ECE 388: Embedded Systems Design Project
Lab 1: Servo Motor and Github

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We certify that this work is original and not a product of anyone's work but our own.

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Abstract

In this lab the Servo Motor SG90, Github, and LaTeX are introduced to students. Students are given the objective and directives of using the function generator's PWM mode to make the motor move. The motor's data sheet is used to complete the given task. Students then were required to complete a tutorial on Github to gain familiarity with the interface. A step-by-step guide was given to complete this task.

1 Introduction

Being familiar with the laboratory equipment is one of the most important aspects of a lab, as that it will allow for the rapid and successful completion of the lab, as well as correctness of the lab. This laboratory experiment was designed specifically with this idea in mind. The lab was very simple, as that it was designed to help the students familiarize themselves with that laboratory equipment to make the completion of future labs easier. The lab consisted of using the function generator to move a Servo motor with PWM. in addition to this, each of the group members planed a top-level view of the projects mechanical interface, which was recorded in the lab notebook. This was to foresee how the project will perform during the final presentation, as well as figuring out the parts needed for the project so that they can be ordered ahead of time.A second part of this lab was to get familiar with the Github environment, where each member had to individually complete a tutorial of the page.

2 Methods

This lab was broken down into two main sections. The first part of the lab required learning about the Servo Motor SG90 and how to make it function. This process required reading the data sheet for the motor and setting the function generator and circuit accordingly. The second part of the lab consisted of gaining familiarity with Github, a web-based hosting service for version control.

2.1 Part 1: Servo Motor

The main part of this laboratory experiment consisted of making a servo motor move with PWM. This was accomplished by using the function generator as well as the power supply. Using the data sheet, it was found that the The Servo Motor consisted of three connections:

- Power (Red)
- Ground (Brown)
- Pulse (Orange)

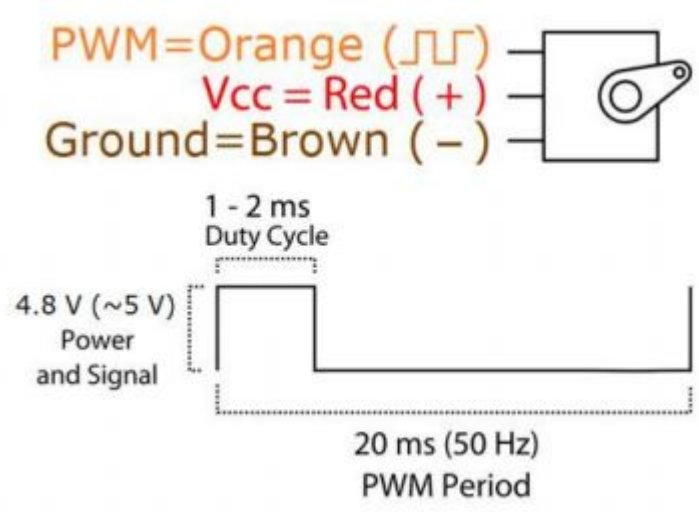

Figure 1: Diagram of the wired connections to the Servo motor as well as the appropriate PWM settings

The circuit was powered using the power supply and giving it 4.8 Volts, and grounding the ground pin. For the pulse, the function generator was set to output a frequency of 50HZ, with the With of 1ms, and the High Level of 4.8 V. To actually make the servo motor move, the width was changed from 1ms to 3ms, which results in the motor move a 180 degrees rotation. At different widths the motor moves to different angle rotations.

2.2 Part 2: Github

The second part of the lab consisted in each member of the group individually completing a tutorial of the Github page. The Github tutorial brought each member through the following steps:

1. Create a Repository
2. Create a Branch
3. Make and Commit Changes
4. Open a Pull Request
5. Merge your Pull Request

This was required because the Github page will be an essential tool that everyone will use during the project to share all the codes for the project throughout the semester.

3 Laboratory Experimental Results

The motor was moved successfully by applying a frequency of 50HZ, the High Level of 4.8 V, and different widths for different rotations. To move the motor to different rotations, the width was set to 1ms for 45 degrees, at 2ms the motor moved to a 90 degree position, and at 3ms the motor completed at full 180 degree rotation.

4 Discussion

During the lab, the specified results were obtained, and the requirements were satisfied as that the servo motor behaved as predicted. The results were consistent with the information acquired from the data sheet for the Servo motor SG90. The motor only moved 180 degrees (90 degrees in each direction) as specified by the data sheet. This was accomplished by changing the width from 1ms to 3ms. The width effectively increased the size of the wave while the voltage is high. A high voltage will then result in the motor receiving 4.8 volts, which enables the motor to turn. The frequency then increases or decreases the time till the next period of high voltage. Creating a very high frequency would then make the motor vibrate violently due to pulses being received before the motor can fully execute the entire pulse width. The Servo motor acted how it was expected to due to the research done on the datasheet.

5 Conclusions

The purpose of this lab was to receive practice with the function generator and to effectively use outside sources to determine the inner workings of an unknown component. This required research of the Servo motor and basic understanding of PWM mode in regards to the function generator. In PWM mode, frequency affected the speed in which the motor would execute a turn. The width of the wave affected the distance in which it the motor would turn. The larger the width, the greater angle in which the motor would turn. If the width exceeded the allotted 180 degree turn radius the motor would rotate the 180 degrees and then move the additional amount of degrees in the opposite direction. With this knowledge, future labs involving these Servo motors will be better understood.

6 Laboratory Reflection

In this laboratory experiment not many issues arose. The methods used to test were deemed valid for the purposes of this experiment. The only thing that may have been done differently is that the motor could have been wired to a breadboard instead of directly being wired. This is more a quality of life change as it would keep the motor locked onto three header pins, which would slightly decrease the vibration of the motor at higher frequencies. The biggest challenge

to this lab was learning how to use LaTeX especially in a group setting. With the help of overleaf.com it made LaTeX a much easier program to work with and will make future labs easier. With the creation of a Github account, future labs will be easier to work together on as well as keep documentation of our progress with the firmware of our design.