UNIVERSITY PARTNER

UNIVERSITY OF WOLVERHAMPTON

HERALD COLLEGE KATHMANDU

Embedded Systems Programming

(4CS016)

Report Writing

on

Speed Detector

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1. Introduction

The Arduino Speed Detector is a dedicated application of the Arduino microcontroller platform for measuring the speed of moving objects. It creates a speed measurement system by combining the capabilities of Arduino boards with sensors and other components. An Arduino board is typically connected to a sensor capable of detecting object motion, such as an optical sensor or an IR proximity sensor, in this case of a speed detector. These sensors send data to the Arduino, which processes it and calculates the object's speed based on the time it takes the object to travel a known distance. These speed detectors have many applications. They can be used in sports training to measure athletes' speeds, in traffic monitoring to enforce speed limits, and in an industrial setting to measure the speed of moving machines. Users can create their own speed detection systems tailored to their needs by using the Arduino Uno platform. (ElectronicsHUB, 2023)

2. Devices Required to build speed Detector

2.1 IR proximity sensor

An IR (infrared) proximity sensor detects the presence or absence of an object within its field of view. It emits and detects reflections from nearby objects using infrared light. An IR proximity sensor is used in speed detector to detect the presence of a moving object, such as a vehicle or person, as it passes by the sensor. (robocraze, 2023)

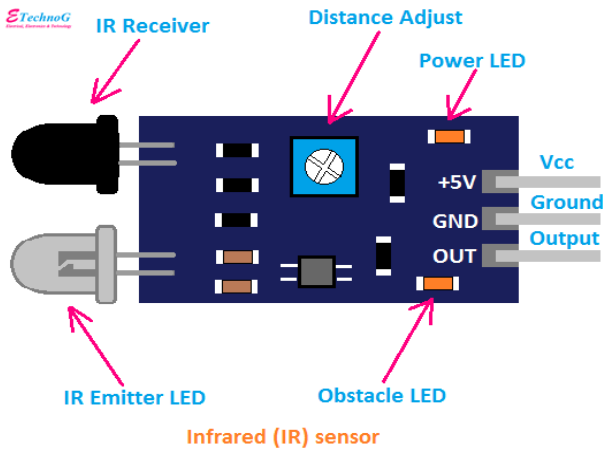

Fig 1 IR proximity sensor

2.2 RGB Diffused Common Cathode

An RGB LED (Light-Emitting Diode) is a type of LED that emits light in three primary colours: red, green, and blue. The RGB LED is diffused, which means the light it emits is spread out for a softer glow. The common cathode configuration means that the cathodes of the RGB LEDs are connected and shared, but the anodes of each colour are controlled separately. RGB LEDs in the speed detector can be used to display various colours or patterns to indicate detected speed or other status information. (RandomNerdTutorials, 2023)

Fig 2 RGB LED

2.3 Arduino UNO

The Arduino UNO is a well-known microcontroller board that is based on the ATmega328p chip. It is the most important component of your speed detector system. The Arduino UNO has digital and analog input/output pins, USB programming and power connections, and a variety of other features that allows you to interface with sensor, control actuators, and run your program. (javaTpoint, 2023)

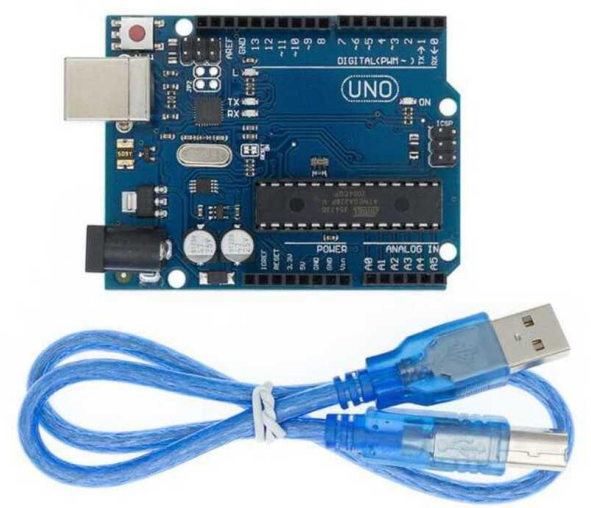

Fig 3 Arduino UNO

2.4 Male/Female Jumper Wires

Jumper wires are used to connect different components in the circuit. Female Patch cords have sockets or receptacles on one end, while male patch cords have exposed pins or connectors. These wires make it simple to connect an Arduino board, an IR proximity sensor, and an RGB LED to build and customize the speed detector. (Hemmings, 2018)

