Real Time Train Track Monitoring System

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Abstract—The project aims at detecting the railway track problems i.e. derailment of trains due problem in tracks. The project includes the railway management system to avoid the accidents. Along with the track detection it has functions like controlling the speed of train based on signals, informing the railway authorities about the problem. The PIC Microcontroller is the heart of the project. The IR sensor is used for detecting the crack in the railway tracks. Once the crack has been detected, railway authorities will be notified via SMS and also the loco pilot of train within the coverage area which will further used to avoid accidents. The GPS issued to trace the location of the failure of railway tracks. The existing system is used as a vehicle to detect the problems in railway tracks vehicle which is not cost effective.

Index Terms— GSM, GPS, MICROCONTROLLER, IR SENSOR, SIGNALS.

1 INTRODUCTION

Indian railways are the largest railway networks in the world and accordingly it has number of routes which joined different states of India by means of transportation as it is affordable, easiest and time efficient transportation as compared to other transportation. As it is commonly used transportation it needs to be secured for the peoples using it, and safety measurement needs to be taken to avoid the loss of lifes.

In most of the countries the train is the most used transportation so any mishap in this transportation may lead to loss in life and halt in the transport as many people uses train as the mean to transport so many lives will be lost due to any mishap or accidents. Many of the incidents takes place due to fault in railway track containing cracks which leads to derailment of train. In order to overcome this problem we are implementing the auto-break mechanism system in engines to avoid the casualties to the minimum. We are using the RF transmitter and receiver in order to receive the red, green and yellow light which is to be used for various purpose in avoiding this problem. The IR sensor is used to detect the crack in the track once the problem has been detected the GSM will send an SMS to notify to railway authorities about the problem with the latitude and longtitude range value which is given by GPS module. Along with the railway authorities the locopilot will alos notify within the same coverage area to avoid the further accident.The GPS and GSM technology gives us the real time location of the train where accident had occurred. The longitude and lalitude value can be converted easily with the help of google link.

2 OBJECTIVE

The project aims at creating a intelligent railway management system based on the MICROCONTROLLER, RF transmission, GSM, IR sensor. Modules of the project will include a speed controlling of train, a crack detection, and makes journey easier for passenger.

[1] We can combine all the features and make it work simultaneously means during wireless signaling the crack in the track can also be detected as well as next station can also be detected.

[2] For crack detection we are using the IR sensor which will be mounted in between the track where the two different tracks are getting joint.

[3] For message alert system we are using GSM function for sending message in large number and maintain and increasing the quality of service.

3 LITERATURE SURVEY

With the advent of powerful digital signal processors, GSM have been explored to formulate solutions to the problem of crack detection and speed control .[3] Though it provides good accuracy, this method uses techniques like IR sensor, RF Transmission all of which take a lot of processing power and an extreme amount of time rendering the process slow and thereby unsuitable.[5]

[2]Recent research has investigated the use of RF TRANSMITTER for crack detection .This technique was found to produce very accurate results in lab based testing. But, unfortunately it requires ROBOT which are both costly and also can't be placed onboard a moving robot because of their delicacy. RF based methods are used to tide over limitations associated with RANGE. However they have the problem of very slow overall speed which reduces the usability of the same.[4]

[3]A vast majority of the work done in the field of crack detection uses the infrared sensing technique .It is a well understood technique so much so that 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.[2]

[4]Techniques that employ sensor tide over some of the problems mentioned earlier, but 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. Several other features like SMS on registered passenger's phone[3][6]

[5]Automatic train control (**ATC**) is a general class of train protection systems for railways that involves a speed control mechanism in response to external inputs. ATC systems tend to integrate various cab signalling technologies and they use more granular deceleration patterns in lieu of the rigid stops encountered with the older automatic train stop technology. ATC can also be used with automatic train operation (ATO) and is usually considered to be the safety-critical part of the system.[6]

[6]Over time there have been many different safety systems labeled as "automatic train control". The first was used from 1906 by the Great Western Railway, although it would now be referred to as an AWS (automatic warning system). The term is especially common in Japan, where ATC is used on all Shinkansen (bullet train) lines and on some conventional rail lines as a replacement for ATS.[5][6]

4 DESIGN AND IMPLEMENTATION

The whole system is implemented in the following manner:

MICRONTROLLER: The PIC 16F877A Microcontroller is the heart of the circuitand it is very easier one of the main advantage is that it can be write and erase as many time as possible because it use flash memory technology. It has a total number of 40 pin and there are 33 pins for input and output. It consist of two 8-bit and one 16-bit timer, Capture and compare modules ,serial port, parallel port and five input and output port are also present in it. Here we are using pic for interfacing various blocks such as power supply, signals (g, y, r), crack detection, LCD display, decoder, level convertor, driver circuit, etc.

