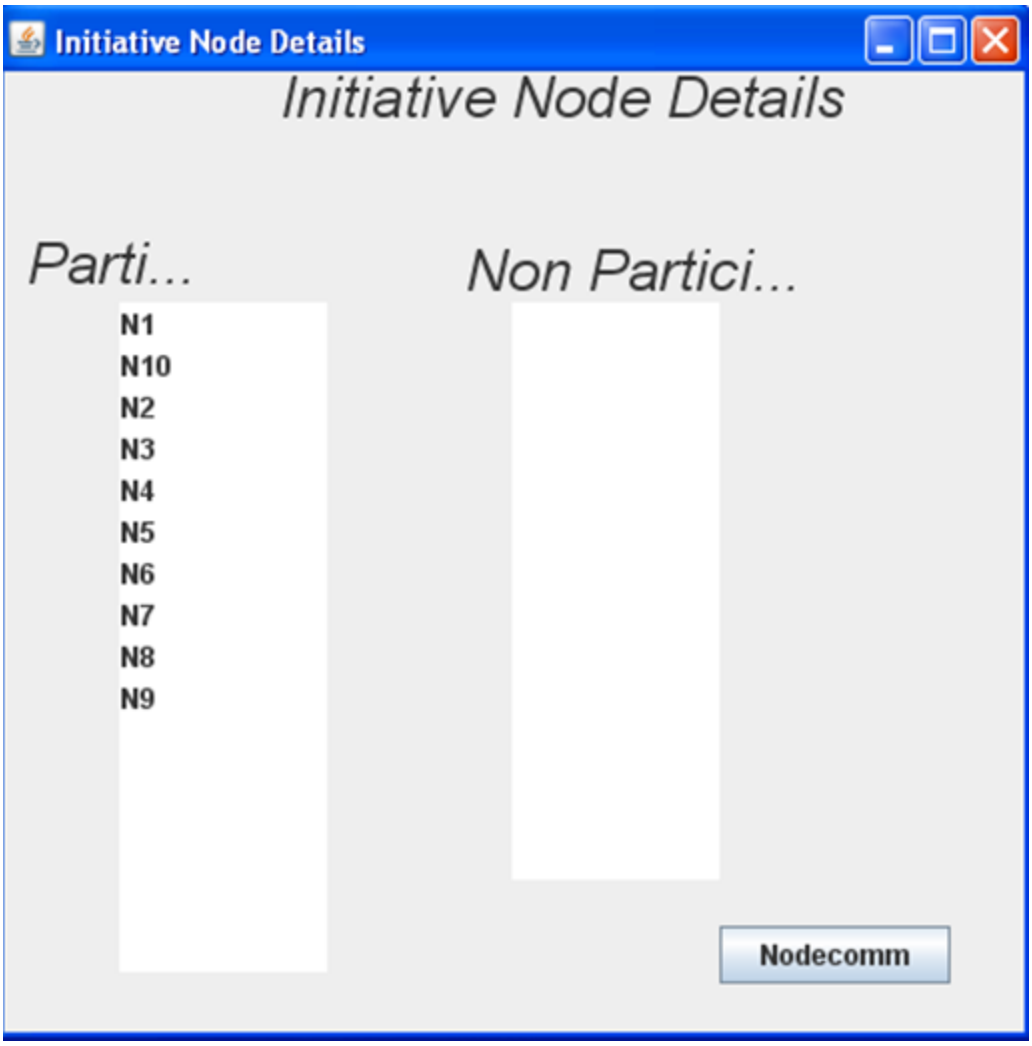
The implementation of this project is done in the software java. The main screen that will be displayed during the implementation is shown clearly in the above screen shot. The java code used is also given in the above screen shot. Initially the java files are compiled using the command javac. After that the execution of the java file will be done using the command java, the first window that will be displayed is shown clearly above.



Before starting the cross layer protocol for communicating, the details of the source node must be given clearly in the window that is displayed above. The details that have to be given are source node, threshold, GPI and the QPI value of the source. After entering all these values, apply button has to be pressed by the user.

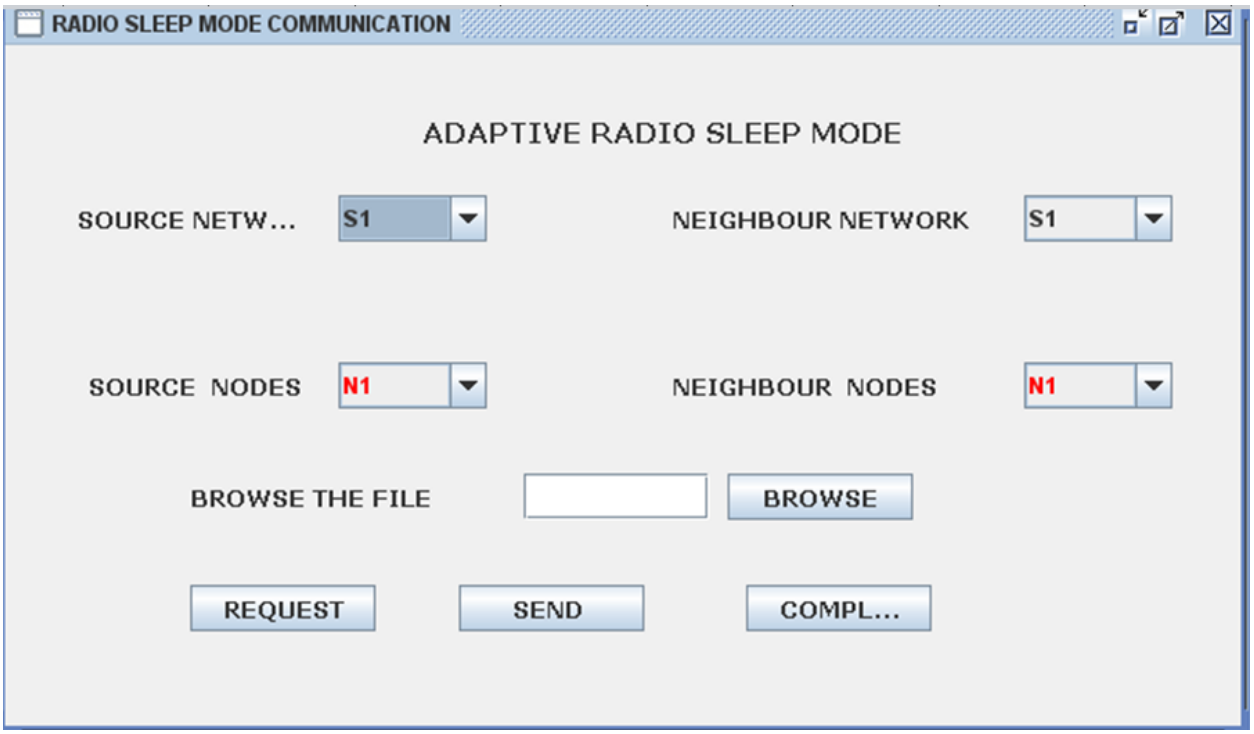


When the apply button is pressed all the entered details will be checked by the system and when all these details are correct, the node will then be added to the network as shown in the above screen shot. This indicates that a node is added to the network. In this way the nodes have to be added to the sensor network and then the communication protocol will be implemented in it.

