Railway Track Monitoring System Using Arduino with LoRa

Soumya Cheedella, Jyothirmayee Manne, Karthik Vamsi B, Navya Yalamanchili

Abstract— Railways provide the cheapest and most convenient mode of passenger transport both for long distance and suburban traffic. Also, most of the transport in India is being carried out by railway network. Still, accidents are the major concern in terms of railway track crossing and unidentified crack in rail tracks in Indian railway. About 60% accidents are occurring at railway track crossing and due to crack in railway tracks resulting in loss of precious life and loss of economy. Therefore there is need to think about new technology which is robust, efficient and stable for both crack detection in railway track and object detection. This project proposes faulty rail track detection and object detection system. This project discusses a Railway track crack detection using IOT and is a dynamic approach which combines the use of GPS tracking system and WIFI module to send alert messages and the geographical coordinate of location. The Arduino and LoRa are used to control and coordinate the activities of these devices. This project prevents train derailment by detecting a crack in railway track using internet of things technology

Index Terms— IR Sensors, LoRa ,GPS, GSM, Arduino UNO, Ultrasonic Sensors, WIFI module,

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1 INTRODUCTION

India has the fourth largest railway networking in the world after the United States, Russia and China. Indian rail network is still following the increasing trajectory to fulfill the commutation requirement of large population economically. The rail network traverses every length and breadth of the country and is known to carry over 30 million passengers and 2.8 million tons of freight daily. In spite of that in terms of the reliability and safety parameters, we are yet a bit away from true global standards. Though rail transportation in India growing fast but due to inadequate safety measures, there have been frequent derailments that have resulted in severe loss of valuables and human lives. One of the major causes of such rail accidents according to the statistics is crack developed in railway track shown in Figure , which may occur either due to improper maintenance or antisocial activities. Manual inspectionof track is a tedious job.

2 EXISTING SYSTEM

In existing To overcome this issue multiple techniques have been proposed which involve graphical inspections, Non-destructive testing (NDT) technologies such as acoustic emissions, magnetic field methods, radiography, thermal field methods, fiber optic sensors of various kinds, use of LDR etc. Another composite detection system is proposed which consists of laser source, a digital processing CCD camera and a supervision system. These existing systems for detection of crack are either not very accurate or a bit of cumbersome process.
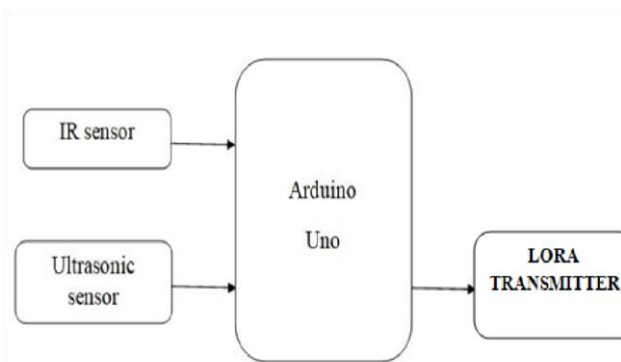
2.1 PROPOSED SYSTEM

The basic objective of the proposed work is to develop a low cost breakage detection system of railway tracks using ultrasonic sensors and IR sensor send the location information to the authorized personnel for further action.

3 BLOCK DIAGRAM

3.1 BLOCK DIAGRAM EXPLANATION

In this project, we are used two Arduino Uno, IR sensor, and Ultrasonic sensor this is using to find the crack and obstacle detection if any crack detected on the railway track means the proposed system will automatically indicate the train driver
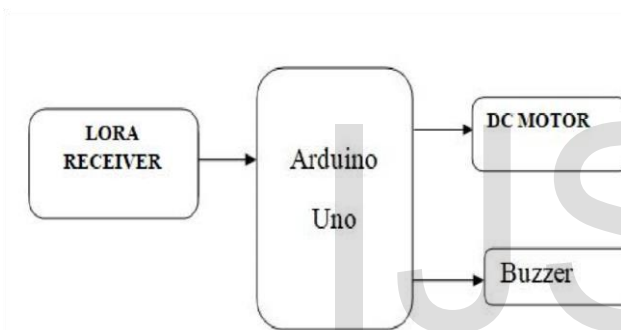
TRANSMITTER SECTION

RECEIVER SECTION

4 HARDWARE COMPONENTS

4.1 ARDUINO

Arduino is a software company, project, and user community that designs and manufactures computer open-source hardware ,open-source software, and microcontroller-based kits for building digital devices and interactive objects that can sense and control physical devices. The project is based on microcontroller board designs, produced by several vendors, using various microcontrollers

These systems provide sets of digital and analog I/O pins that can interface to various expansion boards (termed shields) and other circuits. The boards feature serial communication interfaces, including Universal Serial Bus (USB) on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino project provides an integrated development environment(IDE) based on a programming language named Processing, which also supports the languages C and C++.
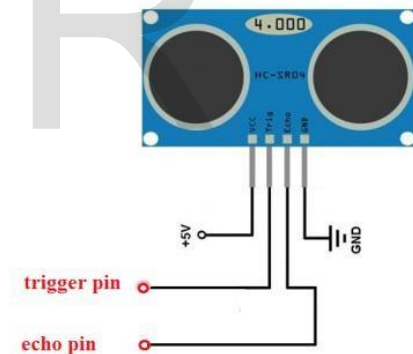
The first Arduino was introduced in 2005, aiming to provide a low cost, easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.
Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board.

