Pet Health & Location Tracking Device & App

Pioneering ARVR development technology for all industries
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Project Vision

Develop a pet collar system that gives the users the ability to track their pet's location as well as its health index through a mobile app.

Engineering Requirements

- Improve the battery life to a decent amount of time of about 3-6 months.
- Expand communication to the cloud to provide data for users through a mobile app.

Design Requirements

- Design a mobile app that connects to pet collar with ability to collect biometric measurements and location through GPS coordinates.

Product Mechanism

- The system adopts the idea of current smart systems that use:
  - a stationary base connecting to the cloud through the internet.
  - a satellite device (pet collar) connecting to the stationary base (figure 1).
- When the pet is in proximity, the collar will only send biometric information. Once the pet exits the vicinity, the collar will send a warning signal to the phone app, then turn on GPS signal.

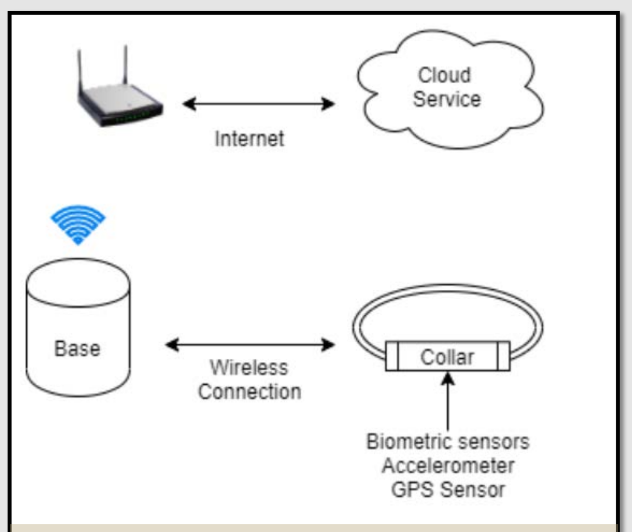


Fig 1. System scheme

System Setup

- TI RTOS-based Gateway Reference Design was chosen for several reasons:
  - TI boards have low power functionality and are reliable with lots of supportive libraries and forums
  - IoT allows further expansion of the system, such that lost pets can be tracked using multiple base sets (figure 3) .
  - CC1350 (figure 2) also supports dual Sub-1Hz connection and Bluetooth for local tracking without relying on the internet.