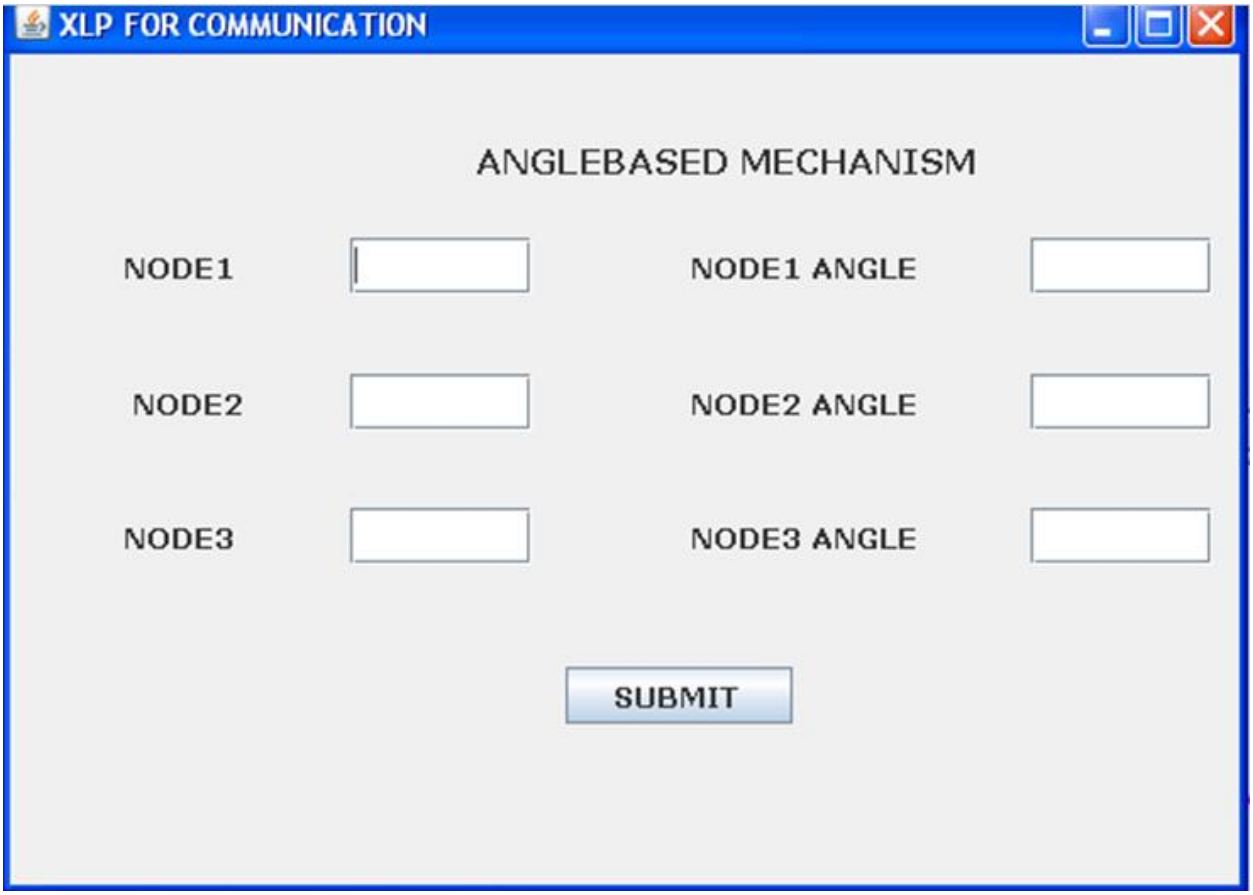


In addition to the source node there will be another type of nodes known as the initiative node. The details of this initiative node are shown clearly in the above screen shot. Initiative nodes are like the intermediate nodes which can be used to transmit the information from the source node to the destination node. The participative nodes will be participating in the communication and non-participative are the ones which will not be used for the communication.

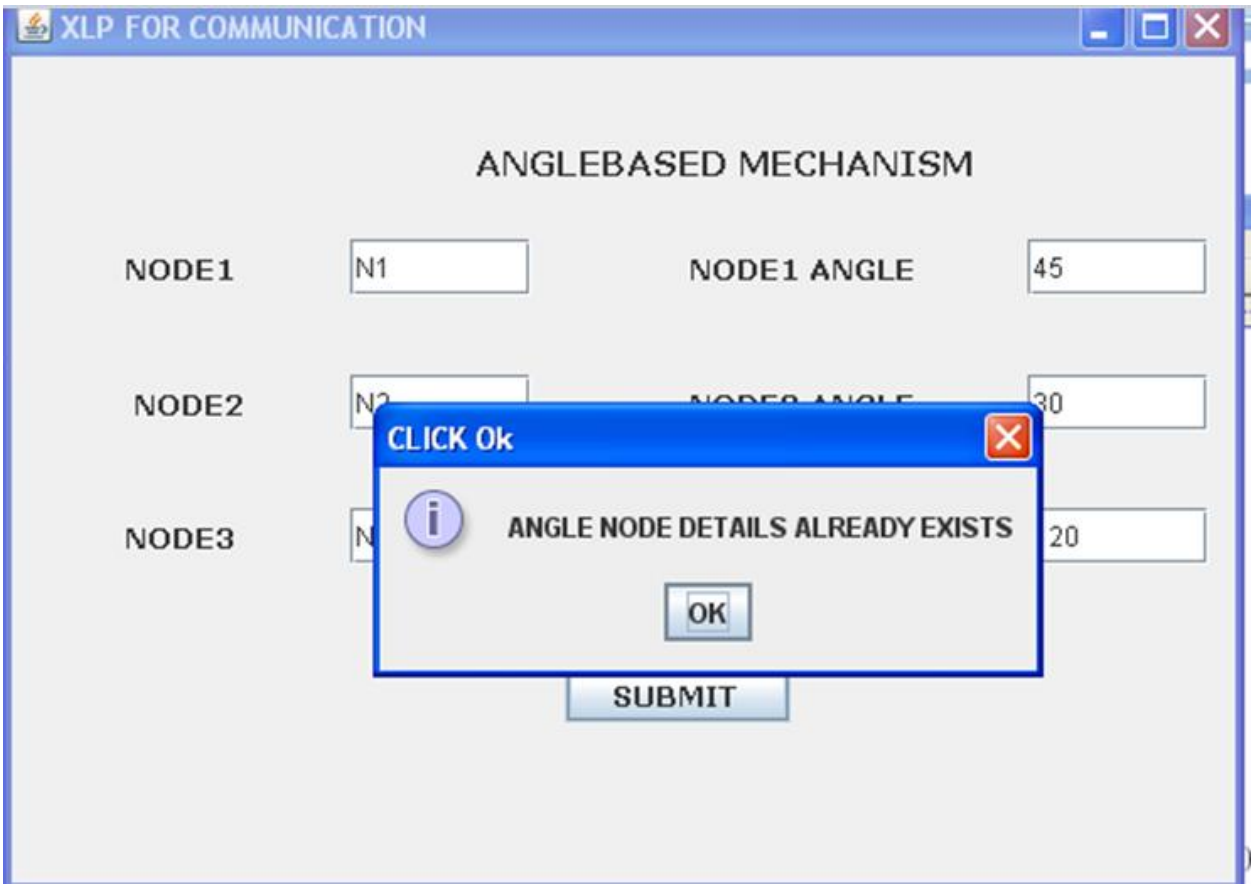
After adding all the node details the cross layer protocol communication can be started in the implemented wireless sensor network. This starting of the communication using this cross layer protocol method is shown clearly above.



