Attendance Monitoring System

Manjushree K (01fe18bec077), Aniketh J(01fe18bec022),
Smrithi R(01fe18bec131)
Under the guidance of Prof. Prashant V.A

KLE Technological University
Vidyanagar, Hubballi-580031
Karnataka, India

July 17, 2021

Contents

Introduction

- GPS is a widely used technology for live-location based systems, but it cannot be used for accurate indoor positioning.
- Bluetooth serves as the perfect technology for indoor positioning systems
- The recent BLE Beacon technology enables low power, efficient, short range WNS (Wireless Network Systems)
- The modified version of the indoor positioning algorithms can be used for attendance monitoring system.
- We have integrated various technologies to design a smart attendance system in this project.

Motivation

- Marking attendance is a tedious and time consuming process if done manually and hence in this automated era, we decided to work on a smart attendance system that would be user friendly and fast.

- An opportunity to explore into WSNs (Wireless Sensor Networks), tools to develop applications for such networks helps gain experience in the field of Embedded Systems and IoT. Developing a real-time application of WSN is an intriguing challenge.

Objectives

Objectives are.

- The dashboard must take inputs from the user-end(admin) and store it in the database and give permissions to edit it.
- The dashboard must also register classes and show them in live sessions
- The anchor must be simulated in android environment.
- The anchor must detect BLE signals from the device and compare it with the registered data base and then send a string data with credentials to the node-red server.
- The server must process the data and compare the data and if not present add the data to the server database and must mark present the student.

Literature Survey

- A Bluetooth Low Energy Indoor Positioning System with Channel Diversity, Weighted Trilateration and Kalman Filtering
  - Objective: To track the position of a device by means of BLE in indoor conditions.
  - Beacon: SensorTag CC2560
  - Gateway: Raspberry Pi with Adafruit Sniffers
  - Working: SensorTag advertises data through three different channels. The sniffers receive the messages. The Raspberry Pi runs a script to use the data received by sniffers to compute the distance.
  - The paper defines error as the difference between estimated position and real position and minimising this error is one of their objective.
  - The paper uses 3 different methods to achieve precision and accuracy in measurements and location tracking: Channel Diversity, Kalman filtering, Weighted Triangulation. The paper claims to have most balanced solution considering cost and precision as parameters.

Literature Survey

- A Survey of Smartphone-Based Indoor Positioning System Using RF-Based Wireless Technologies
  - Objective: To conduct a thorough survey of various Indoor Positioning Systems
  - Choice of signal for signal tags: BLE, WiFi
  - Various Wireless Technologies used in IPS
  - Signal Measurement Solutions
  - Parameters of IPS: Accuracy, Precision, Scalability, Complexity, Cost
  - Algorithms for IPS: Proximity based, Lateral/Angular, Weighted Centroid Localization, Trilateration, Fingerprinting
  - Implementation of Fingerprinting localization, Justification of its results, Drawbacks.
  - Future Scope: Development of better algorithm than Fingerprinting that overcomes common drawbacks using advanced technology.

Problem Statement

To design a smart attendance system using node-red as server and simulate a beacon and gateway in the android environment, so that smart phones can replace the extra hardware used for BLE signal processing i.e, beacons and anchors.

