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Railway Track Crack Detecting System Using Arduino Microcontroller

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ABSTRACT: The Indian railways has one of the largest railway networks in the world, cross- 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 TSOP IR receiver 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 along with location by using GPS and gsm modules. The system also includes distance measuring sensor which displays the track deviation distance between the railway tracks.

KEYWORDS: Railway Track, Crack Detection GSM, GPS, 4-Wheel Robot, Railway Crack, Automation.

I. INTRODUCTION

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 depending on increasing the capacity and level of transport. This paper presents an implementation of an efficient and cost-effective solution suitable for railway application. In this paper we are going to use IR sensor to detect the crack in rail road, when the crack is detected its latitude and longitude values are send as a message to nearby station by using gps and gsm service. Then ultrasonic is used for the surveying process. Then other important component is PIR sensor it is used to detect the presence of humans in track.

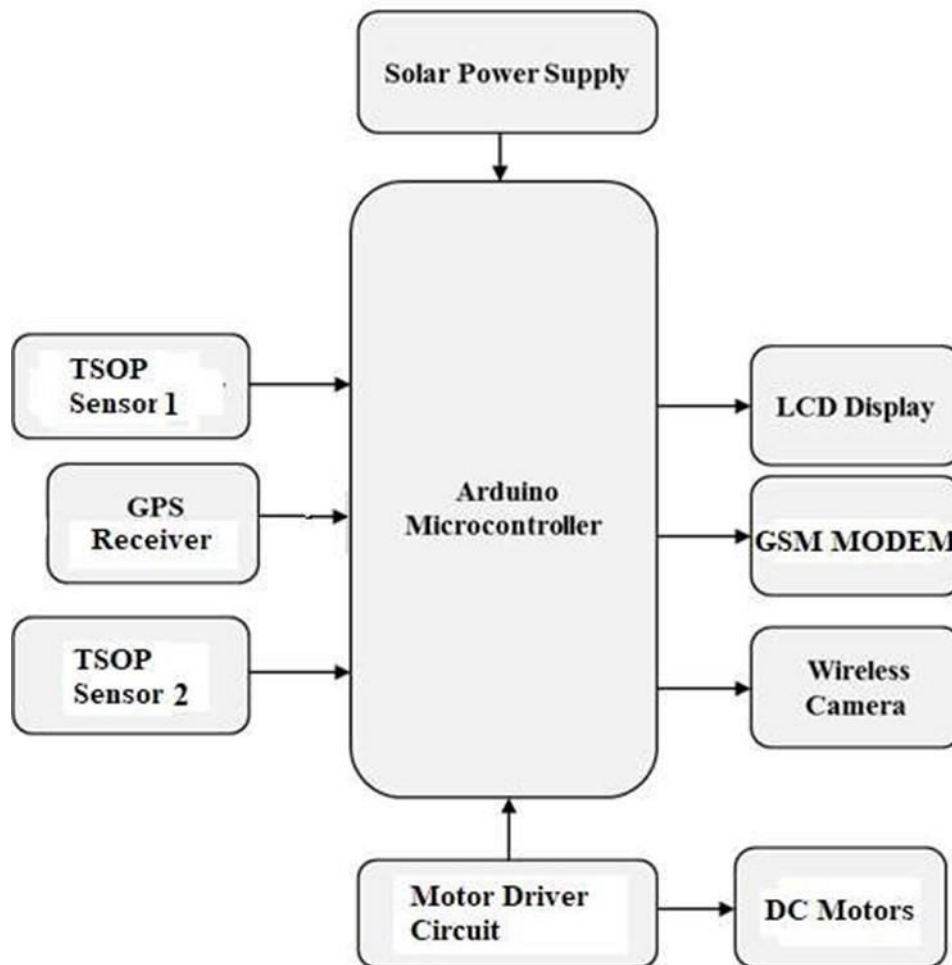
II. RELATED WORK

The prompt detection of the conditions in rails that may lead to a crack or rather a break now plays a critical role in the maintenance of rails worldwide. The understanding of these mechanisms is constantly improving and the evolution of a range of complementary non-destructive testing (NDT) techniques has resulted in a number of tools for us to choose. Among the inspection methods used to ensure rail integrity, the common ones are visual inspection, ultrasonic inspection and eddy current inspection [4]. The ultrasonic inspections are common place in the rail industry in many foreign countries. It is a relatively well understood technique and was thought to be the best solution to crack detection. However, the ultrasonic can only inspect the core of materials; that is, the method cannot check for surface and near surface cracking where many of the faults are located. The eddy currents are used to tide over this limitation associated with ultrasonic. They are effectively used to check for cracks located at the surface of metals such as rails. Further, magnetic particle inspection (MPI) is also used in the rail industry but there are a number of problems inherent with this technique, some of which are mentioned [5]. The surface of the rail or component must first be cleaned of all coatings, rust and so on. To get a sensitive reading, contrast paint must first be applied to the rail, followed by the magnetic particle coating. The same inspection must then be carried out in two different directions at a very slow overall speed. However, in the Indian scenario, the visual form of inspection is widely used though it produces the poorest results of all the methods. It is now becoming widely accepted that even surface cracking. The first conducted a survey of



existing technologies for non-destructive testing of railroad track and track components. This provided insight regarding which tasks were best suited to vision-based inspection for which technology was not already under development [6]. The system can be installed on any track vehicle and can be operated at speeds of up to 160 km/hr (99mph). With all three modules installed, the system can detect tie type and movement, inspect and classify rail fastenings and surface defects, measure rail gap, check for ballast irregularities and vegetation and determine the plate condition and the structural condition of several pieces of on track equipment (e.g. transponders for the European Train Control System).

