Feedback System for a Robotic Arm

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Task 8: Feedback System

A feedback system needs to be built for robotic arms in this task, when one arm is manually moved the other arm should move simultaneously. In this task a more practical project has been performed utilizing the former tasks, it has two servo motors are chosen to be connected through and Arduino to represent two arms, and when one motor is manually rotated the other motor must be rotated with the exact same angle at the same time.

For this task to be accomplished, the interior variable resistance of a servo motor needs to be read, and based on it let the other motor rotate with the same angle. I replaced one servo motor with a potentiometer to represent its interior resistance, and for simulation feasibility reasons, and connect that to another servo motor using an Arduino. As the resistance varies using the potentiometer, which represents the first servo motor's angle of rotation, the other servo motor rotates with the same angle. This project report includes the working algorithm for the project, its circuit design and the Arduino code.

Working Algorithm

Pseudo Code

```
1    Choose motors type for the robotic arm
2    Design the electrical circuit for the control system that consists of:
3        Arduino microcontroller
4        Servo motor to represent the robot arm
5        Potentiometer (variablre resistor) to change the other arm's motor angle of rotation
6    Code the Arduino microcontroller to operate as desired
7        The Arduino reads the potentiometer's value via the analog pin
8        It scales that value to match the servo motor angles values
9        It sets the servo motor to rotate with that scaled angle
10   Rotate one motor for the other motor to rotate simultaneously
11       Use the potentiometer to represent the other arm's servo motor and change its angle
```
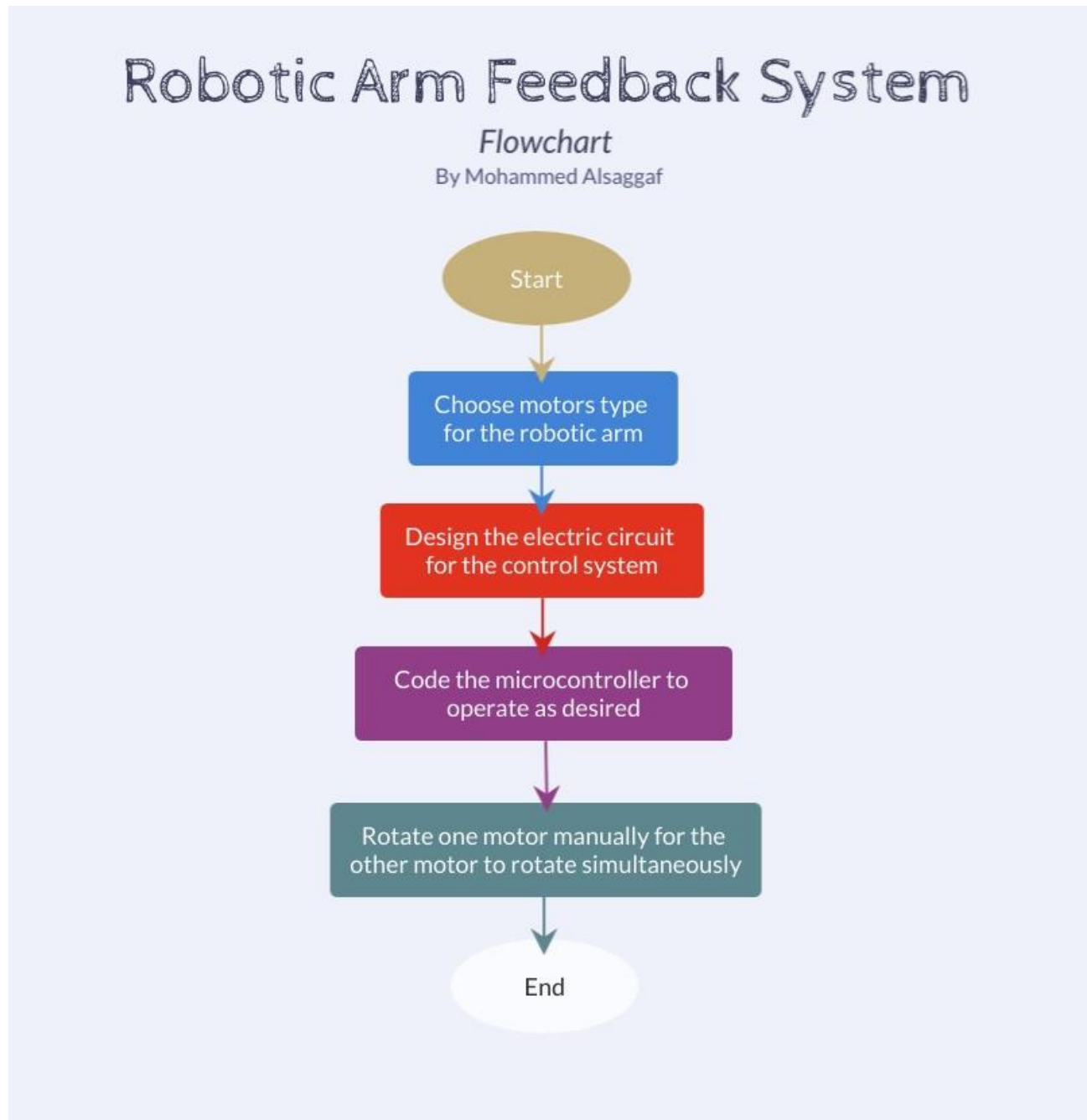
Flowchart

