"Innovative Railway Track Surveying with Sensors and Controlled by Wireless Communication"

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ABSTRACT

The Transportation of train always depends on railway tracks (rails) only. If there is a crack in these rails, it creates a major problem. Most of the accidents in the train are caused due to cracks in the railway tracks, which cannot be easily identified. Also it takes more time to rectify this problem. In order to avoid this problem, we are using the crack detector robot, which detects the crack in the rails and gives an alarm.

A robot is an apparently human automation, intelligent and obedient but impersonal machine. It is relatively, that robots have started to employ a degree of Artificial Intelligence (AI) in their work and many robots required human operators, or precise guidance throughout their missions. Slowly, robots are becoming more and more autonomous.

This system involves the design of crack finding robot for finding cracks in railway tracks. This system uses controller for interfacing the robotic vehicle and crack detection sensor. The sensing device senses the voltage variations from the crack sensor and then it gives the signal to the microcontroller.

The microcontroller checks the voltage variations between measured value and threshold value and controls the robot according to it. If any crack occurs in the rail, the robot will be stopped and then an alarm will be raised.

Keyword: - *GSM Module, GPS Module, Sensors.*

1. INTRODUCTION

Depending on recent developments in railway systems, high-speed trains are being extensively used, and rail transportation is being increased. Reasons for this increase are high speed, economical, environment friendly, safety, and modern characteristics of railway systems.

In railway bridges, any time the bridge it's striking due to weather condition, floods, earthquake, cyclone, etc. Now days system has some limitations, if the bridge or track damaged, that information goes to railway authority people, they notify and informs to the corresponding trains it will takes more time informing that information. So to avoid delays, our proposed system will immediately notify and informs the current train comes on the track through wireless medium.

Transport is a key necessity for specialization that allows production and consumption of products to occur at different locations. 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.The Indian railway network today has a track length of 113,617 kilometers (70,598 mi).over a route of 63,974 kilometers (39,752 mi) and 7,083 stations. It is the fourth largest railway network in the world exceeded only by those of the United States, Russia and China.

The rail network traverses every length and breadth of India and is known carry over 30 million passengers 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. In terms of the reliability and safety parameters, we have not yet reached truly global standards.

Though rail transport in India growing at a rapid pace, the associated safety infrastructure facilities have not kept up with the aforementioned proliferation. Our facilities are inadequate compared to the international standards and as a result, there have been frequent derailments that have resulted in severe loss of valuable human lives and property as well.

2. LITERATURE SURVEY.

The implemented system consists of a microcontroller (LPC2148) as a main processing unit for the entire system and all the sensor and devices can be connected with the microcontroller.

The development of an efficient Weigh-In-Motion(WIM) system, with the aim of estimating the axle loads of railway vehicles in motion, is quite interesting from both an industrial and academic points of view such systems, with which the loading conditions of a wide population of running vehicles can be verified, are very important from a safety maintenance perspective. The evaluation of the axle load conditions is fundamental especially for freight wagons, more likely to be subjected at risk of unbalanced loads that may be extremely dangerous both for the vehicle running safety and the infrastructure integrity.

Squats and corrugation cause large dynamic forces between wheel and rails, leading to rapid deterioration of rapid quality. There is a strong need for improved detection and maintenance methods to treats such defects at reduced costs, and for better track design to avoid or retard occurrence of them.

The paper aims at studying the interaction between an elastic wheel set and ballasted track due to the polygonal wheels. The wheel set is considered a Timoshenko beam with attached rigid-bodies as axle boxes, wheels and brake discs. The track model includes a new model of the rail periodic support consisting in two three directional Kelvin-Voigt systems for the rail pad and the ballast. The main features of the wheel/rail vibration due to the polygonal wheel are analyzed via a new approach of the Green's matrix of the track method.

The prediction of impact forces caused by wheel flats requires the application of time-domain models that are generally more computationally demanding than are frequency-domain models. In this paper, a fast time-domain model is presented to simulate the dynamic interaction between wheel and rail, taking into account the non-linear processes in the contact zone.

