Electronic Instruments and Instrumentation Technology
&
Transducer and Measurement Techniques

Development of a low cost vehicle over speed detection system using infrared sensor and capturing data of the vehicle using RFID Tag

Project

Submitted By

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Objective

To design and develop a low cost model which provides flexibility, scalability and responsiveness to curb over speeding among drivers.

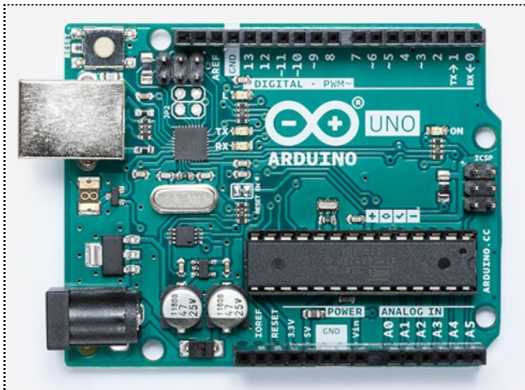
Abstract

The rate of road accidents have increased tremendously. The drivers cause majority of these accidents by over speeding. In order to address this problem, we have tried to develop a system that detects a car which is over speeding and captures all the legal data of the vehicle. Each car on the road has its own RFID Tag. Two infrared sensors are positioned at a distance and a maximum speed is chosen. When the car passes the first sensor, the clock starts and when it passes the second sensor the clock stops. The speed of the car is calculated as the distance between the two sensors is known. If the vehicle is over speeding the RFID reader tags the car using the RFID chip on the car and collects all the information about the car (Car number, Owners identity, etc.). Two measures are taken to slow down the car. First, A segment display is placed a few hundred metres after the car passes the RFID reader which displays the drivers information and the car number and tells them to slow down. Second, A mail is directly sent to the official email id of the owner to pay the fines in accordance with the over speeding traffic rules.

The automatic vehicle tracking facility delivers the flexibility, scalability, and responsiveness that today's traffic police needs. The model requires installing RFID tags on all vehicles and RFID readers on various junctions of location for tracking.

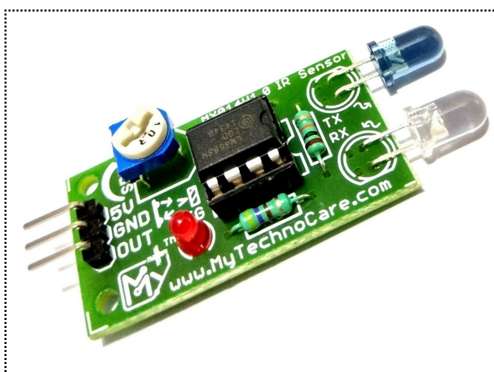
Components Used

- **Arduino Uno**



Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.

- **IR Sensors**

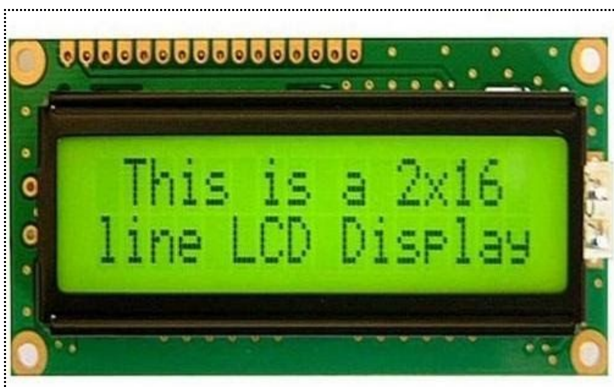


There are two diodes on the IR sensor. The transparent one is the transmitter and the shaded one is the receiver. The transmitter emits wave which bounces off a nearby object and is then received by the receiver. When no object is detected within the range of the IR receiver, the output LED remains off. When an object is detected within the range of the IR sensor the LED glows.

- **RFID Tag and Reader**

Radio-frequency identification (RFID) use electromagnetic fields to identify and tag objects. The tags contain electronically stored information. RFID works similar to barcode but the main feature is that the tags do not need to be within the line of sight of the reader. Thus, the tag can be embedded into objects.

