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IOT Based Real Time Indoor Location Tracking System

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***Abstract* — Real Time Location Systems (RTLS) belong to a class of locating systems capable of remotely determining the location of tagged assets in an environment within a relatively short time frame (real time). Signals from tags are received by readers, which leads signal, to continuously determine the location of the tag relative to each reader. Using readers positioned at several locations around a tag offers multiple location readings, which can be compiled together at a central host to estimate the location of a tag in a two or three dimensional space. The most common RTLS uses a Wi-Fi infrastructure to determine the location of tagged assets. These systems employ Received Signal Strength Indication (RSSI) techniques to wirelessly determine asset location. This presents a new method for providing an accurate, low cost estimate of sub-room indoor Asset location. An iBeacon based Bluetooth Low Energy (BLE) technology used to track and manage assets. Each asset to be tracked is tagged with an iBeacon tag, and tracked using BLE enabled device located throughout a facility. Based on the tracking information, the system allows users to manage assets and generate reports regarding the various tagged assets.**

Keywords- Real time indoor location tracking, ibeacon, IOT based tracking, RTOS, MSP430F247.

I. INTRODUCTION

Since the presentation of GPS innovation, benefits that depend on situating and restriction information have risen in a fast pace. GPS has turned into a true standard for open air situating applications, no comparative across the board method is available for indoor situating or in ranges where GPS is not accessible. The point of indoor situating does not need explore: Several methodologies and recommendations in light of various advances have been created and presented in the course of the most recent two decades. What is regular for every one of them is that no methodology has had any enormous effect inside the region.

One proposed iBeacon based method for indoor situating is to utilize Bluetooth innovation and give situating in light of sign quality parameters that can be effortlessly gotten. A noteworthy point of interest of utilizing Bluetooth is that it is an innovation with high entrance in the public eye. Gadgets, for example, mobile phones, tablets and PCs typically come furnished with the innovation as standard. Research on situating in view of Bluetooth has likewise gained some ground in the previous years, potentially making it a reasonable possibility for huge scale sending in a few situations and applications.

In June 2010, the particular for the Bluetooth 4.0 innovation was discharged. This particular presented another innovation, named "Bluetooth low energy"(BLE) or "Bluetooth brilliant". The new innovation contains some significant contrasts contrasted with customary Bluetooth. An assortment of new administrations and parts are presented, the RF-band utilization is changed, another product stack is presented and as can be speculated from the name, power utilization is significantly diminished to between 50-99% of the exemplary Bluetooth power utilization. A Bluetooth keen gadget could possibly work for a considerable length of time fueled by a solitary coin cell battery.

II. System Overview

Resource following framework gives complete control over their advantages by giving continuous status of the resources for industry. The way things are, logistical frameworks have customarily depended on RFID innovation for offices, resource, and stock administration. In any case, the arrival of iBeacon Technology now displays a productive option for the business, offering some noteworthy favorable circumstances over conventional RFID with longer range and following element.

