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Railway Accident Monitoring

G.J.Deepika, Gurpreet Kaur, Neha Kumari, Suruchi Rathod
B.Tech EEE, Department of EEE
ASET, Amity University Haryana
Gurgaon, India

Sonal Dahiya, Mahendra Singh Meena,
Assistant Professor, Department of ECE
ASET, Amity University Haryana
Gurgaon, India

Abstract: Rail accidents are one of the major issues till the present day. Despite of safety measures, every year at least one major accident is recorded. The aim of this paper is to present a handy module consisting of sensors and microsystems which are used to detect faults which cause accidents. The causes of accidents are categorized into different modules which include anti-collision, track detection, wheel balance, level crossing, and tunnel accidents. IR sensor, Piezo sensor, reed sensor are used to detect faults.LCD(Liquid crystal display), Motor, Led's and Buzzer are output devices which continuously inform the status and occurrence of fault.

***Keywords**-Railway safety, Monitoring, accidents, Level-crossing*

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I.INTRODUCTION

In railway system, safety and reliability are highly required factors. Because of vast Indian railway network, detecting faults is a major issue and implementing new technology includes high cost, efforts and time. The main cause for train accidents are: Derailment, Anti-collision, Wheel balance, Level crossings and tunnel. Derailment is mainly caused due to: crack and bend in the track. This occupies the highest percentage of the causes of the train accident.The unmanned railway crossings are highest accident prone areas next to derailment. Many unmanned crossing were closed causing inconvenience to road passengers. Lack of proper lighting system in tunnels is due to improper power supply and communication problems to remote areas. These factors cause accidents in tunnel. At present, India has employed GPS system for tracking trains and to avoid collision of trains. Wheel balance system balances the wheels of the train and detecting imbalance in the wheels due to damage of wheels, or imbalance while the train is taking steep turns. Simple sensors are used to detect faults and microcontroller is used to control the output according to the value of the input which is the output of the sensors.

II. LITERATURE SURVEY

V.Purnachandra.et.al.[1] in 1987 has proposed microprocessor based system in railways for the first time, which controls the signals and generates output within 20 seconds. This system was designed to control the input and outputs, the main disadvantage is that this system cannot detect the faults. Over the years, the system has developed to large extent. Image processing is used to detect the surface of the rail-head[2]. A camera is used for constant surveillance of the real time rail head surface. This detects the defects of the track. This system cannot detect the defect before the approach of the train. Moreover, image processing in real time has many disadvantages, it cannot detect in bad weather and at high speed. Further, research have been done to detect obstacle on the track[3]. An array of IR transmitter and receivers are placed on the parallel tracks. When there is a signal breakage then it implies the existence of obstacle. This fulfills the purpose, but the receivers are damaged due to frequent contact with train. Climatic condition will also influence the outputs. Placing this system along the whole track includes large investment and low outputs. Further to the first proposed system, the accident prevention system was developed by M.D. Anil.et.al.[4]. This system consists of microcontroller, Zigbee, and IR sensors. IR sensor detects the faults and Zigbee is used for wireless communication. This system prevents the accidents, the failure of Zigbee module is possible. Moreover, every train should consist of Zigbee module which indeed increases the cost of implementation. Furthermore, fuzzy logic based track detection system is using vibration sensor with sensor nodes[5]. Sensor nodes are given an unique ID and they track their own GPS location. A backup system of sensor nodes is attached to the opposite track. When there is major change in vibration then it indicates the crack in the track. Vibration is highly influenced by surroundings. The output is thus highly fluctuating. Wheel based level crossing system [6], in this ultrasonic sensor detects the movement of the wheels calculating the speed of the train and communicating with crossing system using Zigbee. Ultrasonic increases the cost and wear -tear occurs due to frequent contact with the train. Accidents may occur due to defects in rolling stock [7]. This includes hot spots, deformations, and wheel balance system using strain gauge. Strain gauge system is highly complex for detecting real-time wheel balance.

III.DESCRIPTION OF HARDWARE

MCU is a device which combines numerous components of a microprocessor system. The MCU used in our project is ATmega8. It has inbuilt ADC which converts analog input to digital value. All the sensors (Reed, Piezo and IR) are connected to ATmega8 MCU. The output is given to LCD or motor or LED for signaling. MCU is given a supply of +5V. A

battery of 9V is used and then regulated to +5V using LM7805 with a capacitor to filter noise.

