GNG1103

Deliverable G: Prototype II and Customer Feedback

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1. Introduction

In the following report, we will be discussing our prototype along with our gathered feedback. To start, we will outline our prototype test plan. This plan will include the concept we are testing along with the purpose and method of testing. We will then discuss our progress in our Dashboard program and motion sensor prototypes. We will also discuss future objectives we have set for each prototype. We will also summarized the customer feedback we received from our most recent client meeting/presentation. This document will contain the project's second prototype along with its test plan and feedback.

2. Prototyping Test Plan

2.1 Purpose of Test

For prototype 2, we will have a functional prototype. The prototype will concentrate on the user interface. We hope to have a fully functioning Dashboard interface. Based on the feedback in the previous prototype we have a sketch of the appearance of our dashboard. We will use this user interface and desired outputs to design code. Our prototype test will determine if the code we have designed will produce the desired output on the user interface. Our prototype should be completed prior to the pitch presentation so we are able to receive feedback from the ross video representatives.

2.2 Test Objectives Description

-Things we want to test

- If the buttons are able to change the text
- -If we are able to have colours changed based on parameters
- -If our actual dashboard wireframe is easily understood by a potential user
- -If our code is able to change text based on parameters it receives
- Reduce uncertainty
- Receive feedback from client/users
- Reduce risk
- what print speed is needed for the motion sensors to capture the best results
- what setting for PIR motion sensor's sensitivity and delay time are ideal

2.3 What exactly is being learned or communicated with the prototype?

- How parameters interact with text
- Colours and their relationship to the state of the printer
- Design specifications of the PIR sensor and how it relates to print speed
- If our motions sensors will work
- What is the ideal PIR motion sensor settings, (ideal distance away from printer)

2.4 Possible types of results

- Text changes based on parameters received
- Text will not change when parameters are changed
- When a button is pressed text changes

- When a button is pressed no text is changed
- If colour change when parameters change
- Colour does not change when parameters change
- If it is possible to create a listening server
- Print speed needs to be increased to record motion
- Motion sensor position needs to be adjusted (3D printer spool does not yield accurate results)

2.5 How the results will be used to make decisions or select concepts

- We should know the final layout of our dashboard, the complete wireframe based on prototype one drawing has been created. We should also have decided on how we plan on alerting the ceed employee. Potential options are a system in which it immediately updates through a listening server or another simpler option would be using a refresh button which is manually hit by the employee. Additionally, we need to decide if it is possible to change the color of buttons or if we will need to change text instead. After our client meeting, we have learned that changing color buttons was the better solution, and we were able to make that possible in our Dashboard.

2.6 Criteria for test success or failure

- Success for our prototype would be in we are able to have a change in our button that indicates when a parameter has been received
- Failure for the Dashboard would be that we are unable to have the button change
- Success for the Dashboard user interface would be that a new user is easily able to use and understand how to buttons work
- Failure for the Dashboard user interface would be that a new user does not understand the layout of our dashboard and doesn't understand the purpose of each button.
- Success for the motion sensors is being able to track the motion when a print is printing
- Failure for the motion sensor would be the inability to collect motion because of the current location placement or the spool speed is too slow

2.7 What is going on and how is it being done

- Prototype 2 will allow us to prove that our concept will work
- Further work will be continued into the interactions between dashboard and Arduino
- Work will also be continued in research into interactions between Arduino and motion sensor through tutorials
- We will create our user interface based on information from the course website and DashBoard tutorials
- Learning how to change button colors from user inputs (0,1,2,3 variable inputs) to change to other colors
- Research on our specific PIR motion sensor.

2.8 Testing process

Once we have created our dashboard interface and finished coding it we will manually change the parameters to test if this change in parameters will affect the colour of the button. We will also test the the

button in which indicates if the printer is in use or not and based on that if it will change the text. We will also do research on our motion sensor and the 3D ultimaker printer to determine if the sensor would work by analyzing specs and features of both devices.