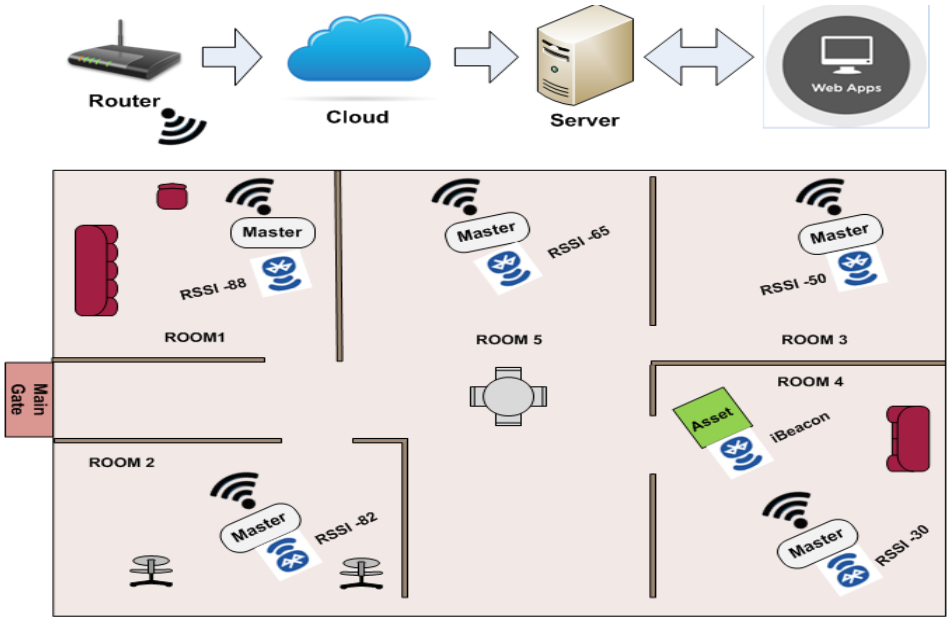

Figure 1 SYSTEM DIAGRAM

As begin working with iBeacon Technology; signal empowered frameworks can be perused straightforwardly from any standard tablet or Smartphone, wiping out the need to buy more costly hand-held per users. Besides, reference points work on a broadly acknowledged overall remote standard, consequently making them equipped for overall operation instantly taking after organization. Ultimately, reference points themselves are greatly moderate and easy to convey. By and large, reference points offer a novel open door for radical changes in every day operations for any logistical need[14].

III. COMPONENTS

3.1 iBEACON TECHNOLOGY

Figure 2 iBeacon

IBeacon is a technology standard developed by Apple, that was introduced in 2013 at the World Wide Developer Conference (WWDC). The standard describes the protocol and the devices. An iBeacon uses Bluetooth Low Energy to send data and it can be any device that has a BTLE-Chip. Devices such as BLE-USB-Sticks or Arduino-Boards and even iPhones can be an iBeacon. However, if you want to call your device an iBeacon, you need a license from Apple. An iBeacon has only one purpose, to send an identification number and the measured power. It is like a lighthouse that sends light signals to ships and boats, so that they know where the coast is. Unlike boats, devices that receive iBeacon signals know exactly which iBeacon it is and the approximate distance. There is no communication between iBeacon and other devices. This means that you cannot send a request to an iBeacon or answer to incoming iBeacon signals. The only way interact with an iBeacon is to configure the values for UUID, Major, Minor and the Measured Power [5].

3.2. HM-10 BLUETOOTH LOW ENERGY MODULE

Figure 3 HM-10 BLE

HM Bluetooth module use CSR Blue Core or TI CC2540/1, Master and slave roles in one, transmission version and remote control version and PIO state acquisition functions in one, Support the AT command modify module parameters, Convenient and flexible.

Transmission version can be used to transmit data between two Bluetooth devices. Remote Control version can be used to Control PIO ports output high or low level without any other MCU. The PIO state acquisition version can be used to acquisition PIO ports state without any other MUC. (Only support Bluetooth V2.1).

3.3. GS2100M WI-FI MODULE

Figure 4 GS2100M WI-FI MODULE

The Gain Span GS2100M module provides a quick, easy and cost-effective way for device and appliance manufacturers to add Wi-Fi connectivity to their products. Intended for smart energy and sensor applications, the GS2100M runs the SEP 2.0 Smart Energy Profile stack and has 3 high bit-rate sigma-delta ADC's for high resolution sensor and measurement devices.
This module provides a low cost, high speed serial to Wi-Fi connection to an embedded design built on an 8/16/32-bit microcontroller, achieving up to 40 Mbps throughput over an SDIO interface.

3.4. BASICS OF MSP430F247

The core requirement of the project was an ultra-low power microcontroller. Among the number of options, available in the market are QE Microcontrollers from Free scale Semiconductor, F series from 2X/4X along with MSP430 from Texas Instruments. However, MSP430 scores well above the other microcontrollers in various categories like Power consumption, speed of operation, cost.

