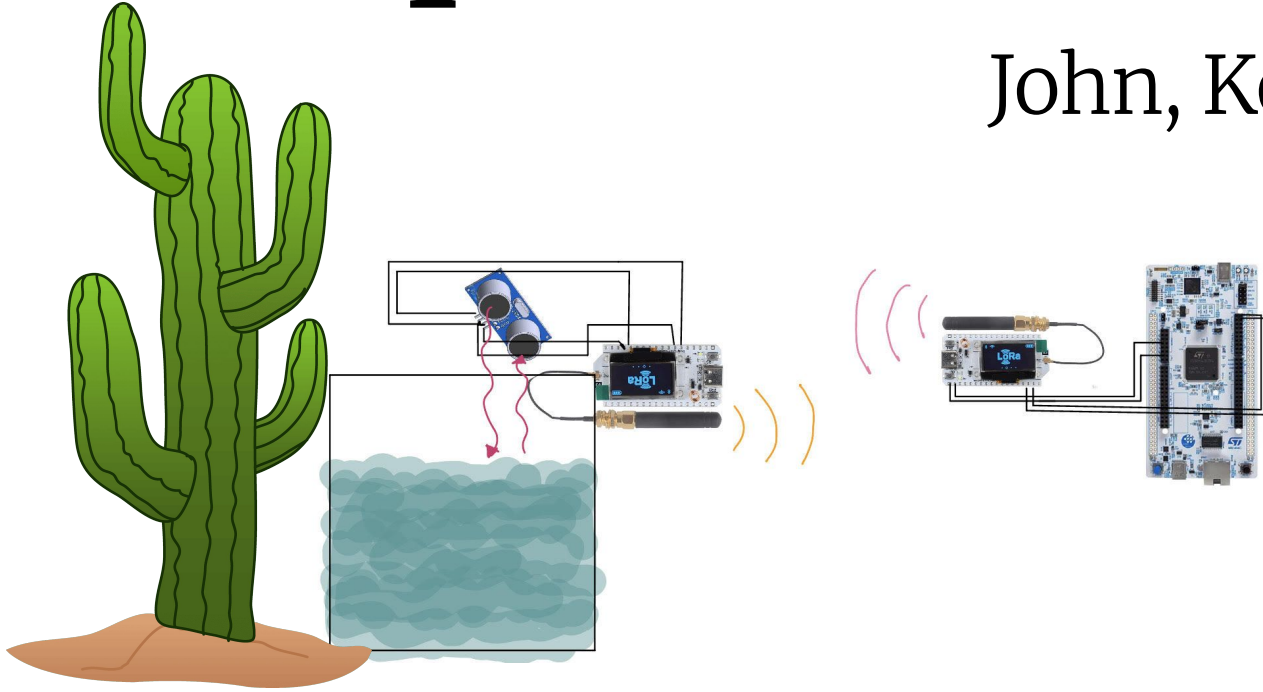
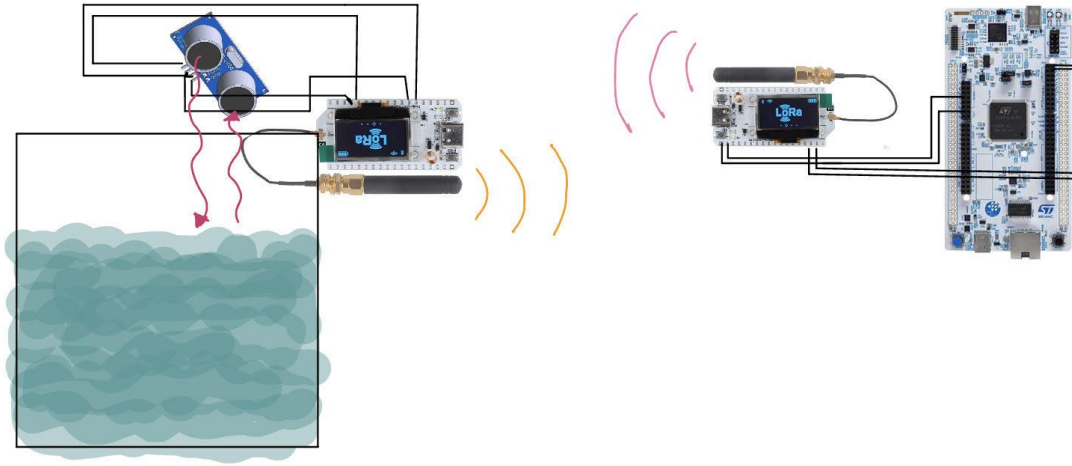


