

1. Components Used:

- Teensy 4.0
- Large Pololu Frame
- 65mm TT Motor Wheels x4
- TT Motor with Encoder x4
- Feather Board Motor Driver
- Battery 18650 x 4

2. Code For Task 2. (Moving robot in straight line for 2~5m)

```
#include <Adafruit_MotorShield.h>

// Create the motor shield object with the default I2C address
Adafruit_MotorShield AFMS = Adafruit_MotorShield();

Adafruit_DCMotor *frontLeftM = AFMS.getMotor(1);
Adafruit_DCMotor *frontRightM = AFMS.getMotor(2);
Adafruit_DCMotor *backLeftM = AFMS.getMotor(3);
Adafruit_DCMotor *backRightM = AFMS.getMotor(4);

int counter = 0;

void setup() {
    Serial.begin(9600); // set up Serial library at 9600
    bps
    Serial.println("Adafruit Motorshield v2 - DC Motor test!");

    if (!AFMS.begin()) { // create with the default
        frequency 1.6KHz
        Serial.println("Could not find Motor Shield. Check wiring.");
        while (1);
    }
    Serial.println("Motor Shield found.");
}

void loop() {
    uint8_t i;
    uint8_t k = 0, l = 0;
    Serial.print("Executing: STRAIGHT LINE!!!\n\n");

    //frontRightM->setSpeed(255);
    //frontLeftM->setSpeed(100);
    //backLeftM->setSpeed(100);
    //backRightM->setSpeed(255);

    // Run Forward -----
}
```

```
backLeftM->run(FORWARD);
frontRightM->run(FORWARD);
frontLeftM->run(FORWARD);
backRightM->run(FORWARD);

for(i=0; i<255; i++) {
    frontRightM->setSpeed(i);
    frontLeftM->setSpeed(i);
    backLeftM->setSpeed(i);
    backRightM->setSpeed(i);
    delay(10);
}

delay(2000);

for(i=255; i!=0; i--) {
    frontRightM->setSpeed(i);
    frontLeftM->setSpeed(i);
    backLeftM->setSpeed(i);
    backRightM->setSpeed(i);
    delay(10);
}

delay(500);
frontRightM->run(RELEASE);
frontLeftM->run(RELEASE);
backRightM->run(RELEASE);
backLeftM->run(RELEASE);
}
```

3. Code for Task 3. (Moving robot in square path)

```
#include <Adafruit_MotorShield.h>

// Create the motor shield object with the default I2C address
Adafruit_MotorShield AFMS = Adafruit_MotorShield();

Adafruit_DCMotor *frontLeftM = AFMS.getMotor(1);
Adafruit_DCMotor *frontRightM = AFMS.getMotor(2);
Adafruit_DCMotor *backLeftM = AFMS.getMotor(3);
Adafruit_DCMotor *backRightM = AFMS.getMotor(4);

int counter = 0;

void setup() {
    Serial.begin(9600); // set up Serial library at 9600
    bps
```

```
Serial.println("Adafruit Motorshield v2 - DC Motor test!");

if (!AFMS.begin()) { // create with the default
frequency 1.6KHz
    Serial.println("Could not find Motor Shield. Check wiring.");
    while (1);
}
Serial.println("Motor Shield found.");
}

void loop() {
    uint8_t i;
    uint8_t k = 0, l = 0;
    Serial.print("Executing: SQUARE!!!\n\n");

    //frontRightM->setSpeed(255);
    //frontLeftM->setSpeed(100);
    //backLeftM->setSpeed(100);
    //backRightM->setSpeed(255);

    // Run Forward -----
    backLeftM->run(FORWARD);
    frontRightM->run(FORWARD);
    frontLeftM->run(FORWARD);
    backRightM->run(FORWARD);

    for(i=0; i<255; i++) {
        frontRightM->setSpeed(i);
        frontLeftM->setSpeed(i);
        backLeftM->setSpeed(i);
        backRightM->setSpeed(i);
        delay(10);
    }

    delay(2000);

    for(i=255; i!=0; i--) {
        frontRightM->setSpeed(i);
        frontLeftM->setSpeed(i);
        backLeftM->setSpeed(i);
        backRightM->setSpeed(i);
        delay(10);
    }

    // Turn -----
    frontLeftM->run(BACKWARD);
    backLeftM->run(BACKWARD);
    frontLeftM->setSpeed(255);
```

```
for (i=0; i<255; i++) {  
    frontRightM->setSpeed(i);  
    backRightM->setSpeed(i);  
    //frontLeftM->setSpeed(i);  
    //backLeftM->setSpeed(i);  
    delay(10);  
}  
  
delay(4500);  
  
frontRightM->run(RELEASE);  
frontLeftM->run(RELEASE);  
backRightM->run(RELEASE);  
backLeftM->run(RELEASE);  
}
```

