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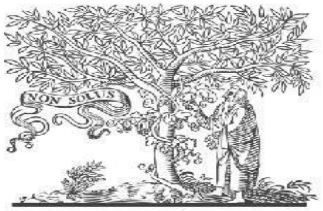

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THE ARDUINO-BASED EMERGENCY RALWAY TRACK FLAWS IDENTIFICATION SYSTEM

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Abstract - Being the most widely utilized and economically advantageous long-distance transportation system in the nation, the Indian Railways operate one of the largest railway networks in the world and provide the most significant form of public transportation in India. The identification of track fractures is the key issue with a railway examination. If these damages are not stopped early on, they might cause a series of derailments that would cause a significant loss of life and property. By spotting track fractures, the suggested technology prevents train accidents. Furthermore, liable for employing GPS and GSM modules to locate itself, sending SMS messages to authorities to inform them of the issue. By doing this, trains will be protected from harm full railway cracks.

Keywords: Arduino Uno, GPS, GSM, Ultrasonic Sensor, Buzzer

I.INTRODUCTION

One of the most important routes of transportation in our nation is the railway, but the fact that our nation's railway lines are very vulnerable is a source of tremendous sadness. This explains why there are so many accidents each year. We lose a significant number of lives each year as a result of this outdated kind of railway track and the effects of those incidents. These kinds of instances urge us to consider the aforementioned problem and take appropriate action to safeguard those lives.[1] We must develop a more advanced and safe railway system using our suggested method. In India, the rail transport sector is expanding quickly. Even though it is one of the main routes of transportation.

According to an online study, derailments are to blame for 60% of all railway accidents, while current data indicates that rail cracks are to blame for 90% of all[2]. Thus, it does not make human life any safer. Extreme care must be taken with this. These are ignored, and the tracks are not properly

Maintained. The proposed system features a robot that will run automatically along the rails, unlike the current method, which requires that the .work to be done by hand.

The solution being suggested includes a robot that will autonomously move along the rails rather than the prior method's requirement that the task be done manually. An ultrasonic sensor is employed to solve this drawback since it can correctly identify the break.[3] The current system is cumbersome, time-consuming, and sluggish. This system's planned GSM and GPS module will send the closest train station a short message service (SMS) including the current position or coordinates.

A. Problem Identification

The primary problem has been the lack of accessible and reliable technology to identify problems with the train tracks caused by improper rail maintenance, which has led to the creation of rail fractures. This issue has caused a number of derailments in the past, which have resulted in significant losses of life and property. Although it has been shown that rail cracks are the primary cause of derailments in the past, there haven't been any accessible low-cost automated options for testing.

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II.PROPOSED METHOD

A.Working Principle

The constraints of the current technologies utilized for the detection of defective tracks are overcome by the suggested approach. The Arduino UNO board is what we're employing in this suggested system. The open-source Arduino is an integrated development environment that drastically streamlined the coding process. The ultrasonic sensor used in the suggested system is for fracture detection. DC motors are driven by motor driver L293D. An Arduino controller is used to control the sensor outputs and communicate data via a GSM module, whose job it is to send an SMS to the base station anytime it detects a crack or impediment. The precise latitudinal and longitudinal positions of the flawed track are determined using the GPS module. This technique can also find hairline fractures, which are invisible to the naked eye. Additionally, it has a buzzer that activates when a crack is found. This uses the battery as the power source for testing tracks. Hence, The suggested system is productive and economical.

