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# Patient Monitoring System using Beacon

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***Abstract:** In the smart moving world everything becomes easy by using the advanced technology in the smartphone. This paper is about monitoring the patient using beacon through the android developed application. Beacon is a device which can be scanned through the smartphone using BLE (Bluetooth low energy). By using beacon, the patient location can be tracked inside the hospital for visitors and the staff can monitor the humidity and temperature of the patient. In addition pulse rate can be checked using the raspberry pi device. The patient records are maintained in the cloud linking with the application, so the doctors can easily manage the patient records. The health status can be tracked and changed through the application. Doctors can modify the patient records and track their health status with the cloud database. The location will be more accurate than GPS (Global Positioning System), so the location can be viewed from anywhere by the doctors or visitors. In real time beacon scanning is restricted to a shorter range to provide more battery life. Beacon is more secure than the GPS, so patient location can be tracked easily and accurately*

***Keywords-Beacon, BLE, Raspberry pi device, patient monitoring, GPS***

## I. INTRODUCTION

The internet of things has evolved over the past years in various fields. The interconnection of physical devices embedded with electronics, softwares, sensors, actuators, and connectivity enabling these devices to exchange data between these devices. These devices are called smart devices, they are used in various fields such as industries, schools, offices, hospitals and home.

These smart devices allow you to directly interact with the computerized world thereby reducing the gap between the physical world and computer world. These IOT platforms can pinpoint what information is useful and what can be ignored. This information can be used to detect patterns, make recommendations, and detect possible outcomes before they occur.

IOT helps the companies to improve the performance through IOT analysis and IOT security to deliver better results. The analysis is used to maintain the cost, avoiding equipment failures and improving business operations. The security system plays a major role in safeguarding the connected devices and the networks in IOT.

IOT is still considered to be in development and promises more opportunities in future.

A Beacon is a small Bluetooth radio transmitter. It repeatedly transmits signals on a regular interval of 1/10$^{th}$ of a second which can be seen by other devices if it is in range.

| Interval | Tx power | Expected range | Expected battery life |
|---|---|---|---|
| **100ms** | 3(-12dBm) | 35m(115') | Upto 7 months |
| **300ms** | 3(-12dBm) | 35m(115') | Upto 2 years |
| **1000ms** | 3(-12dBm) | 35m(115') | Upto 4 years |

Table 1 [1]

From table 1, the range and the battery life and the accuracy is denoted in the table

The accuracy of beacon is comparatively higher than GPS, It can scan even a tiny object. Beacons can be linked with cloud databases for accessing related data.

The beacon contains inbuilt sensors like motion sensor, humidity sensor, temperature sensor for capturing the accurate data for the sensor.

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## II. RELATED WORKS

*A. Authors: Mr.J.Yang , Mr. Z.Wang , Mr. X.Zhang [2]*

Yang proposed a paper based on the ibeacon-based indoor positioning system. In this paper the three layer architecture for the internet of things is used to have push message services through clients.

*1)* The author designed the system only to see the positive state of the patient
*2)* Only the notification will come on the devices

*B. Authors: Mr. Sehul A. Thakkar , Mr. Sunil Patel , Mr. Brijesh Kamani [3]*

A. Thakkar proposed a paper based on the positioning and tracking in indoor places using beacon. In this paper the RSSI (Received Signal Indicator) algorithms and techniques for tracking the places indoor

*1)* The Wi-Fi module collect all the information and send to the router and router send all the data into the cloud
*2)* The database is connected to the server and the server is connected to the web application or mobile application

*C. Authors: K.A.D.K.N Peiris ,S.A Asmina [4]*

K.N Peiris proposed a paper based on the indoor assistance and navigation System using ibeacon on shopping malls. In this paper the push message service is used to navigate the nearest ATMs, Restrooms and the location of the mall

*1)* Dijkstra's algorithm is used for locating the nearest store to the customer
*2)* The K-Nearest Neighbor algorithm is used to analyze the users most visited data's

