

UI Components

- Screen: OLED Breakout Board by Adafruit -
<https://www.digikey.com/catalog/en/partgroup/oled-breakout-board-with-microsd-holder/54834>
- 3 buttons: up, down, "Select" (note: the flowchart says "OK" instead of "Select" but Select might be a better word choice)
 - https://www.amazon.com/Cylewet-12Pcs-Switch-Button-CYT1092/dp/B075VBWF6M6/ref=sr_1_69?dchild=1&keywords=arduino+arrow+buttons&qid=1623354876&sr=8-69

UI Flowchart Explanation (see flowchart images in the UI folder)

- The screen will automatically turn on when the battery is connected.
- Once turned on, press the middle button ("OK" or "Select" - the flowchart says OK but Select might be a better word here) to start setting temperature and time
- Setting up
 - First, the temperature (in degrees C) will be highlighted. Use the up and down buttons to set the temperature, then press Select.
 - The highlighting will switch from the temperature to the time (in hours). Use the up and down buttons again to set time, then press Select to proceed.
 - A display will then show that displays the time and temperature you set. There will be a highlight on "START."
 - Use the Select button to start if the numbers are the ones you wanted
 - Use the down button to highlight "Edit incubation settings" then press Select if the numbers aren't correct.
 - If you select "Edit incubation settings," you'll go back to the beginning of the setting up process.
 - Once the device starts, it will display "Heating..." until the device has not dropped below the set temperature for 15 minutes. This is to make sure that the temperature has completely stabilized. (15 minutes was chosen somewhat arbitrarily, so using less time would probably also work.) Then the device will start the timer and go to the "Running" screen.
- Running
 - Once the device has switched to the "Running" screen, it will stay here for the majority of the time. The display will state the time elapsed (from the beginning of the incubation) and the current temperature.
 - To see more data, press Select on "Extended data."
 - A screen will show up with more statistics. See the section on "potential data to collect" for what could be shown here.

- Warning system
 - The warning system will activate once the device has detected a temperature of $\pm 2^{\circ}\text{C}$ from the set temperature. This range was picked because $35\text{--}37^{\circ}\text{C}$ is the preferable temperature for *E. coli*, but there won't be a significant difference in growth if the temperature is 33°C or 39°C .
 - If the temperature is currently outside of the $\pm 2^{\circ}\text{C}$ range, the screen will display "The temp is currently below (lower bound)" or "The temp is currently above (upper bound)." The device won't stop incubating, and the timer will keep running. Press Select to go back to the main screen.
 - If the temperature is currently inside the $\pm 2^{\circ}\text{C}$ range but was previously outside of that range, the screen will display a statement that the temperature went outside the set range, along with the elapsed time it went out of range and the minimum and maximum temperature during that period. Pressing Select will bring the user back to the "running" screen, where the user then has the choice of going to "Extended data" to check the temperature history. The device will not stop incubating while this warning is displayed, and the timer will keep running.
- Stopping incubation
 - The incubation can be stopped at either the "heating up" screen or during the run. At each point, the screen will go back to the screen for setting time and temperature.
 - To turn the device off, disconnect the battery.

Potential data to collect

- Current (instantaneous) temperature
- Minimum and maximum temp over the last hour
- Running average of the last hour
- Graph of temp vs. time over the last hour

Note: the screen is pretty small, so having a graph and text/numbers on the screen at the same time may make the display hard to read.