IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

ULTRASONIC AND PIR SENSOR FOR CRACK DETECTION SYSTEM FOR RAILWAY TRACK

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Abstract: In this system the integration of ultrasonic and total station for railway track geometry surveying system is given. It consist of GPS module, GSM modem, IR sensor, PIR sensor for application of connection purpose, crack detection and finding of human being present in the railway track. The GPS module and GSM modem help us to find and sending of crack location to nearest railway station or control room. In the present, measurement of track distance is done by using high cost LVDT with less accuracy, but use of the less cost ultrasonic sensor for above process with high accuracy is done. In this PIR sensor is used to avoid manual checking of detection of presence of human being in recent trends of application. The importance of this is that, it is applicable both day and night time crack detection purpose.

Key words:

GPS Module, GSM Modem, IR Sensor, PIR Sensor

I. INTRODUCTION

The Indian Railway network is the biggest rail-passenger drain and it is present the pillar of the country's transport infrastructure. In India, most of the commercial transport is moved out by the railway network, because it is being low price mode of transportation preferred over all other means of transportation such as buses, flights etc. The rapidly improving economy of India has occur in an exponentially increasing demand for transportation in recent years and this has resulted into a very huge rise in the volume of traffic in the Indian Railway network. The better transport leads to more trade. Economic level is mainly depend on increasing capacity and level of transport. It presents an implementation of an efficient and cost effective solution suitable for railway application. In this, IR sensor is used to detect the crack in rail road is used when the crack is detected its latitude and longitude values will send as a message to control room by using GPS and GSM berth. The Ultrasonic is used for the surveying process. Other important component i.e. PIR sensor is used to detect the presence of humans in track.

In proposed system, it detects the rail road crack, measuring distance for two rail road and also measure the pursuing human in the railway track. When IR sensor is used for to detect the crack in the track and ultrasound sensor measure the distance between the two track and also PIR sensor is used to detect human being pursuing in the track. If any crack is occurred in the track means longitude and latitude of the place messaged to the nearest station and ultrasonic sensor measure the distance between the two track. When PIR sensor detects the human being or animals on the railway track, if any one pursuing on the track means they stop the survey work after crossing rail road they detect the track. The three main components used in the block is IR sensor, Ultrasonic, PIR sensor. IR sensor is used to detect the crack in railway track.

Transport is very important to carry the passengers and goods from one place to another. The better transport leads to more trade. Economic level is mainly depends upon increasing the capacity and level of transport. It presents an efficient and cost effective solution

suitable for railway application. In this, IR sensor is used to detect the crack in rail road system, when the crack is detected its latitude and longitude values are send as a message to close station by using GPS and GSM service. Then Ultrasonic is used for the surveying process. Then other important component is PIR sensor used to detect the presence of humans in track.

II. OVERVIEW OF SEMINAR

There are two causes of cracks in rail tracks i.e. Natural and Artificial. Natural causes are like weather, floods, cyclone, landslides etc. Artificial causes are like terrorist attacks etc. Detection and maintenance of rail defects are major issues for the rail community all around the world. The defects mainly include weld problems, internal defects worn out rails, head checks, squats, palling and shelling, corrugations and rolling contact fatigue (RCF) initiated problems such as surface cracks.

2.1: Block Diagram Description

The three main components used in the block is IR sensor, Ultrasonic, PIR sensor. Fig. 2.1 shows the block diagram of ultrasonic and PIR sensor for crack detection system. IR sensor is used to detect the crack in railway track. Infrared (IR) transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly, IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other. When the signal is received by the receiver then it is taken as crack is detected. When the crack is detected the latitude and longitude value is send as a message to nearby station. Passive Infra-Red sensors (PIR sensors) are electronic devices which measure infrared light radiating from objects in the railway track. PIRs are often used in the construction of PIR-based motion detectors. Ultrasonic wave is used to measure the track distance. Then the LCD display is used to view the result.

