ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 5, May 2018

Detection of Broken Railway Tracks and Obstacles by Ultrasonic Technology

[1] Manish Dixit, [2] Bitan Paul, [3] Drishant Sharma, [4] Manik Reshi, [5] Jeyadevan S
[1][2][3][4] UG Scholar, Sri Sairam College of Engineering, Bengaluru, India
[5] Asst. Prof., Sri Sairam College of Engineering, Bengaluru, India

Abstract: **-- Railways are one of the important transports in India. There is a need for manual checking to detect the crack on railway, even though the inspection is made regularly, sometimes the crack may go unnoticed. Because of this the train accident or derailment may occur. To avoid this situation, we have proposed this railway crack detection system. Here, ultrasonic sensor is used to detect the crack in the railway track. We place both the ultrasonic sensors on the train for obstacle and crack detection. If the crack is detected, notification is shown by LCD to the driver and is send through GSM to the base station, and EPM module is used to halt the train depending on the pressure applied.**

Keywords—Ultrasonic Sensor, Electric Pulse Magnetic Braking System, Crack Detection.

I. INTRODUCTION

Criss-crossing over 1,15,000 km in distance, the Indian Railways has one of the largest railway networks in the world. Among other factors, cracks developed on the railway tracks due to absence of timely detection and the associated maintenance pose serious questions on the security of operation of rail transportation. A recent study revealed that over 25% of the track length is in the need of replacement due to the development of cracks on it. Manual detection of tracks is hefty and ineffective owing to much time consumption and requirement of skilled technicians. Indian Railway manages the fourth-largest railway network in the world by size, with 121,407-kilometre (75,439 mi) of total track over a 67,368-kilometre (41,861 mi) route. The rail network traverses every length and breadth of India and is known carry over 30 million passengers and 2.8 million tons of freight daily. This project is aimed towards addressing the issue by developing an automatic detection of broken railway tracks and obstacles by integrating an ultrasonic module and communication module based on GSM technology by which alert message about the crack and/or obstacles can be conveyed to the base station and the pilot of the train. The pilot then halts the train by using EPM module.

II. EXISTING SYSTEM

Rails were being tested manually by "pushing ultrasonic flaw detector," whose efficiency was only 60 per cent. The Spurt Car, which was manufactured with the technical collaboration of Israel, could test 70 km a day. Later on, two cars were manufactured by ICF, each costing Rs. 8.3 crore. The Indian Railways has initiated process to launch the Terrain Imaging for Diesel Drivers- Infrared Enhanced Optical and Radar Assisted (Tri-NETRA)s. The shortcoming of the existing system is the large size of the SPURT cars and the fact that they are not able to give way to an approaching train. They can cover only 70-80 kms of tracks in a day. The situations worsens in foggy conditions where the visibility is very poor.

III. LITERATURE SURVEY

Anti Collision Device (ACD) developed by Konkan Railway Corporation Limited (KRCL) has been provided as a pilot project on 1,736 route kilometers of Northeast Frontier Railway. During 2011-12, nearly 80 internal safety audits and 30 inter-railway safety audits were carried out.

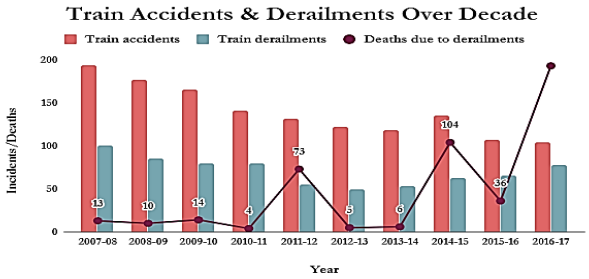

Fig.1: Train Accidents and Derailments Statistics

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 5, May 2018

Nearly 53 per cent of the 586 train accidents in the last five years were due to derailments with the Utkal Express derailment being the latest. Notwithstanding the railways' attempts to upgrade the safety apparatus, many such accidents continue to occur. Over 20 people died and 97 were injured after 14 coaches of the Utkal Express derailed near Muzzafarnagar in western Uttar Pradesh on Saturday evening.

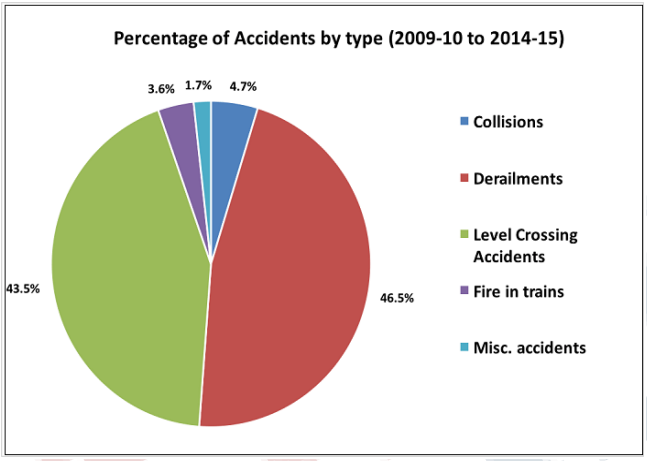

Fig.2: Statistics for Types of Accidents

According to official figures, of a total of 586 rail accidents in the last five years, nearly 53 per cent were due to derailments. Since November 2014, there have been 20 rail accidents, many of them minor.

