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MONITORING OF CRACK INSPECTION AND MAPPING IN RAILWAY BY USING ROBOT

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ABSTRACT: Railway track inspection system plays a vital role in railway maintenance and it is habitually needed to avoid dangerous situations. The abnormalities of the railway tracks are mostly due to Rail crack and misplacements of bolts in Railway Track. These are cause due to the vibration in railway track by running trains. Normally trained railway employees will manually inspect the railway track by walking along with the track to search for visual abnormalities. This system has many faults because of delay, accuracy and objectivities. To prevent such scenario, the proposed system will automatically inspect the rail crack in the railway track. This system detects the rail cracks in the tracks. The system contains pair of sensors to detect the crack of the railway track. After detecting the railway crack the system send the status of particular location with the help of GPS and GSM technologies.

Keyword: *LPC2148 ,laser sensor ,led ,IR pair ,GPS ,GSM ,L293d ,DC motors*

I.INTRODUCTION

Railway track inspection system is to go through the railway tracks for its component inspection. The failure in railway track may leads to extremely large scale accidents. This track defects are the second leading c ause of accidents on railroad travel. This may leads to the derailment of train from the railway tracks. To maintain rail road travel a safety and efficient, railway must inspect their track on periodic basis. The railway track consists of rails, ties (sleepers), tie plates and bolts must to be inspected .The railway track maintenance normally covers a wide spectrum, ranging from detecting surface cracks in the rail, measuring rail profile and gauge and monitoring the conditions of joint bars. When the crack is in railway track which is more dangerous to the railroad travel. It may lead the train to derailment from the track. To avoid such situation on the railroad travel we going for the system called monitoring of crack inspection and mapping in railway by using robot to detect crack in the railway track.

The main goal of the project is to provide more security for railway crack detection. It is used to find the location of the crack in the railway track. This work addresses crack detection and mapping on a railway track using a robotic system. Several challenges including coordinate transformation, robot localization and complete coverage path planning for the proposed robot system are tackled. This paper focuses mainly on the overall framework for such a robotic inspection system.

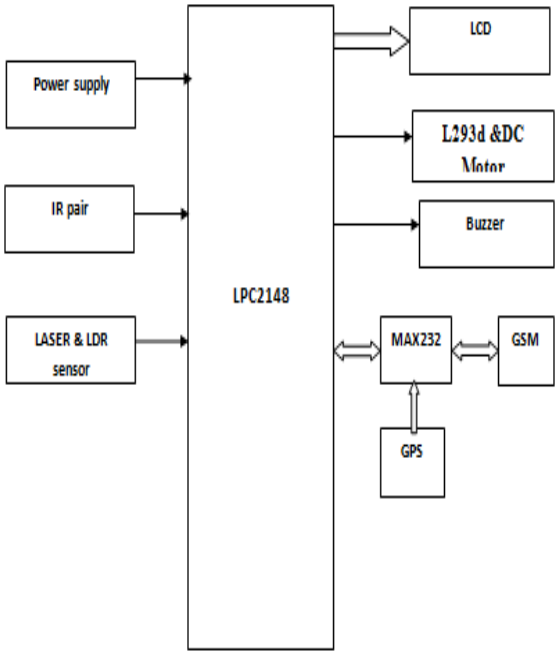
II.SYSTEM DESIGN

Robots have replaced humans in the assistance of performing those repetitive and dangerous tasks which humans prefer not to do, or are unable to do due to size limitations, or even those such as in outer space or at the bottom of the sea where humans could not survive the extreme environments.

In this method, we design one robot and fix the sensors LDR, LASER and IR pairs to use to detect cracks. The LDR and LASER sensors are placed both sides of the track. Initially the LDR output is logic zero. If the track good the LDR won't get the LASER light. If track is cracked the LDR gets the LASER light. Then the LDR sensor will be activated then it will send signal to the micro controller.

The IR sensor will placed to top of the track. The IR section contains two parts. Those are transmitter and receiver. If the track if good the receiver gets status of the transmitter. If the track is crack the receiver won't gets status of transmitter. The buzzer will be activated when robot detects the crack and gets stopped. The microcontroller read the values from GPS. The GPS sends the longitude and latitude parameters to the micro controller. Then the micro controller sends this information to registered mobile number. The crack information and status of Robot will be display on LCD.

III. BLOCK DIAGRAM



IV. ARM 7 MICROCONTROLLERS

In this project, ARM-7 microcontroller acquires and stores different parameter of vehicle. The main block of Intilligent vehicle parameter monitoring system is ARM-7 micro controller which is heart of the system which provides monitoring and controlling actions. It senses signals from input blocks and processes output blocks. The software program is stored in ARM-7 microcontroller on chip memory, according to which it provides the controlling actions. The on chip ADC converts these parameters into digital form and gives to the ARM-7 microcontroller. The status of sterring grip i.e. whether the sterring is gripped or not is sensed by sensor gives the corresponding signal to microcontroller. The features of this micro controller is

- It has 32 bit GPIO pins used for both input as well as output.
- It has data memory 16KB on-chip Static RAM.
- It consists of on-chip Flash Program Memory with 128/256kB in size.
- It accelerates operating speed of 60 MHz range of frequency
- In-System Programming (ISP) and also In-Application Programming (IAP) via on-chip boot-loader software.
- It has 2 CAN communication protocol, interfaces for control of several devices.
- It has PWM unit (6 outputs), RTC, Watchdog and two 32-bit timers (with 4 capture and 4 compare channels),
- It has multiple serial interfaces including two UARTs, Fast I2C (400kbps).
- It 2 SPIs and 2 CAN 60 MHz maximum CPU clock available for programmable on-chip Phase-Locked Loop with settling time of 100ms.