4. Code for Task 4. (Moving robot in circle path)

```
#include <Adafruit_MotorShield.h>  
  
// Create the motor shield object with the default I2C address  
Adafruit_MotorShield AFMS = Adafruit_MotorShield();  
  
Adafruit_DCMotor *frontLeftM = AFMS.getMotor(1);  
Adafruit_DCMotor *frontRightM = AFMS.getMotor(2);  
Adafruit_DCMotor *backLeftM = AFMS.getMotor(3);  
Adafruit_DCMotor *backRightM = AFMS.getMotor(4);  
  
int counter = 0;  
  
void setup() {  
    Serial.begin(9600); // set up Serial library at 9600  
    bps  
    Serial.println("Adafruit Motorshield v2 - DC Motor test!");  
  
    if (!AFMS.begin()) { // create with the default frequency  
        1.6KHz  
        Serial.println("Could not find Motor Shield. Check wiring.");  
        while (1);  
    }  
    Serial.println("Motor Shield found.");  
}  
  
void loop() {  
    uint8_t i;  
    uint8_t k = 0, l = 0;  
    Serial.print("Executing: CIRCLE!!!\n\n");
```

```
backLeftM->run(FORWARD);  
frontRightM->run(FORWARD);  
frontLeftM->run(FORWARD);  
backRightM->run(FORWARD);  
  
for(i=0; i<255; i++) {  
  
    frontLeftM->setSpeed(i);  
    backLeftM->setSpeed(i);  
  
    delay(10);  
}  
  
delay(2000);  
  
for(i=255; i!=0; i--) {  
  
    frontLeftM->setSpeed(i);  
    backLeftM->setSpeed(i);  
  
    delay(10);  
}  
  
delay(500);  
frontRightM->run(RELEASE);  
frontLeftM->run(RELEASE);  
backRightM->run(RELEASE);  
backLeftM->run(RELEASE);  
}
```

