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Autobot for Railway Track Crack Detection Using GSM and GPS

Prof. R. S. Patil [1],Chetan Vijay Rawool [2], Rohan Rajan Satam [3], Ritesh Harishchandra Thukrul [4], Suyog Sunil Waman [5]

1 Assistant Professor Dept of EXTC,B.V.C.O.E,Navi Mumbai, Mumbai, ,India 2,3,4,5 B.E,Dept of EXTC,B.V.C.O.E,Navi Mumbai,Mumbai,,India

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ABSTRACT: Indian Railroad is one of the biggest railroad systems on earth. Despite the fact that there is an enormous development in the Indian railroads, some accidents occur due to cracks which occur in the railway track. In this paper we are thinking about this serious issue that results in accidents. To overcome this major problem we have proposed a monitoring device that uses an ultrasonic sensor which is used to detect the crack in the railway track and to send SMS via GSM and GPS module with the help of Arduino UNO. During different seasons the track is expanded or contracted due to which splits may happen. This testing vehicle is used to detect the crack and when the crack is detected, the vehicle stops and sends the signals to the nearest station. This intelligent system provides protection and online monitoringsystem.

Keywords: Arduino UNO, GSM, GPS, IR Sensor, Intelligent Systems, Online monitoring, Protection.

I. INTRODUCTION

Transport is very important to carry the passengers and goods from one place to another. Better transport leads to more trade. Economy mainly depends 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, The GSM (Global System for Mobile Communications), GPS (Global Positioning System) and micro controller based broken railway track detection when implemented is an efficient method of detection of cracks which is present in the tracks and thus avoiding derailment of the trains. This system is used in-between two stations which will detect the cracks present on the track using ultrasonic sensor. If a crack is detected then this sensor will send a signal to the Arduino UNO board which will activate the GPS receiver. The GPS receiver will pin point the exact location which will then be messaged to the authorities. This smart technology will be a part of the brave new digitalized world which will be able to prevent the loss of precious life or property as mentioned in the above cases.

i. Statement of Problem:

The principal problem has been the lack of cheap and efficient technology to detect problems in the rail tracks and of course, the lack of proper maintenance of rails which have resulted in the formation of cracks in the rails and other similar problems. In the past, this problem has lead to a number of derailments resulting in a heavy loss of life and property. Cracks in rails have been identified to be the main cause of derailments in the past, yet there have been no cheap automated solutions available for testing purposes.

ii. Objective:

A. To detect the cracks present on the railwaytracks.
B. B. To detect the obstacles entry on to the railway tracks.

iii. ApplicationIdeas:

A. Obstacledetection
B. Shaftencoder
C. Fixed frequencydetection

iv. Proposedsystem:

This system involves the design of crack finding robot for finding cracks in railway tracks. This system uses controller for interfacing the robotic vehicle and 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 robot according to it. The robotic model is interfaced with the

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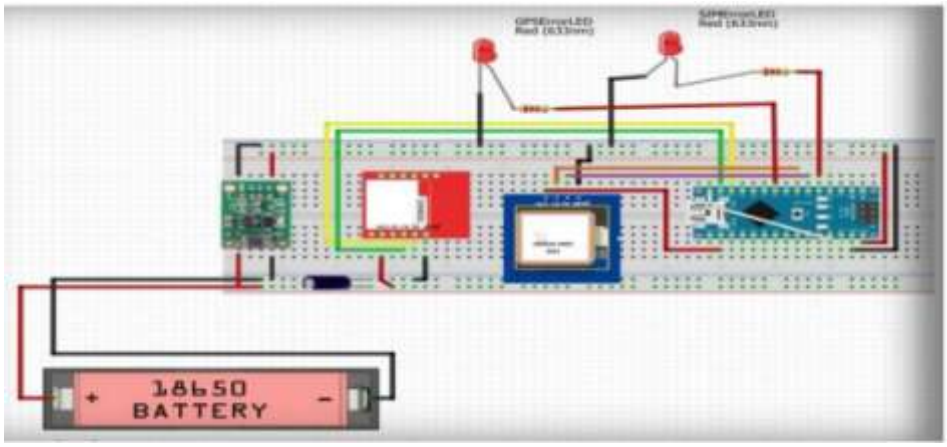
microcontroller with the help of motor driver circuit. If any crack occurs in the rail, the robot will be stopped and then a SMS will be send.

