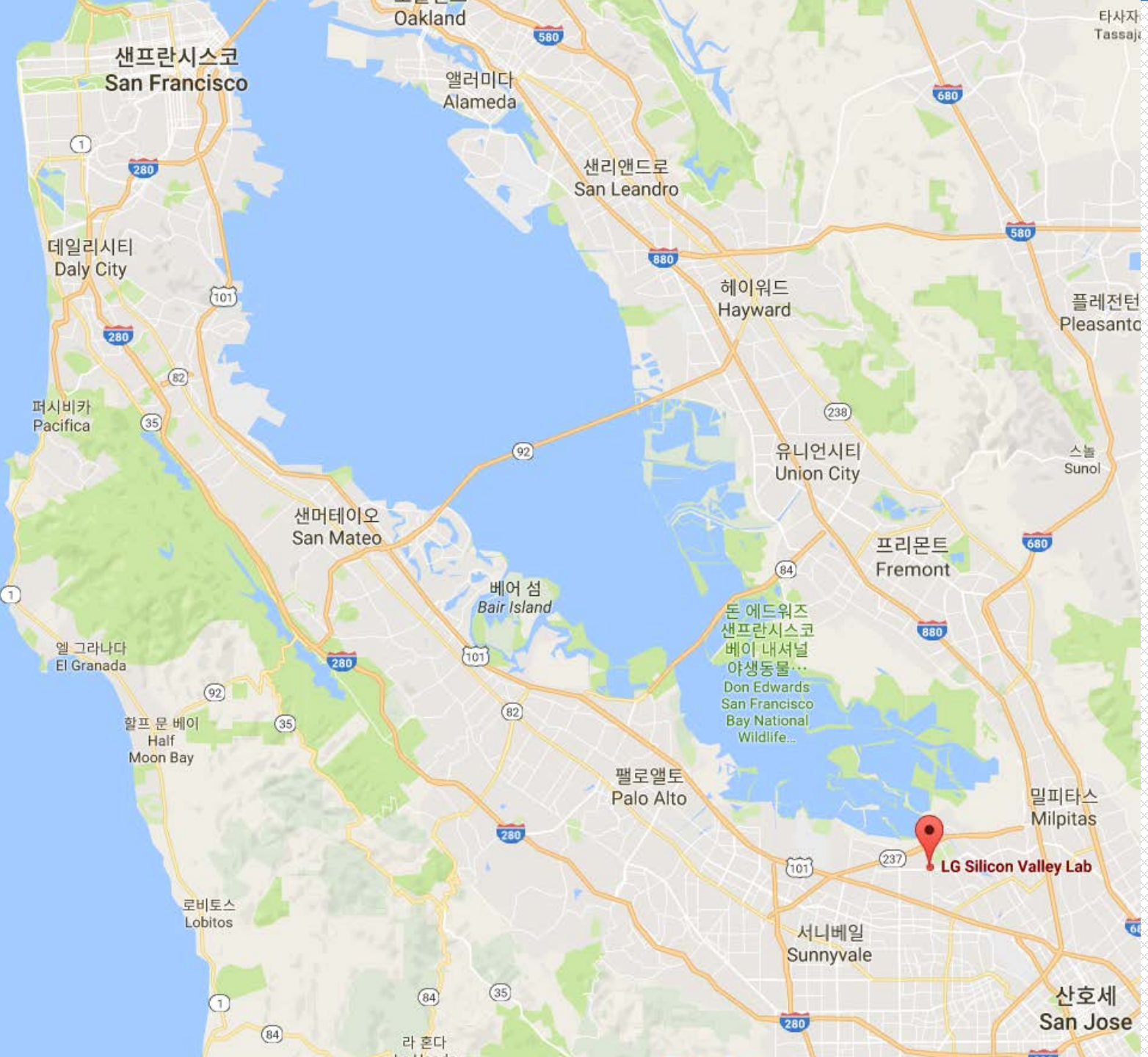
Silicon Valley LAB Intern Report

Hyunjung KIM

Youngsong KIM



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Part 1

LG
Silicon
Valley
LAB

LG Silicon Valley LAB

Internship

LG Silicon Valley LAB

LG Electronics premier innovation center in Silicon Valley focusing on
Home Appliances and webOS platform

Part 1

LG
Silicon
Valley
LAB

LG Silicon Valley LAB

Internship

Internship Under Art Dahm

Name: Art Dahm

Title: Developer Relations Engineer

Years with Company: 2+

Part 2

Intern Project

Bluetooth Tracker

Product Comparison

Development Process

Demonstration

Bluetooth Tracker

Never lose anything again!

Bluetooth tracker helps find your stuff in seconds by easy to-use app.
Lose less of everything, including your valuable time.

Part 2

Intern Project

Bluetooth Tracker

Product Comparison

Development Process

Demonstration

Bluetooth Tracker

VS

- **Bluetooth**

-It can handle a lot of data.
-It consumes battery life quickly

- **BLE(Bluetooth Low Energy)**

-It is used for applications that do not need to exchange large amounts of data.
-It can run on battery power for years at a lower cost

Make Bluetooth Tracker based on BLE!