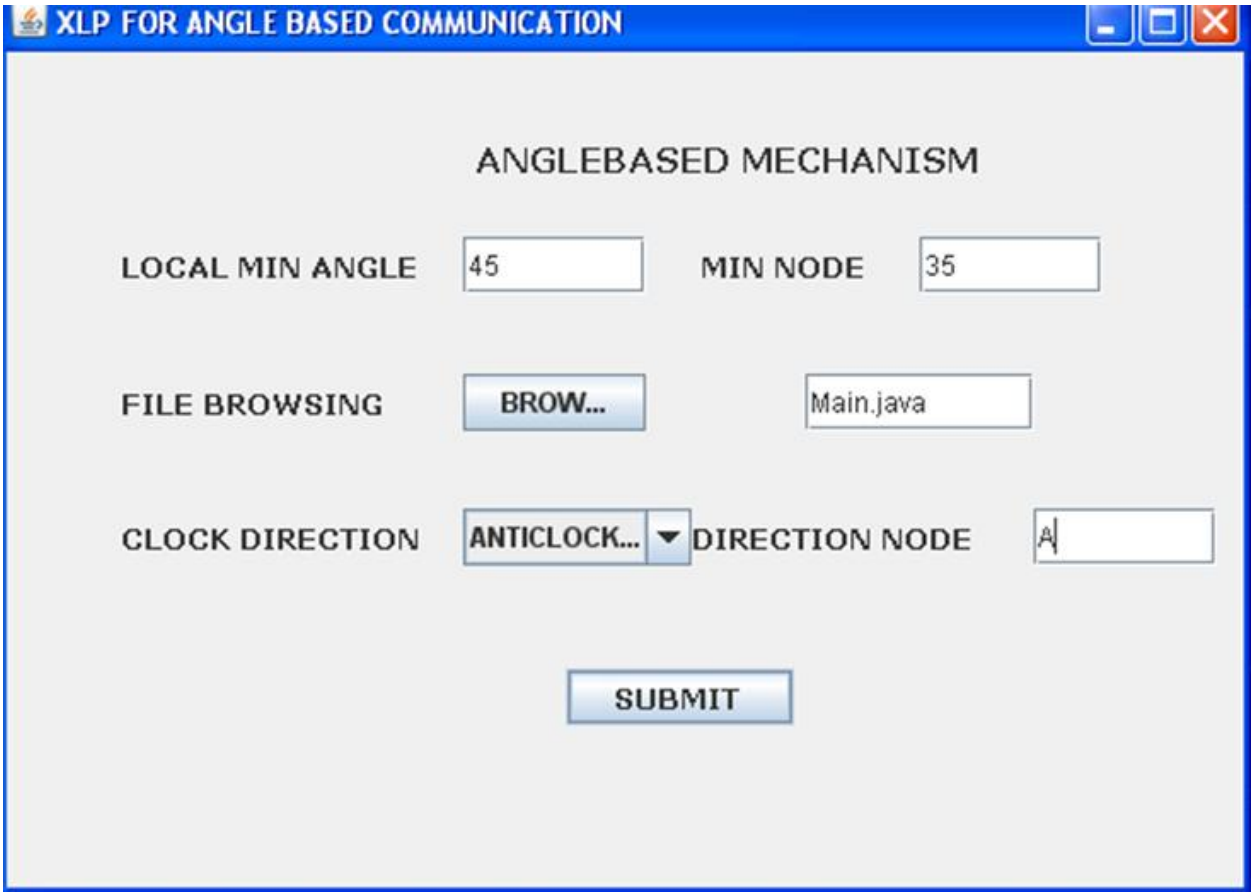
When this cross layer protocol is selected for the communication between the sensor nodes, certain details have to be entered. All these details are explained clearly in the above screen shot.



