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Realtime Safety Measures in railways using Sensor networks

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ABSTRACT

Nowadays Railway accidents quiet common in our daily routine life .So many innocent people lost their lives due to these accidents. For example, recently so many people dead in major fire accident happen in Tamilnadu express train in country India. We can stop like these disasters in future with present science and technology. This work proposes a new system for preventing the accidents in railways using Sensor networks. It involves two parts of implementation. In the first part, the sensor nodes are used for collecting data such as temperature, concentration of smoke in air, intra and inter bogie temperatures automatically. These collected data are processed to monitor temperature and bogie temperature, if any mal detected exit door opens and water is pumped automatically in the compartment at the information is reached to locomotive engineer and the nearby station master. The second part implements the surveying system for the railway tracks which detects the cracks in the tracks using IR sensors and the derailment in train is detected using MEMS sensors. Hence the system performs both the data acquisition and the survey. The overall process is then controlled by the PIC micro controller which is 8 bit microcontroller and suits very well for the Data acquisition and the control system based application used largely in the industrial applications. In this work, PIC microcontroller gets the data's from sensor nodes, the survey sensors (Inclination using MEMS) manipulates and issues the control signals to the final control elements. Also, it uses GSM to send data's to the locomotive engineer. By implementing this work the Railway network will be safe and secure mode for transportation.

Keywords:GSM (Global System for Mobile communication),PIC (peripheral interface controller)micro controller, MEMS(Micro-Electro-Mechanical Systems).

INTRODUCTION

The Railways is the chief mode of transport for thepeople for the people across various strata in the society. Insuch situation there is a need for ultimate security to beimplemented across the railway network. Conventionalrailway networks lack the necessary infrastructure to respondswiftly to the emergencies such as fire accidents. Nowadaysaccidents have become part and parcel in our daily routinelife not a single day passes without them [1,2]. Whether they areroad-accidents or they are train accidents or air crashes, theydefinitely occur every day in various parts of the world. Alsoother problem created when the continuous need inmonitoring and maintaining the railway tracks to ensure tofree from cracks and inclination. Depending on recentdevelopments in railway system, high speed trains are beingextensively used, and rail transportation is being increased.Reasons for this increase are high speed, economical,environment friendly, safety and modem characteristics ofrailway systems.

Depending on various factors, deformationsmay occur on the superstructure of railways[3,4]. Determining these deformations on the time and taking precaution are veryimportant for the safety of railway systems The proposed work introduces a real time survey and real time dataacquisition and results are analyzed at the real time. If anymal detected at the system then the alerts are given at the realtime and necessary safety measure will be provided. Smokeand fire sensors are implemented at specific points of thecarriage to monitor the temperature of the carriage if anyflaws deduced in the temperature then alert are provided toinsure safety. The sudden change in temperature may causemal like fire accidents. This can prevent by automaticopening of the doors of the compartments and pumping outorder to avoid the fire accidents and if any mal detected existdoor opens and water is pumped out automatically in thecompartment. MEMS accelerometer is used to senses the axisof train[5,6].

SYSTEM BLOCK DIAGRAM

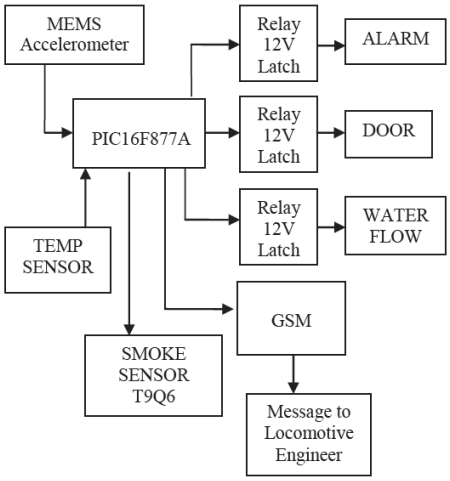

Fig. 1 Block Diagram of System

These are the components used in this work. PIC microcontrollers (PIC16F877A), MEMS Accelerometer, Temperature sensor (LM 235), Smoke Sensor (T9Q6), 12v relay switch and GSM shown in fig 1.We are using temperature sensor for to detect temperature level and smoke sensor for detecting Co2 in the compartment. If the temperature is above the threshold level immediately the doors will open and water is pumped out automatically in the compartment and gives alarm. The message will be send to locomotive engineer through GSM automatically. The MEMS 3-axis accelerometer consists of a Mass at the centre of the sensor's chip, which is suspended by 4Beams doped with Piezo-resistive material. When the sensor is subjected to acceleration in any direction, the movement of the Mass causes the 4 Beams to deform and so change the resistance in the piezo material. This enables the sensor to detect the acceleration motion.