The MSP430 CPU has a 16-bit RISC engineering that is exceptionally straightforward to the application. All operations, other than project stream guidelines, are executed as register operations in conjunction with seven tending to modes for source operand and four tending to modes for destination operand. The CPU is incorporated with 16 enrolls that give decreased guideline execution time. The register-to-register operation execution time is one cycle of the CPU clock. Four of the registers, R0 to R3, are committed as system counter, stack pointer, status register, and consistent generator, individually. The remaining registers are broadly useful registers. Peripherals are associated with the CPU utilizing information, address, and control transports, and can be taken care of with all directions.

IV. CIRCUIT DESIGN

4.1 HARDWARE SPECIFICATION

Our master device consist of GS2100M Wi-Fi module, MSP430F247Microcontroller and HM-10 BLE. According to our master device block diagram we design PCB using EAGLE

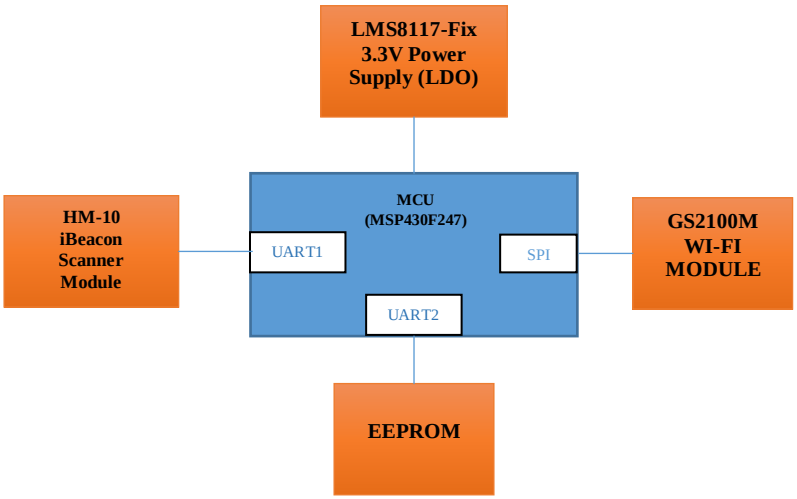

Figure 5 MASTER DEVICE BLOCK DAIGRAM

EAGLE provides users with a relatively easy to learn and use schematic and layout editor, while allowing for advanced users to implement more complex designs as well. But before one can begin creating designs in EAGLE, they will have to gain access to a working installation.
Three Steps required to make custom library.

4.1.1 The Symbol

Draw out the symbol, typically using the rectangle (for ICs) or line (discrete components) drawing tools, be sure to add appropriate pins with the correct direction. Give the name and value using the TEXT command.

4.1.2 The Package

First things first, look for documentation on the part we need a package for. Several company will have datasheets with the dimensions of the parts, and many times the suggesting pad size and positions. The first thing we'll want to do is draw the outline of the physical component using something like the WIRE command. Then set the SMD, Hole as per datasheets.

4.1.3 The Device

Now that the symbol and package have been created, it is time to create the device by clicking the Device button. We simply need to click the Connect button to open a new window that allows you to create a connection between your symbol and package.

4.2 SOFTWARE SPECIFICATION

MSP430F247 provides internal frequency upto 16 MHz The master device is set to 8 MHz frequency. So the frequency generated using DCO is 8 MHz.

The overall process is divided into four phase. In first phase, the parameters are set in the registers. In second phase, we create our own access point and connect with the local router. In third phase, we scan iBeacon and send the data to MSP430F247. Last phase consists of creating a link between local host to server using internet and then sending http POST request. This process is highly accurate, resulting in negligible error. The software diagram is shown in Figure 6.