System Design

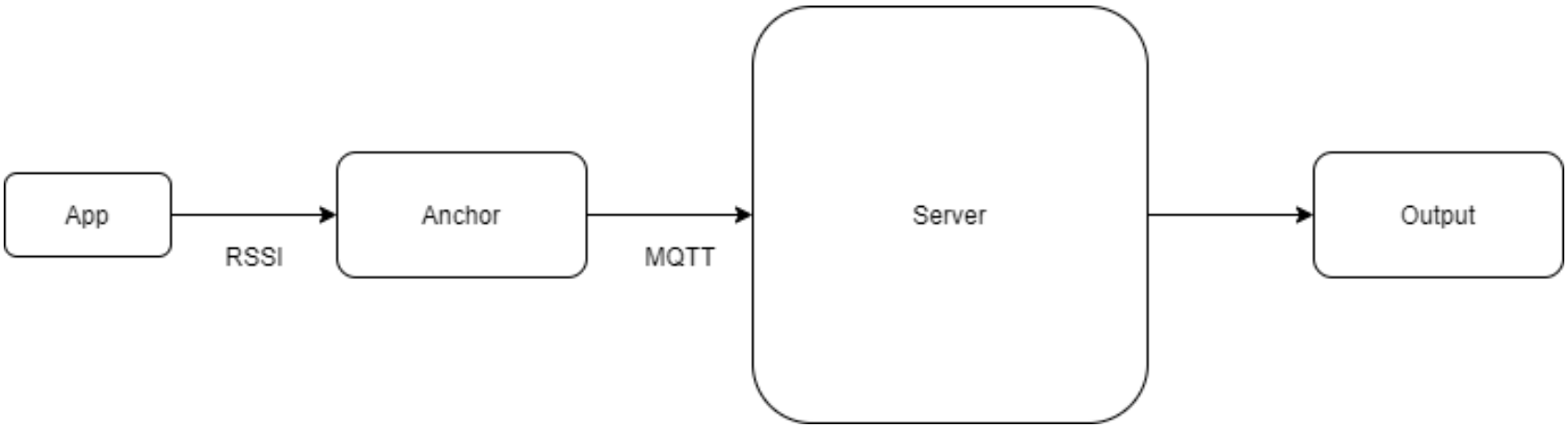


Figure: General flow

