Robot for Railway Track Monitoring with Obstacle Detection

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Abstract: *Our country has one of the largest Railway networks in the world. So, it is required for the improvement of reliability and safety ways to determine the cracks and obstacles across railway tracks. It is mainly due to detecting a crack in the railway track, which may occur as natural or artificial.*

Keywords: Arduino software, Ultrasonic sensor, IR sensors, GPS module, DC motors.

I. INTRODUCTION

In India, rail transport plays an essential part in providing the required transport infrastructure to support and slake the ever-growing needs of a quickly expanding economy. India currently has the fourth-largest railway system in the entire globe. However, we have not yet established extremely universal norms in terms of dependability and safety standards. Fissures may develop in rail due to manufacturing flaws. By altering a rail's metallurgy, wheel burns may lead to cracks in the rail. Rails are also more prone to cracking in cold weather when ballast and ties/sleepers aren't offering as much support as they should, and when the ground or drainage conditions are such that 'pumping' occurs under excessive stress.

This device performs the function of an automatic crack-detecting identifying system for rail tracks. It utilizes an ultrasonic sensor to look for cracks; if one is found, the Arduino UNO board sends a signal to the motor driver and the robot turns on the buzzer. The Global System for Mobile Communications (GSM) module then detects a signal from the Arduino UNO and calls the number provided using that signal. In addition, the GSM module uses the Global Positioning System (GPS) to send a message to the particular number notifying that a "crack detected" signal had been found. Throughout the process, the GPS is active, and the values vary constantly as the latitude and longitude change.

Manual detection of tracks is cumbersome and not fully effective owing to much time consumption and the requirement of skilled technicians. So, the idea is to develop a system that can detect the cracks, bends and missing tracks automatically and can inform the railway department about the cracks and their present location so that it is easy to track the bot as well as the cracks or bends.The most important aspect of rail operation worldwide is safety. Therefore, to prevent delays, the system we suggest will immediately notify and inform the current train when it comes on the track using wireless technology.

Fig: Crack on Railway Track

The infrared sensing technique is used in the field of crack detection, and it is well understood to the point at which it was initially believed to be the best solution to the problem of crack detection. However, it was later discovered to be vulnerable to external disturbances and thus came to be considered inaccurate. Ultrasonic techniques can resolve some of the problems mentioned earlier, but they can only inspect the track's core, so they cannot detect anything.

Fig: People crossing railway tracks

1.1 Problem Statement

By using this intelligent railway track crack and obstacle detection, we can prevent accidents that occur on the railway track. The regions where manual inspection is not possible in mountain and hills regions can easily be done by using this intelligent railway track crack and obstacles detector.

II. LITERATURE SURVEY

India's railway system is one of the busiest in the world spanning a 1,27,000 square kilometer track network. In India, the railway network is used by around two-thirds of the population. Almost 60% of accidents occur at railway crossings and are caused by defective rails, costing human lives and ruining the economy

We have the idea in designing a railway crack detection system using Arduino Microcontroller and sensors in order to detect the cracks and location of cracks been given by GPS module and alert through messages through GSM module. We are committed in building such system which will give an optimal solution to the crack detection problem and reach in achieving higher accuracy and precision than existing systems. Also, our project aims in giving safety assurance to railways.

III. SYSTEM COMPONENTS

Arduino UNO - Arduino is a program circuit with open-source hardware and software. It has 14 digital I / O connectors, 6 analog outputs, a USB interface, an ICSP connector, a power jack and a reset switch.

