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TRACK MACHINE FOR RAILWAY USING INFRARED AND ULTRASONIC SENSOR

***Abhishek P.P*[1], *Aneesh K.G*[1], *Spurthi S*[1], *Vijitha N Shetty*[1] , *Pawan Bharadwaj*[2]**
Students, Department of Electronics and Communication, NIEIT, Mysuru[1]
Assistant Professor, Department of Electronics and Communication, NIEIT, Mysuru[2]

Abstract - *In India, a large portion of the business transport is being done by the railroad organize, any issues in the same has the ability to prompt significant harm to the economy, despite the social effect of death toll or appendage. This paper proposes a financially savvy yet powerful and productive answer for the issue of railroad crack and collision identification using a technique that is special as it is straightforward, the thought is totally novel and straightforward. The paper talks about the specialized and outline angles in detail and furthermore gives the proposed break identification along with collision recognition. The paper additionally shows the subtle elements of the execution consequences of the Track machine using straightforward parts comprehensive of a GPS module, GSM Modem, LED-photo diode based crack identifier and ultrasonic collision detector. The proposed conspire has been displayed for hearty usage in the Indian situation.*

***Key Words*: GSM, GPS, HC-SR04 Sonar, LED-Photodiode, SST89E516RD2 Microcontroller.**

1. INTRODUCTION

India's transport mainly depends on railways and it is developing at greater pace now a day, considered department is not well concentrating about the problems being caused to it. Our offices are poor when contrasted with the worldwide guidelines and therefore, we have been having incessant crashes that have brought about extreme loss of significant human lives and furthermore property. To exhibit the gravity of the issue, measurements say that in the 6-year time frame between 2009-10 and 2014-15, there was a sum of 803 mischances in Indian Railways killing 620 individuals and harming 1855 individuals. 47% of these mishaps were because of wrecking of trains.

With investigations, it has been said that 60 percent of accidents in which 90 percent of accidents is because of the derailments and remaining is from other causes. Cracks and different problems associated with the rail track are unnoticed because of lack of maintenance. Now a day's manual testing for the crack in the rail road is being used it has been noticed that derailments and cracks in the railroad is major cause for the accidents. So, with efficient idea and cheap cost, there is no other solution to this problem. So, bringing this into notice cheap automated mobile controlled robot has been developed for achieving good results in future.

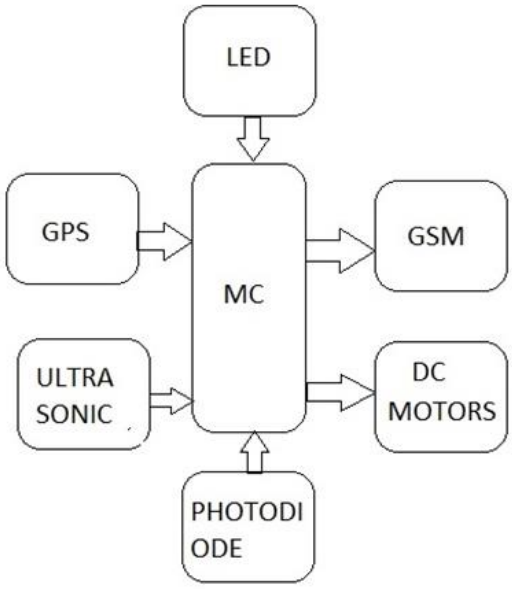

Fig -1: Block Diagram of Crack Detection System

2. LITERATURE SURVEY

The use of the image processing and digital signal processing techniques [2] have been formulized the solution for the railway crack detection Although it is well accurate it uses image segmentation, edge detection and morphology which takes high processing time and makes the robot working slower. For determining the cracks in the rail road's Horn antennas [3] can be used. It gives the accurate results in the lab based testing but the problem is it can't be used in the moving robot as it is delicate. It uses spectrum analyzer which is costly. Eddy current ([4], [5] and [6]) based methods have been used to support the limitations of the microwave and ultrasonic techniques. They have the same limitation as mentioned in above cases. Infrared sensing technique ([7], [8] and [9]) is vastly used in the crack detection. Although it was considered as the best solution for finding cracks, later is brought into notice that is will suffer with external disturbances and hence considered as untrue. Ultrasonic ([10], [11] and [12]) can be used to detect the track which support some of the limitation mentioned above but it is noticed that it just brings into notice the breaks in the core rather than cracks in surface where most of cracks takes place. Other extra techniques analysis of wave propagation

via model impacts, piezo actuation and observations have also been flourished.

