Smart Water Bottle Final Presentation

Robotics Projects Group 8

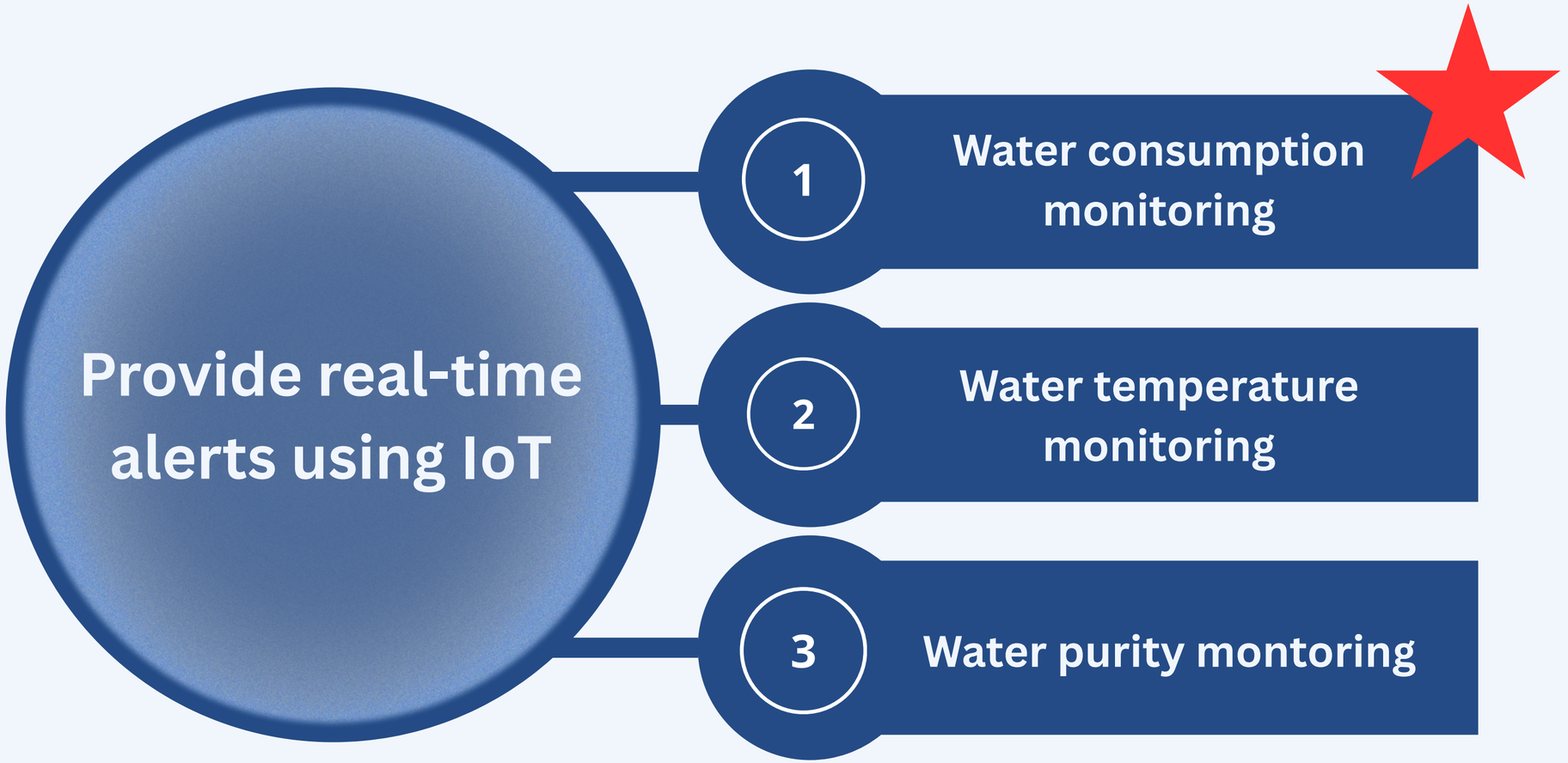
Problem Statement

- Many people are unable to track their water habits, therefore not reaching the daily optimal water intake.
- Existing water tracking system are manual, making water intake tracking difficult
- Users always have to guess the water temperature and quality before drinking which can be dangerous for hot drinks.
- There is no automatic alerting system for water drinking habits

