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AN EFFECTIVE PROTOCOL AND ALGORITHMIC APPROACH FOR DISASTER MANAGEMENT USING WIRELESS SENSOR NETWORKS

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Abstract-Wireless sensor network (WSN) refers to the spatially disseminated self-directed sensors to investigate physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The growth in the wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such as industrial process monitoring and control, machine health monitoring, and so on. Wireless sensor networks can effectively act to prevent the consequences of natural disasters in multiple domains. WSN nodes are widely used for disaster management for analyses the activities of remote objects of scenarios. By this way, the overall control can be fetched and necessary action can be taken. This research work mainly focus on the specific case scenario and the proposal for the disaster management using wireless sensor networks. In this research work, the effective implementation of managing the railway track is performed with better performance and efficiency. In this research work, the deployment of WSN nodes is implemented which form the dynamic cluster and finally communicate with the base station so that preventive actions can be taken in case of any disaster.

Keywords - Wireless Sensor Network (WSN), Analog to Digital Convertors (ADCs), Random Access Memory (RAM), Disaster Manegement.

I. INTRODUCTION

A wireless sensor network (WSN) of spatiallydistributed autonomous sensors to monitor physical or environmental conditions, such as temperature, sound, pressure, etc. and to cooperatively pass their data through the network to a main location. The more modern networks are bi-directional, also enabling control of sensor activity [1]. The development of wireless sensor networks was motivated by military applications such as battlefield surveillance; today such networks are used in many industrial and consumer applications, such health care monitoring, forest fire detection, land slide detection, water quality monitoring, natural disaster prevention, machine health monitoring [2] [3] [4]. The challenges we have to face in the disaster management is sensor platform, network construction and maintenance, data dissemination and collection and localization [5][6] [7]. The component of the sensor used to collect the data to prevent from the disaster having four basic components. A sensor node classically entails of four rudimentary components: the sensing unit, the processing unit, the communication unit and the power unit. The sensing unit typically entails of one or more than one sensors and also the convertor which alters the signal from analog to digital (ADCs). The sensors perceive the corporal phenomenon and also produce sideways signals based on the pragmatic phenomenon [8] The ADCs alter the analog signals into the digital signals, which are then nursed to the processing unit. The processing unit typically entails a microcontroller or the microprocessor equipped with the memory, which offers intellectual governor to the sensor node. The communication unit consists of a short range radio for performing data transmission and reception over a radio channel. The power unit consists of a battery for supplying power to drive all other components in the system. In addition, a sensor node can also be equipped with some other units, depending on specific applications. For example, a global positioning system (GPS) may be needed in some applications that require location information for network operation. All these units should be built into a small module with low power consumption and low production cost [9]

II. LITERATURE REVIEW

For the different – different disaster management there are various types of WSN network like***Wireless Sensor Network for Flood and Water Level Monitoring System*** in this architecture every year floods reason loss of thousands of life or billions worth of possessions in India. Previous year, foremost loss of humanoid breathes cattle as well as billions worth of establishments was testified in the deluges in Bihar and West Bengal. Every year together Ganga and Yamuna cessation their margins and cause numerous fatalities. Although all these victims cannot be eradicated fully but the losses to life and possessions can be reduced to barest tiniest level, if the protective measures can be taken before the disaster has struck in the form of flash floods. This can be made possible with the help of communication technology employed on top of wireless sensor networks. The system development involves the various phases and of course, all phases are equally important. Starting with the first phase of data collection, level one is to deal with the physical deployment of sensing devices in the riverbanks and implementation of an effective localization scheme depending on the situation and environment. The flow path of the river, past records of water flow and future prediction of the route of the river, influence the placements of the wireless sensors. These sensors form clusters to communicate with the local base stations. The local base stations are powerful enough to communicate with one another directly using wireless communications [10].

The system diagram for the entire mote board is shown in Figure 1. As indicated by the low number of blocks, the mote board has been kept simple with a minimum of components. This was in part due to the requirement for low power consumption but also to help reduce the mote size and manufacturing cost. The following discussion will briefly look at each of the system blocks in turn, noting design decisions and their implications. Figure 2 shows the prototype of the mote.

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1) ***Processor:*** To provide the required processing power and memory for the mote, it was determined that a device based on the ARM7TDMI core would be suitable. The ARM7 is a 32-bit core (with support for a reduced 16-bit instruction set), which can typically operate at clock frequencies up to 50 MHz and address up to 256 MB of memory (much less used in practice).