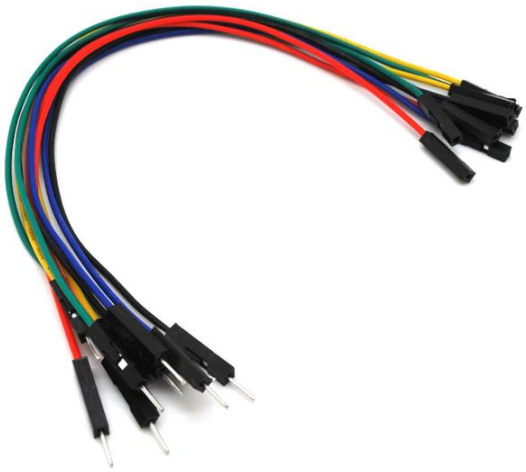

Fig 4 Female jumper wire

2.5 Tinker Cad

Tinkercad is an easy-to-use web-based computer-aided design (CAD) program that allows users to create and design 3D models. It had an easy-to-use interface that makes it suitable for beginners and educational purposes. Tinkercad has a variety of tools and features for designing objects, such as shapes, colors, and transformations. It is often used for 3D printing, prototyping, and the creation of virtual models for a variety of applications. (Tinkercad, 2023)

Fig 5 Logo of Tinkercad

2.6 Fritzing

Fritzing is a free and open-source software application for designing and prototype electronic circuits. It has an easy-to-use interface that allows users, particularly beginners and enthusiasts, to create and document their electronic projects. Fritzing is a visual approach to circuit design that uses a drag-and-drop interface to add components and connect them with wires. It includes a large library of electronic components that can be easily added to a design, such as resistors, capacitors, sensors, and microcontrollers. Users can also create custom components, generate circuit diagrams, PCB layouts, and export Gerber files for manufacturing with Fritzing. Overall, Fritzing simplifies and makes accessible the process of designing and documenting electronic circuits to a wide range of users. (fritzing, 2023)

Fig 6 Logo of Fritzing

3. Method of operation

The Arduino speed detector operates on the principle of detecting the presence of a moving object and measuring the time it takes for the object to travel a known distance using an infrared proximity sensor. The sensor emits infrared light and detects object reflections. When an object enters the sensor's field of view, it reflects the emitted light back, changing the sensor's output state. The timer begins when the object is detected and continues until the object passes the reference point. The elapsed time is measured, and the speed of the object can be calculated using the formula speed=distance/time based on the sensor and the reference point. The calculated

speed can then be displayed or transmitted using a variety of methods that supply real-time information about the speed of moving objects. (ElectronicsHUB, 2018)