III. METHODOLOGY



(a) BASIC BLOCK DIAGRAM

In our project, there are two set of IR sensor units fitted to the two sides of the vehicle. This unit is used to activate/deactivate GSM transmitter unit when there are any cracks in the track. The IR transmitter and IR receiver circuit are used to sense the cracks. It is fixed to the front sides of the vehicle with a suitable arrangement. When the vehicle is Powered On, it moves along the model track. The IR sensors monitor the condition of the tracks. In normal condition the motor, LDR, Serial transmission is in initial stage. When the battery power supply supplies the microcontroller then it starting the motor in forward direction and serial transmission is used to send the messages to the microcontroller. When a crack is detected by the IR sensor the vehicle stops at once, and the GPS receiver triangulates the position of the vehicle to receive the Latitude and Longitude coordinates of the vehicle position, from satellites. The Latitude and Longitude coordinates received by GPS are converted into a text message which is done by microcontroller. The GSM module sends the text message to the predefined number with the help of SIM card that is inserted into the module.



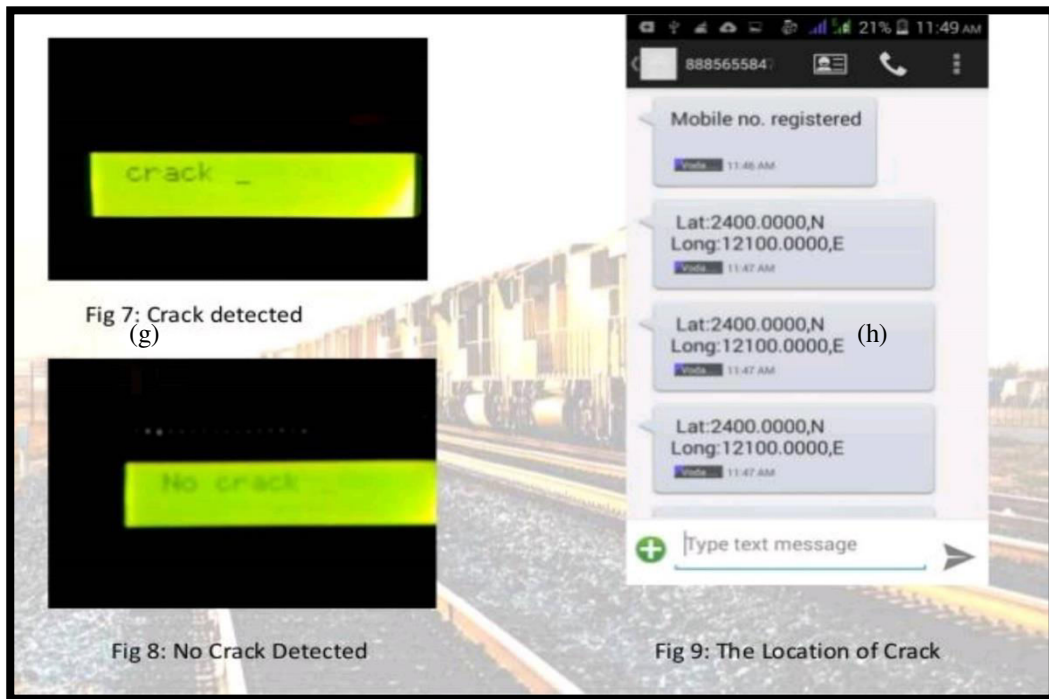
At Normal Condition: The IR transmitter sensor is transmitting the infrared rays. These infrared rays are received by the IR receiver sensor. The Transistors are used as an amplifier section. At normal condition Transistor is OFF condition. At that time relay is OFF, so that the vehicle running continuously.

At Crack Condition: At crack detection conditions the IR transmitter and IR receiver, the resistance across the Transmitter and receiver is high due to the non-conductivity of the IR waves. When the track is in continuous without any cracks then output of IR LED and Photodiode will be high. As soon as the crack detected by the system the TSOP sensor reflection will be equal to zero and the robot will be stopped automatically. Another TSOP sensor is used to monitor the pit on the way of the railway track. When this output is high then it is concluded that there is no pit in the track. But if any pit is detected by the sensor the output of the sensor given to the microcontroller will be zero and again the microcontroller will stop the robot. When a crack is detected by the IR sensor the vehicle stops at once, and the GPS receiver triangulates the position of the vehicle to receive the Latitude and Longitude coordinates of the vehicle position, from satellites. The Latitude and Longitude coordinates received by GPS are converted into a text message which is done by microcontroller. The GSM module sends the text message to the predefined number with the help of SIM card that is inserted into the module to send the SMS.

IV. EXPERIMENTAL RESULTS



(b) DETECTION KIT & MOBILE REGISTRATION PROCESS



(c) FIGURES NO7 & NO8 SHOWS CRACK DETECTION METHOD ON SCREEN

V. CONCLUSION

In this paper 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. By implementing these features in real time application, we can avoid accidents up to approximately 70%.

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