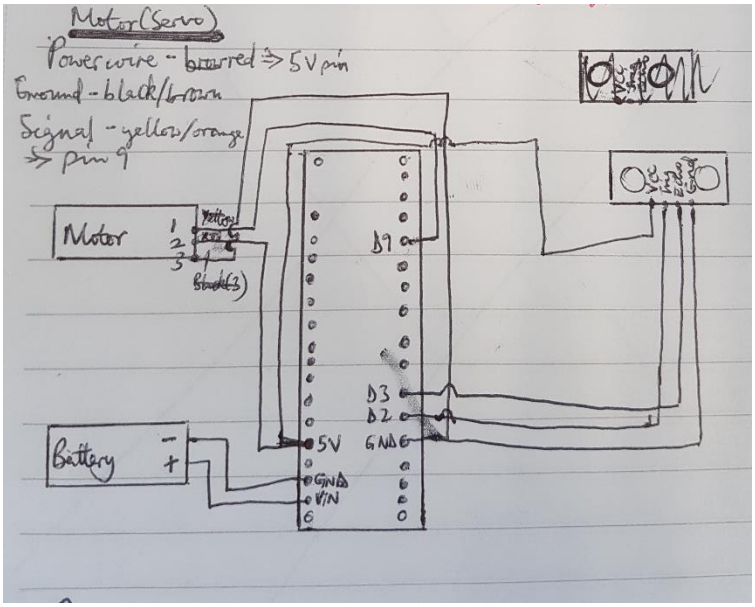
# ELECTRICAL ENGINEERING 1B FINAL REPORT

## Circuit design

Circuit components

- 1 6V servo motor
- 1 Arduino Uno microcontroller
- 1 Ultrasonic sensor
- 1 stripboard




There were different phases of the design and iterations that were made. The first phase was to draw the circuit diagram in order to have a guideline of how to connect the circuit. After this the components were connected in a circuit. A program was then written in the Arduino Integrated Development Environment (IDE). The essence of the program was to cause the motor to move when the ultrasonic sensor detects an object 10 cm away from it. It used signals from the trig and echo pins on the ultrasonic sensor to satisfy a condition that determined whether the motor should move or not. The code used for the program is shown in the image below. After the program was successfully written the circuit was tested. The circuit did not work with the battery as a power source. Unsuccessful attempts were made to swap the battery terminal and change the battery. The final decision was to alter the design and use the laptop as a power source as the microcontroller had a provision for that.

notepadcode - Notepad

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```
#include <Servo.h>

// defines pins numbers
const int trigPin = 2;
const int echoPin = 3;
// defines variables
long duration = 0;
int distance = 0;

Servo myservo;  // create servo object to control a servo
// twelve servo objects can be created on most boards

int pos = 0;    // variable to store the servo position

void setup() {
  pinMode(trigPin, OUTPUT); // Sets the trigPin as an Output
  pinMode(echoPin, INPUT); // Sets the echoPin as an Input

  myservo.attach(9);  // attaches the servo on pin 9 to the servo object

  Serial.begin(9600); // Starts the serial communication
}

void loop() {

  // Clears the trigPin
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);

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

  Serial.print("Distance: ");
  Serial.println(distance);
  delay(1000);


  if(distance < 10){
    for (pos = 0; pos <= 90; pos += 1) { // goes from 0 degrees to 180 degrees
      // in steps of 1 degree
      myservo.write(pos);              // tell servo to go to position in variable 'pos'
      delay(30);                       // waits 15ms for the servo to reach the position
    }
    delay(1000);
    for (pos = 90; pos >= 0; pos -= 1) { // goes from 180 degrees to 0 degrees
      myservo.write(pos);              // tell servo to go to position in variable 'pos'
      delay(30);                       // waits 15ms for the servo to reach the position
    }
  }
  else{
    Serial.println(distance);
  }

 }
```

## Circuit construction

There were challenges encountered in the construction of the circuit especially since it involved aspects of software in addition to hardware. One challenge was a loose pin on the ultrasonic sensor that caused the cable to easy disconnect. Efforts were made to change the cable on that pin, but the issue persisted. In the end care was just taken to ensure this particular part was held in such a way that it does not easily disconnected. There was also a challenge with the code used for the microcontroller program. Initially, the motor was just constantly running even without any object nearby. The unit Lecturer was consulted, and advice was given to check online forums. After receiving helpful suggestions from members of the online community the code was adjusted and the circuit was able to function as intended. This experience was an opportunity to learn how to consult others when challenges arise and analyse code written for minor overlooked mistakes. An image of the final circuit is shown on the next page.


## Circuit Characterisation

Through testing the circuit some lessons have been learned. The challenge with the loose cable has helped to always ensure that different circuit components are connected firmly. This experience will be beneficial in another project or as an employee working on a commercial project. Writing the program improved the ability of the student to design software and debug code. Having challenges with the program and solving them developed the experience in consulting others and using online resources to get information and find answers. The other experience gained in constructing the circuit was soldering on a stripboard after prototyping on a breadboard. The breadboard was used to flexibly iterate and test the circuit until it was finally constructed on a piece of stripboard.

## References

Ping Ultrasonic Range Finder. (2015). Retrieved from https://www.arduino.cc/en/Tutorial/Ping

jee, jeevan. (2019, May 1). *3 Best Arduino Projects For School Compilation*. Retrieved from https://www.youtube.com/watch?v=dRkUq_pVN8I