MIAMI UNIVERSITY
COLLEGE OF LIBERAL ARTS & APPLIED SCIENCE
*Engineering Technology*
ENT 497 / 498 SENIOR PROJECT

# Up Down Vote Badge

## Prepared For:
Project Advisor: Robert E. Speckert
Miami University Professor
Department of Engineering Technology
speckere@miamioh.edu

## Prepared By:
Nicole Eisenbrandt and Liban Mohamed
Miami University Senior Design Students
eisenbn2@miamioh.edu
mohamel@miamioh.edu

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## Acknowledgments

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FIGURE 1: STUDENT GROUP WITH WORKING PROTOTYPES

## Statement of Purpose (Executive Summary)

This project endeavors to generate a battery-controlled vote tabulating device (badge) with count capabilities for future analytical and behavioral study use.

Goals:

- To produce a battery-controlled vote tabulating device for analytical and behavioral study use, as Miami's Psychology Department sees fit.
- To design the device so that there are two indicators, an up and down arrow mimics the vote tabulating machines in the episode, Majority Rule, from the Fox series The Orville [25]. The user, or other individuals, chooses their indicator based upon their, or others, reaction to behavior, where the device counts in an upwards fashion.
- To display the device's count, choose and utilize smart components to connect the tabulating device to the internet via Bluetooth.
- To create an application (App) interface that will display count results. This App design interface creation is to be done in conjunction with Miami's Psychology Department input once the general purpose (showing results) is complete.

This project shall strive to keep the highest standards for ethical obligations with integrity and honesty that align with the National Society of Professional Engineers and shall seek guidance in unfamiliar areas as required [26]. The continuing and conducted research to complete a functional device to achieve this project's goals will be ongoing throughout this project's lifespan. Upon completing a working badge, open dialog with Miami University's Psychology Department will begin so that design modifications can take place to align for a study use application.

This study application could be inclusive of learning more about the herding and groupthink effect. These effects (herding and groupthink) are considered a psychological phenomenon in which individuals make irrational or rational judgments in reaction to an exhibited group reaction [11][19]. Thus, upon completion of a working device and App, the open dialog with Miami's Psychology Department could lead to this project's use in a future study setting.

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## Scope and Methodology

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This project shall strive to keep the highest standards for ethical obligations with integrity and honesty that align with the National Society of Professional Engineers and shall seek guidance in unfamiliar areas as required [26].

This project's scope and intent are to produce a functional vote tabulating device and App using design principles while seeking input from Miami's Psychology Department to be used in future studies. Upon completing a working badge, open dialog with Miami University's Psychology Department will begin so that design modifications can take place to align for a study use application. Future work for this device could be to create multiple copies that interface with the created App, resulting in revisions, as a study requires.

## General Research

Before selecting components, this team's goals and scope align with creating a physical vote tabulating device with haptic and visual feedback. Upon initial coordination with Miami's Psychology Department, at the project start, it was deemed that their involvement would be most beneficial after designing the device, construction, and undergoing a basic test to evaluate its feasibility and applicability for future study [13]. Thus, this research's importance was to generate a device, with implementations in the future made App for its viability and applicability for use in future studies considering design principles and the psychology behind the Human-Computer Interaction (HCI).

Design principles are composed of numerous conceptual elements arranged to form a structure of work to help fulfill a specific purpose, such as displaying functionality with aesthetic features or one or the other [14]. The physical design, and the selection of components, consider several design principles and the psychology behind the Human-Computer Interaction - a multidisciplinary field focused on the interaction between users and computer(s) [12].

## Engineering Analysis

Engineering Analysis is a process in which fundamental parts undergo analysis to ensure the most logical product is selected based on intended scope and project intent [22].

### Design Intent

The inspiration for this project and the vote tabulating device's design comes from the episode Majority Rule from the Fox series The Orville. In this episode, the characters visit a society based upon the majority opinion of citizens who use a vote tabulating device up (good)/down (bad) arrow feature to judge an individual's behavior [25]. The badge type shown in this episode is nonfunctional [25]. However, this group determined potential in a vote tabulating device could open study possibilities to observe individuals' behavior and reaction to societal events and other users' options by seeing others interact with the actual creation. These observed behaviors may lead to gathering analytics and data on the herding or groupthink effects.


FIGURE 2: HERDING AND GROUPTHINK CARTOON DEPICTION [17]

Herding and groupthink effects are the physiological behaviors that are considered a phenomenon in which individuals make rational or irrational judgments in reaction to an exhibited group reaction; such an example is a cartoon depiction shown in figure 1 [11][19]. Though this is one of the device's goals, this project focuses on designing a device that considers the inspiration previously noted while encouraging its use by its actual design. The investigative analysis shows that using design principles can make the badge more appealing for use. Design principles are composed of numerous conceptual elements arranged to form a structure of work to help fulfill a specific purpose, such as displaying functionality with aesthetic features or one or the other [14].

## Connection of Components - Qwiic Connect System

The research at the project start indicated two main types of means of connection for all components used in the design of this project: soldering and using a Qwiic Connect System. The joining of two metal pieces through a third metal, with the third metal melting point below the two metal pieces, is fundamentally known as soldering [15]. The soldering method requires several tools and supplies (soldering iron, sponge to clean iron, solder, solder sucker to de-solder or remove excess, patience, and skill [4]). The number of tools required is a perceived disadvantage because of these items' overall cost, adding to the device cost, and the desire to prototype.

FIGURE 3: COMMON SOLDERING TOOLS AND SUPPLIES [4]

Researching methods of rapid prototyping different components, the Qwiic Connect System is the next viable option. A Qwiic Connect System is an inter-integrated circuit system (I2C) where devices can be daisy-chained together, with just one wire, without soldering. The connection of components through only one wire allows for faster prototyping and is less prone to wiring mistakes [23]. Therefore, due to possible fluid adjustments of chosen components' location, ease of use, and low cost since the extra tools and supplies are not needed, this team has opted to use the Qwiic Connect System.

## Bluetooth Capable Development Board

Upon analysis of the connection method, the development board analysis began where this group determined some parameters are paramount in meeting the project's scope and intent. These parameters and are as follows:

- Utilizes the Qwiic Connect System
- Maintains a small footprint to reduce the overall size of the device
- Is Bluetooth Low Energy (BLE) to allow for connection to the internet and reduce the power draw
- Has an integrated connector for a battery
- Has enough Random-Access Memory (RAM) to run multiple number displays

## Number Display

Investigative research determined the presence of numerous forms of number display available. Such number displays include segment, LED, LCD, E-Ink/Paper, and OLEDs [24]. Since the connection method is determined, the next step for this group was to set other essential parameters based on availability and project objective. Therefore, the following parameters set the selection of the number display:

- Maintains a small footprint to reduce the overall size of the device
- Low power consumption to reduce the overall power draw of the device
- Documentation available to help with programming
- Display crisp enough to easily make out the count numbers for the up/down vote section

## Tactile Switch (Button)

Research of tactile buttons yielded that there are two types: sealed and standard. The sealed type can withstand harsher elements like water and dust, whereas the standard is not accommodating to such features [20]. It is not within this project scope to design a device exposed to harsher elements, so the importance of selection between these two types is not of significant importance. The important researched parameters are its ability to be part of the Qwiic Connect System and provide haptic feedback. Another researched item that would apply to delivering even more sensory feedback would be having an LED within the button that could light up when pressed.

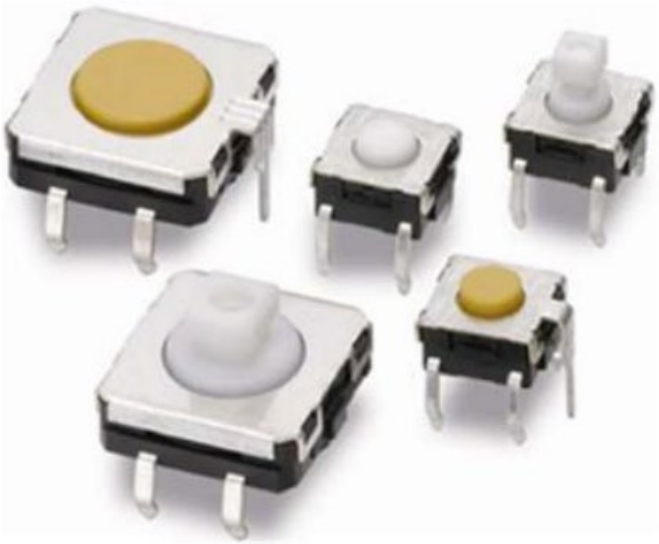

FIGURE 4: TACTILE SWITCHES [20]

## Code Generation

### Development Board Interface

The research performed for the code generation that will be interfaced/uploaded to the development board for displaying count results on the physical number display yielded one clear path; to use Arduino. Arduino is an open-source platform hosting a large community that allows easy software/hardware fulfillment [3].

### App Interface

To align with the project's goal, the intent is to create a prototypical App capable of interfacing with the development board via Bluetooth, which has a user-friendly interface.

## Battery

A vital project parameter is to have the device be mobile. Due to this, investigative research began and determined the presence of numerous types of batteries available. Such battery types include Alkaline, Nickel Metal Hydride, and Lithium-Ion (LiPo) [10]. During this investigation, analysis into those batteries with an easy recharge capability (without the need for extra equipment) to maintain a small footprint determined that the best fit, in conjunction with development board selection, was that of the LiPo battery type. The next step was then to investigate how to calculate the lifespan of different batteries to determine better what capacity size fits the project scope best. Since performing this investigation, the formula provided by PowerStream, shown in equation 1, is essential for lifespan determination [21].

$$Lifespan = \frac{Capacity\ (Ah)}{Current\ Draw\ (A)}$$

EQUATION 1: LIFESPAN CALCULATION

## Expected Findings

Expected findings are the joint exploration of analysis and anticipated outcomes [18].

### Design

Considering the research analysis findings, conceptual drawings, and inspiration from the vote tabulating machine from the episode, Majority Rule, the design is formulated using Autodesk's Fusion 360 (cloud-based platform for generating 3D computer-aided designs [2]) as shown in figure 4. The invention's basis is such that there are two indicators, an up and down arrow with a corresponding number display to show the individuals count, as rendered in figure 5. In conjunction with HCI, the design principles considered to help accomplish this device's goal and scope are inclusive, but not limited to, prototyping, iconic representation, constraint, affordance, highlighting, and mapping.

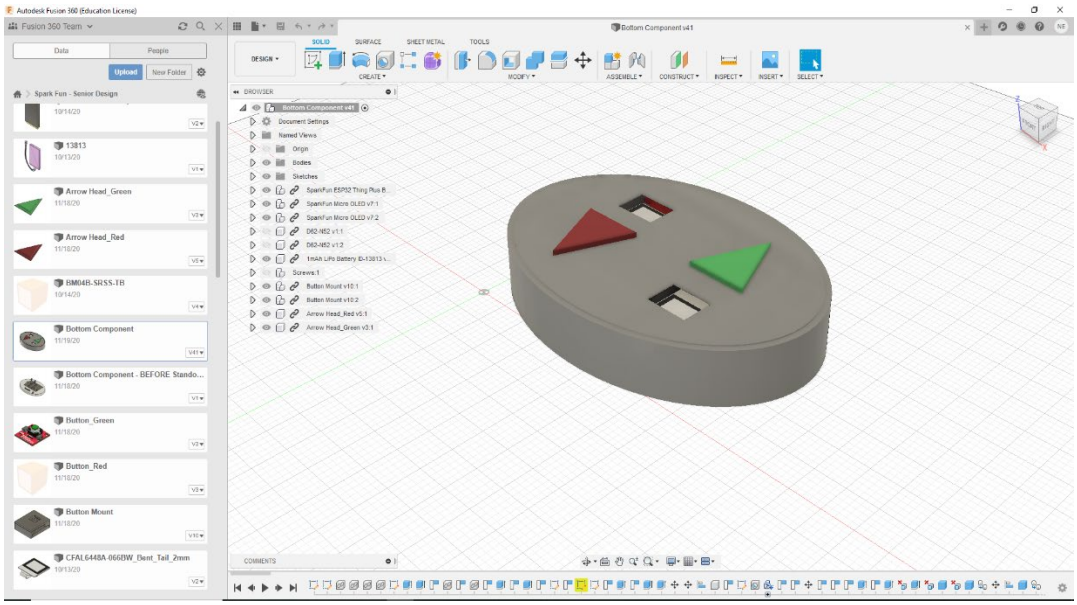

FIGURE 5: DESIGN GENERATED USING AUTODESK'S FUSION 360

The evolutionary prototyping design principle is where a simple model is put into production to test and examine functionalities and ideas that undergo an evaluation and refinement until it reaches its final form [16]. The approach to the expected findings behind the initial device design incorporates this evolutionary prototyping design principle due to the understanding, noted in this project's scope, that based upon feedback from Miami's Psychology Department, the design is open to change to help fit the future needs of a study. Understanding the evolutionary prototype use makes the device easy to use and appeals to the design principles of iconic representation, constraint, affordance, highlighting accessibility, and mapping.

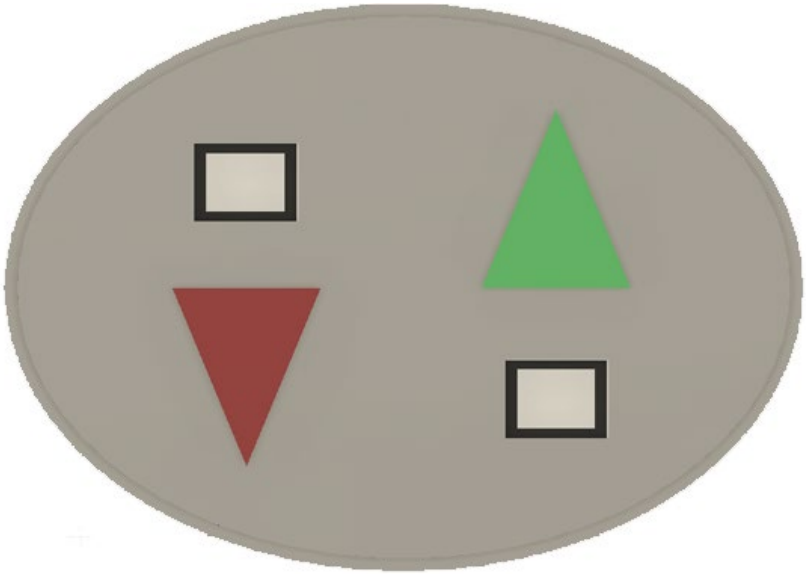

FIGURE 6: TOP VIEW RENDING OF THE DEVICE

The use of icons that symbolizes and can be comparable to an action or object is considered an iconic representation [16]. Simultaneously, the affordance design principle is the intuitive association between an item's look and function and its use [8][16]. Considering the combinational use of these two design principles, for the up/down arrow design, the user has an association with the arrow's direction where up is good and down is bad. Since the user is limited to two actions, the design exhibits the constraint design principle [16]. The press action on either arrow provides the user with a tactile interaction, another design principle incorporated into the design that can elicit a psychological response [27]. This association would be the behavioral meaning that if an individual sees a user's action they like, they will intuitively know and press the up arrow. This intuition is further reinforced with the highlighting design principle.