4. Circuit Diagram (Tinkercad)

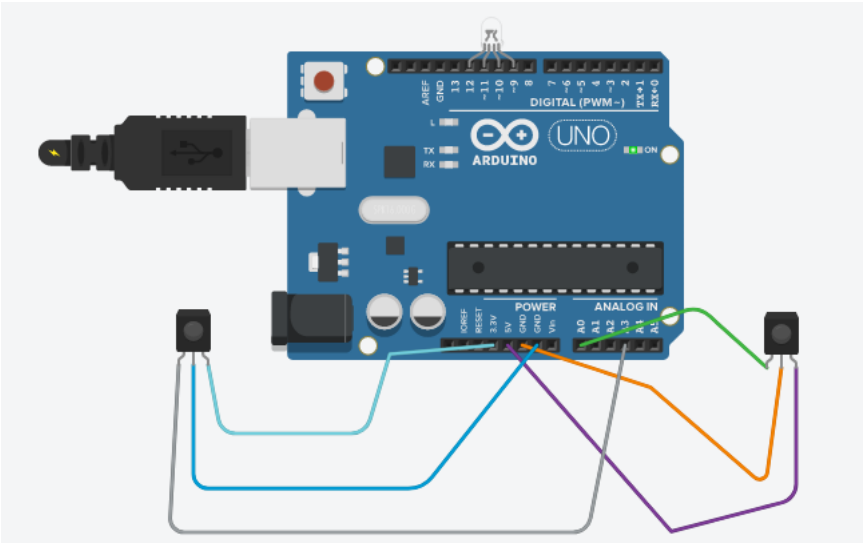

Fig 7 Tinkercad diagram of speed detector

5. Fritzing Diagram

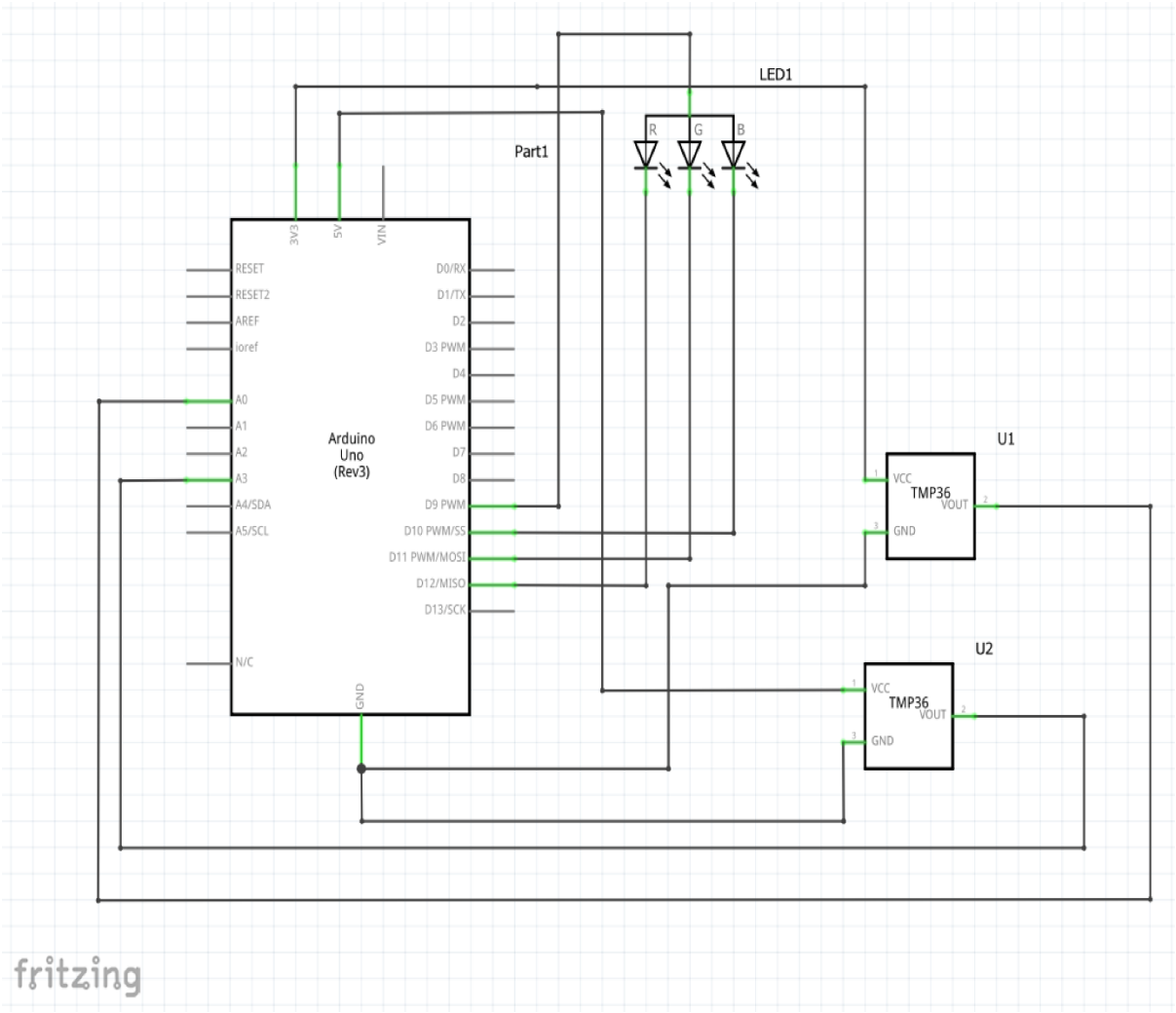

Fig 8 Fritzing diagram of speed detector

6. Code for Speed Detector

```
//Student Name: Naomi Thing
//Student ID: 2332244
//Project Name: Speed Detector
//Date: 2023/05/20

int sen1 = A0;
int sen2 = A3;
int ledPin = 9;
unsigned long t1 = 0;
unsigned long t2 = 0;
int velocity;
int real_velocity;
float timeFirst;
float timeScnd;
float diff;
float speedConst = 7.5; //Speed Conversion constant in centimeter(cm)

void setup()
{
  Serial.begin(9600);
  pinMode(sen1, INPUT);
  pinMode(sen2, INPUT);
```

```
  analogWrite(11, LOW);
  analogWrite(10, HIGH);
}

void loop()
{
  //Checks if an object passed from left to right
  if (analogRead(sen1) < 500 && analogRead(sen2) > 500)
  {
    timeFirst = millis();//records time for first trigger
    digitalWrite(ledPin, LOW);
    delay(30);
  }
  //Checks if an object passed from right to left
  if (analogRead(sen2) > 500 && analogRead(sen1) < 500)
  {
    timeScnd = millis();//records time for second trigger
    diff = timeScnd - timeFirst;
    velocity = int(speedConst * diff);//calculates the velocity
    real_velocity = int((velocity * 360) / 100);//converts the calculated velocity to km/hr
    delay(30);
    digitalWrite(ledPin, HIGH);
```

```
    delay(30);
    digitalWrite(ledPin, HIGH);
    Serial.print("The velocity is: ");
    Serial.print(real_velocity);
    Serial.println("km/hr.");
    delay(500);
  }
}
```