Aquasense

John, Kevin, Jordan



Well Monitoring system



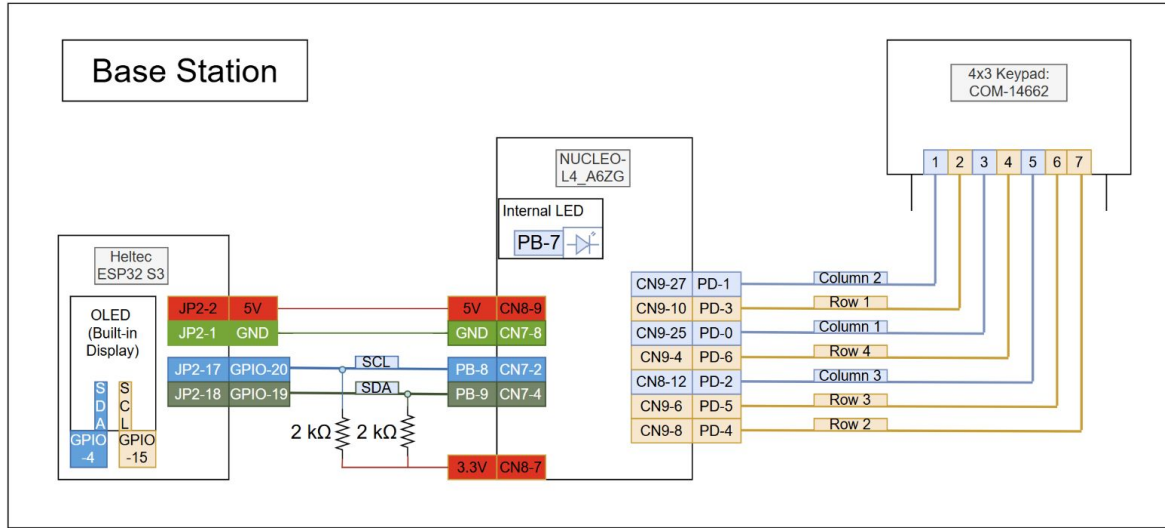
- Wireless communication between base and transmitter up to 2 miles tested to 0.5 miles.
- Initial configuration controlled by user keypad
- STM32 acts as controller, takes keypad input and relays it over I2C to ESP32
- ESP32's communicate over LoRa 915 MHz.

Inspiration for the AquaSense Project



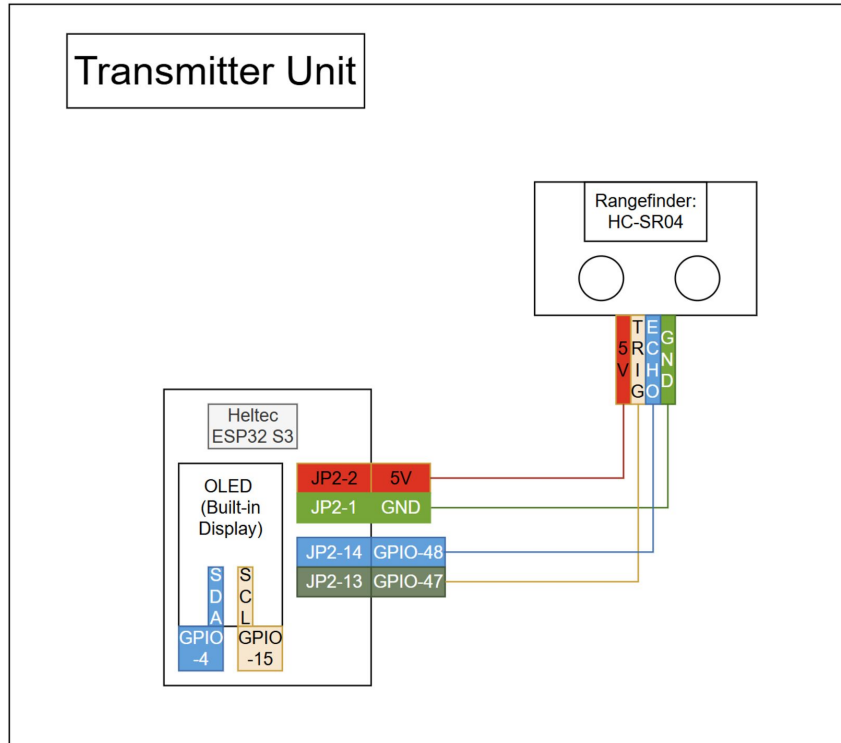
- Inspired by the challenge of monitoring a water tank over 1000 ft away from the house at a rural property.
- Frequent power outages at the well (a few times a year) have caused the tank to drain completely, leaving my house without water unexpectedly.
- The project addresses the difficulty of manually checking the tank due to its distance and provides a remote monitoring solution.
- Likely useful for others with similar rural setups, where wells and tanks are far from homes.