Reed sensors when paired with permanent magnets present an ideal method of sensing and detecting movement, proximity, metal detection, and liquid level and flow measurement. Reed sensors open and close their reed switch contacts in the presence of a magnetic field.

A piezoelectric sensor is a device that uses the piezoelectric effect, to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge.

An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion

III. DESCRIPTION OF SOFTWARE

CVAVR-Code vision AVR is a C cross compiler, integrated development and automatic program generator designed for the Atmel AVR family of microcontrollers. The program is designed to run under the windows 98/Me/NT 4/2000/XP/vista 32 bit operating systems. The C cross-compiler implements nearly all the elements of the ANSI C language, as allowed by AVR architecture, with some features added to take advantage of specificity of the AVR architecture and the embedded system's needs. Embedded C compiler based software is used to create a hex file using Code Vision AVR (CVAVR) using C language. Then simulation software (PROTEUS) is used to test the prepared code. Khazama is software used to burn the hex file into the controller. Extreme Burner-It is software used to check the connections of the controller.

IV. WORKING

There are numerous methods to solve our objectives. Here we use sensors to make our project simple and handy. All the parts represent similar block diagram as in Fig1 in a broader view. ATmega8 microcontroller is used, with different sensors. Many other sensors can be used to fulfill these requirements. Proteus of anti-collision, level crossing and tunnel, and derailment is as in Fig.2.Wheel imbalance can mainly occur while taking steep turns. Although, occurrence is very less, but on occurrence major accidents with huge life loss is observed. Earlier wheel balance was checked using strain gauges.

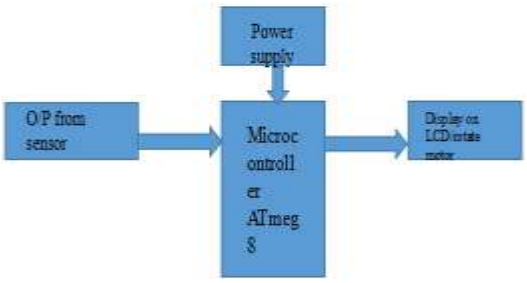

Fig.1. Block diagram of all modules

To simplify the process, each wheel pair is equipped with array of IR transmitter and receiver on opposite sides around the center of axis. Output of IR receivers is fed to ATmega8 and the status is displayed on LCD. Power supply of 9V is converted to 5V and supplied to microcontroller. Circuit diagram is as shown in Fig.3

