International Journal of Scientific & Engineering Research, Volume 6, Issue 10,
ISSN 2229-5518

ADVANCED CRACK DETECTION SYSTEM FOR INDIAN RAILWAY SYSTEM

ATHUL B NAIR, FATHIMA S
ARUN KRISHNAN, ANJU SANKAR
ARUN R

PRAVEENA KRISHNA L
ASST:PROF
EEE DEPT,UKF CET

Abstract— A crucial problem faced by the Indian railway is the formation of crack in the railway track. The existing system for crack detection in India is the Composite detection system which is not efficient. The disadvantage of the existing system is that there is noise in the input image and output is not accurate. This paper attempts to provide a viable solution to this problem by discussing the technical details and design aspect. We are introducing a very new system for crack detection which consist of voltage sensors and LDR sensors.

Index Term- voltage sensor, LDR sensor, LM 35, RF transmitter, RF receiver, pic micro controller, alarmbuffer

1 INTRODUCTION

Indian Railways is an Indian state-owned enterprise, owned and operated by the Government of India through the Ministry of Railways. It is one of the world's largest railway networks comprising 115,000 km (71,000 mi) of track over a route of 65,808 km (40,891 mi) and 7,112 stations.[3] In 2014-15, IR carried 8.397 billion passengers annually or more than 23 million passengers a day (roughly half of whom were suburban passengers) and 1058.81 million tons of freight in the year. Relevant to the international standards, the facilities are inadequate. Because of derailment problem often resulting in damage to human lives and property. The survey in 2011 until the month of July comments that the frequency of accidents is going and in that year itself 11 accidents occurred. To explain the crux of the problem, the accidents in railways are due to 60% derailments and 90% crack problems. Irrespective of natural or anti social reasons.

Hence, this problem of cracks on railways became a crucial problem. Which has to be dealt with paramount importance and attention, as the frequency of usage of Indian railways is high. This problem of cracks which is in major proportion, contributes for major train accidents will go unnoticed. Because of irregularity in manual track line monitoring and maintenance. So, to avoid this drastic condition of Indian railway networks from stopping down still more, an automated system which do not rely upon the manual labour is brought into light.

This paper proposes a cheap, novel yet simple scheme with sufficient ruggedness suitable to the Indian scenario that uses an voltage sensor arrangement to detect the crack in railway lines, which proves to be cost effective as compared to the existing methods.

In addition to the crack detection system, this paper also flashes light to obstacle detection in the railway track and the system that detect any temperature rise in the track that can cause serious track bending resulting in railway accidents.

2. DESIGN ISSUES INHERENT TO INDIAN SCENARIO

Typically, the Indian railways have small gaps in them for thermal expansion in summer. The designing of the tracks is in such a way that there will not be any twists or cracks due to heat. When the techniques developed before the proposed technique came into light, it was found that the existing technique took wrong signals by counting the thermal gaps as cracks. There will be another problem regarding the presence of railway bifurcations. If the physical or mechanical design of the robot is unsuitable, then it will be strucked in the bifurcations or it may fall out of the tracks. The effects of dirt on the track would also contributes to the scenario making the circumstances more complex.

When the existing technique of crack detection was implemented, it was found that the system was giving false positive signals; that is, it was counting the thermal gaps as cracks.

3. EXISTING SYSTEM

COMPOSITE DETECTION SYSTEM

The composite detection system consists of a laser source, whose beam is collimated by a suited optic lens into a light plane, two 512X512 -pixel CCD cameras for complete optimum observation of the track, a digital processing system per camera, and a supervision system.

• *Athul B Nair , Fathima, Arun krishnan , Anju Sankar, Arun R- Bachelor of technology, Electrical and Eletronics engineering, Kerala University, 9496497895*
• *Email ID : anjukingini95@gmail.com*

Praveena Krishna, Asst Professor of UKFCET ,Eletrical and Elotronics Engineering, 9746552646, Email.ID: preveena.lalithambika@gmail.com

