Overview

A 480MHz Swiss Army knife of the embedded team☮

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Purpose

The Sensor Board is a specialized embedded system designed to acquire environmental and motion data from multiple sensors. It integrates position (GNSS), water quality (pH), motion (IMU), force (load cells), and pressure measurements, transmitting all data over Ethernet using Protocol Buffer encoding.

Hardware Platform

- **Microcontroller:** STM32H753ZI (Nucleo board)
- **Real-Time OS:** FreeRTOS with CMSIS-RTOS V2
- **Communication:**
  - Ethernet (LAN8742 PHY)
  - UART (Multiple sensor connections)
  - I2C/SPI (IMU, pressure sensors)
- **Memory:** 64KB heap allocated for FreeRTOS
- **Clock:** 480 MHz ARM Cortex-M7

Key Board Features

- Multi-sensor fusion with independent sensor threads
- Network integration via UDP/Ethernet with Protobuf
- Real-time logging to UART (115200 baud)
- MAC address filtering for selective communication
- Packet dispatcher for incoming control signals
- LED status indicators (Green, Blue, Red)
- Heap monitoring with critical threshold alerts

Core Sensors Integrated

1. **GPS (GNSS)** - Global positioning and velocity
2. **IMU** - 3-axis acceleration, rotation, magnetic field
3. **pH Sensor** - Water quality measurement
4. **Load Cells** - Force measurement (×2)
5. **Pressure Sensors** - Pressure measurement (×2)

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