Wide Coverage Bluetooth Technology with High Speed Transmission

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Abstract—Bluetooth wireless technology has the ability to find a device and send multimedia (audio, video, and text) data to nearby devices. Now a day's Bluetooth technology is becoming part of our life. The technology adopted by Bluetooth does not support wide range of coverage as expected. Machine learning algorithms are being used to address this issue. With the help of these algorithms, we can able to get greater coverage, easily find the devices and also transmit the multimedia data in a high-speed manner. It can also connect large span of devices in short period. At present the technique used in implementing the Bluetooth technology is Bluetooth Low Energy (BLE) Beacons. This paper presents a study of machine learning techniques used to improve BLE accuracy and security. BLE will provide better security to transmit data from one device to another (mobiles, tablets, PC, etc.). By using Random Forest, we can get better connectivity among the devices. Similarly by using Naive Bayes algorithm in the BLE beacons we can establish the connection as well as transmit the data in faster manner when compared to the existing approach.

Key words —**Bluetooth, BLE beacons, Machine Learning algorithms, random forest, Naive Bayes.**

1. INTRODUCTION

Bluetooth technologies have become an integral part of our daily lives in our smart phones. Now we are going to implement GPS in Bluetooth. We use GPS powered services for requesting directions, sharing our location with friends and family, for transmitting to audio, videos and text to device based on location. Bluetooth cause to cover wide area has been so far a long term goal. GPS isn't a perfect decision for Bluetooth on the grounds that the dividers and roofs totally obstruct the flag of the satellites utilized by GPS. Besides, the estimation mistake of GPS is too expansively for its utilization in indoor conditions where meters are huge and can put a client in the wrong room. These technologies BLE (Bluetooth Low Energy), Wi-Fi and Electromagnetic Field have been tested to solve the Bluetooth transmitting problem. Wi-Fi transmitting is known to provide accuracy of a few meters. It is performing power-hungry protocol and access points are randomly arranged with the required measure and density. In contrast, BLE has been designed to be a machine-to-machine energy efficient protocol, allowing devices with lower costs and maintenance. This paper presents a study of wide coverage Bluetooth technology methodology using BLE together with three different machine learning algorithms. The final aim is to produce a robust low-cost Bluetooth technique for in-building navigation. Particularly, our paper focuses on marked effect of beacon density and accuracy of the system.

We tested the Bluetooth technology in our building, it differs some parameters to improve its accuracy.

2. RELATED WORK

Most methodologies found on writing and business frameworks utilize data got from sensors (magnetometer, accelerometer, and so on) and Radio Frequency signals (BLE, Wi-Fi). Here we show the most remarkable cases found on the writing. There are a few methodologies which utilize Wi-Fi signals for confinement. The creators in propose an answer in which a client wears an android based smart watch, which measures the Wi-Fi signal strength to make a Wi-Fi association for assessing its area by means of a machine learning algorithm. They analyses pair of algorithms and learning systems, and analyzed algorithms, for example, Random Forest, SVM (Support Vector Machine), Bayesian Networks, Decision Trees and multilayer Perception with strolling and static testing. Bayes systems were the best approach took after by Random Forest, give a accuracy. A few analysts broke down BLE signals for possibility in building indoor area frameworks. The BLE flags and presumed that 6-8 reference points is a decent number for a unique mark with reference points parameters of - 20dBm furthermore, 10Hz. They likewise recommended that Wi-Fi filtering can lessen BLE flag quality estimations. They came to an accuracy of 2.6m, 95% of the time [1]. Kavitha. S et al. additionally broke down the qualities of the BLE signs of two models (Estimote and BLE beacons) by getting the way loss of the two models and after that utilizing that data for leading reproductions on an arbitrary conveyance of signals utilizing KNN.

Some methodologies utilize just Radio Frequency signals for restriction. Estel and Fischer presented a framework formed of BLE signals in which the area is evaluated by trilateration, yielding an exactness of around 5m, they contended that it isn't sufficient for indoor restriction.

There exists more mistake on BLE signals than on Wi-Fi, caused by quick blurring multi-way obstruction, in this way a few arrangements utilize some separating for lessening the blunder. Propose a trilateration area based framework by utilizing a calculation with Kalman sifting. The frameworks was made out of Android gadgets and Estimotes BLE signals.

