The Implementation of Automatic Fire Rescuing and Information System in a Train using Zigbee and Sensors Networks.

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Abstract— The demand for railway service, have consistently increasing in the last two decades. As a result, more strict safety requirements for railway signaling, control and infrastructure are needed. Same as railway service, in recent years, wireless technology have also advanced rapidly. Especially in this paper we are implementing a zigbee and sensor based information and rescuing system in a train to alert the authorities about the fire accident occurred. Zigbee and sensor network both are effective low cost monitoring system will also help the railway industry for both signalling and communication purpose[11]. Finally presenting a low power embedded system to overcome the fire accidents occurring in railway industry. In this paper a discussion of proposed safety system for railway, using 16f877a microcontroller of PIC as hardware platform, and combine with zigbee and wireless sensor network as a communication platform of wireless area network. Which can transmit, receive and display warnings and emergency signals and for sensing the temperature in trains.

Keywords—Railway signalling, PIC microcontroller, Zigbee, Temperature sensor

I. INTRODUCTION

In present day’s railways are very common and well known for transportation. We also know many accidents are frequently caused in railways. Serious train accidents are caused by a variety of mechanical and/or human factors. The so-called “human error” [6] is the result of many factors. Drivers and the running staff work irregular hours and suffer from safety risks due disturbed sleep patterns. Studies have shown that some drives are less alert and are most likely to commit errors between midnight and dawn. Another problem frequently caused in trains is fire accident. Fire on a running train is more catastrophic than on a stationary one, since fanning by winds helps spread the fire to other coaches. Moreover, passenger’s sometime jump out of a running train on fire resulting in increased casualties. In case of fire in running train, every railway staff available on the train or at the site shall immediately try and stop the train and plunge into action to save lives and property. All railway staff and passengers should take all possible precautions to avoid any of the above mistakes so that possibility of fire breaking out can be minimized [6]. In general fire originates in a small level. When it is surrounded by burning materials with adequate supply of air, fire spreads.

Some of the main source for occurrence of fire accidents in train. 1. Carrying stoves, gas cylinders, kerosene oil, petrol, fireworks etc. in passenger compartments. 2. Making fire/using fire near paper, wood, petrol or such other inflammable articles. 3. Lighted match sticks, cigarette ends carelessly thrown [1]. 4. Short circuit in electrical wirings. 5. Using naked light during authority token delivery to the driver, shunting of inflammable loads, sealing of inflammable wagons.

The goal is to design and implement a cost effective and intelligent full-fledged microcontroller and wireless based system to successfully prevent the fire accidents occurred in a train and also informs to the authorities about the incident immediately [7]. The proposed system consists of self acting micro controller and two way zigbee based data communication system which works round the clock to avoid fire accidents in train [2]. This system can be placed without replacing any existing system. The proposed system gets data from the moving trains, control-centers/stations, Signaling Posts. The efficiency of the system is expected to be considerably increased as the proposed system takes inputs from the signal posts and also from the train. As no change is necessary to be made to the infrastructure of the existing system, the cost of implementation of this system is also less [10].

The system has been designed and simulated using proteus. Models of train system have also be made and tested. The rest of the paper deals with above give details only. Section 2 deals with the overview of the proposed system dealing the schematic diagram and detailed explanations for various blocks. Section 3 details the circuit diagram and proteus simulation details followed [3] with experimental setup of entire prototype, conclusion and reference.
II. OVERVIEW OF THE PROPOSED SYSTEM

The project aims in designing a system which alerts the railway authorities when any fire accidents occurs in the train and this system also provides an immediate effect which controls fire using controlling system. The project mainly helps to avoid accidents which usually occurs when trains crosses the signal although when it is indicating RED color to stop it [9].

This system has three main sections:

- At the signal point
- In the train
- At the railway station

The train signaling lights need to be manually operated through control buttons. Control buttons are used to control the operation of application of project. If the signal is red the Zigbee module continuously transmits the information in its region of operation. When the train comes into the signal point region then the Zigbee module in the train receives it and automatically stops the train [8]. When the signal is green the driver should start the train manually.

The module in the train has a temperature sensor which continuously monitors the temperature. The temperature is read by the ADC (Analog to Digital Converter) module of the microcontroller Unit. This ADC data is processed and converted into the actual temperature reading by the microcontroller in the train. If the temperature exceeds threshold level [4] (Fire accidents) then the Zigbee module in the train transmits this information as an alert to the railway station authorities. Also, starts the fire extinguishing system automatically. The Microcontroller which is the controlling device of the whole system is programmed using Embedded C language.

A. AT THE SIGNAL POINT

At the signal point we are attaching zigbee with a microcontroller and power supply and all required components. The main goal of the signal point is send data light in the signal post. If the Red-LED indicator shows red light then the then the zigbee transmits data continuously to stop the train. When the train comes into the signal point region then the zigbee module in the train receives it and automatically stops the [5] train. If the Green-led indicator shows green light then the driver should manually start the train. Here RS232 is used for interfacing zigbee with microcontroller.

B. IN THE TRAIN

The subsystem in the train contains zigbee module, a microcontroller is interfaced using RS232 for continuous transfer data from signal pole to the train. In this system we are using temperature sensor for scanning the temperature in the
train. If the sensor senses a gradual increase temperature it starts informing to the microcontroller. Then the microcontroller with the help of zigbee starts transmitting the data to near poles. The goal of the system in train is to alert the authorities whenever there is any fire accident happened in the train. In case of emergency, automatic braking system takes control and the train will be stopped. The ZigBee modem sends and receives data at regular time intervals. This information is transferred to the railway station.

C. At the railway station

At the railway station the system has a ZigBee module, a microcontroller unit, a PC with software and necessary driver and power supply units. The main goal of the system at the railway station is to process the data received from other system in the coverage area and transmit them to the other systems. The ZigBee modem sends the data and receives the data to update at regular time intervals.
III. RESULTS AND ANALYSIS

Simulation of the proposed scheme has been carried-out in Proteus. The circuits for the various systems have been simulated and all the necessary conditions verified. Circuits for various systems have been shown in figures 1, 3 and 5. Flow charts for the information of various systems are shown in diagrams 2, 4 and 6. The pin configuration is shown in the diagrams 7 and 8. And the snapshot of the proteus simulation result is shown in Fig 9.

IV. CONCLUSION

In this project, an implementation of an automatic fire-rescuing system for trains have been designed, simulated and tested. The simulation has been done using proteus and testing has been carried out using the developed prototype. It has been estimated that if the system is implemented in railways we can reduce the fire accidents with the help of zigbee and sensor networks. Hence it is expected that major train mishaps can be prevented and human life saved if this system is implemented.
V. REFERENCES