3. PROPOSED SYSTEM

The track machine repairs and maintains existing railroad track and constructs new track. The track machine is implemented using SST89E516RD2 microcontroller with GSM-GPS & IR-PHOTO DIODE ASSEMBLY

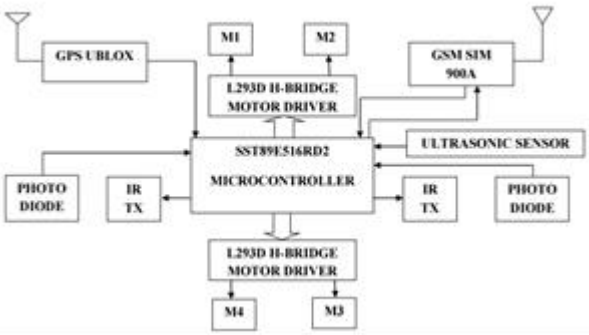

Fig -2: Technical block diagram of crack detection

Here, the Infrared sensor will be attached to one side of the railway track and the, the Photo-diode is attached to the opposite side. When there are no cracks, the light from the IR sensor does not fall on the photodiode and therefore the resistance of the photo-diode will be high in the normal operation. Accordingly, the depletion of the photodiode will be reduced, when the light from the Infrared-sensor falls on the photodiode, and this reduction is closely proportional to the incident IR-intensity.

The random decrease in the depletion value of photodiode ensures that the crack or the other the defect is detected and accordingly the IR light deviates its path. Once the crack is detected, the GPS receiver and the GSM modem is used, where the GPS receiver is used to extract the current latitude and longitude information, and the GSM is used for exchanging the obtained information. Then the GSM module will send an SMS regarding the obtained latitude and longitude information to the respected authorities. The track machine is driven with the help of four geared DC motors. Along with the latitude and longitude information, the exact location i.e. where actually the crack is detected can be found with the help of high resolution IR sensor, and a 40 KHz ultrasonic sensor is placed in front of the track machine to detect the collision and brakes can be applied.

4. DESIGN METHODOLOGY

The project works with the help of both hardware and software backbone. The Hardware components used in this system are SST89E516RD2 Microcontroller, 30rpm Geared DC Motor, GSM Sim800A, Ublox Gps, Hsc-04 Sonar, IR-Photodiode, 6v 4.5ah Sla Battery.

4.1 Microcontroller Unit

The microcontroller used here is SST89E516RD2. It is a Single-Chip 8-Bit Microcontroller manufactured in an advanced CMOS process and is a derivative of the 80C51 microcontroller family. It has 64kb flash ROM, 1kb RAM (plus 256 bytes of extra ram) and the instruction set is 100% compatible with the 80C51 instruction set and it has four 8-bit I/O ports, three 16-bit timer or event counters, on-chip oscillator and timing circuits, a multi-source, four-priority-level, an enhanced UART, and nested interrupt structure. The SST89E516RD2 is a powerful microcontroller, which is used for many applications such as motor control that require PWM, up/down counting capabilities and high-speed I/O.

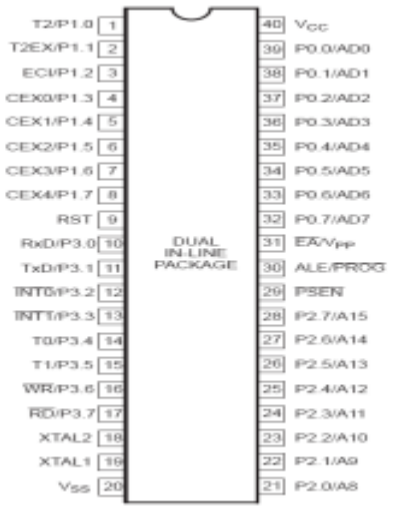

Fig -3: Pin diagram of SST89E516RD2 microcontroller

It contains a non-volatile 64kB Flash program memory that is both parallel programmable and serial In-System and In-Application Programmable. The ISP (In-System Programming), which allows the user to download new code while the microcontroller sits in the application, but in In-Application Programming (IAP) the microcontroller fetches new program code and reprograms itself while in the system. This feature allows for remote programming over a modem link. The ROM which has a default serial loader (boot loader) program allows serial In-System programming of the Flash memory via the UART without the need for a loader in the Flash code. With the help of standard routines contained in the ROM, the user program erases and reprograms the Flash memory in In-Application Programming.

4.2 Gsm and Led-Photodiode Assembly

GSM stands for Global system for mobile communication. It is a digital telephone mobile system, which is commonly used in Europe and other parts of the globe. Its operating frequency is 900-1800 MHz.

