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Automated Railway Track Fault Detection System Using Robot

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ABSTRACT

In India rail transport occupies a prominent position in providing the necessary transport infrastructure to sustain needs of a rapidly growing economy. Today,Indiapossesses the fourth largest railway network in the world.However, in terms of the reliability and safety parameters, wehave not yet reached truly global standards. The mainproblem about a railway analysis is detection of cracks in thestructure. If these deficiencies are not controlled at earlystages they might lead to a number of derailments resulting ina heavy loss of life and property. This system proposes a costeffective solution to the problem of railway track crack detection utilizing IR (Slot sensor) assembly which tracks the exactlocation of faulty track which then mended immediately sothat many lives will be saved.

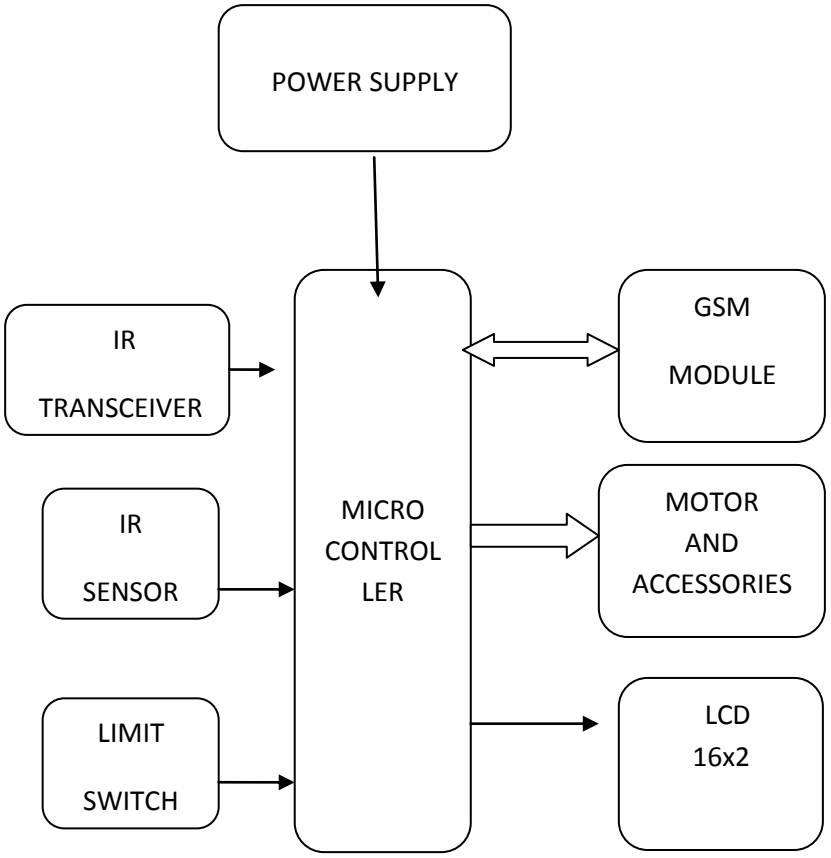
I.INTRODUCTION

Transport is a key necessity for specialization that allows production and consumption of products to occur at different locations. Transport has throughout history been a spur to expansion as better transport leads to more trade. Economic prosperity has always been dependent on increasing the capacity and rationality of transport. But the infrastructure and operation of transport has a great impact on the land and is the largest drainer of energy, making transport sustainability and safety a major issue. In India, we find that rail transport occupies a prominent position in providing the necessary transport infrastructure to sustain and quench the ever-burgeoning needs of a rapidly growing economy. The Indian railway network today has a track length of 113,617 kilometres (70,598 mi).over a route of 63,974 kilometres (39,752 mi) and 7,083 stations. It is the fourth largest railway network in the world exceeded only by those of the United States, Russia and China. 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. Despite boasting of such impressive statistics, the Indian rail network is still on the growth trajectory trying to fuel the economic needs of our nation. In terms of the reliability and safety parameters, we have not yet reached truly global standards. Though rail transport in India growing at a rapid pace, the associated safety infrastructure facilities have not kept up with the aforementioned proliferation. Our facilities are inadequate

compared to the international standards and as a result, there have been frequent derailments that have resulted in severe loss of valuable human lives and property as well**.** 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 caused by anti-social elements which jeopardize the security of operation of rail transport.

II.BLOCK DIAGRAM

TX:-



III.WORKING

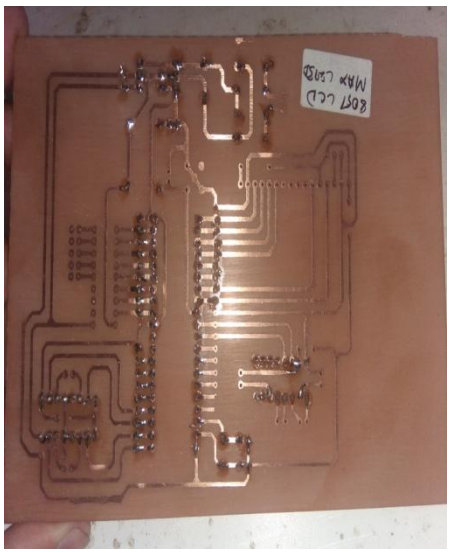
Automation has touched every aspect of our daily life. More and more advancement is being introduce in every field to reduce human efforts and to save time. Thinking about the same we are trying to introduce automation in the field of railway track inspection.

