Ahsanullah University of Science & Technology
Department of Computer Science & Engineering
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CSE 3216 Microcontroller Based System Design Lab

Project Report

Project Name: *Smart vehicle speed limit enforcement system*

Submitted To

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Objective

In Bangladesh the growing accident rates on national highways are becoming a huge concern. The tendency to over-speed can be curtailed by effective implementation of traffic laws against over-speeding and effective ticketing to punish the offenders. Hence, a reliable system for speed violation detection and effective ticketing is required. The current system of speed-sensing and ticketing relies on manual processes and manual interventions. This results in a lower effectiveness of the same. The objective of this project is to propose a system that will use the RFID Tag mandated by the government of Bangladesh for all registered vehicles, to detect over- speeding vehicles and issue the ticket by scanning the RFID tag of the violating vehicle. The proposed system includes the use of smart speed breaker to keep the speed of a vehicle in control.

Social Values

The Smart vehicle speed law enforcement system will confirm normal speed on the road and will eradicate over speeding. As a result the drivers will have more values which will prevent them from irresponsible deeds like running vehicles on high speed. We all know that speeding on the road can be dangerous and lead to crashes, but we also know that slowing down can save lives. Our project will help people stay alert and reduce vehicle speed which will save money, reduce congestion and increase traffic safety. This will create a whole social value. People will learn from their mistakes and change their attitude on the road.

Required Components

These following parts and tools are required for building this project

- Arduino Uno
- HC-05 Bluetooth Module
- Ultrasonic Sonar Sensor HC- SR04
- LED

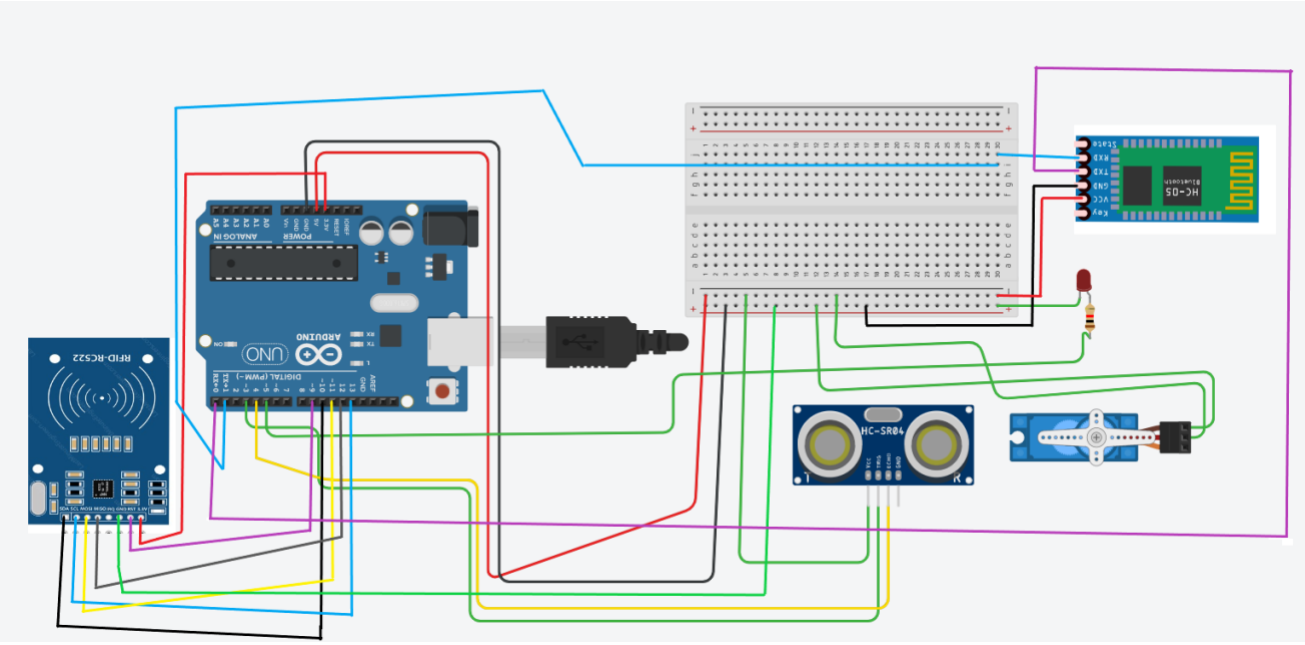
- RFID module
- Mini Servo SG90
- Resistors
- Wire(male to male, male to female, female to female)