Ultrasonic Sensor -The ultrasonic sensor is an electronic device that detects a specific object's distance by generating ultrasound sound waves and transforms the sound transmitted into an electrical signal wave. The ultrasonic sensor HC SR04 has a module of 4 pins whose pin names are VCC, trigger, ground and echo.
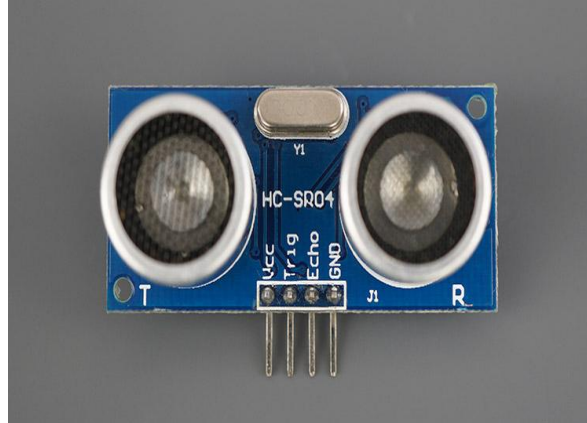
IR Sensor -The infrared obstacle sensor module is equipped with an integrated IR transmitter and IR receiver which sends IR energy and checks for reflected IR energy to identify any obstacles in front of the machine. The sensor has an integrated potentiometer that allows the user to change the range of detections.
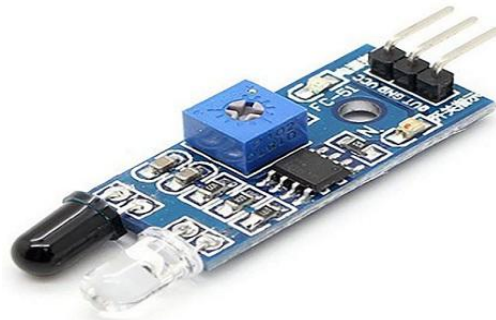

GPS Module -The figure shown below is the module GSM SIM 900A (Global mobile communication system). A GSM module is a designated device with a serial link, USB, Bluetooth or a mobile phone which offers support for GSM modems. A GSM module allows programs like SMS to transmit and receive messages over the modem interface.
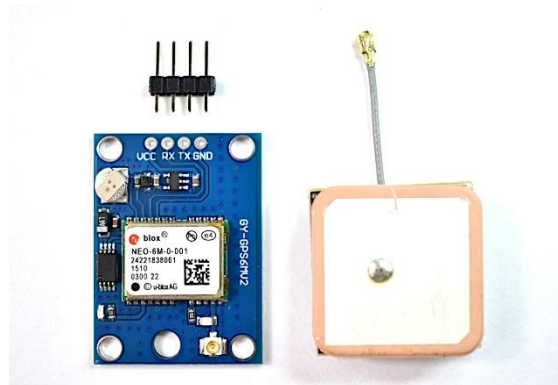
GSM Module -The Global Positioning System is denoted as GPS, It is a satellite communication system used to identify a path of an object on the earth. A GPS receiver measures its location precisely by transmitting the signals sent by GPS satellites well above Earth. The position is then shown on a latitude and longitude view or map view.

DC Geared Motor - A DC geared motor is the device which is used to convert Electrical power to a mechanical power. The DC geared motor speed can be regulated by a dynamic supply voltage, or by adjusting the current strength in its field windings. The stronger the voltage at the input, the greater the engine velocity. The concept proposed uses 4 direct current geared motors of 12 volts.
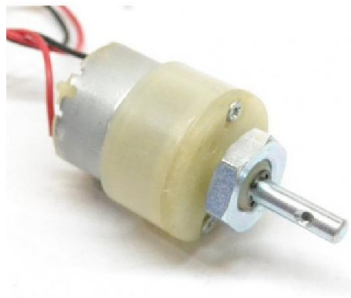
Wheels - Wheel selection is an important aspect, because the torque and speed of the motor may vary depending on the size of the wheel.

Buzzer - A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke.

