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Wireless Node Control and Monitoring System for Emergency Ad-Hoc Networks

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Abstract— In the recent times it has been seen that wireless network is established with the help of nodes and used them as a monitoring system. But the problem arises that the traffic each node handles is of great extent. Also the security and efficiency in working in emergency situations is very low. It has a limitation over worldwide access everywhere due to non-standardized communication between multiple mobile service provider in the emergency conditions .Hence we are proposing a system for wireless modem control and statistics monitoring in such networks. In this the different nodes will be the intermediate between the user and the mobile service provider. So In this model a user will send its data through a message generator node which will further carried by data forwarder node and at last to the GSM node. A sleep scheduling algorithm is used for efficient energy consumption and avoiding congestion and collision of the messages. So this paper discusses about the technology used for fruitful, reliable and secured communication and monitoring in emergency ad hoc networks.

Keywords— Sleep Scheduling Algorithm, Advanced Encryption Standard(AES), Congestion Control, Collision control, Data Forwarder Node, Message Generator Node , GSM Node.

I. INTRODUCTION

Wireless ad hoc networks have long been proposed to enable communication in the absence of any infrastructure terminals, effectively infrastructure offering a truly mobile experience to the users. Due to their broad applicability in various settings (including Sensor and vehicular networks), a plethora of data forwarding/ dissemination strategies have been conceived to meet the needs of the various different services envisioned. However, while highly efficient communication strategies have been designed for popular networking scenarios (with sensor networks being the prevalent example) little work has been documented for the study of ad hoc networks to support public safety solutions. Noticeably, unlike traditional ad hoc networks where each source node knows apriority the set of destination nodes to whom to deliver data to, in emergency response networks such an assumption is not valid. The traditional problems of routing and congestion control must now be jointly optimized with control of and allocation rate at the physical layer. Moreover, the inherent distributed behavior of wireless networks dictates that distributed network algorithms requiring less communication overhead can be developed to implement the optimization. In this paper, we present a unified analytical framework within which power control, congestion control and collision control for wireless networks can be optimized in an integrated and coherent manner. These algorithms work to adapt the changes in network topology and traffic patterns. The algorithm shows superior performance relative to existing wireless network protocols ,system for monitoring and controlling wireless node remotely also implementing cluster head as middle ware between wireless network and user application using web technology

II. RELATED WORK

There are various technologies which have been used for monitoring and controlling of wireless sensor network. But the problem is

that every technology are used to show the result on simulation. The analysis of network optimization began with the study of data dissemination. An efficient data spreading method is discussed in paper [1] where a explore and exploit strategy is purposefully envisioned to stringent requirement for efficient data dissemination in emergency ad hoc networks. Paper [2] describes about an efficient data collection method which is used to improve data receiving efficiency, to protect data and to avoid malicious data selective forwarding in large scale mobile monitoring application. A integrated mechanism using advertisement from the nodes with good connectivity and reduces the traffic for sharing information in paper[3].Paper[4] describes about the monitoring and controlling of the wireless sensor network. Here the node will be the inter ware between the user and the mobile service provider. Paper [5] has explained different network algorithms used for power control, routing and congestion control for wireless network. Paper [6] describes about a QWB algorithm which seeks an active queue management for optimal for optimal target detection. There methods has proved better congestion control which can meet the QOS need of the wireless transmission .In paper [7], author controls the data sending rate of the sender by finding the available bandwidth. The proposed approach is simulated in network simulator [NS-2]. Paper [8], tells about the protection of nodes and guarantees network connectivity and desired converge level. The method enables each node to decide that it is eligible to turn off to save energy to prevent data sharing with its neighbors .In paper [9], the author proposed a design for sleep scheduling that minimizes the expected cost value and energy consumption. In paper [10], the reliability of the network is increased by hop by hop method. The method which the author used increases the reliability without adding control overhead thus increasing the good put as well. Simulation result shows the proposed technique is viable solution for secure inter node communication network and secure connection for broadcasting messages.

