ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 6, Issue 10, October 2017

Automatic Crack Detection of Railway Track Based on Programmable Logic Controller (PLC)

Ramya.P[1], T.N Raghavendra[2], H Prasanna Kumar[3]

M.E Student (C&I), Dept. of EE, UVCE, Bangalore, Karnataka, India[1]

Assistant Professor, Dept. of EE, UVCE, Bangalore, Karnataka, India[2]

Assistant Professor, Dept. of EE, UVCE, Bangalore, Karnataka, India[3]

ABSTRACT: Most of the commercial transport in India is being carried out by railway network and therefore, any problems in the same have the capacity to induce major damage to the economy. Some of the major reasons for rail accidents are due to the faults on the rail.

This work is an attempt to develop an advanced automatic PLC based fault detection technology in railway network to overcome the above problems. If these deficiencies are not controlled at early stages they might lead to a number of derailments resulting in a heavy loss of life and property. This work proposes a cost effective solution to the problem of railway track crack detection utilizing slot sensor which tracks the location of cracked track which then mended immediately so that many lives will be saved.

KEYWORDS: PLC, Sensors, Crack detection, GSM.

I.INTRODUCTION

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. Today, India possesses the fourth largest railway network in the world.

However, in terms of the reliability and safety parameters, we have not yet reached truly global standards. 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. In the past, this problem has lead to a number of derailments resulting in a heavy loss of life and property. Cracks in rails have been identified to be the main cause of derailments in the past, yet there have been no cheap automated solutions available for testing purposes.

The Indian railway (IR) network today has a track length of 1,15,000 kilometres over a route of 65,000 kilometers and 7,500stations.It is the fourth largest railway network in the world exceeded only by those of the United States, Russia and China. In 2011, IR carried over 8,900 million passengers annually or more than 24 million passengers daily 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. Though rail transport in India

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 6, Issue 10, October 2017

is growing at a rapid pace, the associated safety infrastructures are not up to international standards. To demonstrate the gravity of the problem, official statistics say that there have been 14 accidents in 2011, 15 accidents in 2012. On further analysis of the factors that cause these rail accidents, recent statistics reveal that approximately 90% are due to cracks on the rails either due to natural causes (like high expansion due to heat). The present work is focused on bringing down the accident rate by automatically detecting the breakages on the tracks.

Indian train operates 10,773 locomotives, 63,046 coaches and 2,45,000 wagons. As many as 1,394 train accidents were reported in India over ten years considered for this analysis. Of these accidents , 51% or 708 were due to train derailments over last 10 years.At present our railways are using manual methods of fault detection through human inspectors. There are many advantages with this system when compared with the traditional detection techniques. It includes less cost, low power consumption and less analysis time.

II. OBJECTIVE

To research on the problem domain, this includes Sensing technology, existing similar system and also the suitable programming language.To design a sensor based track for detecting crack in railway track.To send the information to the control station through GSM. To inform the loco pilot whether to enter the station.

III. OVERVIEW OF PLC.

The PLC is an industrial computer. It is capable of storing instructions to implement control functions such as sequencing, timing, counting, arithmetic, data manipulation and communication. The I/O interfaces provide the connection between the PLC and the information providers (inputs like pushbuttons, sensors) and the controllable devices (outputs like valves, relays, lamps).

S7-1214 DC/DC/Relay PLC has been used. S7-1214 DC/DC/Relay has been shown in Figure 1.

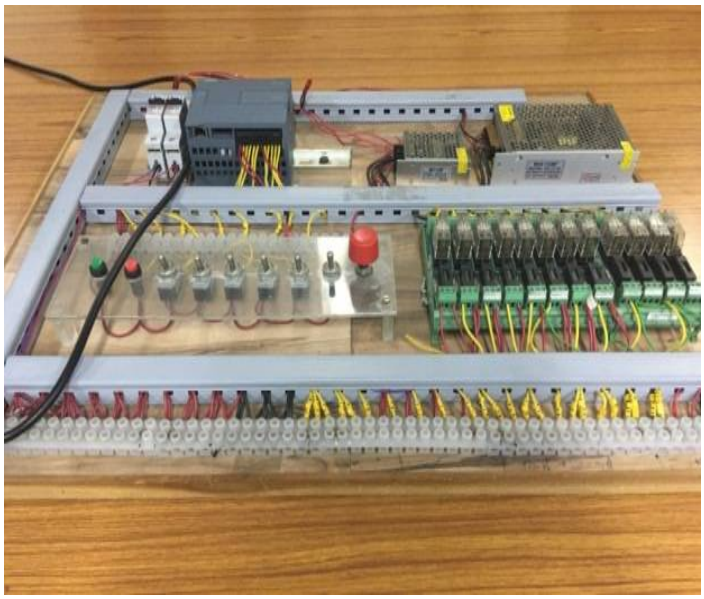

Fig.1. Seimens S7-1214 DC/DC/ RELAY PLC

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 6, Issue 10, October 2017

PLCs are specifically designed to survive the harsh conditions of the industrial environment. A well designed PLC can be placed in an area with substantial amounts of electrical noise, electromagnetic interference, mechanical vibration, and non condensing humidity. The hardware interfaces for connecting field devices are actually part of the PLC itself and are easily connected.
There are different types of Seimens PLC like S7-200, S7-300 & S7-1200 etc.