*D. Authors: Mr.Marco Teran, Mr.Juan Aranda,Mr. Henry Carrillo [5]*

Marco proposed a paper based on the Indoor location system using Bluetooth low Energy (BLE). In this paper the client-Server paradigm is used for the accurate location

*1)* The simple location algorithm is used for localization mechanism. Received Signal Strength footprinting method (RSS) which allows us to detect reference zone inside closed environment
*2)* RF(radio Frequency) and wireless network is used in positioning the person details both indoor and outdoor
*3)* An open source embedded database engine SQLite 3 is used, it uses less resources than other database systems and provides high efficiency and speed.

*E. Authors: Mr.Stefan Gronroos, Mr. Laura Maria Peltonen, Mr.Valentin Soloviev [6]*

Stefan proposed a paper based on the moving analysis in healthcare. In the movement, patterns are calculated and the datas are stored in the database

*1)* An indoor positioning system is designed to provide data on the movement patterns of the hospital Personnel.
*2)* It was designed to be non-intrusive and straightforward to deploy in multiple hospitals.
*3)* It is mainly used for accurate navigation in the hospital infrastructure and detecting the position of hospital personnel.
*4)* The RSSI can be used to roughly estimate the distance of the user from the beacon thereby allowing them to pinpoint their location in the building with a tracking application.
*5)* The main idea is to track the movement patterns of the hospital personnel and pinpoint their location in the building.
*6)* It allows the patient to quickly navigate to the nearest ward or department by saving time and manpower.
*7)* The installation method is quite cheap and works efficiently in most of the building structures.

## III. ISSUES AND OPPORTUNITIES

*A. Issues*

*1)* *Mr.J.Yang et al[2]* devised a method on indoor positioning systems that sends push messages to the patient to locate the nearest ward and department. The drawbacks in this method are:

*a)* It fails to notify the hospital personnel about the arrival of the patient.
*b)* It works under certain conditions such as only when the mobile device is in an open wireless network.
*c)* It merely tells about the wards or departments near the patient instead of navigating the patient to the desired ward or department.
*d)* The system is not very user friendly.

2) *Mr. Sehul A. Thakkar et al [3]* devised a system on indoor tracking is a variant of wireless tracking to track people or objects within a specific area. The drawbacks in this method are:

*a)* It only locates a person or an object, while there are various ways to use beacon such as receiving certain data from server database based on the unique id transmitted by the beacon signal or a guidance in navigation.

*b)* It does not provide enough features such as navigation to a specific room in a hotel or a ward in a hospital, but provides a location of it.

*c)* It does not provide any more information than just the position of the desired person or object.

3) *Pieris.A et al [4]* devised a method on indoor assistance and navigation that helps the customer in locating and using a quicker way to the desired stores in malls. The drawbacks in this method are:

*a)* It provides a 2D map for the user through an android application , a 3d map can be a more better approach

*b)* It may provide unwanted Ads which may be irritating to the user.

*c)* It can maintain a profile of each user and learn their interests to give a better shopping experience.

4) *Stefan Gronroos et al [6]* devised a method on indoor positioning systems for movement path analysis in healthcare institutions. It is used to track the movement patterns.

*a)* It fails to pre inform the hospital personnel about the arrival of the patients and their health record if present and also add up to the cloud database thereby updating information on cloud.