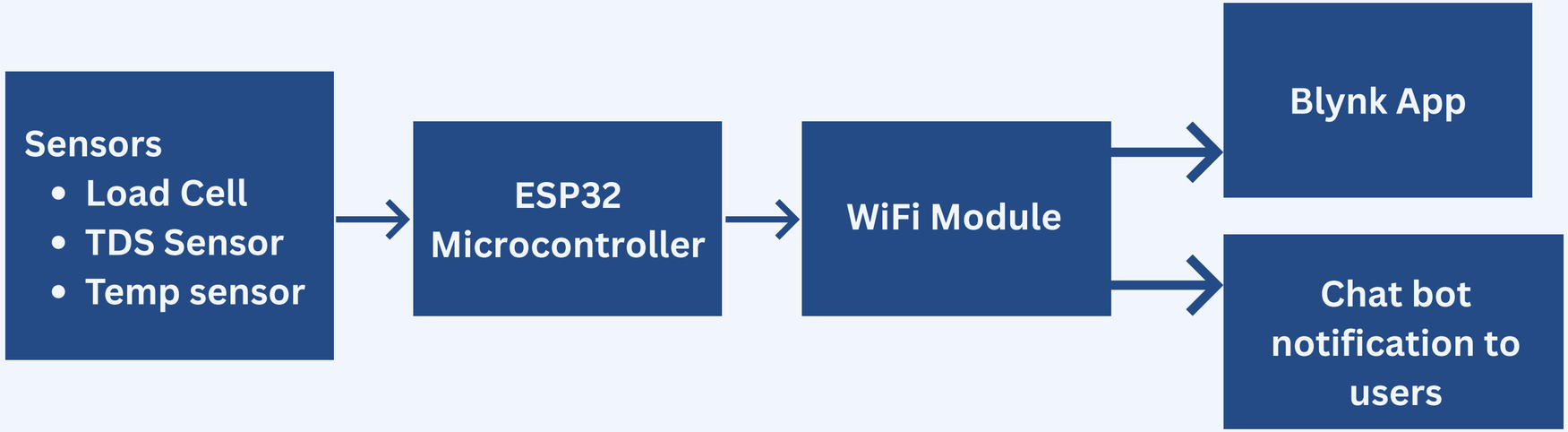


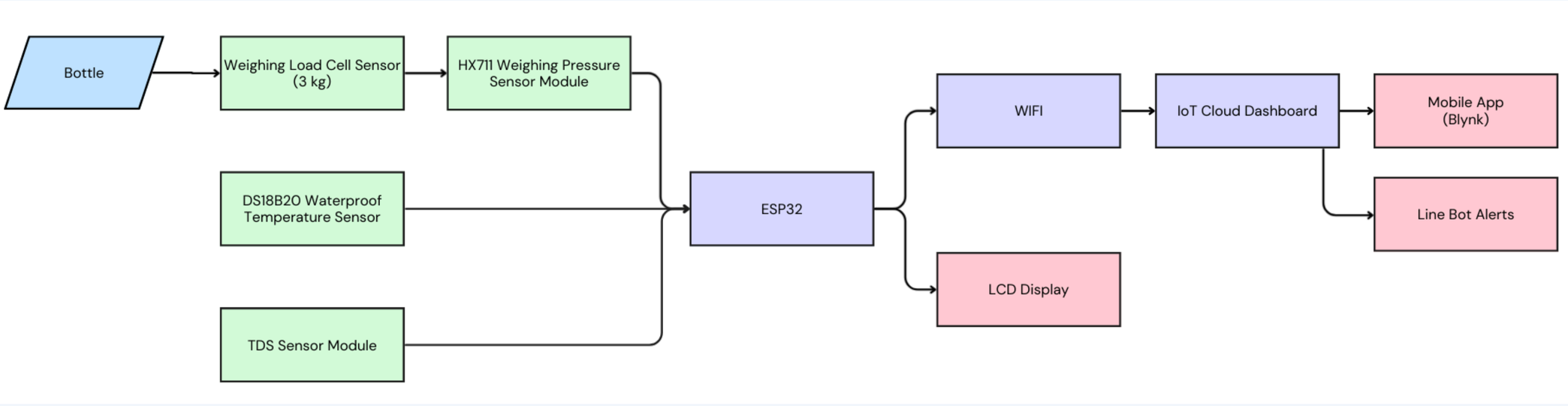


Project Objective

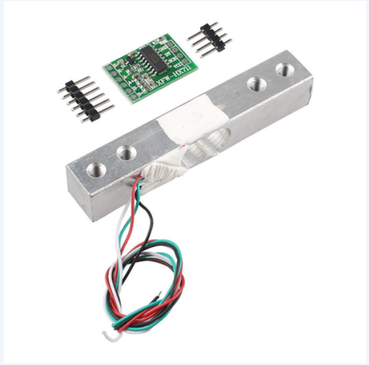


System Overview





Hardware Components



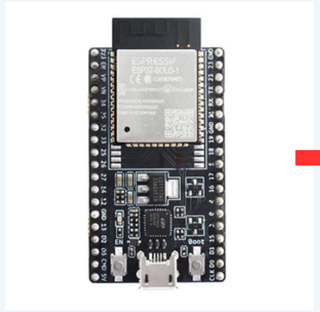
Load Cell



TDS Sensor



Temperature Sensor

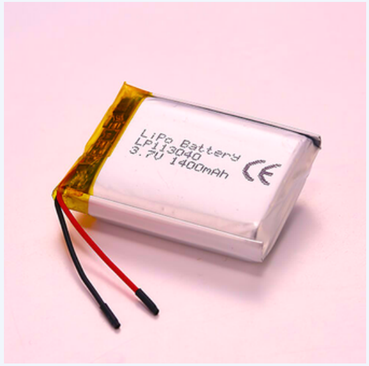


ESP32 Microcontroller

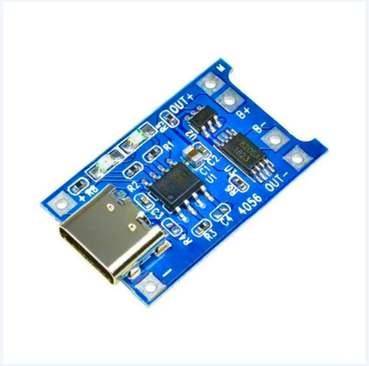
+



ESP32 shield 30 pin



LiPo battery