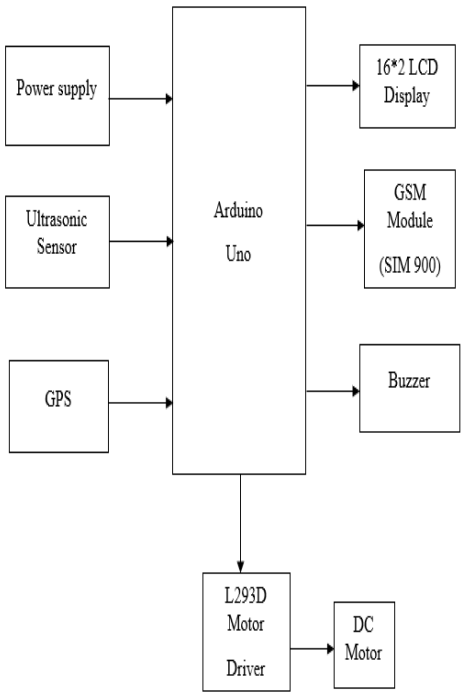

Figure1: Block Diagram

B. Schematic Diagram

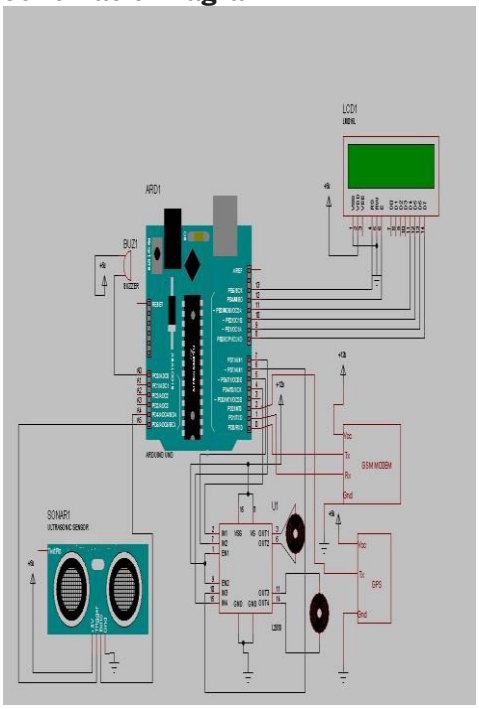

Figure 2: Schematic Diagram

C. Operation of the System

Above diagram shows the block diagram of the proposed work "Emergency Fault Identification System In Railway Tracks Using Arduino". An Arduino Uno microcontroller serves as the system's central processing unit in this setup. The operations of the circuit are managed by this microcontroller. This microcontroller interfaces with several components to carry out the system's required activities. This system's hardware components need a power source to function. The system's attached rechargeable battery supplies this power. By not picking up the echo from the track, an ultrasonic sensor may identify cracks in railway tracks; No fracture is discovered on the tape if the echo sound is picked up. The GPS, GSM, and motor driver ICs are connected to the microcontroller via wires. receives the output from the ultrasonic sensor. The microcontroller's memory stores a mobile number to which the GSM module sends the message. A link to a Google map that displays the route where the fracture was discovered is provided by the GPS in the message that was received. The microcontroller will use GPS to determine the position and send it to a control station if a crack is discovered.

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The robot can move forward with the help of two DC gear motors. The microprocessor is connected to and in control of these motors. A driver circuit is needed to interface between the microcontroller and the motors in order to run these motors using a microcontroller. The suggested system's architecture also includes a microcontroller and 16x2 LCD display are connected for display purposes.. The longitude and latitude values of the crack identified by the system will be shown on this LCD display, and a buzzer will active.

D.Flow Chart

The project consists of ultrasonic sensor, GPS, GSM and Buzzer. Primarily it Initialises the GPS, GSM and Ultrasonic Sensor. Then the Robot start moving in the forward direction and in LCD it shows the distance measurement and when the crack is detected which is greater then 6cm the robot stops and obtains the location's GPS coordinates and transmits the GPS and GSM coordinates to the specified number and Buzzer will active.