In our project fault detection on railway track is done by different sensor modules mounted on the moving robot. The different faults which our system would encounter are:-

1)Break in rails.2)Obstacle on track.

The different techniques used for the detection of same are Infrared Sensor (IR), limit switch and ultra sensor. All these sensor are interfaced with PIC microcontroller. When any of the faults is detected on track, output of the sensor is made high and given to the microcontroller. With this the robot is made to stop then and there and the sensed fault is send to the control room or the railway station by the by GSM module mounted on the robot. Thus the sensed fault is detected and being received at the control room.

Circuit diagram-



POWER SUPPLY-

The AC voltage from the mains supply is converted in to 12V ac using step down transformer.As we require 5V dc supply for AVR processor ,we use a voltage regulator circuit to convert the 12V dc output of filter circuit to 5V dc.

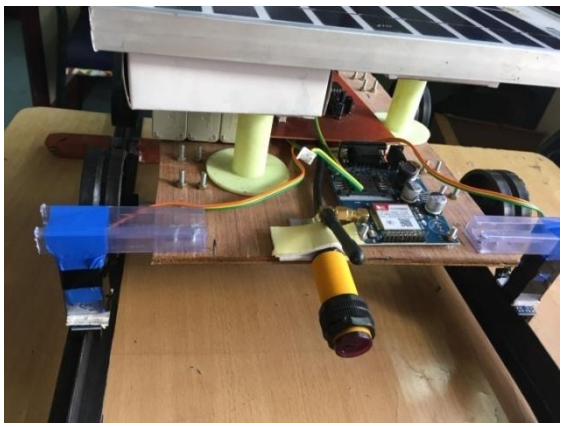
(1)IR SENSOR-

There are two types of sensor -1. IR Transmitter 2 . IR Receiver.

Slot grid sensors are ideal for filling and counting objects in feed devices.The slot grid sensors have an entire field for object detection with a maximum response time of 100micro sec. And a minimum object size of 1mm.When

using dynamic mode, only moving objects are detected.

(2)IR OBSTACLE SENSOR-



This sensor is a short range obstacle detector with no dead zone. It has a reasonably narrow detection area which can be increased using the dual version. Range can also be increased by increasing the power to the IR LEDs or adding more IR LEDs The photo below shows my test setup with some IR LED's (dark blue) as a light source and two phototransistors in parallel for the receiver. You could use one of each but I wanted to spread them out to cover a wider area. This setup works like a Frits LDR but with IR. It has a range of about 10-15cm (4-6 inches) with my hand as the object being detected.

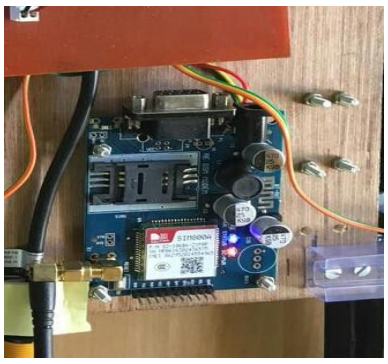
(3) Photodiode:

Photodiode is alight sensitive semi- conductor diode which converts the light energy into voltage or current based on the mode of operation. In general Photodiodes are operated in reverse bias condition. The clear Photodiode can detect visible and IR rays to limit the Photodiode to detect only IR rays a black cutting is applied to the glass of the Photodiode. The photodiode allows the current to pass through it if the photodiode is exposed to IR rays and it doesn't allow current to pass through it if no IR rays falls on it. The amount of current passed through the photodiode is directly proportional to amount of IR rays falls on it.

(4) GPS:

Global Positioning System tracking is a method of working out exactly where something is. A GPS tracking system, for example, may be placed in a vehicle, on a cell phone, or on special GPS devices, which can either be a fixed or portable unit. GPS works by providing information on exact location. It can also track the movement of a vehicle or person. So, for example, a GPS tracking system can be used by a company to monitor the route and progress of a delivery truck, and by parents to check on the location of their child, or even to monitor high-valued assets in transit. A GPS tracking system can work in various ways. From a commercial perspective, GPS devices are generally used to record the position of vehicles as they make their journeys. Some systems will store the data within the GPS tracking system itself (known as passive tracking) and some send the information to a centralized database or system via a modem within the GPS system unit on a regular basis (known as active tracking) or 2-Way GPS.