- LCD (16*2)

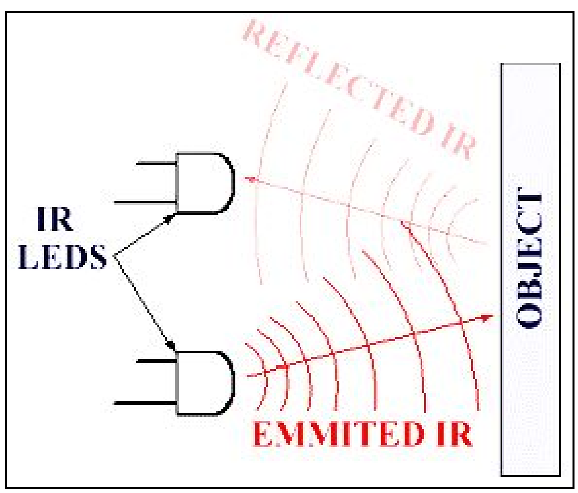


- LEDs
- Breadboard
- Wires

Timeline

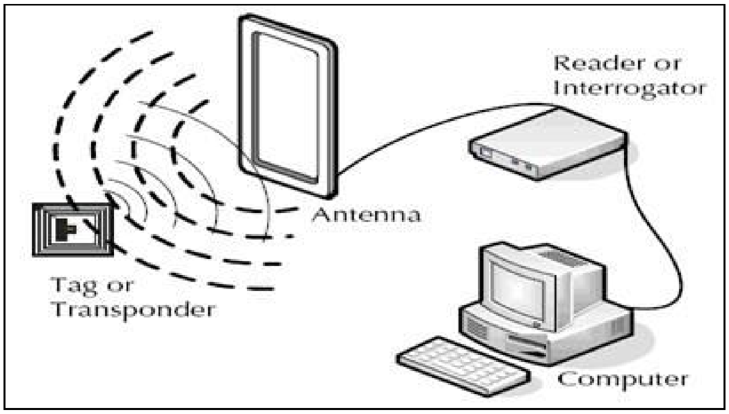
S.No	Target	Date
1	Collection of all the Components	17-10-2019
2	Setting Up the IR Sensors	19-10-2019
3	Setting Up the LCD Screen	22-10-2019
4	Writing the Initial Arduino Code	23-10-2019
5	Setting Up the Rfid Sensors	03-11-2019
6	Finalising - Aesthetics & Arduino Code	11-11-2019

Methodology

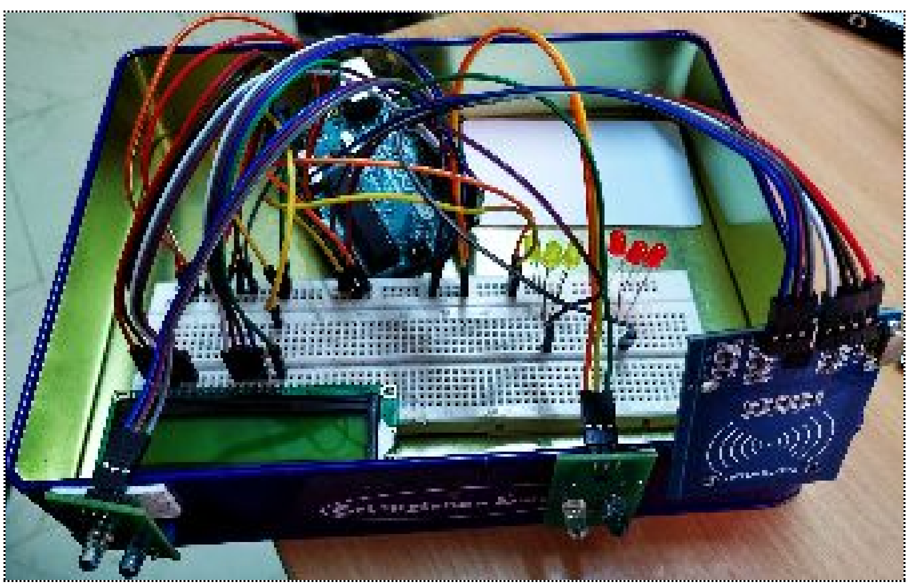


There are 2 IR sensors placed at a distance of 15 cm from each other. When an object moves first IR Sensor - 1 picks up the signal and the timing clock starts. When the objects after 15 cm moves in front of IR Sensor - 2, the clock stops. We know the distance between the sensors and the time taken to travel the distance. Hence, we can calculate the speed of the moving object.