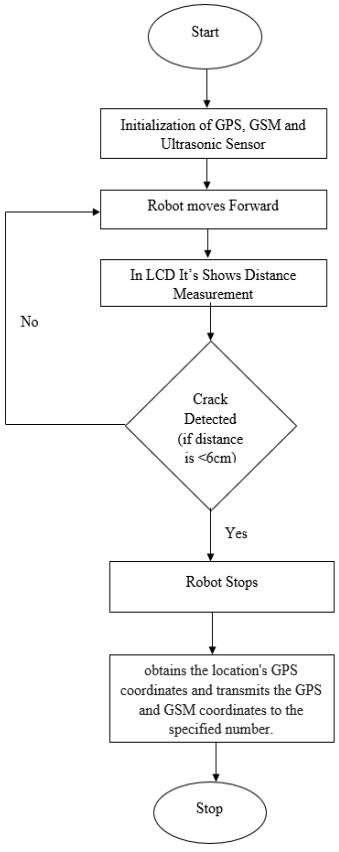

Figure3: Flow Chart

III. SYSTEM DEVELOPMENT

A.Arduino UNO

Arduino is a programmable circuit that is simpler to use and has opensource hardware and software. It has a robust natural constitution and can sustain objects with ease. This emphasizes the ATmega328[4]. It has a USB interface, an ICSP connection, 6 analogue outputs, 14 digital I/O connectors, a power jack, and a reset switch. To dump software, utilize the USB port. The power supply is housed in a power jacket.

The battery being utilized is a 12V/1Amp battery either power required to run the card can be supplied by using USB to connect it to the laptop or using an ACDC's power source[5].

Figure4: Arduino Uno

B.Ultrasonic Sensor

The ultrasonic sensor is electronic device that generates ultrasound sound waves , converts the sound wave delivered into electrical signal waves to determine the distance to a certain object. Ultrasonic waves may move more quickly than electrical signals, such as sound that people can hear. On the HC-SR04, you only need to be concerned about the four pins .The output pin is trig, and the power source is 5 volts[6]. Echo is a pin for input. Both a transmitter and a receiver are part of it.

Figure5: Ultrasonic Sensor

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This inexpensive sensor has non-contact measurement capabilities from 2 cm to 400 cm with a range accuracy that can go up to 3mm.

C.GSM

The Global Mobile Communication System (GMCS) SIM 900 module is seen in the diagram below. A GSM module is a specific type of device that supports GSM modems and has a serial link, USB, Bluetooth, or a mobile phone. Programmes like SMS may send and receive messages through the modem interface thanks to a GSM module.

Figure6:GSM

The costs associated with receiving and sending this communication are identical to those directly associated with using a mobile phone. For transmitting and receiving Text messages, a GSM modem must be compliant with a "expanded set of AT instructions". To make all comments active, use the AT (attention) symbol. AT+CMGF=1 (CM stands for command, and F for format.). When F=1, text format is used.

D.GPS

GPS stands for the Global Positioning System. It is a satellite communication technology used to pinpoint an object's journey across the planet. A GPS receiver uses signals that are transmitted by GPS satellites that are located far above the Earth to determine its precise location. After that, the location is shown on a map or in a latitude and longitude view.

Figure7: GPS

E.LCD

There are several uses for an LCD screen, often called an electronic display module. A 16x2 LCD display is a fairly straightforward module that is frequently utilised in a variety of gadgets and circuits. This LCD's working voltage ranges from 4.7V to 5.3V. There are two rows, each of which may output 16 characters. With no lighting, the current use is 1 Ma[7]. Alphanumeric LCDs display letters and numbers. Can displays operate in both 4-bit and 8-bit modes. Blue & Green Backlight versions of these are available. Several custom-generated characters are displayed.

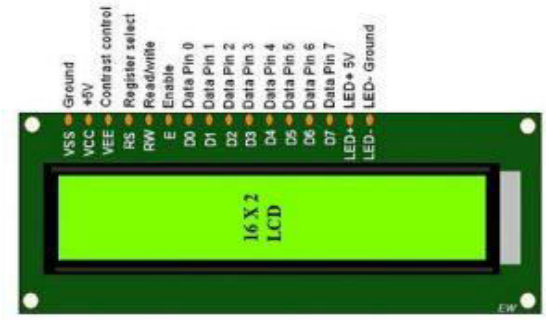

Figure8:16*2 LCD

The longitude and latitude values of the fracture that the system has identified will be shown on this LCD display.