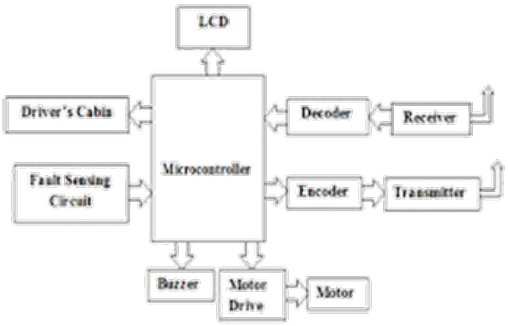
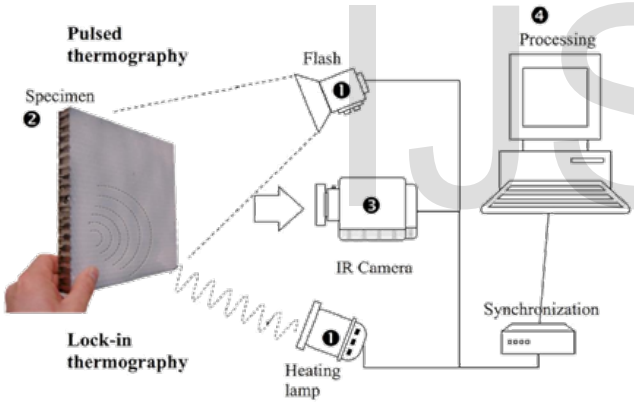


Fig3- Block Diagram of Existing System

The laser beam focused by the cylindrical lens as a thin plane enlightens the upper part of the railway track orthogonally to the track surface. The intersection of the plane is therefore the track profile (in the laser beam plane it is a two-dimensional line) which is observed by the CCD cameras. Each digital processing system performs real-time profile filtering and extraction (in the CCD camera geometrical coordinates) by using a composite approach from images of the corresponding CCD camera.



Fig; 1 Components arrangement and pictorial representation of existing system.(composite detection system)

4. PROPOSED SYSTEM

In this system, three sensors; LDR sensor, temperature sensor and voltage sensor are used.

In proposed system, our project detects the rail road crack, temperature of the track, and also measure the pursuing human in the railway track. In our project, we replace IR sensors by voltage sensor for crack detection. Because in IR sensors, the IR transmitter and receiver should be placed in straight line to eachother, this configuration is unsuitable in bifurcations. The voltage sensors detect the crack in the track and also LDR sensors are used to detect human being pursuing in the track. The temperature sensor detect the overheating of the track due to sun light and continues train movement.

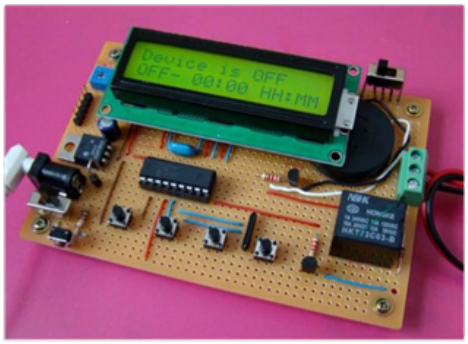
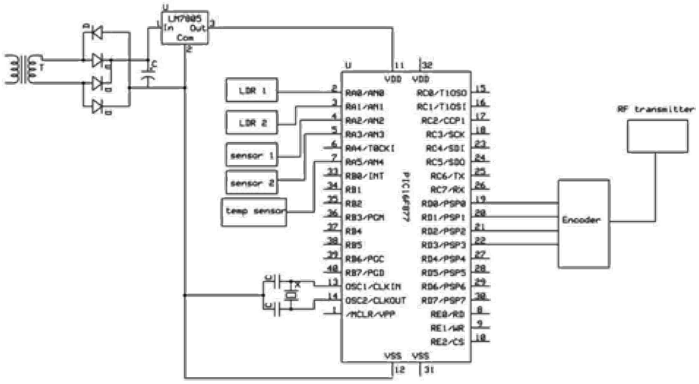


Fig 4-PCB Board connections of Proposed system

If any crack occurred in the track, this is messaged to the nearest station and overhead line supply is automatically cut off. The importance of this project is applicable both day and night in the rural areas where regular manual checking is not possible.

In order to detect the current location of the device in case of detection of a crack or any other faults, this problem is easy to solve by using of a gsm and gps module. The GPS system is not specified in this paper but usage of GPS system we can easy to calculate exact location. A GPS receiver whose function is to receive the current latitude and longitude data is used. To communicate the received information, a PC has been utilized. The function of the PC being used is to upload the current latitude and longitude data to the relevant authority.



Fig; 2 Block diagrame and sensor connections of proposed system

5. DESIGN

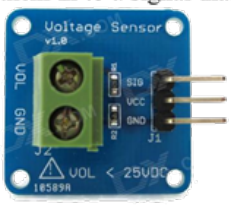
The three main components used in the system is Voltage sensor, LDR sensor, temperature sensor. Voltage sensor is used to detect the crack in the railway track. LDR transmitter emits infrared rays similarly LDR receiver is used to receive the rays transmitted by

the transmitter. If there is any crack or any human/animals pursuing in the track, the signal is send to the nearest substation and then the power line supply is automatically cut off by the help of relay.