4.2 ULTRASONIC SENSOR

There is provided an ultrasonic diagnostic system in which an ultrasonic probe is detachably connected thereto, and ultrasonic waves are transmitted from the ultrasonic probe into the subject to obtain received signals through receiving the ultrasonic waves reflected within the subject, thereby displaying for a diagnosis an image carrying information based on the received signals, and is also provided an ultrasonic module including a processing circuit for the received signals, the ultrasonic module being used in the ultrasonic diagnostic system.

The Ultrasonic Sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has 2 openings on its front. One opening transmits ultrasonic waves, (like a tiny speaker), the other receives them, (like a tiny-microphone. The ultrasonic module is connected through a general-purpose interface to a computer system. An ultrasonic module, which has, as a main element, an analog unit for

performing an analog signal processing, is connected to another computer system.

4.3 IR SENSOR

IR transmitter and receiver can be obtained at low price. Their shape is looks exactly the same as LED. To distinguish between transmitter and receiver, the transmitter always come in clear LED while receiver is black in color. Other than that, there is also receiver that is used to pick up specific frequency IR, 38kHz. For your information, 38kHz frequency IR is commonly used in remote control. IR transmitter will emit infra-red when powered. You can connect the IR transmitter like a LED together with a current limiting resistor. The current limiting resistor is used to prevent too much of current passing through the transmitter and burnt it. I am using 330 ohms resistor for the IR transmitter.

4.4 DC MOTOR

DC engines are arranged in numerous sorts and sizes, including brush less, servo, and apparatus engine composes. An engine comprises of a rotor and a changeless attractive field stator. The attractive field is kept up utilizing either changeless magnets or electromagnetic windings. DC engines are most regularly utilized in factor speed and torque. Movement and controls cover an extensive variety of parts that somehow are utilized to produce as well as control movement. Regions inside this class incorporate direction and bushings, grips and brakes, controls and drives, drive parts, encoders and resolves, Integrated movement control, restrict switches, straight actuators, straight and rotating movement segments, straight position detecting, motors(both AC and DC engines), introduction position detecting, pneumatics and pneumatic segments, situating stages, slides and aides, control transmission(mechanical),seals, slip rings, solenoids, springs.

4.5 GPS

GPS is a system of 30+ navigation satellites circling Earth. We know where they are because they constantly send out signals. A GPS receiver in your phone listens for these signals. Once the receiver calculates its distance from four or more GPS satellites, it can figure out where you are.

The working/operation of Global positioning system is based on the 'trilateration' mathematical principle. The position is determined from the distance measurements to satellites. From the figure, the four satellites are used to determine the position of the receiver on the earth.

5 SOFTWARE COMPONENTS

5.1 ARDUINO IDE

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them.
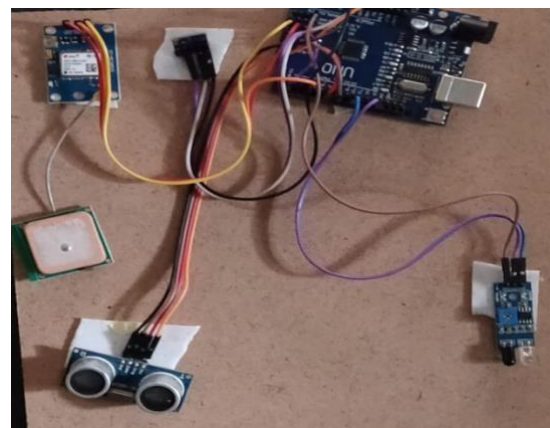
6 RESULT

PROJECT SETUP
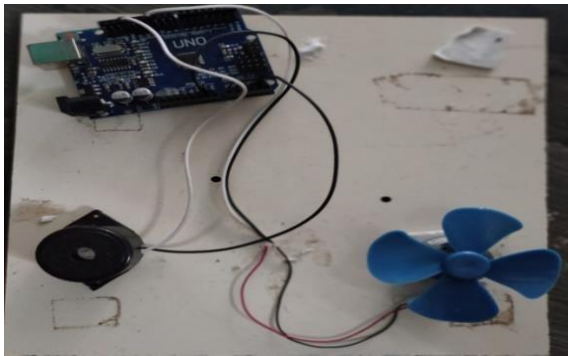

Fig:- Transmitter section

Fig:- Receiver section

7 CONCLUSION

The proposed system can be used to detect the crack effectively and send the location of fault accurately in minimum time to the Predefined Distance. The advantages of the proposed system are that it has no noise, output is very much accurate and the cost is comparatively lesser than the composite system. This system can be used both during daytime and nighttime. Solar panel can be connected to power the system in place of rechargeable battery used for the purpose which would make use of renewable energy sources.

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