III.PROPOSED MODEL

Message broadcast node, data forwarder node and the SMS forwarder node (GSM node) are designed. Here the message generator will have a display and keyboard attached to it. The message generator node in particular will have many codes encoded into it. A microcontroller will be programmed such that after pushing the button again and again, each time it will generate different codes as per need. These codes will be seen on the display screen. The message generate will be forwarded to the data forwarder node. [1]- [3]. Data forwarder node will be a simple node compromising of the basic node components. It will just forward the message received by them to the next data forwarder node or the GSM node. The GSM node will be located on the mobile base station from where it will send a message to the required mobile handset.

A program will be written to send the particular message to the next node, also at the GSM node or the SMS forwarder node a program will be made to forward a message. The problems like congestion control [5]-[7], power optimization and collision avoidance arises. For them a specialized algorithm is written down known as the sleep scheduling algorithm [8]-[9], which can control power usage and the collision among the data messages. Related software will be use used for dumping the code into the microcontroller.

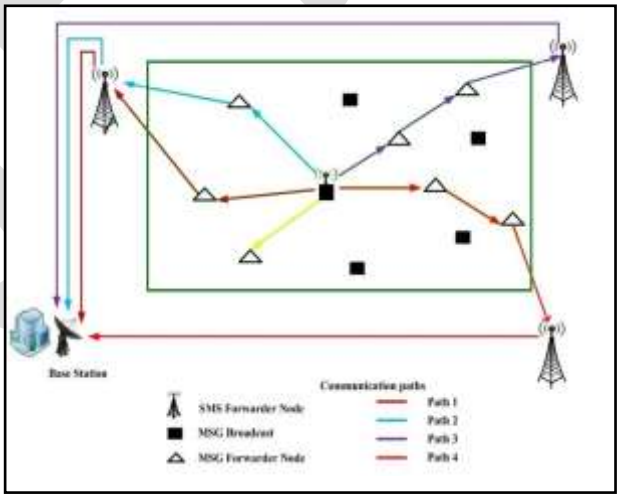

Fig 1: Proposed Work

Phases/Modules involved in the development system are:

i. Built hardware to send and receive messages and control the device called as node.

ii. Nodes will of three types (i) Message generator node (ii) data forwarder node (iii) GSM node or the SMS forwarder node.

iii. Build transceiver module for data transfer between multiple data forwarder nodes. [1]
iv. Write embedded software program to make the message forwarder node to forward the message. [2]- [3].
v. Write a sleep scheduling algorithm in network simulator-2[NS-2] for power optimization and collision control. [5]- [10]
vi. Write another embedded software program for the GSM node to generate/ forward the SMS to required mobile Handset. [4].

Sleep Scheduling Algorithm:

For a wireless networks, the devices operating on battery try to pursue the energy efficiency heuristically by reducing the energy they consumed, while maintaining acceptable performance of certain tasks. However, for multi-hop routing, which is typical for ad hoc networks, this is not the optimal strategy. It is obvious that using the power consumption is not a good enough metric for energy efficiency. Actually, energy efficiency can be measured by the duration of the time over which the network can maintain a certain performance level, which is usually called as the network lifetime.

Recent technological advances have enabled the emergence of tiny, battery-powered modules with limited on-board signal processing and wireless communication capabilities. Wireless networks may be deployed for a wide variety of applications. A typical wireless network may contain thousands of small module. If these modules are managed by the base station directly, communication overhead, management delay, and management complexity could make such a network less responsive and less energy efficient.

Measurements show that idle listening consumes a significant amount of energy. An effective approach to conserve energy is to put the radio to sleep during idle times and wake it up right before message transmission /reception .This requires precise synchronization between the sender and the receiver, so that they can wake up. In this paper, sleep scheduling is tested by NS-2 and practically implemented on the hardware. Practical implementation is done by programing in the microcontroller. Once the node goes in the sleep mode, it is made active by just waking it up. Awaking of a node is done by a wake up bit. Until and unless a wakeup bit is not introduced, the desired node will not be in active mode.
Implementation of sleep scheduling algorithm introduces two advantages to the project as it avoids congestion and collision both.

