Railway Track Crack Detection Vehicle
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Abstract:
Indian Railway is one of the largest networks in the world. Manual inspection of the crack in the railway track is very tedious and very time consuming. So to overcome this, we introduce a kind of LDR sensor which are used for detecting the crack in rails. We use a big microcontroller which is main interfacing input for both input and output models. This project contains GPS system, GSM system, LDR sensor, PIR sensor for communication purpose, crack detection in the railway track. The GPS module and GSM modem help us to find and sending railway geometric parameter of crack detection to nearest railway station. Wheels of the autonomous vehicle are interfaced with the DC motor, which is driven by the driver IC.

Keywords: LDR sensor, GSM Module, GPS Module, Crack, microcontroller, Solar Panel, LCD, Light-emitting diode.

1. INTRODUCTION
Transport is very important to carry the loads and goods from one place to the other and for this purpose Indian Railway play very important role. The length of Indian Railway is about 113617 km over a route of 63974 km and 7083 stations. Indian railway is the 4th largest railway network in the world, but in case of safety we had not reached at global standard. Because it carry passengers and goods from one place to other, we should have to focus on the safety of the Railway. Most of the railway accidents happen due to the cracks in the railway tracks. So for finding the cracks we use LDR sensor which detect the cracks. LDR sensor is interfaced in front of the front wheel of the vehicle. The wheels of the vehicle are interfaced with the DC motor, driven by IC diver. When crack in the railway track is detected by LDR Sensor, a message and location from GSM Module and GPS Module, is sent to the control area, that a crack is detected. The concept is used which contain LED and LDR sensor. This concept is that LED and LDR sensor are aligned opposite to each other, and for the true value from LDR the environment also need to be controlled. The main aim of this project is that it can detect any crack in the railway track using this setup, which can be implemented by Railway Authorities.

1) Board Hardware Features
A) Micro controller
A microcontroller is a device which is self-contained with memory, peripheral and processor. It is also known as embedded controlled because it can be used as an embedded system. This part of the project forms a main control unit of the whole project. Sobasically the micro controller which is used in this project is to control the device interfaced with the device, so this forms a heart of the project.

B) LDR(Light Dependent Resistor) Sensor
LDR is a device which has a variable resistance. These resistance changes, when the intensity of light fall on it. LDR (Light Dependent Resistor) Sensor work in the principle of Photo Conductivity. By indicating intensity of light, light sensor generates output signal. It is a passive device. It converts the light energy into the electrical signal output. Light energy may be visible or in the Infra-red parts of spectrum.

Figure 1. LDR
As the intensity of light increases the resistance also increases. This is shown in the below figure.

Figure 2. Light Intensity

C) GPS
GPS is also known as Global Positioning System is a network which is method or working exactly where something is. A GPS system can be placed in Vehicle, mobile phones or in any GPS
devices. It can either be fixed or portable unit. The main function of GPS system is to provide the exact location and information. For example GPS can be used by company to track the exact location of vehicle or can used by parents to check the location of child, or can used to track a high value assets. In this project the use of GPS system is that it will give the exact location and information of crack in the railway track to the control area.

D) 16X2 LCD Display
LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs.

![16X2 LCD Display](image)

**Figure.3. LCD**

E) Light-emitting Diode
A light-emitting diode (LED) is a two-lead semiconductor light. It is a junction diode, which emits light when activated.[4] When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons.

![Light-emitting Diode](image)

**Figure.4. Light-emitting diode**

F) GSM
GSM stand for Global System for Mobile communication is a wireless service like General Packet Radio(GPRS).The main work of this GSM system in this project is to give message of location of crack (in railway track) to the control area.

2) Design Hardware System: In this project, we have used two railway tracks. Both the tracks are monitored by the LDR sensor. Wherever crack in railway track is detected by LDR sensor the GPS module is activated and location of crack through a
message (containing Latitude and longitude) is sent to the pre-defined number by GSM Module. Hence the design of Solar Railway Track Crack Detection Vehicle is successfully tested on the track. And location of crack with latitude and longitude is sent to the phone number.

**Working:**

When power supply is given to the vehicle from solar panel or from the Electricity, it starts moving forward along the model track. Here LED sensor status monitoring the cracks in the model track.

1) When crack is detected by the LDR sensor the vehicle stops there, and GPS receiver send the position of latitude and longitude co-ordinate of the vehicle from satellite.

2) This latitude and longitude co-ordinate position of vehicle received by the GPS is converted into a message, done by the PIC microcontroller.

3) Now GSM Module sent this message to the predefined number with the help of Sim card inserted into the module.

4) When text message is received on the pre-defined number, the vehicle again starts moving in the model track and starts detecting the crack.

![Figure 6. Model](image)

![Figure 7. Flow chart: Design procedure of working](image)
TABLE 1. COST OF COMPONENT

<table>
<thead>
<tr>
<th>Products used</th>
<th>Price (in Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSM module (Sims 900)</td>
<td>1000</td>
</tr>
<tr>
<td>GPS Module</td>
<td>1000</td>
</tr>
<tr>
<td>At Mega 16</td>
<td>200</td>
</tr>
<tr>
<td>Power Adapter</td>
<td>200</td>
</tr>
<tr>
<td>Wheel</td>
<td>4 * 40 = 160</td>
</tr>
<tr>
<td>Free Wheel</td>
<td>4 * 40 = 160</td>
</tr>
<tr>
<td>Voltage Regulator</td>
<td>5</td>
</tr>
<tr>
<td>DC Socket</td>
<td>5</td>
</tr>
<tr>
<td>Capacitor</td>
<td>2</td>
</tr>
<tr>
<td>LED</td>
<td>150</td>
</tr>
<tr>
<td>Resistor</td>
<td>10</td>
</tr>
<tr>
<td>Crack</td>
<td>500</td>
</tr>
<tr>
<td>Solar Panel</td>
<td>800</td>
</tr>
<tr>
<td>LCD</td>
<td>200</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>4,392</strong></td>
</tr>
</tbody>
</table>

II. CONCLUSION

In this paper, we have represented a Solar Railway track crack detection vehicle by suing LDR sensor. A vehicle, to which power supply is given by Solar Panel, is so designed to detect the crack or any deformities on the railway track. This can be implemented to a large scale which will reduce the Man labor as well as the maintenance cost.

III. REFERENCES

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