Design of Attendance System using BLE Beacon

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***Abstract*— In this paper we demonstrate a novel design for an attendance system which uses BLE beacons. An embedded system design involving a beacon, gateway and a server setup to mark a student present/absent. The main logic of the system is coded in the NodeRed server. It is efficient to handle tasks off of a server than local implementation given the wide range of database and connectivity options that NodeRed offers.**

I. INTRODUCTION

The global positioning system is playing a major role in our day-to-day lives. All smart-phones today have GPS, which has made our lives simple.We can easily track a vehicle or find the route to an unknown place at our fingertips. We can also share our live locations.Besides all these applications, GPS fails when it comes to indoor. GPS is a network of satellites and it finds the location by calculating its distance from 3 or more satellites, based on the signals received. When we try to use GPS indoor, the signals will be scattered by the walls and roof of the building and get attenuated. The distance calculated from the attenuated signals won't be accurate which makes GPS not suitable to use indoor.

There are many situations where we need indoor tracking. We often face the difficulty in finding some important things kept inside the building and waste our time in searching the same. Sometimes, we may also need to keep the track of the time spent by people in a particular place. Such problems can be addressed using indoor asset tracking and management .

A. Summary

In this era, GPS is widely in use where people get the live locations or route to an unknown place at their fingertips. But GPS cannot be used indoor. Hence there is a need to design an indoor asset tracking system where the assets can be tracked indoor as well. The assets should have a BLE tag associated with them,which sends BLE signals continuously. The gateways should be appropriately installed inside the building which can receive the signals and send them to a server through Wi-Fi. The signals are then processed in node-red and the RSSI value of the signal is extracted.Based on the signal strength, its distance from the anchor is calculated to know its position. The details of date and time of entry and exit of the asset is logged. There is a user interface, where user can easily register beacons and anchors and know the location of a user associated with BLE tag, without the need of having any technical knowledge. There is a scope to implement this project by using multiple anchors installed appropriately in a building to know the movements of people in that building.

B. Literature Survey

[1]In this paper, NFC based Attendance system is presented, the motivation to develop this lies in the lack of reuse and tracking ability of the traditional way of taking attendance. A comparative study between both NFC and RFID is also discussed thoroughly, especially in terms of their architectures, functionality and features, benefits and weakness. [2]The paper starts with mentioning about Call-Out attendance system which is one of the primitive methods of taking attendance. It is a complete human-interaction based attendance system with zero use of machines and technology. However the system fails when the no of attendees are too high, giving room for human error at a rate higher than acceptable. It also enables an easy way for faking attendance and is very time consuming. To over come these inconveniences this paper represents a smart attendance system. Radio frequency identification, bio-metric fingerprint sensor and password based technologies are integrated to develop a cost effective, reliable attendance management system. A desktop application is developed in C-hash environment to monitor the attendance system. [3]This paper focuses on a smart attendance system that makes use of Bluetooth 4.0 Technology. It aims at the students studying universities with smart campus as users. Bluetooth 4.0 is a technology that can be seen in smartphones, making use of this the presence of a student in the classroom can be detected to further mark their attendance. The system can also recognize and register students and professors, maintain these records in a database for future use. [4]In the paper, the product built is called Smart Attendance System (SAS) which marks the attendance by using information extracted by RFID database handling system. A RFID database handling system is setup. SAS fetches required data from this database and marks the attendance. Also provides options to make notes and setup reminders for submissions which help students maintain a schedule.