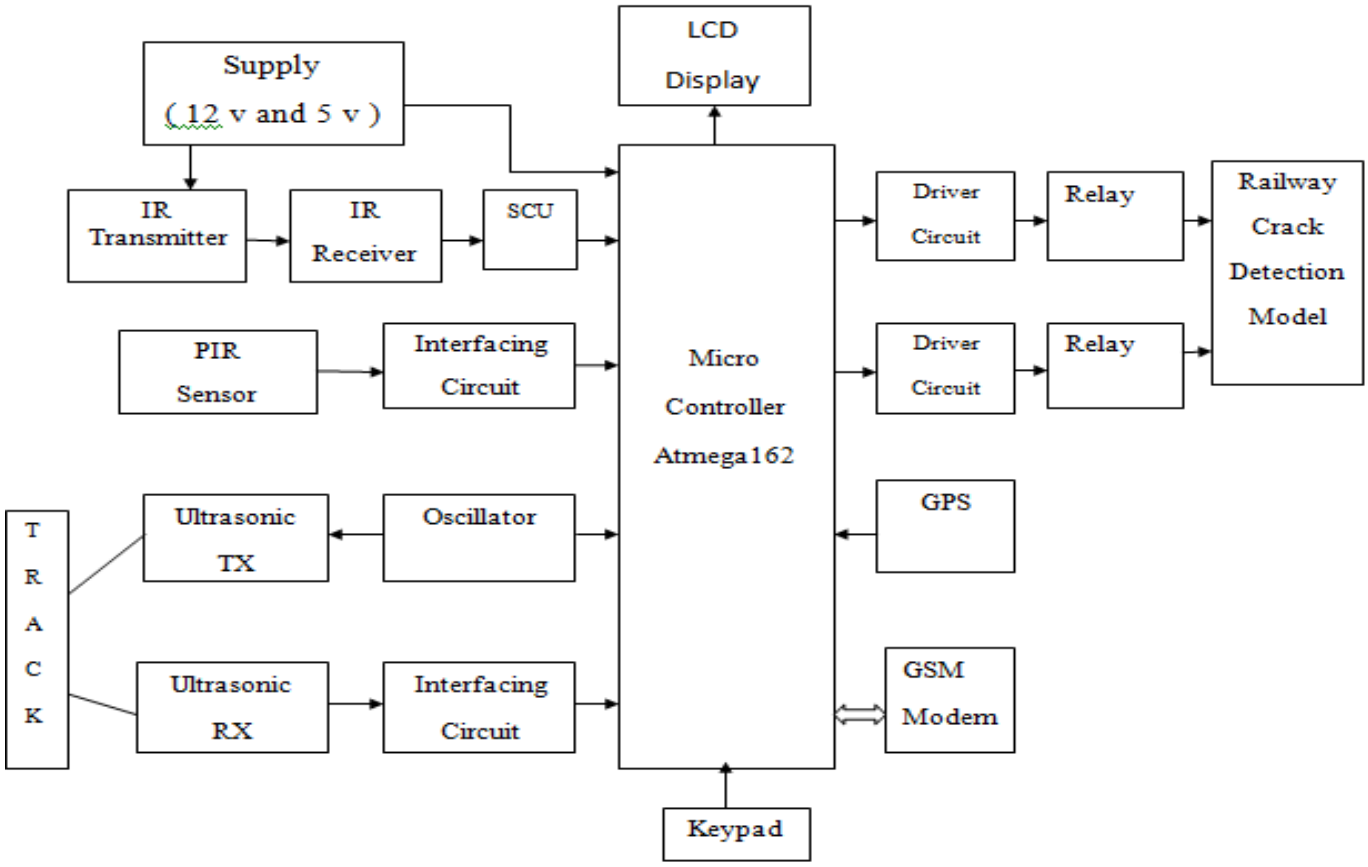

Fig. 2.1: Block Diagram of Ultrasonic and PIR Sensor for Crack Detection System

III. CIRCUIT DESCRIPTION

3.1: Microcontroller ATmega162

ATmega162 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. Fig 3.1show the microcontroller ATmega162 By executing powerful instructions in a single clock cycle, the ATmega162 achieves throughputs approaching 1 MIPS per MHz allowing the system designed to optimize power consumption versus processing speed. The ATmega162 is a low power high performance CMOS 8bit microcontroller with 8k bytes of in-system programmable flash memory. There are 131 powerful instructions present in ATmega162.