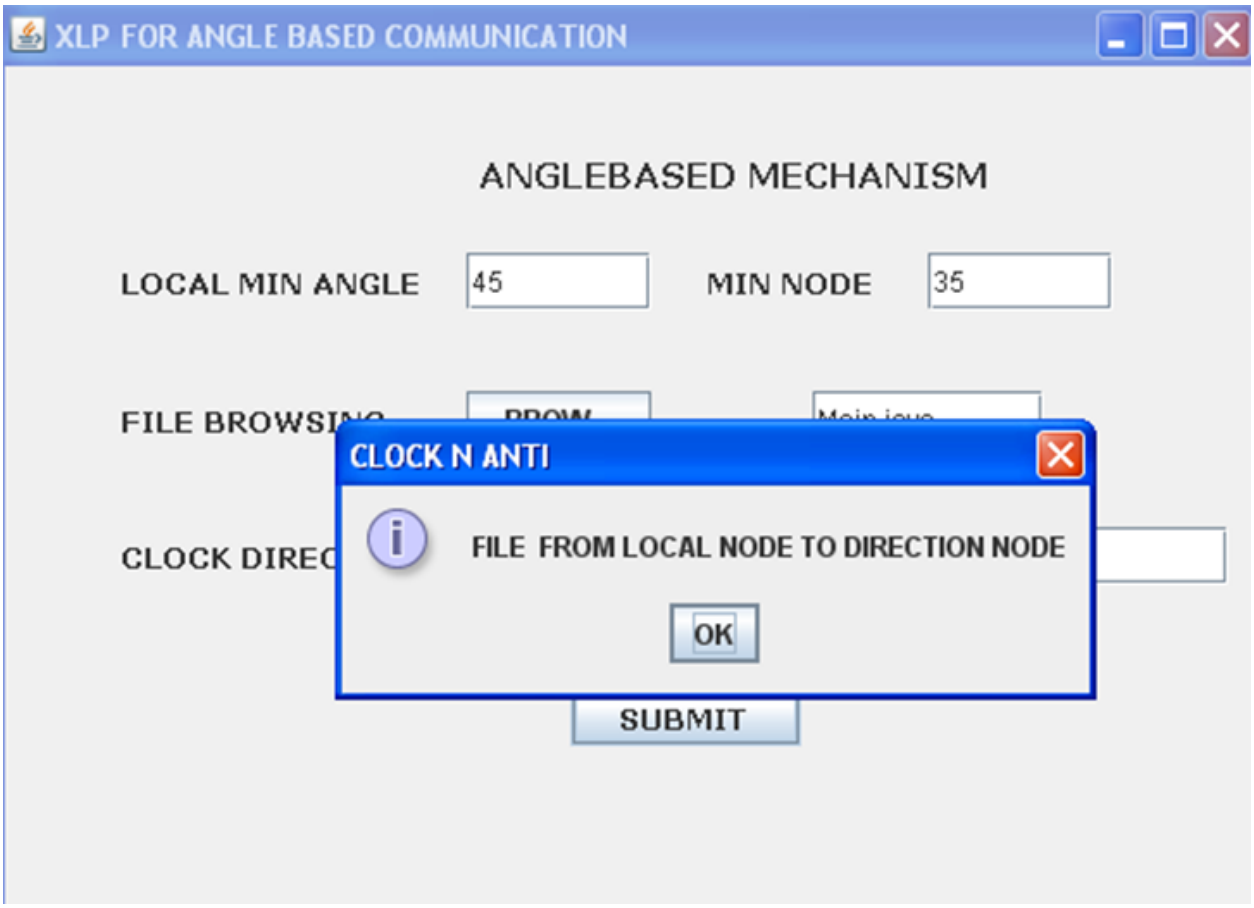
The other technique used to implement the cross layer protocol is the angle based method. Even when this angle based method is selected, certain details of the nodes have to be entered. The above screen shot clearly shown how these details are been added in the angle based method. In this angle based mechanism the data communication between the sensor nodes can be done based on the angel of the sensor nodes in which they are present in the wireless sensor network.



All the entered details in the angel based method are verified properly and then if those details do not exists, they will be added to the system. Otherwise a display message will be given that the details of the angle node is already present as shown in the above screen shot.



In addition to specifying the angle node number, it is also required to specify the direction of the data transfer and in which this angle based mechanism must work. All these details are explained clearly in the above figure. Here we can see that the angle of the sensor nodes is added and using this angle the communication will be decided between the source node and the destination node.



As shown in the above screen shot, a dialog box is displayed that shows that a file is been transmitted successfully from the source node to the angel node. This proves the working of the cross layer protocol in offering better communication for the wireless sensor network.

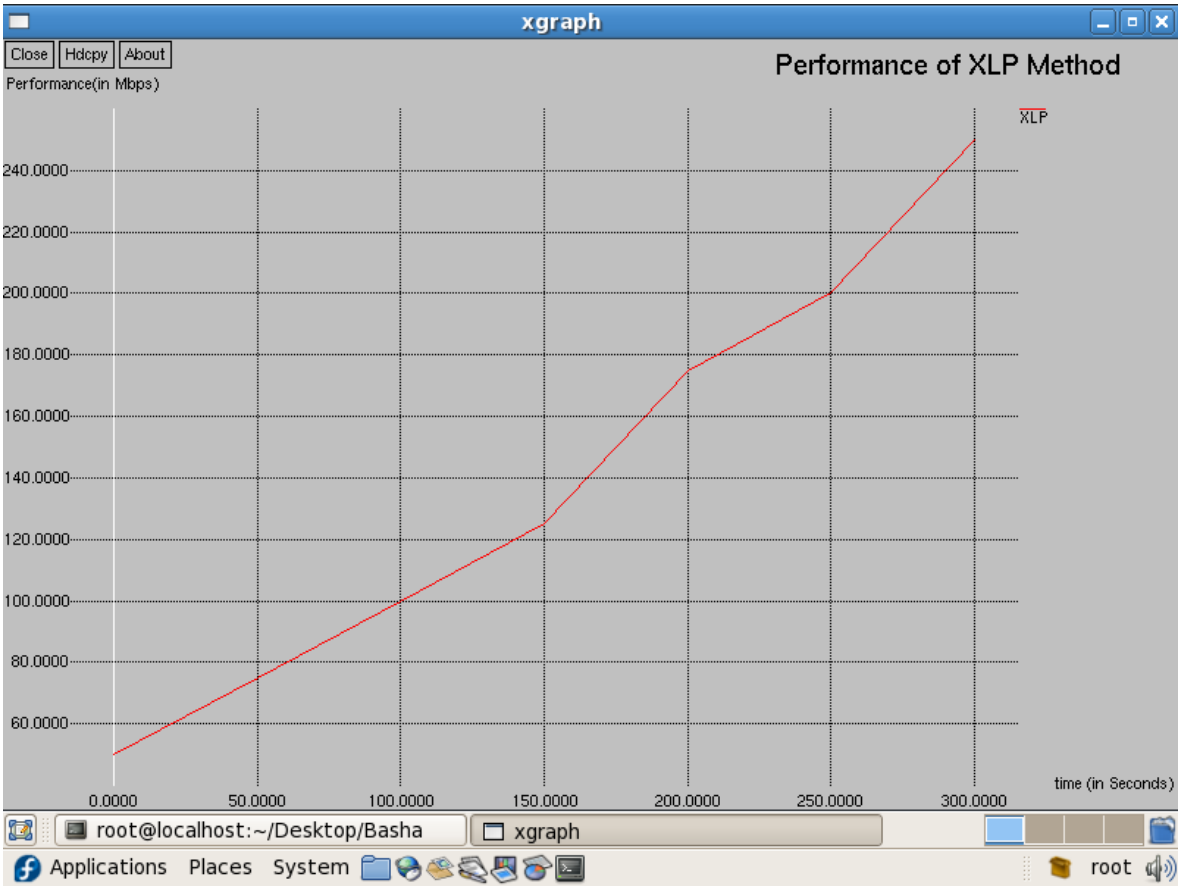
5.3 Testing of the project

After completing the implementation of the cross layer protocol for the wireless sensor network, testing will be carried out. In this testing stage the implemented system will tested to check the correctness of the output and also the internal code. That is both the project output and the internal cod will also be tested. For testing the internal logic of the code white box testing is used and for testing only the outputs black box testing will be used. Hence both the black box and white box testing methods are employed in this project. If any issues are found in this testing

phase that will be rectified there it and this testing process will be done till all the errors in the project are minimized.