II. ATTENDANCE MONITORING SYSTEM

A. Functional Diagrams and Architecture

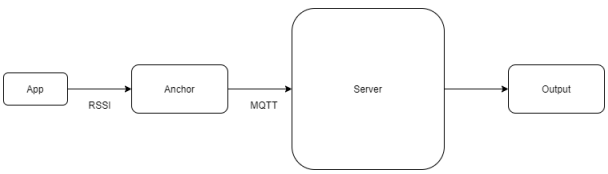

Fig. 1. Schematic of the general flow

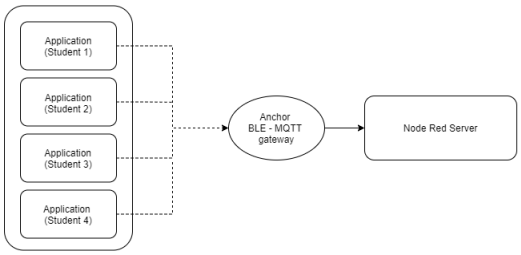

Fig. 2. Schematic of the detailed flow

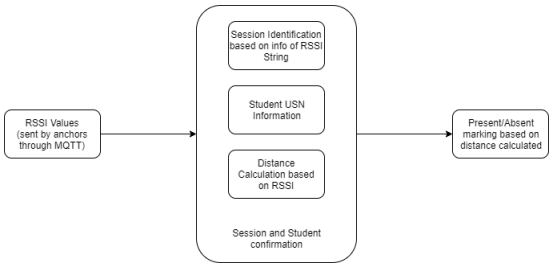

Fig. 3. Node Red Backend Process

B. Process of Attendance Marking

The presence or absence of an individual at a certain event is a very important to mark however, it often gets tedious and time taking. As the number of individuals increase the room for human error also goes up. The design mentioned in figures above is for a scenario of a school/college. The system is built to use available hardware such as smartphones. There are 3 parts to the complete product, Beacons, Gateways and Server. The server holds the main logic that marks the attendance. It also has a database in which all the student, staff and class room session details are stored. The server is situated on Nodered platform which uses java script and the concept of flows. The data from input node flows to a function node where it is processed and the output node provides the logic to present a formatted output.

Beacons and Gateways are local hardware that communicate via BLE (Bluetooth Low Energy). Beacons are setup to advertise signal. Gateways are setup to check for this signal and get the RSSI value. The gateway further passes this RSSI value along with the bluetooth address of the device to the server via MQTT. The server interacts with the gateway using MQTT communication protocol. MQTT operates on Pub-Sub model where a broker allows entities to subscribe or publish data to a topic. Here the gateway application consists a logic to publish data to a topic which is reflected on the server. The server is subscribed to the same topic to get the updates.

Further exploring the server, Nodered as mentioned above is a platform that uses javascipt coding and flows as a concept to map the functions, input and output. This helps in programming applications whose operation is a sequence of events. Here the sequence can be as follows: A student carrying a smartphone enters the classroom, the smartphone is advertising signal through the beacon application which is picked up by the centre-to-the-class gateway. The next

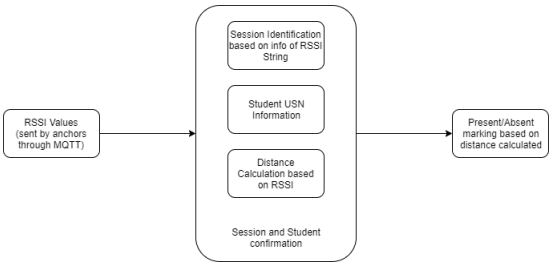

Fig. 4. Node Red Backend Process

event is exhibited by gateway where it takes the RSSI value formats it and publishes it to the topic. Further events are all processes that are written as functions on NodeRed. The device address, student details, class session details are all stored and preloaded. The server consists of logic that cross checks all this data to verify the genuineness of the device in the premises and the student. If the student is verified and authenticated, attendance is marked "Present", else if the verification fails the student is marked "Absent". These are the events that happen in a sequence.

Meanwhile, there are other functions such as addition/deletion of class sessions, faculty details, student details, live classroom feed which can also act as events but need not be in any sequence and can be used at any point of the server's functioning. The flexibility of Nodered provides easy coding and implementation of such functions by enabling multiple small flows to be connected and implemented conditionally. These conditions are defined by the developer.

The Nodered server has functionality to build a front-end for the system using a dashboard add on which lets a developer make a simple and easy to use website to interact, operate, navigate through the functions and store the required details.

C. Results

The results of the implementation of this attendance system was noted based on several inputs.

1) Anchor Registration: The dashboard will have fields to enter ID of the device or anchor. It checks for multiple same devices and eliminates duplicates and confirms registration.

Notify based on correct details: On successful entry of data, the user shall be notified with a message that the anchor and the data entered has been successfully registered

Notify based on incorrect or same details: The system doesn't entertain duplicate entries hence if there the user enters details that match a preexisting anchor, user is notified about it. On entering wrong details, the user is notified with a message asking to provide proper details in-order to register.

2) Beacon Registration: A registration window with fields related to beacon will appear.Unqiue entries will be registered.

Notify based on correct details: On successful entry of data, the device gets registered. This is notified.

Notify based on incorrect or same details: To avoid duplicates, if the ID entered already exists then the user is notified

to enter a different ID, in case of improper entries the user is notified to enter proper details in specified format.

3) Individual Status: User can input ID of the registered beacon. If the ID is valid, the details of the student are presented as output. There is also audio output describing the time of entry, logged time and date.

Notify based on correct details: On proper entry of the details, the details of the student directly appear on the screen along with audio output.

Notify based on incorrect details: On improper entry of details, the user is requested to enter correct details to be able to view the student details.

4) Working of the gateway app: The application is designed to detect the signal from a nearby devices and acquire the details. This data is formatted and further to Nodered server over MQTT.

