Context: AHI Overview

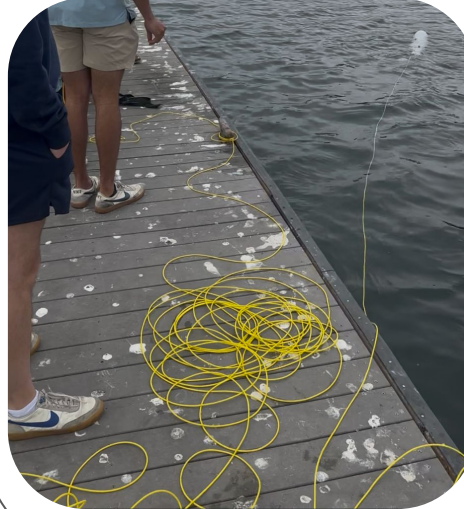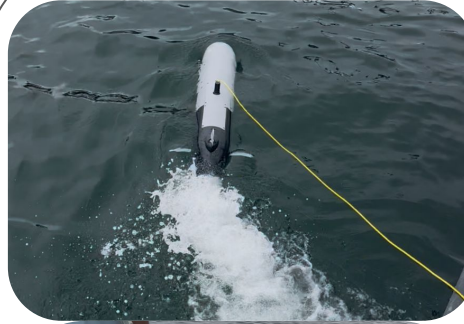| Sea Level	Technology Used	Purpose
Surface	E-Boat	Communication ROV Dispatch ROV Collection
Ocean	AUV	Autonomous Surveillance Subsea Cable Monitoring
Seabed	ROV	Subsea Infrastructure Repairs Oil Platform Inspections

Context: Pilot Test

Several Problems related to the tether were noticed:
- 30 meter max distance
- Tether cable constantly tangled
- Bulky Setup
- Knots formed when reeling in Tether
- Not viable for autonomous deployment

Proposed solution
- Build wireless communication to increase range and eliminate tangles
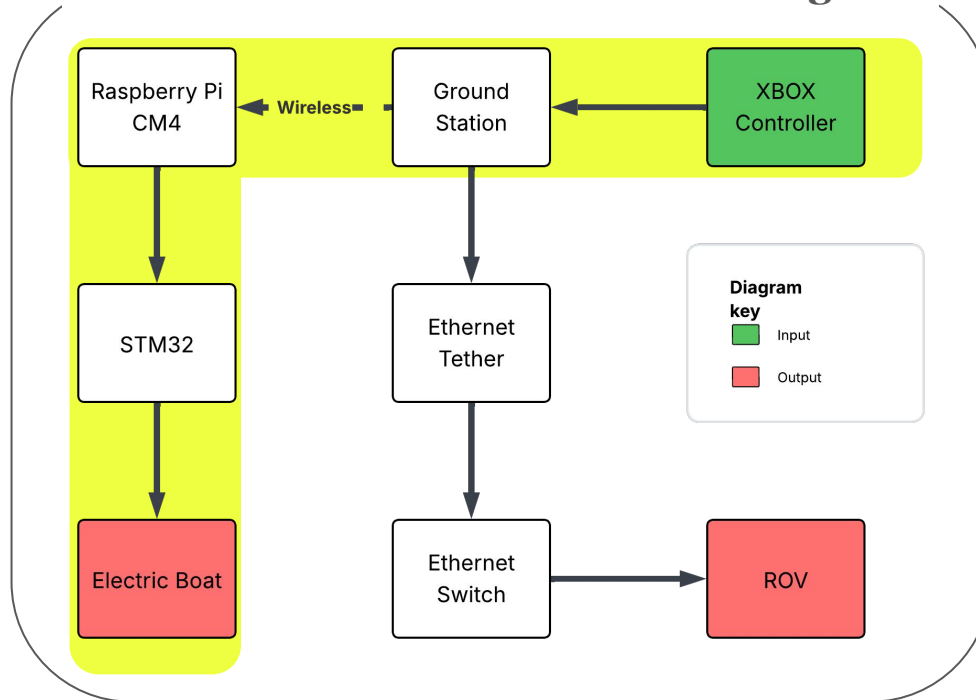
Tether Photos

Communication Network: Goal / Design

High Level Goal:
- Build wireless communication system to enable offshore boat control without a tether