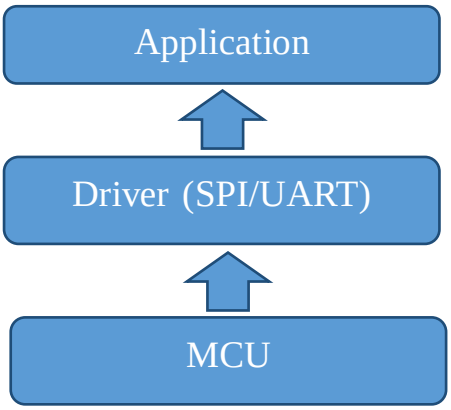

Figure 6 SOFTWARE BLOCK DIAGRAM

4.2 INTERFACE ARCHITECTURE

The Serial-to-Wi-Fi stack is used to provide Wi-Fi capability to any device having a serial interface. This approach offloads WLAN, TCP/IP stack and network management overhead to the Wi-Fi chip, allowing a small embedded host (for example an MCU) to communicate with other hosts on the network using a Wi-Fi wireless link. The host processor can use serial commands to configure the Serial-to-Wi-Fi Adapter and to create wireless and network connections. The embedded host can use either one of the interfaces (UART/SPI/SDIO) to connect to the Serial-to-Wi-Fi adapter.

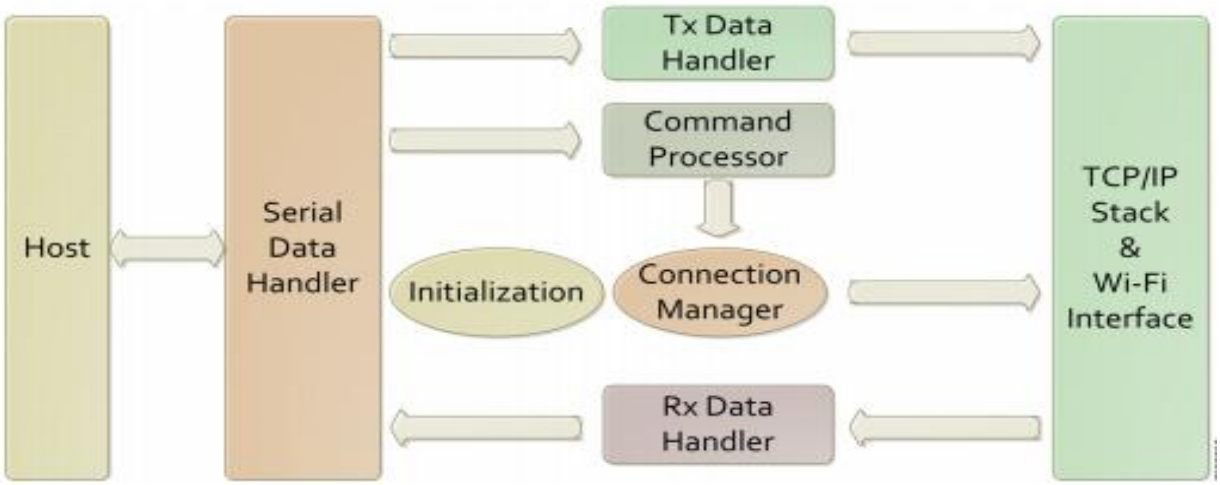

Figure 7 OVERALL ARCHITECTURE OF THE ADAPTER

The overall architecture of the Serial-to-WiFi (S2W) interface is shown in Figure 7. Transmit (Tx) and Receive (Rx) Data Handlers pass messages to and from the TCP/IP network Commands related to management of the S2W interface and the network connections are intercepted by a Command Processor. A Serial Data Handler translates data to and from a UART/SPI/SDIO-compatible format.

V. RESULT ANALYSIS

This chapter specifies that this web application can be accessed from anywhere using internet. The URL of web application is http://flyteksun.com/gotekt/ .