Proposed Design

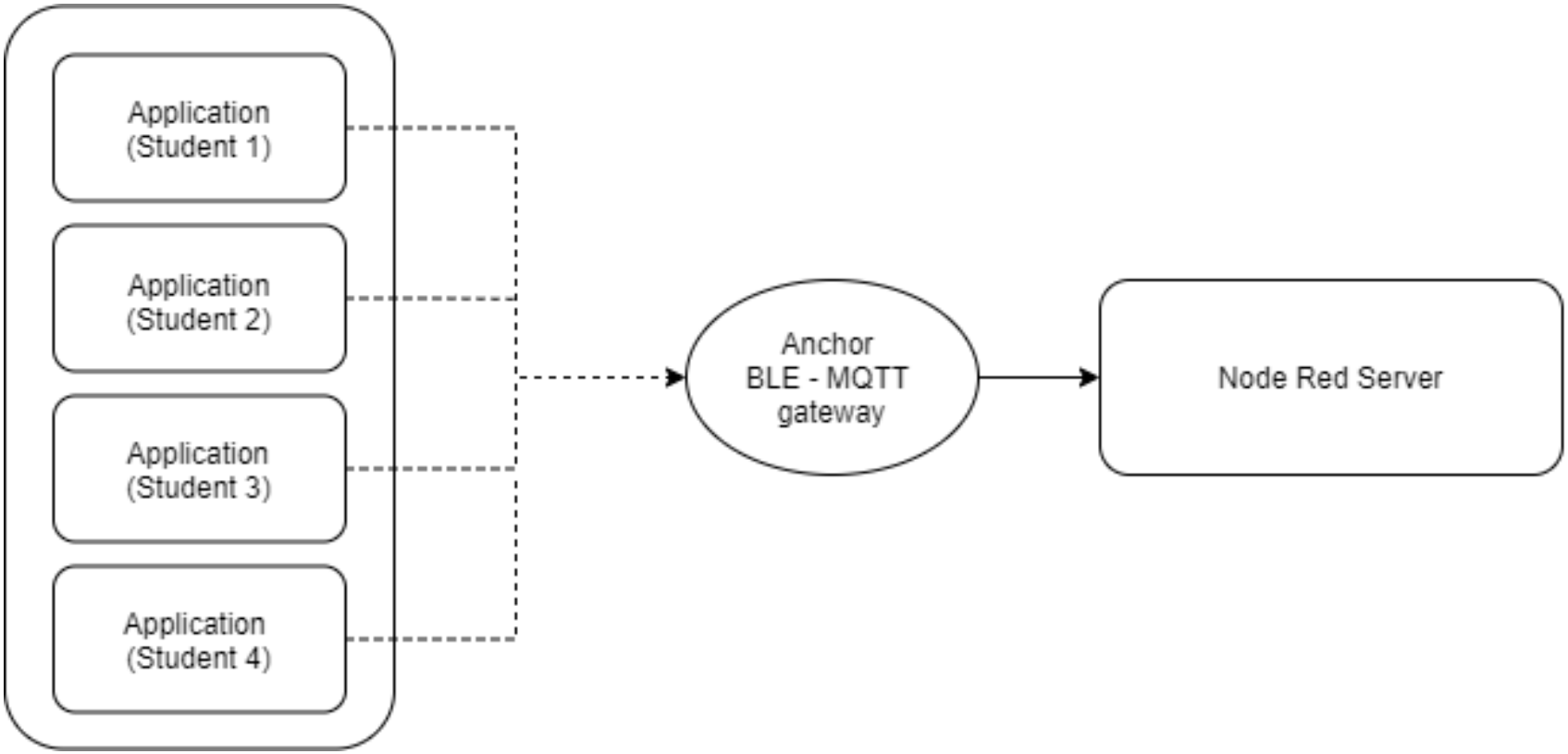


Figure: detailed flow

Proposed Design