More info here -> http://www.link-labs.com/bluetooth-vs-bluetooth-low-energy

Part 2

Intern Project

Bluetooth Tracker

Product Comparison

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Product Comparison

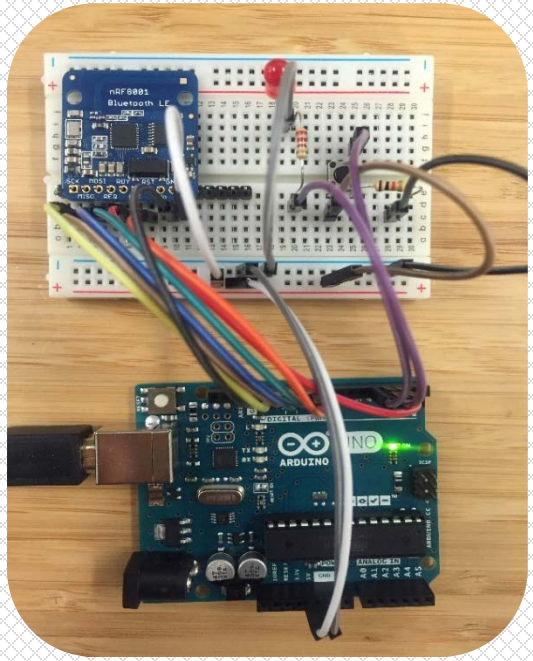
Price (Amazon 16.8.23)	**$24.95**	$24.99	$29.90
Battery Life	**24 months**	12 months	8 months
Map UI	X	**O**	**O**
WiFi Safe	X	X	**O**
Sharing	X	**O**	X
Radar	X	**O**	**O**

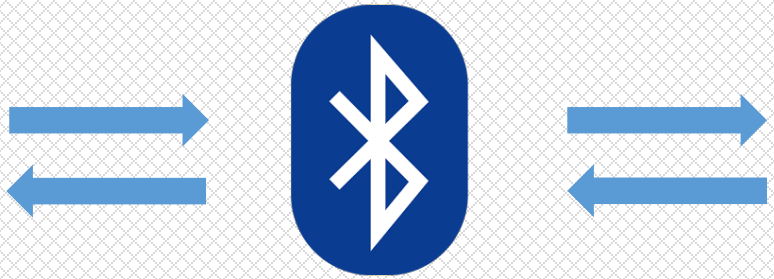
Part 2

Intern Project

- Bluetooth Tracker
- Product Comparison
- Development Process
- Demonstration

Development Process





ARDUINO

ANDROID

Arduino(BT tracker) to Android(Smartphone) Bluetooth Communication

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Intern Project

Bluetooth Tracker

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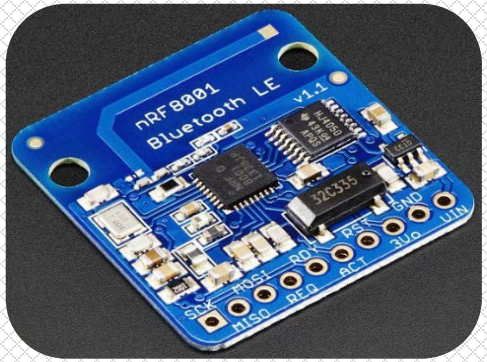
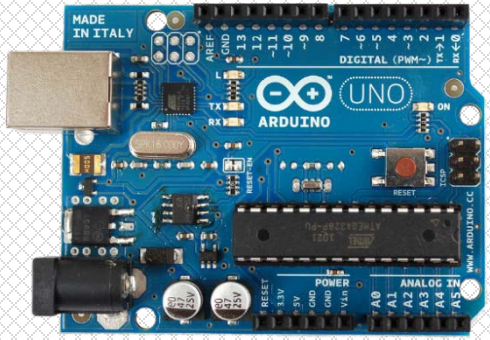
Arduino



nRF8001 BLE chip

Detail description->https://www.adafruit.com/products/1697?gclid=CMLDx4-W2M4CFQ-DfgodAKoFEg



Arduino UNO

Detail description->https://www.arduino.cc/en/Main/ArduinoBoardUno

Make: Bluetooth: Bluetooth LE Projects with Arduino, Raspberry Pi, and Smartphones 1st Edition

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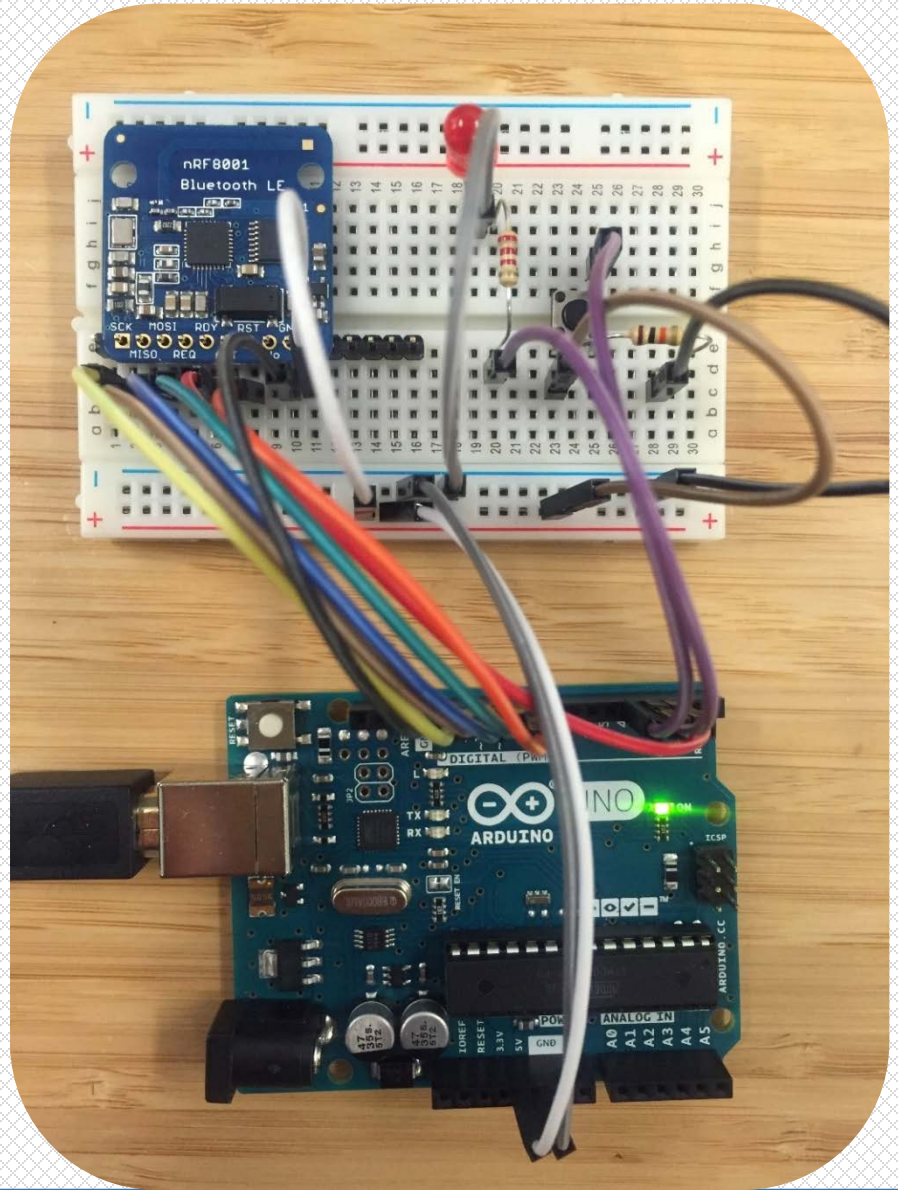
Arduino