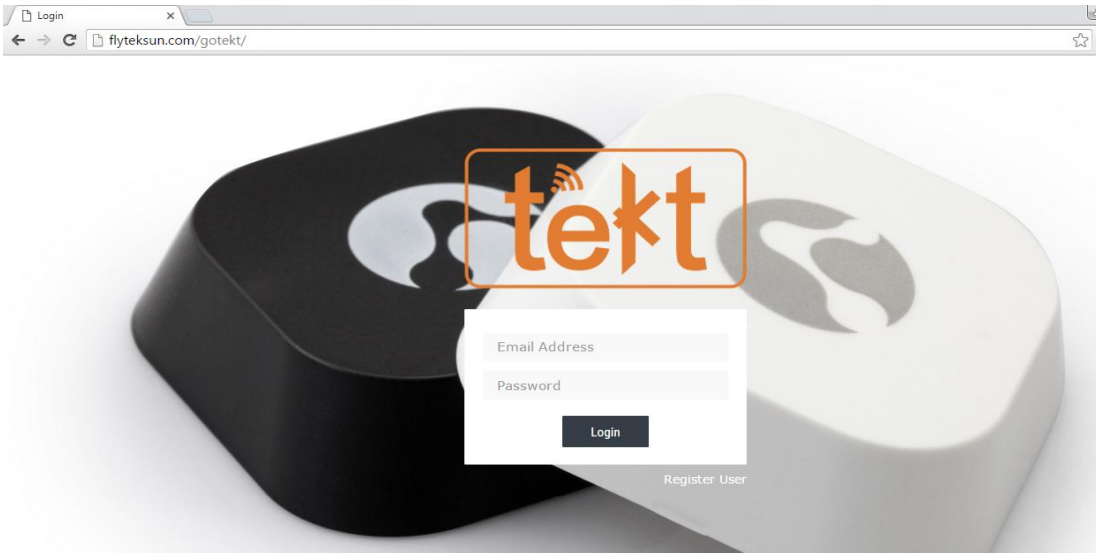

Figure 8 LOGIN PAGE

The login page of 'tekt' application can be shown in Figure 8 where the user can login to the tekt application by entering its user id or email address and password. If the credentials are correct then it will logged in to the main page as shown in Figure 9.