(5)GSM Module-



This GSM module can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number.application like SMS control, data transfer,remote control and logging can be developed easily.An embedded system is a special-purpose system in which the computer is completely encapsulated by or dedicated to the device or system it

Controls. Unlike a general-purpose computer, such as a personal computer, an embedded system performs one or a few pre-defined tasks, usually with very specific

(6) Motor Drive-

: L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

Figure 4: DC Motor In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively. Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

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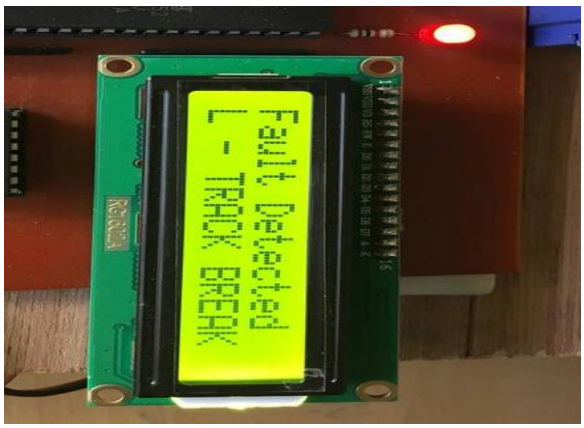
THE HARDWARE SYSTEM-

(1)Micro controller:

This section forms the control unit of the whole project. This section basically consists of a Microcontroller with its associated circuitry like Crystal with capacitors, Reset circuitry, Pull up resistors (if needed) and so on. The Microcontroller forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written.

(2)LIQUID CRYSTAL DISPLAY-

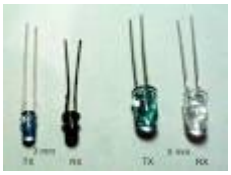


LCD stands for **L**iquid **C**rystal **D**isplay. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:The declining prices of LCDs.The ability to display numbers, characters and graphics. This is in contrast to LEDs, which are limited to numbers and a few characters.Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.Ease of programming for characters and graphics.These components are "specialized" for being used with the microcontrollers, which means that they cannot be activated by standard IC circuits. They are used for writing different messages on a miniature LCD. A model described here is for its low price and great possibilities most frequently used in practice

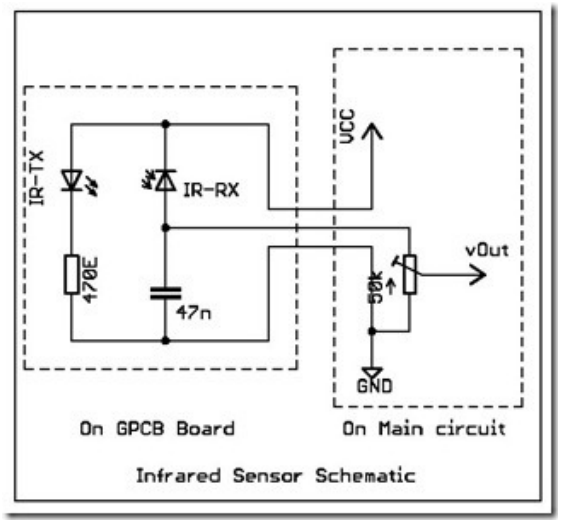
IV.IR SENSOR

IR LED emits infrared radiation. This radiation illuminates the surface in front of LED. Surface reflects the infrared light. Depending on reflectivity of the surface, amount of light reflected varies. This reflected light is made incident on reverse biased IR sensor. When photons are incident on reverse biased junction of this diode, electron-hole pairs are generated, which results in reverse leakage current. Amount of electron-hole pairs generated depends on intensity of incident IR radiation. More intense radiation results in more reverse leakage

current. This current can be passed through a resistor so as to get proportional voltage. Thus as intensity of incident rays varies, voltage across resistor will vary accordingly.



The circuit diagram:



Circuit is divided into two sections. IR TX and IR RX are to be soldered on small general purpose Grid PCB. From this module, take out 3 wires of sufficiently long length (say 1 ft). Then, as shown above, connect them to VCC, preset and to ground on main board. By adjusting preset, you can adjust sensitivity of the sensor. VCC should be connected to 5V supply.

ADVANTAGES:-

1) Introduction of automation for Indian railway.
2) The project saves human effort and time.
3) It is cost effective.
4) No man power required.
5) Human tendencies are not applicable on robot, which enhances its working.

DISADANTAGES:-

1) Loosened nuts and bolts cannot be detected.

APPLICATION:-

1) At present the inspection is done manually. Our project its application here. The inspection is done more accurately and saves time.
2) Our robot can be used for path following also by changing the wheels and sensors.

V.CONCLUSION

By using this Autonomous 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 regions where manual inspection is not possible, like in deep coal mines, mountain regions and dense thick forest regions can be easily done using this vehicle By using this vehicle for the purpose of Railway track inspection and crack detection and automated SMS will be sent to pre-defined phone number whenever the vehicle sensors detect any crack or deformation This will help in maintenance and monitoring the condition of railway tracks without any errors and thereby maintaining the tracks in good condition, preventing train accidents to very large extent Railway track crack detection autonomous vehicle is designed in such a way that it detects the cracks or deformities on the track which when rectified in time will reduce train accidents. The addition of solar panel is an added advantage, which also helps conserving the power resource.