EE/CprE/SE 491 WEEKLY REPORT 4
Feb 21, 2022 – Feb 22, 2022

Group number: 12

Project title: Creating DNA from scratch for DNA-based data storage

Client &/Advisor: Iowa State University / Meng Lu

Team Members/Role: Connor Larson/Software Engineer , Kyle Riggs/Software Engineer , Brandon Stark/Electrical Engineer , Nathan Armstrong/Electrical Engineer , & Lucas Heimer/Electrical Engineer

- **Weekly Summary**

    This week we determined that we will have to incorporate a Raspberry Pi within our design/modification of the Photon Mono 3D printer. We also conducted research regarding what code we might have to implement with the connection between the Raspberry Pi and the LCD screen. Meng Lu gave us insight to how the LCD screen is manipulated by polarizing each pixel to either block or allow light to pass through in order to produce an image on the screen.

- **Past week accomplishments**

    • Team Member 1 (Connor): This past week I worked on an extension of what I did last week. I continued to try and figure out how we will connect to the LCD, to control what areas of the printer we are able to print to. The thing I was trying to figure out was how we can do this, while at the same time controlling the printer and having it print to the proper location. We have figured out that most likely the best way to do this is by using an arduino or raspberry pi instead of the custom SBC that is already installed in the printer.

    • Team Member 2 (Kyle): This week I did research on the polarization surrounding liquid crystals, so we will be able to control each pixel of a screen. This is due to the voltage that we can apply through ITO glass. Our advisor went over a lot of different aspects of this with us and also is helping us procure a raspberry pi, which we've been doing research into.

    • Team Member 3 (Brandon): This past week I worked on researching the communication between the LCD, the Raspberry Pi, and the Photon Mono printer. Any computer can communicate with the 3 via Wifi. I also did some digging around to find out how our default LCD screen might connect to the R-pi.

    • Team Member 4 (Nathan): This week I worked on LCD research, and how different LCD's might function better or worse in our desired system. We also talked through a lot of different ideas with our project advisor, eventually deciding that we will most likely use a raspberry pi to interface with our LCD. I brushed up on my coding skills, specifically the likes of java and python, so we can work on making a user interface for our new LCD.

    • Team Member 5 (Lucas): I worked on completing research regarding the components necessary for programming the LCD. After consulting with our advisor we all came to the conclusion that we will need a raspberry pi to connect to the LCD and control the liquid

crystal from this controller as an intermediary between the computer and the screen.

- **Pending issues**
  - Team Member 1 (Connor): The current issue I am working to resolve is how to control the LCD and the printer with an external device. First I need to figure out what we will use to replace the SBC with (raspberry pi or arduino), then figure out how to implement it into the printer.

  - Team Member 2 (Kyle): No pending issues. Project going smoothly and I feel we are making good progress and learning a ton.
  - Team Member 3 (Brandon): Similar to what Lucas said, our main focus right now is to figure out if we need a new LCD screen or can we use our current one.
  - Team Member 4 (Nathan): We need to figure out if we can use the raspberry pi with our current LCD or if we need a new one. If we do need a new one, we then need to determine how to implement said new LCD into our printer.
  - Team Member 5 (Lucas): Once we have access to a Raspberry Pi, we will need to determine if the current LCD is compatible with it or if we will need to purchase an entirely different LCD which can connect to a Raspberry Pi.

- **Individual contributions**

| NAME	Individual Contributions *(Quick list of contributions. This should be short.)*	Hours this week	HOURS cumulative
Member 1 (Connor)	Research how to implement Raspberry Pi or Arduino to replace the current SBC	6	24
Member 2 (Kyle)	Research polarization surrounding liquid crystal to control pixels of a screen	6	24
Member 3 (Brandon)	Research how to implement Raspberry Pi and what can connect to it	6	24
Member 4 (Nathan)	Researched raspberry pi functions, its language, and connecting pins.	6	24
Member 5 (Lucas)	Research on how to use a Raspberry Pi to connect to the LCD screen and control the configuration of the images it produces	6	24

