International Journal of Recent Trends in Engineering & Research
ISSN (ONLINE) : 2455 – 1457
IMPACT FACTOR : 4.101

Solar Automatic Railway Track Gap Detecting Vehicle

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Abstract— The project aim is designing railway track gap detection autonomous vehicle using Microcontroller, IR obstacle Sensors assembly system, which detects the gap along its path. The central component of the whole system is a microcontroller. The vehicle is powered with the help of Solar panel and Lead Acid battery assembly. The vehicle moves along the path of railway track and IR sensors mounted on the vehicle front end will inspect the track along the path. In our project "Automatic railway track gap detecting vehicle" beings with an introduction to railway track Inspection and it's various application. The sensors are used to detect the crack in the railway track automatically and this signal is given to FM transmitter unit. FM receiver unit is fixed to the nearest railway station. The transmitted signal is received by the receiver unit, and gives the information to the station master by alarm with indication. This is a very efficient method of checking the cracks in the railway track and this is to be used in modern engineering industries. The manual efforts can be completely avoided by using this modern equipment.

Keywords— Solar panel, Lead Acid battery, IR sensors, FM transmitter unit.

I. INTRODUCTION

This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased. Degrees of automation are of two types, Full automation. Semi automation In semi automation a combination of manual effort and mechanical power is required whereas in full automation human participation is very negligible.

Need for Automation:

- Reduction of labor and material cost
- Higher Accuracy
- Reduction of work load to the labor
- Increased safety
- To reduce the inspection time
- Reduction in fatigue
- Improved personnel comfort

The Indian railway network today has a track length of113, 617 kilometers (70,598 mi).over a route of 63,974kilometers (39,752 mi) and 7,083 stations. It is the fourth largest railway network in the world. Indian rail network is still on the growth trajectory trying to fuel the economic needs of our nation. 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. On further analysis of the factors that cause these rail accidents, recent statistics reveal that approximately 60% of all the rail accidents have derailments as their cause, of which about 90% are duet gaps on the rails either due to natural causes (like excessive expansion due to heat) or due to antisocial elements. Hence these gaps in railway lines have been perennial problem which has to be addressed with utmost attention due to the frequency of rail usage in India. These gaps and other problems with the rails generally go unnoticed due to improper maintenance and the currently irregular and manual track line monitoring that is being carried out. The high frequency of trains and the unreliability of manual labor have put forth a need for an automated system to monitor the presence of gap on the railway lines. Owing to the crucial repercussions of this problem, this paper presents an implementation of an efficient and cost-effective solution suitable for large scale application.

In previously existing system, the same concept is used using LED and LDR sensor assembly. The main drawback of the system is that LED and LDR needs to be exactly aligned opposite to each other to detect the gap, also the environment needs to be controlled to detect the true values from LDR. For this reason, we have used IR Obstacle sensor, which has only one alignment will not be an issue. The main objective of the project is to identify any gap or deformation on the railway track using this setup, which can be implemented in live by Railway authorities. The proposed setup would make the inspection and maintenance of railways tracks easier and help them to monitor efficiently by replacing the human inspection which is currently followed. The design of the vehicle and software related to it are very simple and can be easily adopted by the present system.

II. WORKING OF AUTOMATIC RAILWAY GAP DETECTING VEHICLE

Component used

1. Gap detecting vehicle
2. IR sensor
3. Solar panel
4. Railway track
5. Battery
6. Microcontroller 8051
7. RF transmitter & receiver unit

When the vehicle is powered on, it moves along the model track. The IR detected by the IR sensor, the vehicle stops at once, and the RF receiver triangulates the message to the buzzer. A text message which is done by PIC microcontroller .Once the message has been successfully sent to the LCD, the vehicle resumes its movement forward depending on the type of gap

Gap detecting vehicle

Rail inspection is the practice of examining rail tracks for flaws that could lead to catastrophic failures. According to the States Federal Office of Safety Analysis,[1] track defects are the second leading cause of accidents on railways in the United States. The leading cause of railway accidents is attributed to human error. The contribution of poor management decisions to rail accidents caused by infrequent or inadequate rail inspection is significant but not reported by the FRA, only the NTSB. Every year, North American railroads spend millions of dollars to inspect the rails for internal and external

flaws. Nondestructive testing (NDT) methods are used as a preventative measures against track failures and possible derailment.

