AUTOMATIC CRACK DETECTION TECHNOLOGY FOR RAILWAY TRACK.

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ABSTRACT

*In the fast developing country, people are facing many accidents; it would be undesirable for any nation to losing their life for unwanted cause. Railways are one of the important transports in India. There is a need for manual checking to detect the crack on railway track and always railway personnel takes care of this issue, even though the inspection is made regularly. Sometimes the crack may un notice. Because of this the train accident or derailment may occur. In order to avoid this situation and automate the railway crack detection has been proposed. Here ultrasonic sensor is used to detect the crack in the railway track by measuring distance from track to sensor, if the distance is greater than the assigned value the microcontroller identifies there is a crack, also it tells the exact location of the crack by the formula "SPEED=DISTANCE/TIME" "DISTANCE=SPEED*TIME" TIME=DISTANCE/SPEED. While the checking process is going on, the train may approach, it is identified by the vibration sensor and gives alert to the microcontroller, thereby shrinks the size of the robot between the two tracks. After the train has crossed it returns to its normal position and continue its checking process.*

KEYWORDS: track, ultrasonic sensor, inflator, sensor unit, control unit, Track detection.

INTRODUCTION:

The recent Indian railway network has a track length of 113,617 kilometers (70,598 mi) over a route of 63,974 kilometers (39,752 mi) and 7,083 railway stations. It is the fourth largest railway network in the world. Indian rail network is still associated with lack of safety infrastructure. 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. About 60% of all the rail accidents is due to derailments, recent statistics reveal that about 90% are due to cracks on the rails. Hence these cracks in railway lines have to be addressed with utmost attention due to the frequency of rail usage. These cracks generally go unnoticed due to improper maintenance and irregular and human involvement in track line monitoring. The high frequency of trains and the unreliability of manual labor have initiated the cause for an automated system to monitor the presence of crack on the railway lines. This paper proposes an efficient and cost effective solution suitable for large scale application. The existing system includes the concept using LED and LDR sensor assembly. The main drawback of the system is that LED and LDR should be exactly aligned opposite to each other to detect the crack; also the true values from LDR to be detected. For this reason, we have used an Ultrasonic sensor, which has only one module that has both transmitter and receiver and alignment is not an issue. The main objective of the project is to identify any crack or deformation on the railway track. The proposed setup would make the detection and maintenance of railways tracks easier and help to monitor the crack on rails by replacing the human inspection which is currently followed. The proposed design and software related to it are simple and can be easily adopted by the present system. Railroad engineering practices and Federal Railroad for physical defects at specified intervals. These inspection are conducted visually by railroad track inspectors, but due to practical consideration only a certain level of detail can be obtained. Also Enhancement method is possible using machine vision technology, which consists of recording digital image of track elements analyzing those image using custom algorithms to identify defects or their symptoms. A Video track cart was develop for initial video data acquisition, and algorithms were developed to analyze the defect in the rail, tie plates, ties, cut spikes, rail anchors, and ballast using a global to-local. Once defects have been detected and catalogued by the system, a quantitative comparison of data from different runs is possible, making trending and predictive

maintenance scheduling. Ultimately, this system will provide an improvement in track inspection data for not only increasing current inspection capabilities, but also deepening the understanding of track health over time as proposed by J.Edwards (2009)

RAIL TRACK INSPECTION USING VISION BASED SYSTEM :

Most of the common drive assistant systems for detection of obstacles work unstructured environments. These environments generally include many non-planer surfaces which pose a big challenge for vision system. Similar problem exist for railroad environment which often contain complex shapes and surface likes hills and vegetation along railroad tracks. In railroad transportation, the main task of a train driver is to focus on the track. Therefore the field of view of a train driver must contain space between two rails in front of the train and the near lateral area (left and right side) of these rails. An algorithm is used to extract the train course and railroad track space which is fixed in front of the train using dynamic programming. The algorithm extracts the left and right rails using dynamic programming simultaneously. Our method does not need any static calibration process. From this purpose, a camera system was installed in front of a locomotive. As proposed by J.Jaiswai(2006)

CHARACTERISATION of DEFECTS:

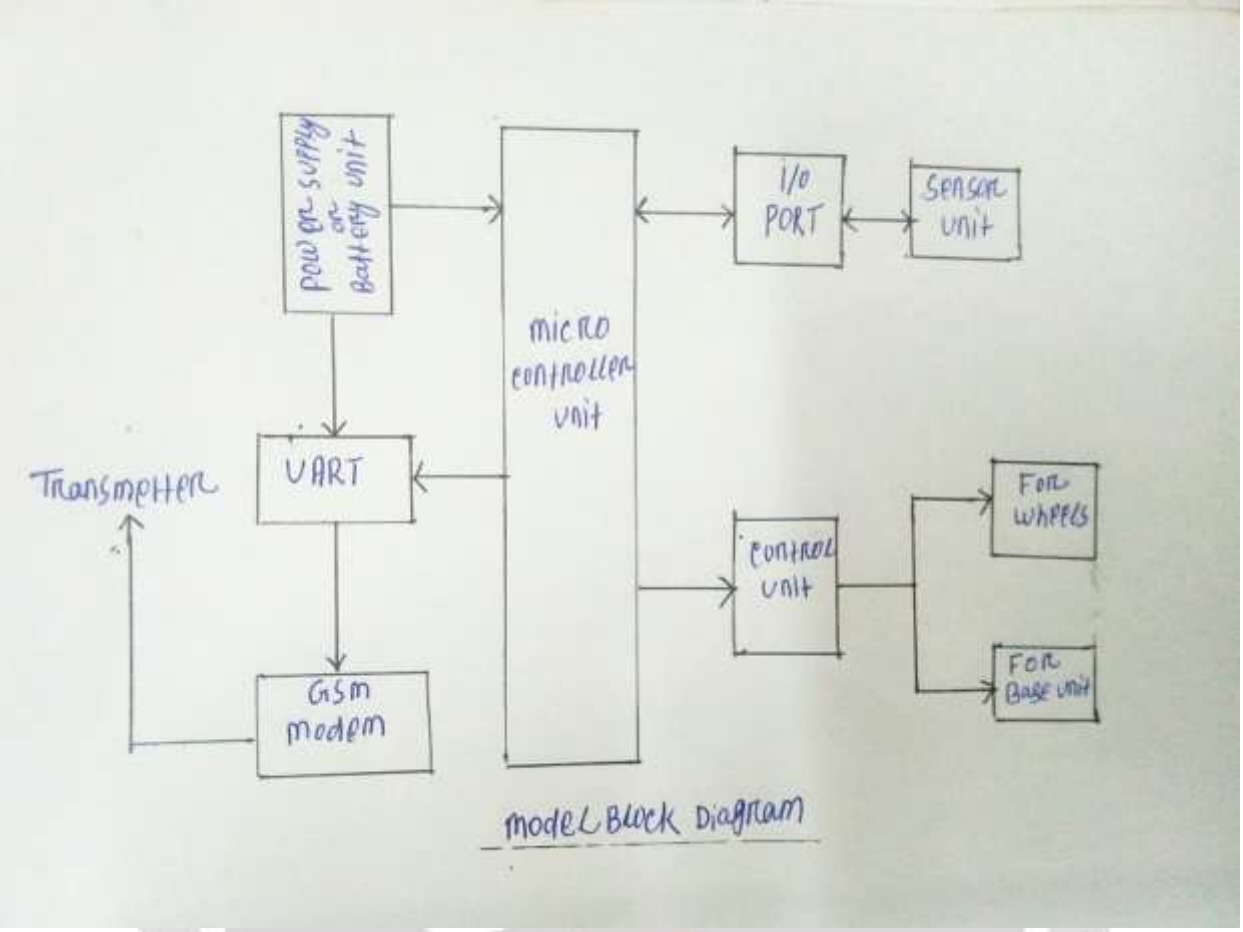
The detection of critical surface cracks in the railhead is a major challenge for the railway industry. Conventional inspection methods have proven not to be reliable enough in this context, therefore the aim was to develop an alternative or complementary screening method. The approach was to scan a pulse through echo probe along the rail which includes low frequency surface waves. The results on initial study of plates were based on thickness, even though the interference of multiple guided wave leads to complicated signal interpretation. The dominant surface wave modes of rails were analyzed and a mode suitable for inspection purposes was determined. However, it was found that there was number of unwanted modes which can be easily excitable from the railhead surface. Signal processing techniques are focused on two aspect, one involving focusing of a phased array across the railhead, the second includes an increased probe length along the rail by a spatial averaging method. The latter was found to be highly effective and robust, rendering the phased array obsolete and thus reducing both system complexity and data acquisition time. As proposed by S.Dixon(2006)

EXISTING WORK:

India has one of the largest railway networks, which utilizing the task of manual Inspection and detecting a crack on these railways tracks is very tedious process. The existing work involved in railway track crack detection is an autonomous vehicle using an PIC Microcontroller, obstacle Sensors assembly setup. This model detects the cracks along its path. The vehicle is also capable of monitoring the location of the crack by using the GPS module and alerts using GSM module. The controlling functions are performed using PIC microcontroller. The vehicle is powered through a Solar panel and Lead Acid battery assembly. The vehicle moves along the path of railway track and IR obstacle sensors mounted on the vehicle front end is used to inspect the crack along the path. When any crack or deformation is detected on the track the vehicle stops and the location of the crack is identified and the Latitude, Longitude coordinates are traced using the GPS module and the GSM module is used to send these Location coordinates in the form of Short Message Service (SMS) to the Pre-defied number.

