A Portable and Affordable iBeacon based Pet Tracking System

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Background

Motivation:

Pet running away is a problem for a lot of families. Family spent money and time to find run away pet, and normally failed. Therefore, an inexpensive and simple animal tracking system application is really helpful for solving this problem.

Goal:

- Build a low cost animal tracking system application on smartphone that will alert user when the pet is out of the control range.
- The tracking device should be portable for pets.
- The way of using the system should be really simple, so all groups of people can use this application

Introduction of iBeacon

- Bluetooth distance measurement technology based on the Received Signal Strength released by Apple
- Multiple types of Beacons on market can use iBeacon technology

Advantages:

- Size: A little bigger than a coin
- Price: Proximity beacon from Estimote costs $60 for 3 2-year battery life beacons
- Easy to use: User only need to know UUID, Major Value and Minor value to register beacon
- Easy to program: iBeacon technology works with Core Location service in iOS
- Security: iBeacon does not require or contain any personal information, so it is really safe to use

Limit:

- The distance measurement have a relatively long reaction time
- Objects can block Bluetooth signal to make the measurement less accurate

The Equipment and Software

Software Environment :

- Swift 3 (Xcode IDE)

Equipment:

- Estimote proximity Beacon
- Estimote Sticker Beacon
- iPhone 7 plus (iOS 10.0.2)

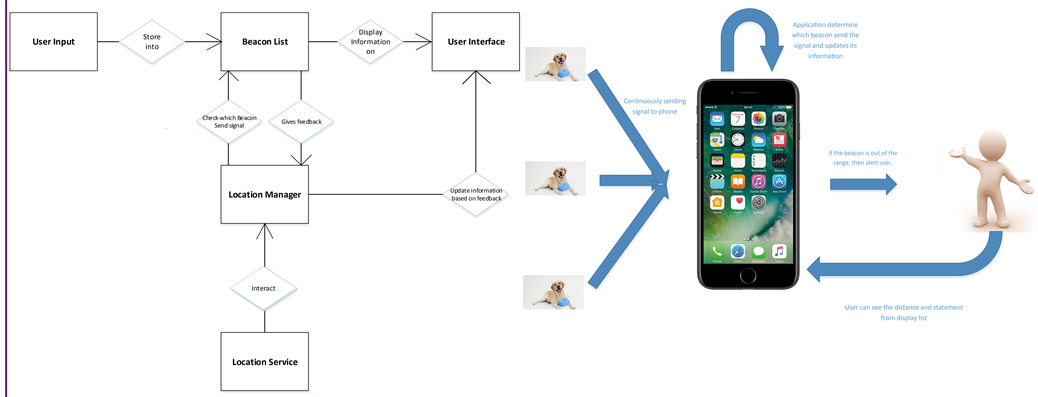
Equipment and Software problem

Estimote Sticker Beacon has ideal size, but its range is too short. (Maximum 10 meters)

Estimote proximity has perfect range for this application, (Maximum 70 meters) but the size is bigger than Sticker Beacon

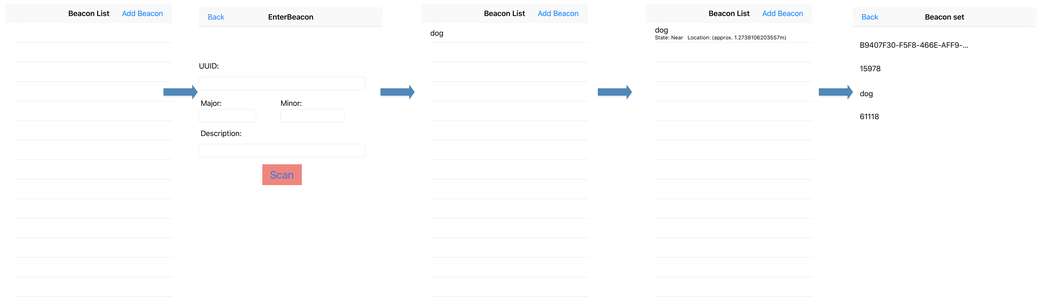
The Swift 3 and iOS 10 was released during the coding process, and a lot of core services are different compare to Swift 2

Program Architecture



- The user input include UUID, major value, minor value, customize identifier and alert distance
- Only user input and user interface information are visible for user
- Bluetooth and location service are required for running the application
- User can delete beacon from Beacon list by deleting the beacon item in the user interface
- User has no control on Location Service or Location Manager

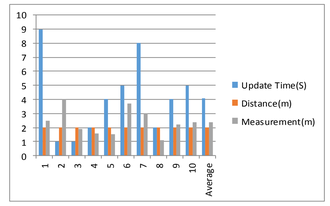
The Application Interface



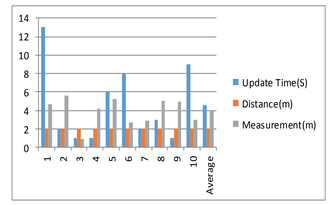
- The initial Beacon List manual has nothing in it
- Click “Add Beacon” and jump to EnterBeacon Manual
- Input required information and click scan button
- Need a few seconds for location service to range the beacon
- Start monitoring beacon, continually update location information and display on Beacon List
- Click the item in Beacon List, and jump to Beacon set Manual, which displays basic information for selected beacon

Testing On The Accuracy and Reaction Time

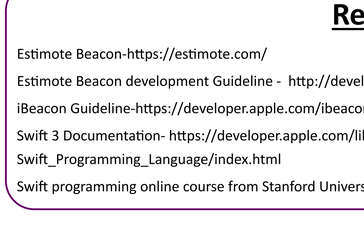
2 Meter Test (Beacon and user In the same room):



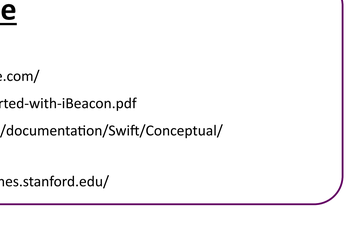
2 Meter Test (Beacon and user in different rooms):



20 Meter Test (Beacon and user In the same room)



20 Meter Test (Beacon and user in different rooms):



Conclusion:

- The distance does not really effect update time. But update time are not fast enough
- Blocking signal can play a big factor in this application (More signal get blocked, bigger measurement we will get)
- More test should be done in the future to determine the pattern of the measurement

Future Work and Updating

- More accurate and frequent measurement
- More user freedom and customization
- More function on the app
- Better user interface
- A user manual to help user
- Test on easier carry device such as Apple Watch
- Create Icon for the application
- More test on measurement and distance comparison

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Reference

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