Technical specifications

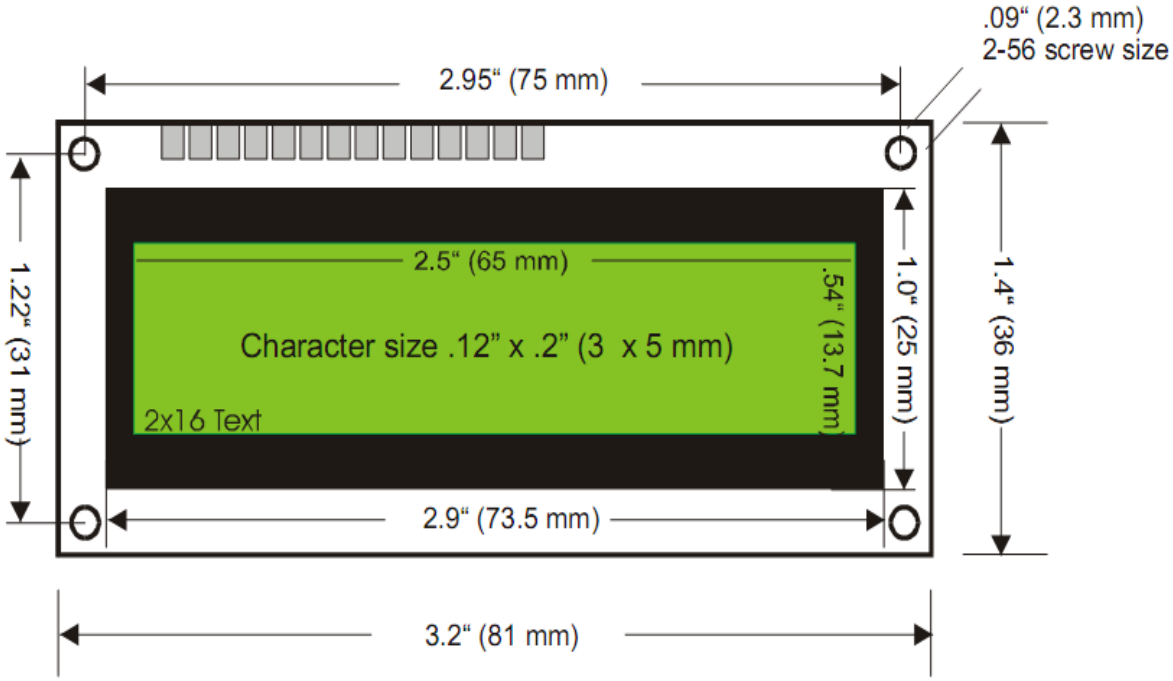

Fig-1.1: Specifications of 16 x 2 LCD

Buzzer

Fig-1.2: Buzzer

III. ADVANTAGE OF SOLAR AUTOMATIC RAILWAY TRACK GAP DETECTING VEHICLE

*The auto gap detection method is more efficient in the technical field
* Quick response is achieved
* Simple in construction
* Easy to maintain and repair
* Cost of the unit is less when compared to other
* No fire hazard problem due to over loading
* Comparatively the operation cost is less
* Continuous operation is possible without stopping
* Automatic alert system to the station master
* The signal transmission is wireless transmission.

IV. LIMITATIONS OF AUTOMATIC RAILWAY TRACK GAP DETECTING VEHICLE

*The signal transmission is below50 feet
*The vehicle operated in battery power, so rechargeable battery is used to drive the vehicle.
*The track should be clean
*Proper maintenance is required
*Due to rain it don't detect gap
*The minimum gap width should be 25mm.