User control



- Receive command from keypad to retrieve ultrasonic data from transmitter unit
- Nucleo communicates with ESP via I2C
- Once base ESP request and receives distance from transmitter it is displayed on the serial monitor

Remote sensing



- Transmitter unit sits in tank to measure distance to water
- Transmitter receives distance to water measurement from ultrasonic sensor and sends Distance measurement on request from the base.

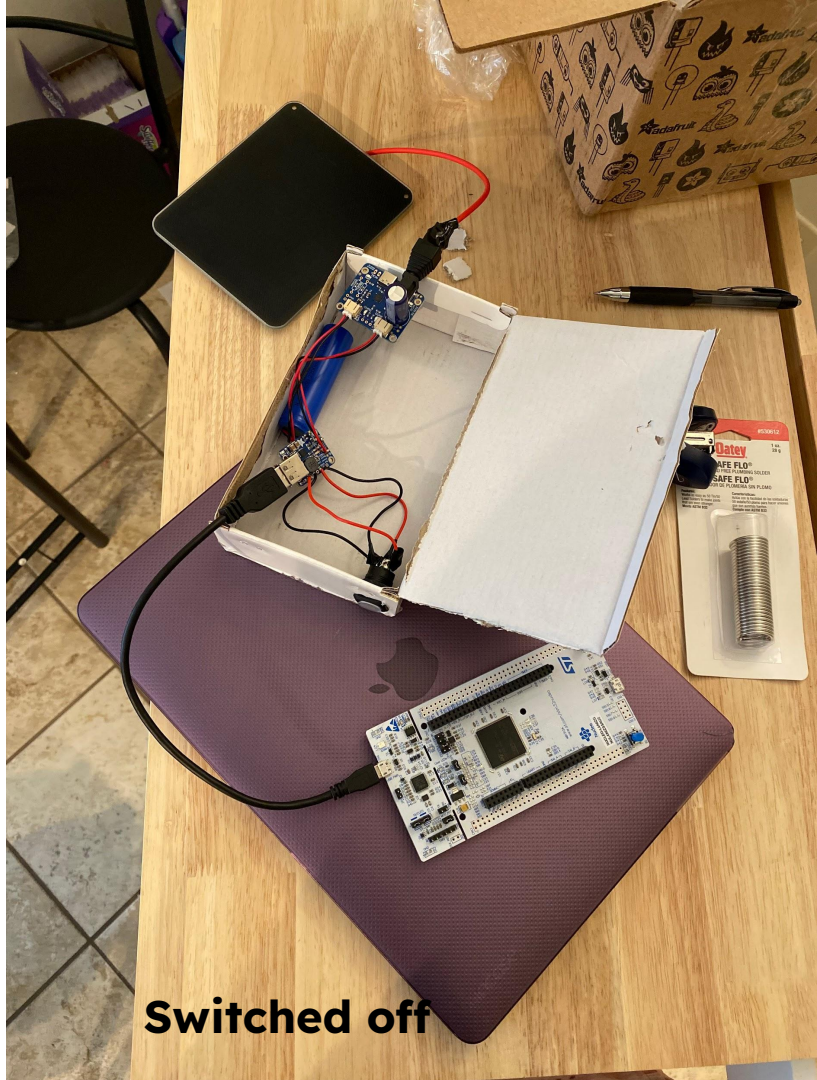
$$\text{Distance} = \frac{\text{Speed of Sound} \times \text{Time}}{2}$$