5. Mean Square Error of Each Run

Straight Line

$$N = 5; Y_1 = 5"; Y_2 = 11"; Y_3 = 13"; Y_4 = 12"; Y_5 = 3"$$

$$MSE = \left(\frac{1}{5}\right) \sum_{i=1}^5 (Y_i - \bar{Y}_i)^2$$

$$MSE = 93.6$$

Square

$$N = 5; Y_1 = 8"; Y_2 = 49"; Y_3 = 20"; Y_4 = 24"; Y_5 = 16"$$

$$MSE = \left(\frac{1}{5}\right) \sum_{i=1}^5 (Y_i - \bar{Y}_i)^2$$

$$MSE = 739.4$$

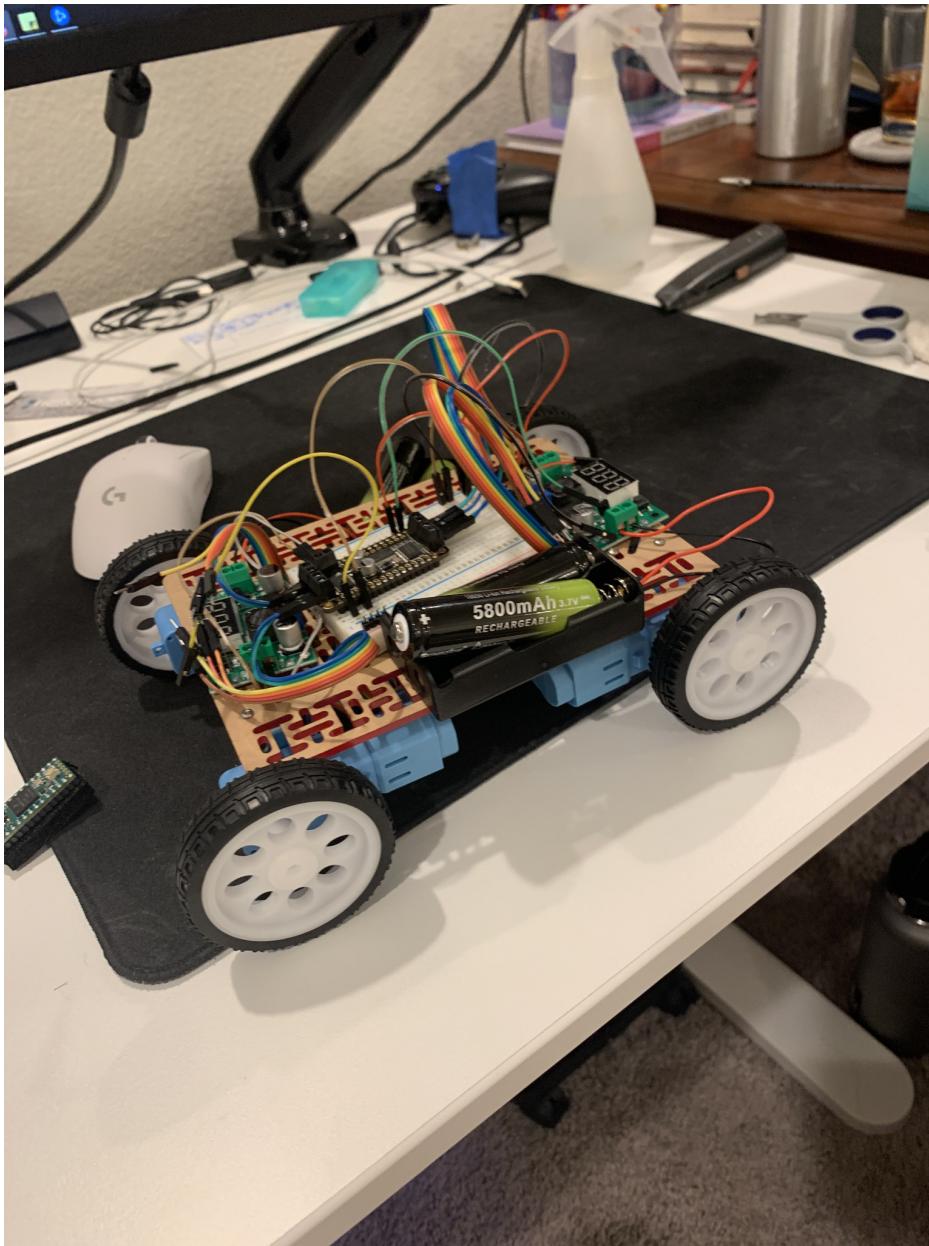
Circle

$N = 5; Y_1 = 11"; Y_2 = 4"; Y_3 = 8"; Y_4 = 4"; Y_5 = 4"$

$$MSE = \left(\frac{1}{N}\right) \sum_{i=1}^5 (Y_i - \bar{Y}_i)^2$$

MSE = 46.6

6. Board Setup



7. Video Link of Demo

<https://youtu.be/0TTVb0w5CmM>

8. Github link to the shared repository

<https://github.com/EyeEsquire/cpe476.git>