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Smart Railway Track Monitoring and Clean System Using Robot

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Abstract: **The major problem faced by Indian railways is that the tracks are old and outdated. These old tracks cause many serious railway accidents. This has also resulted in speed restrictions. Accidents occur due to the errors and negligence of the employees. The railways are attacked during the time of disturbances and violence that arise in any part of the country. This project aims at providing a solution to all the above mentioned problems. Here, we are monitoring the track to get various data like cracks in the track. A device which contains a microcontroller detects the crack by using the light sensing module. The crack once detected, the location is detected and sent to the nearby station authority. Then all these information are sent to the station. From the station, an alert is made according to this information.**

Keywords: Railways, monitoring, microcontroller, robots.

I. INTRODUCTION

The train control system will automatically adjust its speed to the speed indicated by the server. The railway server is a software application that will be running on a secured PC environment and will not be implemented in our project as it is out of the scope of an embedded system. In unmanned railway crossings, truck/car/humans/animals may cross a railway line. The train control system oversees this and can adapt to slow down the speed accordingly.

This overrides the speed setting from the server. The on-board disaster prevention network connects all the compartments of the train with the main control node over CAN bus (Controller Area Network). CAN is a networking protocol widely used in automotive applications to interconnect different parts of the vehicle. It is also being used in industrial automation networks. Each CAN node has got a variety of sensors and devices to ensure the safety and comfort of the passengers. Metal detector sensor detects explosives by sensing the variations in the magnetic field around it. A Digital MEMS Magnetometer is used for this. Thermal sensor detects fire outbreak by sensing large temperature variation in its proximity. An analog output Temperature Sensor helps to find this out.

II. EXISTING SYSTEM

All the monitoring works are done manually so there are possibilities for wrong understanding and hence leading to devastating effects. Manual announcement are followed nowadays intranet phone communication established to check the train current position. Electrical power utilization is not proper manner; all the fan and lights are manually and made it power wastages.

A. LITERATURE SURVEY

TABLE 2.1
PROPOSED SYSTEM

S.NO	AUTHOR	TITLE	COMMENTS
1	SomalrajuS.; Murali V.; Saha G.; Vaidehi V.	Robust railway crack detection scheme (RRCDS) using LED-LDR assembly	This paper proposes a cost effective yet robust solution to the problem of railway crack detection utilizing a method that is unique in the sense that while it is simple, the idea is completely novel and hitherto untested
2	Wu Xun; Li Jie; Zhang Zhichao; Yi Xianshui	Finite Element Analysis of Cracks on Railway Bridge Pier Based on ANSYS	. The result of simulated calculation proves that the cracks on the main pier of railway bridge are induced by indirect effects, such as the temperature stress and shrinkage stress
3	NichogaV.; Storozh I.; Vashchyshyn L.	Application of a magnetic field model above the defect for detection of transverse cracks in the magnetic flaw control of the railway	Method of signal analysis for magnetic flaw control of the railway is presented.
4	ImdadF.; Niaz M.T.; Hyung Seok Kim	Railway track structural health monitoring system", Advanced Information Networking and Applications Workshops	The use of wireless sensor networks (WSNs) for structural health monitoring is gaining popularity since it allows for a low-cost, rapid and robust assessment of structural integrity. paving the way towards alleviating energy constraints that continue to challenge WSNs.

In the track circuit, crack in track is monitored. The information is then transmitted to the station through a GSM module using a microcontroller. The device contain an IR Sensor which is used as object detecting sensor which detects the crack by sensing light intensity detected by photodiode and stop the robot moving . The robot also contain an brush in front which help to sweep the waste and at station end waste can be get collected.

