Journal Of Harmonized Research (JOHR)

Journal Of Harmonized Research in Engineering
2(1), 2014, 194-200

ISSN 2347 – 7393

Original Research Article

RAILWAY TRACK SCANNING AND SURVEILLANCE ROBOT USING WIRELESS TECHNOLOGY

Siddharth S.G.[1], Ramkumar M[2], Kiruthika S[2]

[1]PG Scholar Department of ECE, Bannari Amman Institute of Technology, Sathyamangalam, India

[2]Associate Professor, Department of ECE, Bannari Amman Institute of Technology, Sathyamangalam, India

Abstract
The mishap of trains is the major problem in our country, occurs quite often which puts the mass of human life in danger. The cause for these accidents mainly involves with the rail tracks as they undergo different climatic conditions by which the status of rail track become worse by the formation of cracks and also due to obstacles placed in the rail track, intentionally. The main part of the work was to carry out a feasibility study on two methods for detection of cracks in the tracks and obstacles in the track. The detection of cracks can be identified using gap detector. We have proposed to use microcontroller in this project to control the circuit. For controlling the setup, the signal is generated by the encoder using the computer. The generated signal is modulated and transmitted through the transmitter. This signal received by the receiver is demodulated and through the decoder the original signal from the computer is extracted. This signal is given to the microcontroller, which is a programmable IC, where we can program it to control the motors for guided stopping of trains according to the signals transmitted. This setup is accomplished in a robot. Thus we can monitor the situation and can control the robot for rescuing the people from the disaster to save the rescuing people life. The setup includes a surveillance camera for the detection of obstacles placed the rail tracks.

Problem Description

Nowadays frequent accidents are taking place in all three transportation modes namely roadways, waterways and airways. The roadways are being extensively used out but railways are most often preferred, as it is of low cost and good comfort.

In railways accidents are mainly due to obstacles in the path of the train (i.e) on the rails, placement of fish plates at the rail joints and due making gaps or cracks in the rails. At times even head on collisions may occur due to problem in the signals or negligent act of

For Correspondence:
siddharth.bannari@gmail.com
Received on: February 2014
Accepted after revision: February 2014
Downloaded from: www.johronline.com

www.johronline.com   **194** | P a g e

drivers. Today, rail networks across the world are getting busier with trains travelling at higher speeds and carrying more passengers and heavier axle loads when compared to earlier scenarios. The combination of the above mentioned factors has put considerable pressure on the existing infrastructure, in turn leading to increased demands in maintenance & inspection of the rails. The expense for inspection and maintenance has grown steadily over the last few decades,but nothing has improvement in the industry's safety records. As a direct impact, the key challenges faced by the railway department are: the improvement in the safety of the railway transport system, the development of new railways to accommodate the continued growth in demand, and contributing to a more sustainable railway, in terms of both environmental & economical terms, by delivering further efficiencies and exploiting technological innovation. High

accident free standards required in the management of rails demand the inspection of railway wheels directly after production so as to detect the presence of cracks at the surface that could seriously affect the integrity of the railway, and therefore safety of the travelers.

Software Details Introduction

MPLAB ICD 2 is a low cost, real-time debugger and programmer for selected PIC® MCUs and dsPIC® DSCs, Using the Microchip Technology's proprietary In-Circuit Debugging functions, our programs can be downloaded and executed in direct setups(Real time), then examined in detail with the debug functions of the MPLAB. The secret behind In Circuit Debugging is two dedicated hardware lines (microcontroller pins used only during debugging mode) that control the In Circuit Serial Programming™ (ICSP™) of the device and, after debugging through proprietary, dumped to on-chip firmware.
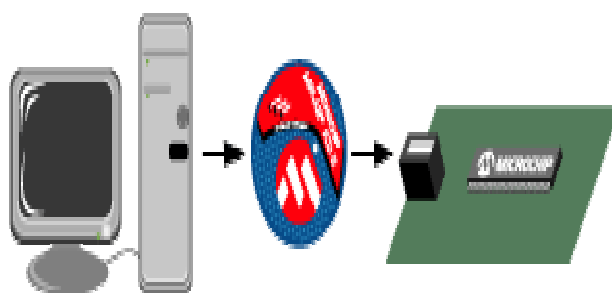

