Led Matrix Display Design Document
CSE 453

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1 Introduction

The Led Matrix is a 16 x 16 grid with individual LED's that light up according to the colors inputted by the user. We created a web application that allows any user to input colors to the Led Matrix. Our web application contains a 16 x 16 grid which corresponds to the hardware Led Matrix. A person can implement a colorful design on the web application and transfer it to the actual Led Matrix with a button press.

1.1 Purpose & Debugging

Our purpose is to supply students another outlet to express their creative minds. This project will enhance a creative design and hopefully garner interest in the connection between hardware and software. We want our project to encourage students to incorporate new technologies in their designs to enrich their creative design process. The following are the debugging steps if any hardware or software related problems are encountered.
If you are encountering issues with the web application or hardware Led matrix try the following solutions.

- **Unable to get to login page.**
  - Make sure the device you are trying to access the web page on is connected to the school's Wifi network.

- **Unable to get to the design page without an account.**
  - Hit the login button and you should be redirected to the design page.

- **Design keeps getting erased.**
  - Be careful when coloring in the squares, squares with the same color as the one selected will be erased or replaced by a new color.

- **Saved design is not there.**
  - Make sure you are logged in too the correct account.
  - If the design still does not appear in the right hand corner, you will be unable to retrieve the design.
  - You must make sure to hit the save button before logging out and closing the application.

- **Color will not show up on color wheel even with hexadecimal code.**
  - Make sure the hexadecimal code is prefaced with a "#". For example, "#32CD32".
  - Hit enter after correctly entering the hexadecimal code.

- **Design on 16x16 matrix does not show up on Led Matrix after hitting "Color Matrix" button.**
  - Ensure the device is powered on by firmly plugging in the power cord into a power outlet.

1.2   Purpose of the Design Document

The design document tracks the fundamental data required to successfully define architecture and framework configuration so as to give the following group direction on the architecture of the framework to be created. Design documents are incrementally and iteratively produced during the system development life cycle, based on the particular circumstances of the computer and electrical engineering methodology used for developing the system.

1.3   Overview

The document is divided into sections in order to provide a complete and understandable perception about the device to target readers. The first section is about the general description and the purpose of the project. Secondly, a general description of the hardware and software system including the functionality and matters related to the overall system and its design is provided. The third section consists of the design considerations consisting of design assumptions,constraints and goals.

1.4   Audience

The intended audience for the Design Document is the project manager, project team, and the future development team.

1.5   References and Code Used

The actual code that was used in the program can be found in GitHub and following is the github address for it.

https://github.com/ccaballe123/cse453-led-matrix

2 Universal Accessibility Design Consideration

2.1 Constraints

The device requires a DC power source so it requires an electrical outlet to power the components such as Ardiuno, LED's and Raspberry Pi. The device is implemented using Arduino Web-Based Graphical User Interface.

2.2 Suppositions

Any personnel wanting to upgrade the current device should have some strong background on RGB's and LED's display mechanisms. In addition to that, previous programming experiences with Java-Script, Node Js and writing to Arduino is extremely necessary.

2.3 Design Methodology

The device is designed in a way that it can be re-programmable. A web user interface built using JavaScript NodeJS modules allows the users to change and modify the functionalists and how the user wants it to be. In addition to that, Arduino setup can also be modified to change the sequence of the LED's in the box.

3 System Architecture

LED Display is built using combination of hardware software components. All of the hardware components are connected together later integrated using Arduino. All the components that are required are listed below.

3.1 Schematics

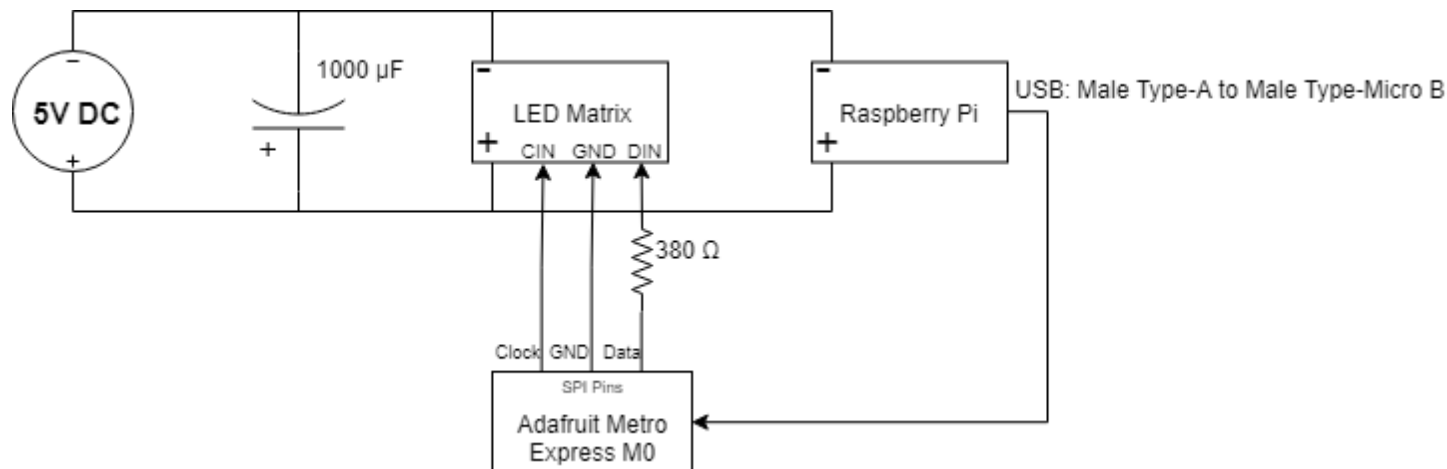The following is the basic structure of how the program operates:

Figure 1: Schematic

3.2 Components

3.2.1 Raspberry Pi

The Raspberry Pi that was used in this project was Raspberry Pi 3 Model B 1.2GHz Mfr Part 83-17300. It is used to locally host the website as well as store the data locally. We will have to configure the IP Address manually on the Raspberry Pi.

Figure 2: Raspberry Pi

3.2.2   Arduino

The Ardino that we used for the sake of this project was Adafruit METRO M0 Express - ATSAMD21G18, PRODUCT ID: 3505. It's main purpose here is to take the data send from the serial port and light up the LED's on the 16x16 matrix.
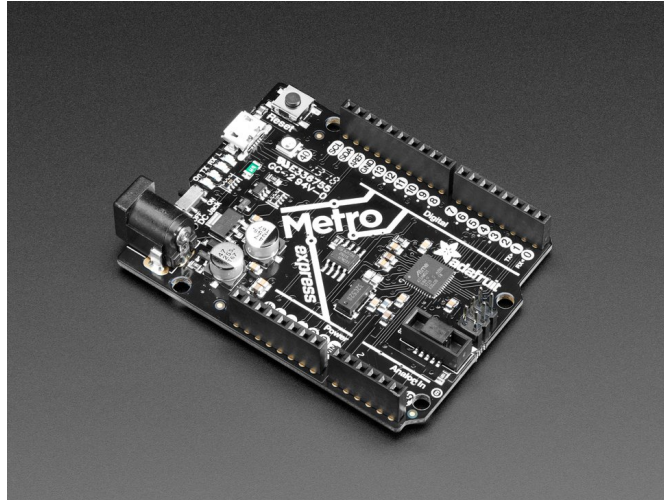

Figure 3: Arduino

3.2.3   Capacitor

The capacitors that was used is of 1000uF, 25V, 105 C, which can be bought from Capacitor:https://www.amazon.com/gp/prod
$UTF8psc = 1$

Figure 4: Capacitor

3.2.4   LED Matrix

16 x 16 Matrix was purchased from Adafruit. Draws 5V and 15mA on lowest brightness.
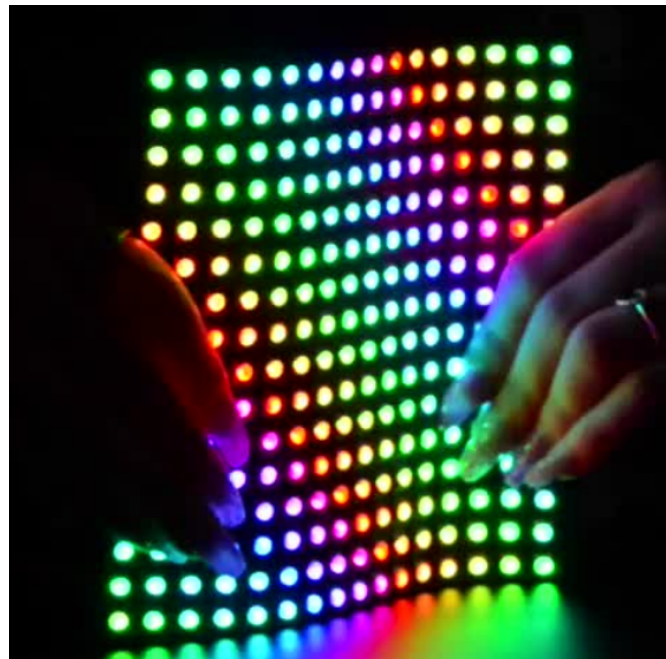

Figure 5: Adafruit LED Matrix

3.2.5   Pi to MC Converter

This wire is used to connect the Pi Serial to the Arduino Microcontroller.