TP4056 module



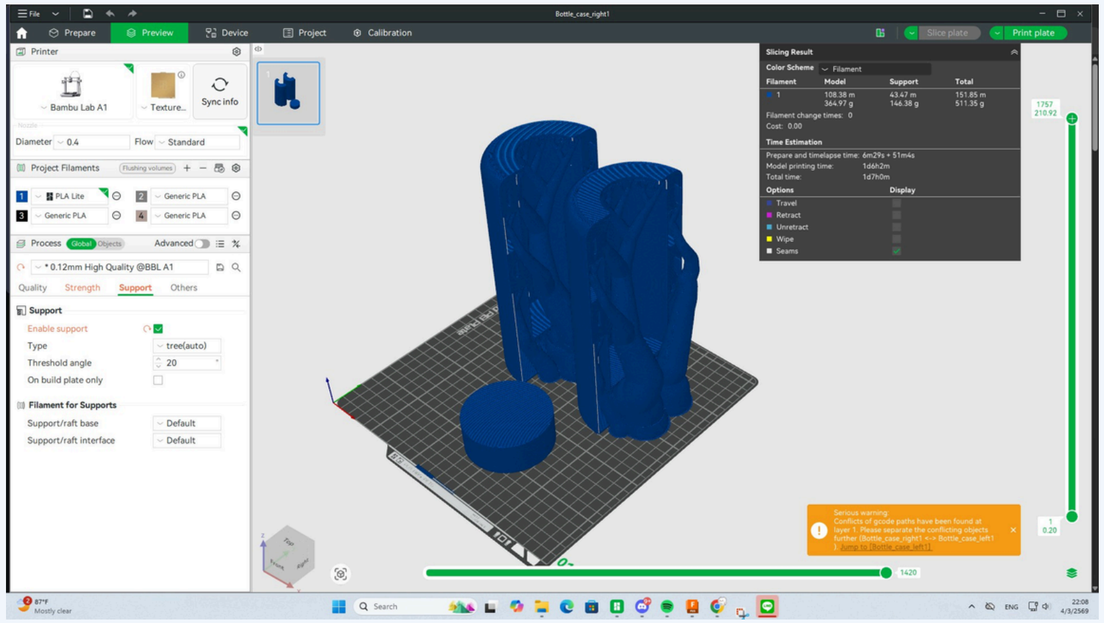
3D printed bottle case

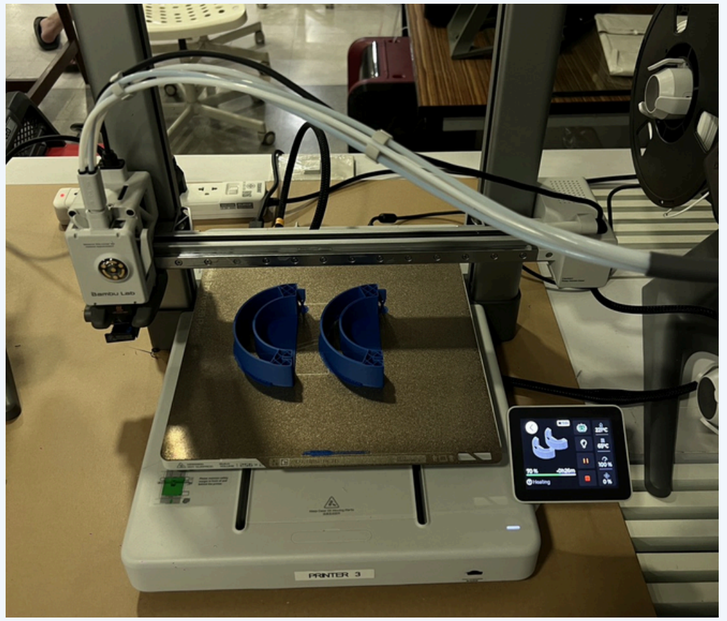


LCD screen

3D Printing Bottle Case

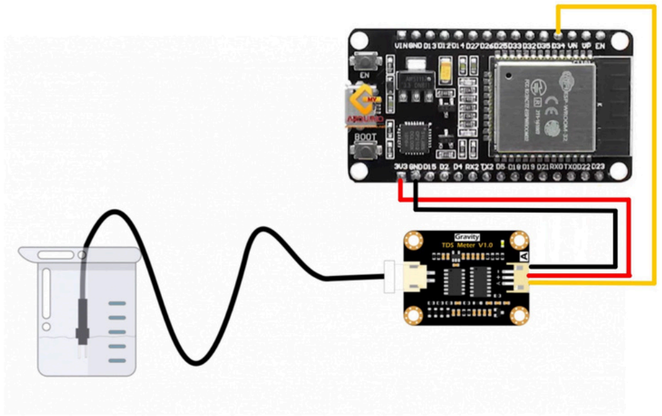
Designing process of the water bottle casing using fusion360 and 3D printing





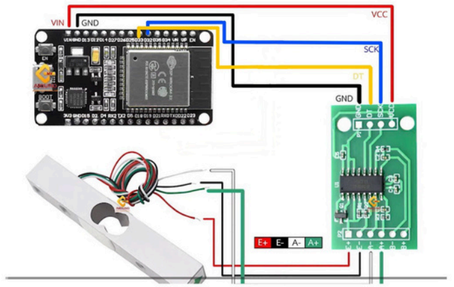
Sensors Connections

TDS Sensor



TDS Sensor	ESP32
-	GND
+	3V
A	D34

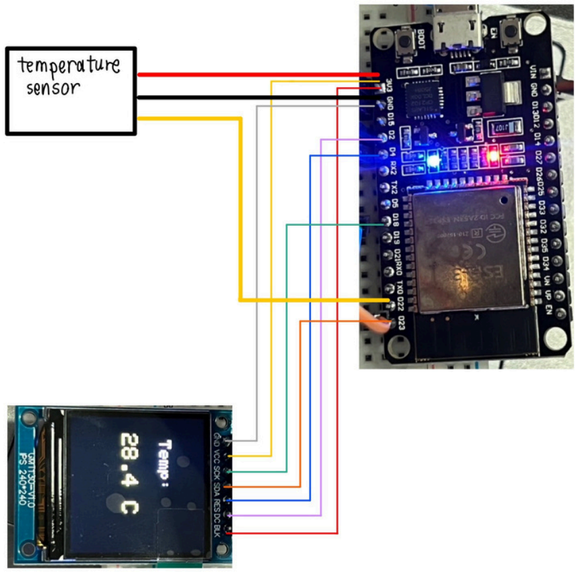
Load Cell



vcc - v3
sck - d32
dt - d33
gnd - gnd

เหลือง tds
ขาว lcd
เขียว temp
ส้ม 3.3v
ดำ gnd

Temperature Sensor



Software Part

- **Individual Sensor Coding & Testing**

Code was written and tested for each sensor (Temperature, TDS, EC, Load Cell) separately to verify correct data reading from the microcontroller.

- **Data Reading and Calibration**

Raw outputs were checked and calibrated to improve measurement accuracy.

