



LASAGNA [technology]

Low power Autonomous System for Adaptive Generalised Naval Assistance

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Container beacon

- Emits identification data periodically
- Should be low power to last a long time
- Containers stacked on top and next to each other

GPS: high power, needs to receive satellite signals, relatively high cost

Painted markings: needs line of sight from a camera

BLE beacon: low power, no satellite dependency



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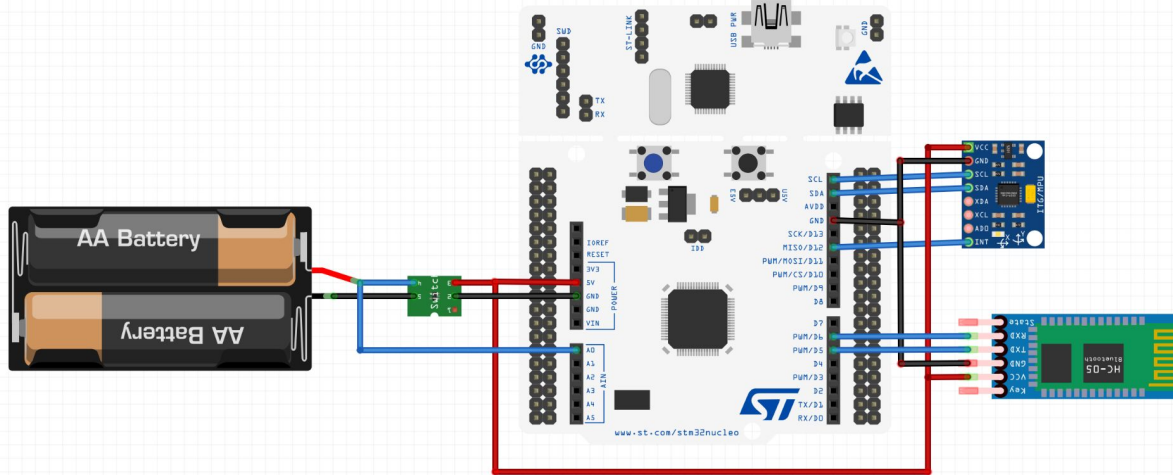
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- If testing shows it is necessary, we will test adding a movement sensor to reduce updates when stationary



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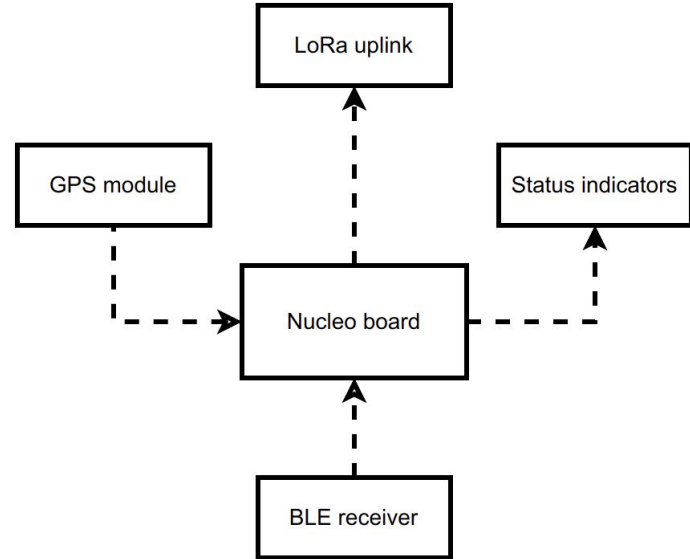
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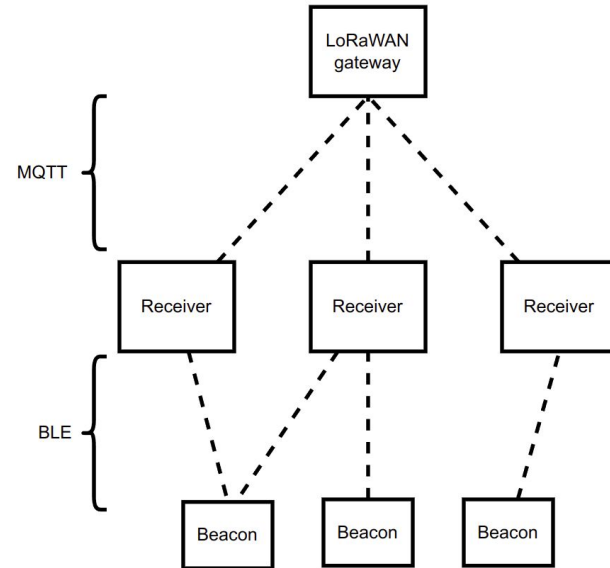
Receiver

- Receives BLE messages from beacons
- Aggregates and tags the received data with location and timestamp
- LoRaWAN network to upload the data
- Much less power constrained than the beacons
- Stationary
 - future exploration: move around to cover more area



Network

- BLE pings contain identification data
 - We will explore the Google Eddystone standard and assess its viability
 - Depending on electromagnetic noise levels, error correction on the BLE link may be required
 - Avoiding network congestion is critical with many containers
- Receivers communicate and store tagged data via MQTT





Cloud storage

- Long term storage of data
- Queries
 - Busiest locations
 - Longest item routes
 - Misrouted items
 - More to be defined in collaboration with port authorities