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AN ADVANCE ROBOTIC SYSTEM FOR BRIDGE DECK AND RAILWAY TRACK MAINTENANCE

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Abstract

This paper is to design and develop a robotic system for inspecting the bridge cracks and to make it a multipurpose robotic system.The bridge maintenance is an important category in order to provide a safety and efficient transportation of heavy vehicles for long distances. The robotic system is developed based on considering the path selection on the bridge for ensuring that the entire bridge is inspected. The robotic system is developed with a proximity detection principle by using IR sensors for bridge crack detection and an LDR along with a laser light is used for railways track crack detection, whenever any crack is detected by the robot, immediately it will send the information to the authority person along with the geographical location details to make it easy for the repair of the crack. The information exchange will be done through a simple SMS with GSM modem and geographical location should be done through the GPS connected to it.

Keywords: GSM Module, GPS, SMS, IR Sensor, LDR, LASER and Micro Controller

I. INTRODUCTION

The bridge examination is useful and might offer homeowners warning to the long rundeterioration of the bridge. Currently, bridge decks square measure inspected with terriblyrudimentary ways within the kind of visual examination by a trained engineer. The inspectors sometimes practise the bridges and live the crack sizes and locations.First one is it's vulnerable tohuman errors. Second,it's terribly restricted accuracy attributable to the restricted visual capability of human inspectors. Third, it cannot guarantee the total coverage of the total bridge. In addition, conducting visual crack examination of a bridge may be a dangerous job with passing traffic. Therefore, it'sextremely fascinating to develop a robotic crack examination and mapping (ROCIM) system which might conduct correct assessment of cracks on bridge decks. The surface of bridge decks are exposed to the environment direct loading from vehicles and exposure to chemicals, constant maintenance is a must.

The ROCIM system can have the subsequent options that surmount the human inspectors. First, a high resolution camera are going to be mounted on the mobile automaton to attain high accuracy of crack detection in the railway track system. Second, the crack locations is accurately determined since the automaton willlocalize

exact place. Third one is themistreatment mobile robots can cut back the protection risk of the human inspectors.The trail designing ought to make sure the mobile automaton will examine the total upper deck surface in AN economical method.This method will normally contrast to the standard complete coverage path designing of a vacuum cleanup automaton become more useful and, which uses the automaton body because thecoverage, the mobile automaton within the ROCIM system is fascinated by the union of camera field of regard the coverage that poses some difficulties within the path designing.

II. LITERATURE REVIEW

To implement the Multipurpose Robotic system the study has done on different researches.

The existed system of ROCIM is only works supported the image process algorithmic rule integrated with the robotic technology. The crack detection using image process methodology involves as virtually same work done by the manual inspectors. The system wants high definition cameras for capturing the pictures of bridge and extract the crack details from the image. All this method wants afully high definition and speed camera to capture the cracks that makes it costlier to implement in an exceedingly robotic vehicle. Due to use of image process methodology, the whole method of capturing and crack extraction canconsume longer process for the detection. The robotic system is once more having a requirement of management unit that is accomplished by the separate detector section will be include in that, in order that the hardware quality are going to be conjointly high. To hide the whole upper deck with the robotic vehicle we are providing another method tendency to should establish the trail consistent with the bridge design and dimensions of the bridge decks. This existed system is additionally wants the pc to method the results of the crack review that makes it costlier and extremely refined algorithmic rule that doesn't suits to the countries like Asian country wherever the monetary things handles everything.

The main objective of this paper is to develop a robotic system for inspecting the bridge cracks and to make it a multipurpose robot, we are implementing it to be useful in railway crack detections also. Here we are using the arm7 based lpc2148 microcontroller interfaced to the infrared ray sensor, laser light and light dependent resistor (LDR).