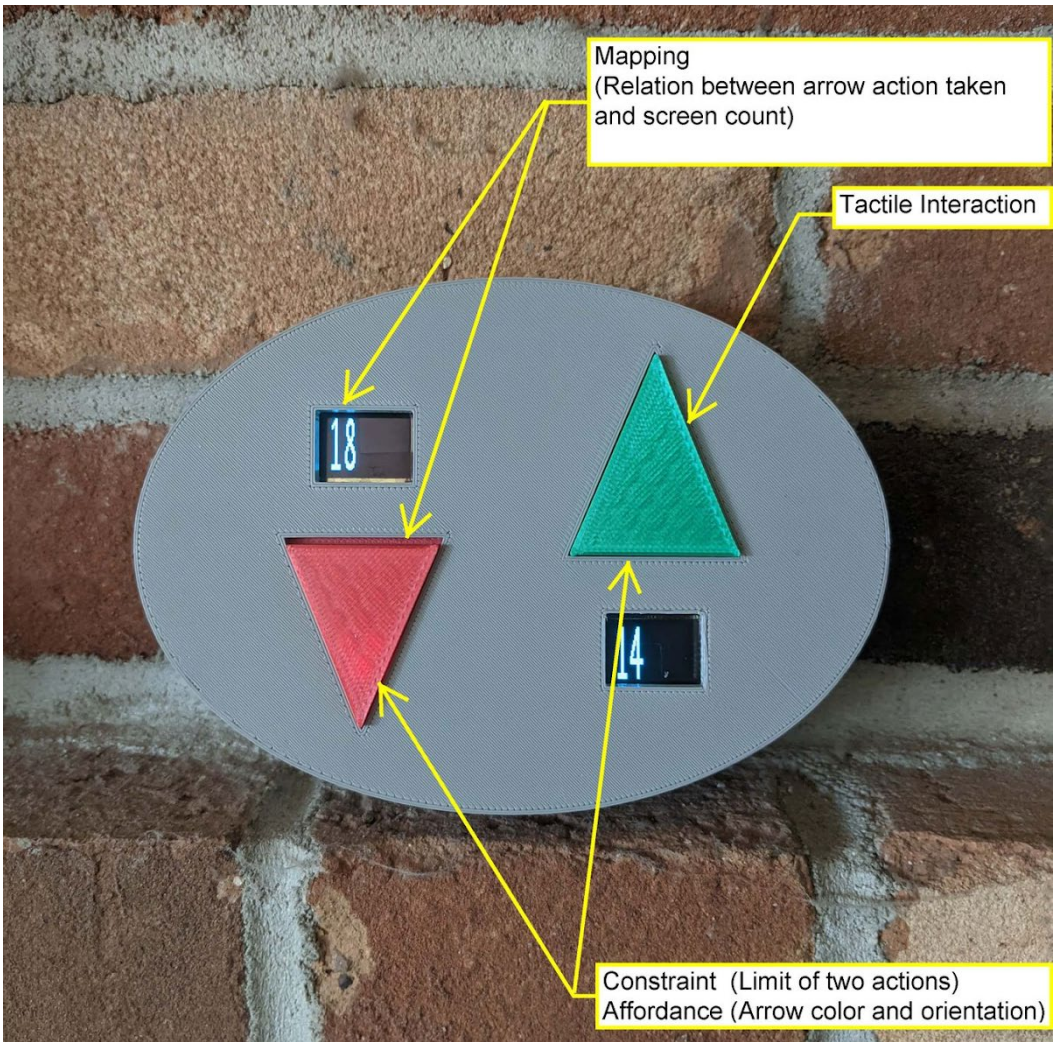


FIGURE 7: EXAMPLE OF DENOTED DESIGN PRINCIPLES

Highlighting is the process of bringing attention to something through color, typeface, or blinking. This highlighting principle helps bring awareness to the arrows on the device and further enhances the mapping principle. Upon further coordination with this student team and a representative from Miami's Psychology Department, it was determined that the initial design did not provide an intuitive correspondence between the arrow and the associated arrow. Therefore, the suggestion was to provide a better means of correspondence through several suggested methods. For this project, a colored film was added to the associated LED screen to highlight and better represent the associated, shown in figure 6 [28]. The mapping principle use furthers the incorporation of design principles. The mapping principle is the relationship between the controls and behavior (i.e., the user associated green with good and red with bad) [8][16].

## Connection of Components - Qwiic Connect System

The Qwiic Connect System's expected findings align with the engineering analysis. This system provides prototyping and overall ease of use due to one wire requirement to connect components in a daisy chain manner. Thus, the electrical schematic in figure 7 exhibits how the Qwiic Connect System will interact with this project. Therefore, to align with the evolutionary prototyping design principle in the interest of possible fluid adjustments of chosen components' location from any of Miami's Psychology Department feedback.

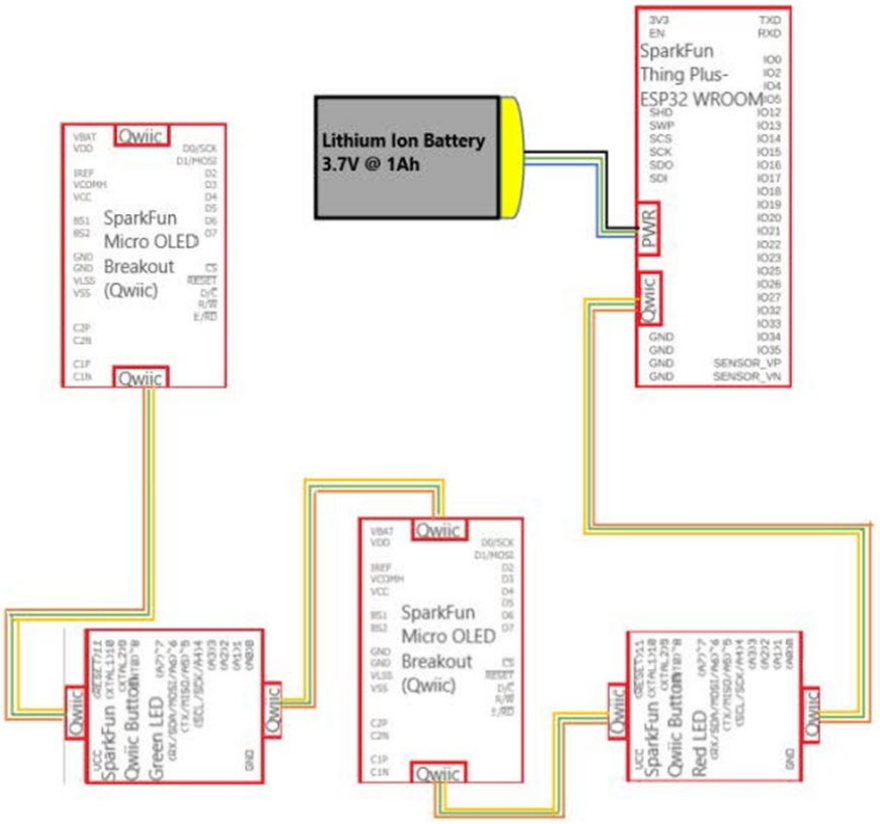


FIGURE 8: ELECTRICAL SCHEMATIC USING THE QWIIC CONNECT SYSTEM

## Bluetooth Capable Development Board

The project scope and parameters in the engineering analysis considered, several development boards have been evaluated, with the SparkFun Thing Plus (figure 8) selection fulfills these items. This development board's findings conclude that it uses the Qwiic Connect System, maintains a small footprint, is BLE capable, has an integrated battery connector, and has enough RAM to run multiple displays [6].

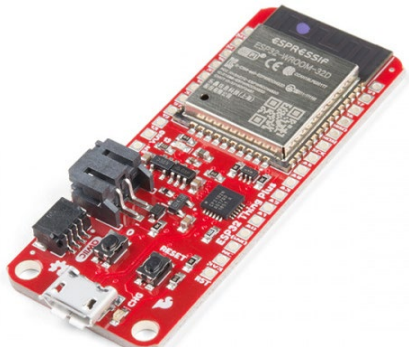

FIGURE 9: SPARKFUN THING PLUS [6]

## Number Display

The expected finding determination was that the SparkFun Micro OLED Breakout would be the best fit for this project, and shown in figure 9. This SparkFun Micro OLED Breakout product is small, has low power consumption, has documentation available to help with programming, and can have varying font sizes to allow the user(s) to make out the count numbers [9].

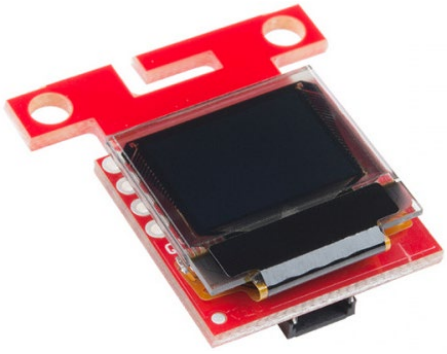

FIGURE 10: SPARKFUN MICRO OLED BREAKOUT [9]

## Tactile Switch (Button)

Since this project intends not to create a meant for harsher environments, selecting the tactile button is not contingent upon being sealed or standard. The findings determined that this project's best fit is the SparkFun Qwiic Button – LED (figure 10). This determination is due to its ability to be a part of the Qwiic Connect System, provide haptic feedback, and has an LED built into the button where further sensory feedback can be provided if desired [5].


FIGURE 11: SPARKFUN QWIIC BUTTON – GREEN LED [5]

## Code Generation

### Development Board Interface

During analysis, the expectation was that the clear yielded path for code generation for the development board interface is Arduino. The expected findings concluded that this platform is best suited for this project because of its open-source nature and large community available for feedback if an issue arose with the code generation and development board interface. Thus, when it came to writing code for showing the count when the user or other individual selects their desired symbol, it has been successful in compiling and connecting to Bluetooth to interface with the prototypical App (Appendix A).

## App Interface

The prototypical App interface selected for its ease of use for this project was MIT App Inventor. MIT App Inventor is a free programming environment that uses visual programming blocks to generate a simple, functional App used on tablets and smartphones [29]. Using the visual programming block feature of this software, the prototypical App was developed to reflect the visual count through Bluetooth communication in real-time, as shown in figure 11, and is referenced in Appendix B.

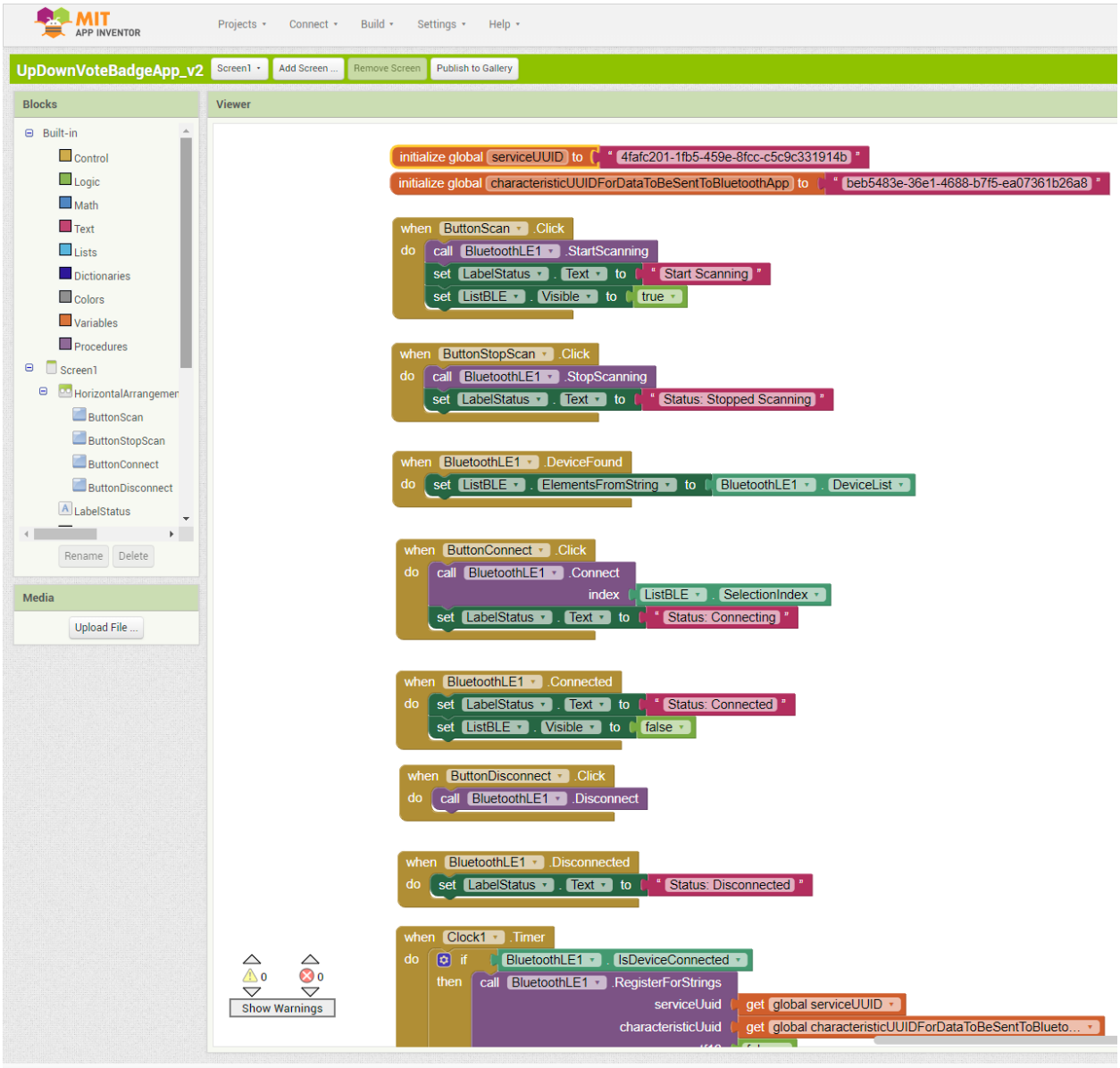


FIGURE 12: SCREEN CAPTURE OF MIT APP INVENTOR PROTOTYPE BUILD

## Battery

Considering the engineering analysis and lifespan calculation, the expectation that a Lithium-Ion battery fits this scope best. This statement is that these batteries maintain a small footprint, work well with the selected development board, and come in varying capacity sizes. Thus, there is a logical choice between two Lithium-Ion batteries, with the only difference in the capacity's size. Evaluating the two batteries, the ultimately chosen one considers the footprint size rather than capacity due to the lifespan not varying wildly, as shown in equation 2 and equation 3. Therefore, the expectation that the one amp-hour Lithium-Ion battery will work best for this project.