V. CONCLUSION

By using this Autonomous vehicle for purpose of railway track inspection and gap detection, it will have a great impact in the maintenance of the tracks which will help in preventing train accidents to a large extent. Regions where manual inspection isn't possible, like 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 gap detection and automated SMS will be sent to pre-defined phone number whenever the vehicle sensors detect any gap 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 large extent Railway track gap detection autonomous vehicle is designed in such a way that it detects the gaps or deformities on the track which when rectified in time will reduce train accidents. The addition of solar panelist an advantage, which also helps conserving energy.

VI. RESULT

We get the result in 3-Steps:-

When Gap is found

Step-1:- LCD screen shows "CRACK IS FOUND"

When any gap in the track of greater than 2.4 cm is found **liquid-crystal display** shows that "GAP IS FOUND" This display unit is one of the output technique which is used in the project and it helps us to know about the gap where the Buzzer sound or LED light does not effective. Sometime outside light is too bright where LED light cannot visible and sometime due to outside noise it is very difficult to hear Buzzer's beeping .That time we use LCD screen as output result.

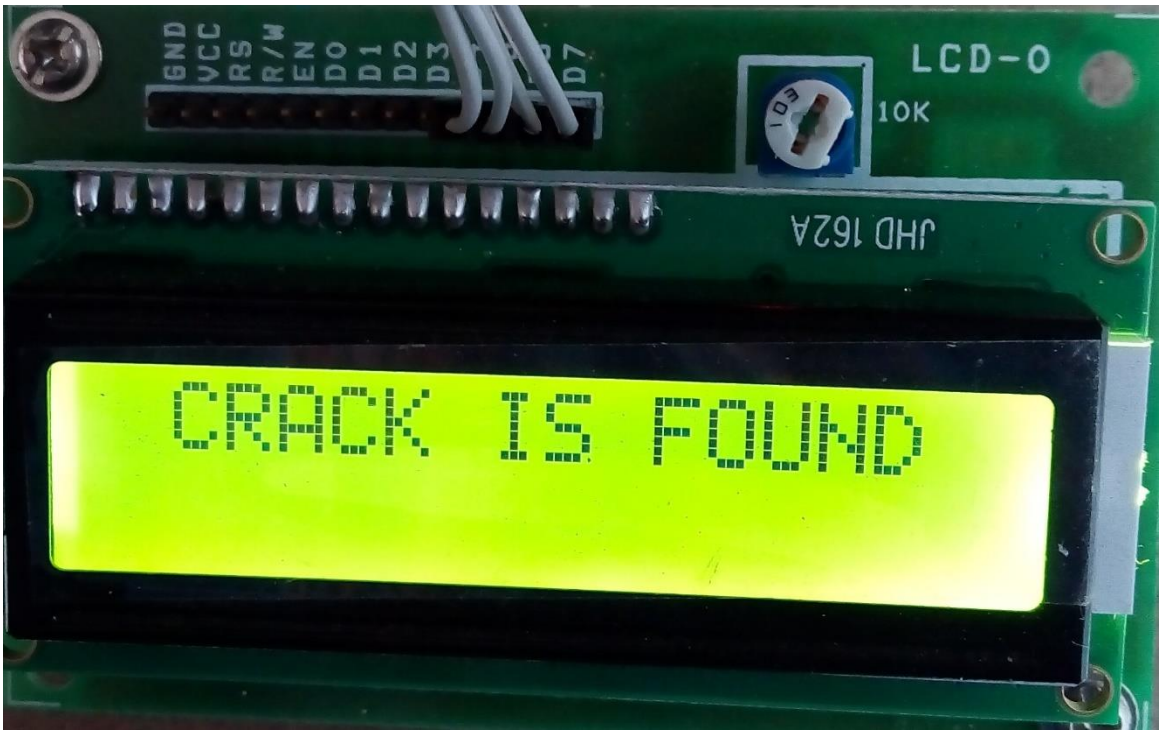

Fig-1.3: LCD screen shows crack is found.