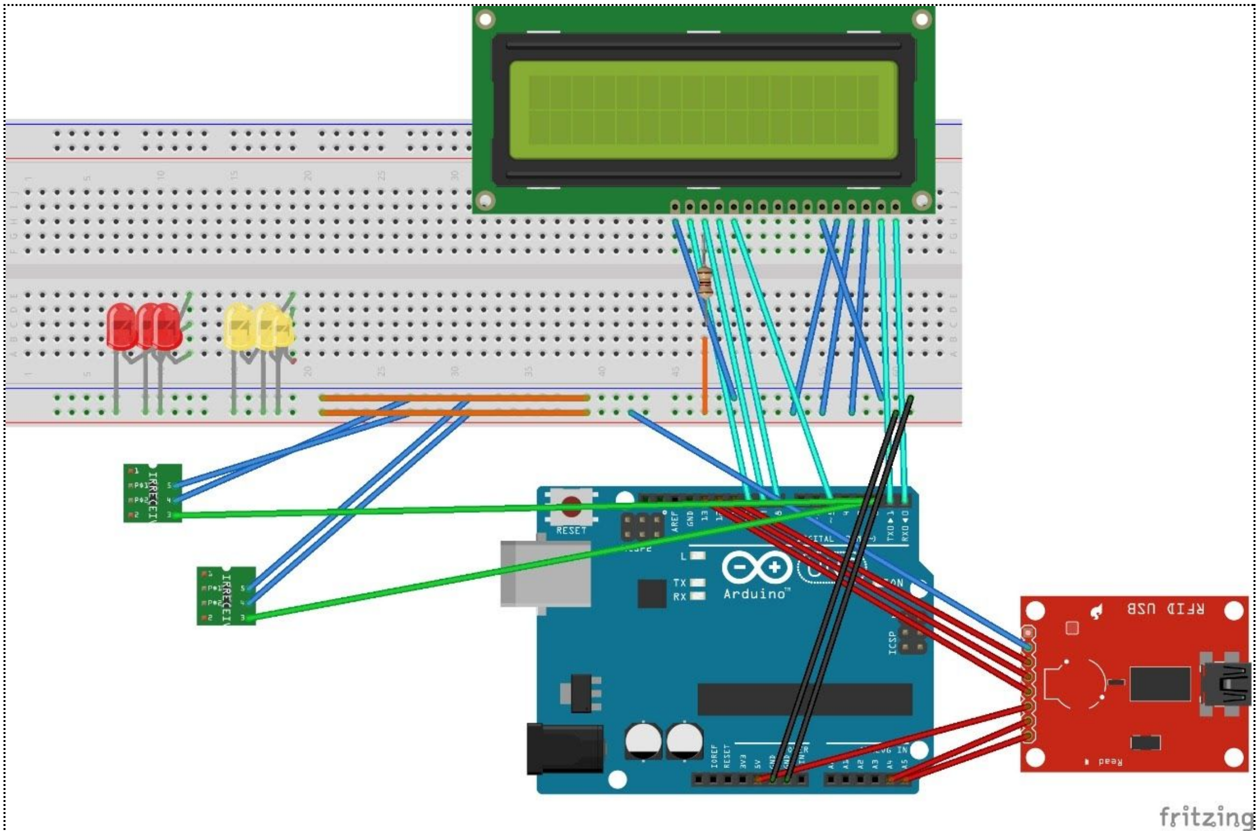
Once, the speed is calculated, we have specified in the code the speed limit which is set at *50 cm/s*. If the calculated speed is less than the specified speed, the LED turns green and no further action is required. The speed of the moving object is also displayed on the LCD screen.



If the calculated speed is greater than the specified speed, the LED turns RED - communicating to the driver that he/she is over speeding and needs to slow down. The speed of the moving object is also displayed on the LCD screen. Next, the RFID reader turns active and tags the RFID present in the tag. The UID Tag is displayed on the LCD.