II. DESIGN



The main component used in the block is IR sensor.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.

III. METHODOLOGY

The vehicle consists of an IR sensor fitted to the vehicle. It is used to activate/deactivate the GSM transmitter unit when there is any cracks in the track. The IR transmitter and IR receiver circuit is 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 supplies power to the micro controller it starts the motor in the forward direction and serial transmission is used to send the messages to the micro controller. When a crack is

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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 micro controller. TheGSM modulesendsthetextmessagetothepredefinednumber withthe helpof SIM cardthatisinsertedinto themodule.

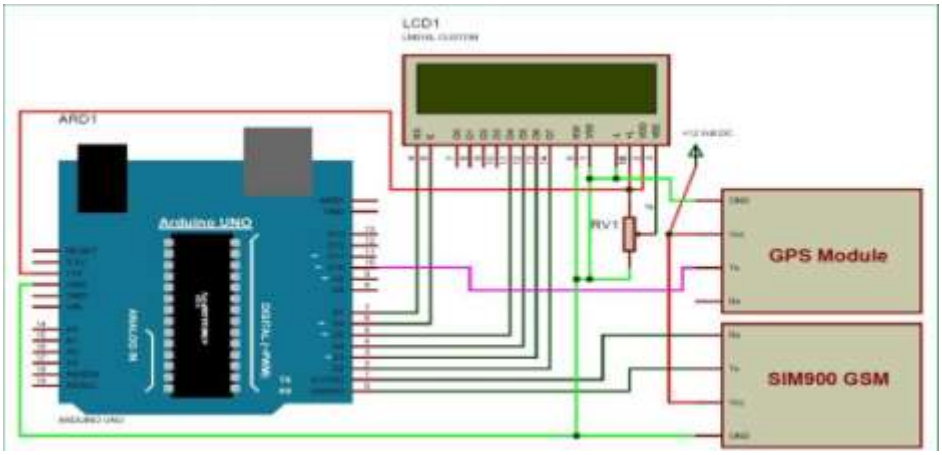

Fig. Assembly of the components

At Normal Condition: The IR transmitter sensor is transmitting the infrared rays. These infrared rays are received by the IR receiver sensor. During this period the vehicle movescontinuously.

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. As soon as the crack detected by the system the ultrasonic sensor reflection will be equal to zero and the robot will be stoppedautomatically.

IV. MODELIMPLEMENTATION

The main objective is to define any railway track fault using this system, which is implemented in effective and will also function efficiently. This method will be helpful in regular track checking as it is more convenient than the handheld checking system. The current system has a railway laborer's walking on the railway tracks and detecting the fault manually. Here we are using Arduino for control action to make system we are connecting IR sensors to detect the obstacle and we are connecting dc motors, GPS module is used .This requires a lot of time and labour. So we are using a IR sensor for railway track crack detection. The testing vehicle consists of motors driven by a motor driver. The IR sensor which is connected to the Arduino. Message is generated using GSM and GPS and will be sent to the nearby station by ArduinoUno.

Arduinoisanopen sourceprogrammablecircuitboard based ontopofeasytousehardware and software.TheabovedepictsArduinouno.It is tough in nature and can support the peripherals efficiently. It is centered on ATmega328. It has 14digital input/output pins 6 analog inputs, a USB connection, a power jack, an ICSP header, and a reset button. The power essential to run the board can supply through connecting it to the laptop using a USB cable or plugging an ACDC powersupply.