Step-2:-Red LED light starts emitting light.
When any gap in the track of greater than 2.4 cm is found **light-emitting diode** (**LED**)starts emitting red light which alert the train coming towards detected gap in the track and prevent it from any possible accident due to the gap. There are three red LED light. Which are used in this project for the output purpose. The visibility of the LED light is very high which can be seen from sufficient distance before the detected gap so that the coming train can be stop safely and it can be prevent from any possible accident in any weather and day-night condition.

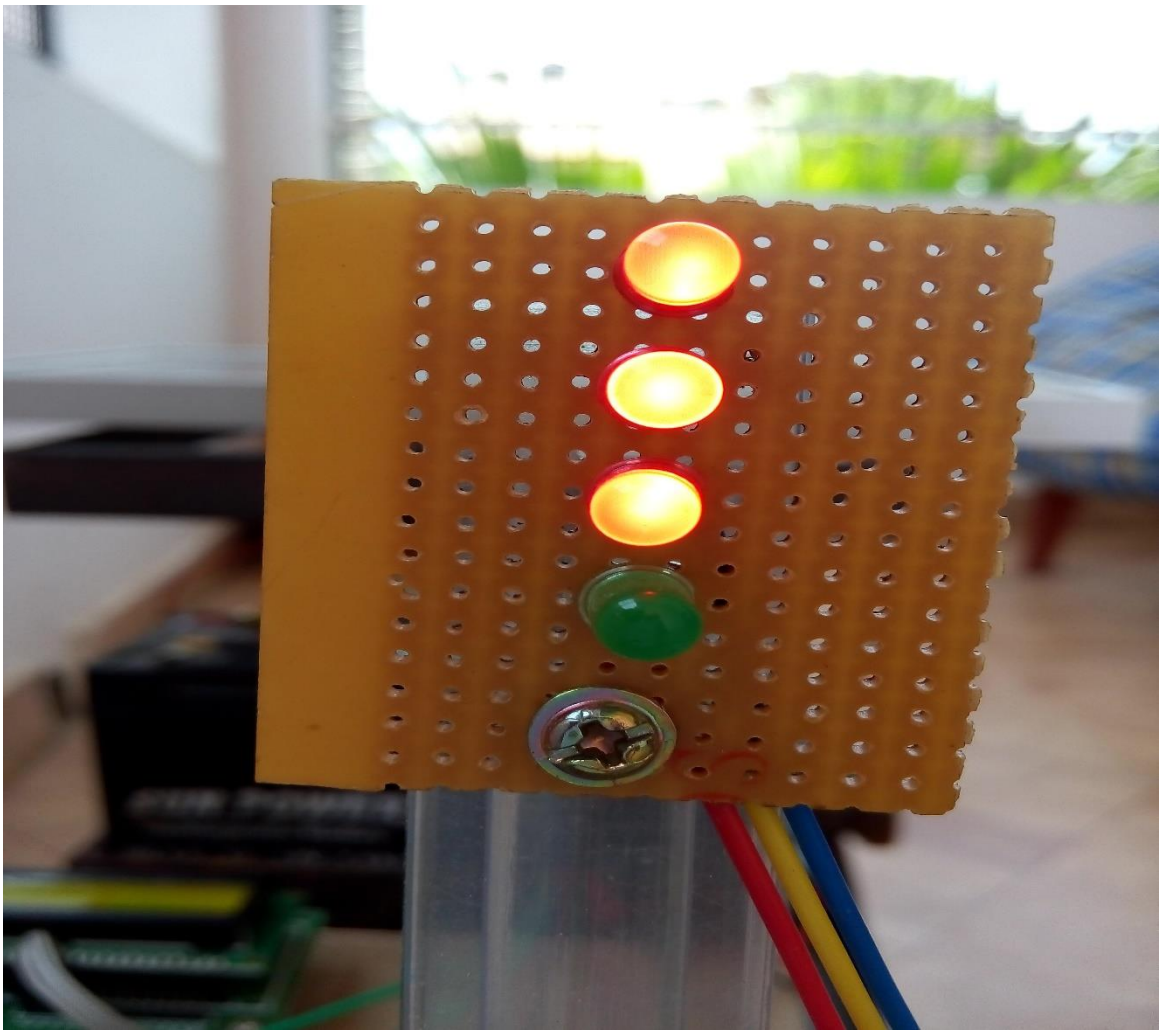

Fig-1.4: Red LED light starts emitting light.

Step-3:- Buzzer activates and starts beeping.

