

NEXT GENERATION ASSET TRACKING SYSTEM

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Objective & Requirements

UW Medical Center manages over 10,000 pieces of equipment with roughly 8,000 devices that move around the facility. UWMC needs to be able to track and locate these medical devices for maintenance and inventory purposes.

<u>Requirements:</u>

Create a new tracking device to be attached onto medical equipment with the following functionality:

- Blinking LED (battery indicator, preventative maintenance recall)
- Wi-Fi agnostic (previous system was BLE reliant)
- Power-efficient (> 1 year battery)

As well as develop:

• Firmware to handle Wi-Fi transmission, battery monitoring, deep sleep management, location sensing data, and command processing

• Local **server** and **database** to handle asset tracker information and communication

• User-end **webpage** to view and recall trackers

Technical Design - Firmware

Firmware role:

Bridges hardware and server via the ESP32-C6

MQTT Communication topics:

- 1) Location:
- Sends 3 strongest APs
- Includes altitude and
- battery level (in mV) 2) Recall
- Server instructs device to turn recall LED on/off
- 3) Sleep • Server sets deep sleep duration

Power Management:

Uses deep sleep cycles to conserve battery between Wi-Fi connections

Flowchart of this cycle with communications can be seen in Figure 1



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Deep Sleep (mA)	BMP390 (mA)	LED Current (mA)
0.007	0.0032	1
Over On (mA)	Over Off (mA)	
50	0.01	
Pings Per Day	Desired Life (Days)	
48	555	
1ax Current (mA)		
405.0082		
ne Till Dead (Days)		
35.43249886		
tory life cal	culator	

Hardware

• PCB:

- Implemented status LED that works independently of SoC power using custom latch circuit
- Chose smaller components to save space

• Enclosure:

- 3-D printed, **3" x 2" x 1"**



Figure 5. PCB design

Firmware

- Power Efficiency: Successfully utilizes deep sleep
- **mode** to reduce Wi-Fi use • See Figure 7 for differences in
- power saving
- Altitude Sensing: Achieved altitude computation with ~20cm accuracy
- Battery Monitoring Sends low-battery alert to server

<u>Software</u>

- Server Successfully calculates tracker
- location **within 10 ft** Able to accurately process and
- store data for **multiple** trackers

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Results

Corrosion-resistant to common hospital cleaners



Figure 6. Transparent view of the case



Figure 7.Power usage during Wi-Fi scan, light/deep sleep, under different voltages and LED states

Webpage

- o LED recall trigger
- Map of access points and trackers
- Adjustable sleep timers
- o Filter specific trackers