RESULTS AND DISCUSSIONS

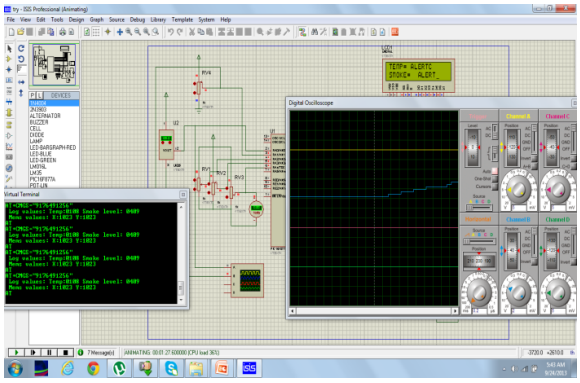

Fig. 2 Simulation of Safety Kit Module

The fig. 2 tells about the simulation of transmittermodule, here all the sensors are connected to the PICmicrocontroller and the readings of all the sensors arecontinuously monitored using the virtual terminal and if anymal detected relay opens and buzzer will be blown. At timeof the buzzer blown it will also send the message to thelocomotive engineer

Smoke Sensor Reading

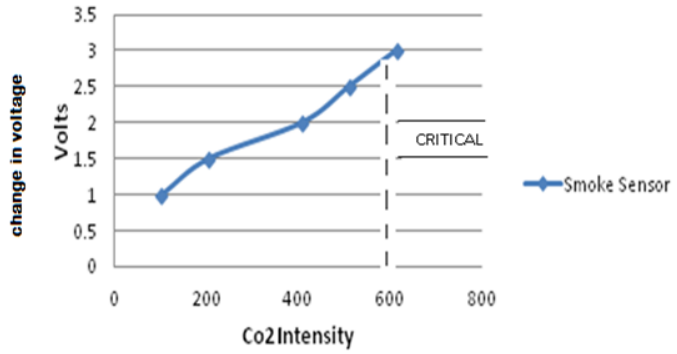

Fig. 3 Graph of Smoke Sensor

Here the fig .3 shows cut off region in the gas level Co2and Co levels are measured using MQ6. The atmospheric gaslevels are measured and to restrict the gas level to 600 ppm.

Temperature Sensor Reading

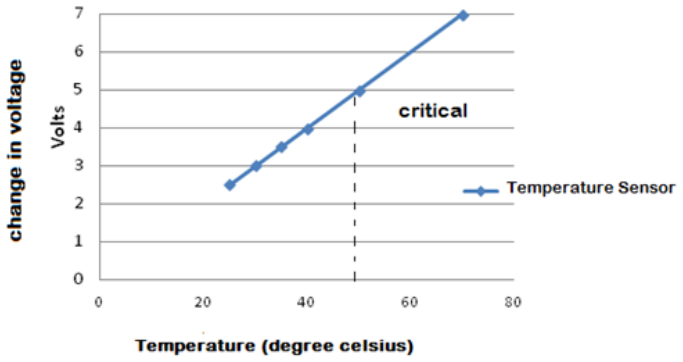

Fig. 4 Graph of Temperature Sensor

The temperature measurement is done to detect the fireaccident in the train, the measurements are made with LM35which has the range from -50° to +150 °C. The sample aregiven to PIC 16f877 at the range of 500hz and the system istested for cut off in 46°C shown in fig 4.

MEMS Sensor Graphs

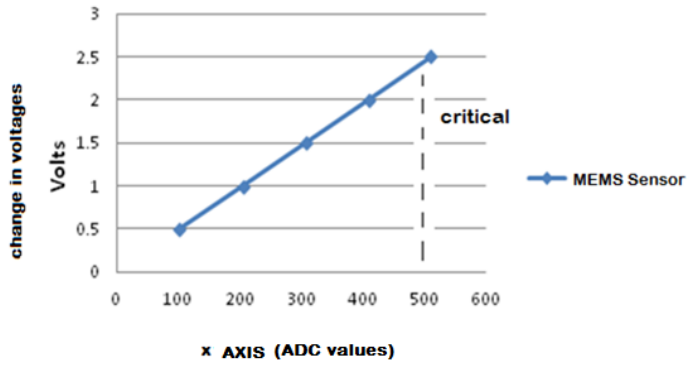

Fig. 5 Graph of MEMS Sensor at X Scale

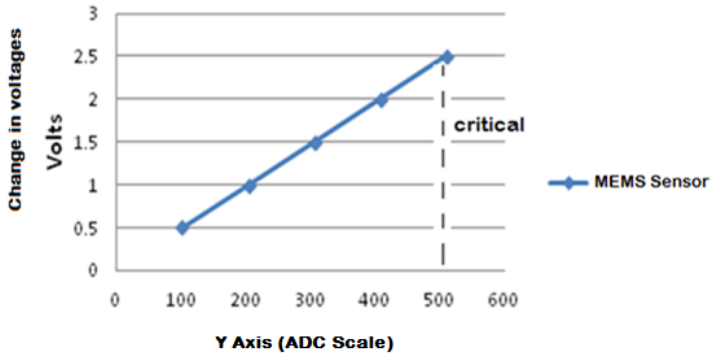

Fig. 6 Graph of MEMS Sensor at Y Scale

Here MEMS accelerometer used here to take the surveyin the railway tracks to detect the derailment in the railwaytracks and it also detects the overall balance of the train. A 3-axis accelerometer is used for the train which is placedperpendicular to the train wheels. If there is any derailmentfrom that of the usual, then alert is shown in fig 5&6.

CONCLUSION

Thus the developed system ensures protection ofaccidents in railways using embedded systems. The sensornodes are used for collecting data such as temperature,concentration of smoke in air, intra and inter bogietemperatures. These collected data are processed to monitortemperature and bogie temperature, if any mal detected exitdoor opens and water is pumped automatically in thecompartment at the time information is reached to locomotiveengineer and the nearby station master. This design gives areal time safety for railways.

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