B. BLOCK DIAGRAM

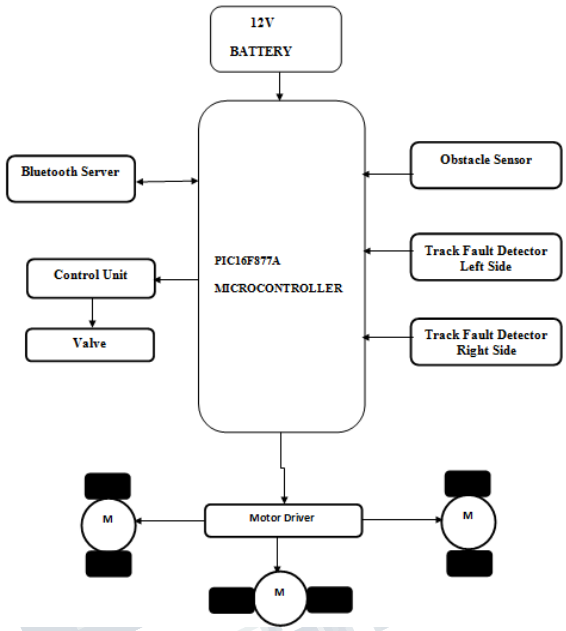

FIG 2.1

III. HARDWARE DESCRIPTION

A. PIC16F877A

It is High performance RISC CPU machine. ONLY have 35 simple word instructions. Operating speed: clock input (200MHz), instruction cycle (200nS).Up to 368×8bit of RAM (data memory), 256×8 of EEPROM (data memory), 8k×14 of flash memory. Wide operating voltage range (2.0 – 5.56) volts.2 8 bit timer and one 16 bit timer is available10bit multi-channel A/D converter Synchronous Serial Port (SSP) with SPI (master code) and I2C (master/slave).

100000 times erase/write cycle enhanced memory.1000000 times erase/write cycle data EEPROM memory.

B. POWER SUPPLY CIRCUIT

The hardware of project requires different power supplies. 5 v. the interfacing devices will get the supply from main microcontroller

C. LCD

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line

and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

D. UART-MAX232

MAX232 is used to convert TTL into RS232 logic level converter used between the microcontroller and the GSM board or PC .Our controller is operated at 5v but interfacing devices are worked with 12 v .so this IC will convert the level of 5v to 12 v for transmitting . while receiving convert 12v into 5v to the microcontroller. It can be detected by checking for a high signal on a single I/O pin.

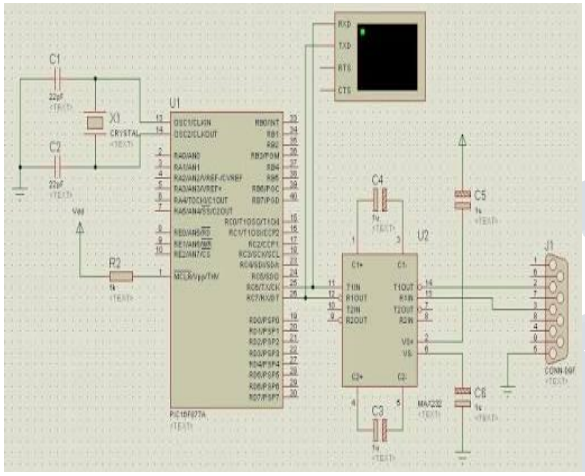

FIG 3.1

E. IR SENSOR

The IR sensor is a very simple device that works by reflecting infrared light off of an object and detecting the reflecting with a photo-transistor that is tuned to the same frequency of light. The LED is mounted next to the photo-transistor, however, the emitted light from the LED does not directly shine into the photo-transistor. Appropriate values for resistance are in series with both the LED to limit current and the photo-transistor in order to show a voltage drop based on distance to the object in front of the sensor.

FIG 3.2

IV. SOFTWARE REQUIREMENTS

A. MPLAB IDE

MPLAB Integrated Development Environment (IDE) is a free , integrated toolset for the development of embedded applications employing Microchip's PIC® and ds PIC® microcontrollers. MPLAB IDE runs as a 32-bit application on MS Windows®, is easy to use and includes a host of free software components for fast application development and super-charged debugging**.**

MPLAB IDE also serves as a single graphical user interface for additional Microchip and third party software and hardware development tools. Moving between tools is a snap, and upgrading from the free software simulator to hardware debug and programming tools is done in a flash because MPLAB IDE has the same user interface for all tools.

Some of the MPLAB IDE features include:

- Recordable macros
- Context sensitive color highlighting
- Drag and drop variables to watch windows
- Full featured debugger
- Third Party tools

B. HI-TECH C compiler

HI-TECH Software is a world class provider of development tools for embedded systems, offering compilers featuring Omniscient Code Generation™, whole-program compilation technology, and an Eclipse-based IDE (HI-TIDE™) for 8-, 16-, and 32-bit microcontroller and DSC chip architectures. NEW freeware compilers supporting Microchip PIC micro® devices. HI-TECH C® PRO compilers include Lite mode - a significant feature sure to impress the students and hobbyists. Lite mode is free download has NO memory or time restrictions and supports ALL devices. However, the OCG optimizations are disengaged.