Watchdog Timer: The purpose of the watchdog is to reset the microcontroller within a reasonable amount of time if it enters an erroneous state. When enabled, the watchdog will generate a system reset if the user program fails to „feed" (or reload) the watchdog within a predetermined amount of time.

Real Time Clock: The RTC is designed to provide a set of counters to measure time when normal or idle operating mode is selected. The RTC has been designed to use little power, making it suitable for battery powered systems where the CPU is not running continuously (Idle mode).

Crystal Oscillator: On-chip integrated oscillator operates with external crystal in range of 1 MHz to 25 MHz. The oscillator output frequency is called fosc and the ARM processor clock frequency is referred to as CCLK for purposes of rate equations, etc. fosc and CCLK are the same value unless the PLL is running and connected.

Transformer: Usually, DC voltages are required to operate various electronic equipment and these voltages are 5V, 9V or 12V. But these voltages cannot be obtained directly. Thus the a.c input available at the mains supply i.e., 230V is to be brought down to the required voltage level. This is done by a transformer. Thus, a step down transformer is employed to decrease the voltage to a required level.

Rectifier: The output from the transformer is fed to the rectifier. It converts A.C. into pulsating D.C. The rectifier may be a half wave or a full wave rectifier. In this project, a bridge rectifier is used because of its merits like good stability and full wave rectification.

Filter: Capacitive filter is used in this project. It removes the ripples from the output of rectifier and smoothens the D.C. Output received from this filter is constant until the mains voltage and load is maintained constant. However, if either of the two is varied, D.C. voltage received at this point changes. Therefore a regulator is applied at the output stage.

Voltage Regulator: As the name itself implies, it regulates the input applied to it. A voltage regulator is an electrical regulator designed to automatically maintain a

constant voltage level. In this project, power supply of 5V and 12V are required. In order to obtain these voltage levels, 7805 and 7812 voltage regulators are to be used. The first number 78 represents positive supply and the numbers 05, 12 represent the required.

RS232 Cable: To allow compatibility among data communication equipment, an interfacing standard called RS232 is used. Since the standard was set long before the advent of the TTL logic family, its input and output voltage levels are not TTL compatible. For this reason, to connect any RS232 to a microcontroller system, voltage converters such as MAX232 are used to convert the TTL logic levels to the RS232 voltage levels and vice versa.

MAX 232: Max232 IC is a specialized circuit which makes standard voltages as required by RS232 standards. This IC provides best noise rejection and very reliable against discharges and short circuits. MAX232 IC chips are commonly referred to as line drivers.

To ensure data transfer between PC and microcontroller, the baud rate and voltage levels of Microcontroller and PC should be the same. The voltage levels of microcontroller are logic1 and logic 0 i.e., logic 1 is +5V and logic 0 is 0V. But for PC, RS232 voltage levels are considered and they are: logic 1 is taken as -3V to -25V and logic 0 as +3V to +25V. So, in order to equal these voltage levels, MAX232 IC is used. Thus this IC converts RS232 voltage levels to microcontroller voltage levels and vice versa.

GPS Technology: The Global Positioning System (GPS) is a satellite based navigation system that sends and receives radio signals. A GPS receiver acquires these signals and provides the user with information. Using GPS technology, one can determine location, velocity and time, 24 hours a day, in any weather conditions anywhere in the world for free. GPS was formally known as the NAVSTAR (Navigation Satellite Timing and Ranging). Global Positioning System was originally developed for military. Because of its popular navigation capabilities and because GPS technology can be accessed using small, inexpensive equipment, the government made the system available for civilian use. The USA owns GPS technology and the Department of Defense maintains it.

DC motor unit:

We are designing a robot which consists of 2 DC motor based wheels. These wheels are operated using 12v DC motor. The µC works at 5v and the DC motors operate at 12V, so to match the voltages we are interfacing a DC motor driver circuit L293D which will in turn drive the DC motors.

GSM (Global system for mobile):

It is a long distance communication device used to interact similar like our mobile phones. The modem is used for voice (call), send and receive depending upon require application. The ARM 7 have two serial ports i.e. UART0 and UART1.By using these two serial ports we are easy to communicate with GSM. We can simultaneously send and receive data to ARM 7 microcontroller and perform the task depending upon application. This Modem used to get alertness whenever a robot detect crack in the railway track.

IR sensor and Laser sensor:

The IR sensor have two components. Those are transmitter and receiver. The transmitter continuously send the IR beam to the receiver. The receiver continuously receive the signal from transmitter. When ever the obstacle between these two the receiver will not receive the signal and send the activated signal to the controller.

The laser sensor is continuously emit the light. Another side led is placed to detect the light.

V.RESULT:

This inspection system is to detect the crack of the railway track. This system also helpful to find the exact location of crack and send the status to the authorized person.

VI. CONCLUSION

we introduced a robotic crack inspection and mapping system. This system provides an overall solution to railway crack inspection. The crack detection algorithm works well for real cracks through the ex- periment and simulation evaluation. We need enhance the robustness of the crack detec- tion algorithm in such conditions. Also, we will address the problem of degraded localization accuracy due to moving objects. The system is tested accordingly and the performance of the system is efficient. The main challenge for the system in near future is to improve the current tie detection approaches and the global component optimization approach needs to be evaluated on other rail object other than tie plates. Finally need to enhance the algorithm with modified imaging system to accommodate a faster and more desirable inspection speed.

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