



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 4, April 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.512



9940 572 462



6381 907 438



ijirset@gmail.com



www.ijirset.com

Embedded Based Railway Track Fault Identification Using GSM Module

S.Murugan ¹, S.Rajesh ², K.Rajesh Kannan ³, K.Sukumar ⁴, N.B.Rajesh ⁵

UG Scholar, Department of EEE, Francis Xavier Engineering College, Tirunelveli, Tamilnadu, India ^{1,2,3,4}

Assistant Professor, Department of EEE, Francis Xavier Engineering College, Tirunelveli, Tamilnadu, India ⁵

ABSTRACT: The Indian Railways has one of the largest railway networks in the world, crises- crossing over 1,15,000 km in distance, all over India. However, with regard to reliability and passenger safety Indian Railways is not up to global standards. Among other factors, cracks developed on the rails due to absence of timely detection and the associated maintenance pose serious questions on the security of operation of rail transport. A recent study revealed that over 25% of the track length is in need of replacement due to the development of cracks on it. Manual detection of tracks is cumbersome and not fully effective owing to much time consumption and requirement of skilled technicians. This project work is aimed towards addressing the issue by developing an automatic railway track crack detection system. This work introduces a project that aims in designing robust railway crack detection scheme (RRCDS) using SENSOR assembly system which avoids the train accidents by detecting the cracks on railway tracks. And also capable of alerting the authorities in the form of SMS messages by using GSM modules. The system also includes distance measuring sensor which displays the track deviation distance between the railway tracks.

KEYWORDS: Maximum Robust Railway Track Crack Detection Scheme (RRCDS), Liquid Crystal Display (LCD)

I. INTRODUCTION

Transport is a key necessity for specialization that allows production and consumption of products to occur at different locations. Transport has throughout history been a spur to expansion as better transport leads to more trade. In India, to find that rail transport occupies a prominent position in providing the necessary transport infrastructure to sustain and quench the ever-burgeoning needs of a rapidly growing economy. Today, India possesses the fourth largest railway network in the world.

Railway is one of the most significant transportation modes of our country but it is a matter of great sorrow that, railway tracks of our country are very prone. That's why, a vast number of accidents are occurred every year due to this primitive type of railway tracks and as the consequences of those accidents we lose huge number of lives every year. These types of incidents motivate us to think over the above mentioned issue and take necessary steps to protect those lives. Through our proposed system, we need to establish more modern and secure railway system. Besides this, there is no such type of technology or system in our country which can stop the collision between two trains coming from the opposite direction of each other on the same track. We actually think over this matter and motivated to do so. Moreover natural disaster can throw any object on the rail track which cannot be removed very quickly in the remote area. We thought if our system can detect those object or barrier and inform to the control room then they can take necessary steps to avoid accident. Figure 1 depicts the crack on track. The Rail transport is growing at a rapid pace in India. It is one of the major mode of transport but still our facilities are not that accurate, safer as compared to international standard. A survey on the internet states that about 60% of all the railway accidents is due to derailments, recent measurements shows that about 90% are due to cracks on the rails. Hence, it is not safer for Human Life. This needs to be at the utmost attention. These goes unnoticed and the properly maintenance of tracks is not done.

In previously existing system, the work is to be done manually, but the proposed system has a robot which will run automatically on the tracks. System having LED and LDR sensor assembly, but the main disadvantage is that the LED and LDR must be placed opposite to each other and also the environment needs to be perfect to detect the track. To overcome this disadvantage, here sensors are used, which will detect the crack accurately. The existing system is slow, tedious and time consuming. This system has GSM module which coordinates in the form of Short Message Service (SMS) to the nearest railway station.

II. EXISTING SYSTEM

Train derailment is to be closely monitored and also pre-alert is the required one for the safety of human mortality. The existing conventional signalling system depends on the oral communication through telephonic and telegraphic conversations as input for the decision making in track allocation for trains. There is large scope for miscommunication of the information or communication gap due to the higher human interference in the system. This miscommunication may lead to wrong allocation of the track for trains, which ultimately leads to the train derailments.

III. PROPOSED SYSTEM

The proposed approach is useful for railway department to reduce the effort for taking care of track and also the railway crossing management. This system involves the design for finding cracks in railway tracks. This system uses controller for interfacing crack detection sensor. The sensing device senses the voltage variations from the crack sensor and then it gives the signal to the microcontroller. The microcontroller checks the voltage variations between measured value and threshold value and controls the railway gate automatically, when the train passing the gate by using sensors. When the railway track is damaged, this system send message to driver and control room through GSM.