Congestion control:

When the message generator node transmits its messages to all data forwarder node then it is of great possibility that the messages get repeated as the network is connected in mesh fashion. So making some of the nodes to sleep reduces repetition of messages thus helping in reduction of traffic at each node. Hence avoids congestion.

Collision control:

Sleep scheduling reduces the repetition of messages. Less number of messages introduces less data traffic towards a node. This situation can avoid collision between messages.

A. Message generator node:

The message is generated by message generator node. It compromises of RF transceiver a microcontroller, a keyboard and a display. When the user wants to send a message , it send it by typing a message on the keyboard and transmit it. The message sent is in encrypted form. Here the encryption method used is AES. The message is being sent to the data forwarder node for further transmission.

B. Data forwarder node:

The message when sent by the message generator node it is then received by the data forwarder node. This node is more in number in this particular network. Data forwarder node compromises of a transceiver a power supply and a microcontroller. Data forwarder node forwarders the message to the other nodes of the same type and also to the GSM node for further broadcasting.

C. GSM node:

The message received from the data forwarder is received by the GSM node. It is placed at the top of the mobile tower away from the desired area. It consist of a GSM module, Display screen, a transceiver and a micro-controller. It converts the data send to the text message which is to be sent to a mobile phone. GSM node sends the message to the headquarter.

Encryption method:

The method used in this paper is AES (Advanced Encryption Standard). AES is a cryptographic algorithm that is used to safeguard electronic data. Precisely, AES is an iterative symmetric key block cipher that uses keys of128, 192, 256 bits, and encrypts and decrypts in blocks of 128 bits (16 bytes). It is not like public ciphers, which uses pair of keys, symmetric key ciphers uses the single key for encryption and decryption data. Encrypted data which is returned by block ciphers have the equal number of bits as the input data. Iterative ciphers use a loop structure that repeatedly does performs combinations and permutations with substitutions of the input data.

Power Supply:

As the modules are situated in the emergency areas, hence a permanent and continuous supply of power to the installed modules is must. So in this paper, a dual power supply is designed such that the each module will get power by a chargeable battery. And if time comes that the battery power is exhausted then the node will take its power from the solar panel. The solar panel along with supplying power to the module will also charge the battery simultaneously. After the battery is completely charged, the solar power is discontinued and the module will get its power from the chargeable battery.

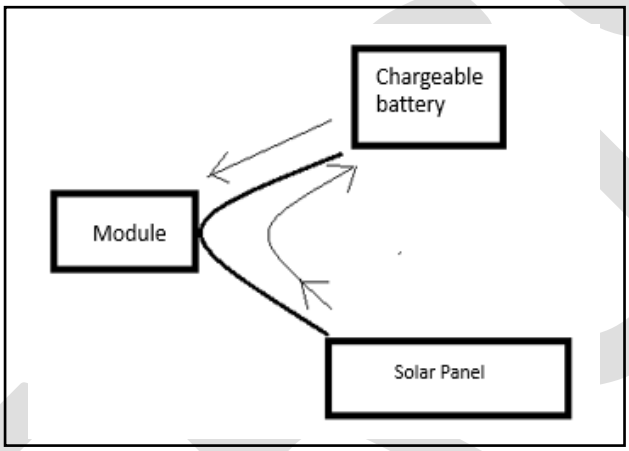

Fig: Power Supply

Here, transceivers are used for communication between multiple nodes. A transceiver is a device having both a receiver and transmitter are combined and share common circuitry on the same board. The RF Transceiver uses RF modules for high speed data transmission.

CONCLUSION

So this paper described about the technology used for fruitful, reliable and secured communication and monitoring in emergency ad hoc networks. The platform developed has been generic and application domain independent and enables anywhere, anytime connectivity to field deployed wireless nodes. The future work will be hardware design of the proposed architecture.

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