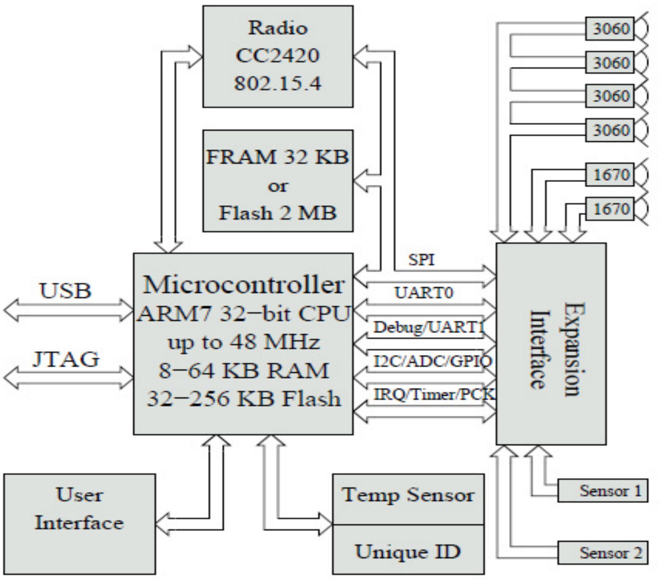

Figure 2 System Diagram of the mote board

2) ***Radio:***The decision of the radio system is critical to the wireless network as a whole. When choosing the radio interface, the performance must be evaluated not just for the individual mote but also for the network as a whole. Narrowband radios for example may consume less power for a mote due to fast start up times but their lower noise tolerance may impose more power drain on the network since all nodes may need to transmit at higher power levels. In addition, the mote must be considered as part of a sensor network which is likely to consist of several different mote types (a multi-tier image sensor network for example). It is not practical for each mote to implement its own radio protocol and thus a standard interface is much preferred. The IEEE 802.15.4 standard defines a physical communications layer for low-power, low data rate (250 kbps) communication. The Chipcon CC2420 combines low power and efficient operation with support for 802.15.4 radio and has been selected [11].

3) ***Expansion interface:***To connect the image sensors and other sensors to the mote, an expansion connector is provided on the board. A simple connector allows for a mechanically robust connector suitable for cable attachment to multiple cameras. The reduced number of connections also simplifies the PCB design of the board. The connector supports a maximum of two Agilent ADCM-1670 CIF image sensors and four Agilent ADNS-3060 image sensors concurrently using two independent UARTs and a shared SPI bus. Additional functions are multiplexed using the remaining pins. These include an I2C (TWI) serial bus, inputs to the analog to digital converter (ADC), timer inputs and outputs, programmable clock outputs, interrupt request lines, plus standard general purpose I/O pins. Several of the GPIO pins are high drive (16 mA) and can be used to power attached sensors instead of using the main board supply. Possible devices are not limited to sensors but can include memory, ADCs/DACs and GPIO expansion devices.

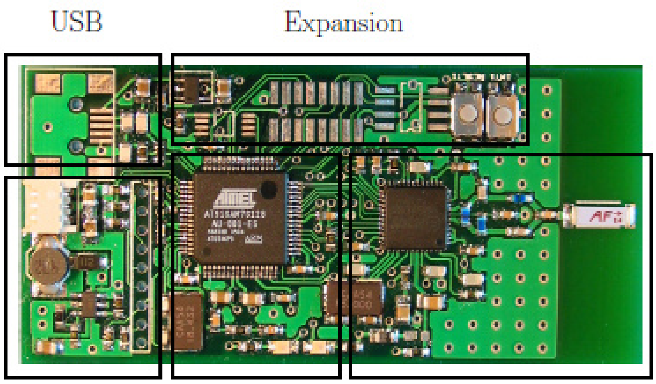

Figure 3 Current prototype of the mote platform with the major functionalunits outlined.

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4) External memory: The AT91SAM7S family offers devices with RAM sizes between 8 and 64 KB and Flash memory sizes between 32 and 256 KB. A standard SPI memory device footprint has been included to allow for external memory. Depending on the requirements, the footprint can be used for two different devices. First, if more RAM is necessary, a FRAM memory chip could be used. These are currently limited to 32 KB but offer unlimited write/erase cycles and no wait states when writing. The memory access would be much slower than on-chip memory or parallel external memory, but it may be acceptable for frame buffering for instance. The second use would be for a Flash memory device. These are currently available in sizes of up to 2 MB. Due to the slow write speed and limited erase cycles, the memory is most suited for program and data storage (pattern matching templates, etc.). If the memory were to be used as a frame buffer, the lifetime of the mote [11].

