

Shipboard Weather Observations

BACKGROUND

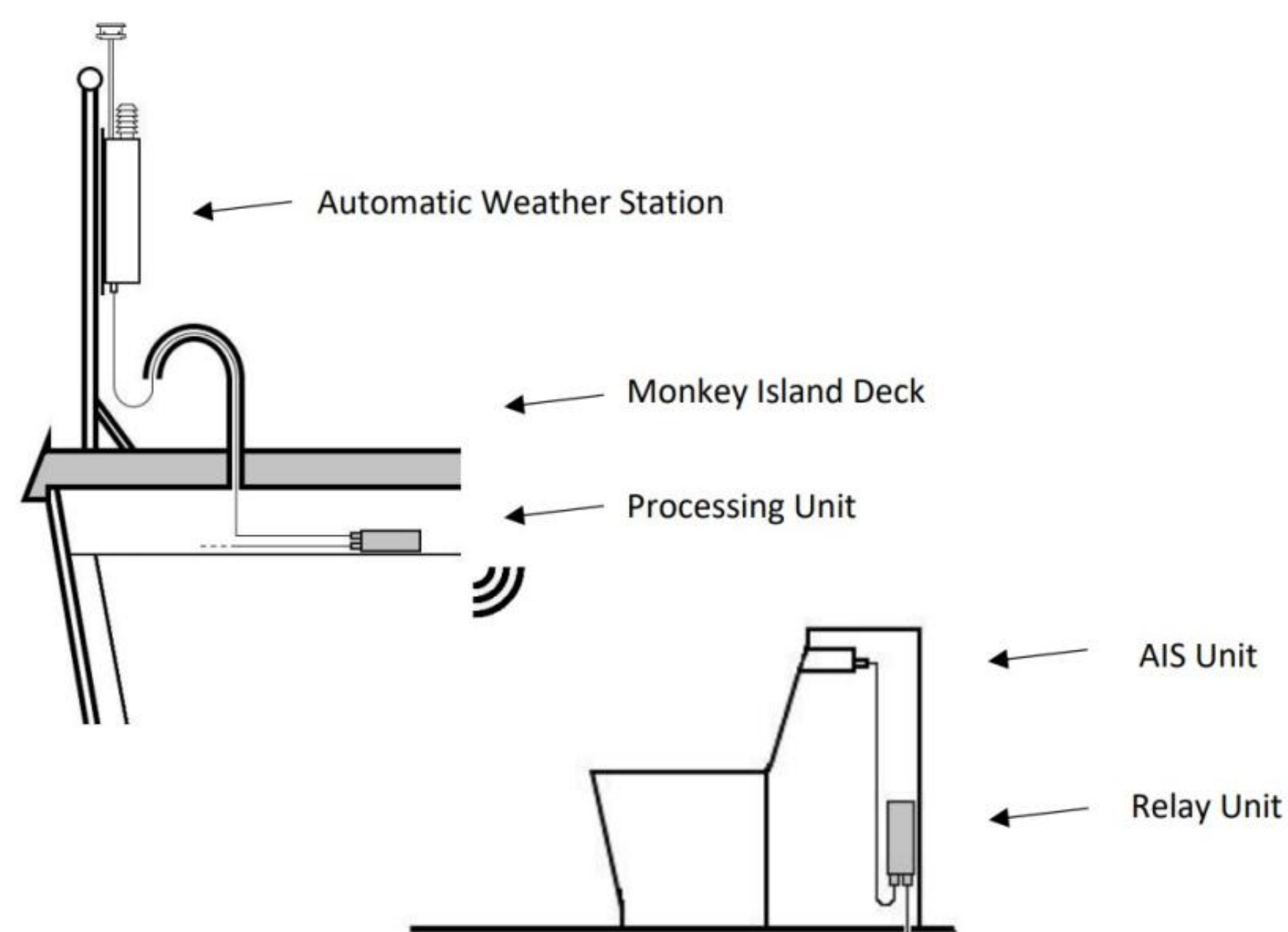
- Numerical models are used to create weather forecasts. The accuracy of these forecasts are directly related to the quality, and quantity of the data sources.
- In remote ocean regions data sources for these weather forecasts are sparse. This inevitably leads to sub-par forecasting in some of the most dangerous conditions on earth.

