

Cat Call!

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Motivation

- We own two cats, Fe and Ginko, who are always picking fights with each other
- They are separated by a door that connects two different sides of the house
- Sometimes, they escape the door and showdown in the living room
- Cat Call was invented to quickly detect when they fight, so we can separate them
- Ideas we had:
 - Detection of Hissing with a Microphone
 - Proximity Detection
 - Localization
 - Mechanical Door Control (Open/Shut)
 - Motion Tracking
 - Speaker Distraction (Beep when Fighting)



Objective

- Condensing our ideas due to the timeframe, we hoped to achieve the following:
 - Track the cats around the house with enough precision to at least know what room they are in
 - Determine whether or not they are hissing
 - Sense the speed at which they are travelling - see if they are sleeping, stalking, walking, or running
- These goals would accomplish most of the detection side of the cats' moods; mitigation of fights was deemed out of scope



Feijoada (Fe)



Plan

1. Determine the necessary hardware
2. Design the hardware setup
3. Build the devices
4. Setup a communication protocol
5. Create a server to handle calculation
6. Design an app to display findings



Ginko (Ginny)



Determining Hardware

- For localization, we decided to use Bluetooth Low Energy (BLE) chips to find the cats
- Each cat would have a chip on their collar, and we would have three beacons around the house
- The collar would also hold an accelerometer/gyroscope, microphone, and power source
- We wanted to create a custom PCB to hold all the sensors compactly on the collar

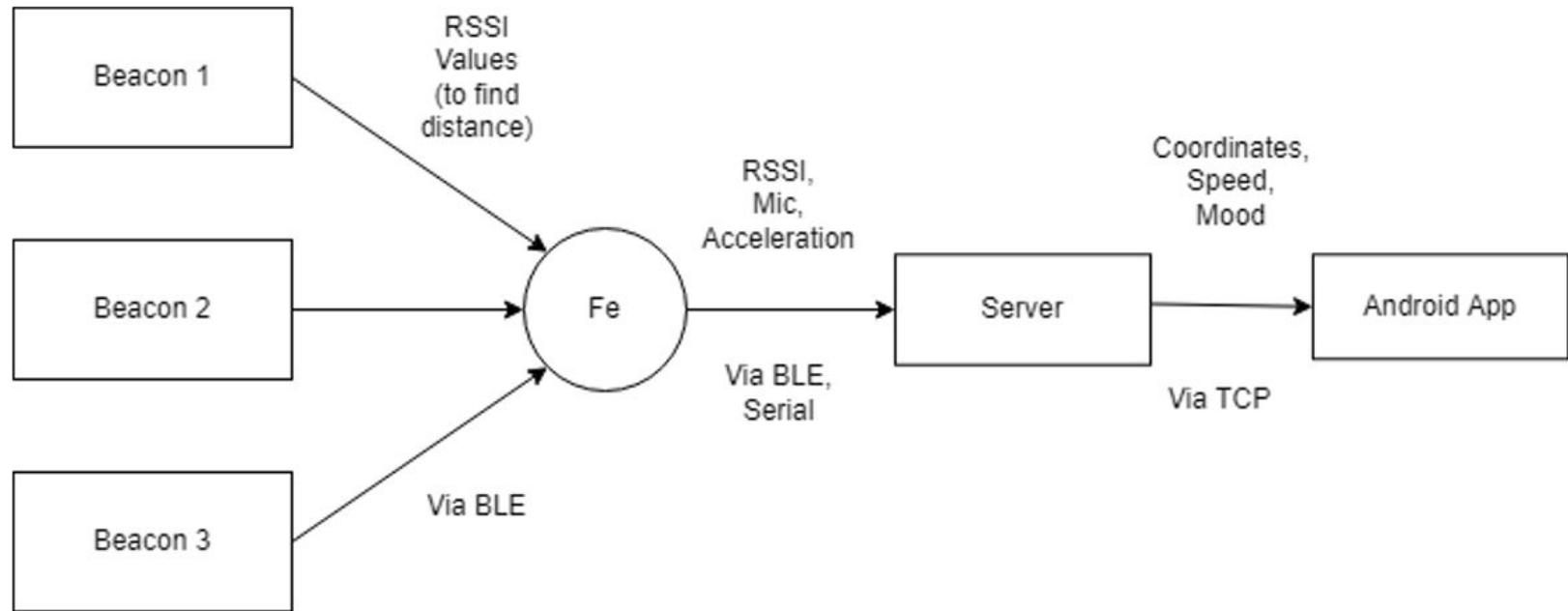


Hardware Constraints

- Unfortunately, hardware ended up being a major bottleneck constraint for us
- Many of our sensor orders ended up being cancelled
- We had significant trouble getting certain sensors to work, requiring us to find new ones or alternatives
- Shipping times were slow and some packages never arrived
- Due to these issues, we downsized our scope to be the following:
 - Localize Fe throughout the house with a device on her harness
 - Record audio from the harness to see if they are fighting
 - Track Fe's motion
 - Use Arduino/Breadboards as our circuits



Devices - Communication



Server Processing

- We created a multi-threaded application that performs the following in parallel:
 - Receive RSSI (signal strength) values from the arduino on Fe's harness
 - Receive microphone data from Fe's harness
 - Receive acceleration data from Fe's harness
 - Calculate distance from RSSI, beacon locations, and empirical constants
 - Minimize a set of equations to find Fe's coordinates
 - See if the microphone data picks up hissing (we use amplitude)
 - See how quickly Fe appears to be moving



Server Constraints

- Due to time/hardware restrictions, the following are next steps for our processing
 - Apply Kalman Filters and Sensor Fusion using accelerometer data for more accurate localization (we incorrectly assumed the accelerometer was an IMU)
 - Use Machine Learning to detect the mood of the cat by the microphone data (we discovered a dataset to train on)
 - Detect other kinds of motion from Fe



Android App

- Our app receives data from the server concurrently to the UI updates
- It shows a map of the house, and the most likely room the cat is in
- The speed of the cat and volume around the harness are shown

