Project Goal:

This is a module of the WaterATM USA Project.

1. Make a product using bluetooth beacon technology.

Feature:

1. Apps that connect with bluetooth clients.
2. Full interface comes to the client app.
3. Payment system also integrates with the client app.

Bluetooth Beacon

Introduction:

Beacon is the next big thing in IoT. According to Webopedia, "Beacon transmits small amounts of data via Bluetooth Low Energy(BLE) up to 50 meters, and as a result are often used indoor location technology, although beacons can be used outside as well."

Benefits of Beacons:

- Improves Customer Experience
- Increase Sales
- Inexpensive and Scalable
- Increase Brand Loyalty
- Stay One step Ahead of the Mobile Curve
- Forget An Expensive POS (Point of Sale)
- It helps Customers Navigate Around Easily.
- It helps You Gather Important Metrics on Customer Behaviour

Received Signal Strength Indicator(RSSI)

RSSI, or "Received Signal Strength Indicator," is a measurement of how well your device can hear a signal from an access point or router.

The RSSI signal acceptable values are as follow:

Signal Strength	TL;DR	comment	Required For
-30 dBm	Amazing	Max achievable signal strength. The client can only be a few feet from the AP to achieve this. Not typical or desirable in the world.	N/A
-67 dBm	Very Good	Minimum signal strength for applications that require very reliable, timely delivery of data packets.	VoIP/VoWiFi/ Streaming
-70 dBm	Okay	Minimum signal strength for reliable packet delivery.	Email, web

-80 dBm	Not Good	Minimum signal strength for basic connectivity. Packet delivery may be unreliable.	N/A
-90 dBm	Unusable	Approaching or drowning in the noise floor. Any functionality is highly unlikely.	N/A

How does BLE Technology work and use Beacons?

BLE is low power consumption technology which is designed for short-range communication and it is preferred where **battery life is more important factor than high data rate**. The data transfer in this communication is one-way only. BLE beacon transmits small data packets at regular intervals of time. These data packets are received and decoded by **beacon scanner apps** installed in smartphones. This received data triggers action like promoting a product or pushing a message.

In Bluetooth beacon an ID number is transmitted 10 times every second by it via BLE channels. Then this ID number is received by the Bluetooth enabled device and recognized by the beacon scanner app, it links it to an action, such as downloading an app or piece of content stored on the cloud, and displays it on the smartphone.

Protocol

1. Eddystone Beacon
2. iBeacon

Eddystone Beacon

Eddystone is a protocol which is developed by **Google** that allows one way messages to be broadcast to BLE devices. The Eddystone-URL forms the backbone of the Physical Web, which helps in discovery of web content in the surrounding.
Beacon can broadcast four types of data using Eddystone protocol. They are as follows:

1. Eddystone-URL for broadcasting URL address
2. Eddystone-UID for broadcasting beacons IDs

3. Eddystone-TLM for broadcasting beacon telemetry like device temperature, battery strength, etc.
4. Eddystone-EID for security.

iBeacon

iBeacon is a small-scale network device that uses Bluetooth Low Energy(BLE) and acts as a transmitter to detect and track smartphones. It is developed by **Apple**.

Typically used for advertising purposes, the iBeacon transmitter will broadcast information such as:

1. The universal unique identifier(UUID)- Which tells the corresponding smartphone user the name of the user or business using iBeacon.
2. The Major- Which contains the beacon's location.
3. The Minor- Which includes a more exact location of the beacon.
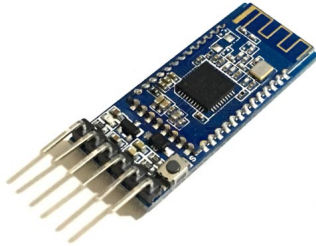4. Tx Power- Which specifies the strength of the signal.

Implementation

A simple ibeacon with esp32

This is a sample program of esp32 ble beacon.
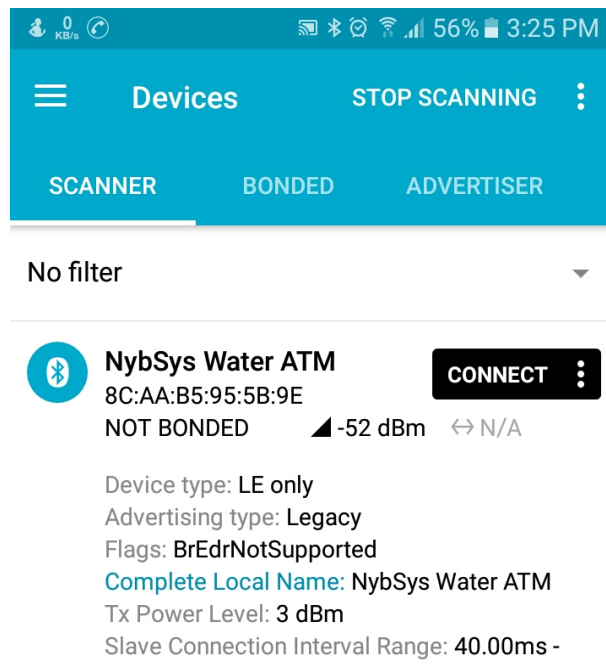
BLE Beacon with HM10(CC5521)

Connection with Arudino:

HM10	Arduino
RX	D9
TX	D10
VCC	5v
GND	GND

AT command set

The Description of the all AT Command used above is as follow:

1. AT+RENEW (Restores the factory defaults)
2. AT+RESET (Reboots the HM10)
3. AT (AT Test)
4. AT+MARJ0x1000 (Sets iBeacon Major Number to 0x1000 HEX converted to 4096 in DEC)
5. AT+MINO0x0007 (Sets iBeacon Minor Number to 0x1000 HEX converted to 4096 in DEC)
6. set UUID to 36996276-CB00-40A2-A81E-D7F95858CA7C
7. AT+IBE036996276 (Sets bytes 0-3)
8. AT+IBE1CB0040A2 (Sets bytes 4-7)
9. AT+IBE2A81ED7F9 (Sets bytes 8-11)
10. AT+IBE35858CA7C (Sets bytes 12-15)
11. AT+ADVI5 (Sets advertising interval to 5 i.e. 546.25 milliseconds)

12. AT+NAMEiBeacon (Set HM-10 module name to iBeacon. Change it according to use)
13. AT+ADTY3 (Sets HM10 non-connectable to save the power and no client can connect to module helps in saving more power)
14. AT+IBEA1 (Enables iBeacon Mode on HM10)
15. AT+DELO2 (Sets the iBeacon in Broadcast mode only to save power. The HM10 can broadcasts its presence and scans for other devices as it is a Bluetooth Transceiver)
16. AT+PWRM0 (Enables HM10 to auto sleep and reduce power consumption from 8 to 0.18 mA. The iBeacon will be always transmitting though)

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