Circuit Design



Tool Used : Fritzing

It is an open source software which helps you to create CAD design of electronics hardware, that supports designers to move from experimenting with a prototype to building a more permanent circuit.

Observations

- When a car is moving within permissible speeds - the speed of the car is displayed on the LCD screen and the LED lights turn *green*.

- When a car is over-speeding - the speed of the car is displayed on the LCD screen, the LED lights turn *red* and the computer screen displays the relevant legal data of the car.

Limitations

1. RFID Tags need to be installed in each and every car. Government has to make this a mandatory rule.

2. The IR sensors need to be sensitive to multiple cars crossing at a time.

3. The RFID Tag reader should be sensitive enough to capture the data of the car going at high speeds. Response time should be almost negligible.

Conclusion

We have successfully designed and constructed a low cost method to curb over speeding among drivers. Using more advanced products can help the model to overcome its limitations. The model offers flexibility, scalability and responsiveness that today's traffic police require.

Software Code

```
#include <LiquidCrystal.h>
#include <SPI.h>
#include <MFRC522.h>

#define SS_PIN A4
#define RST_PIN A5
MFRC522 mfrc522(SS_PIN, RST_PIN);   // Create MFRC522 instance.

// initialize sensor pins, lcd pins and other time & velocity variables
const int ProxSensor=2;
const int ProxSensor2=4;
float t1=0.0,t2=0.0;
float r = 0.0;
int ledPin=7;
int flag = 0;

LiquidCrystal lcd(0, 1, 8, 9, 10, 5);

void setup(){

    //initialize lcd and print constant text
    lcd.begin(16, 2);
    lcd.print("Speed(in cm/s):");

    pinMode(3, OUTPUT);
    pinMode(7, OUTPUT);
    pinMode(ProxSensor,INPUT);
    pinMode(ProxSensor2,INPUT);
```

```
    pinMode(ProxSensor2,INPUT);

    // shift to next row of lcd display
    lcd.setCursor(0, 1);

    SPI.begin();      // Initiate  SPI bus
    mfrc522.PCD_Init();   // Initiate MFRC522

}

void loop() {
    if(digitalRead(ProxSensor)==HIGH){
      t1 = (float)millis();
    }
    else{
      //do nothing
    }

    if(digitalRead(ProxSensor2)==HIGH){
      t2 = (float)millis();
    }
    else{
     //do nothing
    }

    if(t1!=0){
      r = (float)(t2-t1);
    }
```

```
if(r>0){
  r = 10000/r;
  lcd.print(r,2);
  delay(200);
  if(r>70.0){
    lcd.print(" Overspeed");
    digitalWrite(3,HIGH);
    delay(500);
  }
  else{
    lcd.print(" Good to go");
    digitalWrite(7,HIGH);
    delay(500);
  }

  //reset LEDS
  digitalWrite(7,LOW);
```

```
digitalWrite(3,LOW);
lcd.clear();

lcd.begin(16, 2);
lcd.print("UID Tag : ");
lcd.setCursor(0, 1);



// reset time & speed variables
t1=0.0;
t2=0.0;
r=0.0;

//rfid searching
if ( ! mfrc522.PICC_IsNewCardPresent())
{
  return;
}
// Select one of the cards
if ( ! mfrc522.PICC_ReadCardSerial())
{
  return;
}
```

```
        //Show UID on LCD
        String content= "";
        byte letter;
        for (byte i = 0; i < mfrc522.uid.size; i++)
        {
           lcd.print(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " ");
           lcd.print(mfrc522.uid.uidByte[i], HEX);
           content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " "));
           content.concat(String(mfrc522.uid.uidByte[i], HEX));
        }

        delay(2000);

        //reset LCD
        lcd.clear();

        lcd.begin(16, 2);
        lcd.print("Speed(in cm/s):");
        lcd.setCursor(0, 1);
      }
}
```

Contribution

Amit Mishra - Methodology, Timeline, About: IR, About: RFID
Dhairya Parekh - Methodology, Timeline, About: IR, About: RFID
Pratik Rathi - Abstract, Methodology, Conclusions & Limitations
Shrey Khokhra - Circuit Design, Observation, About: Arduino Uno(R3)
Aakash Srivastava - About: LCD