5.1 REQUIRED COMPONENTS

Voltage sensor

Voltage sensor is going to be able to determine and even monitor and measure the voltage supply. It is then able to take those measurements and turn them in to a signal that one will then be able to read



LDR sensor

LDR sensor is the light dependent resistor. It is a device whose resistivity is a function of the incident electromagnetic radiation. They are also called photo conductors. They are made up of semiconductor materials having high resistance. The resistance is decreased when light falls on them and that is increased in the dark. Thus the sensitivity of the LDR varies with the wavelength of light incident on them.

Temperature sensor

The LM35 is an integrated circuite sensor that can be used to measure temperature with an electrical output propotional to the temperature. The LM35 series are precision integrated circuite temperature devices with an output voltage linearly propotional to the centigrade tempeds. The LM35 device has an advantage over linear temp sensors caliberated in kelvin, as the user is not required to subtract alarge constant voltage from the output to obtain convenient centigrade scaling.

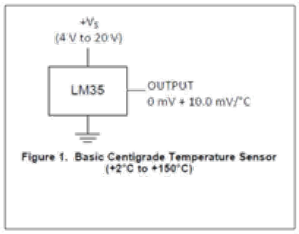


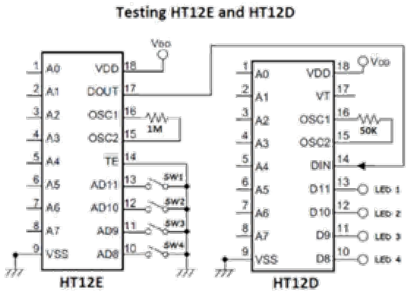
Figure 1. Basic Centigrade Temperature Sensor (+2°C to +150°C)

Micro controller(pic16f877)

It is one of the most popular pic microcontroller- and it has 40 pin dip pinout and it has many internal peripherals. It can do many tasks because it has a large enough programming memory 8k words and 368 bytes of ram. One of the main advantages is that each pin is only shared between two or three functions, so its easier to decide what the pin function.

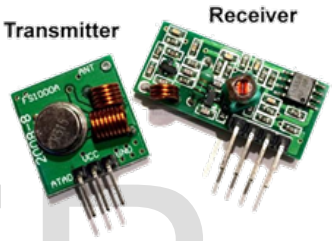
Encoder & decoder

The purpose of encoder is standardization, speed, secrecy, security, or saving space by shrinking size. Eencorders are combinational logic circuitsand they are exactlyopposite of decoders. They accepts one or more inputs and gererate a multibit output code. Encoders perform exactly reverse operation than decoders. Ie, encorder converts analoge to digitaland decder convert digital into analoge signal.



RF transmitter and receiver

The RF module operates at radio frequency. The transmitter/receiver pair operates at a frequency of 434mhz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin 4. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The RF module often used along with a pair of encder and decoder.



5.2 ALGORITHM OF PROPOSED SYSTEM

a. TRANSMITTER SECTION

Step 1. Start
Step 2. If signal from laser receiver
goto step 6
else
goto step 3
Step 3. If signal from Track Break dictator
goto step 7
else
step 4
Step 4. Read temperature sensor if temperature > normal level
goto step 8
Else
Goto step 5
Step 5. Send normal signal through RF transmitter
Step 6. Send obstacle of track signal through RF transmitter
Step 7. Send track break signal through RF transmitter
Step 8. Send over heat signal through RF transmitter
Step 9. Goto step 2

b. RECEIVER SECTION

Step 1. Start
Step 2. Read RF receiver
Step 3. If obstacle on track signal lcd display obstacle on track
relay OFF
goto step 2
else
goto step 4

Step 4.if track break signal lcd out track break
relay OFF
goto step 2
else
goto step 5
Step 5. If overheat signal lcd out overheat
relay OFF
goto step 2
else
goto step 6
Setp 6. lcd out normal track
relay ON
goto step 2

5.3 PROGRAM

Receiver

```
char *text = "Over Heat  ";
char *text1 = "Obstacle  ";
char *text2 = "Break     ";
char *text3 = "Normal    ";
char *text4 = "Track Status";
void main() {
 TRISB = 0;
 TRISD=0XFF;
 TRISC=0;
 portc=0x00;
 Lcd_Init(&PORTB);
 Lcd_Cmd(Lcd_CLEAR);
 Lcd_Cmd(Lcd_CURSOR_OFF);
  Lcd_Out(1, 1, text4);
 Delay_ms(1000);
 l:
 if(portd.f0==1)
 {
 Lcd_Out(2, 2, text);
  portc=0xff;
 Delay_ms(1000);
goto l;
 }
 if(portd.f1==1)
 {
 Lcd_Out(2, 2, text1);
  portc=0xff;
 Delay_ms(1000);
   goto l;
 }
  else if(portd.f2==1)
 {
 Lcd_Out(2, 2, text2);
 portc=0xff;
 Delay_ms(1000);
  goto l;
 }
 {
 Lcd_Out(2, 2, text3);
  portc=0x00;
 Delay_ms(1000);
 }
 goto l;
}//
```

