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ROBOTIC VEHICLE FOR RAILWAY CRACK DETECTION

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ABSTRACT: Indian railroad is the fourth world biggest rail route network on the planet and manual Inspection and discovery of breaks on these rail route tracks is a repetitive cycle and devours a lot of time and human efforts. An enormous extent of crashes and administration interruptions are brought about by track-related issues. Expansions in hub stacks, vehicle's essential gape suspension firmness, wheel-rail iconicity, and limit have brought about more prominent harm to the track. This work points in planning a rail route track break identification self-governing vehicle utilizing Microcontroller, ultrasonic Sensors which identifies the breaks along its way. An ultrasonic sensor recognizes the break and protests and sends this data to the control community quickly through GSM innovation.

Keywords: Railway Track, NEO 6M GPS Module, Ultrasonic distance meter

1. INTRODUCTION

The rail route is quite possibly the main transportation methods of our country yet it involves extraordinary distress that, rail line tracks of our nation are inclined. That is the reason countless mishaps are happened each year because of these crude kinds of railroad tracks and as an outcome of those mishaps, we lose countless lives each year.

In India, we find that railroad transport possesses a significant situation in giving the fundamental vehicle framework to maintain and extinguish the ceaseless necessities of a quickly developing economy. Today, India comprises of the fourth biggest rail line network on the planet. Notwithstanding, as far as the unwavering quality, constancy, and security boundaries, we have not yet arrived at really the worldwide norms. This is a time of mechanization which is comprehensively characterized as the substitution of manual exertion by Electronics and robotization in all levels of computerization. The activity stays a fundamental piece of the framework in spite of the fact that with changing requests of actual contribution as the level of automation is expanded.

Types of automation: -

a) Full automation.

b) Semi automation.

The semi-automation includes a mix of manual exertion and mechanical force which is required while in full mechanization human support is entirely immaterial. Our task is a completely robotized one.

This paper presents a system that includes Arduino Nano, GSM and GPS modules, Ultrasonic Sensors for checking the cracks in railway tracks. An SMS consist of the coordinates of the position of the crack is being sent to the recorded figure when the crack is being detected and then, the split can be quickly patched and be sheltered to utilize railroads once more.

2. OBJECTIVE

The main motive is to locate the gaps in the railroad tracks then to determine if there are any hazards in the tracks to avoid and dissuade accidents.

Fig 2: Railway Track Crack

This type of model provides a cost-effective solution to the railroad crack detection problem by using an ultrasonic sensor that responds to the exact situation of the faulty track, as well as forwarding the information to the control room via SMS so that any incidents can be gridlocked.

2.1 EXISTING SYSTEM

In the existing system, techniques such as visual inspection, video transmission, and Magnetic field methods can identify the cracks on the railway tracks. Physical checking is one of the earliest methods in which all the necessary components will be scanned manually. This process is commonly used in India, despite generating the worst outcome. A camera is used for continuous monitoring of the track while streaming content. In this procedure, small cracks and a high-cost system cannot be seen. The current passes through the railway track for detection of flaws in the eddy current method also, the outcomes delivered are not exact. Large numbers of these procedures require a ton of handling power and an extremely long period, making the robot's speed slow and therefore uncomfortable.

2.2 PROBLEM STATEMENT

The chief issue is the absence of modest and productive innovation to recognize issues in the rail tracks and obviously, the absence of appropriate support of rails which have brought about the development of breaks in the rails and other comparative issues brought about by withdrawn components which endanger the security of activity of rail transport. Previously, this issue has prompted a few crashes bringing about a weighty death toll and property. Breaks in rails have been recognized to be the primary driver of crashes previously, yet there have been no modest robotized arrangements accessible for testing purposes. Although, the railway has a maintenance department which consumes much of the manpower and money

3. PROPOSED SYSTEM AND ITS COMPONENTS

The proposed framework outperformed the current framework restrictions used to recognize damaged railroad tracks. We utilize the Arduino Nano board in this proposed framework. Arduino is an incorporated open-source improvement, which works on coding. The system proposed is consisting of an ultrasonic sensor designed to detect cracks and IR sensors used to detect obstacles. The motor controller L293D helps to power the DC motors. The Arduino regulator is basically utilized for controlling the sensor yields and is utilized for the transmission of data through the GSM module, the reason for which is to convey the message to the base station at whatever point a break or snag is identified by means of a SMS. Utilizing the GPS module, the specific scope and longitudinal bearing of the defective track are gotten. In this gadget, unpretentious breaks that are not noticeable to the unaided eye can likewise be noticed. The proposed framework is in this way useful and productive.