F. L293D Motor Driver

The Motor Driver is a module for keeping track of both the engine and motor speeds. the engine .The L293D IC is the controller seen here. A motor controller with a 16-pin IC is called the L293D. The bidirectional drive current may be supplied by this motor controller between 5 V and 36 V at various voltages.

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Figure9: L293D Motor Driver

G.DC Motor

The tool that transforms electrical power into mechanical power is a DC motor. A dynamic supply voltage or altering the current intensity in the field windings of the DC motor can be used to control speed. The engine velocity increases with input voltage strength[9].The design employs two 300 rpm direct current motors. The robot is propelled forward by two DC gear motors. The microprocessor interfaces and controls these motors.

Figure10: DC Motor

H.Buzzer

Electrical energy is transformed into sound energy by the buzzer. This output can either sound like a beeping or a buzzing. Positive and negative pins, denoted by the (+) sign or a longer terminal lead, make up this device. may be powered by DC at 6 volts. Short terminal leads are used to indicate negative. Normally connected to the circuit's ground. Copper wire, nails, a battery, an armature, and an electronic buzzer make up this item.

Figure11:Buzzer

Likewise, if a crack is found in a railway track, a buzzer will mount it and make a sound to warn everyone around.

IV.IMPLEMENTATION

Hardware that was previously described in the system design description is used to construct the proposed module in this instance hardware.

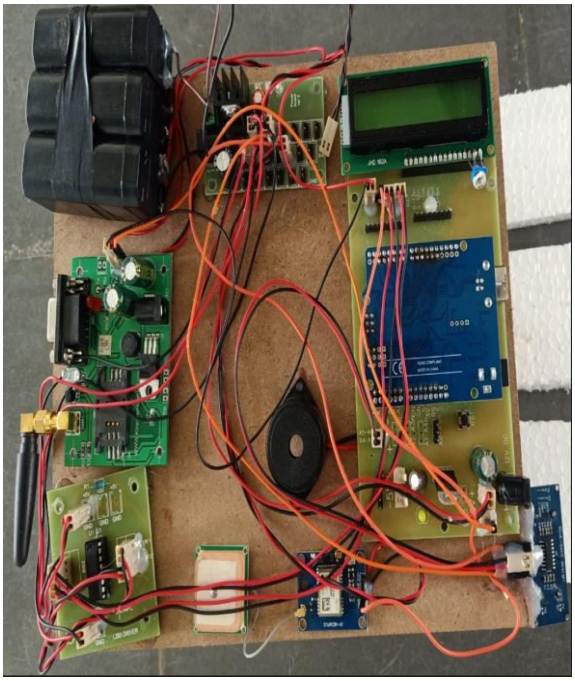

Figure12: Prototype of Hardware Implementation

V.RESULT

The GSM will send a message to the designated registered number when Crack is detected.

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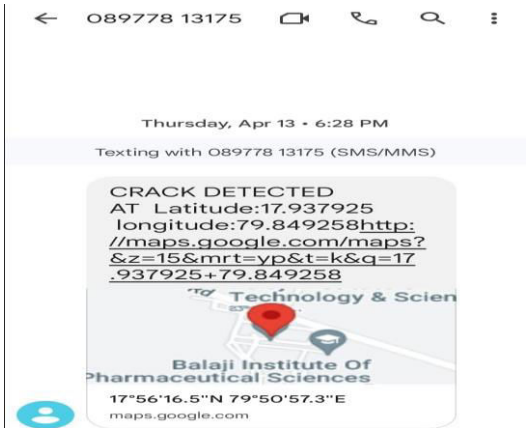

Figure13: Message Received from GSM

VI.CONCLUSION

The proposed technology is capable of identifying track fractures. The suggested system has various benefits over conventional approaches, including lower costs, reduced power usage, a quick detection system without human interaction, and shorter analysis times. To preserve safety and avoid accidents and derailments, railway firms must invest in crack detecting equipment.

VII.FUTURE SCOPE

In the future, power reduction will be achieved by solar panels instead of switching batteries. Additionally, we can also make the hardware kit water-resistant in advance by making it waterproof.

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