2.9 Information being measured

2.9.1 Functional

- If dashboard is able to efficiently change text
- If dashboard is able to change button colour
- PIR sensor features (range, speed, sensitivity, delay time)

2.9.2 Non-functional

- How quickly and effective users can understand our Dashboard platform
- How much clients liked our design

2.10 Information being observed and how is it being recorded

2.10.1 Functional

- Interface alerts when a change has been made

2.10.2 Non-Functional

- New user is easily able to understand how to use the user interface

2.11 What materials are required and what is the approximate estimated cost?

2.11.1 Material we need to purchase

- Jumper cables

2.11.2 Estimated cost

- $3

2.11.3 University material

3-D printer, CEED employee

2.12 Work to be done

- We need to do some self-learning on both Arduino and Dashboard programs and understand the basics.
- Watch Dashboard tutorials on how to create buttons
- Create the user interface and make it functional
- Further research on how to connect the Dashboard to interact with the Arduino
- Further research on how the motion sensors will detect motion and alert Dashboard

3. Prototype

3.1 Feedback from Prototype I

After talking to some CEED employees, we received some helpful feedback that we will try to incorporate in our design. An employee suggested that we incorporate in the user interface the colour of the filament in the printer. This allows people who use the Markerspace to ask the employee for a printer

with a certain colour and the CEED employee can easily check to see what printer has that colour and if it is available. To do this, we will add a textbox in each printer button that will tell the CEED user the current colour of the filament in the corresponding 3D printer. CEED employees will have to manually update the colour when that change the filament to a different colour.

Another suggestion was to include how much filament is left in each printer so they know when to change the wheel. This is a little beyond the scope of what we are doing. We would not be able to detect that using the current motion sensor that is placed behind the printer. Therefore, we decided as a group that this is not a feature that we would add to our design.

3.2 Dashboard Subsystem

The objective of the dashboard prototype II was to design a dashboard interface with text that will hypothetically change depending on values being sent in from the arduino that is hooked up to the motion sensor. The secondary objective for this prototype was to make a UI that was aesthetically pleasing and user friendly. As stated in the test plan, the dashboard interface would be a success if the text on the dashboard changes when a parameter changes and if a new user finds the interface to be easy to understand. After receiving feedback from Ross Video, we decided to create a second prototype. This prototype is styled with buttons and has similar test goals as the text style prototype. The first objective of this prototype is to have buttons change colour depending on their availability, the second objective is user ability. In this section we will determine which prototype is superior.

3.2.1 Text Style Interface Prototype

The text style interface prototype was a preliminary design. This interface is quite simple both in terms of both appearance and the code required to program the interface. Two text boxes were used to indicate what action the CEED employee should take because at the beginning we were not sure that Dashboard had a function to check for two different conditions. Colour was also not incorporporated because we were not sure that there was a function that allowed us to automatically change the colour of the button from changing the content of a different component. This prototype was made in the early stages when we had little knowledge of Dashboard's capabilities. However, upon further investigation and research we discovered that Dashboard was capable of performing the functions that we wanted. This and feedback from our pitch presentation led us to create a new interface with less text and more visual components.

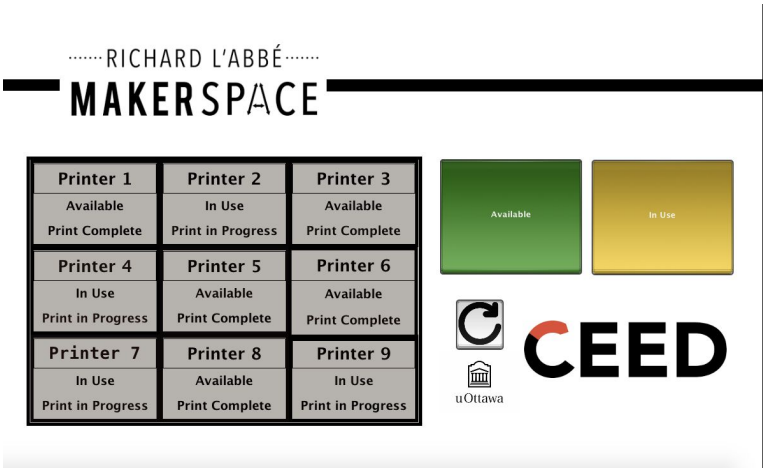
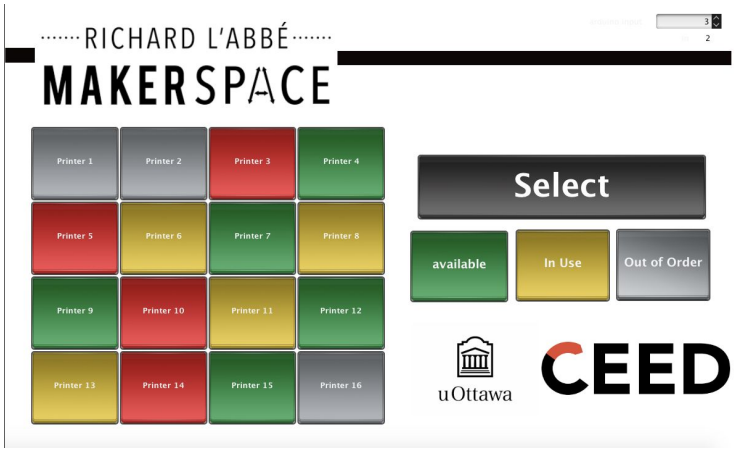


