TEAM 12 Testing

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4 Testing

4.1 Unit Testing

- UV Light Wattage - We will be using a power meter to measure this. It is necessary to assure enough light is getting through the LCD screen in order to synthesize DNA.
- LCD Screen Resolution - We will test this screen to make sure that the UI from our code is properly displayed on the LCD. We will test this by ensuring the screen stays properly displayed throughout the computer; alters the image, changes tabs, and a device is plugged into the computer.
- Systems Software - We will need to make sure all of the different software components within the system work in tandem with each other. To make sure this works, we will first analyze each system individually. We will perform simulating plausible user input into our software and confirming if the response is what we desire.

4.2 Interface Testing

We have a user interface that formulates a matrix to the specifications that the user desires. This is used to replicate a microarray. The interface will request and accept user input and with this data it will initialize another interface that is then sent to the 3D printer to be used. Testing will be quite simple because we can just enter possible user input and then see how each interface reacts.

4.3 Integration Testing

Integration of the user interface with control of the LCD screen. This is critical for the design because the user interface will allow for the control of the LCD screen to selectively control where the UV light passes through to catalyze the bonding reaction between DNA base pairs. This integrated system can be tested by passing information from the user interface to the LCD screen. The image sent will be compared to the final output image. A power meter will be used to verify the proper amount of UV light is being blocked or allowed through by the opaque and transparent region, respectively.

Integration of the microfluidic system with the combination of the LCD and user interface. The main functionality for this integration will be to ensure the clock cycles are synchronous so that the flow controller initiates the flow of a given

compound at the proper time for it to receive sufficient UV exposure when the light module is activated. Testing will be done by checking the percentage of bonding which takes place during one cycle of the system. Changes may need to be made to verify the amount of exposure each chemical is receiving as it flows across the LCD screen and flow cell.

4.4 System Testing

System testing can be seen as complete end to end testing for a specific system. The two main systems that require testing are the user interface and the microfluidic system.

User interface:

The user interface will require testing on multiple aspects. We will need to create Unit Tests that inject user inputs to test and see if we get the desired output. When creating these tests and inputs we will need to make sure we don't forget the corner cases. We also will need to perform some automation tests to assure the image is properly rendered.

Microfluidic system:

The microfluidic system will require testing of the flow rates of each of the chemicals being used. Pressure within the flow cell will also need to be tested and monitored as part of the flow rate testing. The adhesion rate of the molecules to the designed substrate will also be tested. All of these variables can be observed using a software designed by Fluigent known as OxyGEN.

4.5 Regression Testing

Any new additions we have, such as a new LCD screen, we immediately test with our system to make sure everything functions. This testing is required since each step builds off one another, so if the screen does not work then the rest of the project will not work. Testing the UV light with the power meter with the LCD screen also gives us crucial data regarding the cellular bonding of DNA.

In regards to the user interface code, we are continually making more and more branches with plenty of commits. This will ensure we do not lose any critical progress as well as ensuring we are able to revert back to a working version whenever we like.

4.6 Acceptance Testing

- Demonstrate physically that the user interface works as intended in our weekly meetings with the client.
- Successfully and accurately print DNA with correct coding

4.7 Results

What are the results of your testing? How do they ensure compliance with the requirements? Include figures and tables to explain your testing process better. A summary narrative concluding that your design is as intended is useful.

- The results of our testing should follow our acceptance testing in that we successfully synthesized DNA with the correct coding that we input.
- For the user interface, the results of our testing will be checking if the output that is presented to us is the one that we are expecting. Because the nature of our project allows us to know what the output should look like before entering any input, we can simply see how the program reacts to what we enter into it.

Input →	10, 10	1 cm	10 nm
Matrix Size	A matrix with 10 rows and 10 columns will appear		
Cell Size		Each cell will measure 1 centimeter across	
Space Between Cells			The space between each cell of the matrix will measure to 10nm