

Automatic Railway Track Crack Detecting Vehicle

G.Rakesh, Prof. B. Durga Prasad

M.Tech, Mechanical Engineering, JntuA College of engineering, Ananthapuram, India
Professor and Head of the Department, Mechanical Engineering, JntuA College of Engineering, Ananthapuram, India

Abstract: Indian Railways is one of the largest networks in the country. Major transportation is done by the railways in the country. Indian Railways is the fourth largest network in the world. Many people believe Railways is one of the cheapest and safest transport, but there are certain accidents occur in the railways. Out of them 60% of the accidents occur due to the failure of the track or crack formation in the track or the absence of the track in the railway line. Now, in this project we designed the prototype of to detect the railway track crack and absence of the track in the railway line by using sensors like LED(light emitting device), LDR(light dependent resistor) and components like microcontroller,max232,LCD and circuits. In this project railway track cracks are detected by placing photodiode, LDR (light dependent resistor) on either side of the track which are connected to the regulator. The regulator sends the logic of either 0or1 to the microcontroller of 8051 family. From the microcontroller it sends the logic of either 0 or 1 to the LCD in which the status of the railway track will be display on the screen, the display statements will be defined in the C program. From the microcontroller it sends the logic to the motor and GSM modem. From the GSM MODEM the SMS will be send to the concerned authority of the nearest station, if the track is detected with error or crack formation or absence of track.

Keywords: LCD (LIQUID CRYSTAL DISPLAY), LED (LIGHT EMITTING DEVICE), LDR (LIGHT DEPENDENT RESISTOR), MICROCONTROLLER, MAX232, RS232, LOGIC.

1. INTRODUCTION:

In this project to detect the crack and absence of railway track we need several components like LED which emits IR rays, LDR, LCD and embedded components like microcontroller of 8051 family, MAX232 & RS232 etc. The block diagram is as shown below:

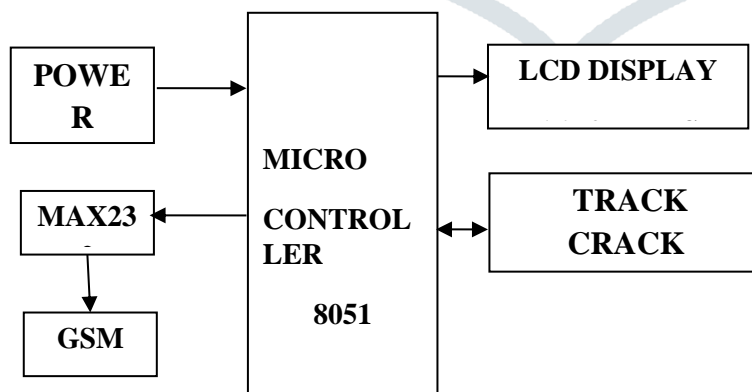


FIG. 1: Block Diagram of Railway Track Crack Detecting Vehicle

A. Microcontroller:

Microcontroller is the important component of the project. The microcontroller we use is from 8051 family and it is the AT89S52 component. Microcontroller also acts as the storage device it stores up to 8k bytes and it is an 8-bit microcontroller. The microcontroller has 40 pins of 20 pins on each side. Out of which one is connected to ground. In the microcontroller there are 32 I/O pins of 4 ports from p0 to p3 which are connected to LCD, MAX232 etc. If external is to be executed then the pin 31 should be connected to ground.

B. Max232:

MAX232 is the serial device used to convert the logic levels into TTL logics. From microcontroller it sends to GSM for communication and for GSM high level language is used. In that way, a mismatch is created between the devices, in order to clear the mismatch MAX232 is used. It sends the data of converting logic levels to high level language and vice versa. MAX232 also fix in between the microcontroller and RS232 as voltage converter.

C. Rs232:

RS232 is nothing but RECOMMENDED STANDARD232. It is used to connect the UART and DB9 converter. RS232 is mostly used as standard I/O interfacing standard, RS232 follows the separate protocol it is RS protocol such that if microcontroller sends LOGIC 1 then the RS232 sends the voltage as -3 to -25v and in the case of LOGIC 0 it represents +3 to +25v.

D. LCD (LIQUID CRYSTAL DISPLAY):

Liquid crystal is one of the important of the project to show the present status of the project. This project makes use of liquid crystal display to display/prompts for necessary information.

E. GSM Modem Section:

GSM Modem section consists of GSM modem. The modem will communicate with microcontroller using serial communication. The modem is interfaced to microcontroller using MAX232, a serial driver. The Global system for mobile communication is a TDMA based digital wireless network technology that is used for communication between the cellular devices.

F. Power Supply:

POWER SUPPLY is the main component for supplying power. In power supply there are four there are Transformer, Rectifier, Filter and Regulator. The INPUT POWER supply is 230VAC and the output voltage is 9Vdc.