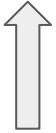**Communication Network Block Diagram**

Communication Network: Steps 1 for Data Transfer

Communication Network Data Flow
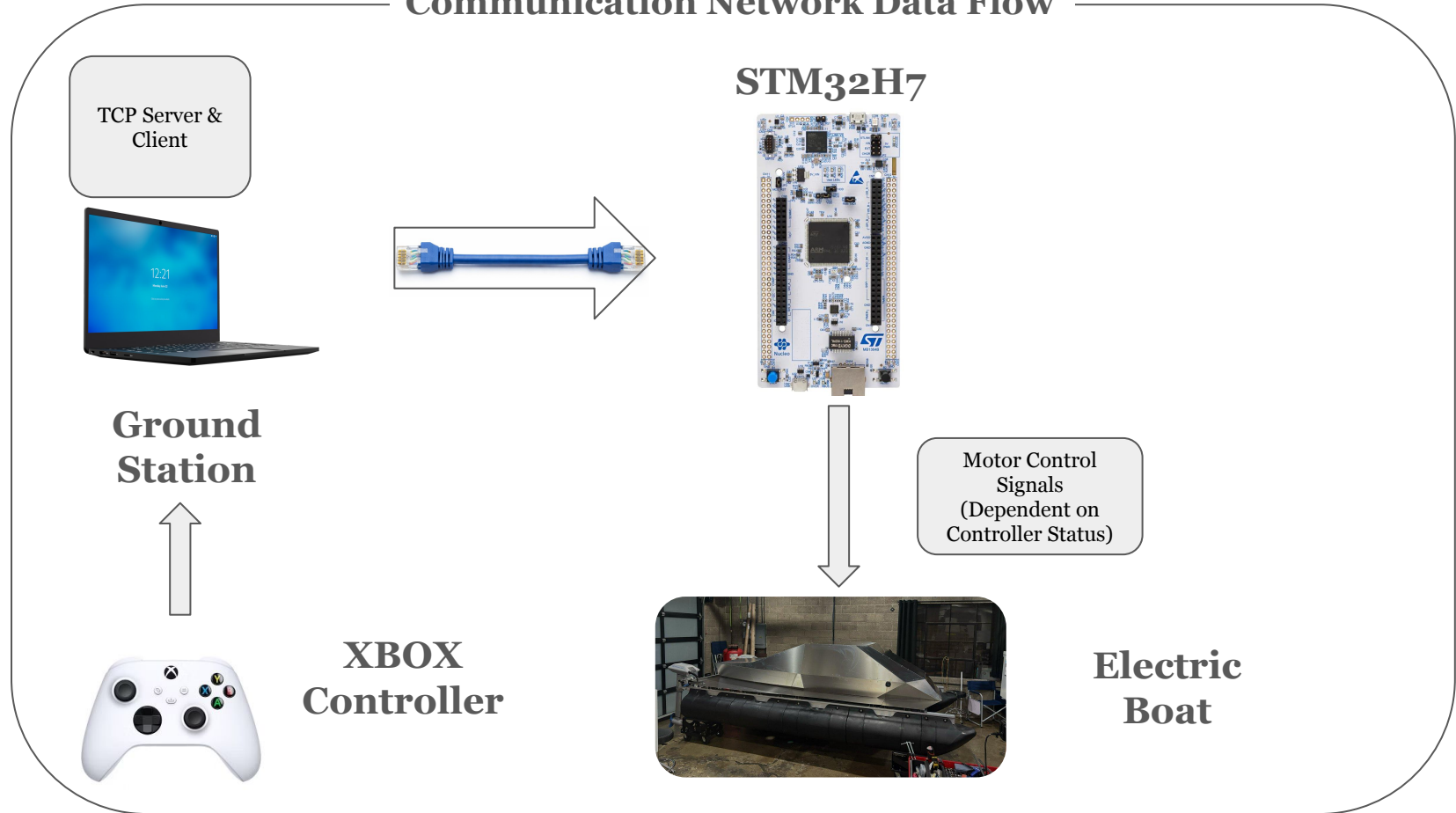
TCP Server &
Client
(Forwarding
over WiFi)