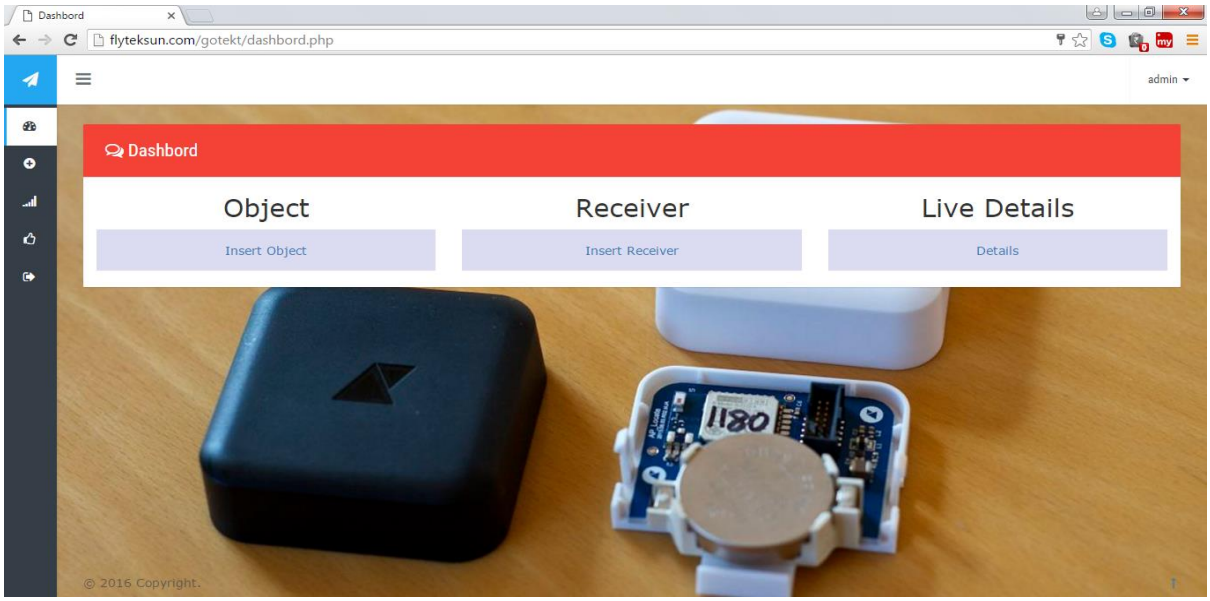

Figure 9 MAIN PAGE

Figure 9 shows the main page which includes the details to be entered. The number of object which needs to be track are inserted. The number of Receiver i.e. Master Device which tracks the object are inserted. And finally the live details of all the objects and receivers inserted.

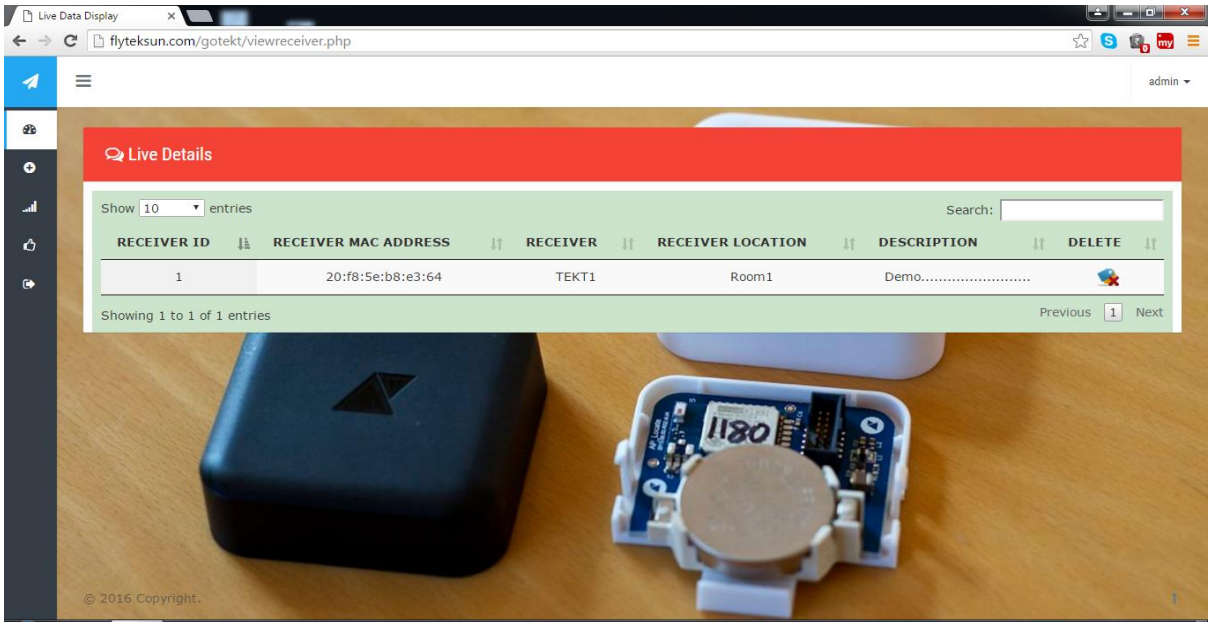

Figure 10 VIEW MASTER DEVICE (RECEIVER)

Figure 10 shows the full detail of the receiver and where it is located. It can contain multiple receivers.

