CSE 461 Lab Report

Spring 24

Group: 4

Title

Introducing servo motor with Raspberry Pi

Created by: Sadman Zahin
ID: 21101100
Section: 06
Group: 04

Introduction:

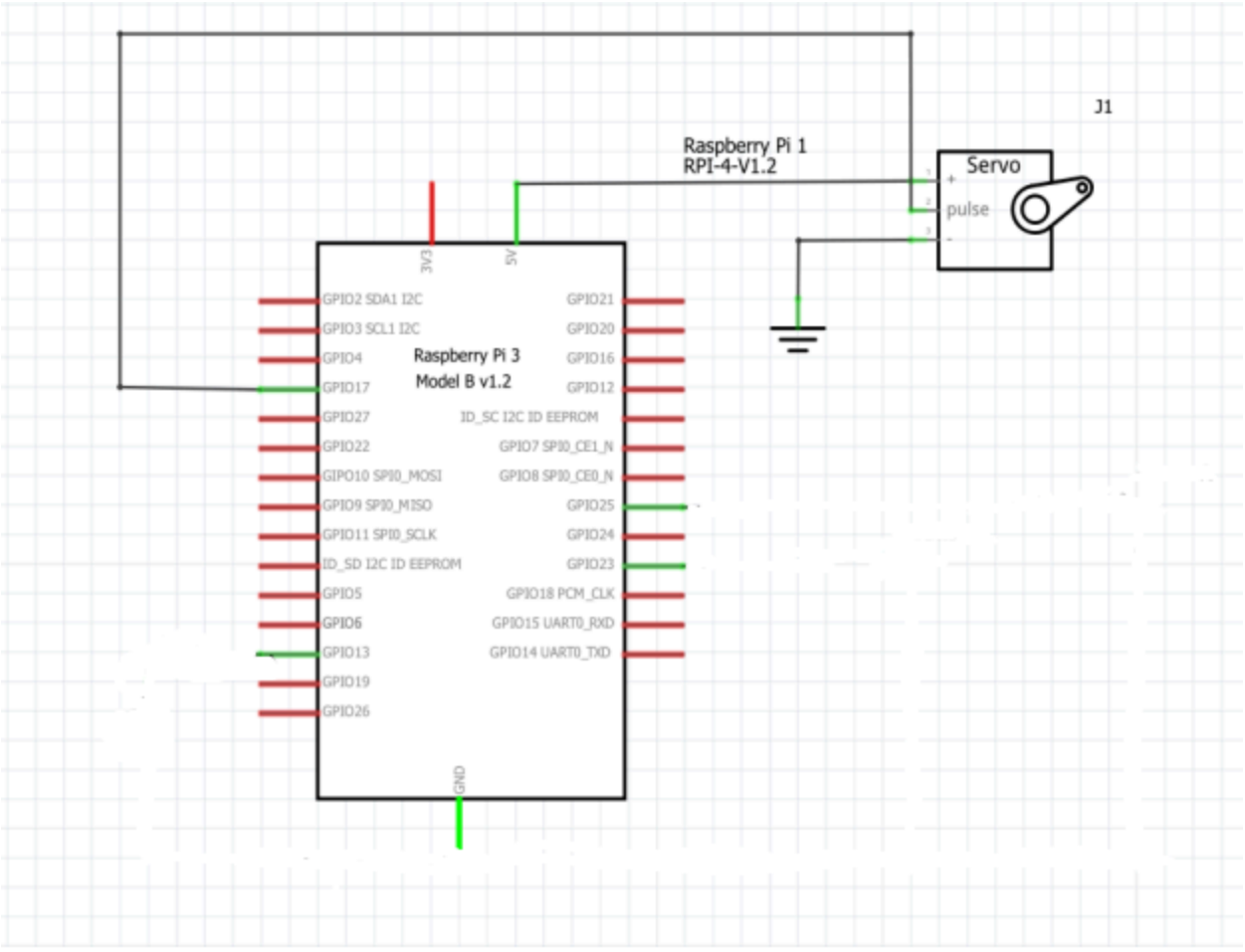
In this Lab, we will get a foundational understanding of servo motors, duty cycles, and the working mechanisms of servo motors. We will also learn how to rotate the servo by putting PWM values which also incorporates a basic understanding of PWM.

Components required for the setup:

