

Aedos Using GSM-R in Wireless Sensor Networks

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Abstract— The demand for emergency aid for accidents is more in today's world ,this project bring forward a new idea in emergency system for fire accident that is to be enforced in trains (in Indian trains) ,in order to open the emergency door automatically during fire without manual help. We deploy this with Wireless sensor Network using Global system for mobile communication in Railways .We place a non-contact temperature sensors with unique identity in each compartment of the train, for fire detection. The engine compartment considered as the main node ,if the sensor detects a high temperature change in the normal environment (due to fire or circuit fluctuation)the sensor transmits a signal to the Track Side Unit beside the train tracks ,this further transfers the signal to the nigh base station and passed on to the main node then the train is stopped by the engine in-charge and simultaneous message is sent to the nearby junction and to the other compartments receivers embedded with a micro-controller that receives the final signal and opens the emergency exit door for the passengers to escape. We are to demonstrate this through simulation.

Keywords— Track Side Unit, Wireless Sensor Network, Global System Mobile Communication in Railways, Automatic Emergency Door Opening System

I. INTRODUCTION

The proposal system in this paper expresses the future implementation of better Emergency system in railway. WSN is used for variety of applications such as military, scientific, industrial, health, forest fire detection and home networks, that consists of linearly arranged wireless sensors connected together to form a with a Linear Network Topology , to monitor environmental changes such as temperature , sound , pressure etc . In modern world sensors plays an important role in many areas GSM-R a standard that implements a number of applications regarding railways for data and voice communication .The GSM-R is using a fast communication between the train and the railway regulation control centres', they consists of TSU they are small cabinets that are arranged beside the

tracks at an equalized distance that helps the sensor to connect to the base station, that helps in fast transmission of signals. The sensor used comes under temperature sensor and they are of two types: (1) contact sensor, (2) non-contact sensor, where we use non-contact sensor temperature sensor with wireless transmitter and a receiver and a monitoring device that can range in open air with resistant. We use multichannel MAC Layer protocol by using lower bandwidth that has high performance in throughput, transferring message, end-to-end delay, and high energy consumption .A micro-controller fixed near the exit door that open the door automatically without hand operated. Section II describes the stages of the project. Section III describes the simulation results of the projects.

II. EXISTING SYSTEM IN EMERGENCY SYSTEM IN TRAINS

In today's Indian Trains the emergency exit door in AC compartments are very compact , so during fire or circuit fluctuation its difficult for passengers to escape in a shortened time through a small way out .The emergency doors are operated physically and , absence of fire alarm system , no information given to the nearby junction regarding the fire accident. We use emergency brake in case of emergency only for valid reason passengers are asked to pay fine in Indian railways.

A. Drawbacks

- Cost installation is high.
- Lack of information transfer to the control centre.
- Signal loss in some areas like tunnels and dense areas.
- Manual interlocking system.

- Nowadays loss of signal since the broadcasting is through walkie talkie.

III. PROPOSAL SYSTEM IN EMERGENCY SYSTEM IN TRAINS

Fast data transmission using GSM-R, placing TSU beside the tracks to connect the base station to pass on the signal to the other sensors and also to the nearby junction. There is no need for separate monitoring system to monitor all the sensors instead each sensors have their own built-in wireless monitoring device, transmitter and receiver. Fire alarm system is provided. Sensors that are used do not create false information by detecting cigarette and bread toaster's smoke.

Messages are transferred in multipath so no collision occur that uses low bandwidth. Decrease man effort and are operated manually and above all saves life.

III. AEDOS DESCRIPTION

The Automatic Emergency Door Opening System Using GSM_R in WSN that consists of a linear network topology of sensors described by the following.

A. Initial Process Fire Detection By Sensor

A sensor is a device that can measure or (sense or detect) various environmental changes like humidity, gas ,temperature. The main sensor types are: Temperature sensor,

IR sensor, UV sensor, Touch sensor, Proximity sensor. The first stage where a non-contact temperature sensor is placed in each of the compartment including the engine compartment with built in monitoring device, transmitter and receiver.