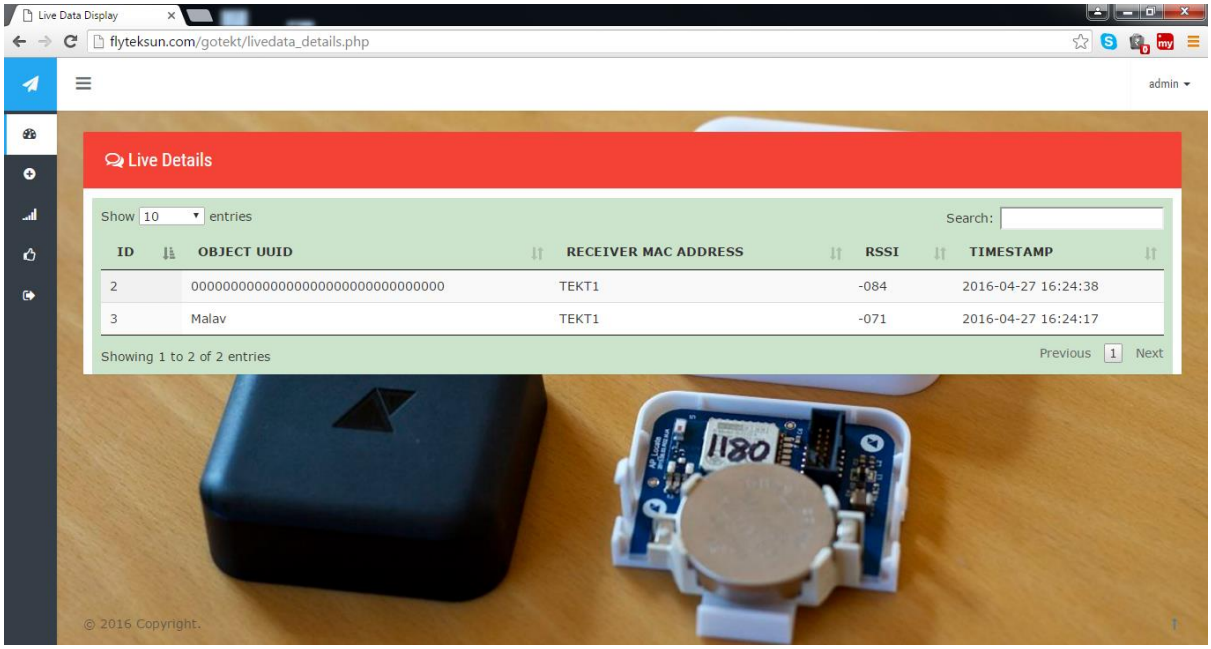

Figure 11 LIVE DETAILS

Figure 11 shows the live details. It specifies which object is tracked by which receiver at what time. The value of RSSI specifies that the object is nearer or far from the receiver. Lesser the value nearer the object to the receiver. Search field let you to search the particular object and receiver. Also if any receiver is searched, then it shows all the objects which comes in its range and if any object is searched, then it shows the object is in which location.

V. CONCLUSION

The main purpose is to design a cost effective Real time Localization System for Indoor Areas. In the first part of the Dissertation I am study about different indoor localization techniques and finding a new approach in indoor localization techniques. Main focus is on existing work that is most of the logistical systems have traditionally depends on the RFID technology for conveniences, asset, and inventory management but the release of iBeacon Technology presents a

successful alternative for the industry. iBeacon's is offering some significant advantages over conventional RFID or other technology with longer range and tracking feature. iBeacon are used to track valuable assets, By simply attaching a BLE proximity beacon to every imperative asset we would like to track so that we can identify and monitor its location in real-time. The Real time Localization System has been aimed to design in such a way that it can fulfil the needs of the user for particular Indoor area. It has countless applications and can be used in different industries and application. We can also get the higher level accuracy by densely deployment of scanning module. In my Dissertation work I am using Web Application for displaying the tracking result. Web Application provides the facility to insert object and receiver details at any time and it also shows the tracked object information in real time.

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