- **Code Integration**

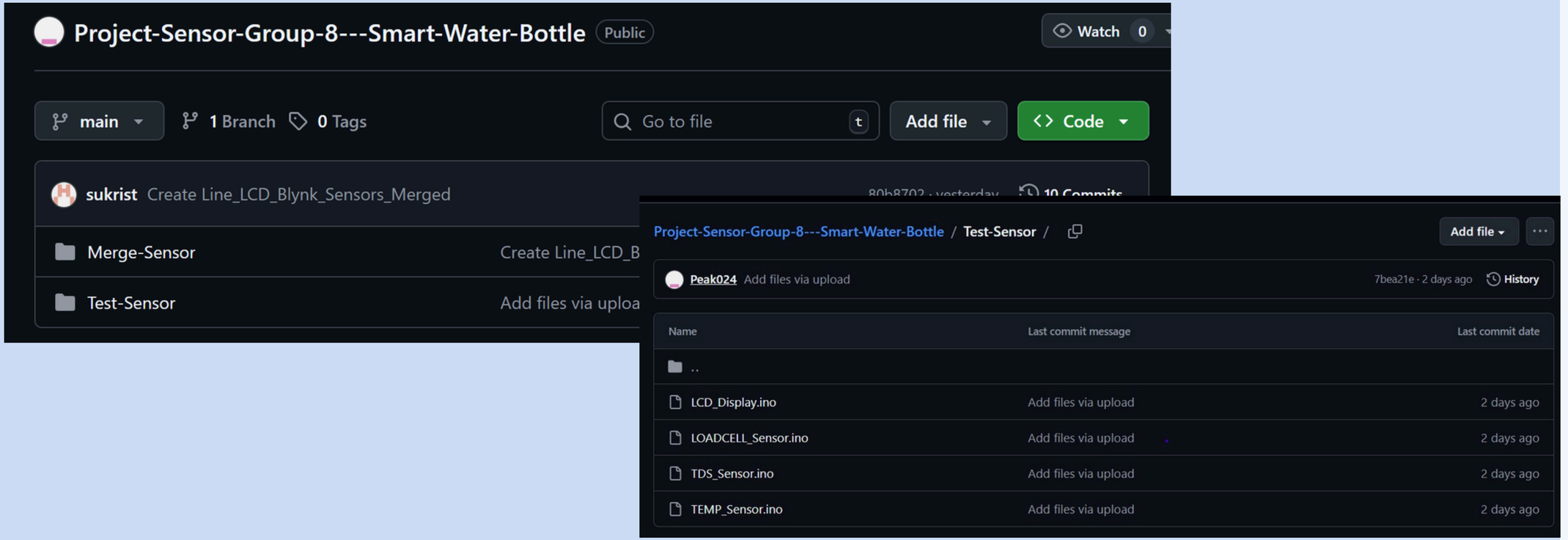
Individual sensor codes were combined into a single microcontroller program.

- **Output Implementation**

The program sends processed sensor data to the LCD display and uploads it to Blynk for real-time monitoring.

Coding

Coding Workspace in GitHub



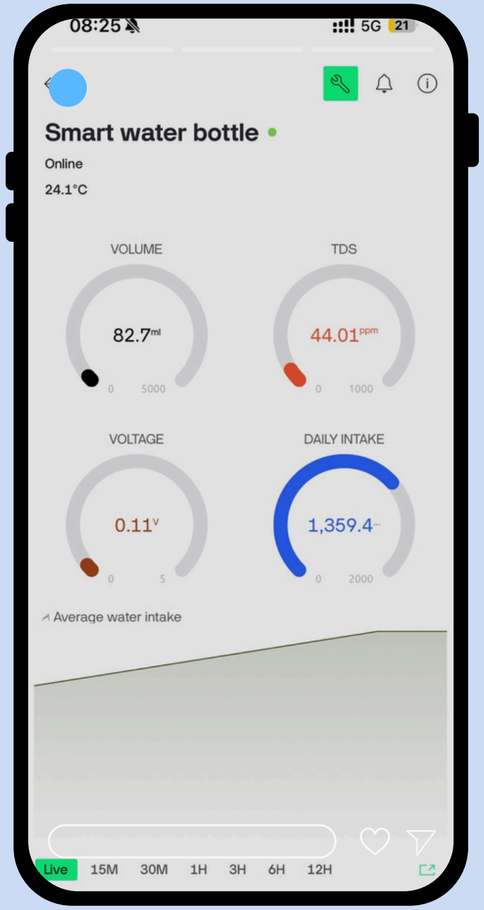
[github link]

Blynk IoT Platform

- Connected to the ESP32 microcontroller for real-time updates
- Provides a simple interface for monitoring hydration status

Displays real-time hydration information to the user

- Shows water intake (mL) measured by the load cell
- Displays water temperature from the temperature sensor
- Shows water quality (TDS & EC level) readings
- Additionally provide total daily water intake and average daily intake
- throughout the whole month

