

Detection of Crack In Rail Road Using Ultrasonic and PIR Sensor

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Abstract - The rail accidents are increasing day by day and this is because of improper maintenance of rail roads which leads to crack in railway tracks hence the proper maintenance should be provided and cracks should be detected to avoid such bad situations. But this is difficult to determine manually hence the solution is provided here. For reducing the derailments, the crack detection systems were designed using various techniques. This paper introduces the detection of cracks in rail roads using ultrasonic and PIR sensor. This system mainly consists of PIR sensor, ultrasonic transmitter and receiver, GPs module and GSM modem, IR sensor. The IR sensor helps to detect the cracks and the PIR sensor is used to detect the presence of human on rail roads. The ultrasonic sensors help for measuring the distance and the exact location of crack is obtained using GPS module. The communication is done through GSM technique. After detecting the crack the message is send to nearest station with location of crack. This system is simple in operation and advantageous over both day and night crack detection. There are several different techniques to detect the cracks but this technique of crack detection has less costing and gives more accurate result.

Key Words: GPS module, GSM modem, IR sensor, PIR sensor, Ultrasonic distance meter.

1.INTRODUCTION

Transportation plays an important role in our day to day life i.e. to transfer the goods and passengers from one place to another. As the railway is essential part of our life, the proper maintenance should be there. Sometimes in Naxalite areas, they purposefully burst the tracks which leads the human life in danger. Hence the effective solution over this problem is introduced in this paper. The ultrasonic and passive infrared sensor(PIR) is used here. The infrared sensor (IR) is used for crack detection and global positioning system(GPS) and global system for mobile communication(GSM) are used to know exact location of crack as well as for communication purpose respectively.

2. PROPOSED SYSTEM AND ITS COMPONENTS

In the proposed system the crack is detected using IR sensor. The IR transmitter and receiver should be placed in a straight line. IR sensor is nothing but the one type of LED which emits infrared rays.

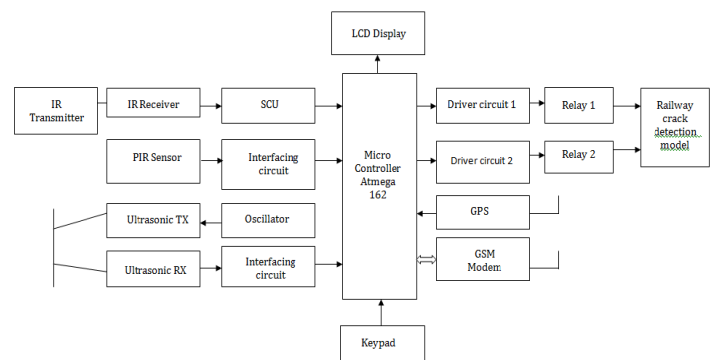


Fig-1: Block Diagram

In normal condition, the light from transmitter does not fall on the receiver .when there is any crack or any disturbances like cracks, the light from transmitter side fall on the receiver side and the set value get increased, the amount by it increases is directly proportional to the intensity of light. The distance 'D' is measured by the ultrasonic sensor. The sound wave travels the distance between the source and the subject therefore the actual distance is measured by D/2.The GPS gives the latitudinal and longitudinal data to obtain the exact position of crack and GSM helps for communicating to the nearest railway stations. The detection of human being is done by using passive infrared sensor (PIR).

The components used in block diagram:

1)Microcontroller ATmega162:The ATmega 162 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 ATmega 162. The on

chip flash allows the program memory to be reprogrammed in the system . The ATmega 162 achieves throughout approaching 1 MIPS per MHZ allowing the system designed to optimize power consumption versus processing speed.

2)PIR sensor(passive infrared sensor):PIR sensor is the motion detector used for sensing the movement of people, animal or other objects.the burglar alarms and automatically activated lightning system consists the PIR sensors.It is also referred as PID sensor i.e. passive infrared detector.The changes in infrared radiations are detected by PIR sensor which depends on the temperature and surface characteristic of the objects in front of the sensor.



Fig-2: Human Detection Using PIR Sensor

3) GSM modem and GPS module: A GSM is a device which can be either a mobile phone or modem device which can be used for communicating purpose. The GPS provides location and time information in all weather conditions.

4) IR Sensor: IR transmitter sends an IR radiation which is reflected of a surface and falls upon a receiver. Due to the falling of light on the receiver a potential difference is created across the ends. This potential difference is recognized by microcontroller as high or low.IR transmitter consists of LED that emits IR radiations and IR receiver receives the IR rays transmitted by IR transmitter.

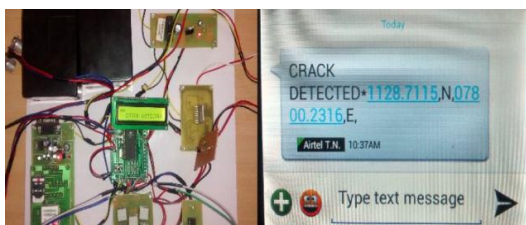


Fig-3: Crack Detection Using IR Sensor

5) Ultrasonic sensor: The flaws in the form of cracks, blowholes, porosity in metallic pipes can be detected using the ultrasonic waves. The ultrasonic sensor works on the

principle of reflection of waves. The crack can be detected by measuring the time interval of reflected beam.

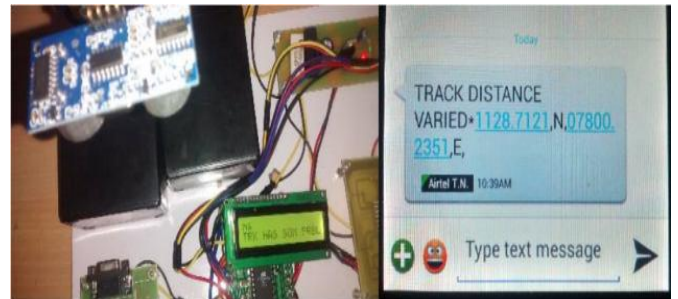


Fig-4: Distance Measurement Using Ultrasonic Distance Meter

6) Oscillator: An oscillator is a mechanical or electronic device that works on the principle of oscillation .A periodic fluctuation between two things based on change in energy. Electronic oscillations are used to generate signal in computer, wireless receivers and transmitter and audio frequency equipment.

7) Relay and Driver circuit: A relay is an electrically operated switch. Relays are used where it is necessary to control a circuit by a separate low power signal or where several circuits must be controlled by one signal. A relay driver IC is an electromagnetic switch that will be used whenever we want to use a low voltage circuit to switch ON and OFF.

8) DC motor: It is advantageous to use the dc motor in special application like electric traction to convert ac into dc.The proposed system uses 4 dc motors and operate according to relay operation. When relay 1 is on state and relay 2 is off, motor run in forward direction. When relay 2 is on and relay 1 is off state , motor run in reverse direction.

9) LCD Display: It is used for displaying alphabets, numbers and also special symbols. The proposed system uses 16*2 alphanumeric display.

RESULT AND CONCLUSION

The crack is detected with high accuracy. By using this system manual checking is avoided hence requires less man power .This idea can be implemented in large scale for safety and helps in reduction of derailments.

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