5.4 Evaluation of the Project

The implemented communication method for the wireless senor networks is again evaluated in order to check the performance levels of this communication protocol. Some metrics will be used for their evaluation and the performance is treated as the main metric in this project. In the below screenshot, the performance of the cross layer protocol is shown clearly.



On x-axis the time is taken and on y-axis performance is considered. As the time goes on the performance level of the communication method will be increasing continuously till the end of the simulation. This indicates that the performance of the implemented cross layer protocol is high and is also increasing without any decrease as shown above.

5.5 Summary

Therefore the implementation details of the cross layer protocol for the wireless sensor network are explained in this chapter. Initially the details of the source node and the destination node are added in to the wireless sensor network. After adding all these details a file will be transmitted from one node to the other node in a successful manner. Finally the implemented system is tested and evaluated in this project. The evaluation of the project is done based on the metric considered which the performance in this project is. Therefore the performance of the cross layer protocol is found to be effective when it is applied in a wireless sensor network.

Chapter 6 Conclusions & Future Work

6.1 Conclusion and Future Work

A wireless sensor network is defined as a collection of several sensor nodes in very large number. These sensor nodes will be equipped with the sensors which are capable of sensing the information from the environment and to send this sensed information to the base station. The wireless sensor networks have gained great importance these days due to its advantages. Despite of having these advantages the sensor networks are also facing several issues. Providing an efficient communication method is the main severe problem faced by the sensor networks and which is considered in this project. The common way of providing communication among the several sensor nodes present in the sensor network is though the routing protocol. Even though several routing protocol are present in literature they are found to be ineffective at some point of the other in these sensor networks. The cross layer protocol is considered in this project to provide an efficient communication method for these networks. In the recent past, cross-layering in perfectly well-designed as a communication stack so that state information or data directly flows throughout the given stack has been thoroughly investigated to a great extent. Most of the research studies conducted on WSN and its cross-layer integration techniques have revealed that the feedbacks and results indicated significant energy gains. In a single protocol, certain developed concepts permitted several communication and networking functionalities be successfully implemented to a large extent. It is to be remembered that the cross-layer protocol (XLP) is perfectly implemented in order to provide the functionalities of congestion control, medium access and better routing in any given situation or environment. It is to be highly noted that based on the concept of the initiative determination, the cross-layer protocol (XLP) perfectly serves as a better proof of best concept and better performs receiver based contention, reliable communication, distributed duty cycle operation to realize efficient and initiative-based forwarding in WSNs.

There is a need for conducting individual research study by the experts and technicians in this particular field to a large extent on various selected topics within the WSN and its cross-layer

protocol (XLP). It is to be highly remembered that team and individual efforts can bring greater level of satisfaction in the field of WSN and its cross-layer protocol (XLP). On the other hand, WSN and its cross-layer protocol (XLP) is a new field for the experts and technicians in this particular field. Therefore they should gather information or data from all the available resources like books, journals, manuals, internet search and so on for the in-depth knowledge in this particular field. Moreover sharing of information or data gathered among the experts and technicians are the need of the hour in this particular field for over all improvement and advancement of WSN and its cross-layer protocol (XLP). There is also a need for continuous research studies to be conducted on various aspects of WSN and its cross-layer protocol (XLP).

Therefore in this project the sensor networks are provided with efficient communication with the help of the cross layer protocol. This cross layer protocol is based on the initiative determination technique. The methodology used to do this project is the agile methodology. The different steps in the methodology are explained clearly in this report. The design of this cross layer protocol is presented here. Finally the project implementation is carried out in java. The implemented system is finally tested and evaluated based on the performance metric of the cross layer protocol. This evaluation is presented in the form of the graphs with respect to performance. From the graphs it can be stated that performance of eth cross layer protocol is good and efficient.

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Personal Experience in the project

Initially I personal thank each and every one who stood as a pillar with me in successfully complete this particular project within the given timeframe in a better manner. I was really comfortable with the allotted topic that is "Design and implementation of a communicating method for WSN" I took keen interest in understanding the given topic with collection of information from all the available sources and interaction with my parents, relatives and close friends who were much comfortable in the given topic and ready to share their part of knowledge with me. My classmates also shared their ideas and knowledge of doing research studies in various topics during their academic life. This really gave me an idea regarding what should be done and what shouldn't be done in a research study in order to get best results or feedbacks. On the occasion of my successful completion of this particular project, I personally thank my guide who support and guided me throughout this particular project from the word "go to finish".

I felt the allotted topic a bit difficult in the initial stage but my guide me understand the significance of the given topic in a better manner and initiated a spark in order to boost my level of confidence. My guide's friendly nature and lot of patience helped me a lot in the completion of this particular project. My guide also instructed me regarding where to search for different information or data related to the allotted topic, its main headings and sub-heading etc. The campus library was really useful for me in gathering information or data related to this particular project. The librarian helped me in correctly picking the books, journals, magazine and other publication related to my allotted project. It is to be highly noted that without my librarian assistance the completion of this given project successful wouldn't have been really possible. I read all the selected materials from the library and from other available sources. The execution of my project was perfectly smo0oth mainly because of my guide or instructor's guidance and timely support.

Certain subject matters, I searched through the internet and gathered the necessary information or data related to my given topic for this particular project. I personally sought-out the information or data based on the main headings and sub-headings and showed to my instructor or guide much before drafting it. I sat with my instructor or guide in order to rightly pick the necessary information or data and ignore all those unwanted or unnecessary information or data that might

look really useful for the given project. This really helped me in drafting within the word limited prescribed for allotted project. I was able to follow all the instruction given by my guide or instructor. I adhered to all the rules and regulations that are followed in the execution of research study based on international standards. While drafting the given project, I had some queries and doubts regarding the proper execution of the given project so I personally clarified regarding it with my instructor or guide. My guide or instructor made me understand significance of the given topic and its execution in the form of a project.