$$Lifespan = \frac{Capacity\ (Ah)}{Current\ Draw\ (A)}$$

$Given$:

$(2) Qwiic\ Buttons\ @\ 50\ mA\ each = 100\ mA$

$(2) OLEDs\ @\ 10\ mA\ each = 20mA$

$So\ that, total\ current\ is\ 120\ mA, and$

$chosen\ Battery\ is\ 1\ Ah$

$Therefore,$

$$Lifespan = \frac{1\ Ah}{120\ mA}$$

$$\boldsymbol{Lifespan = 8.3\ hours}$$

**EQUATION 2: LIFESPAN CALCULATION FOR 1AH**

$$Lifespan = \frac{Capacity\ (Ah)}{Current\ Draw\ (A)}$$

$Given$:

$(2) Qwiic\ Buttons\ @\ 50\ mA\ each = 100\ mA$

$(2) OLEDs\ @\ 10\ mA\ each = 20mA$

$So\ that, total\ current\ is\ 120\ mA, and$

$chosen\ Battery\ is\ 2\ Ah$

$Therefore,$

$$Lifespan = \frac{2\ Ah}{120\ mA}$$

$$\boldsymbol{Lifespan = 16.7\ hours}$$

**EQUATION 3: LIFESPAN CALCULATION FOR 2AH**

## Conclusion and Recommendation for Further Study

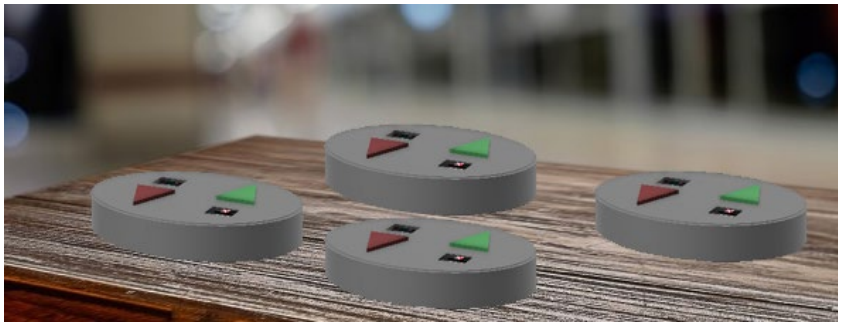

FIGURE 13: RENDERING OF MULTIPLE DEVICES

In conclusion, with available research, engineering analysis, common findings, testing, and coordination, a prototypical device and App was developed. These components can display the count of users on both a physical display and created App. This accomplishment could not have been done without the planning outlined in the appendices and support from Miami University to this student group. This project intends to be used for future studies, as Miami University sees, fit, and could even be built upon to reduce the device size and increase App's functionality.

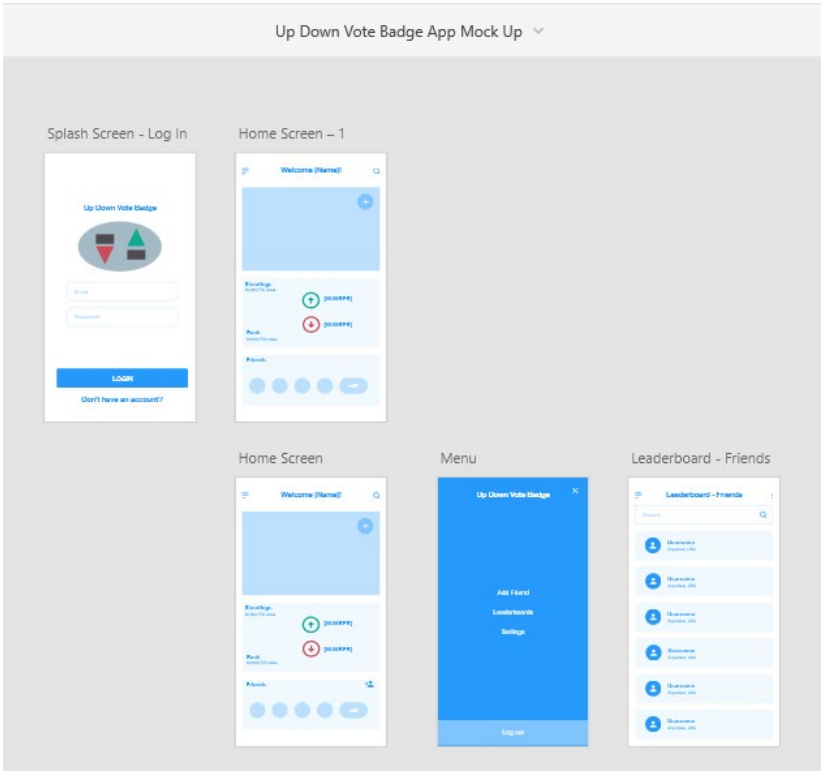


FIGURE 14: EXCERPT OF APP MOCKUP USING ADOBE XD (APPENDIX G)

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# Appendices

# Appendix A: Code

```
/*
  Up Down Vote Badge

  Battery-controlled device capable of keeping count in a visual
  and code manner with two indicators representing up and down arrowheads
  that mimics the vote tabulating machines, in the episode,
  Majority Rule, from the Fox series The Orville.
  The user or other individual chooses their desired symbol,
  and the count of this device counts in an upward fashion.

  Displays results on two 64 x 48 OLED displays (SparkFun Micro OLED Breakout
(Qwiic))
  Uses two SparkFun Qwiic Button - LED ((1)Green & (1)Red)
  Board used in the initial design: one SparkFun Thing Plus - ESP32 WROOM
    - Follow SparkFun ESP32 Thing Plus Hookup Guide:
https://www.sparkfun.com/products/15663

The helpful start points for the generation of count used throughout the code
sections: ESP32 - 7 Segment Scoreboard - Hackster.io.
https://www.hackster.io/jlorentz/esp32-7-segment-scoreboard-33534f

  Up Down Vote Badge 2020
  https://www.updownvotebadge.com/
*/

////Bluetooth Items////

#include <BLEDevice.h>
#include <BLEServer.h>
#include <BLEUtils.h>
#include <BLE2902.h>

BLEServer* pServer = NULL;
BLECharacteristic * characteristicForDataToBeSentToBluetoothApp;
BLECharacteristic * characteristicForDataReceived;
bool deviceConnected = false;
bool oldDeviceConnected = false;

// See the following for generating UUIDs:
// https://www.uuidgenerator.net/

#define serviceUUID        "4fafc201-1fb5-459e-8fcc-c5c9c331914b"
#define characteristicUUIDForDataToBeSentToBluetoothApp "beb5483e-36e1-4688-
b7f5-ea07361b26a8"
#define characteristicUUIDForDataReceived "beb5483e-36e1-4688-b7f5-
ea07361b26a9"

// Include Wire Library for I2C
#include <Wire.h>

////SparkFun Micro OLED Breakout Items////

// Include SparkFun Micro OLED Breakout (Qwiic) library
#include <SFE_MicroOLED.h>

// Define reset pin for Micro OLED. This is pin is not used and is a
requirement
```

```
// for SparkFun Micro OLED Breakout library use
#define PIN_RESET 9

MicroOLED upVoteoledDisplay(PIN_RESET);
MicroOLED downVoteoledDisplay(PIN_RESET);

void printDisplay(MicroOLED oled, int numberToDisplay)
{
  oled.setCursor(0,0);
  oled.setFontType(3);
  oled.print(numberToDisplay);
  oled.display();
}

////End SparkFun Micro OLED Breakout Items////

////SparkFun Qwiic Button Items///

// Include SparkFun Qwiic Button - Color LED library
#include <SparkFun_Qwiic_Button.h>
QwiicButton upVoteGreenLedButton;
QwiicButton downVoteRedLedButton;

// Brightness of LED when pushed: Values between 0 (off) and 255 (MAX)
uint8_t brightnessOfButtonLEDWhenNotPressed = 05;
uint8_t brightnessOfButtonLEDWhenPressed = 200;

///End SparkFun Qwiic Button Items////

// Set counter for Up and Down Vote
int upVoteCount = 0;
int downVoteCount = 0;

// Integer used to compare vote counts to prevent constant update to
Bluetooth App
int upVoteCountBluetoothComparsionToPreventConstantUpdateToBluetoothApp =
upVoteCount;
int downVoteCountBluetoothComparsionToPreventConstantUpdateToBluetoothApp =
downVoteCount;

// This method will initialize the TwoWire I2C library and both OLEDs
void initializeHardware()
{
  Wire.begin();

  upVoteoledDisplay.begin(0x3D, Wire);
  upVoteoledDisplay.flipHorizontal(true);
  upVoteoledDisplay.flipVertical(true);
  downVoteoledDisplay.begin(0x3C, Wire);
  if (upVoteGreenLedButton.begin() == false)
  if (downVoteRedLedButton.begin(0x6E) == false)
  upVoteGreenLedButton.LEDon(brightnessOfButtonLEDWhenNotPressed);
  downVoteRedLedButton.LEDon(brightnessOfButtonLEDWhenNotPressed);
}

void showSplashScreens()
{
```

```
  // NOTE THE BUFFER IS SHARED BETWEEEN ALL "MicroOLED" CLASSES!!!!!
  upVoteoledDisplay.clear(ALL);
  downVoteoledDisplay.clear(ALL);
  upVoteoledDisplay.display();
  downVoteoledDisplay.display();
  upVoteoledDisplay.clear(PAGE);
  downVoteoledDisplay.clear(PAGE);
}

class MyServerCallbacks: public BLEServerCallbacks
{
    void onConnect(BLEServer* pServer)
    {
      deviceConnected = true;
    };

    void onDisconnect(BLEServer* pServer)
    {
      deviceConnected = false;
    };
};

class MyCallbacks: public BLECharacteristicCallbacks
{
    void onWrite(BLECharacteristic *characteristicForDataReceived)
    {
      std::string rxValue = characteristicForDataReceived->getValue();

      if (rxValue == "sendVote")
      {
        sendVoteCountToBluetoothApp();
        }
    }
};

void setupBluetooth()
{
  Serial.begin(115200);

  // Create the BLE Device
  BLEDevice::init("Up Down Vote Badge");

  // Create the BLE Server
  pServer = BLEDevice::createServer();
  pServer->setCallbacks(new MyServerCallbacks());

  // Create the BLE Service
  BLEService *pService = pServer->createService(serviceUUID);

  // Create a BLE Characteristic
  characteristicForDataToBeSentToBluetoothApp = pService-
>createCharacteristic
                    (
                      characteristicUUIDForDataToBeSentToBluetoothApp,
                      BLECharacteristic::PROPERTY_NOTIFY
                    );
```

```
  // Create a BLE Descriptor
  characteristicForDataToBeSentToBluetoothApp->addDescriptor(new BLE2902());

  // Create a BLE Characteristic
  characteristicForDataReceived = pService->createCharacteristic
                    (
                      characteristicUUIDForDataReceived,
                      BLECharacteristic::PROPERTY_WRITE
                    );
  characteristicForDataReceived->setCallbacks(new MyCallbacks());

  // Start the service
  pService->start();

  // Start advertising
  pServer->getAdvertising()->start();
  Serial.println("Waiting a client connection to notify...");
}

void setup()
{
  initializeHardware();
  showSplashScreens();
  setupBluetooth();
}

void
buttonIsPressedAndAssociatedVoteCountIsIncreasedBasedUponTheButtonThatIsPress
ed()
{
  if (upVoteGreenLedButton.isPressed() == true)
  {
    // Increase Up Vote counter
    upVoteCount++;
    upVoteGreenLedButton.LEDon(brightnessOfButtonLEDWhenPressed);
    while (upVoteGreenLedButton.isPressed() == true)
      delay(10);
    upVoteGreenLedButton.LEDon(brightnessOfButtonLEDWhenNotPressed);
    printDisplay(upVoteoledDisplay, upVoteCount);
  }

  // Down Vote Functionality
  if (downVoteRedLedButton.isPressed() == true)
  {
    // Increase Up Vote counter
    downVoteCount++;
    downVoteRedLedButton.LEDon(brightnessOfButtonLEDWhenPressed);
    while (downVoteRedLedButton.isPressed() == true)
       delay(10);
    downVoteRedLedButton.LEDon(brightnessOfButtonLEDWhenNotPressed);
    printDisplay(downVoteoledDisplay, downVoteCount);
  }
}

void sendVoteCountToBluetoothApp()
{
```

```
  if (upVoteCount !=
upVoteCountBluetoothComparsionToPreventConstantUpdateToBluetoothApp)
  {
    // For displaying the count to the Bluetooth App

    //Convert the value to a char array:

    //the ASCII of the integer will be stored in this char array
    char uTString[8];
    //(integer, yourBuffer, base) needed for the integer variable to be
converted to a string for BT app
    itoa(upVoteCount, uTString, 10);
    // this character will be needed for MIT App Inventor
    char upVoteCountCharacterForAppInventorUse[] = "u";
    // represents character of zero
    char upVoteCountBluetoothCharacter[] = {0};

    // Merger of character arrays to have the character required for App
Inventor appear before
    // the count for Bluetooth App control
    // strcat(des, src) where des stands for destination and src stands for
the string to be appended http://www.cplusplus.com/reference/cstring/strcat/
    strcat(upVoteCountBluetoothCharacter,upVoteCountCharacterForAppInventorUs
e);
    strcat(upVoteCountBluetoothCharacter,uTString);

    characteristicForDataToBeSentToBluetoothApp-
>setValue(upVoteCountBluetoothCharacter);
    characteristicForDataToBeSentToBluetoothApp->notify(); // Send the value
to the app!

    Serial.print("*** Up Vote Count: ");
    Serial.print(upVoteCountBluetoothCharacter);
    Serial.println(" ***");
    upVoteCountBluetoothComparsionToPreventConstantUpdateToBluetoothApp =
upVoteCount;

  }
  if (downVoteCount !=
downVoteCountBluetoothComparsionToPreventConstantUpdateToBluetoothApp)
  {
    // For displaying the count to the Bluetooth App

    //Convert the value to a char array:

    //the ASCII of the integer will be stored in this char array
    char dTString[8];
    //(integer, yourBuffer, base)needed for the integer variable to be
converted to a string for BT app
    itoa(downVoteCount, dTString, 10);
    // this character will be needed for MIT App Inventor
    char downVoteCountCharacterForAppInventorUse[] = "d";
    // represents character of zero
    char downVoteCountBluetoothCharacter[] = {0};

    // Merger of character arrays to have the character required for App
Inventor appear before
```

```
    // the count for Bluetooth App control
    // strcat(des, src) where des stands for destination and src stands for
the string to be appended http://www.cplusplus.com/reference/cstring/strcat/
    strcat(downVoteCountBluetoothCharacter,
downVoteCountCharacterForAppInventorUse);
    strcat(downVoteCountBluetoothCharacter, dTString);

    characteristicForDataToBeSentToBluetoothApp-
>setValue(downVoteCountBluetoothCharacter);
    characteristicForDataToBeSentToBluetoothApp->notify(); // Send the value
to the app!

    Serial.print("*** Down Vote Count: ");
    Serial.print(downVoteCountBluetoothCharacter);
    Serial.println(" ***");
    downVoteCountBluetoothComparsionToPreventConstantUpdateToBluetoothApp =
downVoteCount;
  }
}

void bluetoothDeviceConnectivity()
{
  if (deviceConnected)
  {
    sendVoteCountToBluetoothApp();
    delay(10); // bluetooth stack will go into congestion, if too many
packets are sent -> to get better response times from app, adjust the delay
    // info about bluetooth congestion https://github.com/nkolban/esp32-
snippets/issues/624
  }

  // disconnecting
  if (!deviceConnected && oldDeviceConnected)
  {
    delay(500); // need to give the BT stack time to get ready
    pServer->startAdvertising(); // restart advertising
    Serial.println("Start Advertising");
    oldDeviceConnected = deviceConnected;
  }

  // connecting
  if (deviceConnected && !oldDeviceConnected)
  {
    // do stuff here on connecting
    oldDeviceConnected = deviceConnected;
  }
}

void loop()
{
  bluetoothDeviceConnectivity();
  buttonIsPressedAndAssociatedVoteCountIsIncreasedBasedUponTheButtonThatIsPre
ssed();
}
```

# Appendix B: Prototypical App

UpDownVoteBadgeApp_v1 | Screen1 | Add Screen ... | Remove Screen | Publish to Gallery | Designer | Blocks

**Palette**

Search Components...