7. Testing

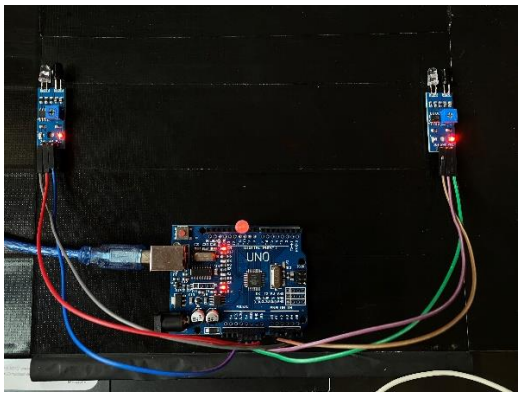

Fig 10 Speed Detector

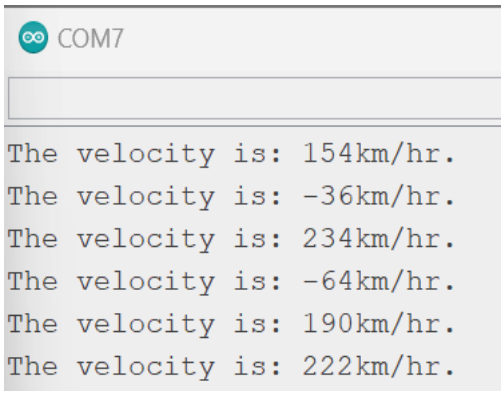

Fig 11 Output displayed in a serial monitor

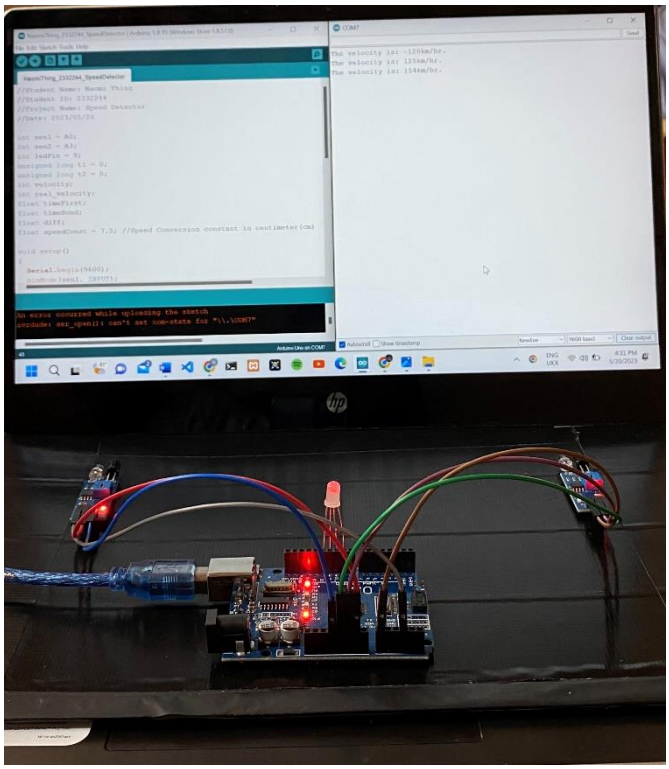

Fig 9 Whole project setup

In general, the figure shows that the speed detector is connected to the laptop/computer through the USB from the Arduino UNO. Once connected the required code for speed detector to sense the speed or velocity of an object passing by them is uploaded to the Arduino and when it senses the velocity, it displays the speed output in the serial monitor as shown in the figure above.

8. Conclusion

The Arduino speed detector mini project successfully showed the use of Arduino microcontroller and sensor technologies in the development of a dependable and correct speed detection system. The project supplied an efficient solution for measuring the speed of moving objects by combining the concepts of interruption, pulse width modulation, and signal processing. The project was implemented by combining an IR proximity sensor, an Arduino UNO board, and a RGB diffused common cathode LED, resulting in a compact and user-friendly device. The speed detection system proved its ability to accurately measure the speed of objects passing through its detection range and display the results on a real-time LCD screen. The project served not only as a practical and educational exercise, but it also showed the potential of Arduino-based systems for a variety of applications such as traffic monitoring, sports analytics, and more. Overall, it may be said that the Arduino speed detector mini project has proven Arduino technology's versatility and capabilities in developing innovative and cost-effective solutions to real-world challenges.

9. References

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