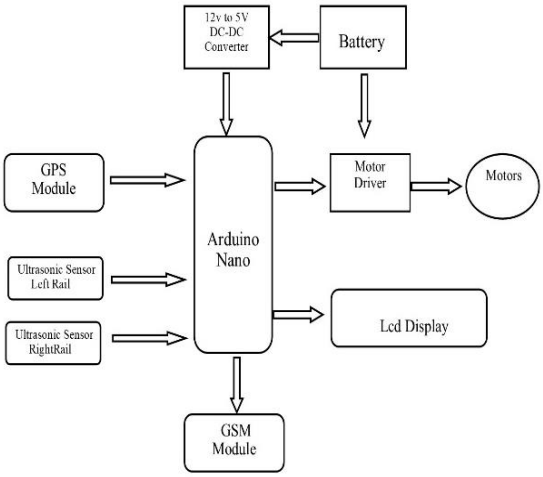

Fig 3: Block diagram of the proposed system

3.1 Arduino UNO

Arduino Nano is one of the microcontroller sheets, it is organized by Arduino. It's made to be worked with a microcontroller like Atmega328. This microcontroller is used in Arduino UNO. It is somewhat greater and versatile with a wide arrangement of employments. Arduino Nano Pinout comprises of 14 modernized pins, 8 straightforward Pins, 2 Reset Pins, and 6 Power Pins. It goes with a functioning voltage of 5V where it can hold a voltage that varies from 7 to 12V. Every one of these Digital and Analog Pins is consigned with different limits yet their essential limit is to be orchestrated as data Arduino Nano goes with a valuable stone oscillator of repeat 16 MHz It is used to convey a clock of definite repeat using reliable voltage.

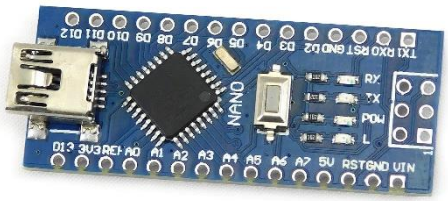

Fig 3.1: Arduino Nano

3.2 Ultrasonic Sensor

The ultrasonic sensor is an electronic gadget that recognizes a particular article's distance by producing ultrasound sound waves and changes the sound sent into an electrical sign wave. Ultrasonic waves can travel faster than electrical sign (i.e., a sound which could be tuned in by people). The

ultrasonic sensor HC SR04 has a module of 4 pins whose pin names are Vcc, trigger, ground, and reverberation.

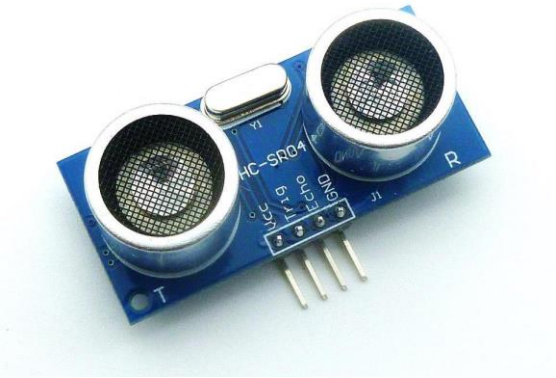

Fig. 3.2: Ultrasonic Sensor HC-SR04

3.3 GPS 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.

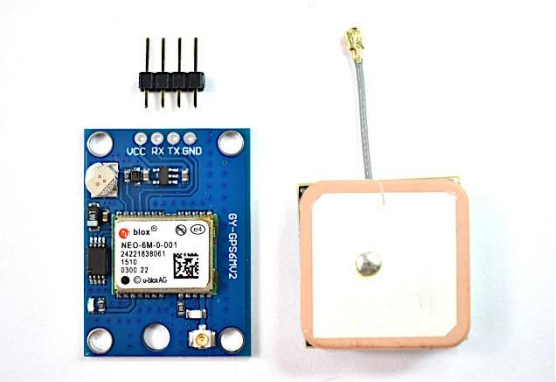

Fig. 3.3: Neo 6M GPS Module

A GPS receiver measures its location precisely by transmitting the signals sent by GPS satellites well overhead Earth. The location is at that time shown on a latitude and longitude view or map view.

3.4 GSM Module

The figure shown below is the module GSM SIM 800L (Global mobile communication system). A GSM module is a designated device by a sequential 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 dial-up connection crossing point. The costs for receiving and sending this communication are the same as the directly incurred on a mobile phone.

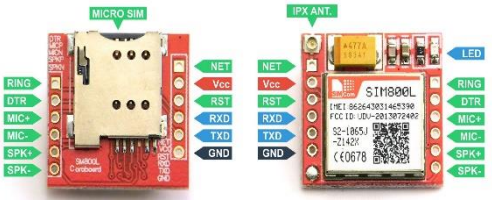

Fig. 3.4: SIM800L GSM Module

3.5 L298n Motor Driver

This L298N Motor Driver Module is a high-power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control