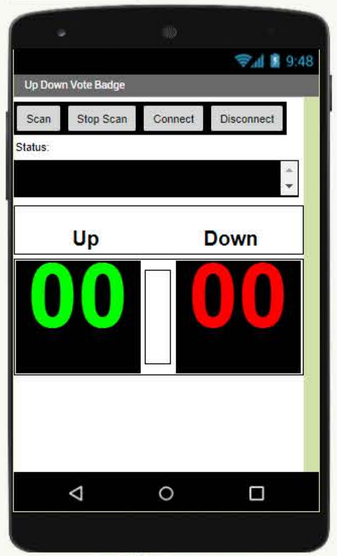
**User Interface**
- Button
- CheckBox
- DatePicker
- Image
- Label
- ListPicker
- ListView
- Notifier
- PasswordTextBox
- Slider
- Spinner
- Switch
- TextBox
- TimePicker
- WebViewer

**Layout**
**Media**
**Drawing and Animation**
**Maps**
**Sensors**
**Social**
**Storage**
**Connectivity**
**LEGO® MINDSTORMS®**
**Experimental**
**Extension**

**Viewer**

Display hidden components in Viewer

Phone size (505,320)




Non-visible components

BluetoothLE1 Clock1

**Components**

- Screen1
  - HorizontalArrangement1
    - ButtonScan
    - ButtonStopScan
    - ButtonConnect
    - ButtonDisconnect
  - LabelStatus
  - ListBLE
  - labelHorizontalArrangeme
    - labelForUpVoteTextInc
    - labelForDownVoteText
  - HorizontalArrangement4
    - labelForUpVoteCount
    - spaceForBetweenThel
    - labelForDownVoteCou
  - BluetoothLE1
  - Clock1

Rename Delete

**Media**

Upload File ...

**Properties**

Screen1

AboutScreen

AccentColor: Default

AlignHorizontal: Left : 1

AlignVertical: Top : 1

AppName: Up Down Vote Badge

BackgroundColor: Default

BackgroundImage: None...

BlocksToolkit: All

CloseScreenAnimation: Default

Icon: None...

OpenScreenAnimation: Default

PrimaryColor: Default

PrimaryColorDark: Default

ScreenOrientation: Unspecified

Scrollable

ShowListsAsJson

ShowStatusBar

Sizing: Responsive

Theme: Classic

Title: Up Down Vote Badge

TitleVisible

TutorialURL

VersionCode: 1

VersionName: 1.0

UpDownVoteBadgeApp_v1 | Screen1 | Add Screen ... | Remove Screen | Publish to Gallery | Designer | Blocks

**Blocks**

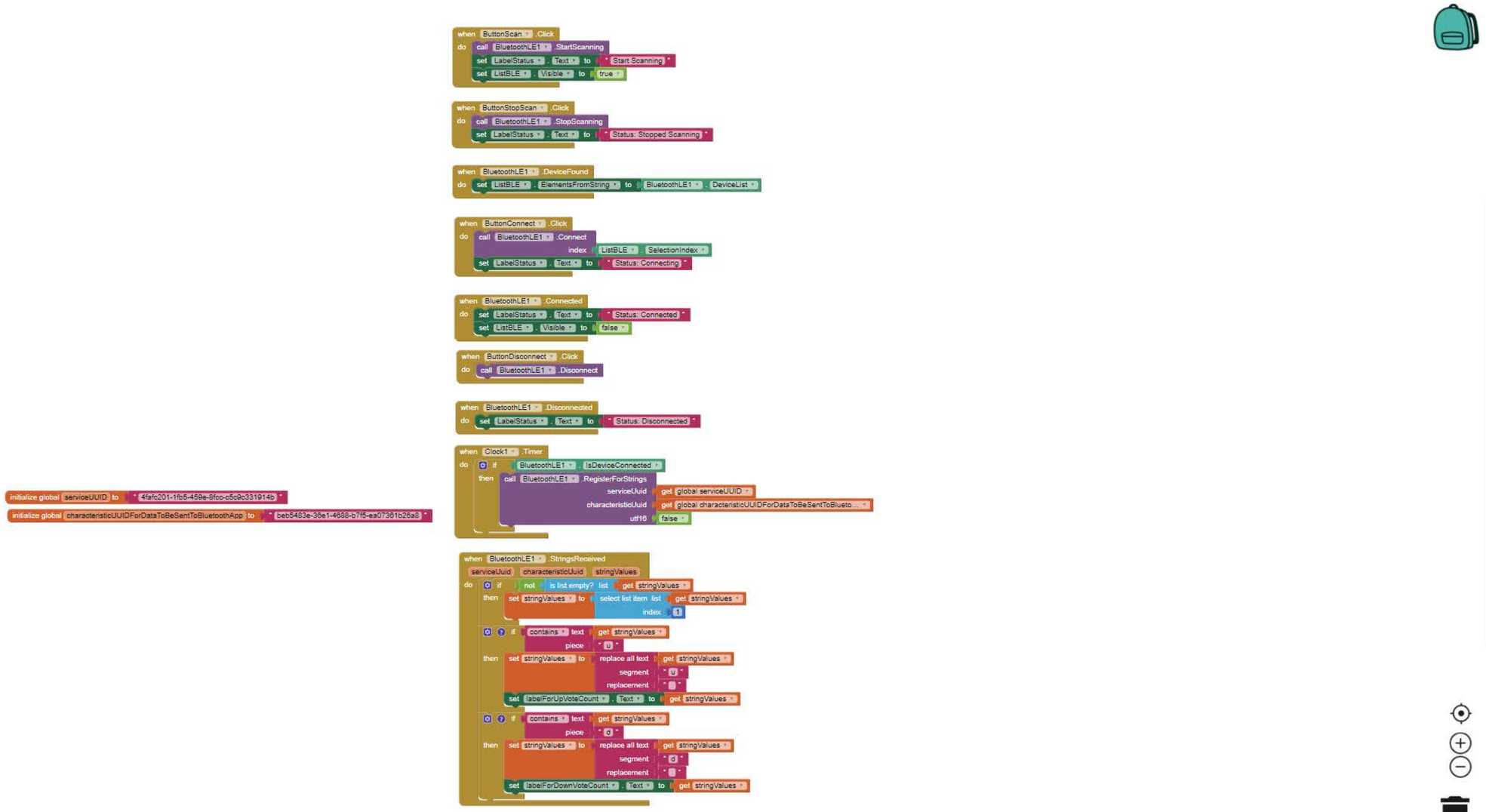
- Built-in
  - Control
  - Logic
  - Math
  - Text
  - Lists
  - Dictionaries
  - Colors
  - Variables
  - Procedures
- Screen1
  - HorizontalArrangemer
    - ButtonScan
    - ButtonStopScan
    - ButtonConnect
    - ButtonDisconnect
  - LabelStatus

Rename Delete

**Media**

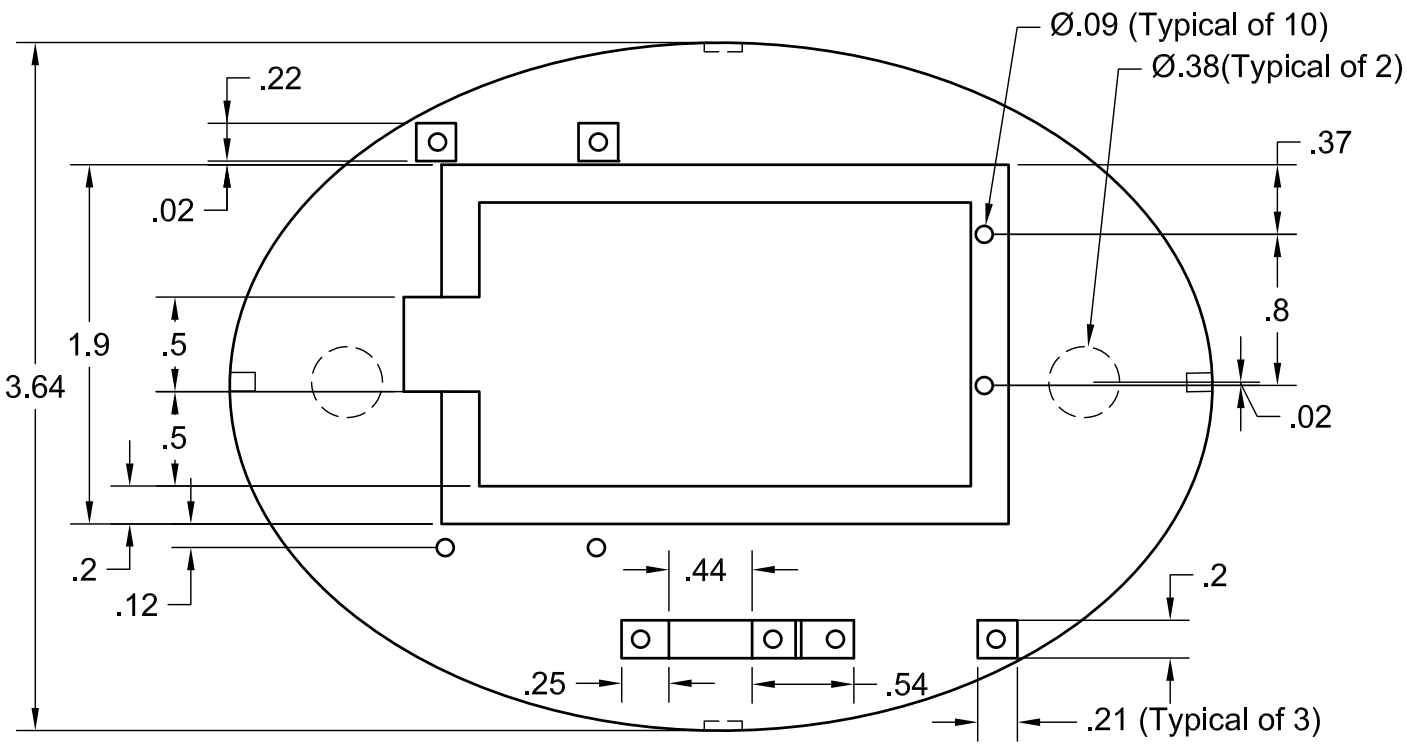
Upload File ...