IV. PROPOSED SYSTEM

A robotic vehicle is the suggested solution for locating the cracks and other irregularities on the railway track. Along the tracks, the robot will automatically move. If a train is coming, it will determine whether there are people on the track and start a loud siren to warn them. From the source railway station to the destination railway station, the robotic vehicle travels along the track for inspection. It uses the battery as its power source to function. Additionally, it has a range of sensors for detecting different defects. It may identify various track defects, including misalignment, track breaks, a lack of nuts and bolts, and track obstructions.If any oddities are found, the latitude and longitude of that place will be communicated to the closest railway station, where it will be possible to recover the precise position of the fault.
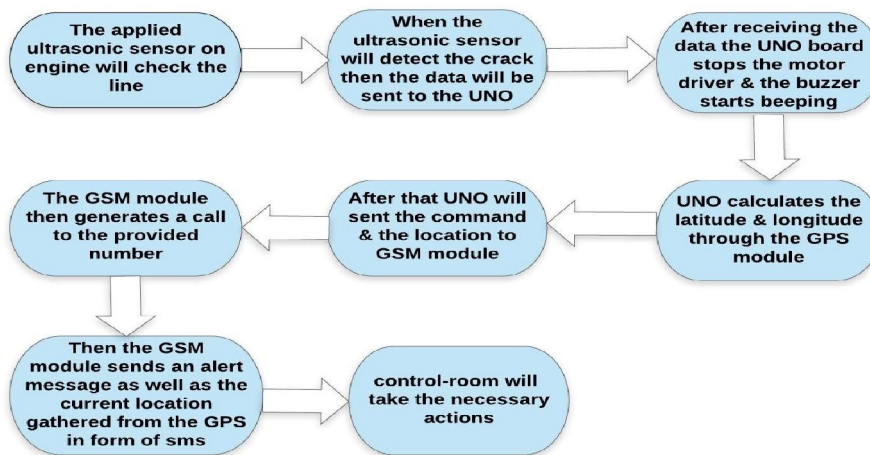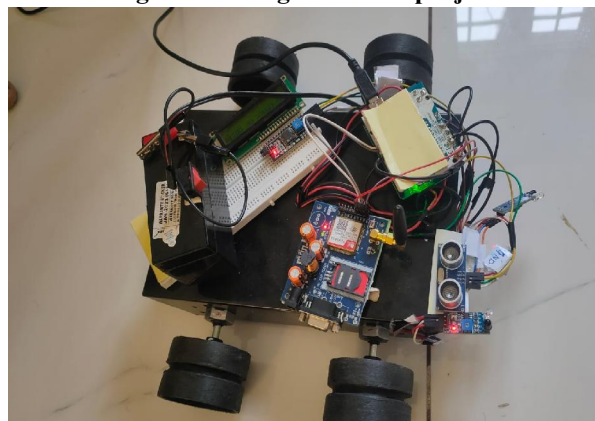

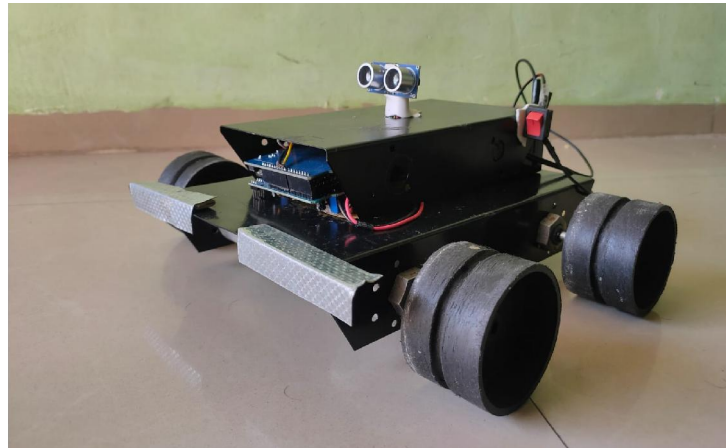**Fig: Block Diagram of the project**

Fig: - Proposed System

V. RESULTS AND CONCLUSION

The approach taken is capable, if there are anyof detecting flaws and obstacles on the surface. The method proposed has lots of advantages over conventional detection approaches that include minimal cost, reduced energy consumption, efficient detection system without human involvement and shorter analytical times. With this prototype, train collisions and derailments can be easily prevented to save many lives. It is also very beneficial for railroad operations testing units. And we can also notice the position failure and the system used in this, and also the location data is sent to the default mobile number. So that this enables us in rail line preservation and control as well. When this robot is used for railway inspections and breakage detection, automatic SMS will be sent to a predetermined mobile number if cracks or abnormalities are identified by the device sensors. This will lead without errors to the management and control of the state of the railway tracks, and thus to the preservation of the tracks in good condition

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