Figure 1: Robotic Arm Feedback System Flowchart
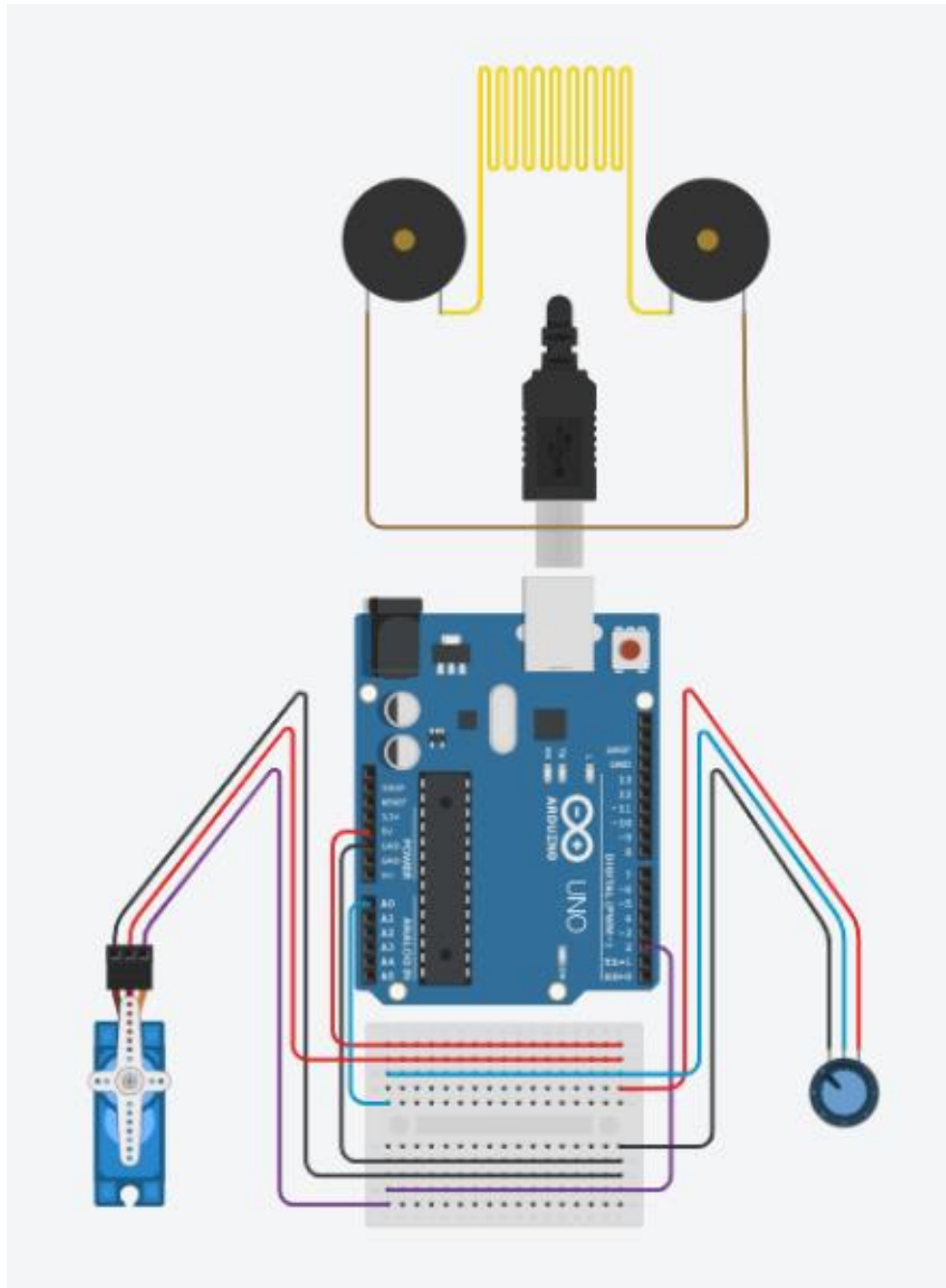
Circuit Design and Coding

Figure 2: Robotic Arm Feedback System Circuit Design via TinkerCAD

The system has a potentiometer, a servo motor and an Arduino microcontroller. Additional components were added to represent the robot's head and arms for Aesthetic values.

```
1   #include <Servo.h>
2   Servo ServoMotor; //Define my servo
3
4   int potPin = A0; //Connect the potentiometer to analog pin A0
5   int value; //Variable assigned to read the value from the analog pin
6
7
8   void setup(){
9
10    ServoMotor.attach(2); //Attaches the servo to the digital pin number 2
11  }
12
13  void loop(){
14
15    //Reading the potentiometer value between 0 and 1023
16    value = analogRead(potPin);
17
18    //Scaling the potentiometer value to a servo motor angle between 0 and 180
19    value = map(value, 0, 1023, 0, 180);
20
21    //Setting the servo motor to rotate with the specified angle
22    ServoMotor.write(value);
23    delay(10);
24  }
```

Figure 3: Robotic Arm Feedback System Arduino Code

First of all, the servo library was included, and my servo motor was defined as "ServoMotor". Two variables were defined afterwards. One is "potPin", which is the potentiometer's pin that's connected to the A0 analog pin in the Arduino. The other is "value", which is the variable that stores the value from the analog pin.

In the void setup section, the servo motor was attached to the Arduino's digital pin 2. Where the void loop section had three parts: Reading, Scaling and Setting. The reading part lets the Arduino store the potentiometer's value in a variable. Then the scaling part used the *map* function to scale the potentiometer's values which are between 0 and 1023 to the servo motor's angles values which are between 0 and 180 degrees. At the end the setting part set the scaled value to be the servo motor's angle of rotation by using the function *write*.

References

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[2] "map() function," Arduino, 15 06 2020. [Online]. Available: https://www.arduino.cc/reference/en/language/functions/math/map/. [Accessed 14 07 2020].

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