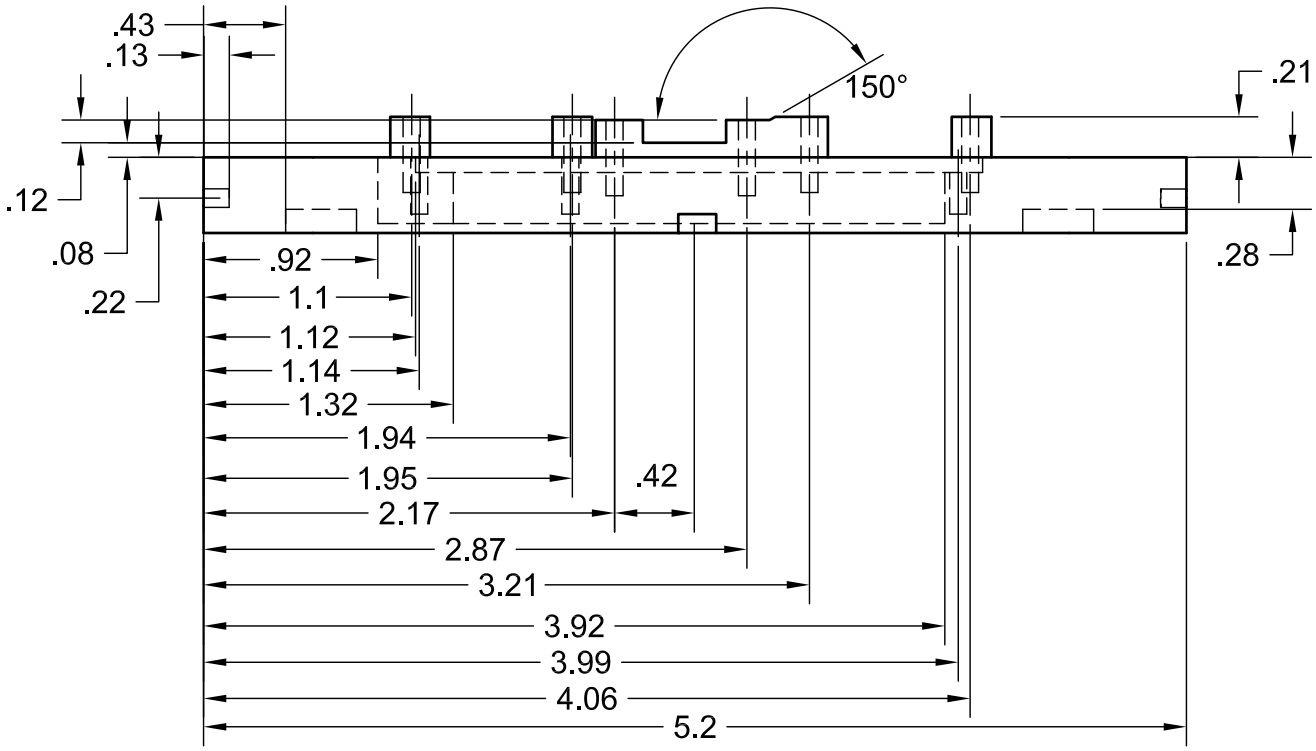
**Viewer**



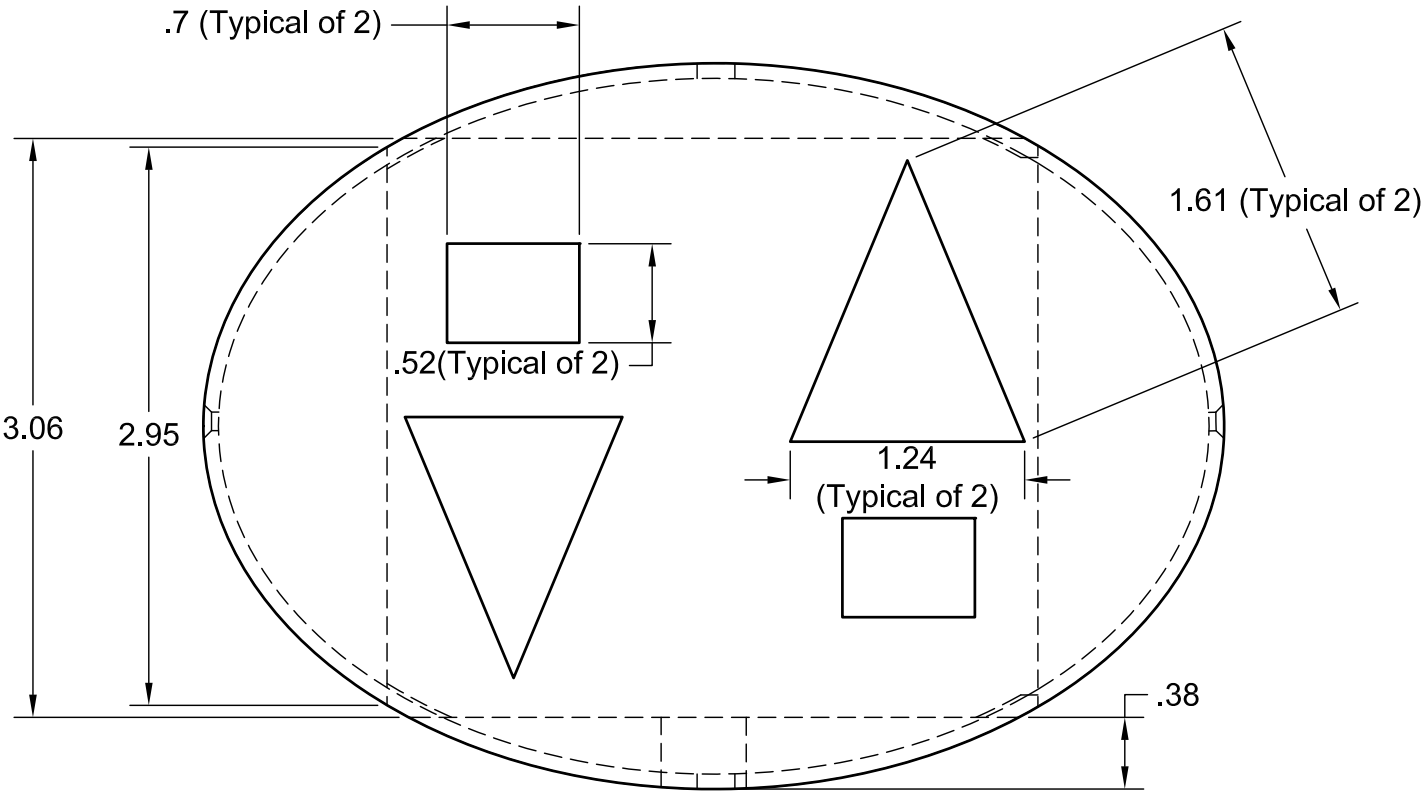

0 0 Show Warnings

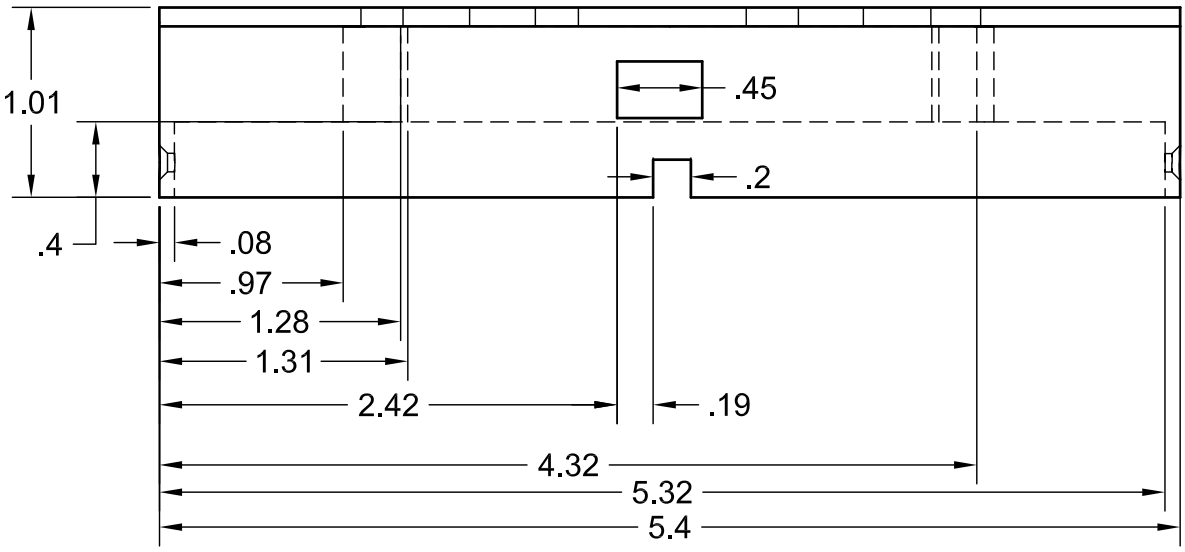
# Appendix C: Computer-Aided Drawing



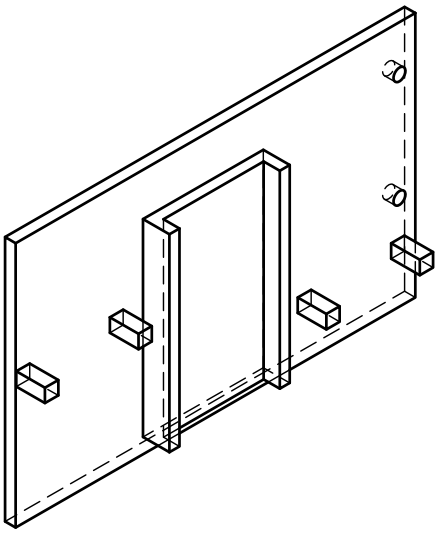



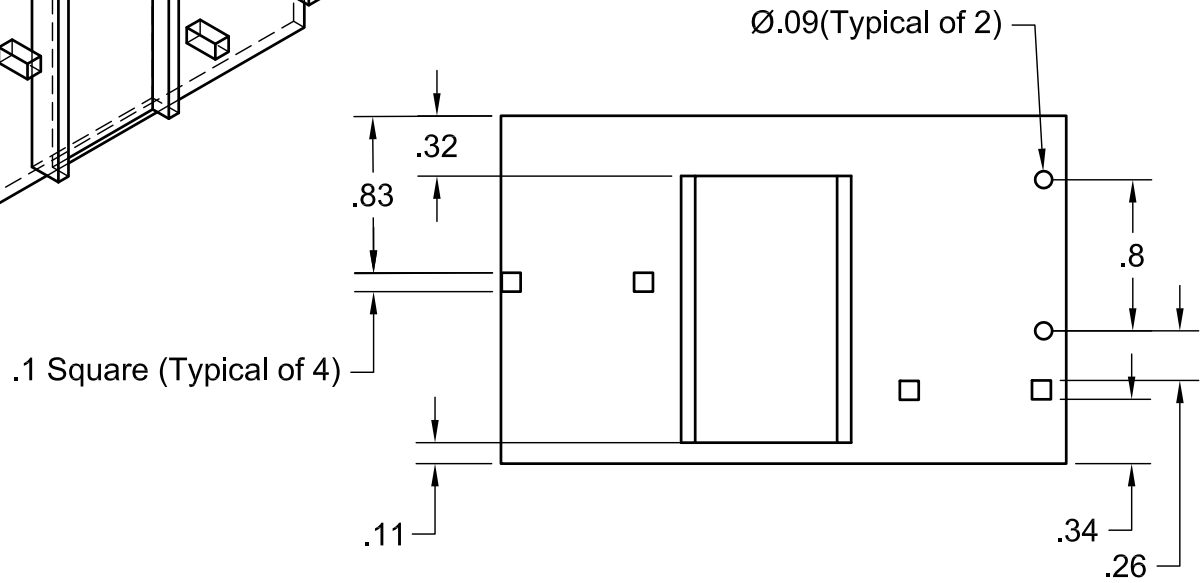

| | | | | |
|---|---|---|---|---|
| | PROJECT: Senior Design | | | |
| | TITLE: Bottom Component<br>Up Down Vote Badge | | | |
| APPROVED | SIZE: A | CODE | DWG NO | REV: 1 |
| CHECKED | | | | |
| DRAWN: Nicole E 02/14/2021 | SCALE: 1:1 | WEIGHT | SHEET: 1/1 | |

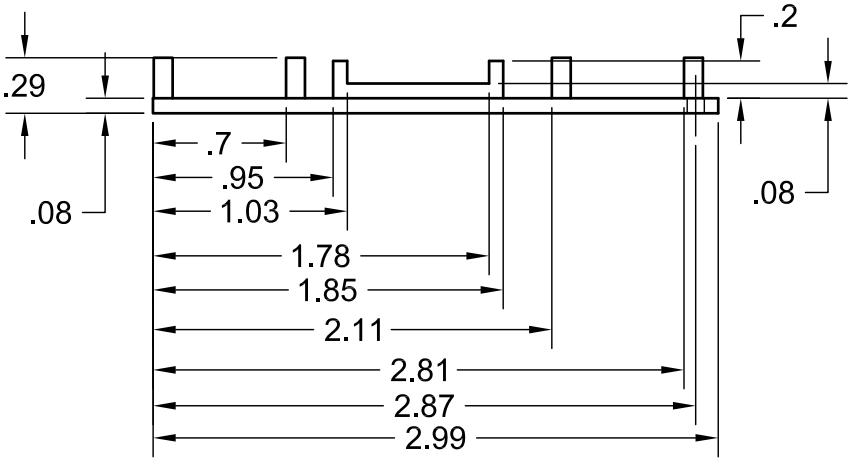


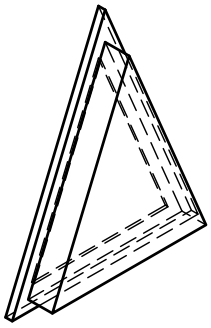

| | | | | |
|---|---|---|---|---|
| | PROJECT: Senior Design | | | |
| | TITLE: Cover Component<br>Up Down Vote Badge | | | |
| APPROVED | SIZE: A | CODE | DWG NO | REV: 1 |
| CHECKED | | | | |
| DRAWN: Nicole E 11/19/2020 | SCALE: 1:1 | WEIGHT | SHEET: 1/1 | |

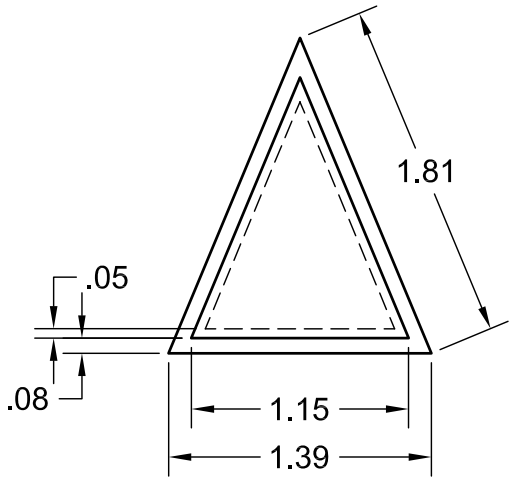


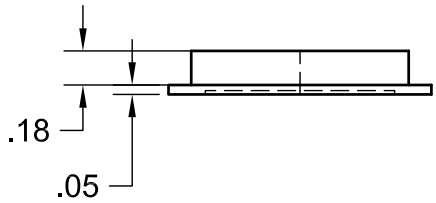


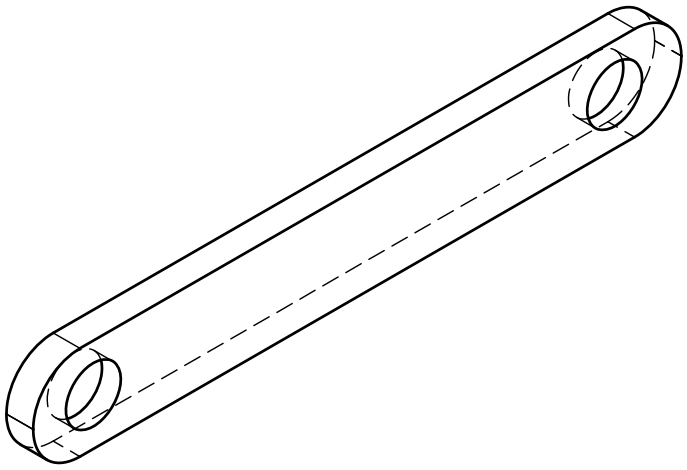

| | | | | |
|---|---|---|---|---|
| | PROJECT: Senior Design | | | |
| | TITLE: Battery Cover<br>Up Down Vote Badge | | | |
| APPROVED | SIZE: A | CODE | DWG NO | REV: 1 |
| CHECKED | | | | |
| DRAWN Nicole E 02/14/2021 | SCALE 1:1 | WEIGHT | SHEET 1/1 | |