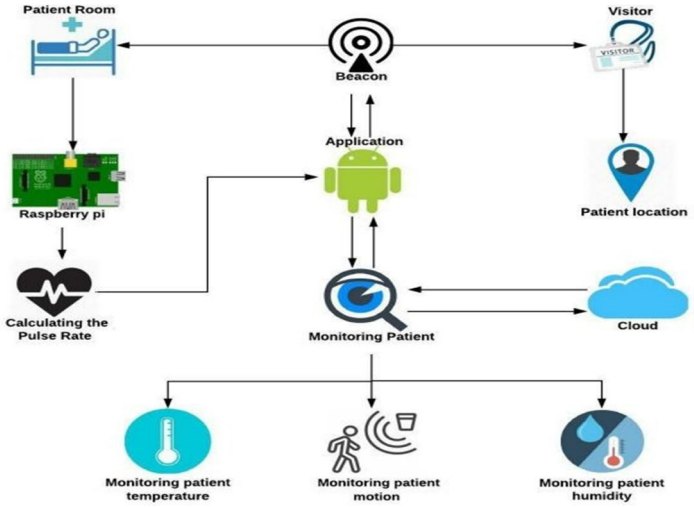
*B. Opportunities*

1) The beacon technology has been implemented in various fields and has a promising future in IoT.
2) IoT considered being a developing technology has so many opportunities.
3) It reduces the gap between the physical world and the computerized world.
4) It can save a lot of manpower and time by using the various features which can be used with beacon.
5) It can be used as a connector between other smart devices for easy accessibility and connection ability.
6) It can be used as an application in hospitals for navigation, monitoring patient health status and also allowing visitors to track patients based on the patient id.
7) Beacon applications can be used in various accessories like wristband, collars and tags

## IV. PROPOSING SYSTEM OBJECTIVE:

The project is used to monitor the patients through the android application. The patient's location can be tracked inside the hospital for the visitors. Also, the staff can identify the temperature, humidity and the pulse rate of the patients using beacon technology. If the temperature and pulse rate goes wrong it will intimate the doctor immediately. These patients' records are maintained in a cloud database. So, the Doctors can easily manage and modify the patient's records.

*A. Architecture*



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*B. Merits*

This system was to make the hospital smarter and to reduce the work of a staff using the beacon technology. The staff can see the pulse rate and temperature of the patients from its cabinets. The visitors can track the patient's location without using the internet connections

*C. Explanation*

From fig.1, The beacon will be connected on the patient room and visitor. The visitor uses the beacon devices for seeing the correct location of the patient. The beacon device is also connected to the patient room to monitor the temperature and humidity of the patient. Then the raspberry pi will collect the pulse rate of the patient and send it to the application. Then the patient details are saved in the cloud database for access to the doctors. The beacon contains an unique id for registering to the database.

The raspberry pi is an IOT device used to connect the pulse monitor sensor because there is no pulse rate calculating sensor in the beacon device. This IOT device technique is used to calculate the pulse rate. And both the temperature sensor and the humidity sensor are present inside the beacon device as paid add-ons. The beacon battery life is up-to two years. It should be well maintained by the staff members in the hospital by changing the battery's after two years.

*D. Implementation*

Beacon Monitoring System (Fig 2)

## V. DISCUSSION ON IMPLEMENTATION

This is the blueprint of a hospital. This blue dot is a beacon located in every room of the hospital with an inbuilt sensor for temperature and humidity. The black dot denotes that the visitor is coming to visit the patient, where the red dot is patient in the beacon connected room. When the visitor connects the first beacon present in the reception the instant application will pop-up on the screen.

If the visitor text the room number in the instant application the beacon will direct the patient location to the visitor.

Also the doctors can also maintain the records of the patients by sitting on its cabinet. If there is any emergency to the patients there will be an intimation message to the doctor about the health status.

## VI. CONCLUSION

In future the world is depending on the IOT for making buildings, homes, hospitals, shopping malls. This paper will be useful for making a smart hospital in the beacon technology which will be a more secure mode of tracking technology in the future.

## VII. RESULT

The beacon technology being used in various fields fulfils the smart hospital management system with the use of BLE (Bluetooth Low Energy) and cloud database to form a system capable of monitoring the patient, allowing the hospital personals to easily keep track of the patient health status, it also enables the visitors to easily locate the patient and navigates them to the patient and all these features being implemented using an android application. Thus providing an efficient way of hospital management.