At the end of each and every phase of the allotted project, my instructor or guide had fixed a timeframe for submission of the next phase. This really helped me in planning the given project and its perfect execution in a better manner within the allotted timeframe of each and every phase. This also taught me time management and certain discipline to be followed in life with perfection. My guide or instructor also gave me instruction in order to make certain changes in the executed project in order to derive the expected level of satisfaction. I immediately made all those changes or alteration as per the instructions given by my guide or instructor. Before the submission of the allotted project, I personally did editing in order to check the grammar mistakes, spelling errors, framing of the meaningful sentences, paragraph alignments, neat presentation, etc. finally, I successfully submitted the allotted project to my guide or instructor within the allotted deadline with perfection. The smile from my guide or instructor's face made me personally feel happy regarding the results of my hard work and commitment towards this particular project.

Appendix- project poster -

Design and Implementation of a communicating method for WSN

Student Name: Nazeer Basha Shaik Khadar Basha **Student Id: 1136245**

Supervisor Name: Dr.Vitaly Schetinin **Programme :MSc Computer Networking**

University of Bedfordshire

Problem Statement:

•The wireless sensor networks are been defined as the event based systems.
•The main aim of these networks is to identify the accurate events from the group of information given by the sensor nodes with respect to their restrictions in memory, processing and energy.
•Huge research is been taking place in this field in order to develop an effective networking protocol for providing effective communication in the sensor networks through high energy efficiency.
•A traditional layered protocol approach is being used in the existing system for providing communication in sensor networks.
•This exiting system suffers from several limitations related to overhead and the congestion of traffic.

The Aim & Objectives of the Project:

The aim of the project is to provide reliable communication method for the wireless sensor networks through cross layer protocol (XLP).

Objectives:

•To perform research and to gather all the requirements of the project in an effective manner.
•To complete the literature review of the project based on the research conducted.
•To design this cross layer protocol for the sensor networks.
•To implement this cross layer protocol in the sensor networks java language.
•To check the performance of the system using network simulator 2.0 software.

Technology Used:

Java Language and Network Simulator

Research Methodology:

A particular methodology has to be followed in order to develop particular software. The methodology that is used in this project is the agile methodology. This methodology specifies a list of steps that can be used effectively for developing the project. Agile methodology is the technique that is selected in most of the projects. In contrast to the sequential execution, this agile methodology helps in executing all the stages in acyclic manner.

Design of the System:

Implementation Results:

The implementation of this project is done in the software java. The main screen that will be displayed during the implementation is shown clearly in the above screen shot. The java code use is also given in the above screen shot.

When the prioritization method is selected for this cross layer protocol, certain details have to be entered. All these details are explained clearly in the above screen sh

As shown in the above screen shot, a dialog box is displayed that shows that a file is been transmitted successfully from the source node to the angel node. This proves the working of the cross layer protocol in offering effective communication for the wireless sensor network.

Conclusion:

Therefore in this project the sensor networks are provided with efficient communication with the help of the cross layer protocol. This cross layer protocol is based on the initiative determination technique. The methodology used to do this project is the agile methodology. The different steps in the methodology are explained clearly in this report. The design of this cross layer protocol is presented here. Finally the project implementation is carried out in java.

References:

Takuya, A. and Sakiko, K. (2012) 'Event –driven Wireless Sensor Networks using energy-saving data collection', 'Communications(APCC),18th Asia-Pacific Conference on Digital Object Conference *Publications'*, Page(s):300-305. Jeju Island 15 -17 October. Available at: http://ieeexplore.ieee.org.brum.beds.ac.uk/stamp/stamp.jsp?tp=&arnumber=6398153&tag=1. (Accessed on 17 March 2013).

Interim report:

Simulating an effective communicating method for WSN

Introduction

The sensor nodes present in the wireless sensor networks are concerned of energy as they are powered with the help of battery. Deployment of the sensor nodes in the hostile environment makes it unfavourable for the people to change the battery of the senor nodes when it is executed. Due to the energy limitations there is a great need of providing any energy efficient way of communication for the wireless sensor networks. Several techniques of offering communications in a sensor network use the classical layered method that results in great overhead of the network. It will be very effective when a unified technique is present for converting the functions of common protocol to the cross layer method. A cross layer protocol is been implemented in this project to provide congestion control, effective routing over the cross layers. This cross layer protocol is designed based on the initiative determination present in cross layer module. This initiative determination offers congestion control forwarding based on initiatives contention based on receivers and effective communication between the sensor nodes of a wireless sensor network. The implementation of this initiative determination is very easy as it just involves the comparison with the threshold values. Through this cross layer protocol the functions of each layer can be combined very easily (Asaka Takuya and Kawai Sakiko, 2012). The performance of this cross layer protocol is also identified in this project. Through this cross layer protocol effective communications can be provided between the sensor nodes of a wireless sensor networks and also is far better than the classic layered protocols with respect to energy consumption and network performance.

Problem Statement

- The wireless sensor networks are been defined as the event based systems.
- The main aim of these networks is to identify the accurate events from the group of information given by the sensor nodes with respect to their restrictions in memory, processing and energy.
- Huge research is been taking place in this field in order to develop an effective networking protocol for providing effective communication in the sensor networks through high energy efficiency.
- A traditional layered protocol approach is being used in the existing system for providing communication in sensor networks.
- This exiting system suffers from several limitations related to overhead and the congestion of traffic.

Proposed System

- In the proposed system cross layer protocol (XLP) is being used which combines the functions all the layers into a single cross layer protocol.

- The disadvantages of this cross layer protocol are routing, congestion control and the medium access control.

Soft Requirements	Java Language

Aim and Objectives

The aim of the project is to provide reliable communication method for the wireless sensor networks through cross layer protocol (XLP).

Objectives:

1. To perform research and to gather all the requirements of the project in an effective manner.
2. To complete the literature review of the project based on the research conducted.
3. To design this cross layer protocol for the sensor networks.
4. To implement this cross layer protocol in the sensor networks using network simulator software.
5. To test the implemented system with the existing protocols.

Artefact of the project

The main functionality of the sensor nodes present in the sensor network is to sense the information from surroundings and to communicate it with the other nodes. My artefact in this project is to design and implement a communication method for the sensor nodes of the sensor network. Through this designed communication method, the sensor nodes will be communicating very easily with the other sensor nodes and can also minimise the data loss in the network.