A satellite navigation system used to position the ground place of an object. A GPS modem. A GPS receiver calculates the position by timing the signals send by the GPS satellites high above the earth. The position is then displayed through moving map display or latitude and longitude. By the GPS module longitude and latitude value canexist

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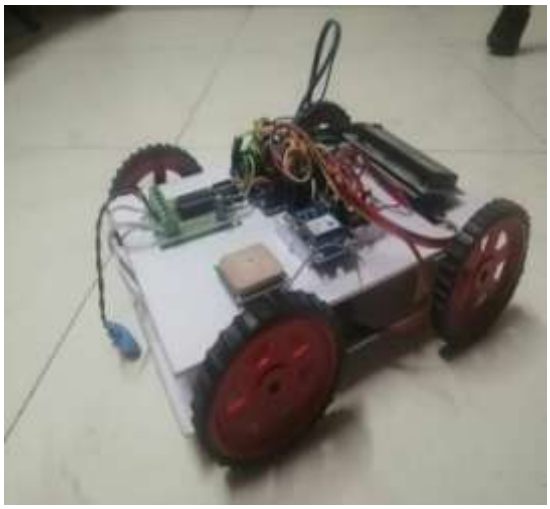
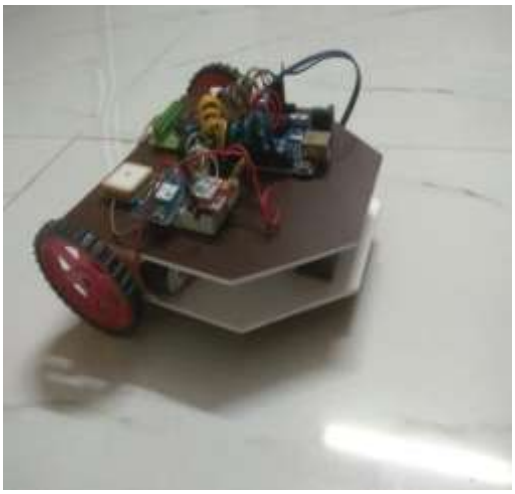
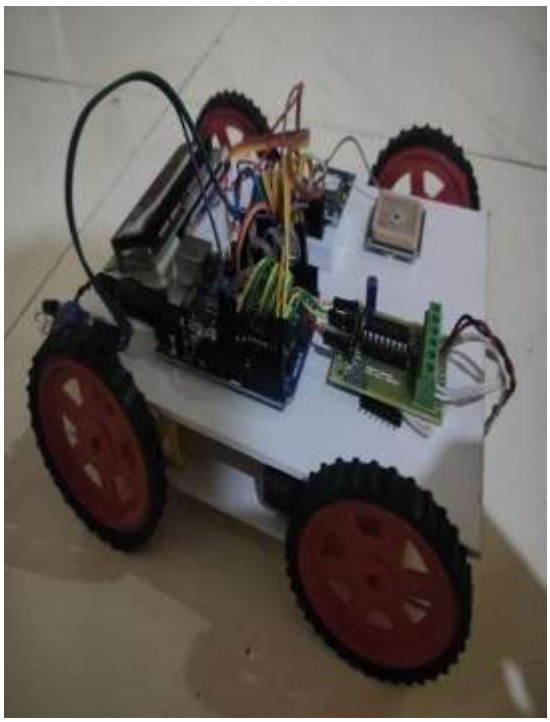
V. RESULT

Final Robot







i. Features:

1. Light in weight
2. Portable
3. Compact
4. Durable
5. LED indicating dataoutput
6. Low powerconsumption
7. Real timenavigation

ii. Applications:

1. SMS based R securityapplications.
2. Sensor monitoring.
3. GPRS mode remote datalogging.

iii. Advantages:

1. Highly efficient and user friendlydesign.
2. Easy tooperate.
3. Low powerconsumption.
4. Location of the vehicle can be known usingGPS.
5. To detect the crack using IR obstaclesensors
6. GPS and GSM based tracking details sendingSMS
7. To avoid the accidents at a singletrack.
8. Efficientdesign.
9. Works anywhere in the world (GSMavailability).

VI. FUTURESCOPE

Work can be done in order to provide a better speed to the automated vehicle robot. Also enhancement can be done to get better accuracy about the location of the place where the fault had occurred. A zig-bee module can also be incorporated for low cost short distance scrutinizing mechanism in order to provide good connectivity at a low inputcost.

VII. CONCLUSION

In this paper we have designed a cost effective, low-power embedded system, which facilitates Better safety standards for rail tracks for preventing railway accidents due to cracks and obstacles on railway tracks. This 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 approximately70%.

I.

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