Marine Vehicle AIS Transponder

Cameron Miller, Connor Davis, Marcus Von Rausch, Josh Smith (Neptune Pink)

System Overview

Data Acquisition
- RTL-SDR USB dongle receives AIS signals from boats/ships at VHF frequencies
- Raspberry Pi reads AIS data from the RTL-SDR over USB

Data Processing
- Raspberry Pi parses and decodes the AIS data
- Extracts relevant information like MMSI, position, heading, speed.
- Publishes parsed AIS data to a website (cameronm.tech)

Web Visualization
- Website displays textual AIS information
- Interactive map shows locations of detected vessels

Base Station
- PC queries website to retrieve latest AIS data in JSON format
- Transmits data over UART to nRF52840 development kit

Bluetooth Advertising
- nRF52840 unpacks JSON data with vessel information
- Advertises MMSI, position, course, speed over BLE

Remote Display
- M5 Core device listens for BLE advertisements
- Displays vessel information from advertisements on its screen

Aims (KPI)

1. RTL-SDR receives AIS signals.

2. Raspberry Pi publishes all received AIS messages to server within 5s.

3. PC reads accurate vessel position, velocity, MMSI, name, time from server every $\leq$5s and communicates to nRF52840 development kit.

4. nRF52840 development kit broadcasts relevant vessel info via BLE every 30 seconds.

5. M5 Stack updates and displays info for $\geq$4 vessels every 30 seconds via BLE.

Results and Conclusion

- The project achieved its objectives successfully.
1. Received AIS signals from vessels, though reception was not fully reliable
2. Published all messages on Raspberry Pi within 5 seconds
3. PC received information from 4 vessels every 5 seconds
4. nrf52840 exceeded KPI, advertising all 4 vessels' data within 5 seconds (target: 30 seconds)
5. M5 featured robust UI for viewing 4 vessels' information, updating every 5 seconds.

Ship
Radio Signal
RTL SDR
USB
Raspberry Pi
WiFi
Web Server
WiFi
PC
UART
nrf52840 DK
BLE
M5 Core