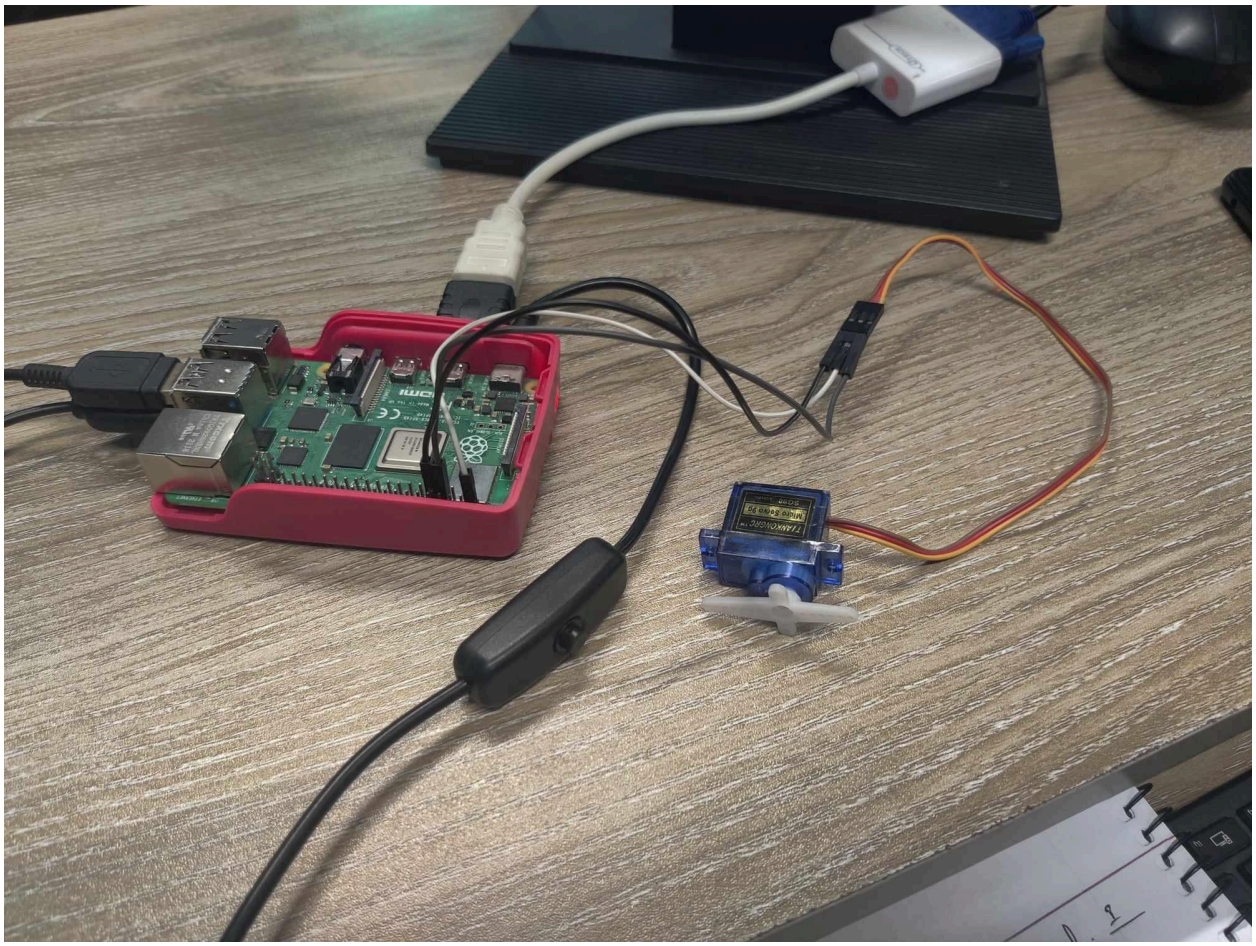
For controlling the Servo on the Raspberry Pi 4, we need the following electronic components:

- Raspberry Pi
- Servo motor MG996R
- Breadboard
- Jumper Wires
- MicroSD Card
- USB Cable
- Monitor, Keyboard, and Mouse (Optional)

Circuit Diagram:


J1
Raspberry Pi 1
RPI-4-V1.2
Servo
+
pulse
-
3V3
5V
GPIO2 SDA1 I2C
GPIO3 SCL1 I2C
GPIO4
GPIO17
GPIO27
GPIO22
GIPO10 SPI0_MOSI
GPIO9 SPI0_MISO
GPIO11 SPI0_SCLK
ID_SD I2C ID EEPROM
GPIO5
GPIO6
GPIO13
GPIO19
GPIO26
Raspberry Pi 3
Model B v1.2
GPIO21
GPIO20
GPIO16
GPIO12
ID_SC I2C ID EEPROM
GPIO7 SPI0_CE1_N
GPIO8 SPI0_CE0_N
GPIO25
GPIO24
GPIO23
GPIO18 PCM_CLK
GPIO15 UART0_RXD
GPIO14 UART0_TXD
GND

Circuit setup:



Results:

After connecting all the components, we powered on the device and entered the code. The code initializes a PWM signal on pin 7, moves a servo motor to three different positions (0-180-0 and then 90), and then stops the PWM output. The servo motor's position is controlled by adjusting the duty cycle of the PWM signal.

The code:

```
import RPi.GPIO as GPIO
from time import sleep
GPIO.setmode(GPIO.BOARD)
GPIO.setup(7,GPIO.OUT)
pwm = GPIO.PWM(7,50)
pwm.start(0)
print('left-90 deg position')

pwm.ChangeDutyCycle(2.5)
sleep(5)
print('right +90 deg position')

pwm.ChangeDutyCycle(11.5)
sleep (5)

pwm.ChangeDutyCycle(7)
sleep(5)

pwm.stop()
GPIO.cleanup()
```

Discussion:

After finishing this project, we learned about the basic uses of servo motors and how to configure and use them on the Raspberry Pi with the help of Thonny software and the Python programming language. We had to change the values consistently so that we could get the desired output.

Question Answer:

We didn't use any buttons or LEDs in our lab task. We calculated the slope values using the formula of y=mx+c and then used the result value in the duty cycle formula (Duty Cycle = (1/18) * 60 +2) which led us to get our desired angles.

Conclusion:

To wrap it up, this lab provided valuable hands-on experience in working with Raspberry Pi and servo motors and their applications. We successfully understand the basic principle of how the servo motors work and how to measure accurate angles by using pwm values and how to get the value from the equation of the Duty cycle.