Literature Review

The wireless sensor networks which have gained huge importance these days are actually event based networks which continuously sense the surroundings in order to collect the required information. The main aim of this network is to extract the event features based on the information that is collected by the sensor nodes with less energy and storage abilities. On the other hand huge research has been taking place to develop several networking protocols in order to provide effective communication in energy efficiency manner. Most of the protocols that are developed are based on a particular layer like network layer, physical layer, transport layer and medium access layer. Even though these protocols can offer higher performance matrix with respect to that particular layer, they are not effective to improve the overall performance of the network and also to minimize the energy consumption. Based on

these energy restrictions and processing capabilities of these sensor networks cross layer design that combines all the layers is considered as the best solution for the wireless sensor networks. Research also specifies that the protocol design based on this cross layer approach can provide an energy efficient way of communication in a wireless sensor network. This research also resulted in providing various solutions based on the interactions present in the cross layer approach (Patnaik Lalit Mohan, 2009). However there is a lack of particle implementation of this communication protocol in a wireless sensor network and the performance of this cross layer protocol is not partially verified. Hence it can be stated that there is a need of an efficient way of unifying the functions of all the protocol layers so as to offer efficient communication between the nodes of a wireless sensor network. In this project a concept called initiative determination is considered and it is applied for the cross layer operations in order to provide congestion control, distributed routing, medium access control etc. Using this initiative determination method any node present in the wireless sensor network can decide whether to take part in the communication depending on several aspects like energy level, link quality, buffer level, location and the traffic load. All these parameters are integrated and provided in a particular decision that a node has to provide weather is willing or not willing to participant in a particular communication. Based on this concept cross layer protocol is implemented in this project to provide an effective communication between the sensor nodes of a wireless sensor networks in an energy efficient manner. This simulation for this cross layer protocol is done on a wireless sensor network that is simulated using a real simulator which is also known as a network simulator. From the simulation it can be known that cross layer protocol provides effective communication methods and also improves the network performance when compared to the other existing protocols. The implementation of this initiative determination is very easy as it doesn't involve any complex operations and also provides an energy efficient way of communication (Hu Jiang and Han Yang, 2012).

Research Approach

Research is defined as the procedural way of investigating so as to collect the required data from various sources. The research should also be performed in a very systematic and sequential approach in order to minimise the time for collecting the data. Therefore the main aim of conducting the research is to gather the data itself and to acquire more knowledge. The approaches to conduct the research are two types. The first approach is the qualitative approach and the second approach is the quantitative approach. In this project the qualitative research methodology is used in order to collect the subjective and descriptive type of information. On the other hand collection of the data through this qualitative research approach is very easy when compared to the quantitative research approach. In this qualitative approach data collection can be done using different methods like interviews, focus groups, surveys etc. In this qualitative research method, a theoretical problem will be considered and the data regarding this theoretical problem will be gathered. This methodology also offers a high volume of information. Structured or semi-structured responses can be obtained from this qualitative research methodology (John Kuada, 2012).

As theoretical data is collected in this approach, non-statistical methods are used for analysing the data that is collected in the research. The reliability and the validity of the data that is collected in this research method are also very high when compared to the other methods. Data analysis and the data generalisation will be done very easily using this theoretical data. As data collection and data generalisation is easy using this qualitative approach, this approach is being selected for the project.

Agile Methodology

A particular methodology has to be followed in order to develop particular software. The methodology that is used in this project is the agile methodology. This methodology specifies a list of steps that can be used effectively for developing the project. Agile methodology is the technique that is selected in most of the projects. In contrast to the sequential execution, this agile methodology helps in executing all the stages in acyclic manner. The different stages of the project life cycle are described as follows: (Gordon .Rugg and Marian. Petre, 2009)

1. **Requirements gathering**

In this first stage requirements will be collected for developing particular software from the end users. These requirements will be identified based on the software functionality and the software structure. The collected requirements will then be analysed.

2. **System design**

When the requirements are analysed, the design of the system will be carried out. The system design will be presented using the unified modelling language diagrams.

3. **System implementation**

After designing the project, the coding part of the project will be carried out. In this coding part the programs will be written using the required software.

4. **Testing**

When the implementation is completed, the testing of the system will be carried out in this testing phase. Each implemented component will be tested and then will be integrated and finally tested. The main aim of the testing is to check if the developed system is according to the requirements.

5. **Risk analysis**

Risk analysis is another important part of the spiral methodology. In this risk analysis phase the risks that can occur in the project will be identified very easily and thereby the risks can be avoided very easily in the project.

Blue Print

The blueprint for the cross layer protocol of the wireless sensor networks is given clearly in the below figure. This blue print shows the complete working of this cross layer protocol.

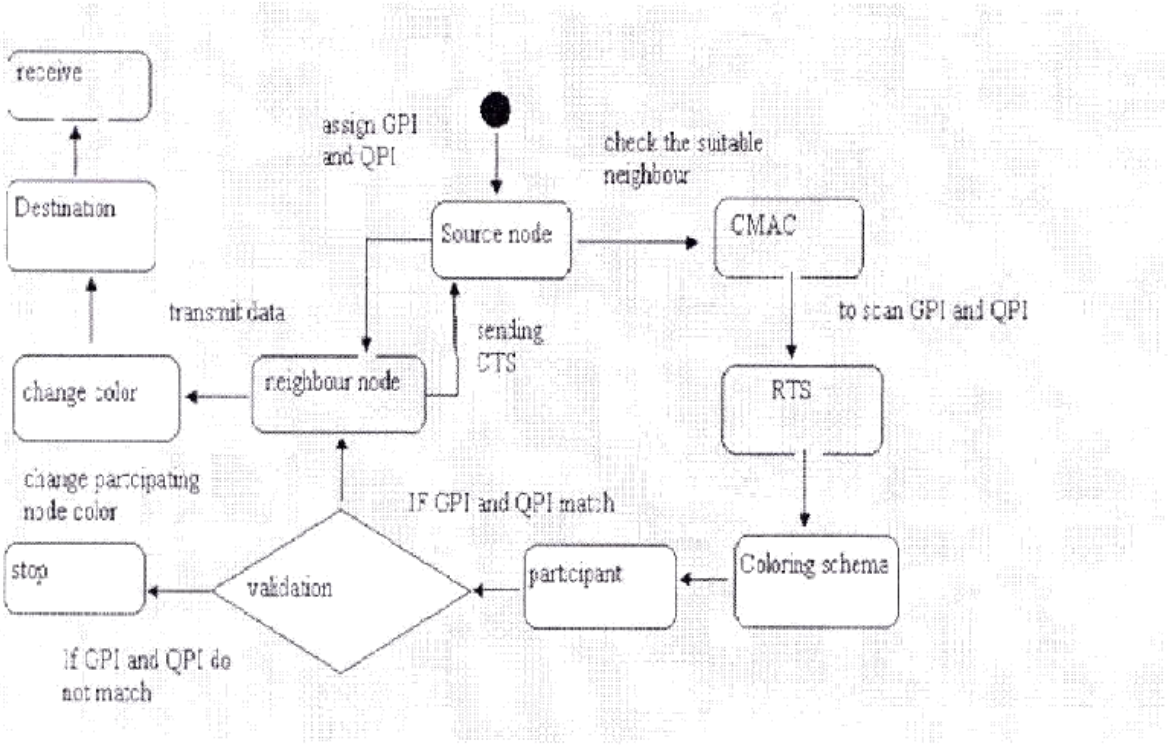

Figure: Blueprint of cross layer protocol

The main reason of using different shapes of the boxes is to differentiate the actions. Whenever a node is taking decision about the available routes then it will be shown in diamond colour boxes. The steps are presented very clearly in the above figure.