The normal area following mistake was around 1.77 m. The usage of the Kalman Filter in presents an change for Bluetooth flags, and utilizing the trilateration through guides enhanced the exactness estimation of the situating. Different methodologies utilize gadget sensors and Radio Frequency signals. Duco utilizes passerby dead retribution along with iOS remote area estimation (CoreLocation) which utilizes a blend of GPS, cell, Wi-Fi and Bluetooth signals to appraise area. Be that as it may, Core Location's particular usage is obscure. iBeacons are sent in Wi-Fi no man's lands, stairs and lifts. By utilizing trilateration, dead retribution and Kalman sifting, Rbesaat et al. created a framework that accomplishes an exactness of short of what one meter by utilizing BLE reference points. In the change for the RSSI estimations is ruled by two stages, averaging and smoothing, the test had two stages, with and without alignment, the adjustment comprises on assuming the way

misfortune esteems and measure them with the way signals accumulated some time recently. These means diminish blunders caused by conditions, for example, recurrence obstructions. There are three strategies actualized, the nearest beacon, the Gaussian-commotion, and a molecule channel. The creators proposed a mapping plan to speak to the earth as a hub chart with the client's way, and utilizing the situating calculations to compel the pursuit space. Another execution of two business arrangements are clarified in, Navigate and Go Indoor, and an online substance administration framework (CMS) for the guide scaling and estimation. Both arrangements utilize an advanced cell gadget for perceiving and putting the reference points. These arrangements enable the guide to isolate through dividers for better situating.

3. METHODOLOGY

We propose an android application with Bluetooth technology implemented in a beacon infrastructure. It establishing signal to distribute data between devices. Beacons are designed to obtain a device location in across the building or campus. In this beacons infrastructure are processed with Eddystone. Eddystone is an open beacon format developed by Google and designed with transparency and robustness in mind. It have Several different types we using to payload can be included in the frame format, including:

- Eddystone-UID: A unique, static ID with a 10-byte Namespace component and a 6-byte Instance component.
- Eddystone-URL: A compressed URL that, once parsed and decompressed, is directly usable by the client.
- Eddystone-EID: A time-varying beacon frame that can be resolved to a stable identifier by a linked resolver, such as Proximity Beacon API.

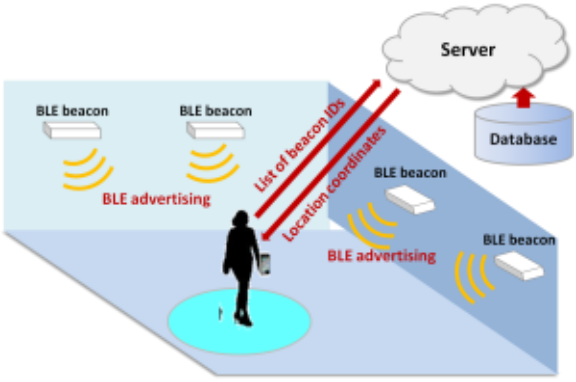


Fig 1.1 Architecture of BLE beacons

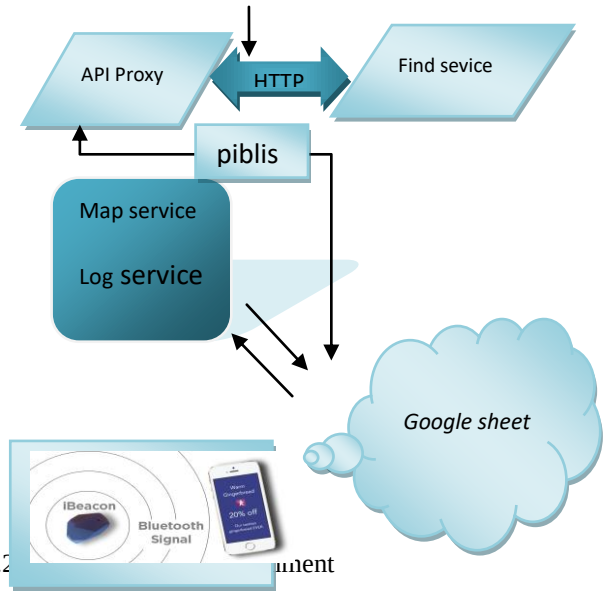


Fig 1.2 virtual machine signal establishment

In this beacon infrastructure we using two types of beacons. One is estimate and another one is ibeeks. The architecture of system function are processed by using estimate and ibeeks. Which is used to transmit signal through beacons. We can transmit the data throughout the room to room and also the floor to floor with use of beacons. They were placed 2.50m height for signal transmission. It can able to cover to bigger room.