Working Procedure

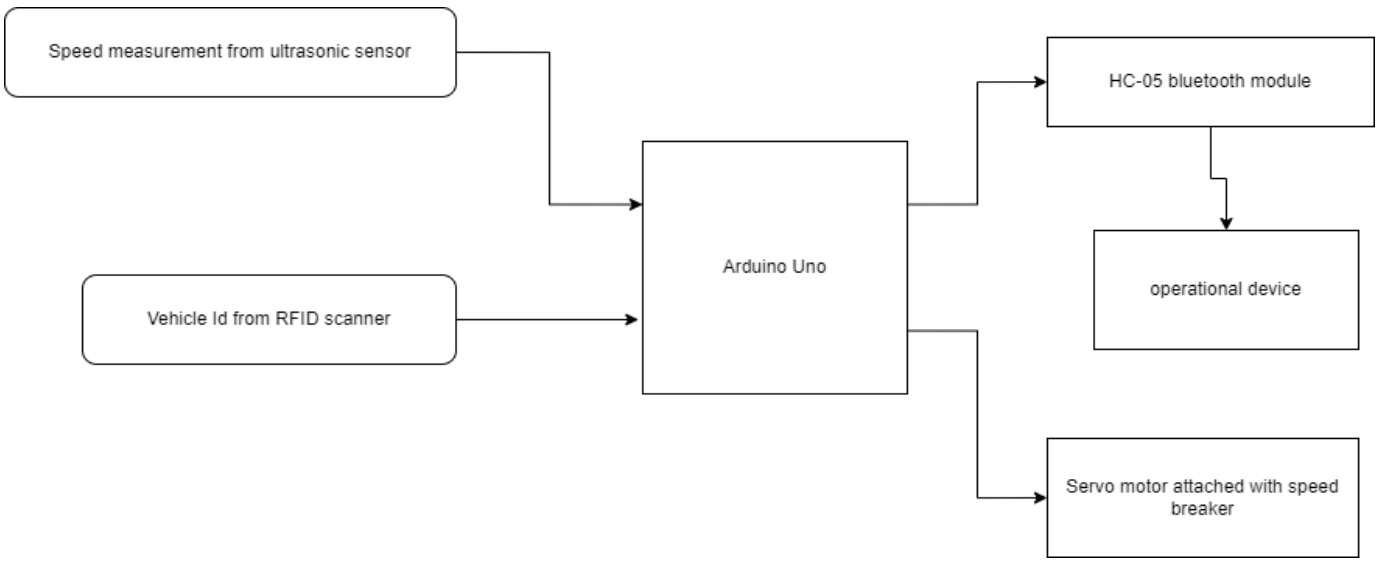
The basic components that react to the input are

- Servo motor it controls the movement of the speed breaker to lift or close
- LED to notify the driver about the over speeding and speed breaker
- RFID module is used for detecting RFID attached with the vehicle
- Bluetooth sensor to send RFID data to the operating device
- Ultrasonic sensor is used to measure the speed of vehicle. We measured the distance travelled by a vehicle in 100 milliseconds after reaching the range of Ultrasonic sensor and calculated the difference. Then by dividing it by the time lapse we got the velocity.

Circuit Diagram



System Diagram



Estimated budget

Equipment	Quantity	Budget(Tk)
Arduino Uno	1	1110
LED	2	10
Ultrasonic Sonar Sensor HC- SR04	1	85
RFID module	1	188
HC-05 Bluetooth Module	1	347
Mini Servo SG90	1	130
Wire(male to male, male to female, female to female)	As required	200
Resistor	2	6
Total		2076