Conclusion

Therefore in this project the sensor networks re provided with efficient communication with the help of the cross layer protocol. This cross layer protocol is based on the initiative determination technique. The methodology used to do this project is the agile methodology. The different steps in the methodology are explained clearly in this report. The design of this cross layer protocol is presented in the form of the blueprint. Finally the project implementation is carried out in java.

References

- Asaka Takuya and Kawai Sakiko(2012),"Event –driven Wireless Sensor Networks using energy-saving data collection", Communications(APCC),18th Asia-Pacific Conference on Digital Object Conference Publications, Page(s):300-305.
- Patnaik Lalit Mohan,Venugoal K.R,Shenoy Deepak Deepa,Sserubiri Dennis and Kanavalli Anita(2009),"A flat routing protocol for sensor networks", Methods and

Models in Computer Science,ICM2CS Proceeding of International Conference on Digital Object Conference publications, Page(s):1-5.

- Hu Jiang, Han Yang and Kang Yimei (2012),"A node scheduling based on partition for WSN ", Wireless Telecommunications Symposium (WTS), Page(s):1-6.
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- Gordon Rugg Marian Petre (2009),"A Gentle Guide to Research Methods", McGraw-Hill International, Study Aids-256 Pages.

proposal form

Student Number	1136245
Student Name	NAZEER BASHA SHAIK KHADAR BASHA
Degree Course	MSc COMPUTER NETWORKING
Supervisor Name	Dr VITALY SCHETININ
Title of Project	**Simulating an effective communicating method for the WSN**
Description of your artefact	**Problem Statement** ➢ The wireless sensor networks are been defined as the event based systems. ➢ The main aim of these networks is to identify the accurate events from the group of information given by the sensor nodes with respect to their restrictions in memory, processing and energy. ➢ Huge research is been taking place in this field in order to develop an effective networking protocol for providing effective communication in the sensor networks through high energy efficiency. ➢ A traditional layered protocol approach is being used in the existing system for providing communication in sensor networks. ➢ This exiting system suffers from several limitations related to overhead and the congestion of traffic.

Proposed System

- In the proposed system cross layer protocol (XLP) is being used which combines the functions all the layers into a single cross layer protocol.

- The disadvantages of this cross layer protocol are routing, congestion control and the medium access control.

Aim and Objectives

The aim of the project is to provide efficient communication method for the wireless sensor networks through cross layer protocol (XLP).

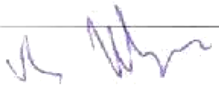
Objectives:

1. To perform research and to gather all the requirements of the project in an effective manner.
2. To complete the literature review of the project based on the research conducted.
3. To design this cross layer [protocol for the sensor networks.
4. To implement this cross layer protocol in the sensor networks using network simulator software.
5. To test the implemented system with the existing protocols.

Requirements	The requirements used are Network Simulator, Linux operating system and Java.
What methodology (structured process) will you be following to realise your artefact?	I have chosen agile methodology for realising my project. According to the agile methodology, the project will be having different stages like the requirement collection, product designing, implementation it, testing and deployment. This methodology offers an iterative way of developing the end product.
How does your project relate to your degree course and build upon the units/knowledge you have studied/acquired	The project which I selected is related to wireless sensor networks and the communications. This project will certainly be related to my degree course MSc Computer Networking.
Resources	The resources that are used in this project are IEEE papers and the online journals.
Have you completed & submitted your ethics form?	**Yes** No

FACULTY OF CREATIVE ARTS, TECHNOLOGIES AND SCIENCE

Form for Research Ethics Projects (CATSethicsform)

1. Student Name	NAZEER BASHA SHAIK KHADAR BASHA
2. Student Number:	1136245
3. Degree Pathway:	Msc COMPUTER NETWORKING
4. Supervisor's name	Dr VITALY SCHETININ
5. Supervisor Signature	
6. Working title of project	**Simulating an effective communicating method for the WSN**

SECTION A Proposal

Please summarise below the ethical issues involved in the research proposal and how they will be addressed. In any proposal involving human participant's clear explanation of how informed consent will be obtained, how confidentiality will be observed, how the nature of the research and the means of dissemination of the outcomes will be communicated to participants must be provided.

NO ETHICAL ISSUES

SECTION B Check List

Please answer the following questions by circling **YES** or **NO** as appropriate.

1. Does the study involve vulnerable participants or those unable to give informed consent (e.g. children, people with learning disabilities, your own students)?

   YES **NO**

2. Will the study require permission of a gatekeeper for access to participants (e.g. schools, self-help groups, residential homes)?

   YES **NO**

3. Will it be necessary for participants to be involved without consent (e.g. covert observation in non-public places)?

   YES **NO**

4. Will the study involve sensitive topics (e.g. obtaining information about sexual activity, substance abuse)?

   YES **NO**

5. Will blood, tissue samples or any other substances be taken from participants?

   YES **NO**

6. Will the research involve intrusive interventions (e.g. the administration of drugs, hypnosis, and physical exercise)?

   YES **NO**

7. Will financial or other inducements be offered to participants (except reasonable expenses or small tokens of appreciation)?

   YES **NO**

8. Will the research investigate any aspect of illegal activity (e.g. drugs, crime, underage alcohol consumption or sexual activity)?

   YES **NO**

9. Will participants be stressed beyond what is considered normal for them?

   YES **NO**

10. Will the study involve participants from the NHS (patients or staff) or will data be obtained from NHS premises?

    YES **NO**

If the answer to any of the questions above is "Yes", or if there are any other significant ethical issues, then further ethical consideration is required. Please document carefully how these issues will be addressed.

Signed (student): S K Nazeer Date: 08-03-13

Countersigned (Supervisor): Date: 08.03.13