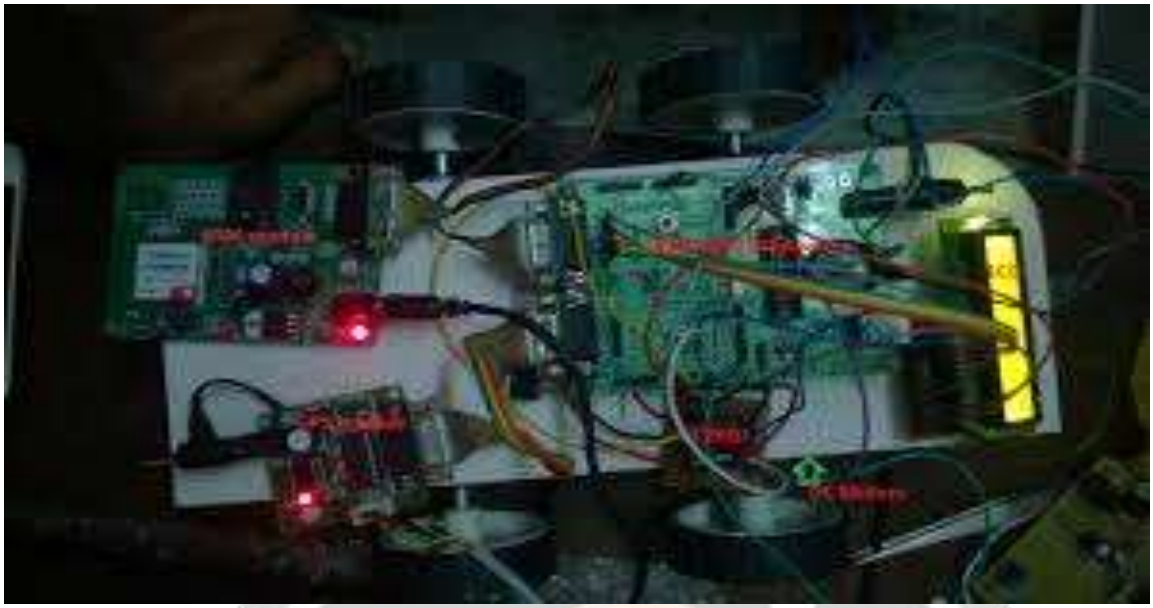
PROPOSED SYSTEM:

The proposed work consists of ARM processor based CC3200 microcontroller, sensor unit and a control unit. In CC3200 has an inbuit UART setup, GSM modem and 32bit I/O ports. The 32 bit register bits are directly connected to ALU allowing two independent registers to be accessed for one single instruction executed during one clock cycle. A JTAG interface is available for Boundary-scan, On-chip Debugging support for programming. Three flexible Timer/Counters with compare modes for Internal and External Interrupts used for assigning functions, A serial programmable UART, a byte oriented Two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain, a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes are available within the board which is used for implementing the proposed work. The Idle mode stops the CPU while allowing the UART to send the information to remote place. A two level sensor is placed in front of vehicle track detection unit to analyze the crack on the track.



The Microcontroller unit is operated in low power mode which saves the register contents disabling all other chip functions until the next External Interrupt or an hardware reset occurs. In Power-save mode, the Timer continues to run, allowing the user to maintain a timer base while the rest of the device is in idle state. The ADC Noise Reduction mode stops the CPU minimize the switching noise during ADC conversions. In Standby mode, the crystal/resonator or oscillator is running while the rest of the device is inactive. In Extended Standby mode, both the main Oscillator and the Asynchronous Timer continue to run. In the proposed work set low the Trig and Echo port when the module initializes. Transmit at least 10us high level pulse to the Trig pin and then wait to capture the rising edge output by echo port at the same time open the timer to start timing. Next, once again capture the falling edge output by echo port. Also read the time of the counter, which is the ultrasonic running time in the air. According to the analysis: test distance = (high level time * ultrasonic spreading velocity in air) / 2 , and the distance to the obstacle is calculated.

Inflator is used to provide air to the pneumatic air cylinders. It operates on 12v DC. It converts supplied voltage into air with the help of inbuilt propeller. It is used to control the air cylinder through solenoid valve. It acts as an air compressor.



ProtoType

CONCLUSION:

By using this Autonomous vehicle for purpose of railway track inspection and crack detection, it will have a great impact in the maintenance of the tracks which will help in preventing train accidents to a very large extent. The regions where manual inspection is not possible, like in deep coal mines, mountain regions and dense thick forest regions can be easily done using this vehicle. By using this vehicle for the purpose of Railway track inspection and crack detection and automated SMS will be sent to predefined phone number whenever the vehicle sensors detect any crack or deformation. This will help in maintenance and monitoring the condition of railway tracks without any errors and thereby maintaining the tracks in good condition, preventing train accidents to very large extent Railway track crack detection autonomous vehicle is designed in such a way that it detects the cracks or deformities on the track which when rectified in time will reduce train accidents.

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