Transmitter

```
unsigned int tem,tem1,tem2,tem3,tem4,kk;
void main() {
  TRISA  = 0xFF;
 TRISB  = 0x00;
 TRISD  = 0xff;
 portb=0x00;
 do {
 l:
   tem = Adc_Read(0);
   tem1 = Adc_Read(1);
   tem2 = Adc_Read(2);
   tem3 = Adc_Read(3);
   tem4 = 75;
   if(tem>tem4|| tem1>tem4 || tem2>tem4 || tem3>tem4)
   {
  portb.f7=1;
   portb.f6=0;
  portb.f5=0;
 portb.f4=0;
   Delay_ms(9000);
    goto l;
   }
   if(portd.f0==1 || portd.f1==1)
   {
 portb.f7=0;
  portb.f6=1;
  portb.f5=0;
  portb.f4=0;
 Delay_ms(1000);
  goto l;
   }
    if(portd.f2==0 || portd.f3==0)
   {
portb.f7=0;
  portb.f6=0;
  portb.f5=1;
  portb.f4=0;
 Delay_ms(1000);
  goto l;
   }
   {
portb.f7=0;
   portb.f6=0;
 portb.f5=0;
  portb.f4=1;
   Delay_ms(1000);
   }
     Delay_ms(100);
  } while(1);
  }
```

International Journal of Scientific & Engineering Research Volume 6, Issue 10, October-2015
ISSN 2229-5518

6. RESULT AND DISCUSSION

The voltage sensor sense the crack and LDR sensor detect the presence of humen being/animals in the track. Also temperature sensor detects the overheating of the track. These informations are send to the microcontroller ; where it responds give the command to the purticular components with predefined algorithm, the time parameters can be changed by modifying the programs. The signal from the receiver section is send to the RF transmitter in the transmitting section.

7. CONCLUSION

This paper makes an attempt in providing a viable solution for many problems associated with indian railway including crack in the track by the use of various sensors. Hence it is expected that, major train accidents can be prevented and humen life saved if this system implemented on a large scale

References

[1] Qiao Jian-hua, Li Lin-sheng and Zhang Jinggang, "Design of Rail Surface Crack-detecting System Based on Linear CCD Sensor", IEEE Int. Conf. on Networking, Sensing and Control, 2008.

[2] K. Vijayakumar, S.R. Wylie, J. D. Cullen, C.C.Wright, and A.I.AIShamma'a, "Non invasive rail track detection system usingMicrowave sensor", Journal of App. Phy., 2009.

[3] M. Cacciola, G. Megali, D. Pellicanμo, S. Calcagno, M. Versaci, an F. C. Morabito, "Rotating Electromagnetic Field for Crack Detection in Railway Tracks", PIERS ONLINE , Vol. 6, NO. 3, 2010.

[4] Wojnarowski, Robert John Welles, Kenneth Brakeley Kornrumpf, andWilliam Paul, "Electromagnetic system for railroad track crack detection and traction enhancement".

[5] Richard J. Greene, John R. Yates and Eann A. Patterson, "Crack detection in rail using infrared methods", Opt. Eng. 46, 051013, May 2007.

[6] Hartman, G.A., "Infrared Damage Detection System (IDDS) for real time, small-scale damage monitoring, Charlotte, North Carolina (2003).

[7] A. L. Polivka and W. L. Matheson, "Automatic train control systemand method", U.S. Patent No. 5828979, (2014) October 27.

[8] A. L. A. T. D. Ambegoda, W. T. S. D. Silva, K. T. Hemachandra, T. N.Samarasinghe and A. T. L. K. Samarasinghe, "Centralized traffic controllingsystem for SriLanka railways", 4th International Conference on Informationand Automation for Sustainability (ICIAFS08), Sri lanka, (2013) December 12-14.

[9]"Automatic railway track switching sytem"International Journal of Advanced Technology, vol. 54, (2014).

[10] F. R. L. Boyles- tad and L. Nashelsky, "railway crack detection using gpa technology", 9th edition, Prentice Hall, USA, (2012), pp. 196-199.