Two proximity sensors we used. If train pass the first proximity sensor the gate is closed. Then the gate is closed when the train pass the second proximity sensor. Ultrasonic sensor is used to detect the obstacle in track. Conductivity sensor is used to measure water level in track for rainy season.

IV. BLOCK DIAGRAM

In this project to test the railway track by using track (slot) sensor. Railway gate is control when the train passes the proximity sensors. Two proximity sensors we used. If train pass the first proximity sensor the gate is closed. Then the gate is closed when the train pass the second proximity sensor. Ultrasonic sensor is used to detect the obstacle in track. Conductivity sensor is used to measure water level in track for rainy season

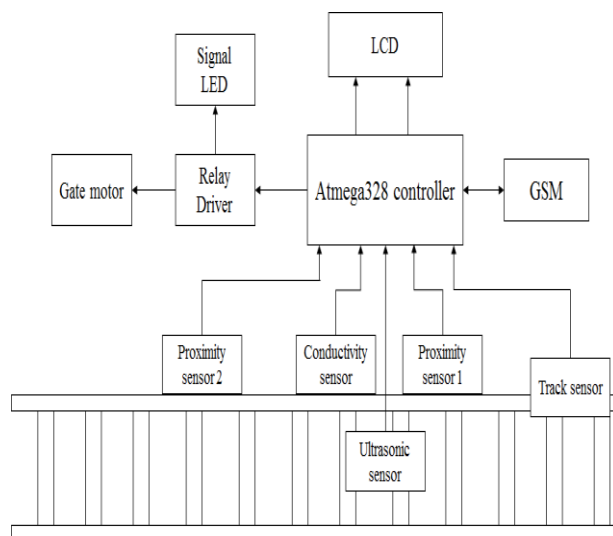


Fig.No.1.Block Digram

Controller we used Atmega328. It has inbuilt ADC. Controller receive the sensors data and to display the information is LCD display. If the railway track is damaged, this system send SMS to driver and control room through GSM modem. Controller to control railway gate for close/open through relay driver unit. Driver we use ULN2003. It is used to drive the motor through relay. Relay is act as a switch. Driver also to intimate the signals for LED indications.

V. CIRCUIT DIAGRAM

Power supply gives supply to all components. It is used to convert AC voltage into DC voltage. Transformer used to convert 230V into 12V AC. 12V AC is given to diode. Diode range is 1N4007, which is used to convert AC voltage into DC voltage. AC capacitor used to charge AC components and discharge on ground. LM 7805 regulator is used to maintain voltage as constant. Then signal will be given to next capacitor, which is used to filter unwanted AC component. Load will be LED and resistor. LED voltage is 1.75V. If voltage is above level beyond the limit, and then it will be dropped on resistor. In this project used Atmega328 controller. It has 28 pins. Reset switch is connected to controller port 1 for resetting purpose.