Figure 1.0

3.2.2 Button Style Prototype

The button style prototype was designed after our pitch presentation to Ross Video. The prototype works by using information that is sent from the arduino to change the colour of each button. The arduino will send information in terms of 0 and 1, 0 means that there is no motion and 1 means that there is motion. If the arduino sends a 1, the button automatically changes to yellow, meaning the printer is in use. If the arduino sends a 0 the button colour changes to red, meaning that there is no motion. When the CEED employee sees that the button is red they will pick up the print and then click the green 'available' button, changing the button colour to green for available. If the printer is out of order the CEED employee can click the grey 'Out of Order' button which will turn the printer button grey. There is also a select button that will be coded for prototype III, this button will allow users to manually change the status of multiple buttons at once. As of right now the arduino input needs to be inputted manually, in prototype III we will have the values sent automatically through the arduino.

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2
3
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5  if (params.getValue('input0', 0)  ==  1)
6  {
7     ogscript.setStyle("print", "bg#FFEC39");
8  } else {
9     if (params.getValue('input0', 0)  ==  0) { ogscript.setStyle("print", "bg#ff0000");
10    } else { if (params.getValue('input0', 0)  ==  2) { ogscript.setStyle("print", "bg#009933");
11    } else { ogscript.setStyle("print", "bg#999EA3");
12    } }
13 }
14 /*!!
15   <block id="1041" type="if" x="283" y="10" w="268" INPUT1="ID:1040" OPERATION="equals" INPUT2="ID:1042" TRUE="ID:1044" FALSE="ID:1051" I(
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17 <block id="1042" type="integer" x="10" y="72" w="168" VALUE="1" />
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19 <block id="1051" type="if" x="854" y="100" w="268" INPUT1="ID:1052" OPERATION="equals" INPUT2="ID:1053" TRUE="ID:1054" FALSE="ID:1072" I(
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28 !!*/
29 /*!!<checksum>fe6a7838faa8757873ea32a8169f7a36</checksum>!!*/
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Figure 2.0

3.2.3 Prototype II Interface

After showing CEED employees, we have decided to use the button style interface because it is more visually appealing and easier to understand and use. The text style interface was confusing and difficult to understand at the start, it was not intuitive for the user. After some prompts, the user were able to figure out how it works but because it required some thinking, they were not motivated to use it.

The button style interface was a lot more intuitive. Users were quickly able to identify how the system works and how to use the system. They liked the colours because it allowed them to easily identify the course of action they should take without much thought. They liked the overall system in general. They said it was very easy to understand. Therefore we decided to use the button style interface.

3.3 Motion sensors

Firstly, we want to preface by saying that the Maker store did not have the appropriate jumper wires in stock for us to do an appropriate physical prototype test for the motion sensors, so we will be analyzing the features and specs of the motion sensors to determine if the motion sensors would actually work.

PIR Motion Sensor Features

- Wide range of input voltage varying from 4.V to 12V
- Can distinguish between object movement and human movement
- Can cover a distance of about 120° and 7 meters
- Operating temperature from -20° to +80° Celsius
- Adjustable sensitivity (110 degrees x 70 degrees detection range)
- Divided Fresnel lenses in the dome
- Delay time (2-200 seconds) adjustable*
- Response time : 100ms