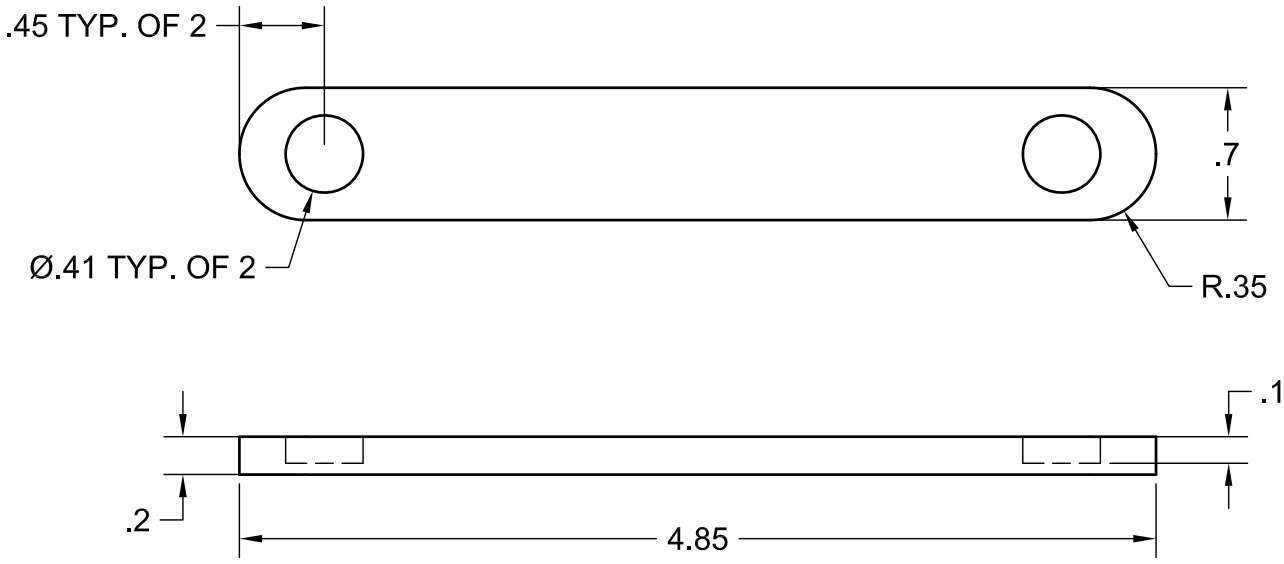





| | | | | |
|---|---|---|---|---|
| | PROJECT: Senior Design | | | |
| | TITLE: Arrow Head Red & Green<br>Up Down Vote Badge | | | |
| APPROVED | SIZE: A | CODE | DWG NO | REV: 1 |
| CHECKED | | | | |
| DRAWN Nicole E 5/5/2021 | SCALE 1:1 | WEIGHT | SHEET 1/1 | |

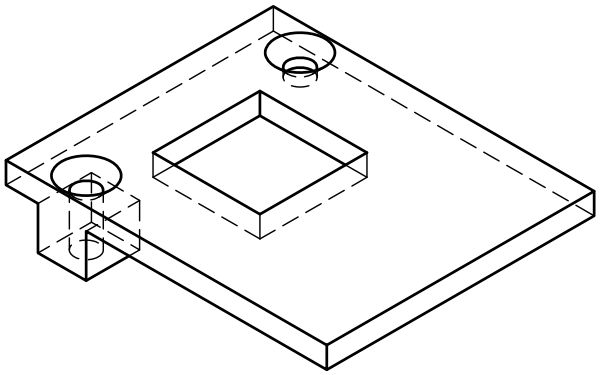


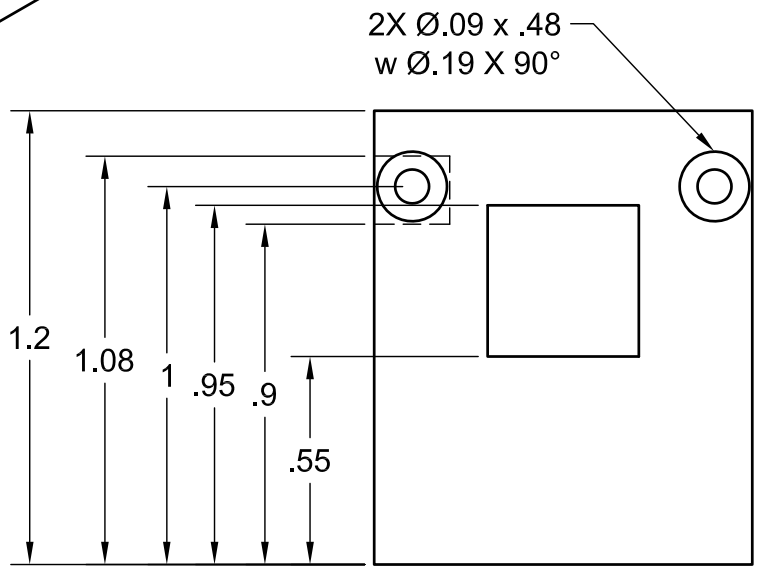


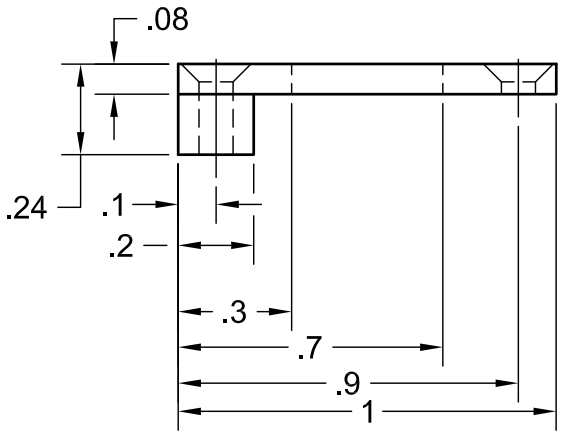




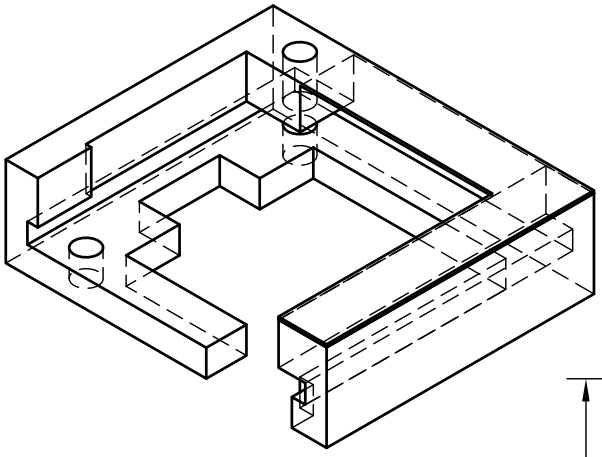
| | | | | |
|---|---|---|---|---|
| | PROJECT: Senior Design | | | |
| | TITLE: Shirt Magnet Holder<br>Up Down Vote Badge | | | |
| APPROVED | SIZE: A | CODE | DWG NO | REV |
| CHECKED | | | | |
| DRAWN Nicole E 5/5/2021 | SCALE 1:1 | WEIGHT | SHEET 1/1 | |

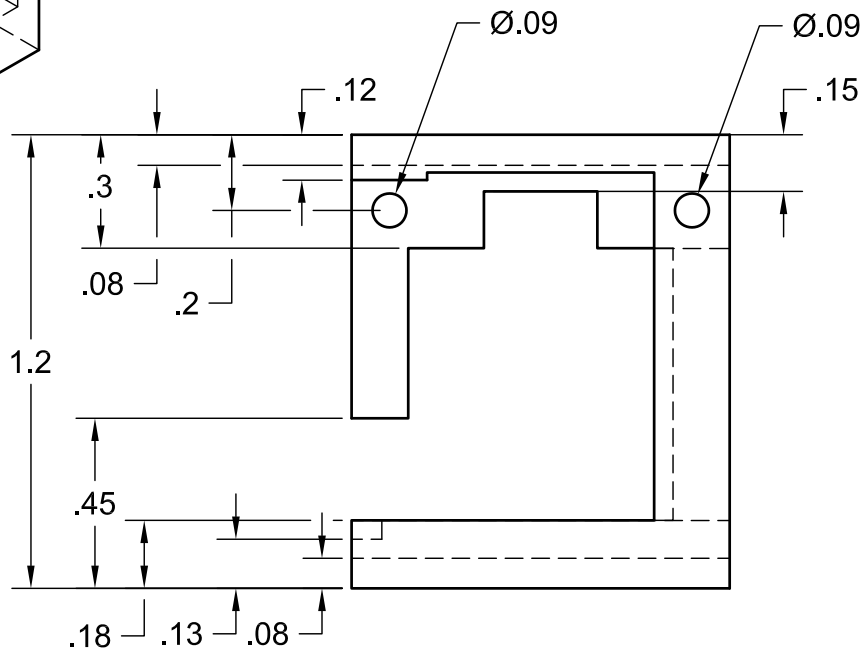


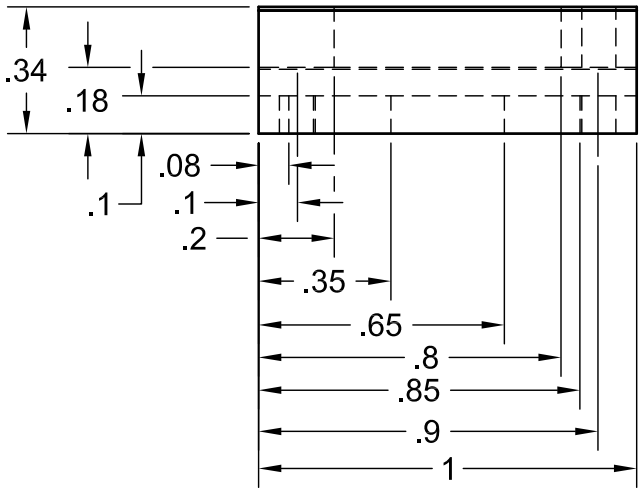



| | | | | |
|---|---|---|---|---|
| | PROJECT: Senior Design | | | |
| | TITLE: Button Mount - Top<br>Up Down Vote Badge | | | |
| APPROVED | SIZE: A | CODE | DWG NO | REV |
| CHECKED | | | | |
| DRAWN Nicole E 11/19/2020 | SCALE 2:1 | WEIGHT | SHEET 1/1 | |