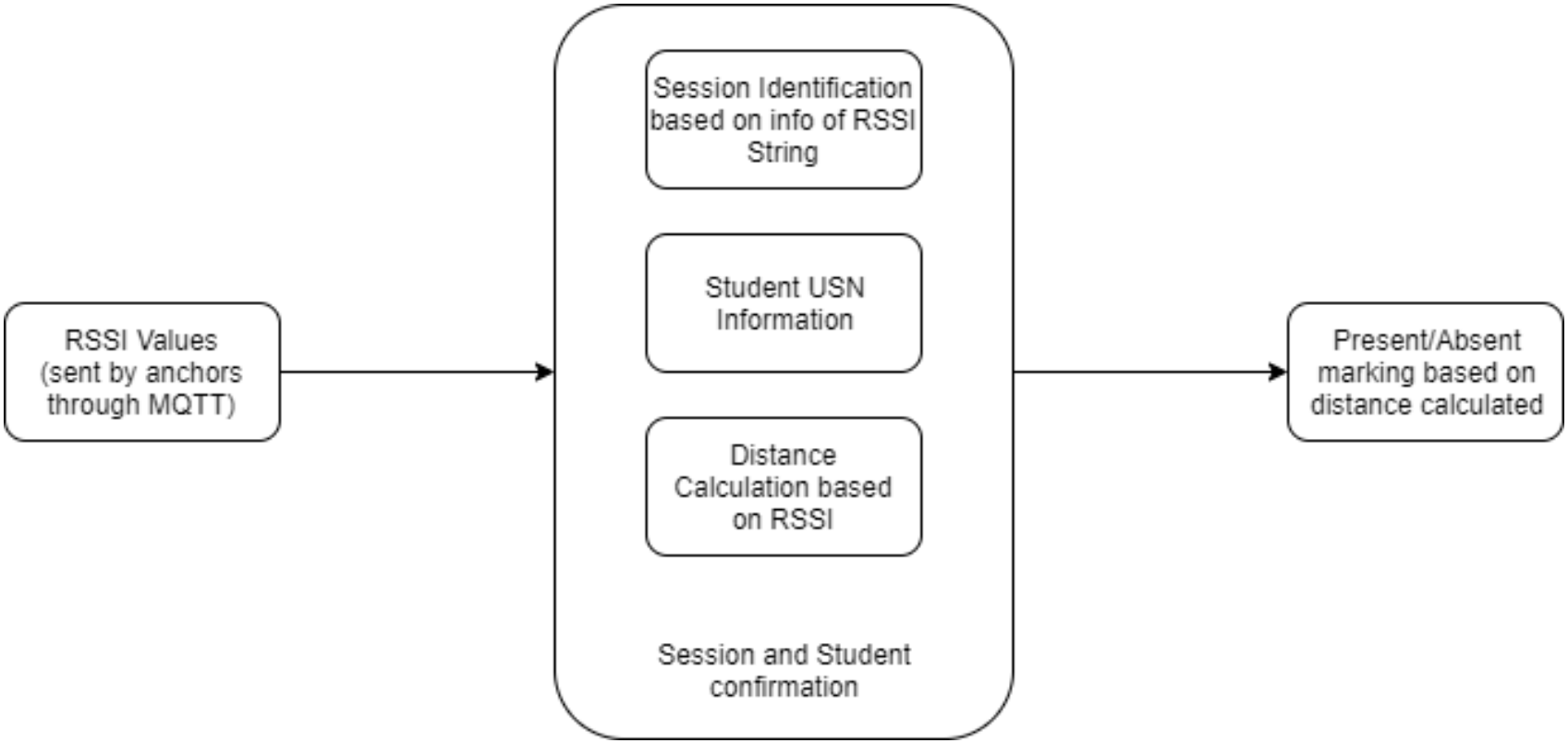
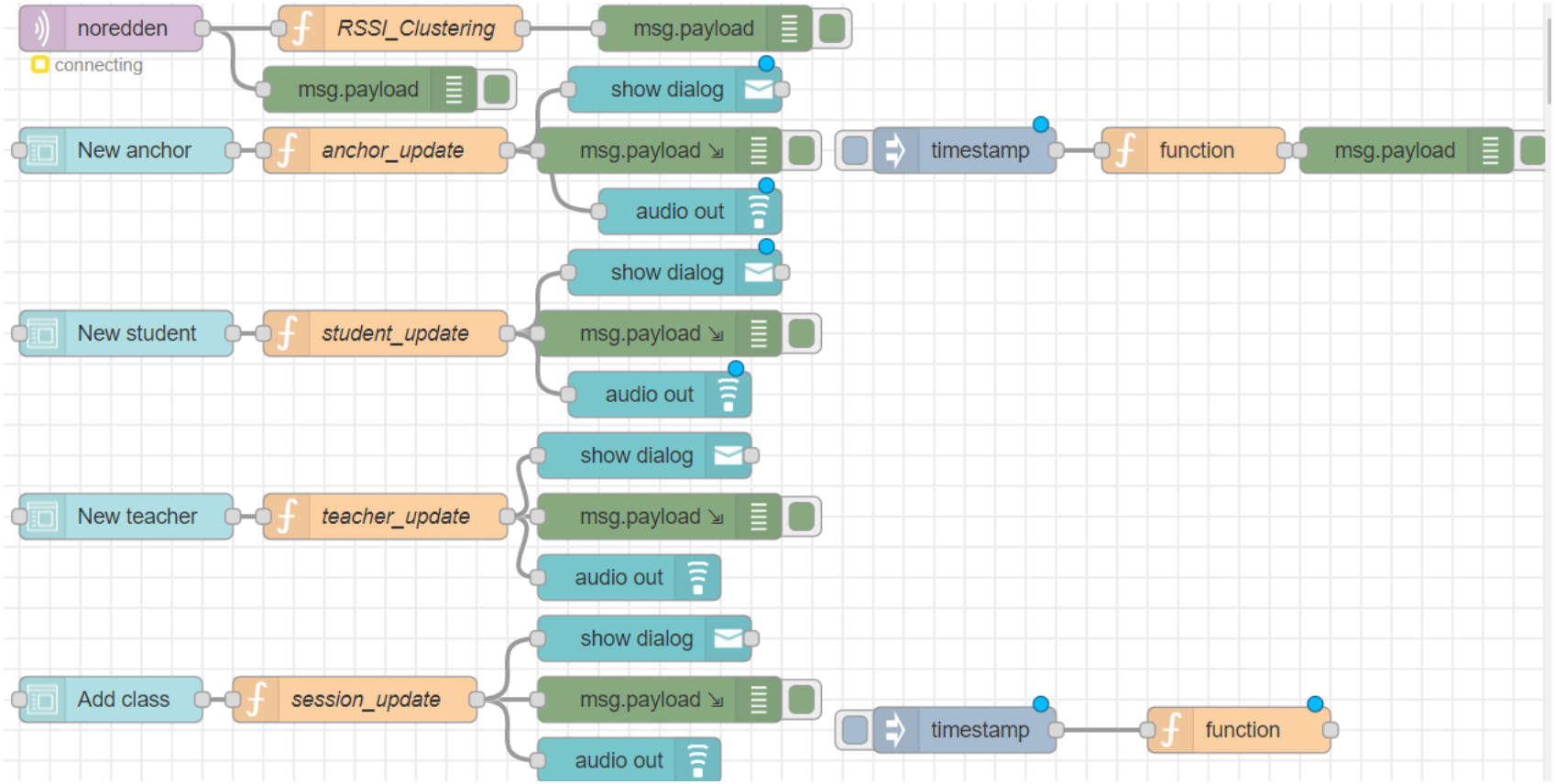