Code

```
       //Arduino Uno Pin used
//servo: 2; Ultrasonic trig: 3, echo: 4;
//RFID sda or SS: 10, sck: 13, mosi: 11, miso: 12

// servo
#include <Servo.h>
//RFID
#include <SPI.h>
#include <MFRC522.h>
//BlueTooth
#include <SoftwareSerial.h>
// Create a servo object
Servo Servo1;
// defines pins numbers------------------------
// Servo motor pins
int servoPin = 2;
// Ultrasonic pins
const int trigPin = 3;
```

```
const int echoPin = 4;
//RFID
#define SS_PIN 10
#define RST_PIN 9
MFRC522 mfrc522(SS_PIN, RST_PIN);  // Create MFRC522 instance.
//led light
const int ledpin = 5;

// defines variables---------------------------
//measure speed
long duration1, duration2;
int distance1, distance2;
int range = 30;
double limit = 80;  // set speed limit

// Main function ********************************
void setup() {
  Serial.begin(9600);  // Starts the serial communication

  // servo
  Servo1.attach(servoPin);
  //ultrasonic
  pinMode(trigPin, OUTPUT);  // Sets the trigPin as an Output
  pinMode(echoPin, INPUT);   // Sets the echoPin as an Input
  //rfid
  SPI.begin();          // Initiate  SPI bus
  mfrc522.PCD_Init();  // Initiate MFRC522

  pinMode(ledpin, OUTPUT);
}
void loop() {
  //Rfid
  String rf = rfidRead();
  // measure speed using ultrasonic sensor
  double speed = measureSpeed();
  // set speed bump up or down using servo motor
  if (speed > limit){
    Serial.print("RFID: ");
    Serial.println(rf);
    Serial.println("\n");
    digitalWrite(ledpin, HIGH);
    Serial.print("speed: ");
    Serial.print(speed);
    Serial.println("m/s");
    setBump(speed);
  }
    Servo1.write(54);
}

// User Defined Functions    +++++++++++++++++++++++++++++++
// set speed breaker using servo motor
void setBump(double speed) {
    Servo1.write(0);  //bump up
    Serial.println("Bump Up");
    delay(2000);
    digitalWrite(ledpin, LOW);
}
```

```
// Speed Measure function using ultrasonic
int measureSpeed() {
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);  // Sets the trigPin on HIGH state for 10 micro
seconds
  //delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration1 = pulseIn(echoPin, HIGH);  // Reads the echoPin, returns the sound
wave travel time in microseconds
  distance1 = duration1 * 0.034 / 2;   // Calculating the distance

  delay(100);  // measure distance 2 after 100 ms
  digitalWrite(trigPin, LOW);

  digitalWrite(trigPin, HIGH);  // Sets the trigPin on HIGH state for 10 micro
seconds
  //delayMicroseconds(10);
  digitalWrite(trigPin, LOW);
  duration2 = pulseIn(echoPin, HIGH);  // Reads the echoPin, returns the sound
wave travel time in microseconds
  distance2 = duration2 * 0.034 / 2;   // Calculating the distance

  if (distance1 <= range && distance2 <= range && distance1 > distance2) {
    //Serial.println(distance1);
    //Serial.println(distance2);
    double speed = abs(distance1 - distance2) / .1;  // m/s
    //Serial.print("speed: ");  // Prints the distance on the Serial Monitor
    //Serial.print(speed);
    //Serial.println("m/s");
    return speed;
  }
  return 0;
}
//RFID
String rfidRead() {
  // Look for new cards
  if (!mfrc522.PICC_IsNewCardPresent()) {
   Serial.print("LOOK: \n");
    return;
  }
  // Select one of the cards
  if (!mfrc522.PICC_ReadCardSerial()) {
   Serial.print("Select: \n");
    return;
  }
  //Show UID on serial monitor
    String content = "";
    byte letter;
    for (byte i = 0; i < mfrc522.uid.size; i++) {
      content.concat(String(mfrc522.uid.uidByte[i] < 0x10 ? " 0" : " "));
      content.concat(String(mfrc522.uid.uidByte[i], HEX));
    }
    Serial.print(content);
    Serial.print("\n");
    return content;  //sending data to loop function to save rfid data
}
```

Member contributions

Each of our group members has equal contribution in this project.

Difficulties

In our project we use a RFID module to detect the vehicle which is over-speeding. But for quality limitations, sometimes we get the Id from the module and sometimes we don't.

Conclusion

The main objective of this system is to make highways safer. In this system, each lane will have a dedicated ultrasonic sensor, RFID reader for detecting the vehicle which is overspending and a automated speed bump to control vehicle speed.
This work can further be developed by adding more sensors and AI cameras for detecting the many other violations like rash driving, overtaking, solid line crossing, inappropriate lane change etc.