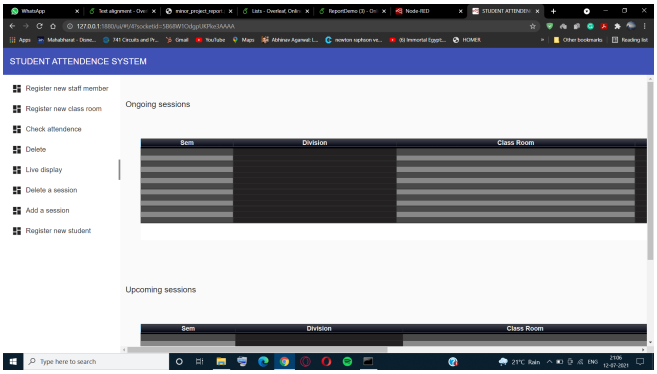

Fig. 5. Live and upcoming sessions

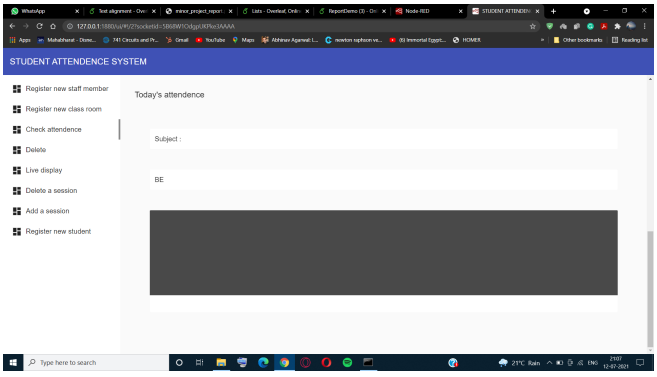

Fig. 6. Attendance

III. CONCLUSIONS

To conclude the paper, the motivation to address the concerns regarding traditional attendance systems lies in the advancement of technology and the skill implementation to find solution and services that have a good impact. The team has put in efforts to design a attendance system that is adaptable to real world scenarios. It highlights other such solutions that are based off of technologies such as RFID.

Attendance Monitoring System has been designed to work with hardware that a human usually carries around to avoid

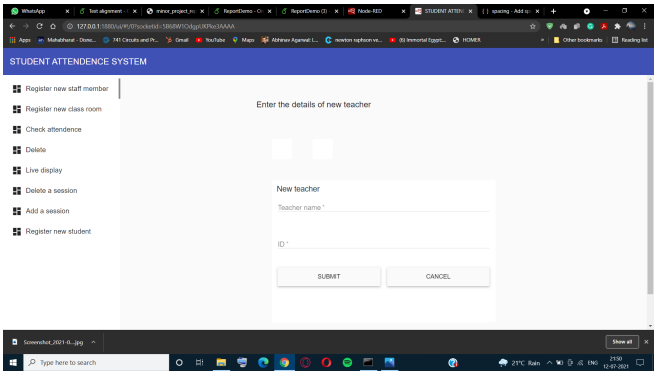

Fig. 7. New Teacher

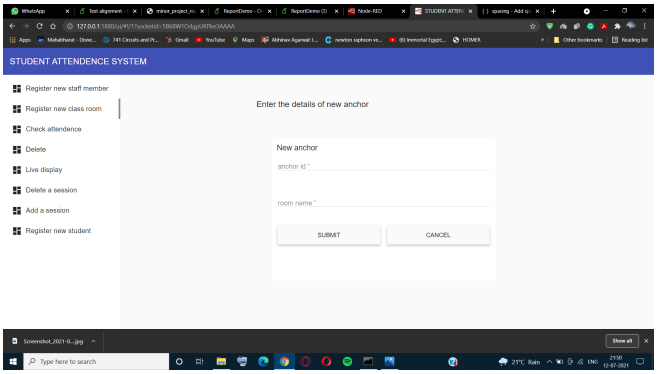

Fig. 8. Remove Students or Class

cost, maintenance and e-waste that comes with using extra hardware. There are systems designed with programming logic to achieve various functions that facilitate communication, data processing, data storage, presentation of output.

REFERENCES

[1] Sensors-enabled Smart Attendance Systems Using NFC and RFID Technologies; Authors: Cheah Boon Chew, Manmeet Mahinderjit-Singh, Kam Chiang Wei, Tan Wei Sheng, Mohd Heikal Husin, Nurul Hashimah Ahamed Hassain Malim, School of Computer Sciences, University Sains Malaysia

[2] Design and Implementation of Smart Attendance Management System Using Multiple StepAuthentications; Authors: Dhiman Kumar Sarker, Nafiz Ishtiaque Hossain, Insan Arafat Jamil, Department of Eletrical and Eletronics Engineering, Chittagong University of Engineering and Technology, Chittagong, Bangaldesh

[3] Design and Implementation of Automatic Attendance Check System Using BLE Beacon

[4] Smart Attendance System by using RFID

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