TABLE I
COMPARISON OF THE WORKING PRINCIPLES OF TEMPERATURE SENSORS

S. no	Principles	Temperature Range
1	Thermocouples	-184°C to 4000°C
2	Resistance Temperature Detectors	(-30°C to 260°C) or (200°C to 600°C)
3	Thermistors	-40°C to 300°C

As shown above the sensors must be selected accordingly in terms of its capability of

withstanding very high temperature where as in case of a bomb blast in train, the sensor must be able to send in the emergency signal instead of being dead.

In our project when fire or circuit fluctuations occur the sensor detects the high temperature and sends the signal to the main node and also raises an alarm. This is essentially implemented in the AC compartments where the temperature is very low and containers are much closed.

1) Characteristics and Features:

- *Link Quality:* Actual no. of transmission / Expected no. of transmissions
- *Mote Status:* To analyse node failure
- *Power status:* Charged by solar panels

2) Requirements for power supply for sensor nodes:

- *Processor:* 8mA current in operation state and 8A in sleep state.
- *Radio:* 8mA current in receive state, 12mA in transmit state and 2A in sleep state.
- *Sensor board:* 5mA in operation state and 5A in sleep state.

The sensor can withstand for more days and can be charged with any external source and its life time is calculated by its capacity.

TABLE III
CAPACITY AND LIFE TIME OF BATTERY

Battery Capacity (m A -hr)	Battery Life(months)
250	1.45
1000	5.78
3000	17.35

B. The Method of Signal Transmission

The frequency bandwidth of GSM-R is (876-880 MHz uplink and 921-925 MHz downlink). The distances between two compartments are 2m. A sensor can transmit a signal from 1-3m. The sensor transmit signal to the TSU placed beside the rain track that keeps track of the signals and transfers it to the nigh base station that is located 7-15km distance between the other stations and the train.

Communication & transmission
 Communication Between monitor & sensor
 sensing monitor & sensor Layer

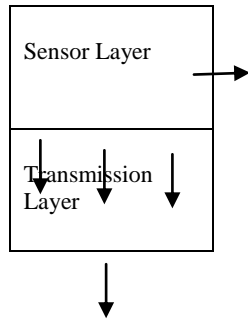


Fig. 1 The communication between the sensing layer and the transmission layer.

Then it transfers the signal to the sensor in the main node that receives the signal. Now, the train is stopped by the train in charge.

We use Medium Access (Multiple channel MAC protocol) data communication protocol. They use a common communication medium that can share data without collision. They also initiate frame transmission and backup from failure.

Example: ALOHA is a suitable for radio broadcasting and also satellite communication.

C. Descriptive process of Opening the Emergency Door Automatically

In finally stage simultaneous signal is sent to all the sensors through the TSU and base station to the of all the other compartments and to the micro-controller (its receiver) fixed near the exit door and thus opens the emergency exit door for passengers to escape and messages also sent to the nigh junction, through the same base station if needed it can be attached with a service provider for further medical requirements.

V. DIAGRAMATIC REPRESENTATION

Is a tool used to represent the working of a network communication, that consists of a network animator NAM which we use a language called Tool Command Language this constructs the network topology and helps to create nodes and the links and represents the way of communication between them and also constructs the x-graph ,its more convenient of installing in open source software than in Windows .

A.. Node Creation

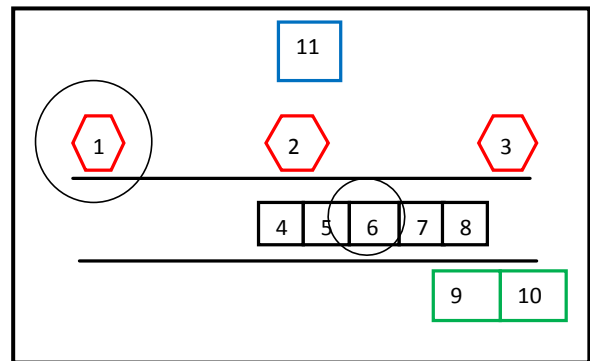


Fig. 2 The result of the different types of nodes created

Fig. 2 has total of 15 nodes , hexagon as the Base station node 1,2 and 3,the node 4,5,6,7,8 represents the compartments of the train, node9 and 10 represents the railway junction and the service provider, and the node 11 represents the base station and node 12,13,14,15 are the two nodes made in-visible by linking them to represent as a train track.

