2 Project Plan

2.1 Project Management/Tracking Procedures

Which of agile, waterfall or waterfall+agile project management style are you adopting. Justify it with respect to the project goals.

- We will use a more agile waterfall approach as our team's roles have us divide up several waterfall approach as our team's roles have us divide up several different projects to work on concurrently while still reaching milestones as a team. For example, Anna works on improving the flow control system while Colin and Evan work on improving software, and Astha and Caden improve the 3D printer and backlight screen. These are projects that occur simultaneously and will still allow us to achieve goals in a linear fashion.

What will your group use to track progress throughout the course of this and the next semester. This could include Git, Github, Trello, Slack or any other tools helpful in project management.

- Our group will use Slack, Discord, Figma, and our shared online notes document to track progress, ask questions, and plan out the next steps. We plan to maintain contact with the client throughout the summer using our official Slack channel.

2.2 Task Decomposition

In order to solve the problem at hand, it helps to decompose it into multiple tasks and subtasks and to understand interdependence among tasks. This step might be useful even if you adopt agile methodology. If you are agile, you can also provide a linear progression of completed requirements aligned with your sprints for the entire project.

Flow Control Tasks + Subtasks

- Familiarize self with flow control system
  - Gather dimensions
  - Compile parts and materials list
- Make more/better flow cell (single use)
  - Learn about how prior team built the flow cells
  - Practice using plans from last year to replicate flow cell
- Think of ways to improve pressurized piping/identify the problem areas - test with ink
  - Construct pressurized piping using last year's designs
  - Test with ink under different conditions heat, wear, etc.
  - Brainstorm ways to improve and create alternative piping options using ETG
- Integrate codes
  - Flow control system comes with software, combine commercial software provided with our developed code

2.3 Project Proposed Milestones, Metrics, and Evaluation Criteria

What are some key milestones in your proposed project? It may be helpful to develop these milestones for each task and subtask from 2.2. How do you measure progress on a given task? These metrics, preferably quantifiable, should be developed for each task. The milestones should be stated in terms of these metrics: Machine learning algorithm XYZ will classify with 80% accuracy; the pattern recognition logic on FPGA will recognize a pattern every 1 ms (at 1K patterns/sec throughput). ML accuracy target might go up to 90% from 80%.

In an agile development process, these milestones can be refined with successive iterations/sprints (perhaps a subset of your requirements applicable to those sprint).

Key milestones proposed in our project varies depending on what area of the project.

Software:

Study the C# code from the S22 team to generate pattern on a monitor screen (March)

- Understand the overall frame of the code
- Update the GUI user input and image generation function

Add the code to control the Fluigent pump and switch (April)

- Include the Fluigent SDK
- Write a loop to run 30-40 cycles of liquid injection, incubation, wash

Add the control of LED light source (May)

- Directly comminate via the USB port

Hardware:

LCD panel update (March/April)

- Study the display interface
- MIPI/LVDS (https://focuslcds.com/the-mipi-and-lvds-display-interfaces/)
- Optical characterization of the LCD panels
- Transmission measurement
- Black/white transmission ratio

LED on/off switch (May)

- Use the software to turn the LED on/off
- Add the function to adjust LED intensity

Flow System Design:

Fabricate flow cell (March/April)

- Use acrylic sheets to assemble 5-10 flow cell
- Add inlet and outlet connector

Test the flow cell stability (April)

- Run 30-50 cycles of the flow
- Potential problem (clogging of the pipe, trapped air bubble, broken connectors)

Surface functionalization of the flow cell (May)

- This step is to immobilize the DNA molecules on the surface

2.4 Project Timeline/Schedule

• A realistic, well-planned schedule is an essential component of every well-planned project

• Most scheduling errors occur as the result of either not properly identifying all of the necessary activities (tasks and/or subtasks) or not properly estimating the amount of effort required to correctly complete the activity

• A detailed schedule is needed as a part of the plan:

– Start with a Gantt chart showing the tasks (that you developed in 2.2) and associated subtasks versus the proposed project calendar. The Gantt chart shall be referenced and summarized in the text.

– Annotate the Gantt chart with when each project deliverable will be delivered

• Project schedule/Gantt chart can be adapted to Agile or Waterfall development model. For agile, a sprint schedule with specific technical milestones/requirements/targets will work.

Gantt Chart

2.5 Risks And Risk Management/Mitigation

Consider for each task what risks exist (certain performance target may not be met; certain tool may not work as expected) and assign an educated guess of probability for that risk. For any risk factor with a probability exceeding 0.5, develop a risk mitigation plan. Can you eliminate that task and add another task or set of tasks that might cost more? Can you buy something off-the-shelf from the market to achieve that functionality? Can you try an alternative tool, technology, algorithm, or board?

Agile project can associate risks and risk mitigation with each sprint.

Risk Factors	Probability	Risk mitigation plan
Continued issues with dark spots in the new LCD screen	.5	We may need to add a more complex and efficient heat sink to the bottom of the LCD
The high-power LEDs not being	.2	

responsive using the given API		
Issues integrating the previous groups code together with itself/old bugs in the code	.7	We will keep our options open on needing to rewrite code if there are unforeseen issues with using the code of the previous group
Issues controlling the fluigent pump and switch automatically with code	.3	
Leakage in the connection points of the Flow Cell	.2	
Clogging of the pipe in the flow system	.4	

2.6 Personnel Effort Requirements

Include a detailed estimate in the form of a table accompanied by a textual reference and explanation. This estimate shall be done on a task-by-task basis and should be the projected effort in total number of person-hours required to perform the task.

Task	Software	Hardware	Flow System
March	Look over and understand previous teams code, get better intuition on programing language, run it to make sure it works, then update the code GUI to make it work better.	Study the display interface, learn how it all works and what needs to be done to improve it	Use acrylic sheets to assemble 5-10 flow cell. Build better flow cell sheets to improve how the DNA gets dispersed from the system
April	Include the fluigent sdk and write the loop to help automate the system and bringing it all together	Optical characterization of the LCD panels (Transmission measurement and Black/white transmission ratio). Need to make the LCD better, reduce light leakage and flow heat away from system so it doesn't mess with final DNA image.	Run 30-50 cycles of the flow and Potential problem (clogging of the pipe, trapped air bubble, broken connectors) After making them, test them and make sure all fluid gets cleared out after A,T,G,C and that those get to microarray properly.

May	Set it all up to get the picture array more consistent with the code and connecting it to the USB port to connect to the computer to display the picture	Use the software to turn the LED on/off and add the function to adjust LED intensity. Connecting software and hardware together to help automate system	This step is to immobilize the DNA molecules on the surface. Combing it all together to get the DNA to flow properly to where its supposed to be and making sure that it gets cleared properly so there is no contamination.
Total Hours:	45 hours for software	45 hours for hardware	45 hours for flow system

2.7 Other Resource Requirements

Identify the other resources aside from financial (such as parts and materials) required to complete the project.

Looking at previous senior design notes and ETG