Figure 6: Wire Link

3.2.6   Frame Work

The setup that was used to enclose the Arduino and Raspberry pi can be found below:
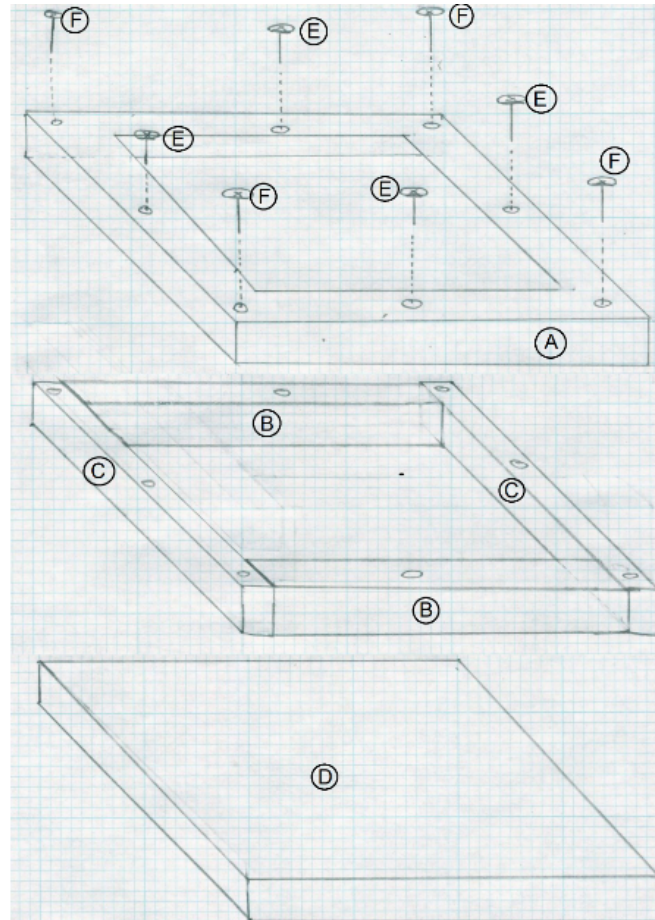

Figure 7: Box Setup

Frame work description:-

- A: Description: Kimberly Bay® Pine Wood
  Dimensions(x w x h):- Overall: 27.6cm x 27.6cm x 1.7cm- Center Cutout: 17.0cm x 17.0cm x 1.7cm

- B: Description: Kimberly Bay® Pine Wood
  Dimensions(x w x h): 24.2cm x 1.7cm x 4.3cm

- C: Description: Kimberly Bay® Pine Wood
  Dimensions(x w x h): 27.6cm x 1.7cm x 4.3cm

- D: Description: Kimberly Bay® Pine Wood
  Dimensions(x w x h): 27.6cm x 27.6cm x 1.7cm

- E: Description: Spax® 6 x 1/2 in. Phillips Square Drive Flat-Head Full Thread Zinc Coated Multi-Material Screw

- F: Description: Spax® 10 x 1-1/2 in. Phillips Square Drive Flat-Head Full Thread Zinc Coated Multi-Material Screw

3.2.7   USB cable from terminal to pie

This cable was used to connect terminal to the raspberry pie. newline

Figure 8 :USB Cable

4 Future Expansion

4.1 Hardware/physical improvements

- Board Size and LED Matrix
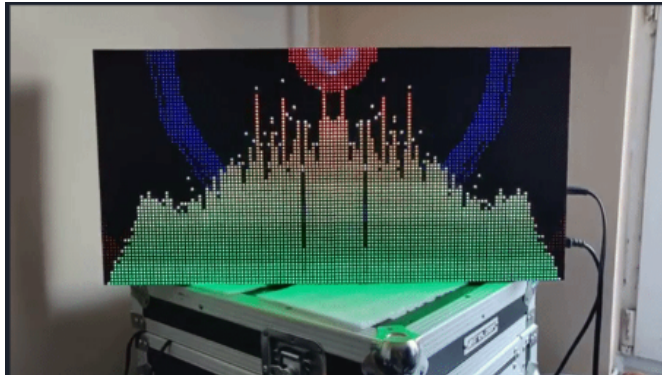- Exterior Casing
- Aesthetics

Figure 9 :Idea 1

4.2 Software/internal improvements

- Have multiple matrices
- Matrixes can communicate with each other
- Online Database/Website Access

Figure 10 :Idea 2

5   Conclusion and Findings

Building LED display showed us various parts of designing. While building the display, we utilized diverse sort of hardware and integrated with software. There were things that we had never done, for example, binding, utilizing hand saws to cut woods and parcel more. Anyway this undertaking gave us involvement in every one of these variables. We kept running into part of issues amid the construct however with most extreme exertion and research we had the option to beaten each one of those issues. Time the board was one significant part that we managed. Generally speaking our task was a triumph as had the option to finish and test every one of our functionalities and it was victory for our problem solving, communications and sentimental skills.