III. PROPOSED MODEL

In the proposed model we will deploy the sensors along with railway track. After that they will arrange themselves in cluster. Then they start sending the data to the BS as shown in below figure 4.

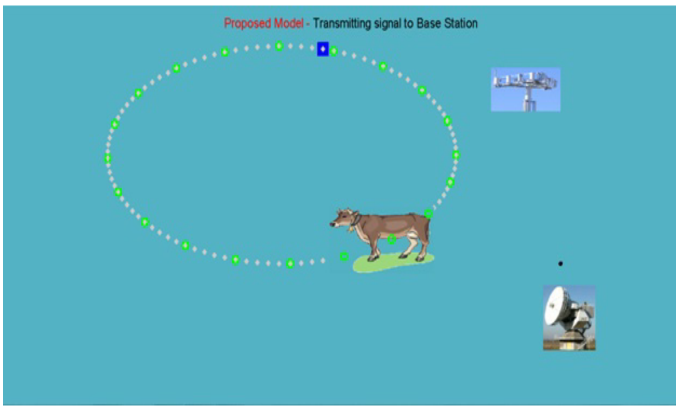

Figure 4 Proposed model of the network deployment.

In Proposed model, there are the Cluster formation with cluster head and each cluster head working together to transmit the data to base station for any obstacle to stop the train. It is visible that there is obstacle in between the railway track and the train should be stopped with prior information.

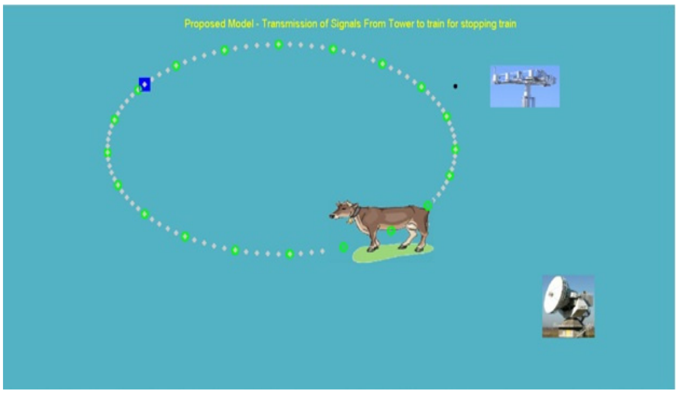

Figure 5 BS sending the signal to stop the train.

As in above figure we see that there is some obstacle on the railway track. After receiving the signals form the cluster head now BS is sending the signal to the receivers which is placed in the train that to stop the train at a particular distance that there is some obstacle on the track.

IV. RESULTS

The algorithm is mentioned below on which we had simulated our proposed work and the results came out.

1. Activation of the Railway Track $R_i$with a specific area of deployment.
2. Set of WSNi={i<=n) Max. N Nodes
3. Assign the Specific Th Threshold for the Distance Vector
4. Deployment of the network scenario
5. Activation of the WSNi with Cluster CHj

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6.Investigate and Calculate the Vector of Hindrance or Obstacle
7. Activate BS *i*
8. Regularly Monitor the Dist of CH to OB
9. If (dist>Th)
Sig[i]=BS[i]
10.Report Ri to BS and Satellite (S)
11.Comparative Analysis and Report Generation with Final Vector Generation

As if we compare the performance level of our proposed model from the existing model the result is much better than that which is calculated in percentage. The existing results and compared results are shown in figure 6.

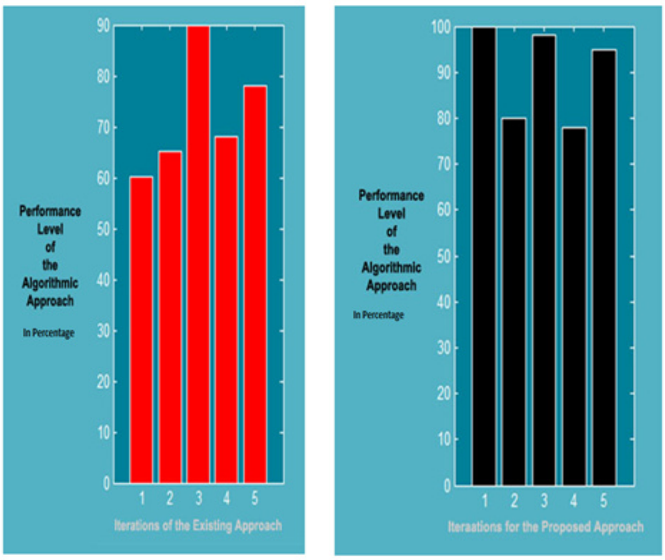

Figure 6 The red color bar is the existing approach and the black color bar is the proposed approach.