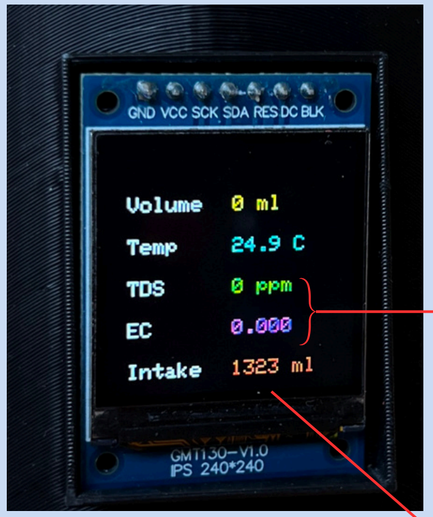


LCD display

- Displays real-time hydration information to the user similar to blynk



After Drinking



TDS and EC level reduced to 0 due to no water detected

Water intake increased

Volume: Amount of water measured in millilitres (mL)
Temp: Water temperature measured in degrees Celsius (°C)
TDS: Water purity measured as total dissolved solids in parts per million (ppm)
EC: Electrical conductivity of water, indicating ion concentration
Water Intake: Total amount of water consumed by the user during the day

Line Bot - IoT

- **LINE Bot Setup**

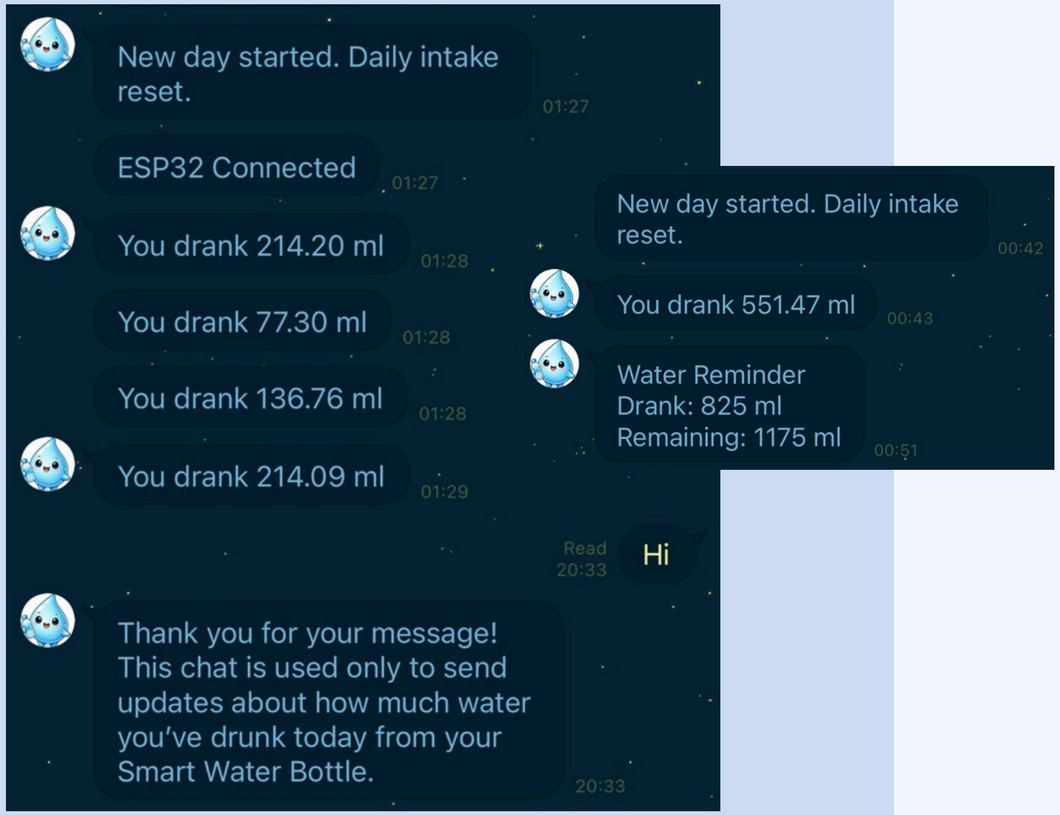
Chatbot was created using LINE Official Account to send hydration alerts to the user.

- **Hourly Reminder**

The system calculates daily water consumption from load cell data. If intake is below 2000 ml, the bot sends a reminder every hour with the current intake.

- **Goal-Based Stop**

Notifications stop once the 2000 ml target is reached, and intake counter resets automatically at the start of a new day.