Fig.MPLAB-IDE

The ICD 2 debug features are built into the microcontroller and activated by programming the debug code into the target processor. There is one stack level addition which is a shared overhead expense that includes, some general purpose file registers and a small area of program memory when in the debug mode.USB (Full Speed 2 M bits/s) & RS-232 interface to host PC

FEATURES
- Real time background debugging
- MPLAB IDE GUI (free copy included)
- Firmware upgradeable from PC

- Totally enclosed
- Supports low voltage to 2 volts.
- Diagnostic LEDs (Power, Busy, Error)
- Read/Write memory area and EEDATA areas of target microcontroller
- Programs configuration bits
- Easy to handle program memory space without conflicts
- The peripheral freeze-on-halt stops the timer at breakpoints

The MPLAB ICD 2 connects using USB or RS-232 between the design PC operating with MPLAB IDE and their target being
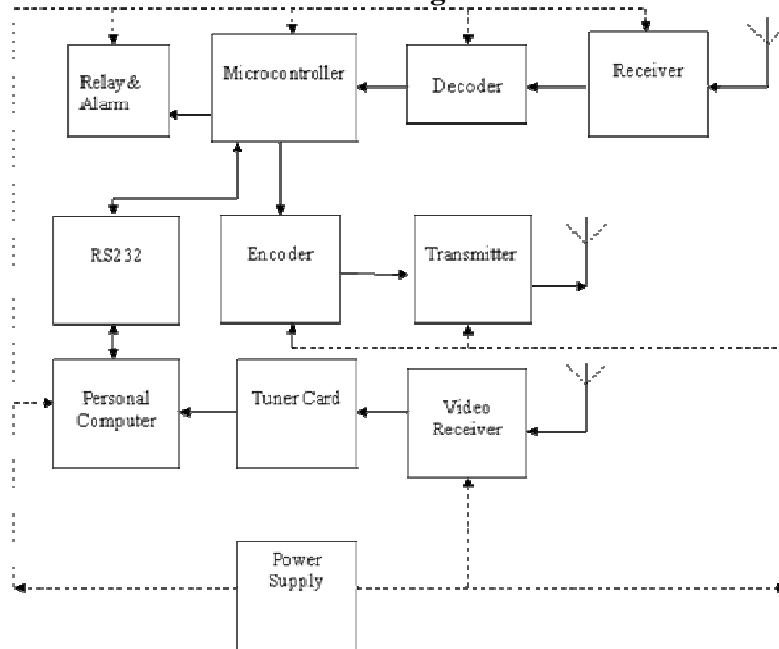
developed. It acts as an intelligent interface in

between them.

Simulation results Front panel
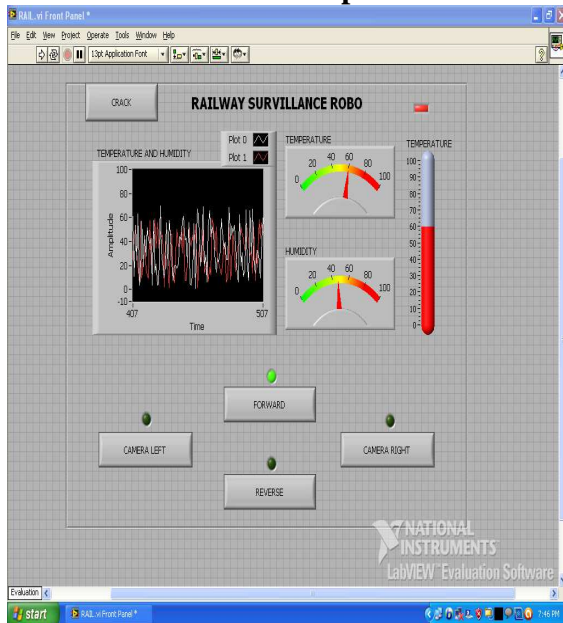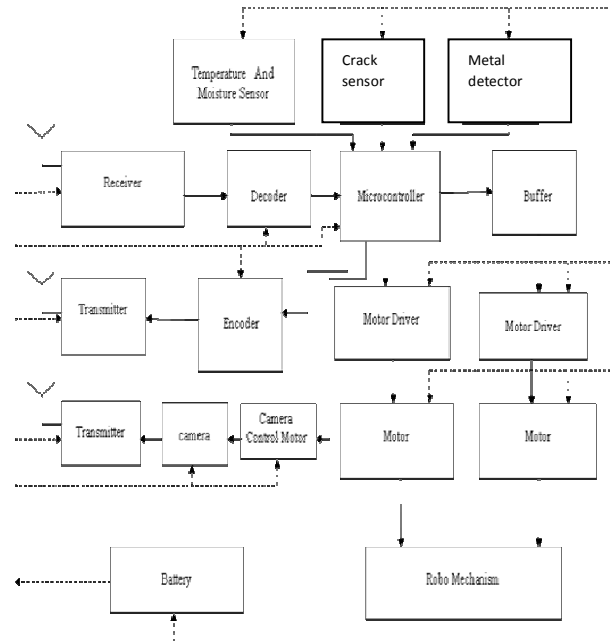
Block Diagram