Just connected LED Pin to show whether or not BLE is connected.

If BLE is connected,
RED LED is turned on.

If BLE is disconnected,
RED LED is turned off.

Use BLEPeripheral Library.
https://github.com/sandeepmistry/arduino-BLEPeripheral/blob/master/API.md#set-event-handler-callbacks

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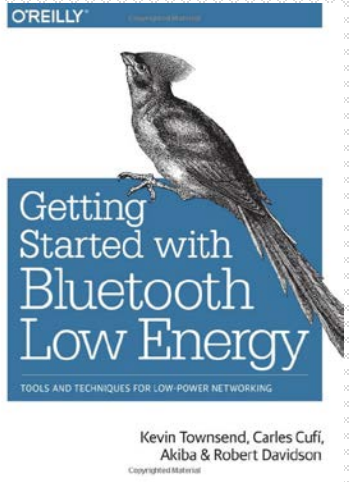
Android

Use ‘BluetoothLeGatt’ Open source
https://github.com/googlesamples/android-BluetoothLeGatt



Getting Started with Bluetooth Low Energy: Tools and Techniques for Low-Power Networking 1st Edition

Intern Project

Bluetooth Tracker

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Android

Bluetooth (below version 3.0)

- **RFCOMM**(**R**adio **F**requency **COMM**unication) is the most common type.
- RFCOMM is known as **SPP**(**S**erial **P**ort **P**rofile)
- Use Bluetooth socket programming in the same ways as TCP.

Bluetooth (above version 4.0)=BLE

- Use **GATT**(**G**eneric **ATT**ribute Profile)
- GATT is a general specification for sending and receiving short pieces of data known as "attributes" over a BLE link.

GATT requires less energy than SPP.
GATT is much faster to establish connection than SPP.

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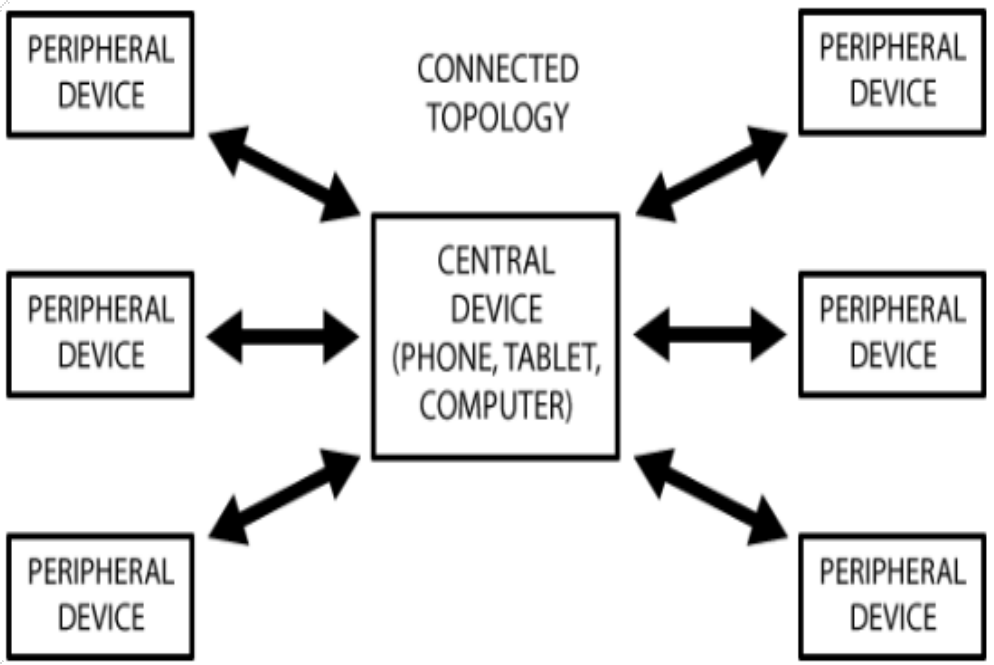
Android-GATT

Connected Network Topology



A peripheral(BT tracker) can only be connected to one central device (Smart phone).