IR SENSOR: The IR sensor is used for detecting the crack in the railway track. IR sensor is used as a wireless communicator between GSM module and cracks detected. Once the problem is detected in the railway track the ir sensor will detect and give the information to the Microcontroller, LCD, GSM for further notification.

GSM MODULE: GSM module stands for global system for mobile communication. Its operates at 850Mhz,900Mhz, 1800Mhz frequency band.GSM is connected with Microcontroller for its operation,once the GSM receives the signal from microcontroller after detecting the crack, the GSM will send blthe SMS to the railway authorities.

GPS MODULE: GPS module stands for global positioning system. Its is connected with microcontroller, it gives the location of the place where the problem has been detected. When the signal is received from microcontroller, the GPS will give the longitude and latitude value.This values are converted and send to the authorities with the help of GSM module.

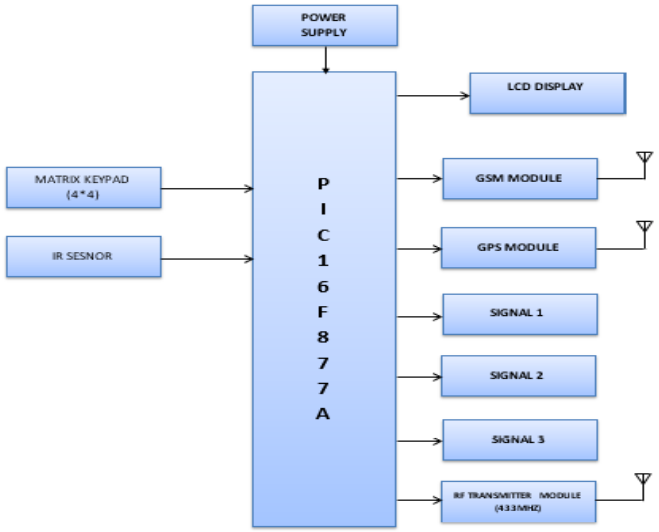

FIG. NO: 1 TRANSMITTER SECTION

LCD DISPLAY: Liquid crystal oscillator display is used in project to get the message displayed as it can controlled on pixel level by doing the specific programming which should be displayed. We have used this, as it is most commonly used type of display and easily available.

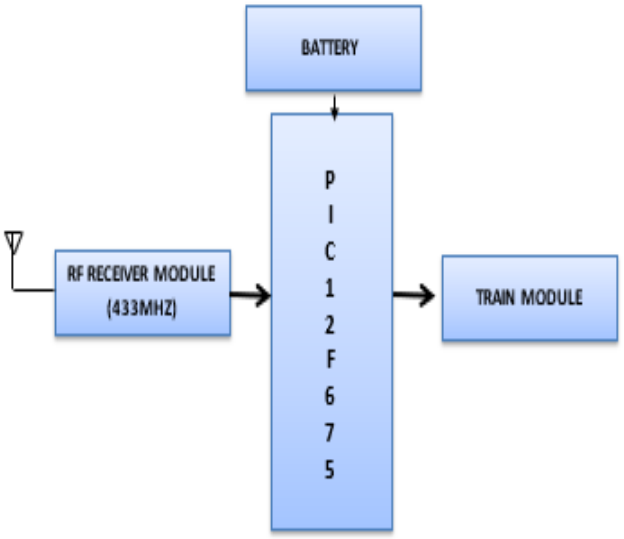

FIG. NO: 2 RECEIVER SECTION

RF TRANSMITTER AND RECEIVER:

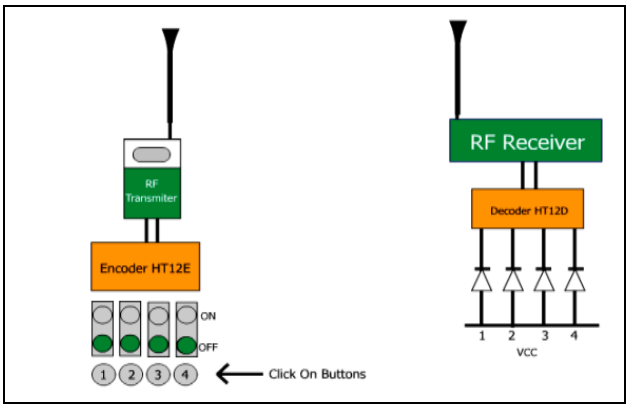

FIG. NO: 3 RF TRANSMITTER AND RECEIVER

In our project we are making use of HT12E-D which is used for decoder and encoder part respectively. The RF module has a four encoder/decoder ICs. The RF transmission is employed using Amplitude Shift Keying (ASK) at transmitter/receiver operating at 434MHz.

4.1 PROPOSED SYSTEM:

When there is some obstacle is present in front of the track or there is a presence of gap between two joining tracks, the IR sensor will detect the gap between the two tracks and indicate on LCD display and with the help of GSM and GPS system the authorized person of railway will be informed via SMS function.When the LDR and LED pairs are cut in the sequence, the alert message is sent via GSM about the NEXT STATION and it is displayed on LCD display.When there is RED light on signal pole, the RF transmitter will sent the notification to the loco pilot to stop the train which is in the particular range or else the train will be stopped automatically.

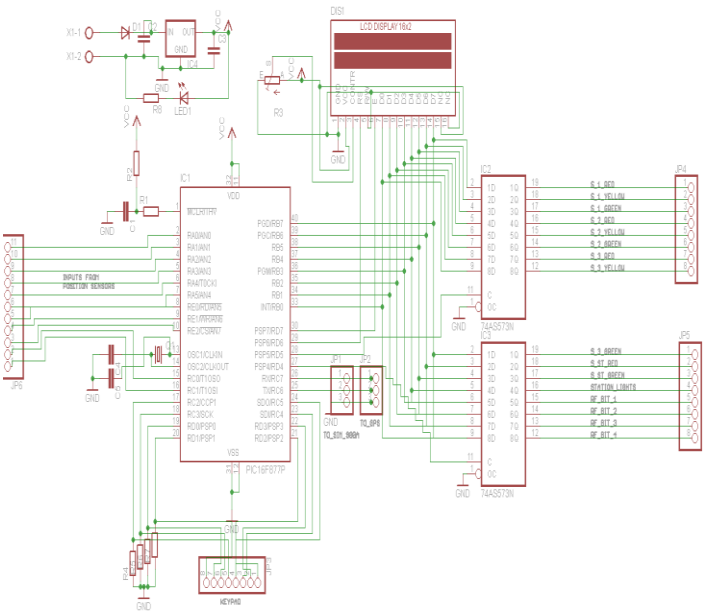

FIG. NO: 4 TRANSMITTER CIRCUIT DIAGRAM

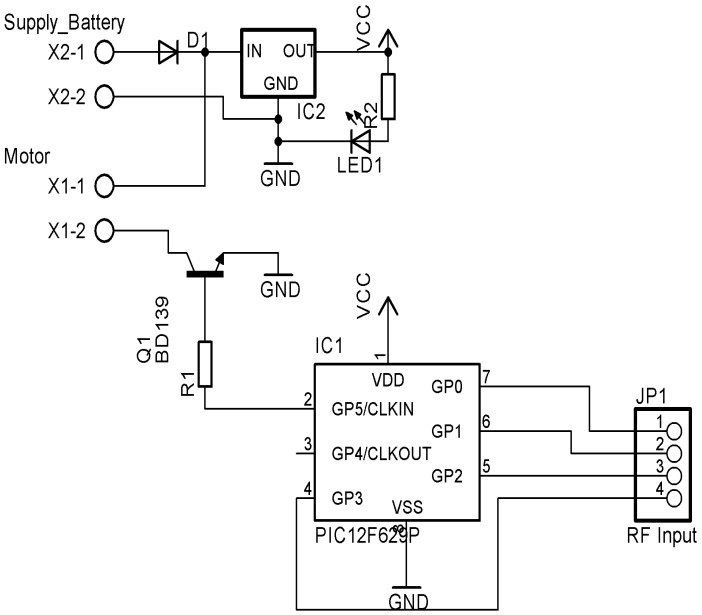

FIG. NO: 5 RECEIVER CIRCUIT DIAGRAM

All the signals poles will have LDR and LED detectors to locate the train's current position. Let S_ST may be the signal on Station. This signal will have only red and green signals. Let S1, S2, S3 be the three signals on tracks. These signals have Red, Yellow and Green signals.