IV.BLOCK DIAGRAM

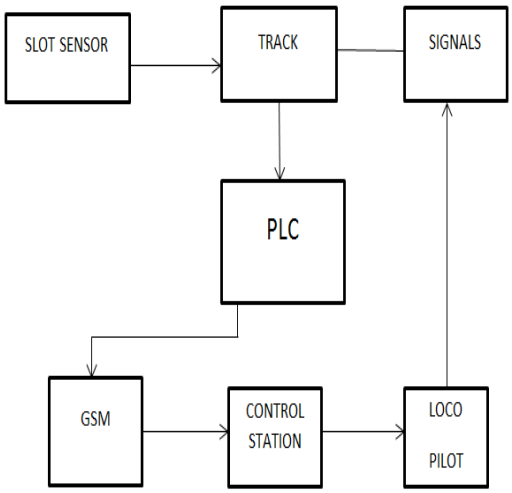

Fig. 2 Block diagram

The figure represents the complete block diagram of automatic crack detection in railway tracks. The slot sensors will be placed near the joints in the rails of railway track. The sensor senses if the crack is occurredor not.

After getting signal from the sensor the information is passed to the control station through GSM. Then control station will inform to loco pilot .

V. WORKING

The slot sensors are placed near the joints in the rails of railway track. Each control station checks the status of the sensor before the train reaches the next station. If there is no crack then train will move from station.sensor is an input to the PLC.If there is a crack on track the status of sensor becomes high.

The output is then read by external control unit PLC that converts sensor ON and OFF state into useable information. After getting signal from the sensor the information is passed to the control station through GSM. As the control station continuously monitor the status of the sensor it stops the train by informing the loco pilot before it reaches the next station.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 6, Issue 10, October 2017

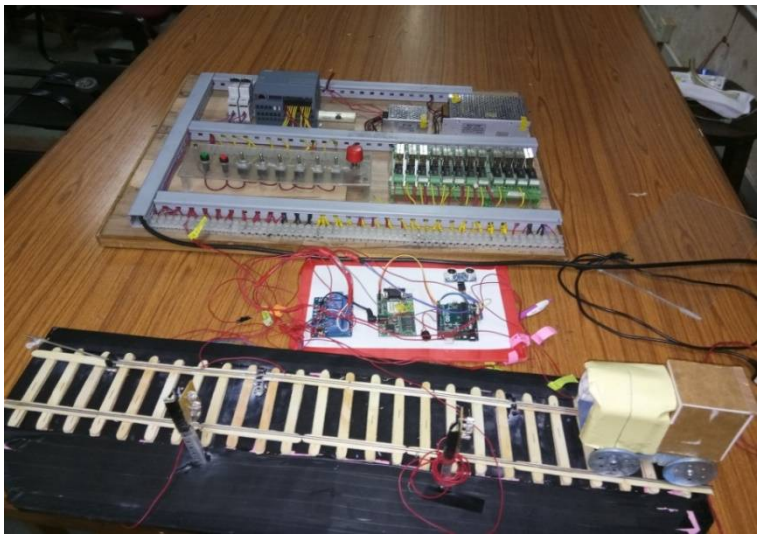

Fig 3 Automatic Crack Detection in Railway Track system

VI. RESULT

CONDITION OF THE TRACK	STATUS OF SENSOR	LEDs	ROLE OF CONTROL ROOM	STATUS OF TRAIN (MOTOR)
Proper	OFF	GREEN	No alert	Running
Damage	ON	BLUE	Sends SMS alert to the loco pilot	Stop(after receiving SMS alert from control station)
Broken	ON	RED	Stops the train	Stopped

Whenever there is a crack or if the track is damaged the state of the sensor goes HIGH and the RED colour LEDs would glow and an SMS alert will be sent to the driver and the train will be stopped before it reaches the next station.

VII. CONCLUSION

The existing manual method of fault detection can be replaced by the proposed work which is an advanced alternative solution with a PLC based automated fault detection system. The human intervention for detecting faults can be completely eliminated. It provides a high speed fault detection system that automatically communicates the predicted railway track defects information immediately to the concerned railway traffic control room by using GSM system, hence this will reduce the accident rates and loss of precious life.

REFERENCES

[1] Raghupatty, Pranab, Dineshkumar, Bharath," Automatic Rail Detection Using Ultrasonic Detector", International Conference on Modern Trends in Signal Processing, 2012.
[2] Stefan et al, "HMM Based Segmentation of Continuous Eddy Current Sensor signal", 11th International IEEE conference on intelligent transportation systems, china, vol.13, Page 760-765, 15 Dec 2008
[3] Selvamraju et al, "Robust Railway Crack Detection (RRCDS) Using LED-LDR Assembly", IEEE published, Page 477- 482, 2012.

ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Website: www.ijareeie.com

Vol. 6, Issue 10, October 2017

[4] AnjaliBissal et al, "Train Collision Avoidance System Using Sensors and Zigbee Technology", international journal of research inSelvamraju Somalraju, Vigneshwar Murali, Gourav Saha, Dr.V.Vaidehi, "Robust Railway Crack Detection Scheme (RRCDS) Using LEDLDR Assembly," IEEE Int. Conf. on Networking, Sensing and Control, vol. 6, iss. 3, pg. 453-460 , May2012
[5]. Qiao Jian-hua; Li Lin-sheng; Zhang Jing-gang; "Design of Rail Surface Crack- detecting System Based on Linear CCD Sensor," IEEE Int. Conf. on Networking, Sensing and Control, vol. 14, no. 4, pp. 961-970, April 2008
[6]. K. Vijayakumar, S.R. Wylie, J. D. Cullen, C.C. Wright, A.I. Shammaa, " Non invasive rail track detection system using Microwave sensor,"Journal of App. Phy., vol. 9, iss. 11, pg. 1743-1749, June 2009
[7]. Richard J. Greene, John R. Yates and Eann A. Patterson, "Crack detection in rail using infrared methods," Opt. Eng. 46, 051013, May 2007