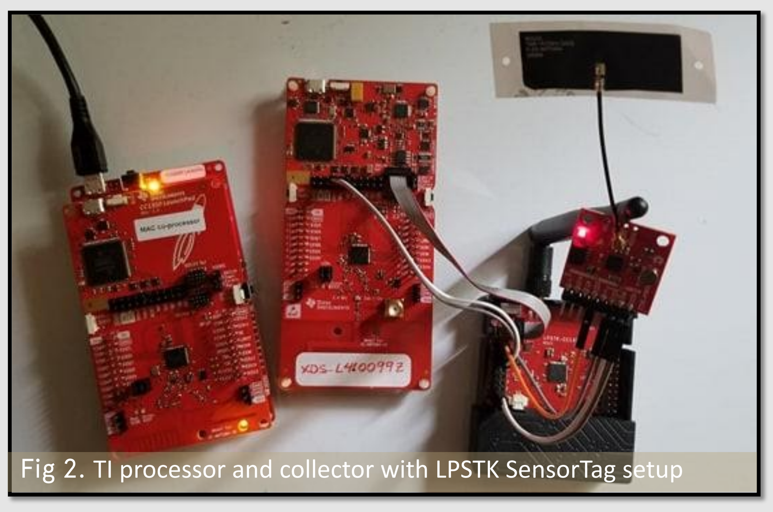


Fig 2. TI processor and collector with LPSTK SensorTag setup

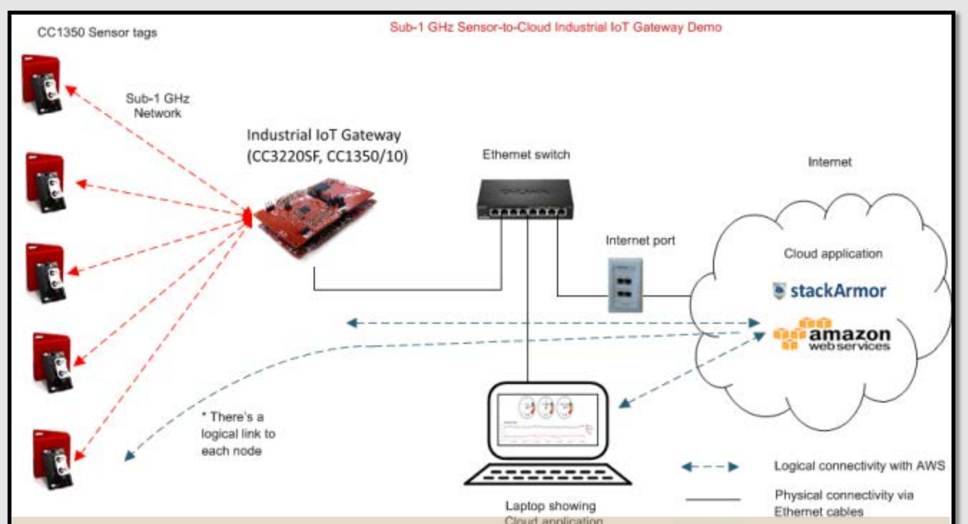


Fig 3. TI RTOS-based reference design

PCB Design Process

- Aimed to design a board that includes all the desired features: wireless MCU, 3 low power sensors (temperature, accelerometer, GPS) USB-UART interface and battery supply terminal. The design is based from the LPSTK SensorTag module but eliminates unused components such as the hall effect and ambient light sensors, thus making it compact for the collar use.
- EAGLE was chosen as the primary design software due to its UI and vast amount of supportive resources for novice use. The software is also compatible with the SparkFun libraries that includes pre-made footprints for most modules.

Power Optimization

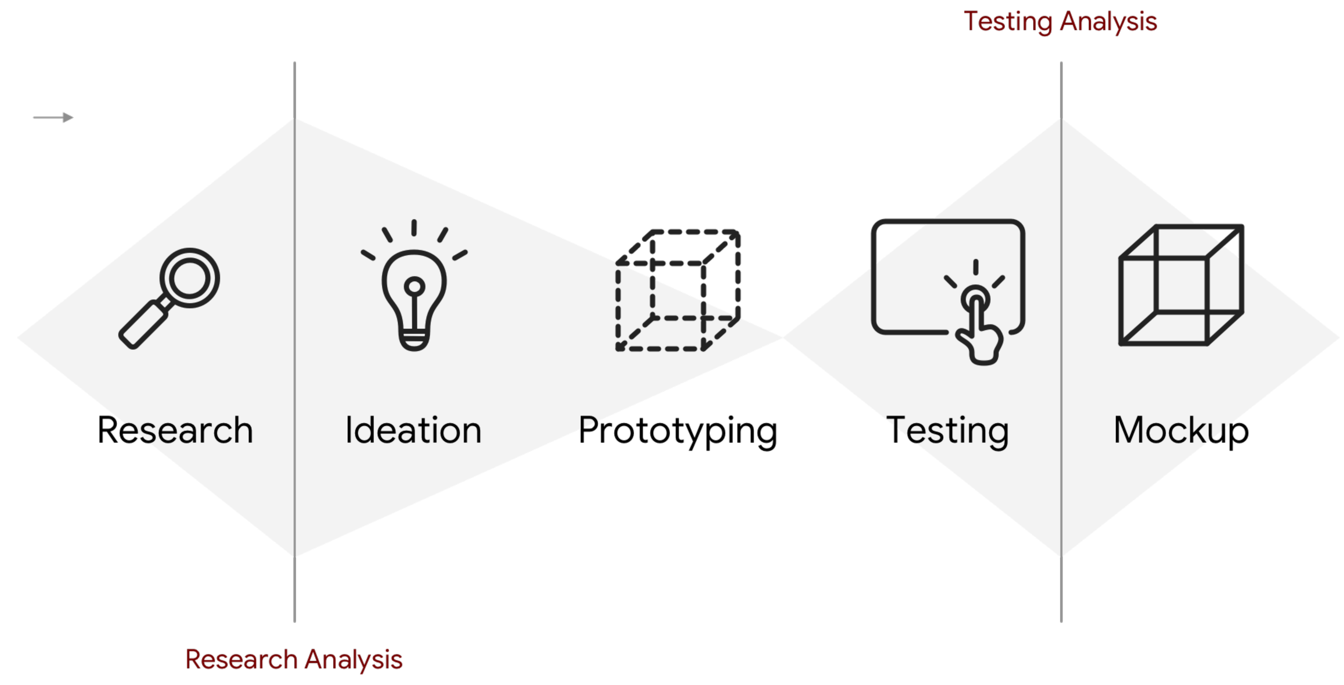
- Optimize battery life by limiting frequency of data transmission. Reduce bio sensors wakeup times to a lower rate such that information transmission and power requirements are balanced. GPS activates only when the collar exits the range of the central gateway hub.
- Current measurements taken through EnergyTrace++ for variations of LPSTK SensorTag components to serve as a control.
  - MCU + Temp/Humidity + Accelerometer + GPS (figure 4)

EnergyTrace™ Profile (Relative Measurement)

Name	Live
System	
Time	3 sec
Energy	0.057 mJ
Power	
Mean	0.0145 mW
Min	0.0000 mW
Max	0.0698 mW
Voltage	
Mean	3.3000 V
Current	
Mean	0.0044 mA
Min	0.0000 mA
Max	0.0212 mA
Battery Life	CR2032: 3 year 11 mo...