Proposed Setup

At present, the crack is detected by the field men manually in before the departure of

the train. Due to this manual inspection, sometimes some potential defects may not be found out by oversight which may lead to the

misfortune. If these deficiencies are not controlled, they may cause huge economical problems affecting the network, handling of accidents becomes a serious one

Many accidents that occur in the railways is due to the cracks in the tracks. In our paper "Railway Track Scanning and Surveillance Robot Using Wireless Technology" we have designed a device in such a way that all the above reasons for accidents is taken into consideration and a precautionary action will be taken. This is done by using a robot which is synchronized to the speed of the train ,the robot will be running 2kms ahead of the train collecting the information of the rails and the prevailing conditions ,there is a communication path established between the robot and the train, the details are being displaced on the LCD screen. An alarm is being added to alert the driver if the measured value goes beyond the given range.

A camera setup is made so as to get a live view of what is happening at the remote end. It is also used to visualize the objects placed on the path of the train to derail it and also to capture if any lively creature is on the path. The communication between the robot and the train is done by using signee technology where in there is no mismatch of signals between trains that pass each other. In addition to the display and the alarm device an arm setup which is made to automatically stop the train if the driver is not in a condition or not aware of what is happening.

At present, the crack is detected by the field men manually in before the departure of the train. Due to this manual inspection, sometimes some potential defects may not be found out by oversight which may lead to the misfortune. If these deficiencies are not controlled, they may cause huge economical problems affecting the network, handling of accidents becomes a serious one

Hardware Description
Robot section:

The complete block diagram as described below. The robot section scans the railway track and detecting the cracks, increase in temperature and moisture and also detect any metal parts in the track. The transmitter sends these signals information to the receiver and in the control and monitoring section the receiver receives these information and sends these information to the controller, the controller takes necessary action to stop the train.

1.Crack sensor:

Crack sensor is used to detect the cracks in the railway track. Here we uses IR based crack sensor .the sensor is fitted on the both sides of the railway track the IR transmitter sends the IR rays if the receiver receives the crack is present the track otherwise there is no crack in the track.

2. Temperature and moisture sensor:

The temperature and moisture sensor is use to sense the increase in the temperature and moisture in the railway track and send these information to analog to digital controller .increase in the temperature may produce the crack in the track.

3.Metal detector:

Metal detector is used to sense any metal particles present in the railway track. the presence of any metal particles in the railway track may cause the train to move away from the track. And the information obtained is given to the microcontroller.

4. Microcontroller:

Microcontroller is used to control all the parameters measured and sends the information to the transmitter .and the moving mechanism of the robo is also controlled by the microcontroller. The Micro Controller we have chosen for this project is PIC16F877A, since it has more advantages than any other controller.

- It has in built ADC, DAC, TIMER, COUNTER etc.
- It is of RISC type (reduced instruction sets) , there are only 35 instructions.
- The compiler used for it is C++.

- And the simulator software used is MP LAB IDE.
- The IC DOWNLOADING software is IC PROG.