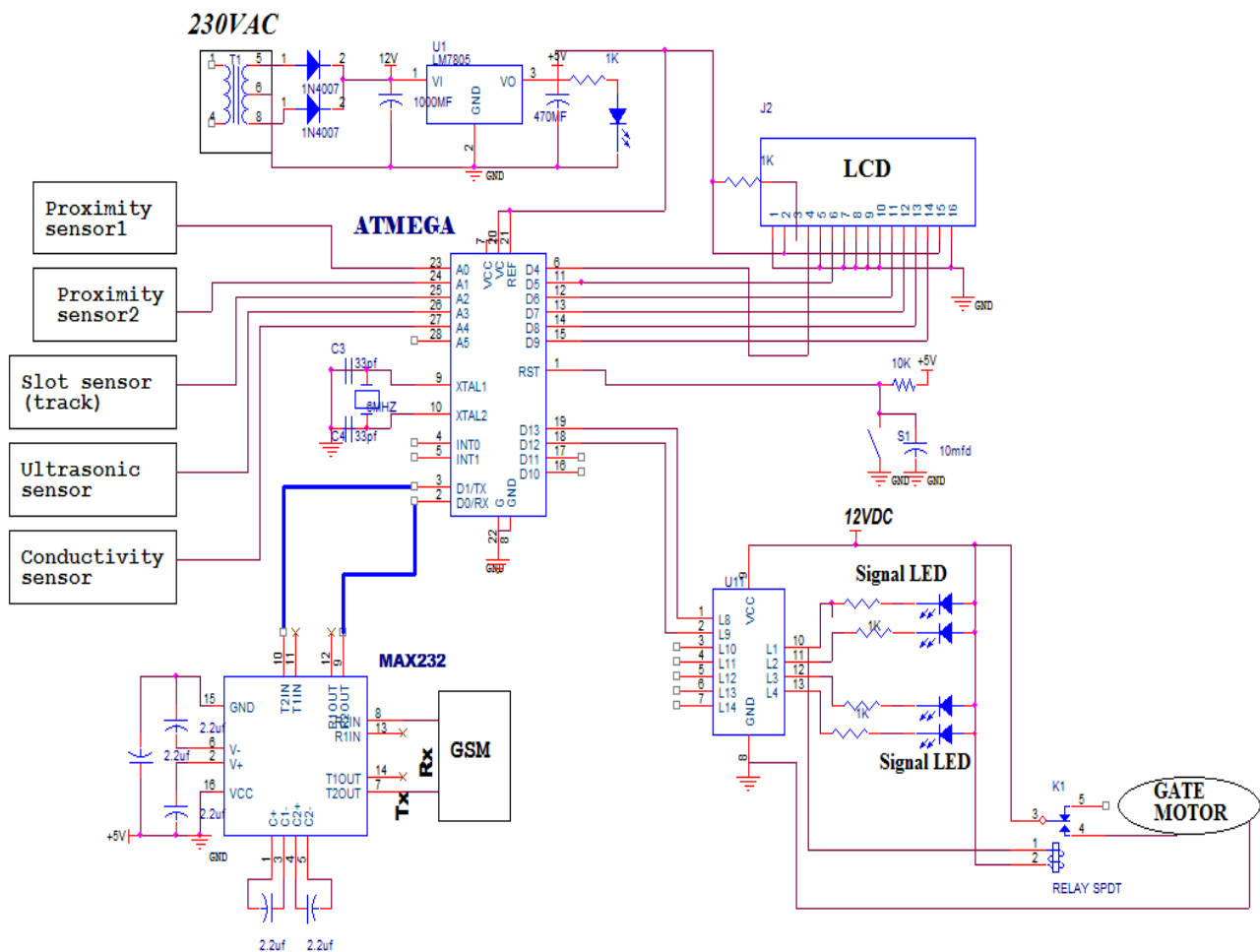


Fig.No.2 Circuit Diagram

Crystal oscillator is connected to controller port 9 & 10. It is used to give the clock signal to controller. Two proximity sensors are connected to controller port A0 and A1. Slot (track) sensor is connected to controller port A2. Ultrasonic sensor is connected to controller port A3. Conductivity sensor is connected to controller port A4. Controller to control the railway gate motor through driver unit. Driver we use ULN2003. It is connected to controller port D12 and D13. It is used to drive the motor through relay. Relay is act as a switch. It is connected to driver output port. Motor is connected to relay N/O port. GSM modem is connected to controller port 2 & 3 through MAX232. MAX is used as interfacing unit between controller and GSM modem. It is send the data as serial communication. LCD is connected to controller port D4 to D9. It is used to display the short messages.

VI. ATMEGA 328 CONTROLLER

ATMEGA328 is an 8-bit and 28 Pins AVR Microcontroller, manufactured by Microchip, follows RISC Architecture and has a flash type program memory of 32KB. It has an EEPROM memory of 1KB and its SRAM memory is of 2KB. It has 8 Pin for ADC operations, which all combines to form Portal (PA0 – PA7). It also has 3 built-in Timers, two of them are 8 Bit timers while the third one is 16-Bit Timer. You must have heard of Arduino UNO, UNO is based on atmega328 Microcontroller. It's UNO's heart. It operates ranging from 3.3V to 5.5V but normally we use 5V as a standard. Its excellent features include the cost efficiency, low power dissipation, programming lock for security purposes, and real timer counter with separate oscillator. It's normally used in Embedded Systems applications.

VII. PROXIMITY SENSOR

Proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors.