THE PROJECT

- Our goal is to create a system that will be retrofitted to travelling vessels, which will take weather readings and broadcast them to an onshore facility through the AIS transceiver standard on most seafaring vessels.
- This will increase the quantity and quality of the data used in forecasting models.

DELIVERABLES

- Main Deliverables:** An onboard unit to collect, parse, and transmit the data from a weather sensor.
- The system shall be wireless to reduce the intensity of the retrofit. Consisting of a transmitter on the weather sensor and a receiver on the AIS system.



- Stretch Goal:** A solution to the shore-based cleaning and filtering of the data.

SYSTEM OVERVIEW

- System to consist of an “off-the-shelf” weather sensor (GMX500), 2x Raspberry Pi’s (Transmitter/Receiver), and a Wi-Fi Antenna

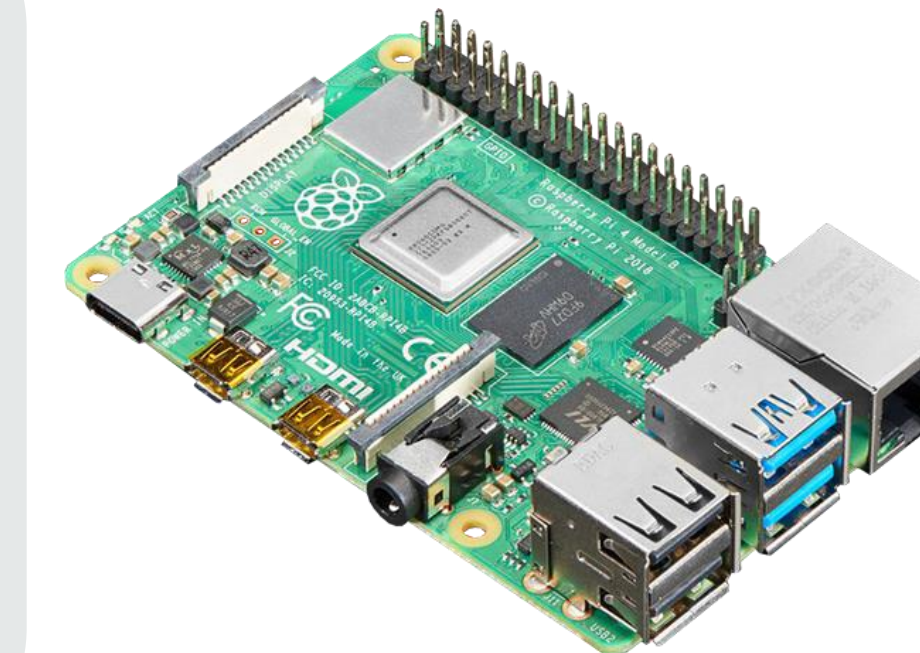
1. Weather Sensor

- Weather Sensor gathers data.
- Sends the data strings to the transmitter Pi through wireline.



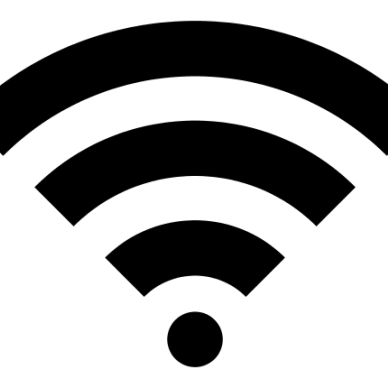
2. Transmitter

- Transmitter Pi equipped with software to parse weather sensor data strings into AIS message formats.