Central : scanning
Peripheral : Advertising

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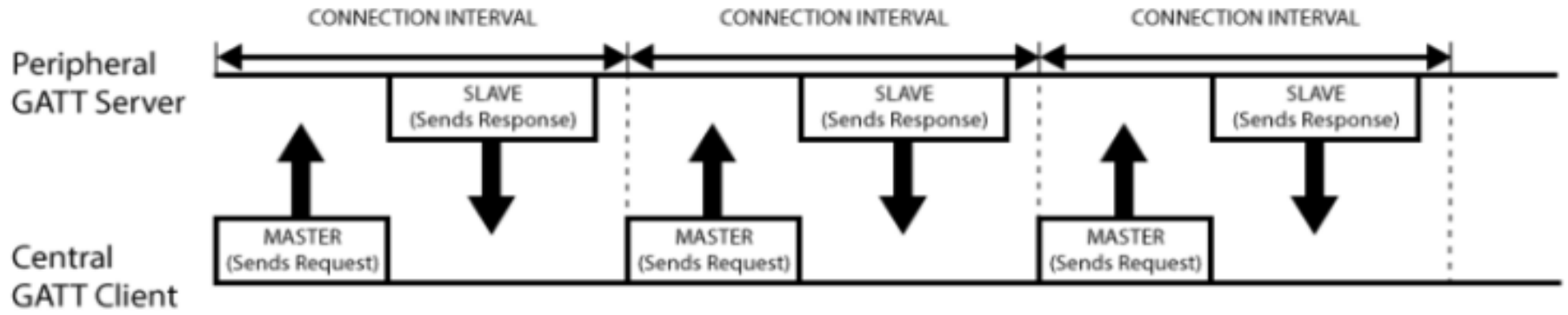
Android-GATT

GATT Transactions



Peripheral (=GATT Server, Slave) : holds ATT lookup data, services...
Central (=GATT Client, Master): sends requests to this server.

When establishing a connection, the peripheral will suggest a 'Connection Interval' to the central device, and the central device will try to reconnect every connection interval to see if any new data is available.

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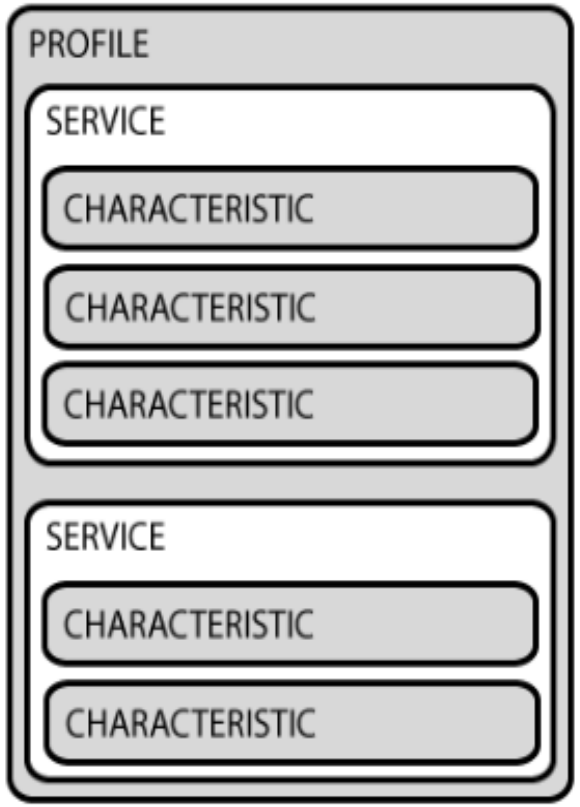
Android-GATT

Services and Characteristics



- **Profile**

-It's a simple pre-defined collection of Services.

- **Services**

-It contains specific chunks of data called characteristics.
-Each service distinguishes itself by 128 bit **UUID** (**U**niversally **U**nique **ID**entifier).

- **Characteristic**

-It encapsulates a single data point.
for example, write/read characteristic
-Similar to Services, it distinguishes itself by UUID.

More info here -> https://learn.adafruit.com/introduction-to-bluetooth-low-energy/gatt

Part 2

Intern Project

Bluetooth Tracker

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Demonstration

***Please enter 'slide show' mode for demonstration**

- **First, User must set Bluetooth, GPS and Network to track BT tracker.**
- **This activity is handled by Broadcast Receiver.**