The above diagram is taken at the same time when gap was detected by the I.R Sensor. When any gap in the track of greater than 2.4 cm is found RF receiver activates and buzzer connected to it starts beeping which alert the station master about the detected gap in the track and then station master can take necessary action to prevent accident due to the gap. There is a complete receiver unit. Which is used in this project for the output purpose. The sound of the Buzzer is very high and periodic in nature which can be heard by the station master. It is the only output unit used in this project which is not attached with the vehicle. This output unit should be fixed at every railway station for effective use of this model.

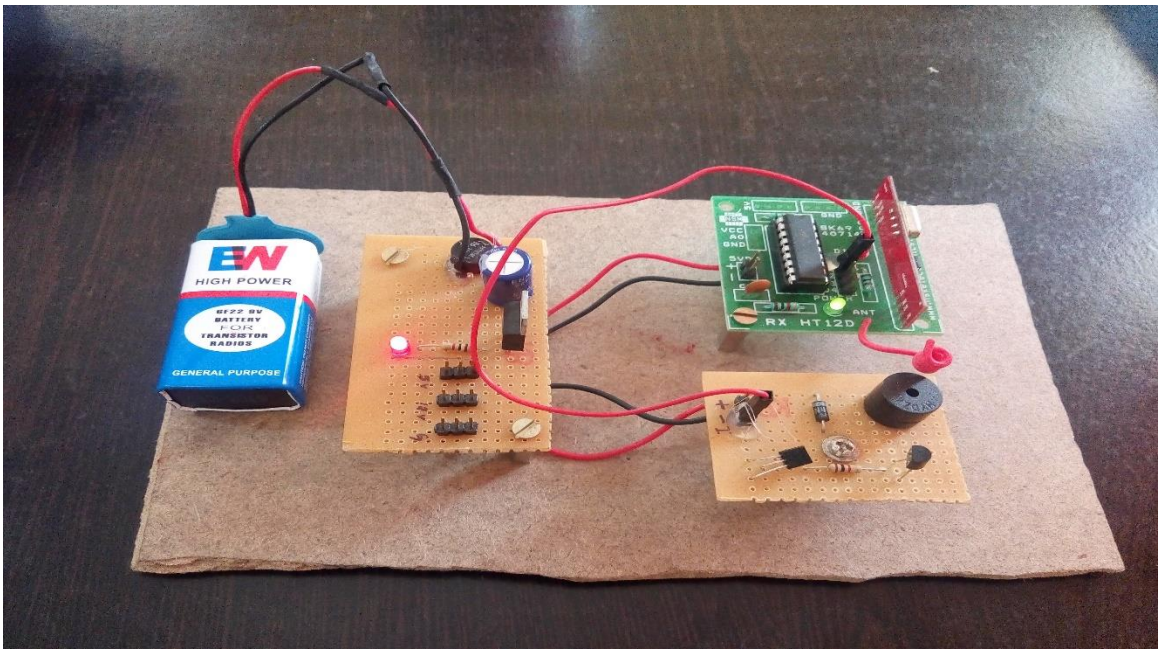

Fig-1.5: Buzzer activates and starts beeping.

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