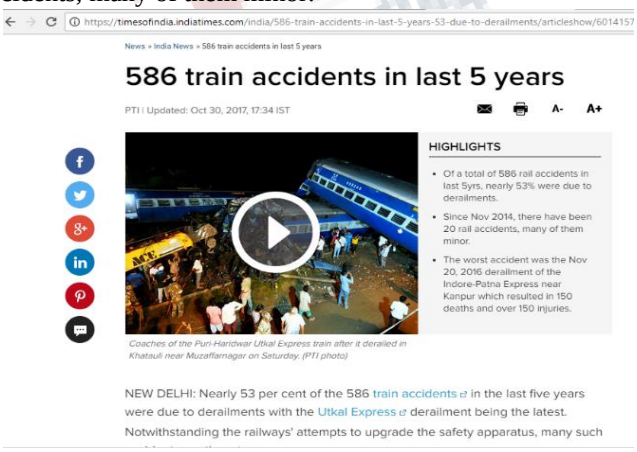

Fig.3: Utkal Express Derailment

A single flaw in the 64,600 route kms of track that crisscross the country, a defect in over 9,500 locos, 55,000 coaches and 2.39 lakh wagons that haul about 23 million passengers and nearly 2.7 million tons of freight every day.

IV. PROPOSED SYSTEM

We make use of Ultrasonic Sensors, Electric Pulse Magnetic Braking System, LPC2148 ARM Microcontroller, GSM Module, LCD Display & LEDs, DTMF Technology in our proposed system. Here, we use ultrasonic sensors for crack detection as well as obstacles. When the obstacles or the cracks are detected using the sensors, an alert message will be displayed on the LCD accordingly. The LPC2148 microcontrollers are based on a 32 or 16-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high-speed flash memory ranging from 32Kb to 512Kb. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. Due to their tiny size and low power consumption, LPC2148 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. The mobile based robot incorporates a cheaper GSM phone with a active service provider telecom connection and a DTMF decoder which sends binary signals to the microcontroller. The tones generated from another GSM based phone is decoded through the headset port of the GSM phone connected to the DTMF Decoder. The tones produced when dialing on the keypad on the phonecould be used to represent the digits, and a separate tone is used for each digit. Each key pressed on the phone generates two tones of specific frequencies, so a voice or a random signal cannot imitate the tones. One tone is generated from a high frequency group of tones and the other from low frequency group. The frequencies generated on pressing different phone. The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. Ultrasonic ranging module provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. The modules include ultrasonic transmitters, receiver and control circuit.

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 5, May 2018

The basic principle of work:

(1) Using IO trigger for at least 10us high level signal,
(2) The Module automatically sends eight 40 kHz and detect whether there is a pulse signal back.
(3) IF the signal back, through high level, time of high output IO duration is the time from sending ultrasonic to returning.
Test distance = (high level time × velocity of sound (340M/S) / 2.
An LCD is a thin, flat panel used for electronically displaying information such as text, images, and moving pictures. Among its major features are its lightweight construction, its portability, and its ability to be produced in much larger screen sizes than are practical for the construction of cathode ray tube (CRT) display technology. Its low electrical power consumption enables it to be used in battery-powered electronic equipment. L293D a dual H-Bridge motor driver, so with one IC we can interface two DC motors which can be controlled in both clockwise and counter clockwise direction.
DC motors are configured in many types and sizes, including brush less, servo, and gear motor types. A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent magnets or electromagnetic windings. Motors are the devices that provide the actual speed and torque in a drive system. This family includes AC motor types and DC motors, and gear motor as well as linear, stepper and air motors, and motor contactors and starters.
The L293D is quadruple high-current half-H driver. It designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V and to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications. Keil µVision2 is an IDE (Integrated Development Environment) that helps you write, compile, and debug embedded programs. The Flash Magic tool is an open source software that allows us to port the hexadecimal codes in to the microcontroller. The flash magic supports over a large range of the microcontrollers widely used. The in-system programming feature of the LPC2148 enables the user not to use any separate device for the porting of the Hex files. In our proposed system, ultrasonic sensors are mounted on the train. Ultrasonic sensor mounted on the train is used for crack detection. If the sensor incorporated for crack detection on the train running on the track encounters any crack, an alert notification is displayed to the pilot through LCD. At the same time, the LED which is connected to the LPC2148 ARM Microcontroller along-with other components, glows and the buzzer goes ON indicating crack detection. And, an alert message is also send to the base station through GSM Module. The GSM Module used in our project is SIM 900 with a baud rate of 9600 bps. The messages are sent and displayed over by using the Dual Tone Multi-Frequency (DTMF) Technology. DTMF is the signal communication to the phone company that you generate when you press an ordinary telephones touch keys.