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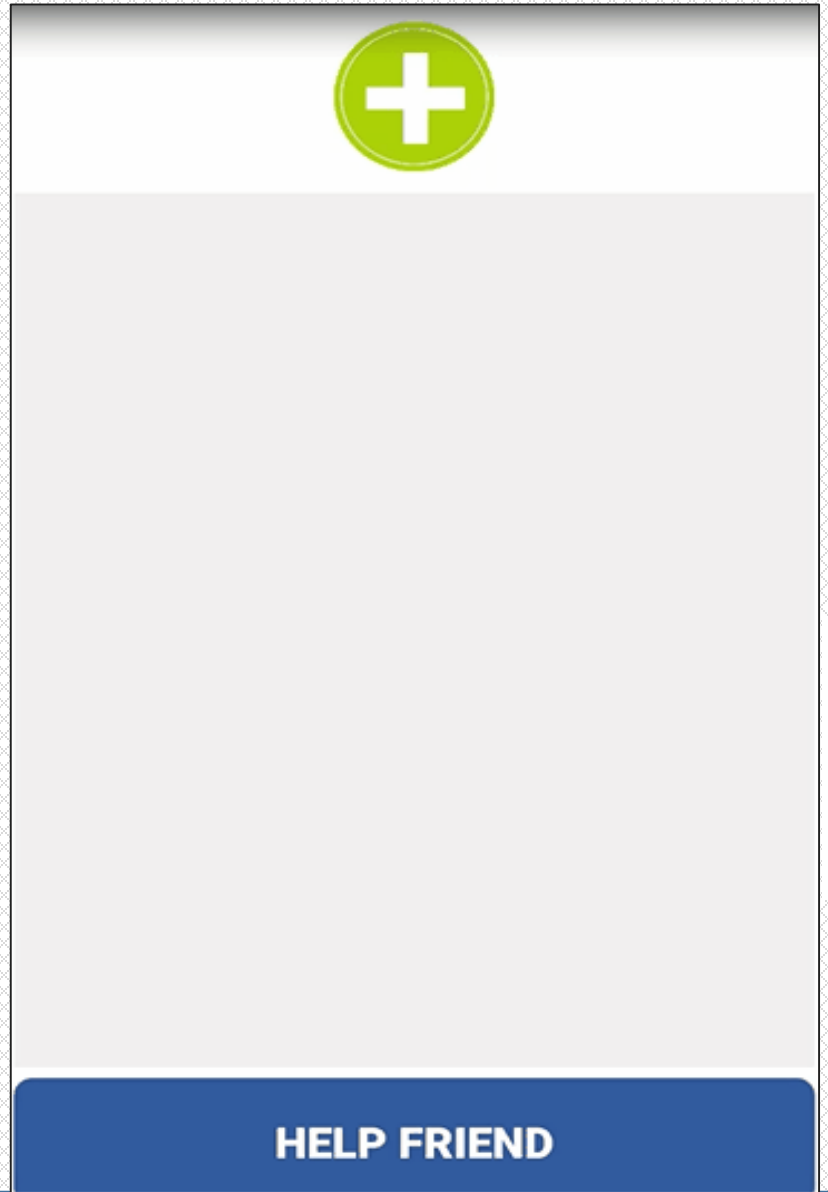
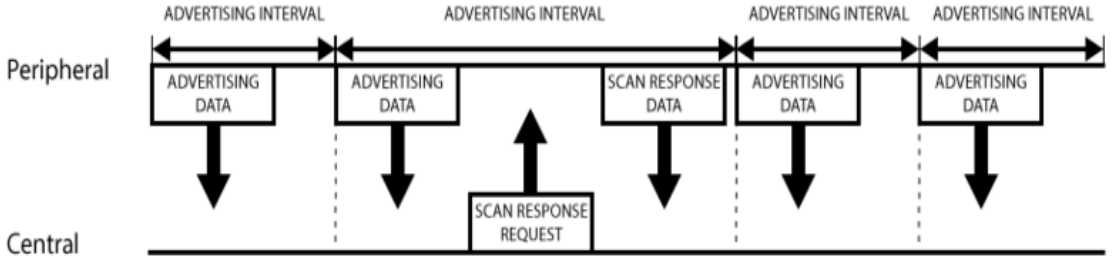
Demonstration



- Through '+' button, can add BT tracker.
- Smart Phone scans nearby BT trackers by pre-defined UUID. It neglects other devices which have different UUIDs.



- If state is connected, BT tracker is added

Part 2

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- Bluetooth Tracker
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Demonstration

Long Click : Delete

Click : Enter BT tracker

Part 2

Intern Project

Bluetooth Tracker

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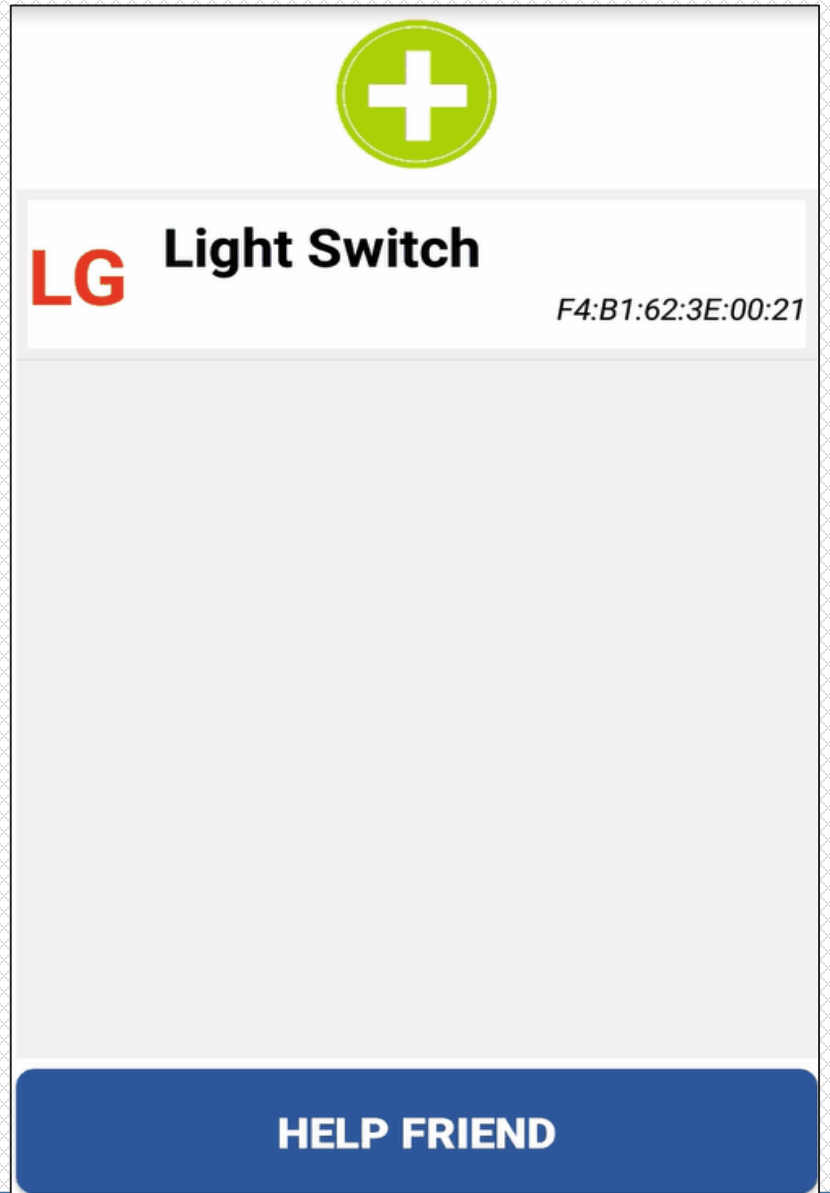
Demonstration