Result / Testing

Load cell successfully detected weight changes as users drank water

System calculated water intake and compared it to the 2,000 ml daily hydration goal

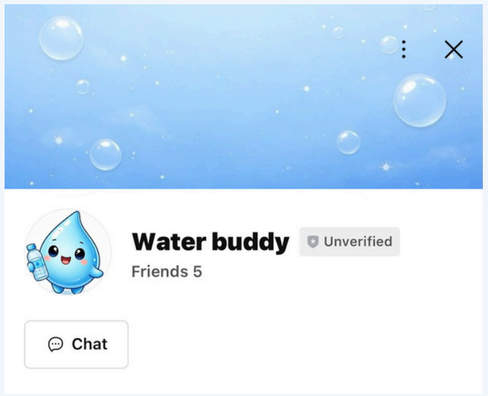
Mobile alert system (LINE Official) sends notifications and automatically resets at 23:59

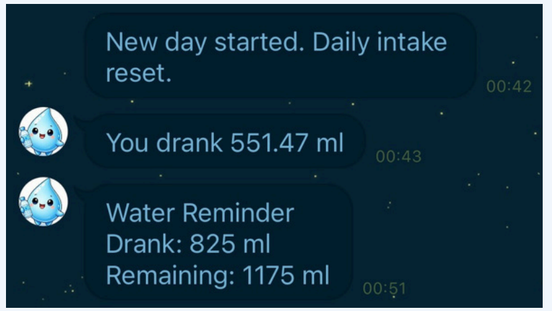
TDS sensor measured total dissolved solids, providing water quality monitoring

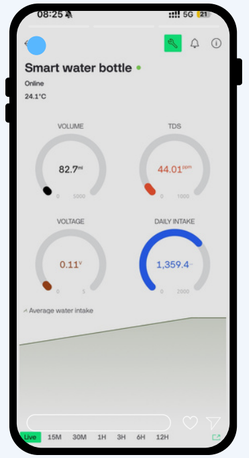
Sensor produced consistent readings

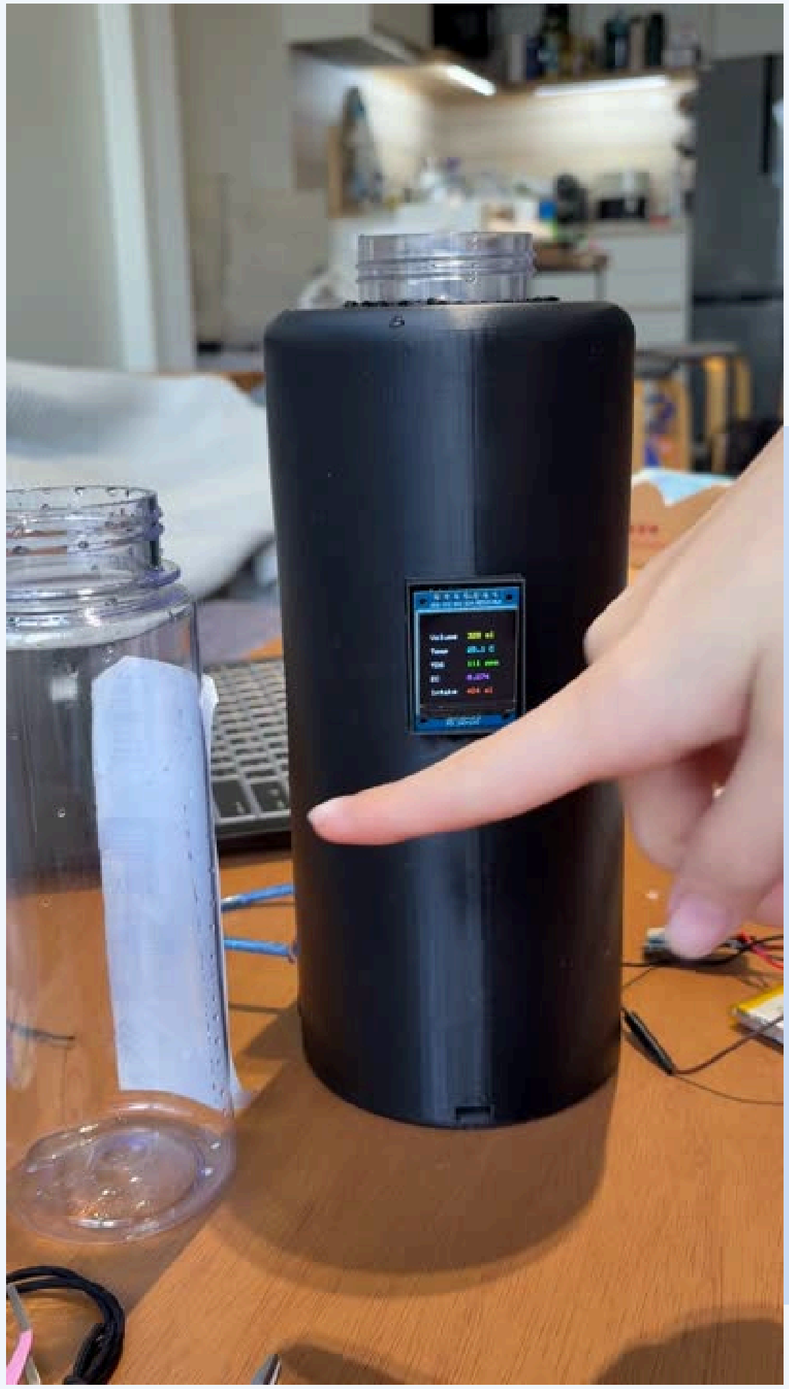
Temperature sensor accurately measured water temperature and displayed it on the LCD