Fig.4: Broken Railway Track

Other ultrasonic sensor incorporated in the train is used for obstacle detection. If the sensor incorporated for detection on the train running on the track encounters any obstacle, an alert notification is displayed to the pilot through LCD. At the same time, the LED which is connected to the LPC2148 ARM Microcontroller along-with other components, glows and the buzzer goes ON indicating obstacle detection. And, an alert message is also send to the base station through GSM Module. To prevent the collision of the train with the obstacle, relay switch is used to change the track. Also, the train is halted by making use of the Electric Pulse Magnetic Braking System (EPM) Module. The EPM Module has a previous threshold pressure value. While applying the brakes through EPM, similar value must be applied to the EPM to halt the train avoiding collision with the obstacle. Another feature of our proposed system is Panic Switch which is used to notify any emergency and/or panic situation. If any such situation takes place, the passenger can ON the panic switch. At the same time, the buzzer also goes ON alarming the pilot of the train. Also, an alert notification is displayed to the pilot through LCD. And, an alert message is also send to the base station through GSM Module.

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 5, May 2018

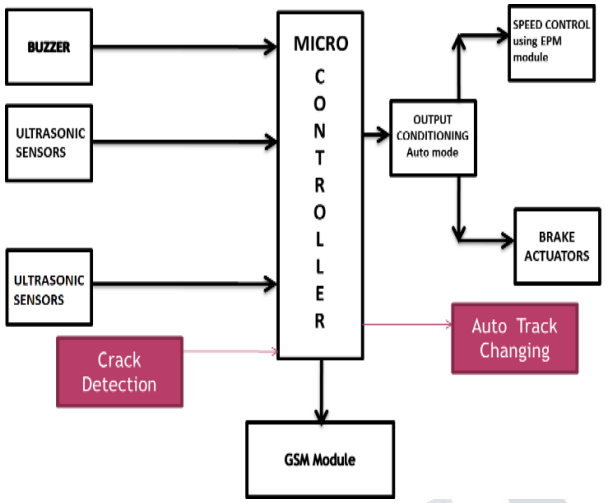

Fig.6: Block Diagram

IV. REQUIREMENTS

A. Hardware Requirements

1. ARM7 (LPC2148) controller
2. EPM Module and LCD Display
3. SIM 900 GSM Module
4. Ultrasonic Sensor
5. DC Motor and L293D Motor Driver
6. Alarm and GSM Module
7. Dual Tone Multi-Frequency(DTMF) Decoder

B. Software Requirements

1. Embedded C
2. Flash Magic
3. Keil µVision2 IDE

V. ADVANTAGES OF PROPOSED SYSTEM

1. No need for separate equipments
2. Cost-effective
3. Run-time effectiveness
4. Safe and efficient Skid Proof Braking System
5. Enhancing the security of passengers
6. Tracks are utilised efficiently
7. Rapid Responses

VI. DISADVANTAGES OF PROPOSED SYSTEM

1. Range of ultrasonic is limited.
2. No GSM network coverage in some areas.

VII. CONCLUSION

The Indian railways are the largest rail passenger transport in today's world and it is the back bone of the country transport infrastructure. The main problem about a railway analysis is detection of cracks in the structure. If these deficiencies are not controlled at early stages they might lead to a number of derailments. By using this automatic vehicle for purpose of railway track inspection and crack detection, it will have a great impact in the maintenance of the tracks which will help in preventing train accidents to a very large extent. The proposed broken rail detection system automatically detects the faulty rail track without any human intervention. This project is aimed towards addressing the issue by developing an automatic detection of broken railway tracks and obstacles by integrating an ultrasonic module and communication module based on GSM technology by which alert message about the crack and/or obstacles can be conveyed to the base station and the pilot of the train. The pilot then halts the train by using EPM module. The advantages include cost effectiveness, low power consumption and rapid response time.

VIII. FUTURE ENHANCEMENTS

1. Range of the ultrasonic sensors can be optimized.
2. Motor used for auto-track changing can be connected wirelessly and controlled accordingly.
3. Automatic Level Crossing can be implemented using Ultrasonic Sensors.

REFERENCES

[1] www.google.com

[2] www.wikipedia.org

[3]https://timesofindia.indiatimes.com/india/586- train-accidents-in-last-5-years-53-due-to-derailments/articleshow/60141578.cms

[4] http://www.onlinejournal.in

[5] www.internationaljournalssrg.org

[6] http://www.ijettjournal.org
[7] http://www.railsonic.com