3. Wireless Transmission

- Wireless Transmission over WI-FI (2.4GHz - 5GHz) to avoid interference with the AIS transceiver frequencies (161MHz - 162MHz).



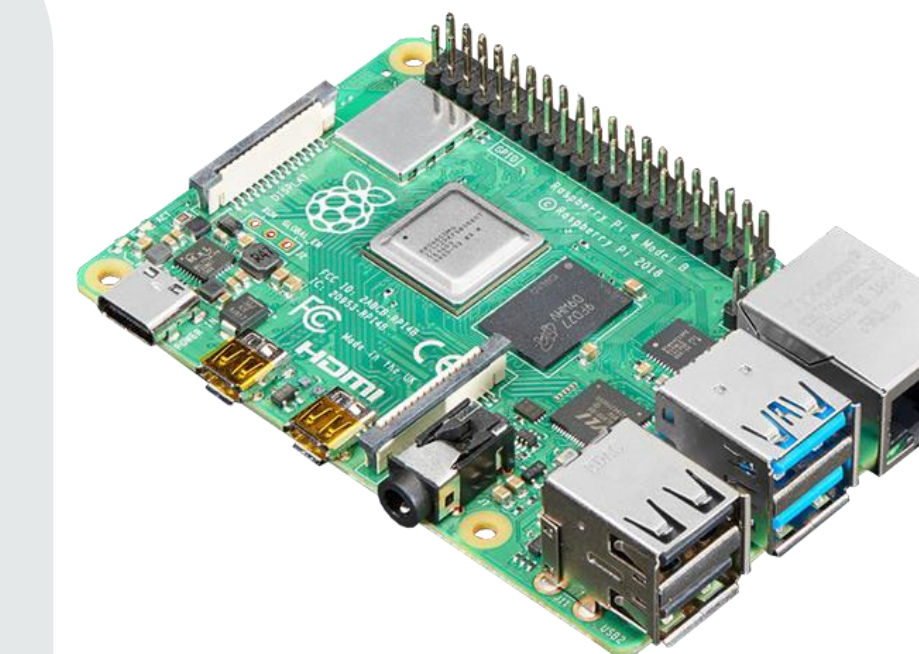
6. Onshore Processing

- Decodes the AIS messages and processes the data.



5. AIS Transceiver

- AIS transceiver then sends the data to an on-shore processing unit.



4. Receiver

- Receiver Pi to verify message format and perform error correction (if needed).
- Send message to AIS through wireline

DETAILED DESIGN

Software

- The software will be written in Python due to its flexibility and compatibility with the Raspberry Pi’s.
- The python program will take in binary serial data, convert it into text, and split the data into its datum counterparts.

For example, with the text string:
datum1,datum2,datum3,datum4

It becomes a list of datum points separated by the comma:

datum1	datum2	datum3	datum4
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- By separating the data like this, each datum can be verified and the list of data can be reformatted for transmission through the AIS with offshore processing in mind.

Hardware

- Raspberry Pi’s chosen for:
- Ease of development, cost, community support, long term support.

Wi-Fi Connection:

- Used to reduce installation effort.

Signal flow:

- Weather sensor outputs data over RS232, 422, 485, SDI-12, NMEA, MODBUS.
- RS232 output is used and converted to USB serial.
- Data is parsed and transmitted over Wi-Fi between devices.
- Communication with AIS is through the ships pilot port.

Miscellaneous:

- Power: Sensor is powered from ships 24VDC line, Pi requires buck convertor.
- Case(s): Must be water/weatherproof, low profile, inexpensive.

CURRENT PROGRESS

- Requirements derivation complete with client.
- Research phase; gathering information on AIS, equipment selection, and high-level design completed.
- Detailed design in progress. This includes code structure, data processing flows, and wireless transfer testing.

FUTURE WORK

- Testing with a Class A AIS system.
- Implement error correction at the receiver.
- Solution for shore-based cleaning and filtering of the data

ACKNOWLEDGEMENTS

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