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AC bridge techniques commonly used for precision impedance measurements have been adapted to develop an eddy current sensor for rail defect detection. By using two detected coils instead of just one as in a The sensors can be operated by the microcontroller to retrieve the data from them and it processes the analysis with the sensor data and updates it to the internet through GPRS module connected to it. In the above block diagram, there it is showing the main elements in the proposed system.

3. SYSTEM ARCHITECTURE

3.1 Block Diagram

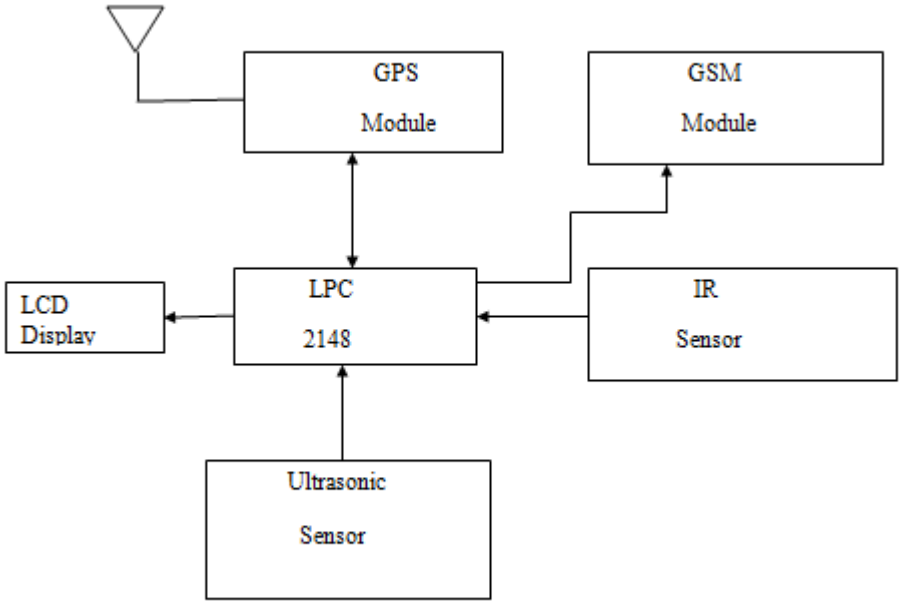

Fig-1. Block Diagram of Proposed System

3.2 LPC2148

The LPC2148 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty.

3.3 GPS Module

EM-406 GPS receiver has been used as the GPS module. It follows NMEA convention. With a baud rate of 9600 bps, 1Hz update rate and 1 sec hot start time, the properties of the said module was found to ideally match the requirements. It is interfaced with ARM-7 using the UART0

Fig.2- GPS Module

3.4 GSM Module

The SIM900A GSM module has been chosen to achieve the SMS functionality. Since the ARM-7 has two UART ports, it was easy to connect the two modules to the two ports of the ARM-7 ports. Here the GSM module is connected to the UART1 port. The overall electrical design of the RRCDS has been shown in Figure.

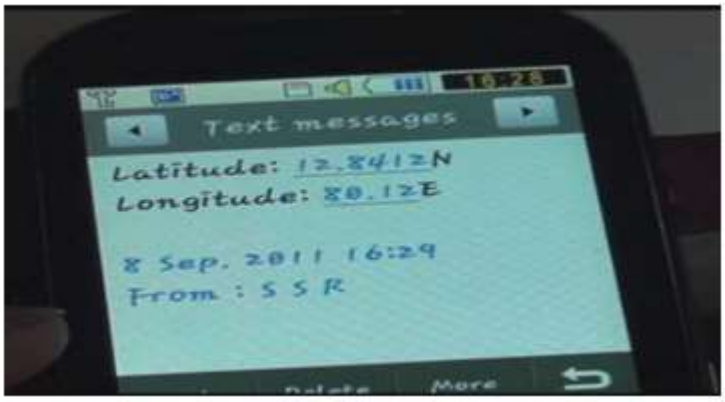

Fig.3- Message Received From GSM Module

3.5 Sensors

3.5.1 IR Sensor

The IR Sensor-Single is a general purpose proximity sensor. Herewe use it for collision detection. The module consist of a IR emitterand IR receiver pair. The high precision IR receiver always detects aIR signal.The module consists of 358 comparator IC. The output of sensoris high whenever it IR frequency and low otherwise. The on-boardLED indicator helps user to check status of the sensor without usingany additional hardware.
The power consumption of this module is low. It gives a digital output.