- **After Click, user can see BT tracker information.**
  -device name
  -RSSI (signal strength)
  -last location(address)
  -last date
- **User can easily know BT tracker's last location through Map UI.**

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Demonstration

- If Bluetooth is connected, Arduino turns on LED. Android turns on Bluetooth icon and measures RSSI.
- If Bluetooth is dis-connected, Arduino turns off LED. Android turns off Bluetooth icon and stops measuring RSSI.
- Checking Bluetooth status is handled by Broadcast Receiver and Service component.

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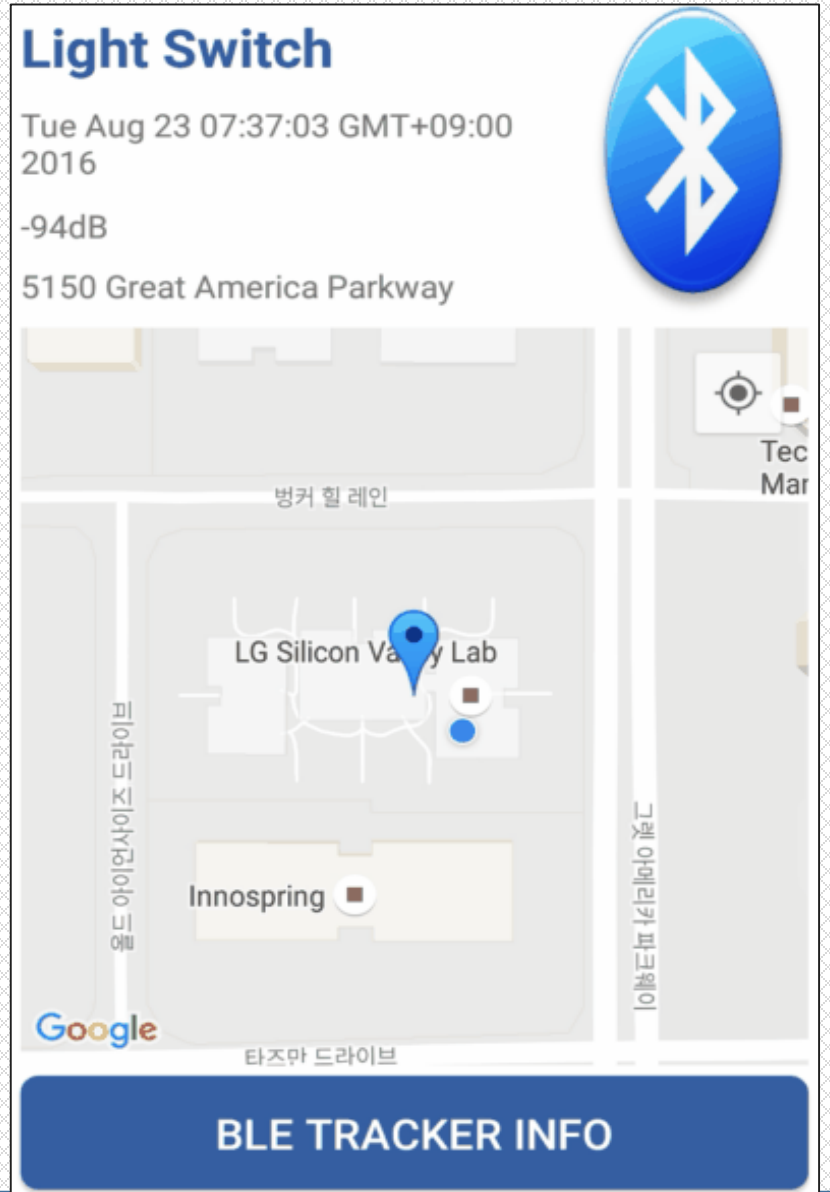


- User can know whether or not BT tracker is dis-connected in real time
- Once BT tracker is dis-connected, Smart Phone vibrates until user dismisses.