5 RESULTS

The Fig.No 6 shows the output displayed on LCD when the crack is detected by the IR sensor. When the crack was detected the SMS is received on the registered mobile number with the longitude and lalitude value as shown in Fig.no 7.

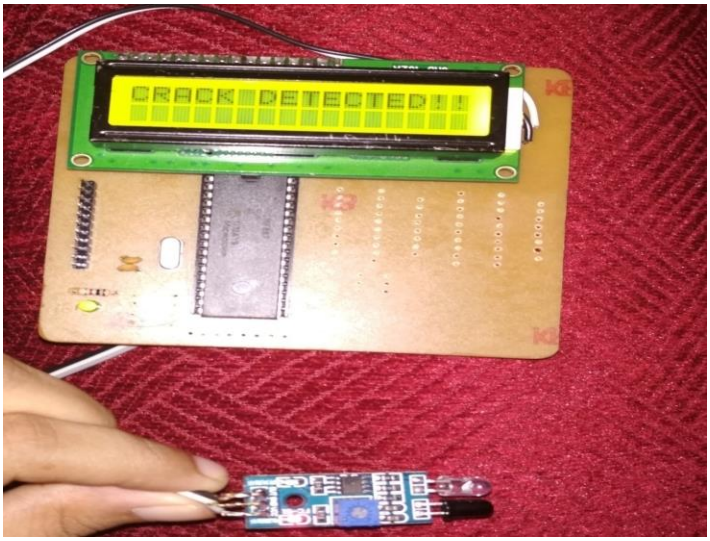

FIG.NO 6: WHEN CRACK IS DETECTED ON THE TRACK.

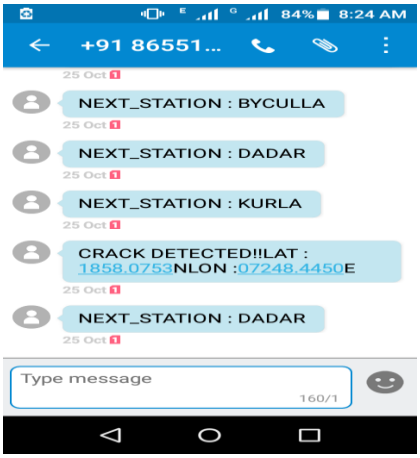

FIG.NO 7: WHEN SMS IS RECEIVED

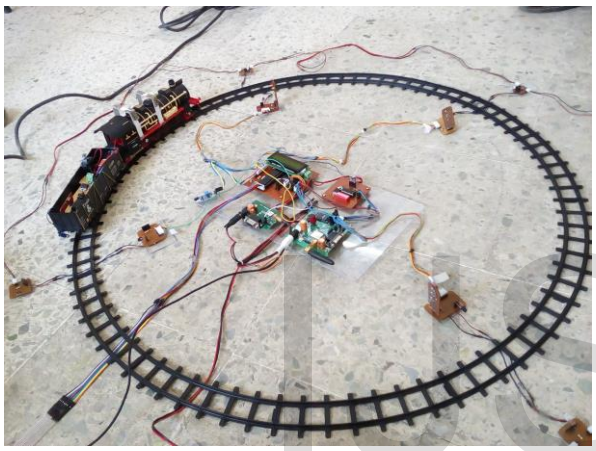

FIG.NO 8: IMPLEMENTED CIRCUIT

6 CONCLUSION

Cracks in rails have been identified to be the main cause of derailments in the past. Hence, owing to the crucial solution of this problem, we are working for implementing an efficient and cost effective solution suitable for this application. We are presenting the wireless signaling system, message alert system using GSM and IR Sensor based railway crack detection system. This system automatically detects the faulty rail track without any human intervention. There are many advantages with the proposed system when compared with the traditional detection techniques[8]. The advantages include less cost, low power consumption and less analysis time. By this proposed system, the exact location of the faulty rail track can easily be located.

7 ACKNOWLEDGE

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