**Ground
Station**

**XBOX
Controller**

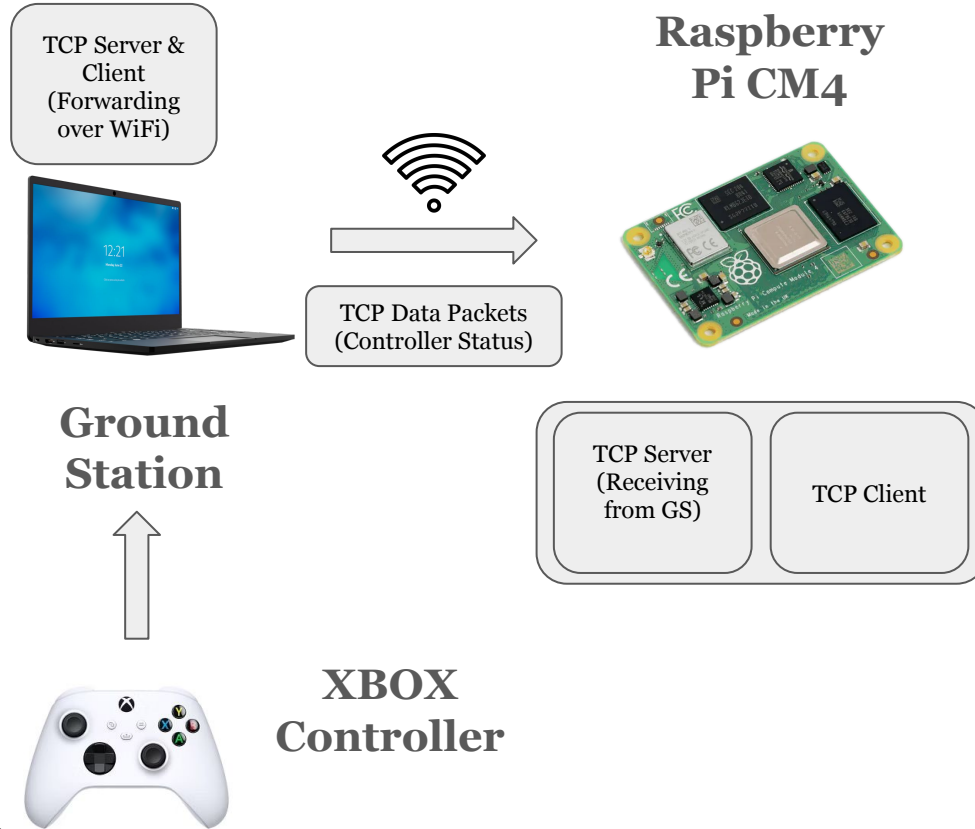# **Communication Network**: Step 2 for Data Transfer