II. WORKING OF AUTOMATIC RAILWAY TRACK CRACK DETECTING VEHICLE:

Automatic railway track crack detecting vehicle consists of sensors LED which emits IR rays and LDR consists of two pairs which are placed on both side of the track of the two tracks. LED and LDR works on the principle of "High power low resistance and low power high resistance". When by placing the sensors on either side of the track and the sensors is connected to the PSB (power supply board) which consists of microcontroller, liquid crystal display, MAX232, power supply circuit. The input power of the supply is 230vAC and the output power supply is 5vDC n the four stages i.e., through transformer, rectifier, filter and regulator. The output DC voltage is also supplied to the track circuit board consists of sensors. When the current flows through the LED (which emits the light) when the track is in good condition LED light does not fall on the LDR.

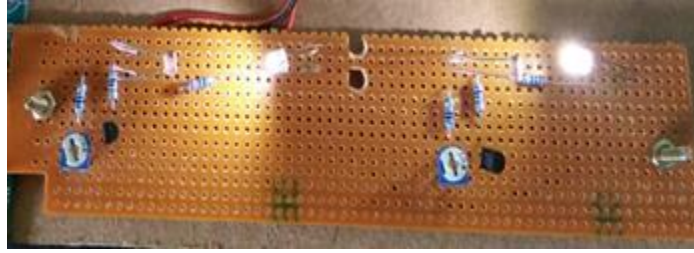


FIG.2: TRACKCRACKDETECTINGCIRCUIT

If the crack occurs in the track or gets holed or in the absence of the track in the railway line, the light falls on the LDR, which then collects at the base collector of the circuit. Then the regulator will send the LOGIC 0 to the microcontroller, the microcontroller will in return send to the LCD, motor and GSM modem. Then the LCD will display the present status of the project of that the crack is detected at that time the motor stops running and the microcontroller will send in the form of logics to the GSM modem in between max232 is placed which creates the communication between the GSM modem and microcontroller. Then the GSM will send the SMS to the predefined number of the nearest station authority. The prototype is as shown in figure.

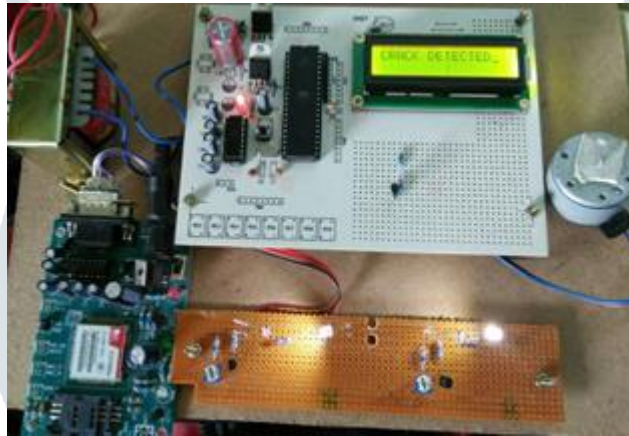


FIG. 3: Prototype of Railway Track Crack Detecting Vehicle

When the LED light falls on the LDR, it means crack or absence of the track is selected. So that it reaches the base of the collector, then the regulator will send the logic 0 to the microcontroller. When the LOGIC 0 reaches the microcontroller it sends the same logic to the LCD, motor and GSM modem. Then the LCD will display the current status of the project that the crack or absence of the track is detected. At the same time, motor stops running and the vehicle is automatically stops that is why it is 'Automatic Railway Track Crack Detecting Vehicle' then we can easily understand where or at which place track is damaged. Then at the same time from microcontroller will send the logic 0 to the GSM modem. Then the GSM modem will send the SMS to the nearest station authority officer. In GSM modem there are LED indicators which are used to indicate the modem on/off, the other one is used to show the signal network of the sim card we placed. In microcontroller there are 40 pins. In that there are 32 I/O pins, one is connected to ground, and there are 4 ports of 8 pins each. The board which we placed the LED and LDR is the track circuit board. If we want to connect to the external memory then the pin EA should be connected to ground. By placing buzzer we can alert when the crack or absence of the track is present, so that we can easily identify at the time where the vehicles identifies the crack of the track or absence of the track.

III. CONCLUSION:

Nearly 60% of the railway accidents done due to the track failure or track defect. In this project we try to detect the railway track errors or failures or absence of the railway track and send the displaying message to the nearest railway station of the respective authority to reduce the railway accidents. By using the Autonomous vehicle we can easily and accurately detect the crack of the track or the deformation of the track. This project will be useful at the places where human cannot be involved in work i.e., in hilly areas, dense thick forests, desert areas and in mining areas. By this project or product cracks or absence of the track will be easily identified and sends the current status of the project to the pre-defined phone number of the nearest station authority or to the train without any delay, then the identified error or crack will be rectified. Then at the time there will be increasingly decrease in the accidents by the crack or deformation or absence of the track in the railway line.