Fig.3.1: Microcontroller ATmega162

3.2: GPS

GPS stands for Global Positioning System. Fig.3.2 shows the diagram of GPS. The GPS is used to receive the position data from the vehicles and display on a digital map. It will have the interface to the communication link. Enhanced features include video features, trace mode, history track, vehicle database, network support. The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS.

Fig. 3.2 shows the GPS Module

3.3: GSM Module

The GSM net used by cell phones provides a low cost, long range, wireless communication channel for applications that need connectivity rather than high data rates. Fig. 3.3 shows the GSM Module. It is used to send the SMS to mobile phone. The origins of GSM can be traced back to 1982 when the Group Special Mobile (GSM) was created by the European Conference of Postal and Telecommunications Administrations (CEPT) for the purpose of designing a pan-European mobile technology. It is approximated that 80 percent of the world uses GSM technology when placing wireless calls, according to the GSM Association (GSMA), which represents the interests of the worldwide mobile communications industry. This amounts to nearly 3 billion global people.

Fig. 3.3 shows the GSM Module

3.4: IR Sensor

Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Fig. 3.4 shows the crack detection using IR sensor. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other.

Fig. 3.4: IR Sensor

3.5: Passive Infrared Sensors (PIR)

Passive Infra-Red sensors (PIR sensors) are electronic devices which measure infrared light radiating from objects in the field of view. PIRs are often used in the construction of PIR-based motion detectors, shown in fig.3.5. Apparent motion is detected when an infrared emitting source with one temperature, such as a human body, passes in front of a source with another temperature, such as a wall.

Fig. 3.5: Human Detection using PIR Sensor

3.6: Ultrasonic Sensor

The flaws in the form of cracks, blowholes, porosity in metallic pipes can be detected using the ultrasonic waves. Fig. 3.6 shows the circuit of the distance measurement using ultrasonic distance meter. The ultrasonic sensor works on the principle of reflection of waves. The crack can be detected by measuring the time interval of reflected beam.

Fig. 3.6: Distance Measurement Using Ultrasonic Sensor

3.7: Relay

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof. Relays are used where it is necessary to control a circuit by an independent low-power signal, or where several

circuits must be controlled by one signal. Relays were first used in long-distance telegraph circuits as signal repeaters: they refresh the signal coming in from one circuit by transmitting it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

The traditional form of a relay uses an electromagnet to close or open the contacts, but other operating principles have been invented, such as in solid-state relays which use semiconductor properties for control without relying on moving parts. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called protective relays.

3.8: DC Motors

To traverse a distance of 22 Km in 4 hrs, an average speed of 1.5 meters/sec is needed. Fig. 3.8 shows the DC motor. The proposed design uses 4 DC motors. DC motor works according to relay operation.

i) When relay 1 is in the ON state and relay 2 is in the OFF state, the motor is running in the forward direction.

ii) When relay 2 is in the ON state and relay 1 is in the OFF state, the motor is running in the reverse direction.

Fig. 3.8: DC motor

3.9: LCD Display

It is used for displaying alphabets, numbers and also special symbols Fig. 3.9 shows the LCD Display. The proposed system uses 16*2 alphanumeric display.

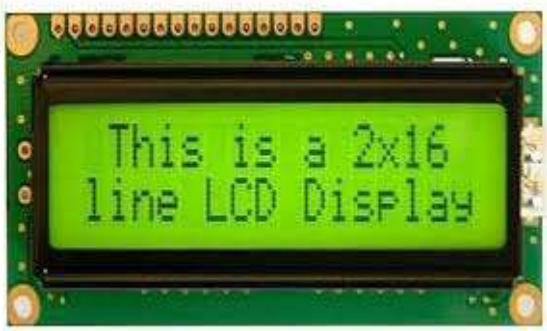

Fig. 3.9: LCD Display

CONCLUSION

In this paper studied the IR sensor based railway crack detection system and PIR sensor based presence of human detection system. It does not give false output. The idea can be implemented in large scale in the long run to facilitate better safety standards for rail tracks and provide effective testing infrastructure for achieving better results in the future.

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