We scanning the eddystone packets in the particular time and obtain the value with each beacons create a data containing the beacon MAC and RSSI for that beacon and then send the data to a server.

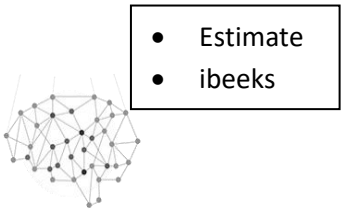


Fig 1.3 ibeeks signal connections

This technique create a map and identify the points in an area and distribute the data to given particular address. This process are processed with help of beacons MAC and RSSI are issue this address.

TABLE 1 Learning Tracking

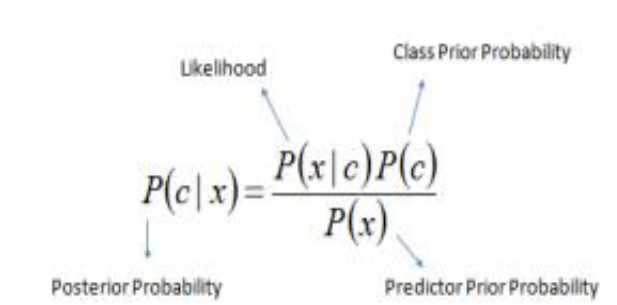
TABLE 2 Data set

	MAC 1	MAC 2	...	MAC n
1	-79	0	...	0
. . .	. . .	. . .	. . .	. . .
n	...	...	...	...

location	
R1	R1
R2	R2
Rn	Rn

The server and the mobile application are based on open source technique. This finding technique is designed for Wi-Fi fingerprinting. So we adopting the mobile application for scan eddystone packets. And send the MAC address, RSSI to nearby beacons. We using three machine learning algorithm for develop a Bluetooth technology. Machine learning is a field of computer science that gives computers the ability to learn without being explicitly programmed. That are Random classifier, Bayes classifier, SVM. SVM algorithm, we plot each data item as a point in n-dimensional space (where n is number of features you have) with the value of each feature being the value of a particular coordinate. a Naive Bayes classifier assumes that the presence of a particular feature in a class is unrelated to the presence of any other feature. Naive Bayesian model is easy to build and particularly useful for very large data sets. Along with simplicity, Naive Bayes is known to outperform even highly sophisticated classification methods.

Bayes theorem provides a way of calculating posterior probability P(c|x) from P(c), P(x) and P(x|c). Look at the equation below:



$$P(c \mid X) = P(x_1 \mid c) \times P(x_2 \mid c) \times \cdots \times P(x_n \mid c) \times P(c)$$

Here,

- $P(c|x)$ is the posterior probability of *class* (*target*) given *predictor* (*attribute*).
- $P(c)$ is the prior probability of *class*.
- $P(x|c)$ is the likelihood which is the probability of *predictor* given *class*.
- $P(x)$ is the prior probability of *predictor*.

Random Forest is a trademark term for an ensemble of decision trees. In Random Forest, we've collection of decision trees (so known as "Forest"). To classify a new object based on attributes, each tree gives a classification and we say the tree "votes" for that class. The forest chooses the classification having the most votes (over all the trees in the forest).

- n estimators: the amount of trees in the woods.
- max depth: it deeply explore the whole tree.
- min specimens split: the least amount for tests should. Perform an inner part in the hub.
- irregular state: those irregular generator paradigm.