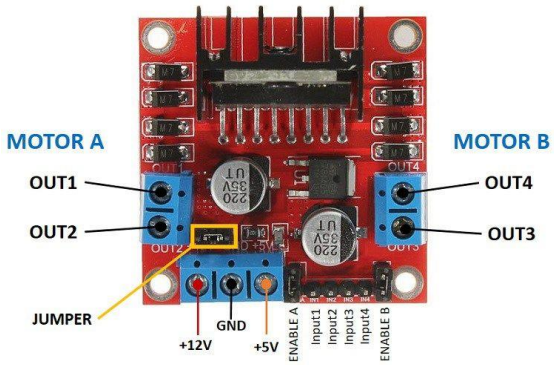

Fig. 3.5: L298n Motor Driver

4. SYSTEM OPERATION

In our task, there are two arrangements of ultraviolet sensor units fitted to the front side of the vehicle. This unit is utilized to enact/deactivate the GSM transmitter unit when it experiences any breaks in the track. The sensors in the circuit are used to sense the cracks which occur when the programmed value changes. At the point when the vehicle is Powered On, it moves along the model track. The sensors persistently screen the state of the tracks. In normal conditions, the motor, transmission is in the initial stage. When the battery power supplies the microcontroller then it starts the motor in a forward direction and serial transmission is used to send the messages to the microcontroller. When the break is identified by the Ultrasonic sensors the vehicle stops without a moment's delay and the GSM module sends the instant message to the predefined number with the assistance of a SIM card that is embedded into the module and the situation of the break is sent alongside the message including the GPS module subsequently this empowers the administrator to

find the situation of break effectively at the hour of support.

4.1 At Normal Condition:

At normal condition, the vehicle is continuously sensing the defined track and the vehicle is running continuously with the fine message on the LCD.

4.2 At Crack Condition:

As soon as the crack is detected by the system the UV sensor reflects the value equal to zero and the vehicle stops at once, The GSM module sends the instant message to the predefined number with the assistance of a SIM card that is embedded into the module to send the SMS and the GPS beneficiary locates the situation of the vehicle to get the Latitude and Longitude directions of the vehicle position, from satellites. The Latitude and Longitude organizes got by GPS are changed over into an instant message which is finished by a microcontroller.

4.3 Flow Chart

The flowchart drawn below describes the step-by-step procedure involved in the working of our Model.

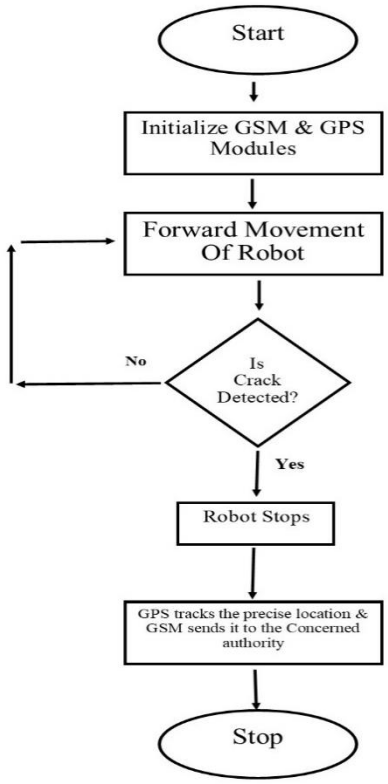

Fig. 4.3: Flow chart

5. RESULT

Crack is detected and the GPS module sends the SMS to the registered mobile device through the GSM Modem as shown in figure 5. The SMS contains the latitude and longitude data of the damaged track which remains detected by the device

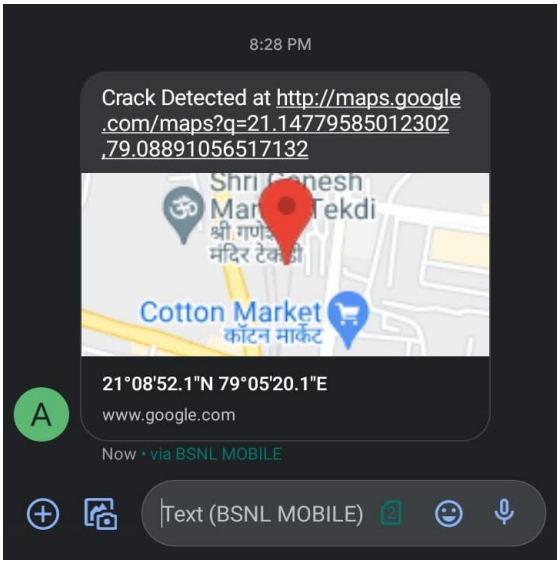

Fig. 5: SMS received in Mobile Phone

6. SCOPE FOR DEVELOPMENT

We can incorporate a vibration sensor to identify the train on the track and a webcam to break down the break when it is recognized. This prototype takes the power supply from a 12v battery that can be replaced by a solar panel which increases its amount of time it can work which was limited with the battery. A more efficient prototype can be built with image recognition which will eventually increase the efficiency and accuracy of the vehicle as the vehicle can differentiate between the minor and the major cracks.

7. CONCLUSION

The method proposed has lots of advantages over conventional detection approaches that include minimal cost, reduced energy consumption, and efficient detection system without human involvement, and shorter analytical times.

we can make an expense proficient and robotized vehicle to distinguish breaks on the rail line track. It will limit the time and expand the work speed and requires less human exertion. Utilizing this we can diminish the odds of rail route track breakages and train mishaps.

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