III. HARDWARE DESIGN

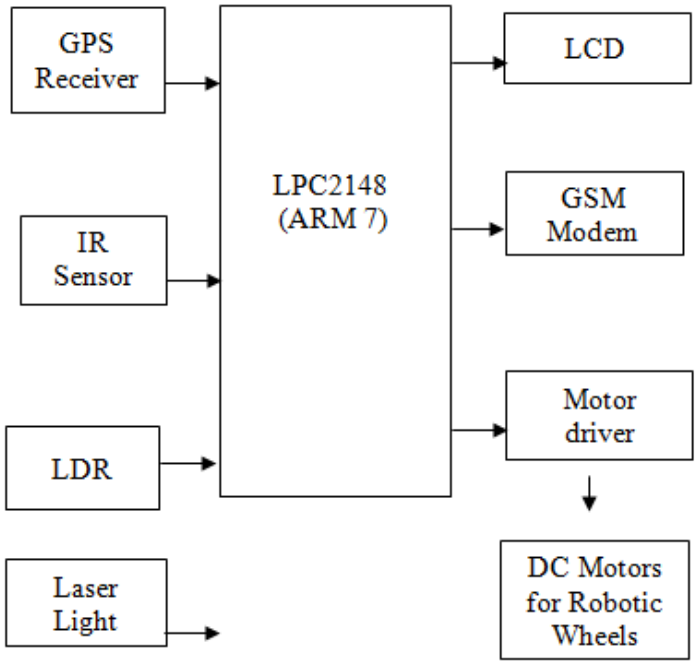

Fig 1: Block Diagram

The Multipurpose robot system using GSM and GPS technology consists of different hardware and software modules. The following block diagram shows the overview of hardware components included in the system.

3.1 LPC2148 Microcontroller

The LPC2148 microcontroller board based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation, 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package, 8 kB to 40 kB of on-chip static RAM and 32 kB to 512 kB of on-chip flash memory; 128-bit wide interface/accelerator enables high-speed 60 MHz operation, In-System Programming/In-Application(ISP), Single 10-bit DAC provides variable analog output, Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog, Low power Real-Time Clock (RTC), Multiple serial interfaces including two UARTs (16C550), two Fast I2C-bus (400 kbit/s), SPI and SSP with buffering and variable data length capabilities.

3.2 GSM Modem

GSM modem is a gadget which can perform all the mobile operations like calling, and GPRS network with it. However, the main contrast is the GSM modem is the crude type of a cell telephone which is planned to use in modern and test applications for the exchanging the information on wireless. The GSM modem utilizes 900MHz data transfer capacity as a part of India according to the telecom administrative tenets. As we say prior it is a crude type of a cell telephone, the GSM modem contains a SIM card space, Antenna and a Max 232 driver in it.

3.3 GPS Receiver

A GPS receiver calculates its position by exactly temporal arrangement the signals sent by the GPS satellites high on top of the world. Every satellite regularly transmits messages containing the time the message was sent to the gps receivers on the earth, precise orbital data, and therefore the general system health and rough orbits of

all GPS satellites. The location is displayed, maybe with a moving map show or latitude and longitude; elevation data could also be enclosed.

3.4 Motor

The 12V DC Geared Motor can be utilized as a part of assortment of mechanical technology applications and is accessible with extensive variety of RPM and Torque.In this paper we are utilizing a 12v DC engine with the 60 rpm speed.

3.5 Infrared ray Sensor

An infrared device is an instrument that's accustomed sense sure characteristics of its surroundings by both emitting and work actinic radiation. It's additionally capable ofmensuration heat of an object and police work motion. Infrared waves don't seem to be visible to the human eye. These ir sensors are used to the detect the objects, the ir continuously emits the rays whenever obstacle comes to the opposite of it then the rays will be get reflected.

3.6 Light Dependent Resistor

The Light Dependent resistance (LDR) is formed victimization the semiconductor mineral. The device is employed au fait circuits to show lights on and in photographic exposure meters.The resistance of the LDR decreases because the intensity of the sunshine falling on that will increase. Incident photons drive electrons from the valence band into the physical phenomenon band. The resistance of the ldr will vary with the intensity of the light falling on it.