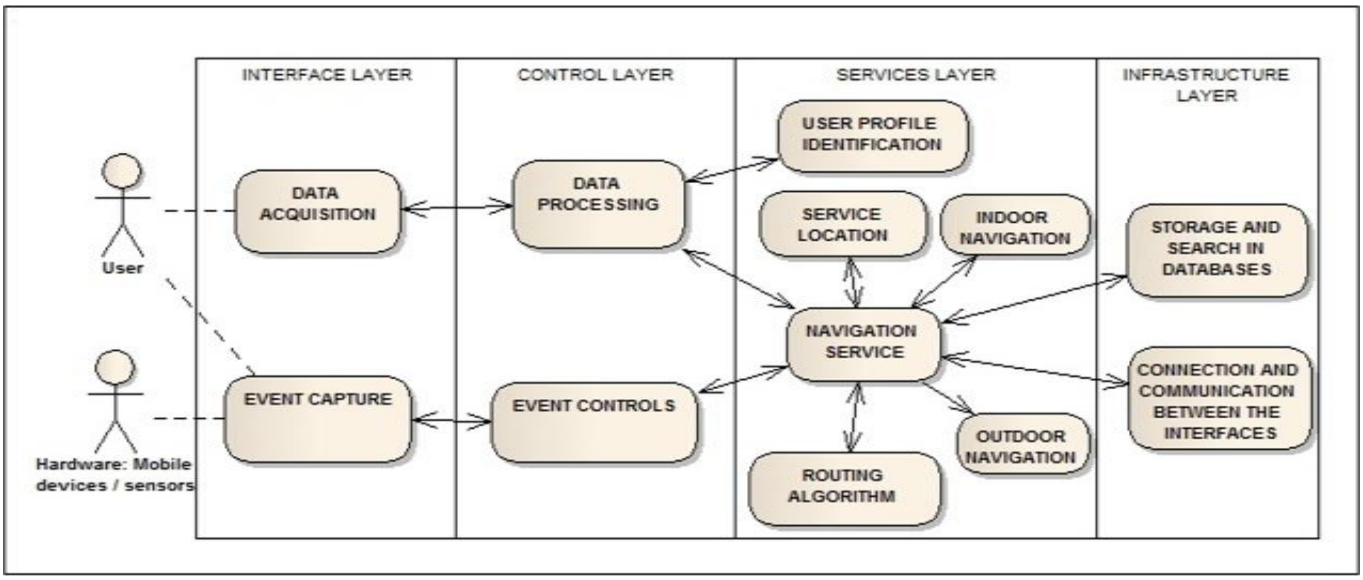


Fig 1.4 Data navigation process

We are testing with these Strategies using these machine learning algorithms. The proxy server is placed between the server and the application. We developed map, chart, and logging utility. The map shows real time location to the user. It uses MQTT and Web sockets for shows real time information.

4. RESULTS

We produced some investigations with examine the exactness of the system. Some process were done differing the transmission and sampling rate of the beacons, the RSSI's selected of the same MAC address, and defining proximity zones in the application. Examining rate of the beacons, the RSSI's Choice Of the rehashed occurrences of the same MCA address, What's more. Characterizing AROUNDED zones in the requests. To the beacons infrastructure, at first transmission rate about 1 second, later on it might have been transformed on 100ms. For preferred execution the transmission rate's build permits. We cn catch additional beacons Throughout the same filtering window. We tried those framework in An static setting, the beacons were. It can transmit toward 1Hz. In this test, we prepared the areas utilizing. Those Apps are same time strolling parallel of the dividers inside those rooms. We checked that accuracy, eventually perusing putting three diverse brands of versatile apparatuses over differentiated positions inside the space. We cover signal large area to transmit the throughout building.

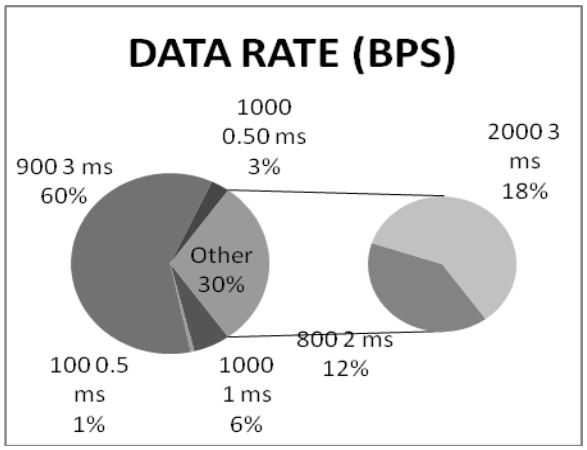


Chart 1 Data Rate(BPS)

5. CONCLUSION

In this paper we introduced n investigation of a indoor positioning. Framework executed utilizing Bluetooth low energy beacons. In This implementation, we utilized a fingerprinting system for Estimating area with three machine Taking in algorithms: Bayes classifier, SVM, random forest. We uses those best outcomes for best expansion correctness through the bayes classifier algorithm. And more right area ID number are indentified in room-level accuracy is incremented. A indoor positioning framework is those backend of a indoor route system. The important process for our Work is addressing device and data transmission processed in few micro seconds. And we have ability should find number of objects. This process also functioned in floor-level transmission. It can be processed same accuracy in the second floor of our office Building. The smart-phone's magnetometer sensor using Dijkstra's shortest path algorithm for finding the shortest path to transmitting

data between the devices. Way to this algorithm will discover the best course between two clients inside the building.

6. ACKNOWLEDGMENT

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