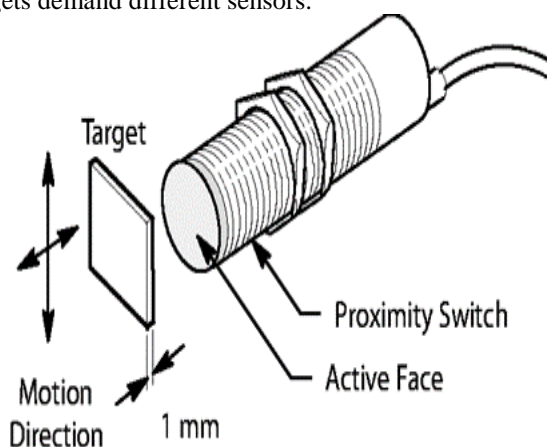


Fig.No.3 Overview of Proximity Sensor

For example, a capacitive photoelectric sensor might be suitable for a plastic target an inductive proximity sensor always requires a metal target. The maximum distance that this sensor can detect is defined "nominal range". Some sensors have adjustments of the nominal range or means to report a graduated detection distance. Proximity sensors can have a high reliability and long functional life because of the absence of mechanical parts and lack of physical contact between sensor and the sensed object. Proximity sensors are also used in machine vibration monitoring to measure the variation in distance between a shaft and its support bearing. This is common in large steam turbines, compressors, and motors that use sleeve-type bearings. There are different types of proximity sensors namely inductive capacitance and infrared .the working principle of proximity sensor is consists of coil, oscillator, detector and trigger circuit

VIII. ULTRASONIC SENSOR

The UTR (Ultrasonic Transmitter / Receiver) is a hybrid circuit that allows to realize an ultrasonic detector adding few external components. Detection is based on amplitude variation of received ultrasonic signal (40 KHz) due to the movement of an object. It shows stable electric characteristics thanks to the "Thick film hybrid" technology. Ultrasonic sensors have an acoustic transducer which is vibrating at ultrasonic frequencies. The pulses are emitted in a cone-shaped beam and aimed at a target object. Pulses reflected by the target to the sensor are detected as echoes. The device measures the time delay between each emitted and echo pulse to accurately determine the sensor-to-target distance.

IX. SLOT SENSOR

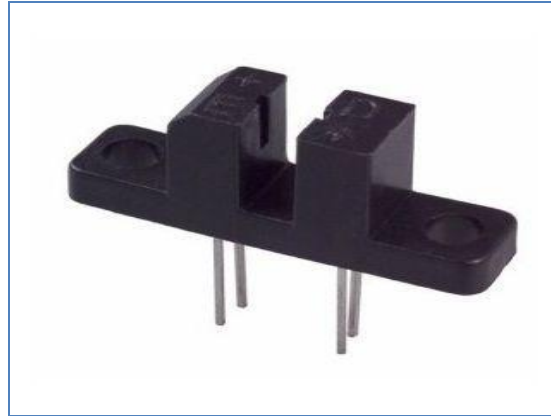


Fig. No.4 Slot Sensor

The slot sensor is an opto-electronic coupler and it is a combination of a LED and a Photo-transistor in a single package. The LED is used at the transmitter side and the Photo-transistor is used at the receiver side. The LED is forward biased so that it can emit light. A +5v supply is given to the anode of LED through 330 ohm resistor and cathode of LED is grounded. According to the selection of LED, it emits visible light in different colours. But normally slot sensor LED's are infra and it emit invisible light radiations. When the supply is given to the LED, the invisible light is focused on the base of the Photo-transistor.

The glass openings present in the slot sensor allows the light emitted by LED to reach the base of the Photo-transistor. The base of the Photo-transistor is kept open and no connection is made to the base. The transistor is NPN-type and its collector is connected to +5v supply. A 1 Kohms resistor is connected to the emitter and it is grounded. In the absence of light, no base current flows and the transistor is in the OFF state and the emitter output will be low. At the output, no signal is obtained. When the light is focused on the Photo-transistors, it will conduct and the emitter output will be high. Any interrupt in between the LED and Photo-transistor in the slot of the slot sensor. The disc will hide the operation of the photo transistor by blocking the light emitted by LED. Therefore at the output of Photo-transistor, no pulses or signals are obtained. When the disc crosses the slot, the light will be focused on the Photo-transistor and the output pulse will be obtained. For each rotation of the disc one pulse will be sent at the output.