Result / Testing

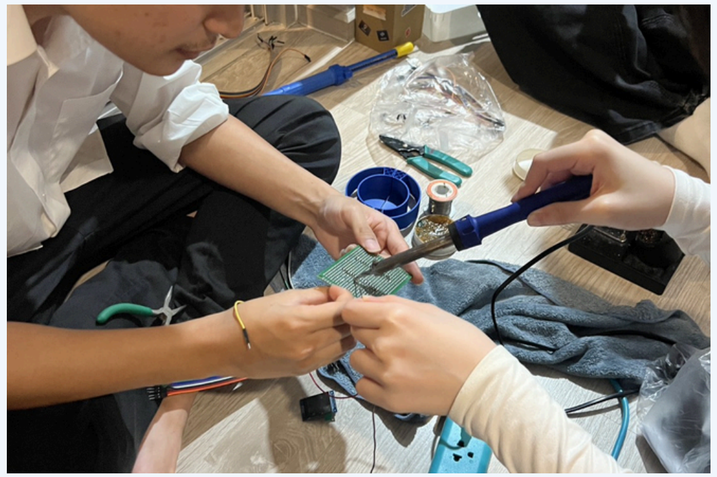
- System successfully tracks water consumption, water quality, and water temperature.
- Sensors performed reliably during testing.
- Smart monitoring system increases user awareness of hydration habits by making them more aware.

Problems

- The 3D printing of the case took 15 hours which made it difficult to have quick modifications with the fitting.
- The water sealant the we used couldn’t prevent water from leaking out that well. Since we need to glue many layers which lead to water leakage, it took more space than the designed we printed.
- The case layout doesn’t support the weight measuring of load cell, causing the water level output to not be entirely accurate.
- A 3.7V Li-Po battery does not provide enough voltage for the ESP32 5V/VIN pin, so the onboard regulator cannot produce a stable 3.3V. When the WiFi draws high current, the voltage drops and the ESP32 not working properly

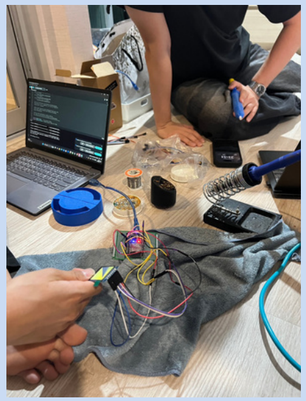
Problems

- All wiring needed to fit within the limited space inside the 3D-printed case, which made the assembly process complex and intricate.
- We tried wiring with perfboard but it required more mastery with soldering



Future Improvements

- Improve the casing design to better fit together and reduce 3D printing time.
- Redesign the case dimension to obtain more accurate loadcell output along with having more open space in the casing to wire everything easily.
- Using the pcb circuit board or any integrated circuit board to reduce/avoid the mess of wiring
- Rich Menu in Line Bot (Water Homie) for more convenient use.



Engineering Lessons Learned

Load Cell Integration

The 3D-printed housing should not support or suspend the bottle, as this can interfere with load cell measurements and reduce accuracy.

Microcontroller Placement

The ESP32 board and expansion module should not be positioned beneath the bottle. This placement increases space constraints and exposes the electronics to potential water leakage risks.

Sensor Placement

The TDS and temperature sensors were mounted at the bottom of the bottle, which created mechanical interference due to shared mounting and wiring connections..

Hardware Degradation

White residue and corrosion were observed on the ESP32 and expansion board, indicating oxidation caused by moisture exposure, which may result in short circuits or component failure.

Wiring Management

The wiring layout was initially complex and disorganized. Improved cable management and internal case routing would enhance assembly stability and system reliability.

Thank You

By Group 8