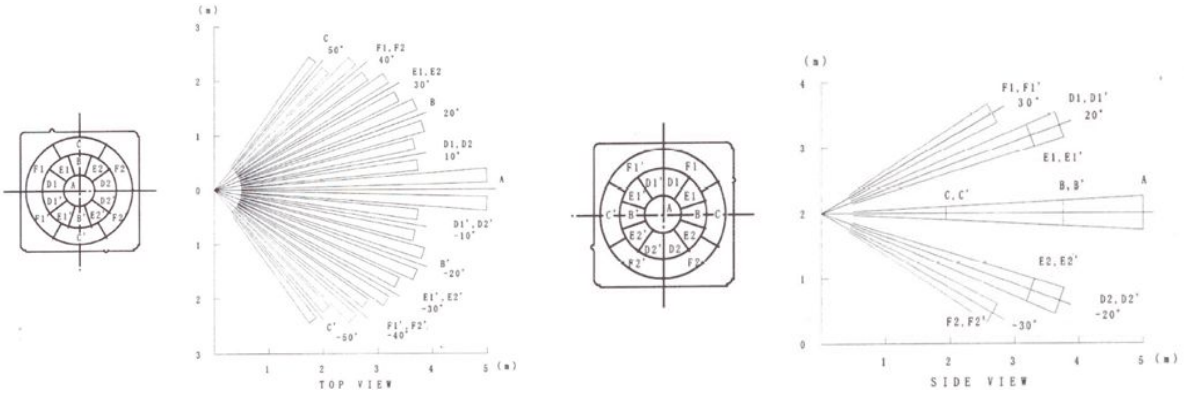

Figure 2.0 fresnel lens planes to cover a greater range of motion

Our PIR motion sensors have a variety of features that will allow our plan to work. First of all, PIR sensors have adjustable sensitivity knobs. Increasing the sensitivity allows us to monitor from a greater ranger (20 feet) while decreasing the sensitivity is good for monitoring a shorter maximum range of 10 feet. In our case, we would be turning the sensitivity down to allow for detecting of a shorter ranger when we place the motion sensor next to the spool. Because the range is shorter and focused on the spool we would be able to avoid the possibility of the motion sensor picking up motion from people in the background.
After talking with CEED employees, we have learned that the spool speed is determined by how fast the filament is ejected from the nozzle. This print speed can be adjusted by the user (30 mm/s - 300 mm/s), the recommended speed is 60mm/s. Having an adjustable print speed will make it easier for the motion sensor to detect movement more clearly. If the recommended speed of 60mm/s does not capture the data we want, we can always turn up the print speed so our motion sensor should be able to track it.
PIR sensors also have adjustable delay time knobs. This means that if we were to lower the delay time, the motion sensor will switch from LOW to HIGH more frequently. Having it switch more frequently will help the motion sensor quickly detect changes in motion (so if there was motion when it switches from HIGH to LOW, and no motion when it switches back from LOW to HIGH, then we would know a print is done or has stopped)
To summarize, if we place the motion sensors close to the spool and set the sensitivity and delay time to low we would be able to track movement from the spool. We could also adjust the print speed if we believe that the spool needs to spin faster for better results. We would do a physical test when we are able to obtain the appropriate wires to build the Arduino-motion sensor mechanism.

5. Feedback

5.1 CEED Employee 1 Feedback:

Employee 1 was shown both the text style prototype and the button style prototype. When asked to identify the status of a specific printer was able to quickly answer correctly while looking at the button style dashboard but took around a minute to determine the status while looking at the text style dashboard and was confused by the two separate texts.

5.2 CEED Employee 2 Feedback:

Employee 2 was shown both text and button style prototypes. When asked the status of a certain printer the employee was able to easily identify the status on the button and text style prototype. However the employee said the text style prototype was confusing and they would prefer to use the button style.

6. Conclusion

After the second prototype, we will build upon our Dashboard design, as well as, do a physical test of our motion sensors and Arduino. From prototype 1 to 2, we have changed our Dashboard based on customer feedback from text outputs to colored buttons. Ross video stated that they thought buttons would be easier to understand than text labels. Also, after talking to CEED employees, we have gathered substantial feedback about our Dashboard Design. The overall input we received was that the color-coding of the buttons makes it really easy for users to understand the status of prints. We have also done an analytical prototype of our motion sensors, and after analyzing the motion sensor's features and specs, we have determined that the motion sensors should work. Our next objective is to test the motion sensor and code the Arduino, as well as do research on how to incorporate all our components, Dashboard, Arduino and motion sensor into a unified system.