- X2 because of round trip

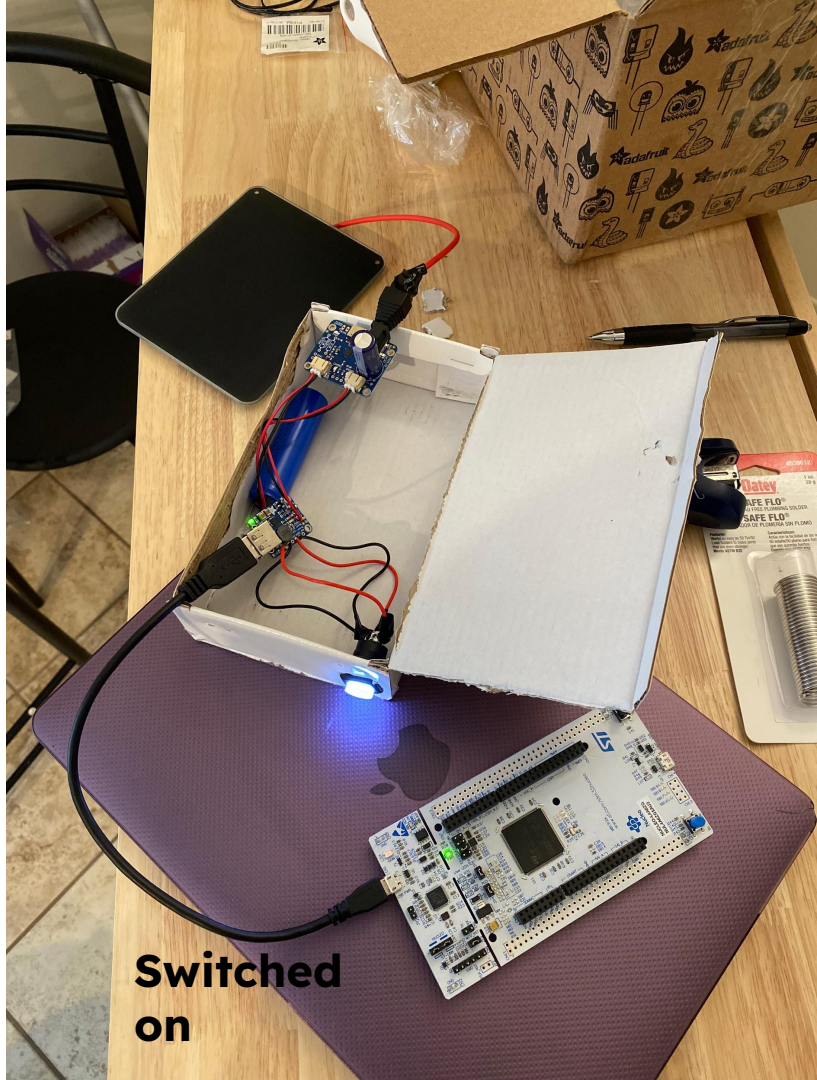
Difficulties



- I2C connection between ESP32 and STM
 - Getting configured as peripheral
 - Getting ESP to acknowledge the STM and allow for data transfer
 - Matching the ESP and STM address
 - Address sent
 - Write bit
 - Acknowledge
 - Stop bit



Switched off



Switched on

Technical Specs

Remote Unit Specifications:

- Supply voltage: 5V (typical), 4.7-6 V (Min-Max)
- Current draw: 48.5 mA (typical), 61.2 mA (LoRa TX)

Base Station Specification:

- Supply voltage: 5V 5V (typical), 4.7-6 V (Min-Max)
- Current draw: 82mA (Min) - 94 mA (Max)

LoRa SX1262 Specifications:

- Max TX Power: 21 dBm
- Max Receiving Sensitivity: -134 dBm
- 470~510 MHz, 863~928 MHz (915 MHz in U.S.)

I2C Operating Specifications:

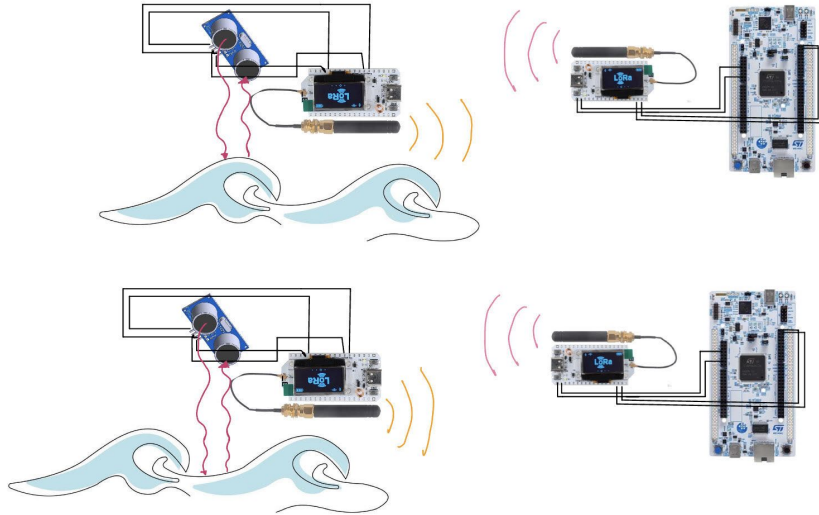
- Standard Mode - 100 kHz
- 3.3 V Logic

Ultrasonic Rangefinder Specifications:

- Sonic Frequency: 40 kHz
- Measuring Angle: 15°
- **Max Range: 4m**
- **Min Range: 2 cm A**

ESP32-S3FN8 Spec's (Xtensa®32-bit lx7 dual core processor) :

Potential Development



- Cost effective tidal/ wave height monitoring system
- Tracking wave height:
Measuring difference between peak and trough measurements over a given period
- Tidal measurements: measuring at larger time increments to encapsulate 12 hour 25 minute tidal cycle
- Can be mounted on piers up to 13 feet above low tide line
- Capability to track both tide and wave height

Demo