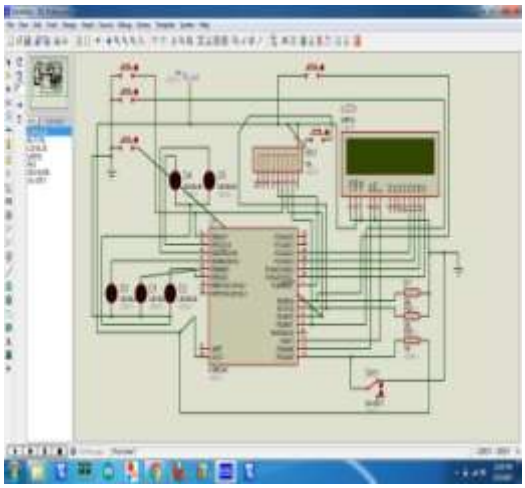

Fig.2. Proteus of level crossing, anti collision, and derailment

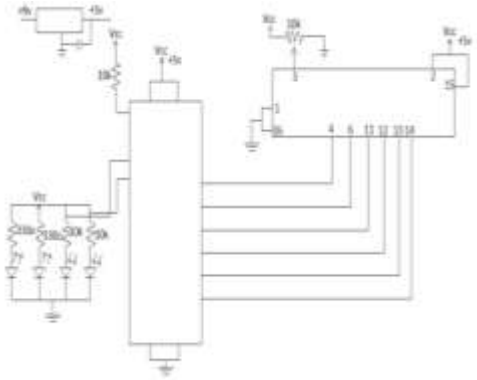

Fig.3. Circuit Diagram of Wheel Balance system

Level crossing is most prone to accidents. Reed sensors which act like switches are placed on the railway tracks, on both sides of level crossing to detect entry and leaving of the train. Magnet is fitted to train and reed sensor contact closes and acts as closed switch and thus detects the train. The output of reed switch is given to Atmega8. A DC motor is connected to controller for opening and closing of gate. To avoid crossing of passengers while the gate is closed, a new type of gate is used which locks the road passengers on either side of track is implemented. Red and Green LED's are used for signaling. This system is economic, handy and can be used in remote areas. Block diagram of level crossing is as shown in Fig.4.Tunnels are places where many accidents happen, mainly life loss due to improper signaling. Entry and exit of train are indicated and lighting system is provided.

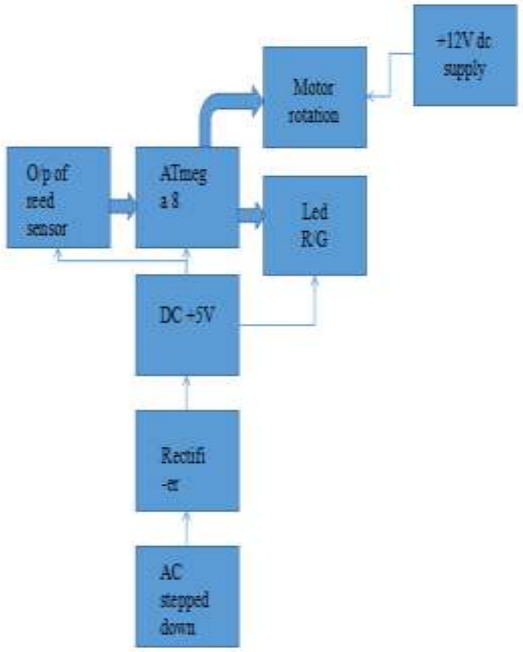

Fig.4. Block diagram for level crossing

Derailment is caused due to crack and bends in track. Infrared sensor is used to detect both the defects in the track. Many experiments have been done to avoid accidents due to derailment. But they are not handy. IR sensor is placed in the front of the train, continuous monitoring is done by IR sensor. When there is any defect then it output of sensor will defer, displaying error on LCD. Bend in track is detected by an array of IR sensors. In normal working condition, the array gives a fixed output with 5% but when there is a bend output of IR sensors in between show a different value. Hence, Bend in the track can be detected.

Anti-collision is controlled to great extent using GPS system but still there are many chances of accident, which may be due to network failure, difficulty in monitoring remote areas etc. Anti-collision system is attached to train, this system comprises of Piezo sensor which detects vibrations in the track and gives voltage as output. This output is given to microcontroller and by using ADC this output is processed. When a train is moving it has its own vibrations in track, when any other train is approaching then the value of vibration in the track changes. Depending on the value the approaching of train can be detected. All the outputs from all sensors are displayed on the main screen to inform the driver. The concepts used will remain same but can be implemented using different types of sensors. Block diagram of anti-collision system is as shown in Fig.5.

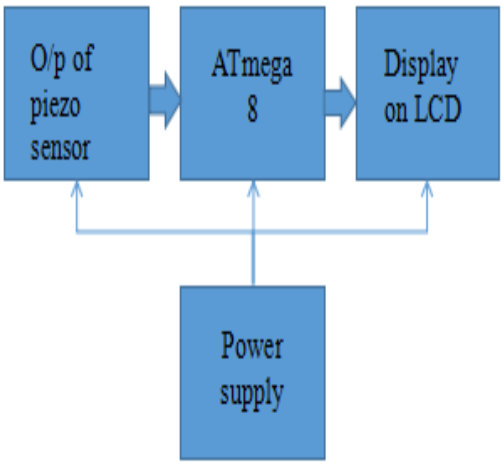

Fig.5. Block diagram for anti-collision

V.CONCLUSION

This paper has proposed to detect faults using IR, Piezo, and Reed sensors. The system has been stimulated using Proteus and a prototype is designed on the basis of the stimulation. The level crossing system is designed to reduce accidents to a very large extent by implanting an automatic gate closer system with new model of gate. This system is the cheapest and efficient of rest all. Furthermore, a prototype is presented, for practical applications the concept can be applied. Environment effects, temperature, and many other factors should be considered for practical application.

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