5. Buffer:

A voltage buffer amplifier is used to transfer a voltage from a first circuit, having a high output impedance level, to a second circuit with that of a low i/p impedance level. The buffer amplifier at the intermediate prevents the second circuit from loading the first circuit suddenly and interfering with its desired operation. In the ideal voltage buffer shown below, the input resistance is infinite, the output resistance zero (impedance of an ideal voltage source is zero).

6. Motor driver:

The voltage from the buffer is not able to drive the motor of the robot moving mechanism. Motor driver is an amplifier that amplifies the signals to drive the motor.

The L293D is a quadruple half H-bridge bidirectional motor driver IC that can drive current of up to 600mA with voltage ranges from 4.5 to 36 volts. It is suitable to drive bipolar stepper motor & DC-Geared motors etc.

- Supply Voltage Range 4.5V to 36V
- 600-mA o/p current capability for each driver
- Separate Input-logic supply
- It can drive small DC-geared motors, bipolar stepper motor.
- Pulsed Current 1.2-A Per Driver
- Internal ESD Protection
- High-Noise-Immunity Inputs

7. Robo mechanism:

Robot mechanism is used to move the robot forward and reverse direction by the control action provided by the control and monitoring section.

8. Camera control motor:

Camera control motor is used to change the position of the camera to focus all the parts of railway track.

9. Camera:

Camera is used to scan the railway track entirely all direction and it gives the data to transmitter. The transmitter transmit the data to the receiver so we can identify any suicide attempts and serves the human life.

10. Encoder:

We cannot transmit the signal from the microcontroller directly .The transmitter transmits only coded signals. An encoder is a device or a circuit or a transducer or software program and even algorithms or persons that converts information from one form to another, for the purpose of standardization, , security, or saving space speed, secrecy by size shrinking.

11. Transmitter:

The transmitter is used to transmit the data from the microcontroller to the receiver section. Transmitter or radio transmitter is an electronic device which, with the help of an antenna, generates radio waves. The transmitter by itself generates a radio frequency alternating current, which is applied to the antenna. Which on excitation by the alternating current, radiates radio waves in the antennae.

12. Receiver:

Receiver is used to receive the signals from transmitter that are transmitted by the control and monitoring section these signals are used to drive the robot mechanism. And the signal from the transmitter is given to decoder.

13. Decoder:

Microcontroller does not accept the signal from the receiver because the receiver contains coded signals so we want to convert the coded signal into original signal for this purpose decoder is used. A decoder is a device which does the reverse of an encoder; it is that opposite of encoding, so the original information can be retrieved. The method used is similar to that of encoding which is usually just reversed in order to decode.

In digital electronics, a decoder can take the form of a multiple-input, multiple-output logic circuit that converts coded inputs into coded outputs.

14. Battery:

A battery is a device that converts chemical energy directly to electrical energy. Acts as a power source for all the components present in the robot section.

Control and monitoring section:

The complete block diagram (fig.1)as discussed below.

1. Receiver:

The signals from the transmitter in the robot section is received by the receiver .the receiver receives the information and sends it to decoder.

2. Microcontroller:

Microcontroller is used to control all the parameters measured and sends the information to the transmitter. If any crack or temperature rise or any metals present in the track the controller takes necessary action to stop the train.

3. Stepper motor & Alarm:

The stepper motor is used to stop the train by pulling the emergency break and the alarm is used to indicate there is a problem in the path of the train.

4. Transmitter:

The transmitter is used to transmit the data from the microcontroller to the receiver section. Transmitter or radio transmitter is an electronic device which, with the help of an antenna, generates radio waves. The transmitter by itself generates a radio frequency A.C, which is applied to the antenna. On excitation by the A.C, the antenna produces radio waves.

5.Video receiver:

Video receiver is a device which is used to receive the video signals captured by the camera in the robot section.

- Wireless Audio + Video Receiver
- FM design
- Video Input: 1 Up-p / 75 Ohms
- Audio Input: 2 Vp-p Max
- Includes Antenna
- Easy to use with all types of cameras.

6.Tuner card:

A TV tuner card is a computer component that allows television signals to be received by a computer. It is a kind of television tuner; most of the TV tuners also function as cards, record television programs into a hard disk.