Application Ideas

- Obstacle detection
- Shaft encoder
- Fixed frequency detection

Pin No. Connection Description

1. Output Digital Output (High or Low)
2. VCC Connected to circuit supply
3. Ground Connected to circuit ground pin

3.5.2 Ultasonic Sensor

Ultrasonic transducers convert AC into ultrasound, as well as the reverse. Ultrasonics, typically refers to piezoelectric transducers or capacitive transducers. Piezoelectric crystals change size and shape when a voltage is applied; AC voltage makes them oscillate at the same frequency and produce ultrasonic sound. Capacitive transducers use electrostatic fields between a conductive diaphragm and a backing plate.

The beam pattern of a transducer can be determined by the active transducer area and shape, the ultrasound wavelength, and the sound velocity of the propagation medium. The diagrams show the sound fields of an unfocused and a focusing ultrasonic transducer in water, plainly at differing energy levels.

Since piezoelectric materials generate a voltage when force is applied to them, they can also work as ultrasonic detectors. Some systems use separate transmitters and receivers, while others combine both functions into a single piezoelectric transceiver.

4. PROPOSED SYSTEM

The proposed method for the automatic detection of squats in railway track is illustrated in fig 1. The supply of 5Volt DC is given to the system which is converted from 230Volt AC supply. Firstly, the step down transformer will be used here for converting 230Volt AC into 12Volt AC. The microcontroller will support only the Direct Current supply, so the Alternating Current supply will be converted into DC using the bridge rectifier. The output of rectifier will have some ripples so we are using the 2200uf capacitor for filtering those ripples. The output from the filter which is given to the 7805 voltage regulator which will convert the 12Volt Direct Current into 5Volt DC. The output from the regulator will be filtered using the 1000uf capacitor, so the pure 5Volt DC is getting as the output from the power supply unit. Here we can use the PIC microcontroller which will be capable of getting the supply of 5Volt DC so we have to convert the 230Volt AC supply into 5Volt DC supply.

The microcontroller unit is used to detect the crack in the track by using the IR transmitter and IR receiver then the corresponding information is send to the control section using GPS, the movement of robot also controlled by the controller. The display unit is mainly achieved by the 16X2 LCD. A liquid crystal display (LCD) is a flat panel display, an electronic visual display, or video display that uses the light modulating properties of liquid crystals (LCs). LCs do not emit light directly. In this project LCD is used to display sensor value.

Software is used to compile the coding of the desired application for the corresponding embedded system. GPS stands for Global Positioning System (GPS). It is a space-based on Global navigation satellite system. It provides position, and navigation to worldwide users on a continuous basis in all weather i.e. day and night, anywhere on the Earth. GPS is made up of 3 parts: between 24 and 32 satellites orbiting the Earth, 4 control and monitoring stations on the Earth. GPS satellites will broadcast signals from space that are used by help of GPS receivers to provide two-dimensional location (latitude, and longitude) .

5. CONCLUSION

In this paper, the design of crack finding robot for finding cracks in the railway tracks. Here the microcontroller is interfaced with Robot, Global Positioning System (GPS), Liquid Crystal Display (LCD) and Crack Sensor. The IR sensor senses the voltage variations from the crack sensor and then it gives the signal to the microcontroller. The microcontroller checks the variations in the voltage of the measured value with the threshold value. If the microcontroller detects the crack in the railway track, it immediately gets the exact location information using Global Positioning System (GPS) and Global System for mobile (GSM) and sends that location and crack information to the control section. The control section displays the exact location that is latitude and longitude value in map by using .NET Software. The Liquid Crystal Display (LCD) is used to display the current status of the system. The exact location of the crack in the track with can easily be identified with the help of Global Positioning System (GPS) and Global System for mobile (GSM).

6. REFERENCES

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