In Figure 7, the graphs of the proposed and existing approach is shown with the relative efficiency of the approaches. In the graphs it is visible that the packet transfer in the proposed approach is less and giving better results.

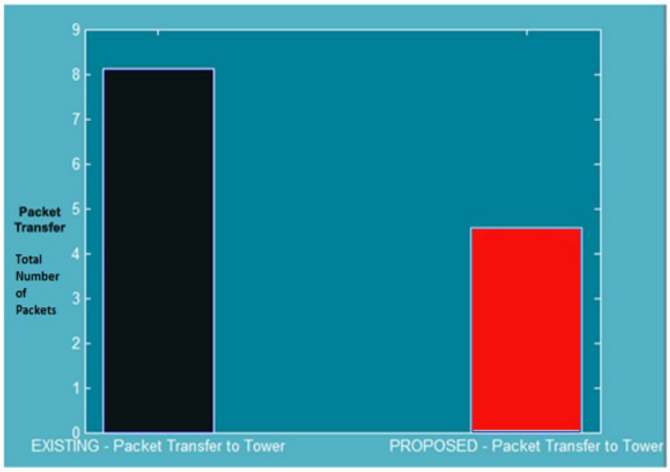

Figure 7 The graphs for the proposed and existing approach, efficiency of the approaches are specified.

In Figure 8 it is clear from the graph that the total time consumption in the Existing and Proposed Model is clearly visible and the performance of proposed approach is better. In this graph we are considering the time taken to complete process, energy consumed in that process and packet data rate.

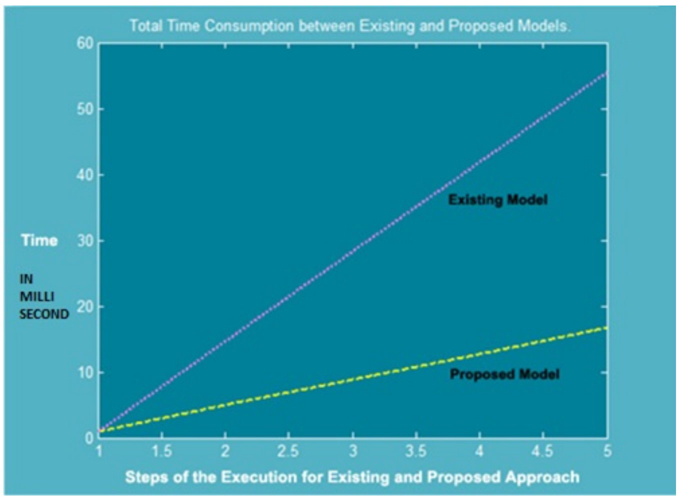

Figure 8 Graph for the Total Time Consumption in the Existing and Proposed.

V. CONCLUSION

Wireless Sensor Networks (WSNs) may be considered as the third wave of a revolution in wireless technology. They promise to have a significant beneficial impact on many aspects of our human existence. These benefits include more efficient utilisation of resources, better understanding of the behaviour of humans, natural and engineering systems, and increased safety and security. Emergency response in disaster management using wireless sensor networks has recently become an interest of many researchers in the world. This interest comes from the growing number of disasters and crisis (natural or man-made) affecting millions of lives and the easy-use of new and cheap technologies. This research work details another application of WSN in the post disaster scenario and comes up with an algorithm for localization of sensors attached to the railway track. This solution is very efficient and rapidly deployable since no pre-installed infrastructure is needed. The proposed technique is based on the prediction of the rescuers velocities and directions considering previous position estimations using clustered sensor network and base station communication. The evaluation of our solution shows that our technique takes benefit from prediction in a more effective manner than previous solutions. The simulation results show that the proposed approach is efficient in terms of communication and network lifetime. For the future work, the existing work can be associated with wimax technology for better throughput and efficiency of the network.

VI. FUTURE RESEARCH WORK

Wireless sensor networks can effectively act to prevent the consequences of natural disasters, like floods. Wireless nodes have successfully been deployed in rivers where changes of the water levels have to be monitored in real time.A landslide detection system makes use of a wireless sensor network to detect the slight movements of soil and changes in various parameters that may occur before or during a landslide. Through the data gathered it may be possible to know the occurrence of landslides long before it actually happens.

For future scope of the work, following techniques can be used in hybrid approach to better and efficient results –

- Particle Swarm Optimization
- Honey Bee Algorithm
- Simulated Annealing
- Genetic Algorithmic Approaches

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