7. RS -232 :

In telecommunications, RS-232 (Recommended Standard 232) is the traditional name for a series of standards for serial binary single-ended data and control signals connecting between a *DTE* (Data Terminal Equipment) and a *DCE* (Data Circuit-terminating Equipment),commonly used in computer's serial ports.

Conclusion & Future Work

A fully automated setup for detection of cracks ,temperature & humidity is done, so that the passengers can avail a safety travel .Since we have automated the setup which was done manually so far, the time consumption made to detect the various parameters has reduced to a good extent . The future work could be the exact prototype development for the same. Gates could be automated so the human intervention at the gates may be even avoided.

References

1. Ramesh Shunmugam and Ramesh,K.(2011) 'Modeling and detecting damage in rails and avoidance of collision in the tracks', International Journal of Scientific and Engineering Research, Vol.2, No.2,pp.1-16.
2. Cacciola,M., Megali,G., Pellicano,D., Calcagno,S., Versaci,M and Morabito,F,C.(2010) 'Rotating electromagnetic field for crack detection in railway tracks', in Proc.of The Plan Index, Enquiry and Retrieval System, Italy,Vol.6, No.3, pp.242-246.
3. Roach,D.(2009) ' Real time crack detection using mountable comparative vacuum monitoring sensors',in Proc.of conference on Smart Structures and Systems, U.S.A., Vol.5, No.4, pp. 317-328 .
4. Cesare Alippi., Ettore Casagrande., Fabio Scotti and Vincenzo Piuri.(2000) 'Composite real-time image processing for railways track profile measurement', in

Proc.of IEEE conference on Transactions on Instrumentation and Measurement, Italy,Vol.49,No.3, pp.559-564.

5. Simon Ghionea and Pallavi Dhagat.(2008) 'Ferromagnetic resonance detection for magnetic microbead sensors', in Proc.of IEEE conference on sensors, Vol.8, No.6,pp.896-902.

6. Jongwoo Jun., Jungmin Kim.,Jinyi Lee and Youngmin Park. (2011) 'A Hand held magnetic camera system for real time crack inspection',in Proc.of IEEE conference on sensors,Republic of Korea.,Vol.3,No.6,pp.298-301.

7. Jeus Garcia,J., Jesús Urena., Alvaro Hernande., Manuel Mazo., Jose Antonio Jimenez., Fernando J. Alvarez., Carlos De Marziani. , Ana Jimenez.,Jesus Diaz,M., Cristina Losada and Enrique Garcia.(2010) 'Efficient multisensory barrier for obstacle detection on railways', in proc.of IEEE conference on Transactions on Intelligent Transportation Systems, Vol.11, No.3, Spain.,pp.702-713.

8. Gow Moh Kee.(2008) 'Design and development PIC based autonomious robot', in proc.of IEEE conference on Robotics,Automation and Mechatronics, Malaysia.,Vol.10,No.2,pp.1-5.

9. Chuliang Wei., Chuncheung Lai., Shun-yee Liu., Chung,W,H., Ho,T,K., Hwayaw Tam., Ho,S,L. and McCusker,A., Kam,J and Lee,K,Y.(2010) 'A Fiber bragg grating sensor system for train axle counting', Journal of sensors, Vol.10, No.12,pp.1908-1912.

10. Dastjerdi,M., Rubesam,M., Ruter,D., Himmel,J and Kanoun,O.(2011) 'Non destructive testing for cracks in perforated sheet metals',in Proc.of 8th International Multi-Conference on Systems, Signals & Devices, Vol.8,No.14, Germany.,pp.1-5.

11. Zhu,Y,W., Zhong,X,X and Shi,J,F.(2006) 'The design of wireless sensor network system based on zigbee technology for greenhouse', Journal of Physics Conference Series,Vol.48,No.15,pp.1195-1199.

12. Pratheepa,S and Purushothaman Srinivasan.(2011) 'Surveillance robot for tracking multiple moving targets' in an International Journal on Scientific & Engineering Research,Vol.2, No.3,pp.1-4.

13. Suresh Kumar,N., Hari Kumar,S., Senthil Nathan,M and Shanmugam,S.(2011) 'A survey on near field communication in accordance with Bluetooth and Zigbee technologies', in International Journal of Advanced Computing,Vol.3,No.2,pp.54-58