- HI-TECH C Compiler for PIC10/12/16 MCUs (Lite mode)
- HI-TECH C Compiler for PIC18 MCUs (Lite mode)
- HI-TECH C Compiler for PIC32 MCUs (Lite mode)

HI-TECH Software has provided this freeware HI-TECH PICC-Lite compiler as a tool for hobbyists and students, but the license allows to use commercial purpose. It is ideal as a teaching tool for an introduction into the 'C'

language and embedded programming on a Microchip device. The selected processors were chosen for this compiler due to their popularity.

The HI-TECH PICC- Lite compiler is a freeware version of industrial-strength HI-TECH PICC™ STD compiler available for windows, linux or MAC OS. The HI-TECH PICC-Lite compiler is the same in every respect as the full HI-TECH PICC STD compiler, except that it has support for only a limited subset of processors, there are some limitations on the amount of memory that can be used and source code for the standard libraries is not provided. The supported processors and their limitations (if any). Due to program memory constraints, support for printing floating-point and long data types via printf family functions is not included.

C. Embedded C

Looking around, we find ourselves to be surrounded by various types of embedded systems. Be it a digital camera or a mobile phone or a washing machine, all of them has some kind of processor functioning inside it. Associated with each processor is the embedded software. If hardware forms the body of an embedded system, embedded processor acts as the brain, and embedded software forms its soul. It is the embedded software which primarily governs the functioning of embedded systems.

During infancy years of microprocessor based systems, programs were developed using assemblers and fused into the EPROMs. There used to be no mechanism to find what the program was doing. LEDs, switches, etc. were used to check correct execution of the program. Some 'very fortunate' developers had In-circuit Simulators (ICEs), but they were too costly and were not quite reliable as well.

As time progressed, use of microprocessor-specific assembly-only as the programming language reduced and embedded systems moved onto C as the embedded programming language of choice. C is the most widely used programming language for embedded processors/controllers. Assembly is also used but mainly to implement those portions of the code where very high timing accuracy, code size efficiency, etc. are prime requirements.

Initially C was developed by Kernighan and Ritchie to fit into the space of 8K and to write (portable) operating systems. Originally it was implemented on UNIX operating systems. As it was intended for operating systems development, it can manipulate memory addresses. Also, it allowed programmers to write very compact codes. This has given it the reputation as the language of choice for hackers too.

As assembly language programs are specific to a processor, assembly language didn't offer portability across systems. To overcome this disadvantage, several high level languages, including C, came up. Some other languages like PLM, Modula-2, Pascal, etc. also came but couldn't find wide acceptance. Amongst those, C got wide acceptance for not only embedded systems, but also for desktop applications. Even though C might have lost its sheen as mainstream language for general purpose applications, it still is having a strong-hold in embedded programming. Due to the wide acceptance of C in the embedded systems, various kinds of support tools like compilers & cross-compilers, ICE, etc. came up and all this facilitated development of embedded systems using C.Subsequent sections will discuss what is Embedded C, features of C language, similarities and difference between C and embedded C, and features of embedded C programming

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V. PROTEUS SOFTWARE

Proteus 8 is best simulation software for various designs with microcontroller. It is mainly popular because of availability of almost all microcontrollers in it. So it is a handy tool to test programs and embedded designs for electronics hobbyist. You can simulate your programming of microcontroller in Proteus 8 Simulation Software.
After simulating your circuit in Proteus 8 Software you can directly make PCB design with it so it could be a all in one package for students and hobbyists.

VI. CONCLUSION

Cracks in rails have been identified to be the main cause of derailments in the past. Hence, owing to the crucial solution of this problem, we have worked on implementing an efficient and cost effective solution suitable for this application. This system automatically detects the faulty rail track without any human intervention. There are many advantages with the proposed system when compared with the traditional detection techniques. The advantages include less cost, low power consumption and less analysis time. By this proposed system, the exact location of the faulty rail track can easily be located which will mended immediately so that many lives can be saved.

APPLICATIONS/SCOPE OF THE SYSTEM

Project can be used for inspection at various places like Automatic detection of crack on railway tracks. Calculation of distance of the crack from the origin.

Automatic crack detection in forged metal parts. Detection of cracks in concrete pipe.

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