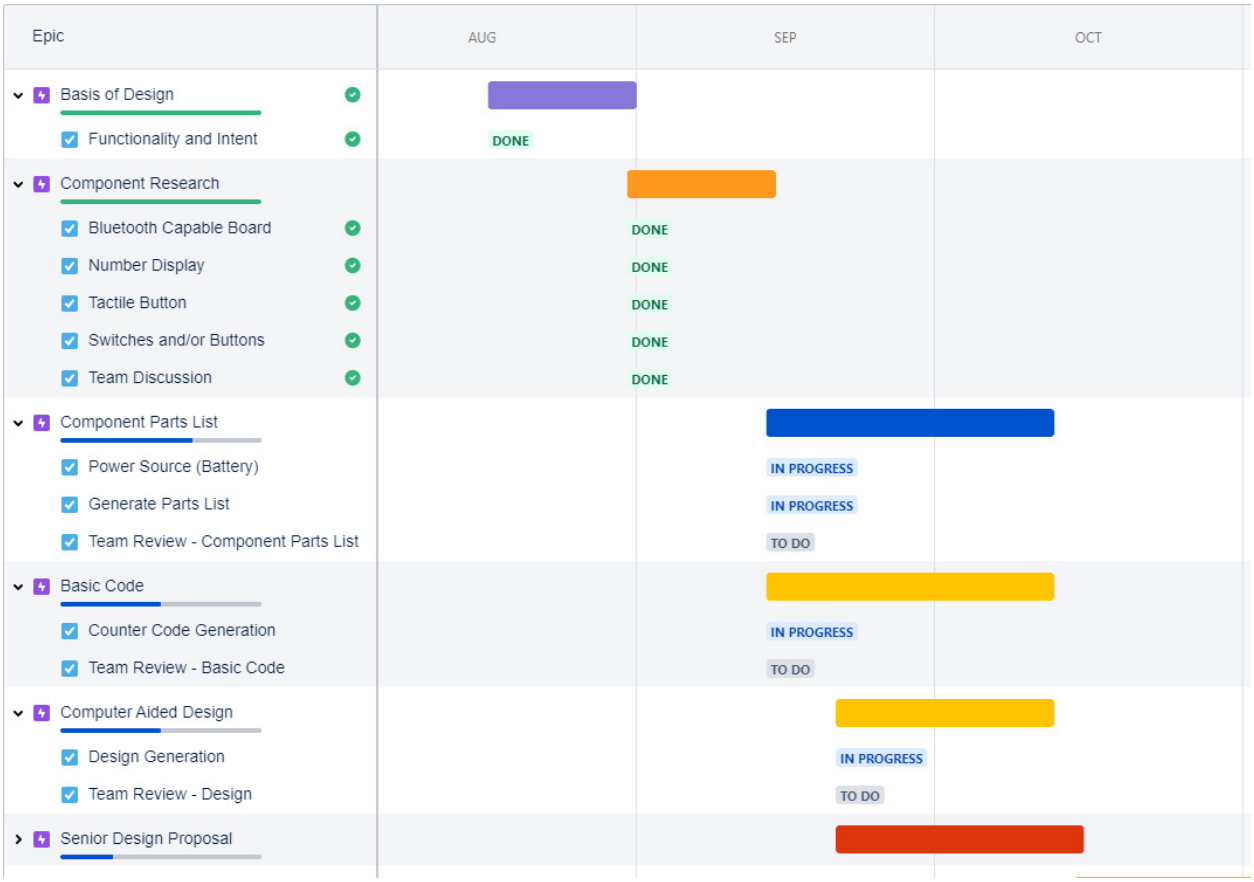


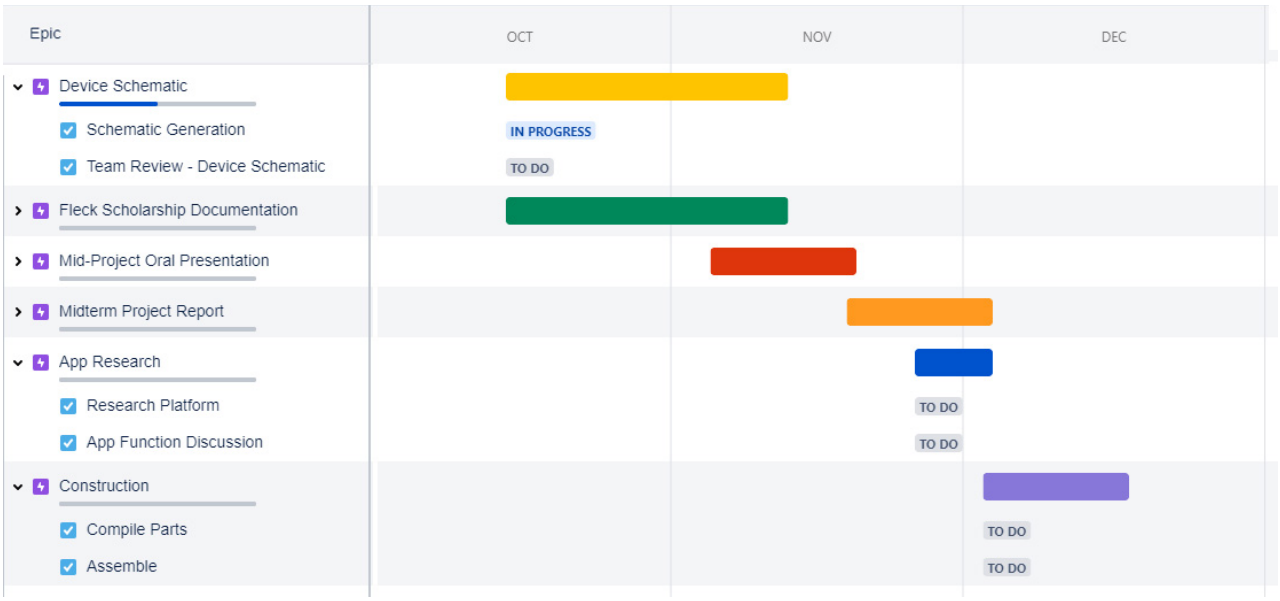



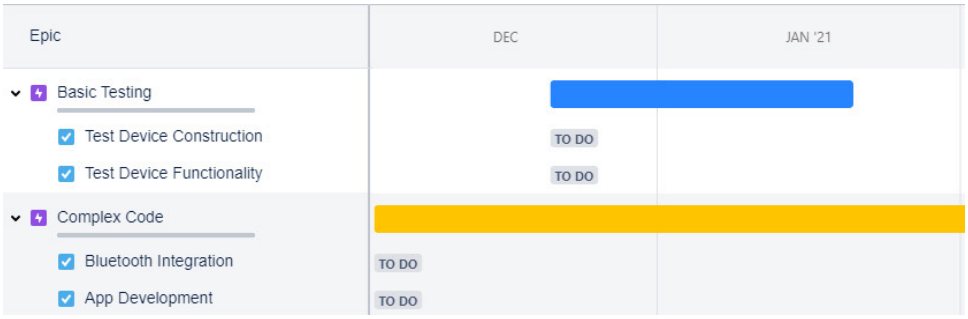

| | | | | | |
|---|---|---|---|---|---|
| | PROJECT<br>Senior Design | | | | |
| | TITLE<br>Button Mount - Bottom<br><br>Up Down Vote Badge | | | | |
| APPROVED | | SIZE<br>A | CODE | DWG NO | REV |
| CHECKED | | | | | |
| DRAWN Nicole E 11/19/2020 | | SCALE 2:1 | WEIGHT | SHEET 1/1 | |

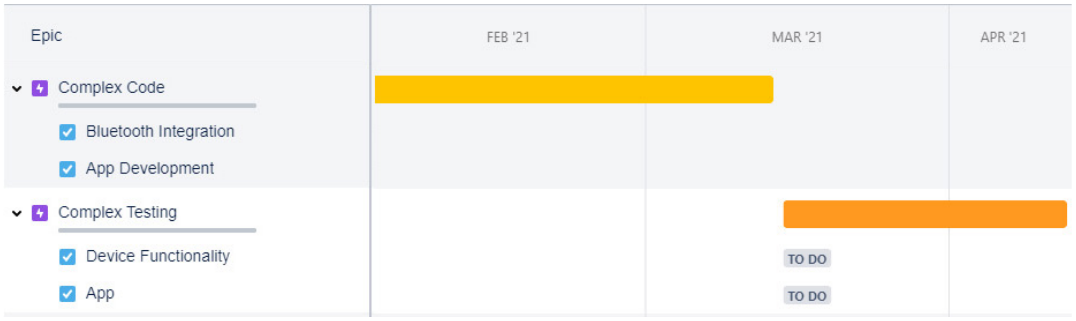
# Appendix D: Project Timeline (Roadmap)

Using Jira Software, the schedule for this Senior Design project is composed. Jira Software is a free web-based application that allows teams to manage work for a useful work management tool [1]. In the Jira Software, the critical milestones are called Epics, with subcategories called Child Issues associated with completing these Epics [7]. These items will be present in the Timeline (Roadmap), Appendix D, and the Step by Step Plan, Appendix E, of this document.




Epic
OCT
NOV
DEC
Device Schematic
Schematic Generation
IN PROGRESS
Team Review - Device Schematic
TO DO
Fleck Scholarship Documentation
Mid-Project Oral Presentation
Midterm Project Report
App Research
Research Platform
TO DO
App Function Discussion
TO DO
Construction
Compile Parts
TO DO
Assemble
TO DO


Epic
DEC
JAN '21
Basic Testing
Test Device Construction
TO DO
Test Device Functionality
TO DO
Complex Code
Bluetooth Integration
TO DO
App Development
TO DO


Epic
FEB '21
MAR '21
APR '21
Complex Code
Bluetooth Integration
App Development
Complex Testing
Device Functionality
TO DO
App
TO DO

# Appendix E: Step by Step Plan

Step by Step Plan

In this section, the numbered steps are Epic events (milestones) with their respective subcategories called Child Issues.

1. Basis of Design
    A. Functionality and Intent
        - Frame the purpose of functionality and intent to instructors and others regarding the Up Down Vote Badge for the Senior Design project.

2. Component Research
    A. Bluetooth Capable Board
        - Select a small board, Bluetooth capable (for connection to the IoT), an integrated connector for LiPo battery, and enough RAM capable of running multiple number displays.
    B. Number Display
        - Select number display that is small, easy to program, with low power consumption. Two number displays, one for the upvote and one for the downvote) is ideal.
    C. Tactile Button
        - Select a tactile button for haptic feedback when the user, or others, press the associated up-down vote section of the badge. There will be two tactile buttons, one for the upvote and one for the downvote). The ideal selection would have an LED light built-in for visual feedback.
    D. Switch
        - Select a small switch for turning the device on and off through a physical means. The on/off switch will be for prototyping and final design if the final system allots.
    E. Team Discussion – Component Research
        - Upon component research, the team will discuss the best fit for the Up-Down Vote Badge project.

3. Component Parts List

    A. Generate Parts List

        - Using Microsoft Excel, compile the list of components from the Team Discussion – Component Research. This list of elements is for the Cost section of the project proposal.

    B. Size Appropriate Power Source

        - Perform calculation for power draw from chosen components. After the power draw calculation, an appropriate power source (battery) is discussed and selected.

    C. Team Review – Parts List

        - Upon completion of the parts list, the team will discuss and critique it.

4. Basic Code

    A. Arduino Counter Code Generation

        - Write code, using Arduino capable of displaying count results on number display, from user/others pressing the tactile button on the device. This necessary code will be a starting point for the second half of the class (ENT 498)—testing code performance when device components are present.

    B. Team Review – Counter Code

        - Upon completion of this necessary code, the team will discuss and critique it.

5. Computer-Aided Design

    A. Design Generation

        - The preliminary device design is to be generated by a Computer-Aided Design program. This design will be a starting point for evaluation and critique when components arrive. After component integration evaluation, feedback from Miami University's Psychology Department is to be requested. Feedback from Miami University's Psychology Department is for the Senior Design program's lifecycle, with revisions expected.

    B. Team Review – Design

        - Upon completion of this preliminary device design, the team will discuss and critique it.

6. Device Schematic
    A. Electrical Schematic Generation
        - Create a diagrammatic depiction of the electrical circuit taking all the components and preliminary Computer-Aided Design into consideration.
    B. Team Review – Device Schematic & Power Source
        - Upon completion of this electrical schematic, the team will discuss and critique it.
7. App Research
    A. Research Platform
        - Discuss what App platforms would be best for the Bluetooth interface during the Complex Code phase. Considerations of the App may include feedback from Miami University's Psychology department.
    B. App Function Discussion
        - Upon completing this App discussion, the team will choose the most logical App medium for Up Down Vote Badge use.

8. Construct Device
    A. Compile Parts
        - The time in which the complementation of parts for construction is contingent upon the Armin Fleck Scholarship acceptance. Once accepted, the ordering of components is to be performed by a Miami University faculty member.
    B. Assemble
        - The obtaining of components will allow for the assembly and testing of the Up Down Vote Badge device.

9. Basic Testing – Testing Device
    A. Construction
        - The testing of the structure of the device is to help determine if there are any issues. Issues that occur will be addressed immediately and discussed.
    B. Functionality
        - The testing of the Basic Code of the device to help determine if there are any issues. Issues that occur will be addressed immediately and discussed. The testing of this Basic Code is an essential step since the code used here will be a starting point for the complex code build.

10. Complex Code
    A. Bluetooth Integration
        - Write code that allows Bluetooth integration to enable the connection to IoT.
    B. App Development
        - Hand in hand with the Bluetooth Integration, the app development will be continuous throughout the rest of the Senior Design lifecycle, up until Senior Design day. This App will be designed and developed with input sought from Miami University's Psychology department.

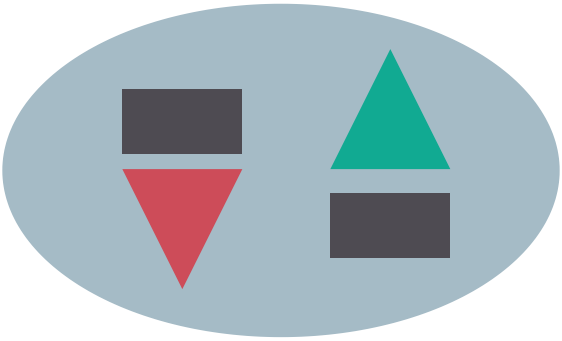
11. Complex Testing
    A. Device Functionality
        - The testing of the device functionality will be inclusive of the implementation of the Complex Code. The approach is to test the Bluetooth functionality and connection to IoT through the developed App.
    B. App
        - The testing of the App functionality is a culmination of the Senior Design project. This testing will include testing the App from the team's input and Miami University's Psychology department.

# Appendix F: Bill of Materials (One Device)

| Reference Photo | Part Name | Manufacturer / Distributor | ID / SKU | Description | Quantity | Unit Cost | Total Unit Cost |
|---|---|---|---|---|---|---|---|
|  | SparkFun Thing Plus - ESP32 WROOM | SparkFun | WRL-15663 | 16MB of flash memory, 520kB of internal SRAM, WiFi transceiver, Bluetooth capabilities, Qwiic connector, and a JST connector to plug in a LiPo battery. | 1 | $ 20.95 | $ 20.95 |
|  | SparkFun Micro OLED Breakout (Qwiic) | SparkFun | LCD-14532 | 64 wide x 48 tall (pixels), 0.66" across, (2) Qwiic connectors, ADDR jumper & I2C pull-up jumper (Back of Board) | 2 | $ 16.95 | $ 33.90 |
|  | SparkFun Qwiic Button - Green LED | SparkFun | BOB-16842 | Button with built-in green LED, (2) Qwiic connectors | 1 | $ 3.95 | $ 3.95 |
|  | SparkFun Qwiic Button - Red LED | SparkFun | BOB-15932 | Button with built-in red LED, (2) Qwiic connectors | 1 | $ 3.95 | $ 3.95 |
|  | Mini Power Switch - SPDT | SparkFun | COM-00102 | SPDT Slide switch, .1" pin spacing | 1 | $ 1.50 | $ 1.50 |
|  | Qwiic Cable - 50mm | SparkFun | PRT-14426 | Qwiic enabled 4-conductor cable with 1mm JST termination | 5 | $ 0.95 | $ 4.75 |
|  | Qwiic Cable - 100mm | SparkFun | PRT-14427 | Qwiic enabled 4-conductor cable with 1mm JST termination | 1 | $ 1.50 | $ 1.50 |
|  | Lithium Ion Battery - 1Ah | SparkFun | PRT-13813 | Output: Nominal 3.7V @ 1000mAh | 1 | $ 9.95 | $ 9.95 |
|  | M2.5-0.45 x 6M Flat Head Machine Screws | Albany County Fasteners | 1011-1002-0012 | Flat head metric machine screws for decice construction | 4 | $ 0.25 | $ 1.00 |
|  | M2.5-0.45 x 10M Flat Head Machine Screws | Albany County Fasteners | 1011-1002-0032 | Flat head metric machine screws for device construction | 6 | $ 0.25 | $ 1.50 |
|  | M2.5-0.45 x 12M Flat Head Machine Screws | Albany County Fasteners | 1011-1002-0042 | Flat head metric machine screws for device construction | 2 | $ 0.25 | $ 0.50 |
|  | Metric Coarse Thread Taper for Machine Screws - M2.5-0.45 | Albany County Fasteners | 8000-006-0022 | Hand tap for the mounting holes, allowing better fitting | 1 | $ 10.06 | $ 10.06 |
|  | Round Magnet D62-N52 | K & J Magnetics, Inc. | D62-N52 | 3/8" dia. x 1/8" thick. The magnets are used to make the device wearable without puncturing clothing and holding the bottom and top components of the device together | 6 | $ 0.77 | $ 4.62 |
| **Total** | | | | | **33** | | **$ 98.13** |

## Appendix G: Future App Mockup [28]

# Up Down Vote Badge



Email

Password

LOGIN

Don't have an account?

# Let's Set Up Your Account!

Full Name

Email

Password

Confirm Password

By creating an account you agree to our

Terms of Service and Privacy Policy

CREATE

# Let's Find Your Badge

Click to Turn on Bluetooth

Ensure your Device is On

FIND YOUR DEVICE

Not now. Another time...

# Connecting...

Finding your Badge, please hold

*pretend you're listening to waiting music*

Find your Device

Your Badge was found.
Hooray!!

CONTINUE

Find your Device

Error finding your Badge.
Please Try Again

RETURN

Find your Device

# Welcome [Name]!

## Standings

80,640,700 votes

[NUMBER]

[NUMBER]

## Rank

80,640,700 votes

## Friends

+2K

# Up Down Vote Badge

Add Friend

Leaderboards

Settings

Log out

# Leaderboard - Friends

Search

**Username**
Anywhere, USA

**Username**
Anywhere, USA

**Username**
Anywhere, USA

**Username**
Anywhere, USA

**Username**
Anywhere, USA

**Username**
Anywhere, USA

# Leaderboard - Global

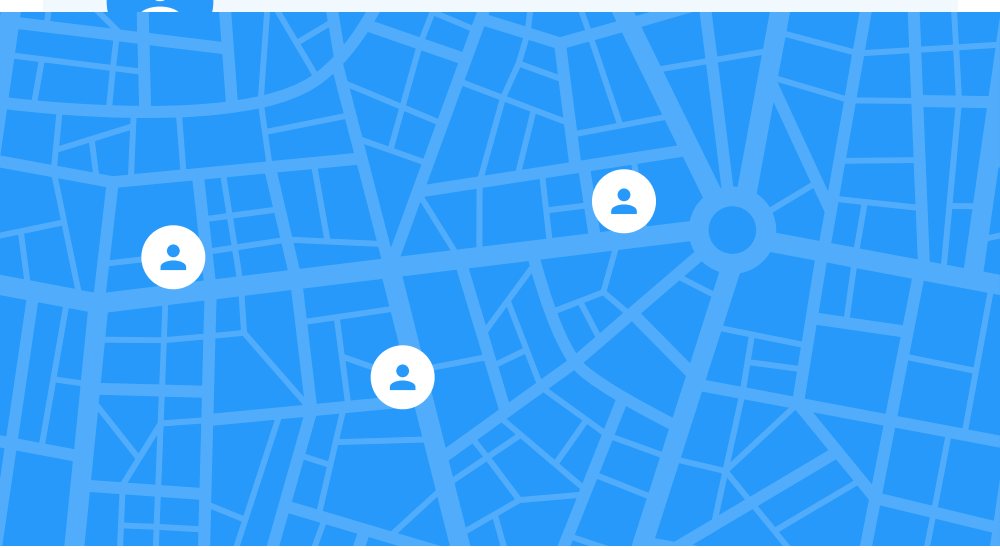
Searchs

**Username**
Anywhere, USA

**Username**
Anywhere, USA

**Username**
Anywhere, USA

**Username**



# Appendix H: Meeting Journals

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry # **1**

Meeting Date: 8/27/2020 Meeting Time: 4:30 pm

Advisor: TBD Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

General project discussion, discuss overall goals and interests of team members.