The circle around the node 1 and 6 shows us that they are sending signals. Here we represent the node 4 in the engine compartment.

B. Fire Detection and transfer of signal

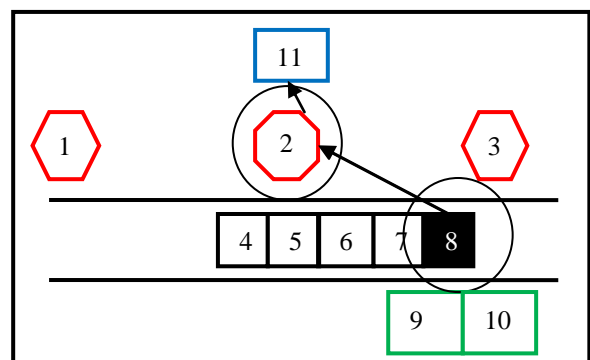


Fig. 3 Fire detection in node 8

Fig. 3 shows that the fire is detected in node 8 and this informs the TSU node 2 and that transmits signal to the node 11 the base station.

C. Response

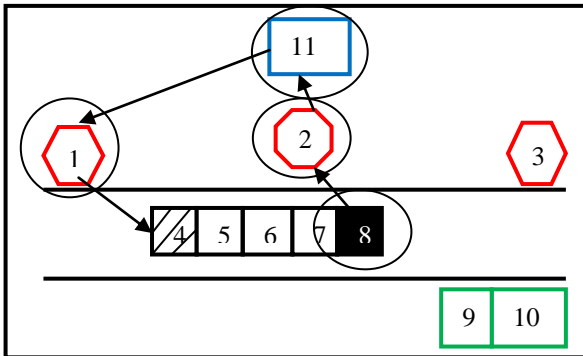


Fig. 4 Response signal

Fig. 4 represents the response signal from the base station to the TSU and finally to the main node 4.

D.. Automatic emergency Door Opening Process

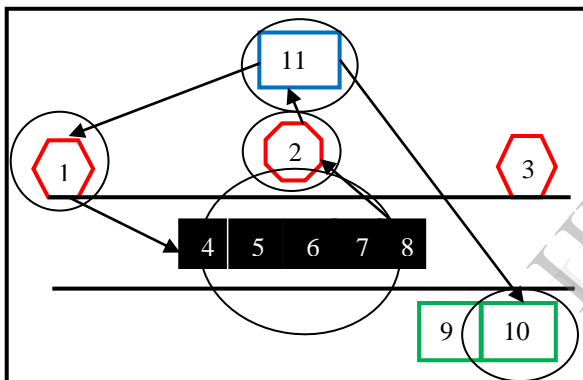


Fig. 5 Door opening

Fig. 5 shows that the door is opened in all compartments in node 4,5,6,7,8 and message sent from base station to the other compartments.

VI. CONCLUSION

This project brings a new method of Fire Emergency system using GSM-R in Wireless Sensor Networks, further it can be implemented with many advanced technologies with satellite communication and can be used for other Medical Emergencies, this may help to save passengers' lives.

REFERENCES

- [1] En.wikipedia.org/wiki/Wireless_sensor_network.
- [2] www.wsn.tkk.fi.
- [3] www.etsi.org/images/files/ETSITechnologyLeaflets/GSMfor%20railways(GSM_R).pdf.
- [4] www.moxa.com.

- [5] www.nokiasiemensnetworks.com/rail.
- [6] En.wikipedia.org/wiki/Temperature_data_logger
- [7] Ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=1343280&abstractAccess=no&userType=inst
- [8] Ecomputernotes.com/computernetworkingnotes/communication_networks/describe_the_mac_layer_protocol.
- [9] Icawww1.epfl.ch/cn2/0910/slides/2.mac.pdf
- [10] www.srl.wustl.edu/~pcowley/cse/591/new_phd_students_lu.pdf