SIM800 is a total Quad-band GSM/GPRS arrangement in a SMT sort which can be implanted in the client applications. SIM800 supports Quad-band 850/900/1800/1900MHz, it

can transmit Voice, SMS and information data with low power utilization. With minor size of 24*24*3mm, it can fit into thin and reduced requests of client outline.
IR sensor is a type device which has a pair of an IR LED and a photodiode, collectively known as photo coupler or opto-coupler. Its main function is to perform non-contact object sensing. IR sensor and photodiode is placed on the either side of track. When the track machine detects crack in the track, the light from IR LED falls on the either side of photodiode. As, a result the photodiode resistance falls down and sends an interrupt to the microcontroller, indicating crack detection.

4.3 Dc Motor

The proposed design basically consists of 4 geared DC motors which is interfaced with the L293D H-bridge motor drive. Motor is a mechanical analogy device which consumes 100mA of current at 12v. The speed of geared DC motor is limited to 30rpm.

4.4 Sonar

Ultrasonic ranging module HC-SR04 gives a non-contact, high accurate value. Distance can be varied from 2cm to 400cm for collision detection. The whole package comes with the receiver and a transmitter module.
FEATURES:
1) Effectual Angle: <15°
2) Power Supply=+5V DC
3) Dimension: 45mm x 20mm x 15mm
4) Measuring Angle: 30 degree
5) Ranging Distance: 2cm to 400cm

4.5 Gps

Abbreviated as Global positioning system. Used to locate the position of the object. There is no need of transmitting any data from the user to GPS in order to obtain the coordinates of the object. Its basic principle relays on time and the known position of specialized satellites.

5. RESULTS

Track machine status indicates that track machine is online. It sends a message to a designated number indicating track machine is online.

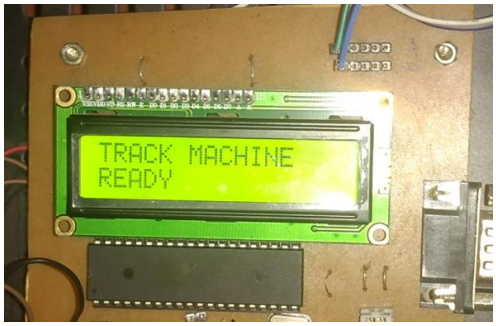

Fig -4: Status indicating Track machine is online

Once a Command is being sent to the track machine from the designated number or other, command will get activated and the crack detecting process will be started.

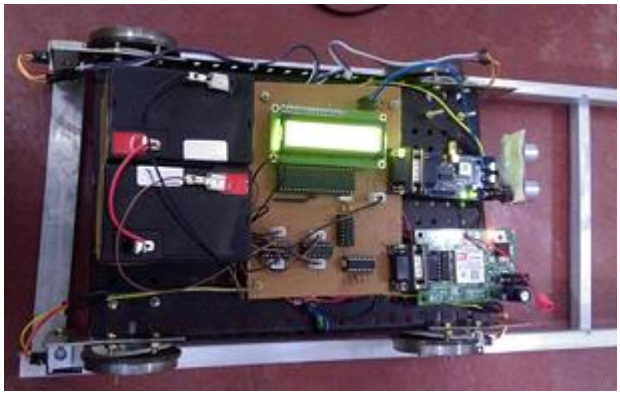

Figure 5: Track machine running on the rail road

A crack or a collision is detected, then the message of GPS coordinates will be sent into a respective number indicated in a source code to get the location.

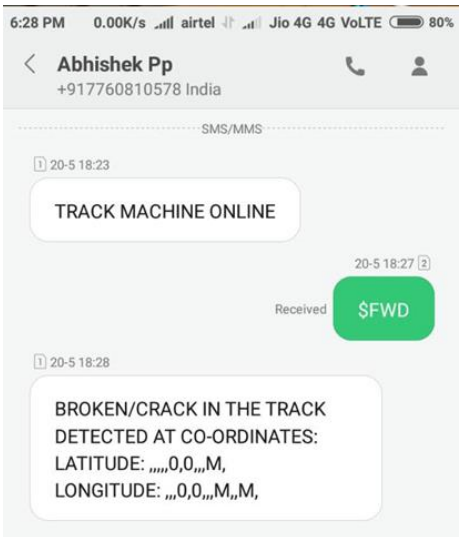

Fig -6: Status indicating Track machine is online

6. CONCLUSIONS

The proposed track machine automatically detects the faulty rail track without any human intervention successfully. It is self-reliant, cost effective, less analysis time and low power consumption. Added to these advantages mentioned the exact location of the faulty rail can be detected which saves life of many humans.

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