Part 3

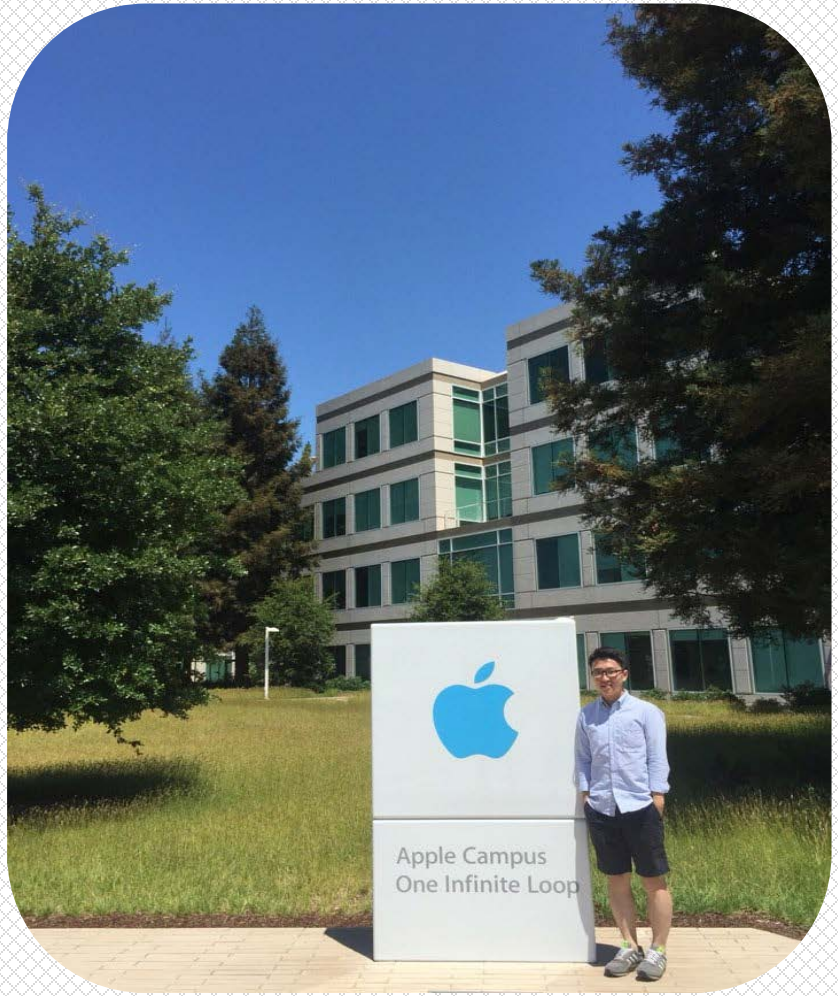
Company Visit

Apple Campus

Googleplex

Apple Campus

Curpertino, CA 95014



Part 3

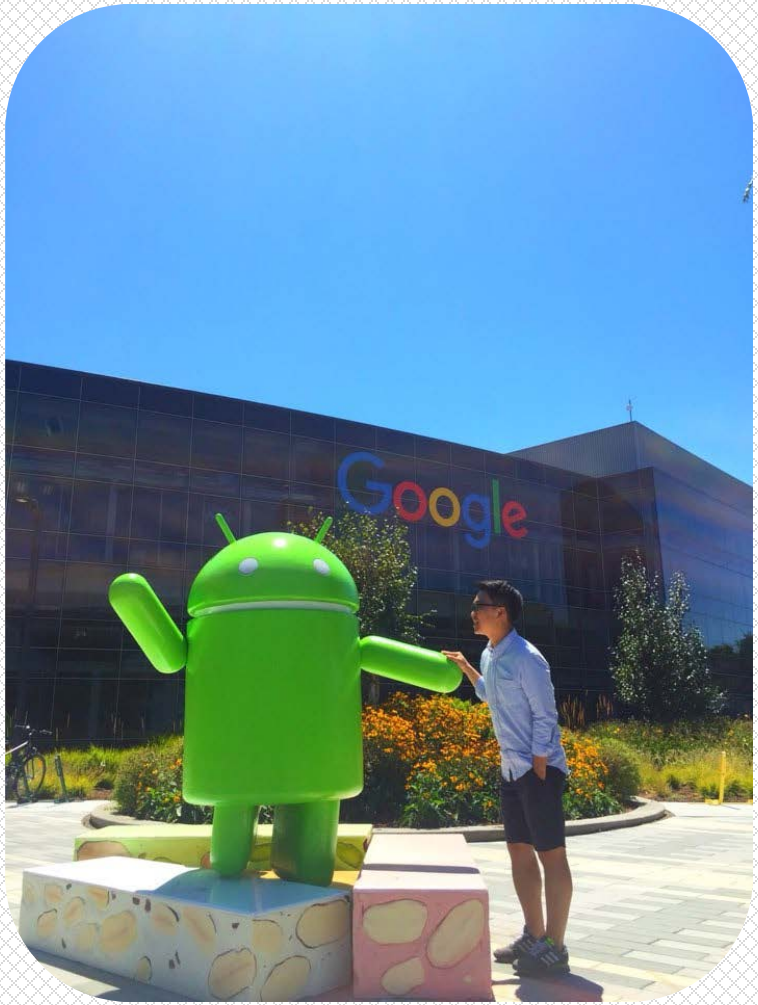