REFERENCES:

- 1) *High speed detection of broken rails, rail cracks and surface faults*, Prof. M Dhanasekar, Wirtu, LBayissa & M Dhanasekar
- 2) *Robust Railway Crack Detection Scheme (RRCDS) Using LED LDR Assembly*, Selvamraju, Somalraju, VigneshwarMurali, GouravSaha, Dr. V. Vaidehi.
- 3) Hartman, G.A., "Infrared Damage Detection System (IDDS) for real time, small-scale damage monitoring, Charlotte, North Carolina (2003).
- 4) Wojnarowski, Robert John Welles, Kenneth BrakeleyKornrumpf, and William Paul, "Electromagnetic system for railroad track crack detection and traction enhancement".
- 5) QiaoJian-hua, Li Lin-Shang and Zhang Jing gang, "Design of Rail Surface Crack-detecting System Based on Linear CCD Sensor", *IEEE Int. Conf. on Networking, Sensing and Control*, 2008.
- 6) Spencer Ackers, Ronald Evans, Timothy Johnson, Harold Kess, Jonathan White, Douglas E Adams, Pam Brown, "Crack detection in a wheel end spindle using wave propagation via modal impacts and piezoelectric actuation", *Health Monitoring and Smart Nondestructive Evaluation of Structural and Biological systems V*, SPIE (2006).
- 7) Lanza di Scalea, F., Rizzo, P., Coccia, S., Bartoli, I., Fateh, M., Viola, E. and Pascale, G., "Non-contact ultrasonic inspection of rails and signal processing for automatic defect detection and classification, *Insight – NDT and condition monitoring*", *Special Issue on NDT of Rails* 47(6) 346-353 (2005).
- 8) Komal B. Dandge *Int. Journal of Engineering Research and Applications*, ISSN: 2248-9622, Vol. 4, Issue 11 (Version - 6), November 2014, pp.01-06, *Automatic Broken Rail Crack Detection Scheme by Komal B. Dandge**, Prof. G.R.Gidveer.
- 9) *Journal IJAICT Volume -1, Issue-1, May 2014, ISSN 2348 – 9928, CRACK DETECTION SYSTEM FOR RAILWAY TRACK BY USING ULTRASONIC AND PIR SENSOR*, Prof. P.Navaraja Assistant Professor, *Electronic and Communication Engineering, Mahendra Institute of Technology, Namakkal, Tamilnadu, India.*
- 10) *Journal Richard J. Greene, John R. Yates and Eann A. Patterson, "Crack detection in rail using infrared methods"*, *Opt. Eng.* 46, 051013, May 2007.
- 11) *Paper IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 2, Issue 2, Apr-May, 2014, ISSN: 2320 – 8791, Innovative Railway Track Surveying With Sensors and Controlled By Wireless Communication by Athira Ajith1, Aswathy K S2, Binoy Kumar H3, Dantis Davis4, Lakshmi S Pai5, Janahanlal P Stephen.*

- 12) Paper I. Milev and L. Gruendig, *“Rail track data base of German rail The future automated maintenance,”* in Proc. INGEO FIG Regional Central Eastern Eur. Conf. Eng.Surv., Bratislava, Slovakia, Nov. 11-13, 2004, pp. 1-8.
- 13) Paper. Trehag, P. Handel, and M. Ögren, *“Onboard estimation and classification of a railroad curvature,”* IEEE Trans. Instrum. Meas., vol. 59, no. 3, pp. 653-660, Mar.2010.
- 14) Paper L. Beales, *Track system requirements, Railway Group Standards, GC/RT5021, Railway Safety, London, Oct.2003.*
- 15) Journal B. Akpinar, *“A new measurement system design for determining the geometrical changes on railways,”* Ph.D.dissertation, Yildiz Technical Univ., Istanbul, Turkey, 2009.
- 16) *An article on LED-LDR Based Railway Crack Detection Scheme on internet open access articles.*
- 17) C. Saravanan, Dr. M. A. Panneerselvam, and I. William Christopher, *“A Novel Low Cost Automatic Solar Tracking System,”* International Journal of Computer Applications, 31(9), pp.62-67, October 2011.
- 18) M. W. Daniels and P. R. Kumar, *“The optimal use of the solar power Automobile,”* Control Systems Magazine, IEEE, vol. 19, no. 3, 2005.
- 19) *SOLAR VEHICLES AND BENEFITS OF THE TECHNOLOGY”,* by John Connors, ICCEP paper2007.
- 20) http://www.seeedstudio.com/depot/images/product/s_r-92.pdf
- 21) http://www.wvshare.com/datasheet_html/LPC2148-PDF.html
- 22) <http://www.npeducations.com/2013/01/railway-track-crack-detection-robot.html>
- 23) http://www.Microchip.Com/wwwproduct_s/Devices.aspx?Product=PIC16F877A

