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Railway Crack Detection System

AKHIL N[1], DINU MOHAN [2], FAYIS P[3], SIJA GOPINATH[4]

[1]*B.Tech student, Dept. of EEE, MACE Kothamangalam, Kerala, India*
[2] *B.Tech student, Dept. of EEE, MACE Kothamangalam, Kerala, India*
[3]*B.Tech student, Dept. of EEE, MACE Kothamangalam, Kerala, India*
[4]*Assistant Professor, Dept. of EEE, MACE Kothamangalam, Kerala, India*

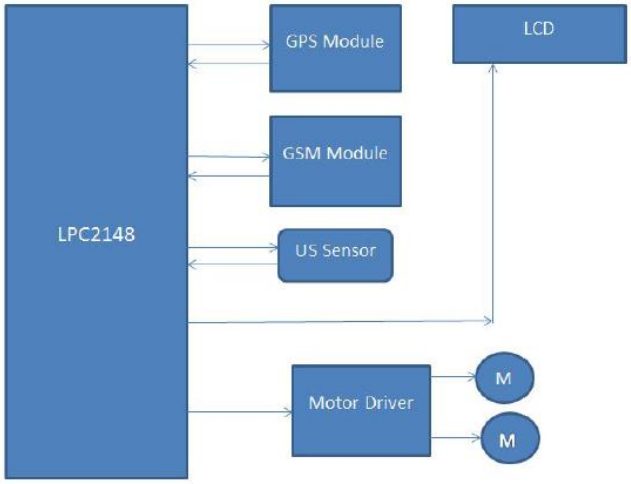
Abstract - *Transportation is very important to carry the passengers and goods from one place to another. A better transport leads to more trade. Economic level mainly depends on increasing the capacity and level of transport. This paper presents an implementation of an efficient and cost effective solution suitable for railway application. This paper consists of GPS module, GSM module (for application of communication purpose) and Ultra Sonic sensor (for crack detection). A motor driver is used to control the motor. The GPS module and GSM module helps us to send railway geometric parameter of crack detection to nearest railway station. In the present days we use the measurement of crack by using high cost LVDT having less accuracy. But here we use less cost ultrasonic sensor for above process. The importance of this paper is that, it is applicable in the detection during both day and night.*

Key Words: Ultrasonic sensor, LPC2148 , MINI ARM 7 KIT, GPS module, GSM module,L293D Motor driver

1. INTRODUCTION

Depending on recent developments in railway systems, high-speed trains are being extensively used, and rail transportation is being increased. Reasons for this increase are high speed, cost effectiveness, environment friendly, safety, and modern characteristics of railway systems. In railway tracks, anytime the track is damaged due to weather conditions, floods, earthquakes, cyclones etc. The existing track surveying systems have some limitations. It takes more time and it is less accurate. In this paper, the proposed system immediately notices the cracks in the track and informs the railway authority and hence can reduce the train accidents. Thus by placing the robot in each station and checking at uneven intervals will help to reduce train accidents. The robotic section in the proposed system consists of ultrasonic sensor which finds the cracks on the track. This section mainly consist of GPS module which is used to find the exact position of the crack and GSM modules for transmitting the information to railway authority. It also consist of two motors which is controlled by the motor driver L293D.The microcontroller used is the LPC2148 A vast majority of the work done in this field of crack detection uses the infrared sensing technique. It was initially thought to be the best solution to the problem of crack detection. But later it was found to be prone to external disturbances and hence came to be considered inaccurate. They can only inspect the core of the track that is it cannot check for surface and near surface cracking where most faults are usually located. The introduced surveying system in this project is operational on both ballast and slab tracks. The system can be operated in tunnels without interruption. This project proposes a cheap, simple scheme with sufficient ruggedness suitable to the Indian scenario to track geometry survey by using sensor, which proves to be cost effective as compared to the existing methods

1.1 Block Diagram



The circuit mainly consist of an ultrasonic sensor, GSM module, GPS module, micro controller, LCD and motor driver. The microcontroller used is LPC2148.It belongs to ARM family. It is 32 bit risc controller. Widely used IC from ARM7 family (8-40 kB on chip static RAM.32-512 kB on chip ash program memory).
DC motor is used to run the robotic section with the help of motor driver L293D. A motor driver can control 2 motor at a time. Ultrasonic sensor is used to detect the crack. It sends the sound signal to track and receives the echo signal. The GPS module will collect the longitude and latitude position of the crack and send to the authority by GSM module.
These parts are placed inside robotic vehicle that travel through the track. Two motors are used to drive the vehicle

and a motor driver is used to drive the motor. The LCD display is used to find which function is now active.

1.2 Program Flow Chart

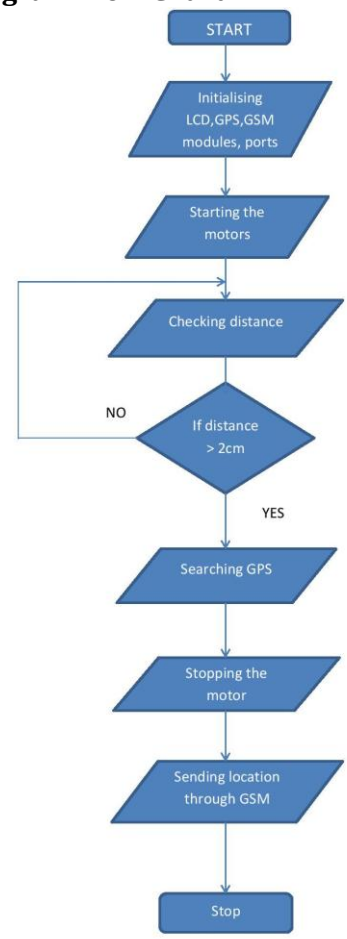


Figure: flow chart

First initialise the LCD, GPS module, GSM module and input - output port of the microcontroller. Then start the motor using motor driver L293D.At that time microcontroller sends a trigger pulse continuously to the ultrasonic sensor and turn on the timer. And the transmitter of the ultrasonic sensor send sound signal to the track. Receiver of the ultrasonic sensor receives the echo signal. So now microcontroller turn on the timer. So we get the time and velocity of the sound. So we can calculate the distance between the sensor and track continuously and check it with reference value (2 cm) . If the distance is 2 cm, then continue the same process (checking distance). Otherwise (distance greater than 2 cm), then stop the motor. GPS module will collect the position of the crack and send to the authority by GSM module

