

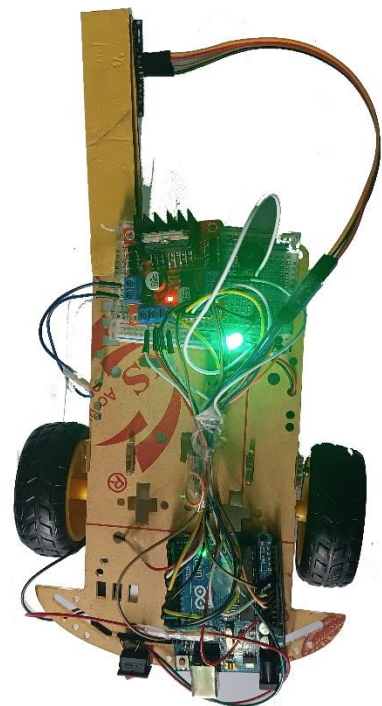
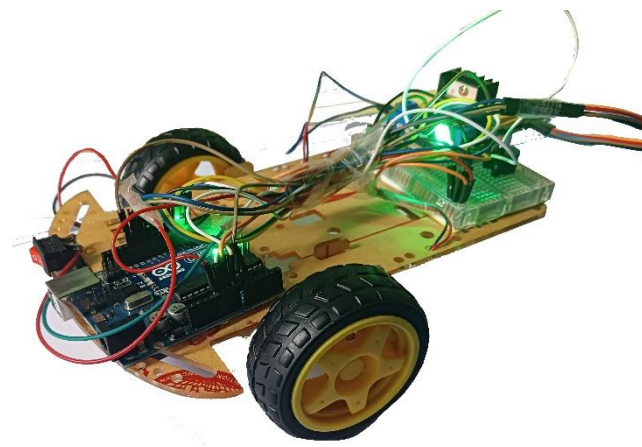


European University of Bangladesh

Project Report

On

Railway Track Crack Detection System Using Ultrasonic Sonar Sensor



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Abstract:

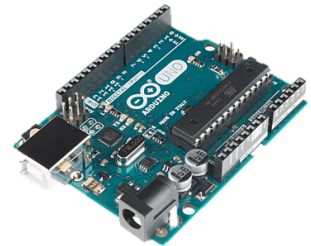
In the whole world, most of the people uses the Railway transports system to travel one place to another place. The proposed system is suitable for railways transportation to identify the cracks in the railway tracks earlier and prevent the accidents. In this project we introduced the integration of ultrasonic sonar sensor and GSM Module to detect the railway track crack problem. This project consists of GPS module, GSM modem for application of communication purpose, ultrasonic sensor crack detection present in the railway track. The GPS module and GSM modem help us to find and sending railway geometric parameter of crack detection to nearest railway station. The importance of this project is applicable both day and night time detection purpose.

List of Components:

1. Arduino
2. Ultrasonic Sonar Sensor
3. GSM Module
4. Motor Driver
5. Motor
6. LED
7. Buzzer
8. 3.7V Lithium Battery

Arduino:

Arduino is an open-source hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. In this project we use Arduino UNO R3. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 digital I/O pins, 6 analog I/O pins, and is programmable with the Arduino IDE. It accepts voltages between 7 and 20 volts.



Ultrasonic Sonar Sensor:

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).



GSM Module:

A customized Global System for Mobile communication (GSM) module is designed for wireless radiation monitoring through Short Messaging Service (SMS). This module is able to receive serial data from radiation monitoring devices such as survey meter or area monitor and transmit the data as text SMS to a host server. There are several type of GSM module. In our project we used GSM SIM800L.



Motor Driver:

A motor is an electronic device that helps convert electrical energy into mechanical energy. Therefore, a motor driver allows you to conduct automatic works using electrical power. Here we Used L298N Motor driver.

Motor:

In our project, we used 2 DC gear motor. This motor connected with motor driver.

LED & Buzzer:

When crack detected, then LED & Buzzer get power.

Battery:

It is the most important component is Battery. It is used for supply the power to circuit connection. Here we use two 3.7V Lithium Battery. It is rechargeable battery.