- **Plans for the upcoming week**
  - · Team Member 1 (Connor): I plan to figure out if we will use an Arduino or Raspberry Pi to implement the SBC. Then I'd like to order the device to get my hands on it for next week. While waiting for the device, I'd also like to look into how to implement it to the printer, so upon its arrival I know the direction I want to head.
  - · Team Member 2 (Kyle): Try to connect to the 3D printer via WIFI and use this in conjunction with a raspberry pi, so no usb connection to a computer or flash drive is needed.
  - · Team Member 3 (Brandon): Work with Nathan and Lucas and try to determine if we can use our current LCD screen with the given raspberry pi.
  - · Team Member 4 (Nathan): Dive into the raspberry pi and how it connects to the LCD. Also, reviewing its coding language and how we might implement the user interface we plan on doing into the 3D printer system.
  - · Team Member 5 (Lucas): I plan to experiment with the LCD screen and Raspberry Pi once we have access to the device. I want to try to determine the best method for connecting the two regardless of if we have a compatible screen or not currently.

- **Summary of weekly advisor meeting**

  In our weekly meeting with Professor Lu we focused on our potential options for the LCD screen. We discussed how using a Raspberry Pi would be one of the more likely routes taken for our design and how we can obtain a device. He then provided us an in depth overview of how an LCD screen works using polarizers for each pixel to either block and allow light to pass through, thus creating an image on the screen. We also briefly discussed the microfluidic system we will be creating in the second semester and how that will be integrated with the current structure of the 3D printer. At the end of the meeting we agreed upon obtaining a Raspberry Pi to do research with and determine whether or not we will be needing a different LCD screen to perform the DNA synthesis process.

Use-Case Diagram: 3D print DNA for data based Storage

User

- Pick DNA sequence
- Modify 3D printer
- Code GUI
- Synthesize DNA

Us
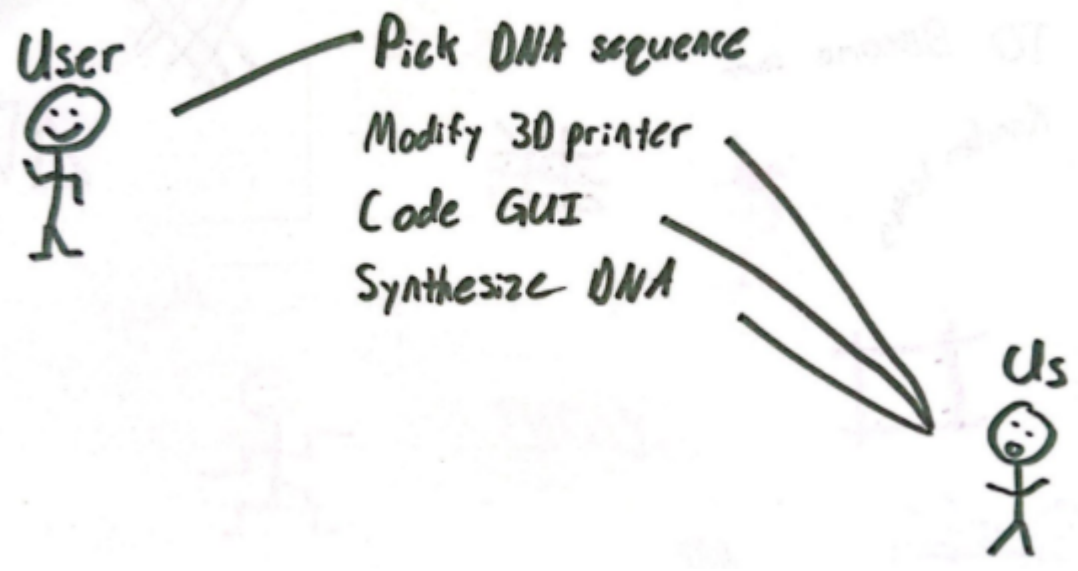
SPRING '22 491 PERSONA PROFILE

Bob
Lab Scientist
Age: N/A
From: Iowa

Challenges:
- Not enough money, poor
- Lab caught on fire
- Working from home

Goals:
- Synthesize DNA
- Cheap
- Data storage

Influences:
- Stress
- Friends / family
- Love for science