Action Items (what, who, when):

Rough Draft of Project Timeline - NE & LM - Within next couple weeks
Rough Draft of Desired Project Output - NE & LM - Within next couple weeks

Next meeting (date/time/location): Week of August 31st/Afternoon/Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry # **2**

Meeting Date: 8/31/2020 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

- Preliminary timeline/Gantt chart on Jira
- Component Research & Living Google Doc
- Talk about weekly meeting times (Decided Monday's at 5 PM work best)

Action Items (what, who, when):

Component Research (Update Living Google Doc) - NE & LM - 8/31 to 9/14

Next meeting (date/time/location): September 7th / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry # **3**

Meeting Date: 9/9/2020 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

- Component Research & Living Google Doc
  - Decided on board (SparkFun Thing Plus)
- Device Functionality and next steps (see Jira - Gantt Chart)

Action Items (what, who, when):

Finish Up Component Research (Update Living Google Doc) - NE & LM - 8/31 to 9/14
Prepare for Final Component Selection Discussion During Next Weeks - NE & LM - 9/14

Next meeting (date/time/location): September 14 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry # **4**

Meeting Date: 9/14/2020 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

- Finished Up Component Research & Updated Living Google Doc
  - Board was decided last meeting
  - Items decided:
    - Board (reconfirmed)
    - Display
    - Tactile Switch
    - Multiplexing Board

Next steps (See Jira - Roadmap - Gantt Chart))

Action Items (what, who, when):

Create Build of Material & Order Components - NE (LM Support) - 9/14 through 9/21
Work on Device Schematic - LM (NE Support) - 9/14 through 10/5
Work on Basic Code - NE (LM Support) - 9/14 through 10/5

Next meeting (date/time/location): September 21 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**5**

Meeting Date: 9/21/2020 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ Y ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ N ]

---

Topics discussed:

- Schedule adjustment to obtain Fleck Scholarship (See Jira for Gantt Chart)
- Role of team members
- Connecting with psychology department

Action Items (what, who, when):

Work on

Bill of Material - NE (LM Support) - 9/14 through 9/28
Device Schematic - LM (NE Support) - 9/14 through 10/12
Basic Code - NE (LM Support) - 9/14 through 10/12
Computer Aided Design - NE & LM - 9/21 through 10/12

Next meeting (date/time/location): September 28 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**6**

Meeting Date: 9/28/2020 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

Progress status on
- Bill of Material
- Device Schematic
- Basic Code
- Computer Aided Design

Action Items (what, who, when):

Work on
- Bill of Material - NE (LM Support) - 9/14 through 10/12
- Device Schematic - LM (NE Support) - 9/14 through 10/12
- Basic Code - NE (LM Support) - 9/14 through 10/12
- Computer Aided Design - NE & LM - 9/21 through 10/12

Next meeting (date/time/location): October 6 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #7

Meeting Date: 10/06/2020 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

Progress status on
- Bill of Material
- Device Schematic
  - Decided to push to after project proposal due because having Computer Aided Design will be helpful with layout
- Basic Code
- Computer Aided Design

Action Items (what, who, when):

Work on
- Bill of Material - NE (LM Support) - 9/14 through 10/12
- Device Schematic - LM (NE Support) - 10/12 through 11/12
- Basic Code - NE (LM Support) - 9/14 through 10/12
- Computer Aided Design - NE & LM - 9/21 through 10/12

Next meeting (date/time/location): October 12 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**8**

Meeting Date: 10/12/2020 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

**Kicked off the team discussion on**

- Battery Source
  - LM will provide calculations and battery options (selection via email discussion)
- Bill of Material
  - Will be complete when battery source is chosen and design is finished since there will be a line item for 3D filament use
- Basic Code & Project Proposal
  - NE asked LM to review documents in Google Drive, and provide input

**Project status on**

- Computer Aided Design
  - Date adjusted to 10/14 so preliminary design can accommodate chosen battery, based on calculations (LM). Design document will *not* be included in Proposal, but a rendering of the device may appear in the Proposal for enhanced content.

Action Items (what, who, when):

**Finish Up**

- Project Proposal - **DUE** 10/15
- Computer Aided Design - NE - 9/21 through 10/14

**Work on**

- Device Schematic - LM (NE Support) - 10/15 through 11/12

Next meeting (date/time/location): October 15 / After Class (~ 7PM) / Google Meet - Tie up Proposal

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**9**

Meeting Date: 10/19/2020 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

**Project status on**

- Computer Aided Design / Device Schematic
  - NE Handed off 3D rendered design for components for schematic generation to LM
- Fleck Scholarship Documentation
  - Filling our documentation, submission awaiting project approval

**Looking ahead**

- Mid-project Oral Report & Midterm Project Report
  - NE: Added Rubric found on Canvas into Google Drive project folder. During our next class meeting, if Professor Rob is not present during this touchbase, ask for an example of the Oral Report.
- App Research

Action Items (what, who, when):

**Work on**

- Device Schematic - LM (NE Support) - 10/15 through 11/12
- Fleck Scholarship Documentation - NE (LM Support) - 10/15 through 11/12
- Mid-project Oral Report - NE & LM - 11/05 through 11/19
- Midterm Project Report - NE & LM - 11/19 through 12/03
- App Research - NE & LM - 11/26 through 12/03

Next meeting (date/time/location): October 26 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**10**

Meeting Date: 10/26/2020 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

**Project status on**
- Device Schematic (LM)
- Fleck Scholarship Documentation
  - NE: Aiming to be complete (10/29) for Team Review (via Google Docs/Drive)

**Looking ahead**
- Mid-project Oral Report & Midterm Project Report
  - NE: Ask for an example of the Oral Report from Rob.
- App Research

Action Items (what, who, when):

**Work on**
- Device Schematic - LM (NE Support) - 10/15 through 11/12
- Fleck Scholarship Documentation - NE (LM Support) - 10/15 through 11/05
- Mid-project Oral Report - NE & LM - 11/05 through 11/19
- Midterm Project Report - NE & LM - 11/19 through 12/03
- App Research - NE & LM - 11/26 through 12/03

Next meeting (date/time/location): November 2 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**11**

Meeting Date: 11/02/2020 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

**Project status on**

- Device Schematic (LM)
- Fleck Scholarship Submission - DONE - NE sent submission onward to Rob
- Ethics Team Assignment - Due 11/12

**Looking ahead**

- Mid-project report
- App Research

Action Items (what, who, when):

**Work on**

- Device Schematic - LM (NE Support) - 10/15 through 11/12
- Mid-project Oral Report - NE & LM - 11/05 through 11/19
- Midterm Project Report - NE & LM - 11/19 through 12/03
- App Research - NE & LM - 11/26 through 12/03

Next meeting (date/time/location): November 9 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**12**

Meeting Date: 11/09/2020 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

**Project status on**

- Device Schematic (LM) - Due 11/12
- Ethics Team Assignment - Due 11/12
- Mid-project Oral Report - NE & LM - 11/05 through 11/19
- Midterm Project Report - NE & LM - 11/19 through 12/03

Action Items (what, who, when):

**Work on**

- Device Schematic - LM (NE Support) - 10/15 through 11/12
- Mid-project Oral Report - NE & LM - 11/05 through 11/19
- Midterm Project Report - NE & LM - 11/19 through 12/03
- App Research - NE & LM - 11/26 through 12/03

Next meeting (date/time/location): November 16 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**13**

Meeting Date: 11/16/2020 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

Mid-project Oral Report - NE & LM - 11/05 through 11/19

- Content Review
- Brief Rehearsal

Action Items (what, who, when):

**Work on**

Mid-project Oral Report - NE & LM - 11/05 through 11/19
Midterm Project Report - NE & LM - 11/19 through 12/03
App Research - NE & LM - 11/26 through 12/03

Next meeting (date/time/location):
November 17 / 5:30 PM / Google Meet (Oral Presentation Rehearsal)

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**14**

Meeting Date: 01/28/2021 Meeting Time: 8:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

- Status on:
  - Overall Project
    - Construction
    - Basic Development
  - App research

Action Items (what, who, when):

**Work on**

App Research - NE & LM
Rework Fusion360 Model - NE
3D Print - NE

Next meeting (date/time/location):
February 2 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**15**

Meeting Date: 02/02/2021 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

- Status on:
  - Overall Project
    - Construction
    - Basic Development
  - App Determination
    - Selected Android of App Development

Action Items (what, who, when):

**Work on**

App Functionality Intent - NE & LM
Rework Fusion360 Model - NE
3D Print - NE

Next meeting (date/time/location):
February 8 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**16**

Meeting Date: 02/08/2021 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

- Status on:
  - Overall Project
    - Construction
    - Basic Development
  - App

Action Items (what, who, when):

**Work on**

App Functionality Intent - NE & LM
Rework Fusion360 Model - NE
3D Print - NE

Next meeting (date/time/location):
February 15 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**17**

Meeting Date: 02/15/2021 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

- Status on:
  - App
  - Device Delivery

Action Items (what, who, when):

**Work on**

App Functionality Intent - NE & LM
Rework Fusion360 Model - NE
3D Print - NE

Next meeting (date/time/location):
February 22 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**18**

Meeting Date: 02/22/2021 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

- Status on:
  - App
  - Device Delivery
  - Photos and project description assignment

Action Items (what, who, when):

**Work on**

App Functionality Intent - NE & LM
Device Delivery - NE to LM
Photos and project description - NE & LM

Next meeting (date/time/location):
March 1 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**19**

Meeting Date: 03/01/2021 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

- Status on:
  - Photos and project description assignment
  - Device Delivery
  - Complex Code (App)

Action Items (what, who, when):

**Work on**

App Functionality Intent - NE & LM
Device Delivery - NE to LM
Photos and project description - NE & LM

Next meeting (date/time/location):
March 8 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**20**

Meeting Date: 03/08/2021 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

- Status on:
  - Photos and project description assignment
  - Complex Code (App)

Action Items (what, who, when):

**Work on**

Poster - LM
Final Report - LM & NE
Email to Dr. Jardin - NE

Next meeting (date/time/location):
March 15 / 7:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**21**

Meeting Date: 03/15/2021 Meeting Time: 7:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

- Status on:
  - Email to Dr. Jardin: 3/18 or 3/19
  - Project Presentation
    - Discussed request for early completion per Advisor request (3/11)
      - Powerpoint expected completion date: 3/25
      - Dry run of presentation: 3/29
      - Recording: week of 3/29(?)
  - Poster development
    - Expected completion date: 4/7
  - Final Report
    - Expected completion date: 4/14

Action Items (what, who, when):

**Work on**

Email to Dr. Jardin - NE - 3/18 or 3/19
Project Presentation - LM & NE - See Topics Discussed for Dates
Poster - LM - 4/7
Final Report - LM & NE - 4/14

Next meeting (date/time/location):
March 29 / 7:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**22**

Meeting Date: 03/15/2021 Meeting Time: 7:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

- Status on:
  - Email to Dr. Jardin
    - Follow up with recommendation (adding color to number)
  - Project Presentation
    - Discussed request for early completion per Advisor request (3/11)
      - Powerpoint expected completion date: 3/30
      - Recording: week of 3/29
  - Poster development
    - Expected completion date: 4/7
  - Final Report
    - Expected completion date: 4/14

Action Items (what, who, when):

**Work on**

Email to Dr. Jardin (Follow-Up) - NE - 3/30
Project Presentation - LM & NE - See Topics Discussed for Dates
Poster - LM - 4/7
Final Report - LM & NE - 4/14

Next meeting (date/time/location):
April 5 / 7:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**23**

Meeting Date: 04/5/2021 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

---

Topics discussed:

- Status on:
  - Email to Dr. Jardin
    - Follow up with recommendation (adding color to number)
  - Project Presentation
    - Oral Presentation Dry Run: 4/5
    - Recording: week of 4/5
  - Poster development
    - Expected completion date: 4/7
  - Final Report
    - Expected completion date: 4/14

Action Items (what, who, when):

**Work on**

Email to Dr. Jardin (Follow-Up) - NE
Project Presentation - LM & NE - See Topics Discussed for Dates
Poster - LM - 4/7
Final Report - LM & NE - 4/14

Next meeting (date/time/location):
April 12 / 5:00 PM / Google Meet - Tentative for recording

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**24**

Meeting Date: 04/12/2021 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

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Topics discussed:

- Project Presentation
    - Recording
- Poster development
- Final Report
    - Expected completion date: 4/30

Action Items (what, who, when):

**Work on**

Poster
Final Report

Next meeting (date/time/location):
April 19 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**25**

Meeting Date: 04/19/2021 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

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Topics discussed:

- Project Presentation
    - Turn In
- Quick 1 minute synopsis of project for design day
- Poster development
    - Revision
- Final Report
    - Expected completion date: 4/30

Action Items (what, who, when):

**Work on**

Poster
Final Report
Quick 1 minute synopsis of project for design day

Next meeting (date/time/location):
April 26 / 5:00 PM / Google Meet

Miami University
Department of Engineering Technology
ENT 497-498 Senior Design

Journal Entry #**26**

Meeting Date: 04/26/2021 Meeting Time: 5:00 pm

Advisor: Professor Rob Speckert Present: [ N ]

Team Members:

Nicole Eisenbrandt (NE) Present: [ Y ]

Liban Mohamed (LM) Present: [ Y ]

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Topics discussed:

- Quick 1 minute synopsis of project for design day
- Final Report

Action Items (what, who, when):

**Work on**

Final Report

Next meeting (date/time/location):
None - End of Meeting Series for ENT 497-498