Block Diagram of this project:

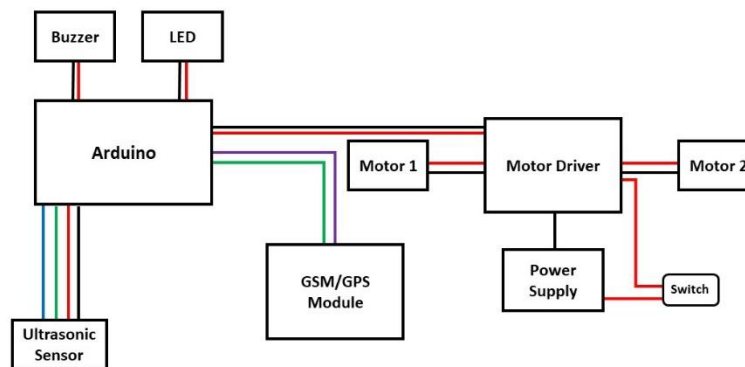
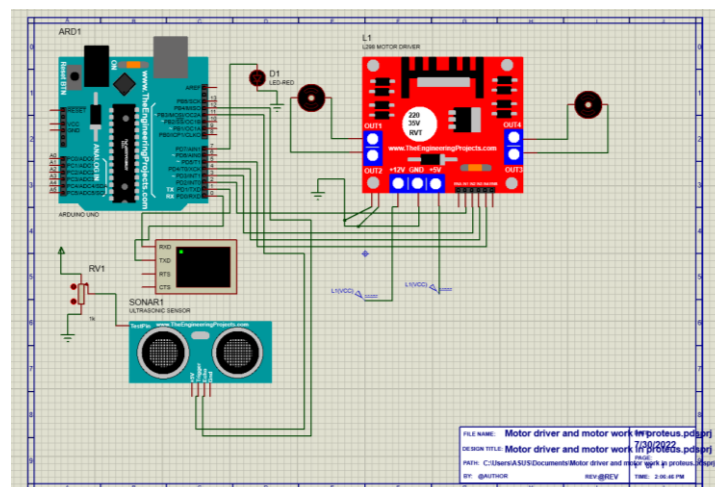


Fig: Railway Track Crack Detection System Block Diagram

Circuit Simulation of this Project:



Coding of this project:

```
int in1 = 13;
int in2 = 6;
int in3 = 4;
int in4 = 5;
int ENA = 9;
int ENB = 10;
int speed = 220;
int trigpin = 11;
int echopin = 12;
int buzzer=A0;
float distance;
float duration;
int led = 7;

void setup() {
  pinMode(in1, OUTPUT);
  pinMode(in2, OUTPUT);
  pinMode(in3, OUTPUT);
  pinMode(in4, OUTPUT);
  pinMode(ENA, OUTPUT);
  pinMode(ENB, OUTPUT);
  pinMode(trigpin, OUTPUT);
  pinMode(echopin, INPUT);
  pinMode(led, OUTPUT);
  pinMode(buzzer,OUTPUT);
  Serial.begin(9600);
}

void loop() {
  analogWrite(ENA, speed);
  analogWrite(ENB, speed);
  digitalWrite(trigpin, LOW);
  delay(2);
  digitalWrite(trigpin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigpin, LOW);
  duration = pulseIn(echopin, HIGH);
  distance = (duration * 0.034) / 2;
  Serial.print("the distance is = ");
  Serial.print(distance);
  Serial.print("cm\n");
  if (distance > 2.5)
  {
    tone(buzzer,450);
    digitalWrite(led, HIGH);
    digitalWrite(in1, LOW);
    digitalWrite(in2, LOW);
    digitalWrite(in3, LOW);
    digitalWrite(in4, LOW);
```

```

}
else
{
  noTone(buzzer);
  digitalWrite(led, LOW);
  digitalWrite(in1, HIGH);
  digitalWrite(in2, LOW);
  digitalWrite(in3, HIGH);
  digitalWrite(in4, LOW);

}
}

```

Working Process:

We used toy car for implement this project. At first connect the power supply with Motor Driver. We used switch for on/off the power supply. Arduino get the power from motor driver. Motor driver also control the Motor 1 and Motor 2. And Arduino control the Buzzer, LED and Ultrasonic sonar sensor. When power supply on, then car start running. If any crack is occurred in the track means longitude and latitude of the place are messaged to the nearest station then car stop running automatically and also power on the LED and Buzzer. Ultrasonic sensor measures the distance between rail line and rail. We set the ultrasonic sensor distance (2.50 cm). When distance is greater than 2.50 cm crack is detected then car stop running. When distance smaller than 2.50 cm then car start running. Here Arduino control the Motor, Buzzer and LED.

Benefits of this project:

- We identified there are any crack in railway track.
- Railway can be saved from accidents.

Problem of this project:

- Power problem of the biggest problem.
- Protecting sensor
- Implementing this prototype in real life is difficult.
- When we are using GSM network connection is difficult.

Conclusion:

In this project, we have presented the ultrasonic sensor based railway crack detection system. The crack can be detected without only error. It does not give false output. The idea can be implemented in large scale in the long run to facilitate better safety standards for rail tracks and provide effective testing infrastructure for achieving better results in the future