Company Visit

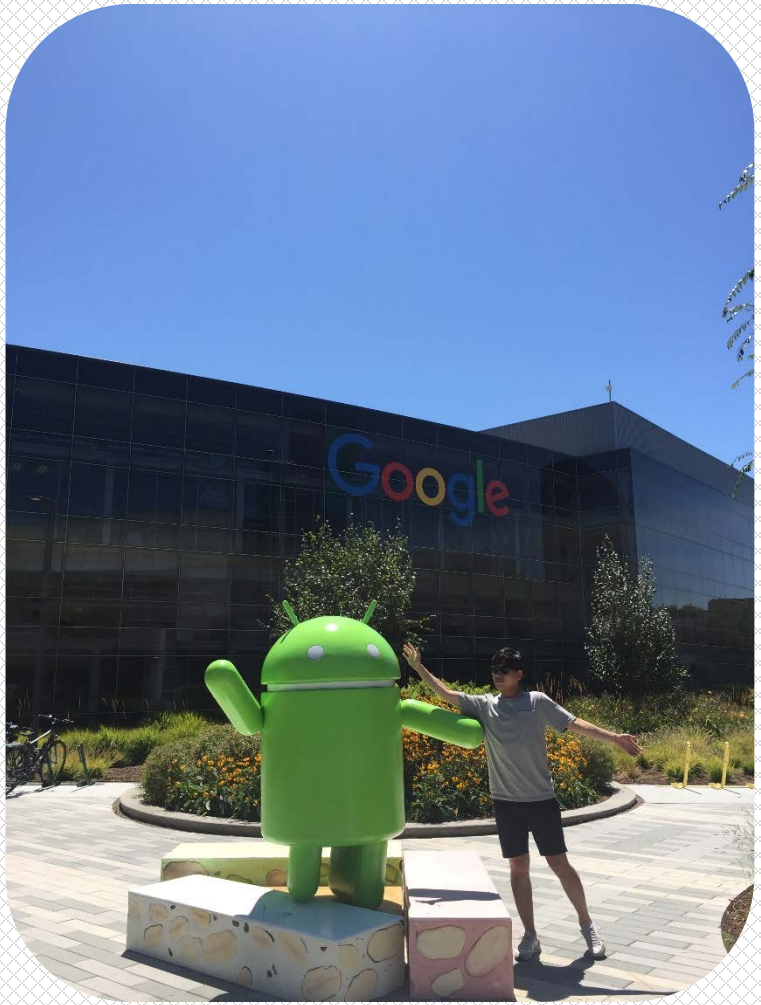
Apple Campus

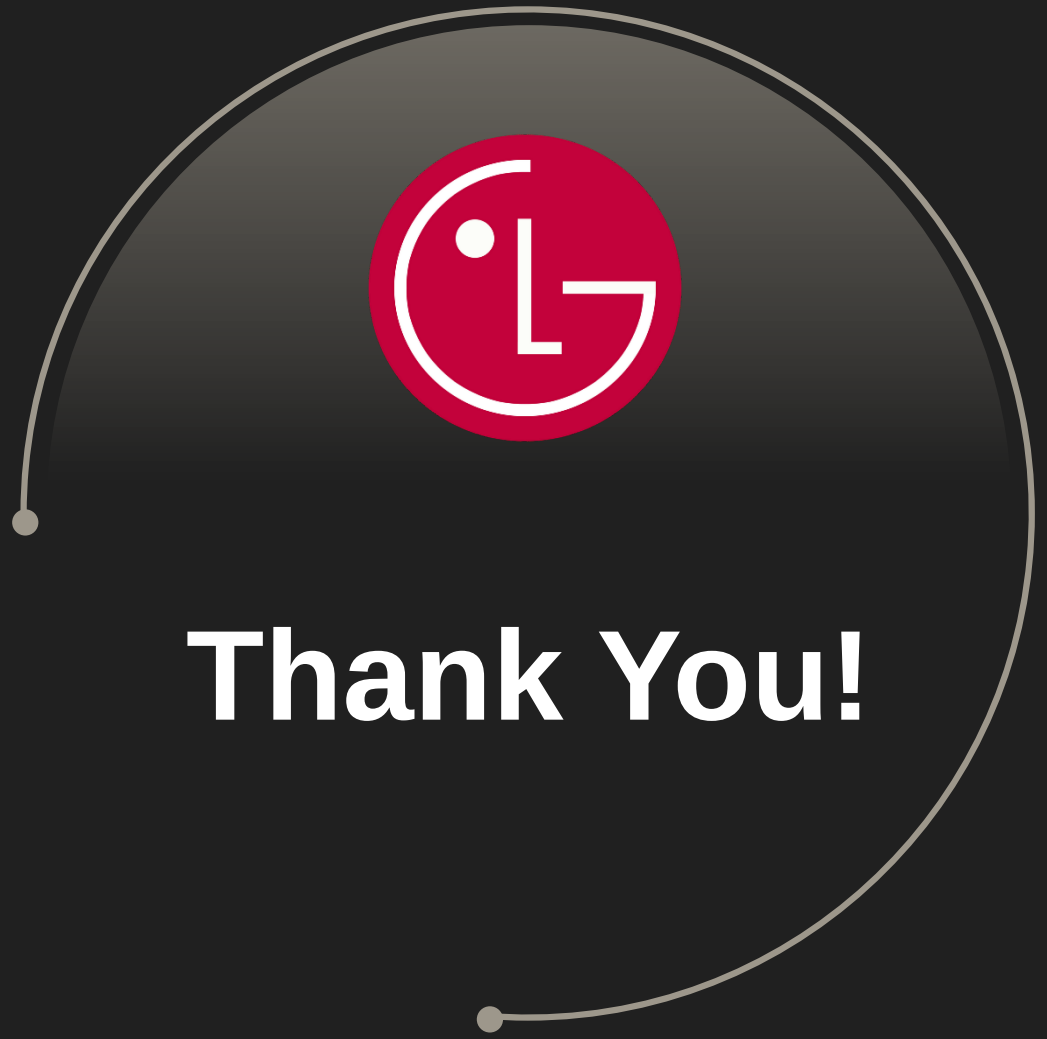
Googleplex

Googleplex

Mountain View, CA 94043







Thank You!