3.7 Laser light

The laser light could be a device that emits lightweight through a method of optical amplification supported the stirred emission of radiation. A Laser light will be differs from different sources oflightweightof sunshine in this it emits light coherently.Lasers square measure distinguished from different lightweight sources by their coherence. Abstraction coherence is often expressed through the output being a slim beam that is diffraction limited.

IV. SOFTWARE DESIGN

In this proposed system, as we used LPC2148 we need to use following software tools to program for it.

1. Keil uVision
2. Flash Magic

The Keil uVision is an IDE for Embedded C language. In this IDE, we need to import the utilities and libraries according to the controller we are using. This IDE is very simpler and in user friendly manner to use. It includes all the C/C++ compilers, assemblers, and debuggers in it. It simplifies the process of embedded simulation and testing along with Hex file generation.

The flash magic is a programming utility. The C/C++ program written in IDE will be processed into Hex file i.e. in .hex format. It is necessary to dump the hex file on to the microcontroller.

V. WORKING DESCRIPTION

The Multipurpose robotic system working start from powered up and it is continuously run along with the railway track whenever the crack will be detected and also whenever the bridge decks gets damage it will also get detected then immediately the location details will be sent to the authorized person through GPS and GSM technology.

VI. RESULTS

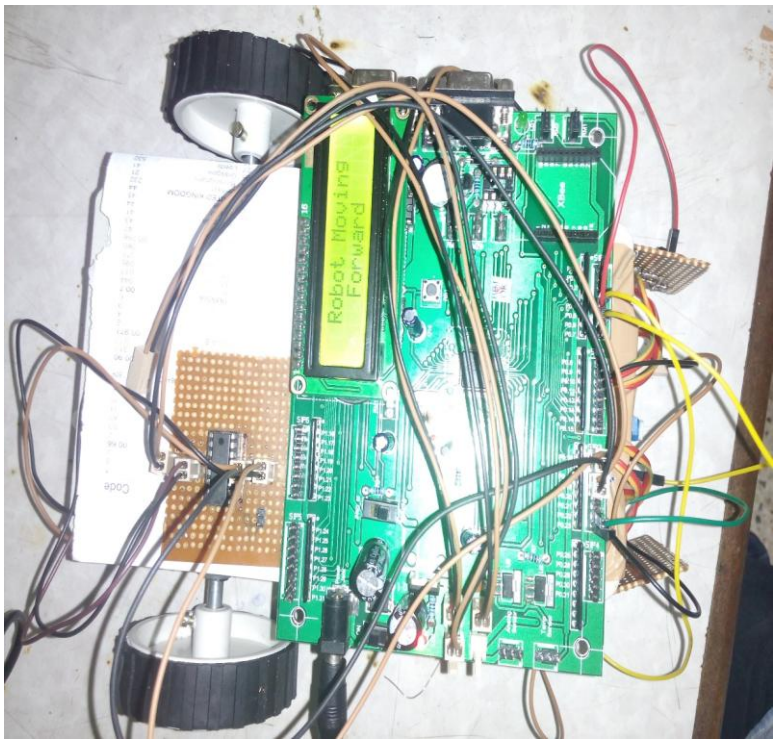

Fig : Overview of System Design Model

VII. CONCLUSION

The Enforced robotic system is economical and automatic resolution for crack review of bridge decks and railway tracks. The system can cut back the human efforts by seventieth of the desiredefforts. The robotic vehicle can give the crack review in a very less time and exchange the situationdetails through GSM. The GPS makes the situation info terribly correct attributable to its vastcoverage of twenty four satellites round the earth.

The robotic system are increased to discover the landmines and bombs organized by the terrorists for reducing the human requirement. By adding it a bomb detection detector and metal detector indicators, area unit able to realize if any bombs/landmines are unbroken in bridges to crash them or anyplace else for specific use of bomb detection. In in a different way, we are able to enhance this technique to utterly avoid the human involvement by adding the robotic arms and needed material arrangement to create a patch on crackspace.

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