Electrical Overview

Year: 2023 Semester: Spring Team: 3 Project: Rigged Card Shuffler

Creation Date: 2/2/2023 Last Modified: February 4, 2023

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Assignment Evaluation:

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| **Item** | **Score (0-5)** | **Weight** | **Points** | **Notes** |
| **Assignment-Specific Items** | | | | |
| **Electrical Overview** |  | x3 |  |  |
| **Electrical Considerations** |  | x3 |  |  |
| **Interface Considerations** |  | x3 |  |  |
| **System Block Diagram** |  | x3 |  |  |
| **Writing-Specific Items** | | | | |
| **Spelling and Grammar** |  | x2 |  |  |
| **Formatting and Citations** |  | x1 |  |  |
| **Figures and Graphs** |  | x2 |  |  |
| **Technical Writing Style** |  | x3 |  |  |
| **Total Score** |  | | |  |

5: Excellent 4: Good 3: Acceptable 2: Poor 1: Very Poor 0: Not attempted

General Comments:

*Relevant overall comments about the paper will be included here*

1.0 Electrical Overview

The main computation done in our product will be carried out by a thirty-two-bit microcontroller as well as a raspberry pi. Our raspberry pi will interact with a camera and will then use image recognition to figure out what card is being read. The raspberry pi is also responsible in tracking where the cards will be placed in the shuffler and ultimately determining the order of the deck of cards.

Our thirty-two bit microcontroller will be communicating with our raspberry pi by using UART. In addition to this, the micro will also receive inputs from push buttons. These push buttons will work in conjunction with an LCD screen through the microcontroller so that way the user will be able to pick out how they want the cards to be shuffled. In addition to this the microcontroller will also be controlling two stepper motors and two dc motors. The microcontroller will communicate with the stepper motor driver and these drivers will communicate with the motors to command them the direction and degree that they should turn. The microcontroller will also be used to power an LED light that will help the camera recognize the cards.

2.0 Electrical Considerations

Our product will be powered by wall power. From this wall power we will need to divide the voltages into three different sources. The raspberry pi and the LCD screen is powered at five volts. The microcontroller is powered at three volts. And the stepper motors are powered at twelve volts.

In terms of frequency, we just need to ensure that the frequency is high enough into the stepper motor so that was no steps are skipped. The clock that is used for both the LCD screen and communication between the raspberry pi will run at 16MHz. All of the power supplied to everything in my circuit is DC.

The spec sheets I found for the raspberry pi did not specify a maximum or minimum current or voltage load. It recommends a voltage input of five volts at 2.5 amps. The microcontroller can manage anywhere between 3 and 3.6 volts. The maximum current supply is 500 mA. The LCD screen can operate between 3.3 volts to 5 volts and can handle around 80 – 110 mA. For the stepper motor we chose to keep the voltage at 12 and have the current be at .25 amps to get our desired torque. However, the motor can operate anywhere between 6 to 25 volts.

To make sure we are using power wisely in our design we will have everything optimized to only be running when needed. For example, the LED light will only be on when the camera is about to take a picture of the card. We will have the enable pin of our stepper motor driver connected to a GPIO pin so that way we can control when the motor is enabled so that way the motor isn’t constantly pulling voltage.

3.0 Interface Considerations

The two main interfaces in our system will be the UART and SPI. The UART will be used in order for the raspberry pi to communicate with the microcontroller. The raspberry pi will tell the microcontroller when the card has been read and communicate where it wants the card stored. The microcontroller will be where the user puts in the desired card order which will then be communicated to the raspberry pi. The baud rate that will communicate between the two system is 115200.

The microcontroller will communicate with the LCD screen by using SPI. The SPI we will be using will be four wires in order to effectively display the correct things we need on the screen.

4.0 Sources Cited:

“Raspberry Pi 3 Model B,” *Stontronics Ltd*. [Online]. Available: <https://us.rs-online.com/m/d/4252b1ecd92888dbb9d8a39b536e7bf2.pdf>. [Accessed: 04-Feb-2023].

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Appendix 1: System Block Diagram

Diagram

Description automatically generated