X. CONDUCTIVITY SENSOR

Conductivity Sensor measures the conductivity of aqueous solutions in industrial and municipal process applications. It is designed to perform in the harshest of environments. The Conductivity Sensors are based on an inductive principle. This provides for stable measurement without electrodes that are easily fouled and may wear out in the field.

XI. GSM MODEM

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. When a GSM modem is connected to a computer, this allows the computer to use the GSM modem to communicate over the mobile network. While these GSM modems are most frequently used to provide mobile internet connectivity, many of them can also be used for sending and receiving SMS and MMS messages.

XII. RESULTS AND DISCUSSIONS

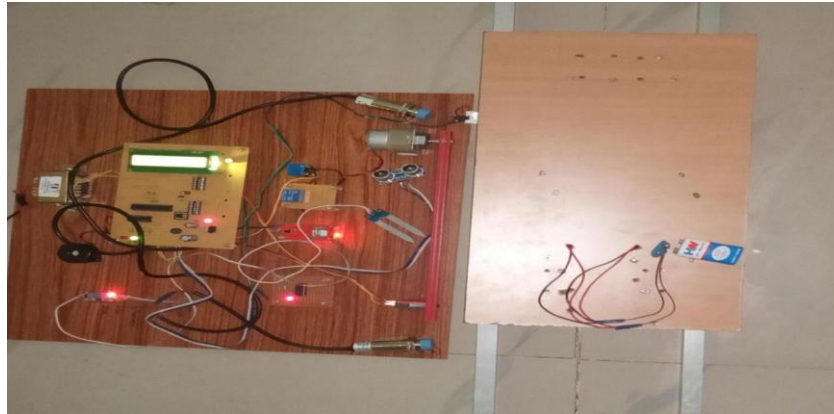


Fig. No.5 Hardware Model



Fig. No. 6 Sensor output and During Fault

If train pass the first proximity sensor the Gate is closed. The gate is opened when the train passed the second proximity Sensor. In LCD display the letter 'C' denotes the proximity sensor. In LCD display the Letter D denotes the ultrasonic sensor. If any fault occurs, an alert message is given to the station. When the fault occurs the red signal is given. In LCD display the S indicates the slot sensor. If any fault occurs, the fault is indicated in the LCD display and by SMS. Conductivity sensor is used to measure water level in the track for rainy Sensor. In LCD display the p indicates the water conductivity sensor. If any fault it is displayed in the LCD display and by SMS by GSM Modem. If any of the fault occurs in the system , the signal will be in the red

XII. CONCLUSION

In this project we have designed a cost effective, low-power embedded system, which facilitate better safety standards for rail tracks for preventing railway accidents due to cracks and obstacles on railway tracks. The Prototype of testing vehicle can efficiently detect cracks and obstacles on railway tracks. The result shows that this new innovative technology will increase the reliability of safety systems in railway transport.



REFERENCES

- [1] Achim Berger, Student Member, IEEE, Markus Pichler, Member, IEEE, Johannes Klinglmayr, Albert Pötsch, Student Member, IEEE, and Andreas Springer, Member, IEEE “Low-Complex Synchronization Algorithms for Embedded Wireless Sensor Networks” vol. 64, no. 4, April 2015.
- [2] Cindy K. Harnett, Matthew T. Schueler, Nick R. Blumenthal, Kristy L. Hopf, Jimmy F. Fox, and SrutiPulugurtha “Calibration and Field Deployment of Low-Cost Fluid Flow-Rate Sensors Using a Wireless Network ” vol. 60, no. 2, February 2011.
- [3] HalukKulah, Member, IEEE, and Khalil Najafi, Fellow, IEEE “Energy Scavenging From Low-Frequency Vibrations by Using Frequency Up-Conversion for Wireless Sensor Applications” vol. 8, no. 3, march 2008.
- [4] M. Magno, Member, IEEE, T. Polonelli, L. Benini, Fellow, IEEE, E. Popovici , Senior Member, IEEE “A low cost, highly scalable Wireless Sensor Network Solution to achieve smart LED light control for Green Buildings”vol. 6, no. 3, march 2010.
- [5]Arian Rahimi, ÖzgeZorlu, Member, IEEE, Ali Muhtaroglu, Senior member, IEEE, and HalukKulah, Member, IEEE “Fully Self-Powered Electromagnetic Energy Harvesting System With Highly Efficient Dual Rail Output” vol.12, no.6, June 2012.



**Impact Factor:
7.512**



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details