Communication Network: Step 3 for Data Transfer
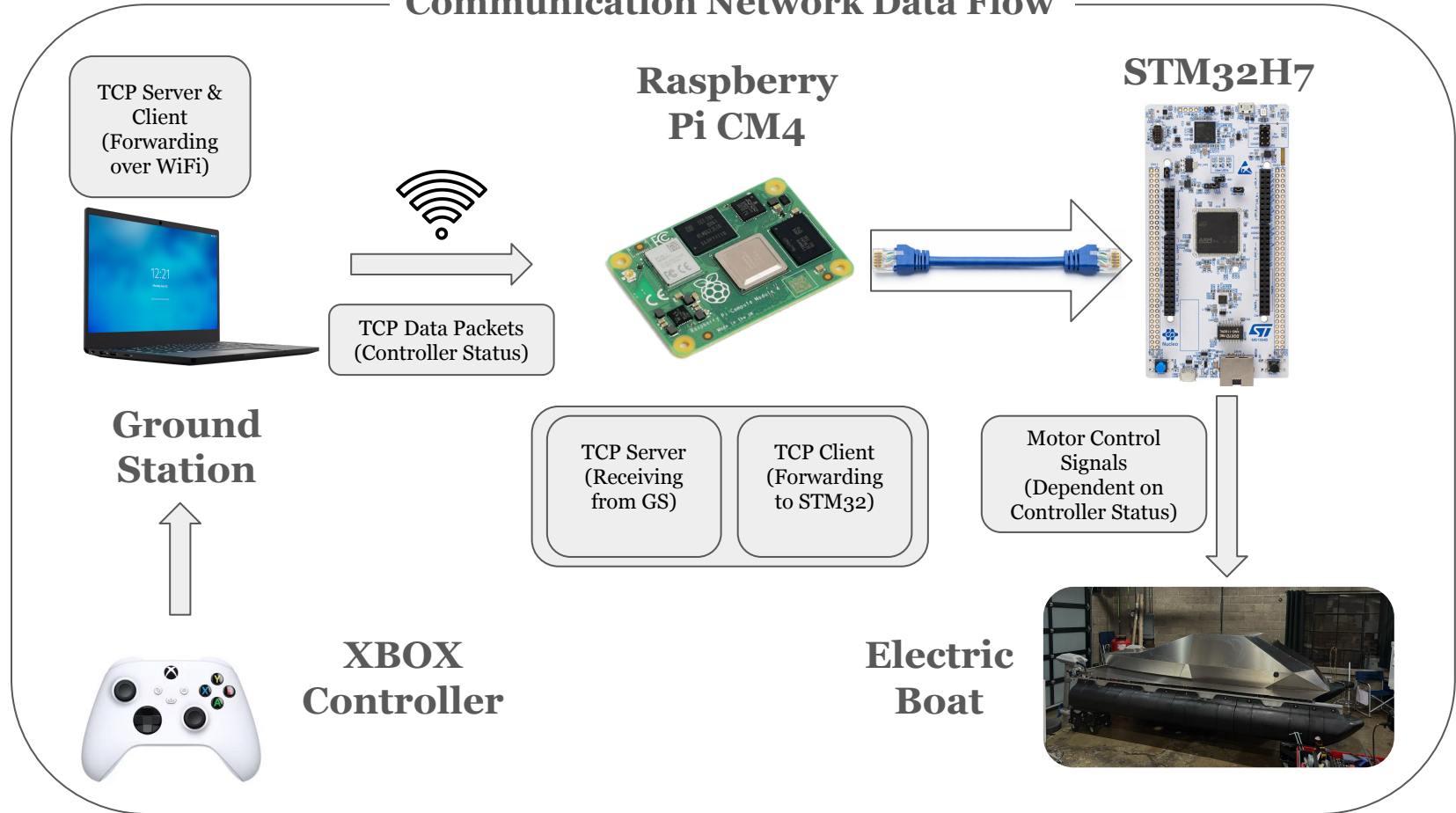
Communication Network Data Flow

TCP Server & Client (Forwarding over WiFi)

Raspberry Pi CM4

TCP Data Packets (Controller Status)

Ground Station

TCP Server (Receiving from GS)

TCP Client

XBOX Controller

Communication Network: Step 4 for Data Transfer

Communication Network Data Flow

TCP Server & Client (Forwarding over WiFi)

Raspberry Pi CM4

STM32H7

TCP Data Packets (Controller Status)

Ground Station

TCP Server (Receiving from GS)

TCP Client (Forwarding to STM32)

Motor Control Signals (Dependent on Controller Status)

XBOX Controller

Electric Boat

Communication Network: Building WiFi Gateway

Problem #1

Ping from ground station to STM32 over wifi not working

Approaches for #1

Used Wireshark to sniff signals aiding in testing communication

Problem #2

Had to constantly reconfigure the ip address whenever I disconnected the ethernet cable

Approaches for #2

Changed static IP address, also wrote a script automating configuring the ip address

Communication Network: Ethernet/ MPU Configuration

Problem #1

Xbox TCP server didn't work when integrated into the main codebase due to MPU memory configuration

Approaches for #1

Reconfigured MPU with LWIP
a. Heap, Rx buffer, and DMA descriptors are in SRAM
b. Set the region to non-cacheable region (prevents cache coherency CPU & DMA)

Problem #2

There was a pre-established pin configuration and thread priority in the main codebase

Approaches for #2

Consulted with the other software engineer to agree on pins and determine thread priority for operations

Technical Dive: Outcome & Impact

Communication Network Impacts

- Plausible Operating Range increase from 30m to 300m (assuming 15 dB signal)

- No range limiting knotts

- Increased maneuverability

- Large decrease in operation cycle time

- Increase in viability for long distance autonomous system