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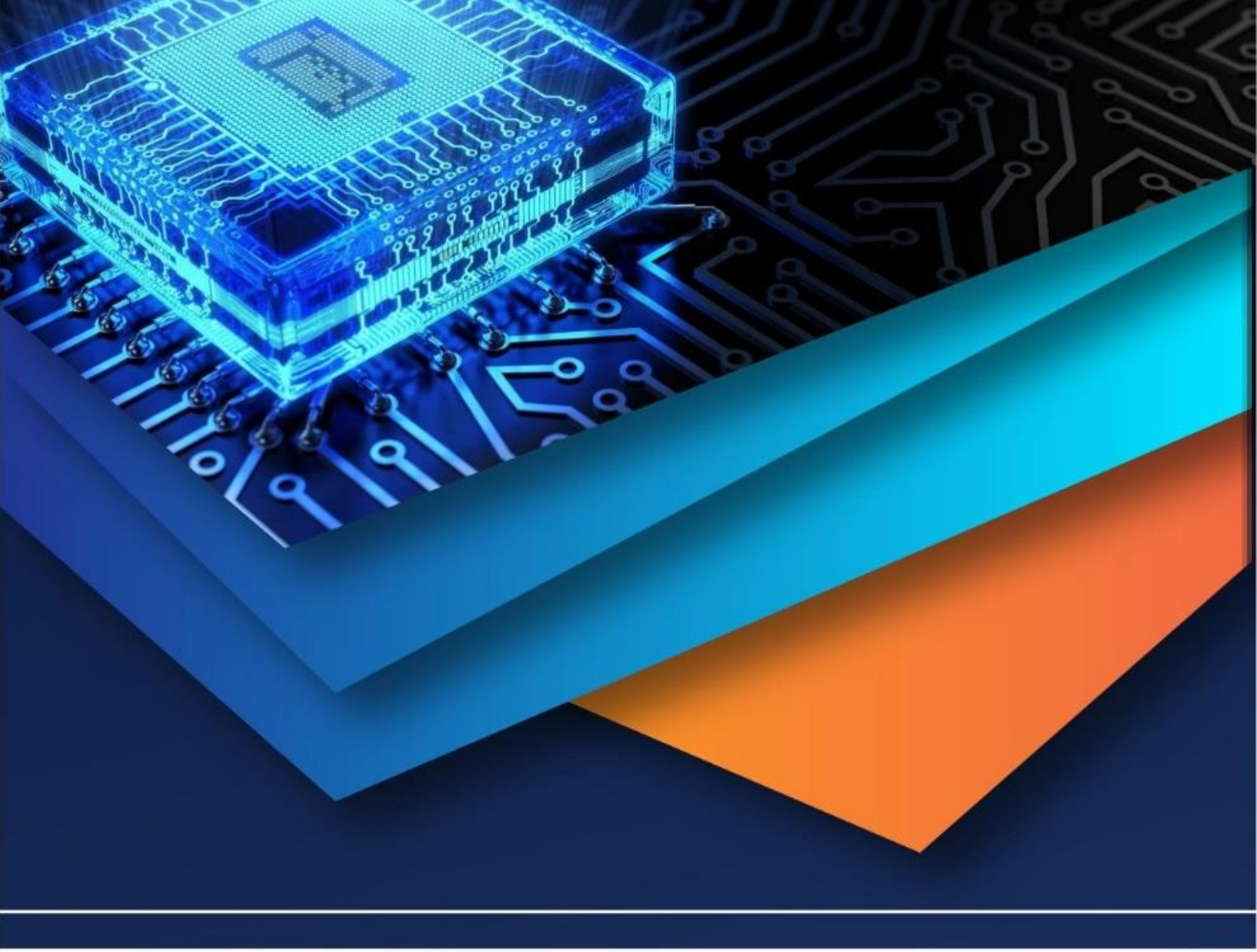

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