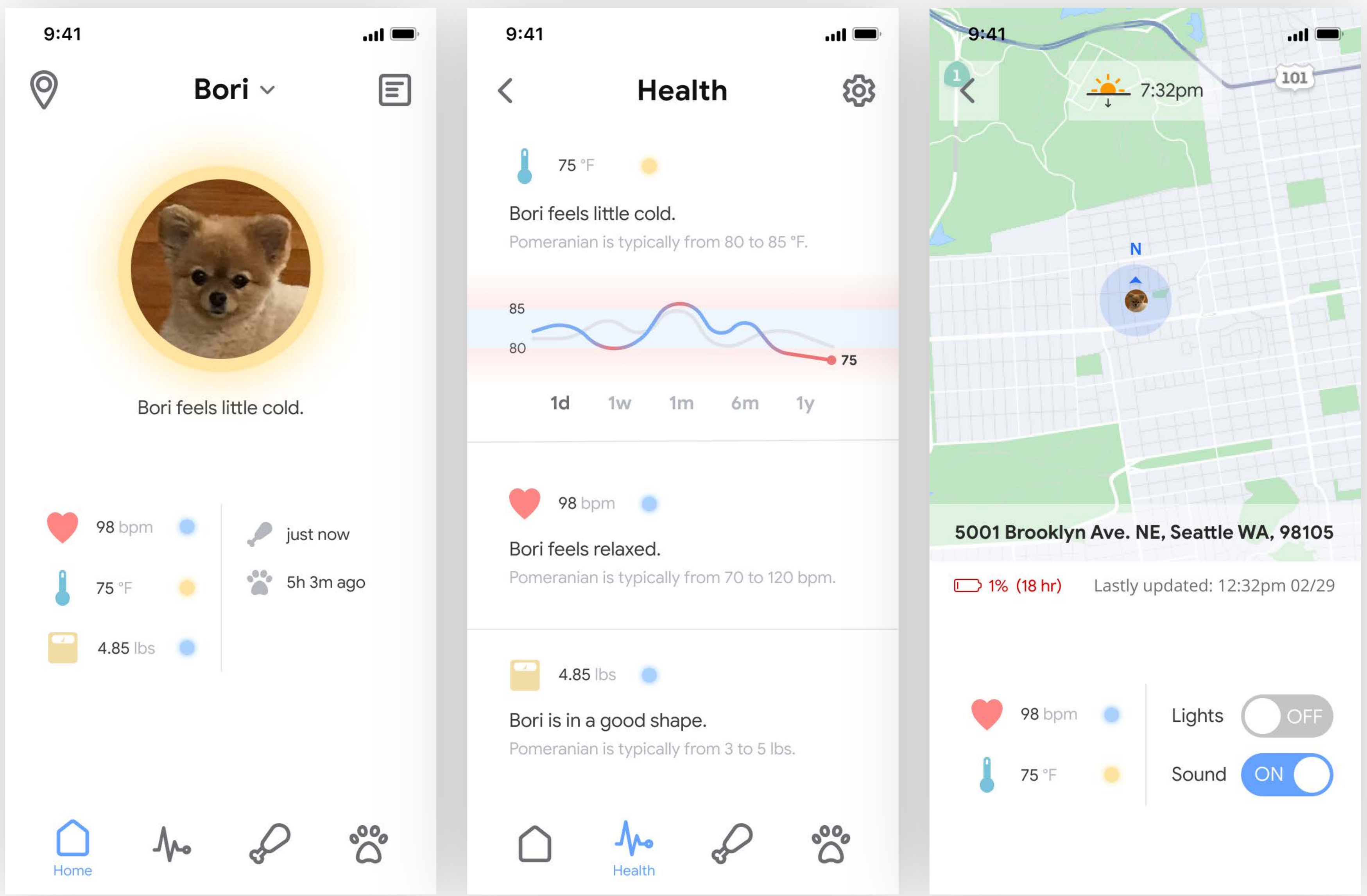
Fig 4. EnergyTrace++ measurements for MCU + LPSTK

Human Centered Design Process



UX/UI Design

- System Usability Scale: **80.83%** (10 usability testing)
  - SUS score above a 68 would be considered above average.
- Success Rate: **76.2%** (10 usability testing)
  - According to Nielsen Norman Group, most websites score less than 50%.



Future Works

- Develop Bluetooth functionality to connect collars to users' local phone applications without the use of internet.
- Perform extensive stress testing on PCB centered around the functionality of biometric & GPS sensors.
- Take EnergyTrace++ measurements on new board to compare with CC1352R + SensorTag setup for continued power optimization.

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