2. SIMULATION AND RESULT

The simulation was run using Keil micro vision and Proteus software. The circuit was drawn using Proteus software. The programming for robotic section was written in Keil micro vision software. The program was then loaded to the microcontrollers and was simulated using proteus software.

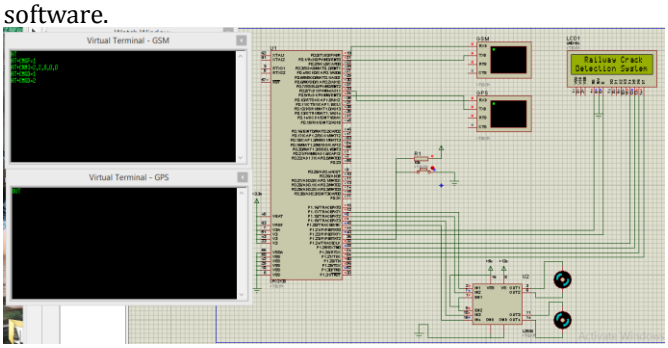


Figure: Simulation

Ultrasonic sensor is replaced by a switch and a supply and it is (transmitter pin) connected to P1.23 of the microcontroller. GPS, GSM modules are replaced by the virtual terminals. +3.3 V is given to the microcontroller. +5 V is given to the motor driver. +12V is given to the motor using the motor driver. Make the enable pin of the motor driver always high (by connecting it to the +5 V) . Two motors are connected across 3,6 and 11,14 th pin of motor driver . 2,7,10 and15th pins of motor driver is connected to P1.17 to P1.20 respectively. 4,5,12 and 13th pins of motor driver are connected to the ground. 5th to pin of the lcd is connected to the ground. 11,12,13,14th pins of the lcd are connected to P1.24 - P1.27 respectively.

If crack found, then stop the motor. GPS module search for the location. The virtual GSM module sends that location to the mobile number given.

2. EXPERIMENTAL SETUP

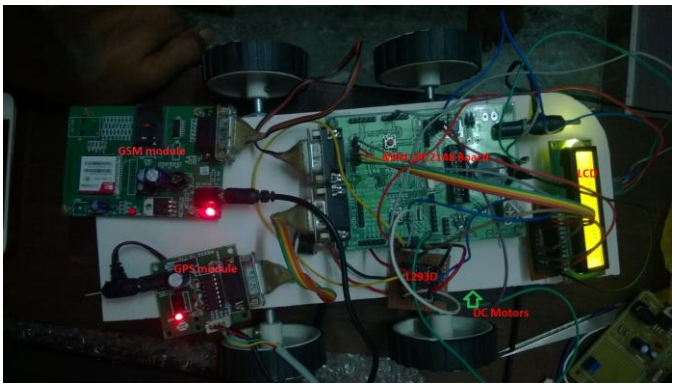
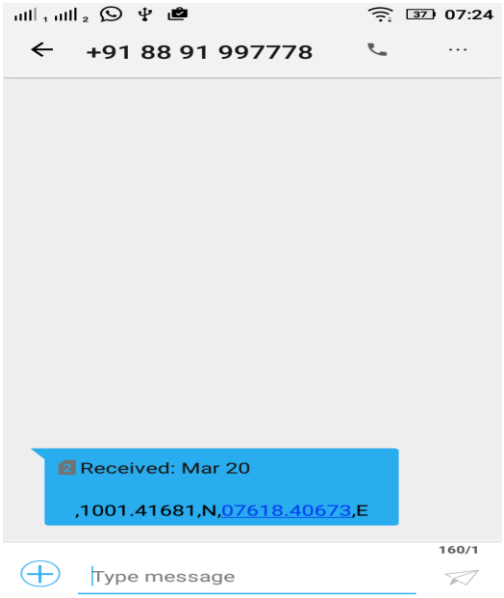


Figure Robotic section

It contains GPS module, GSM module, motor driver(L293D), 2 DC motors (60 rpm), LCD display, vehicle kit and an arm board



When crack found, the robotic section sends that location of the crack to the authority. Above given is the message received from the robotic section. The crack is found at 1001.41681, N,0768.40673, E position.

3. CONCLUSIONS

To test the accuracy of the designed surveying system, experiment had been done on a surface having crack, by running our designed robot section having ultrasonic sensor to sense the crack. It is more accurate than the existing works more over the GPS module gives the exact position of the crack.

In this project, the system is presented to detect the cracks in the tracks effectively. With the ultrasonic sensor the cracks in the railway track is detected and by using wireless modules the information is passed to the authority. The robotic section is continuously check the crack. The location can be found out by using GPS module in the system. The introduced surveying system in this project is operational on both ballast and slab tracks. The system can be operated in tunnels without interruption. In future work some more sensors can be adopted to fasten the detection, we may also use the cctv systems with IP based camera for monitoring the visual videos captured from the track.

Here DC supply is given to the system from ac supply through adaptors. A rechargeable battery can replace the adaptors and making the system much more user friendly

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