Figure: Node-red server Back end process

Node Red Flow



Algorithm

- Set a PC as a server.
- Configure the anchors to the server and the Wi-Fi network to send data to the server. Here we use MQTT based communication system.
- Program the beacon/tag(android device) with Eddystone protocol.(any third party app for the current purpose)
- Install the anchors inside the building appropriately to cover the entire area.
- Make sure the android devices are well within the signal detecting area and are transmitting BLE signals and are registered.
- The signals are received continuously by the anchors and the data packets are sent to the node-red server.
- Node-red is used to process the received data packets.
- Extract RSSI value,Anchor ID and the Beacon ID from the data packets and compute
- Mark the attendance of the student as required

Optimization

- Test the system in a complete **hardware devoid environment** except for smart phones. Simulating the hardware in an android environment was one of the optimisation features.
- **Optimising the code** was done by dialing down the robust indoor positioning algorithm to accommodate just one central anchor.
- Moving to **cloud based storage** from local storage options to increase accessibility and data-loss safety.

Results

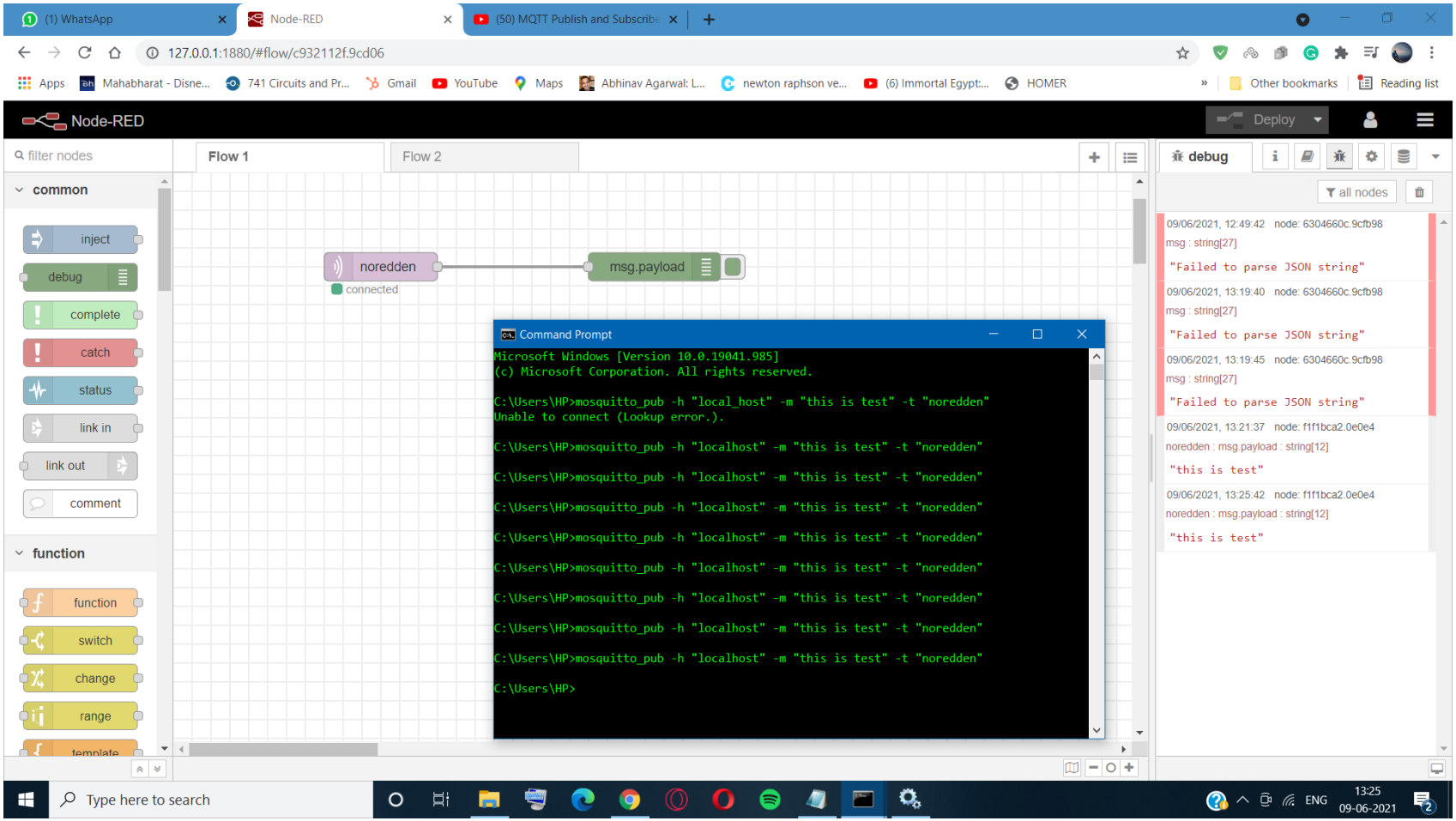


Figure: Results of MQTT testing

Results

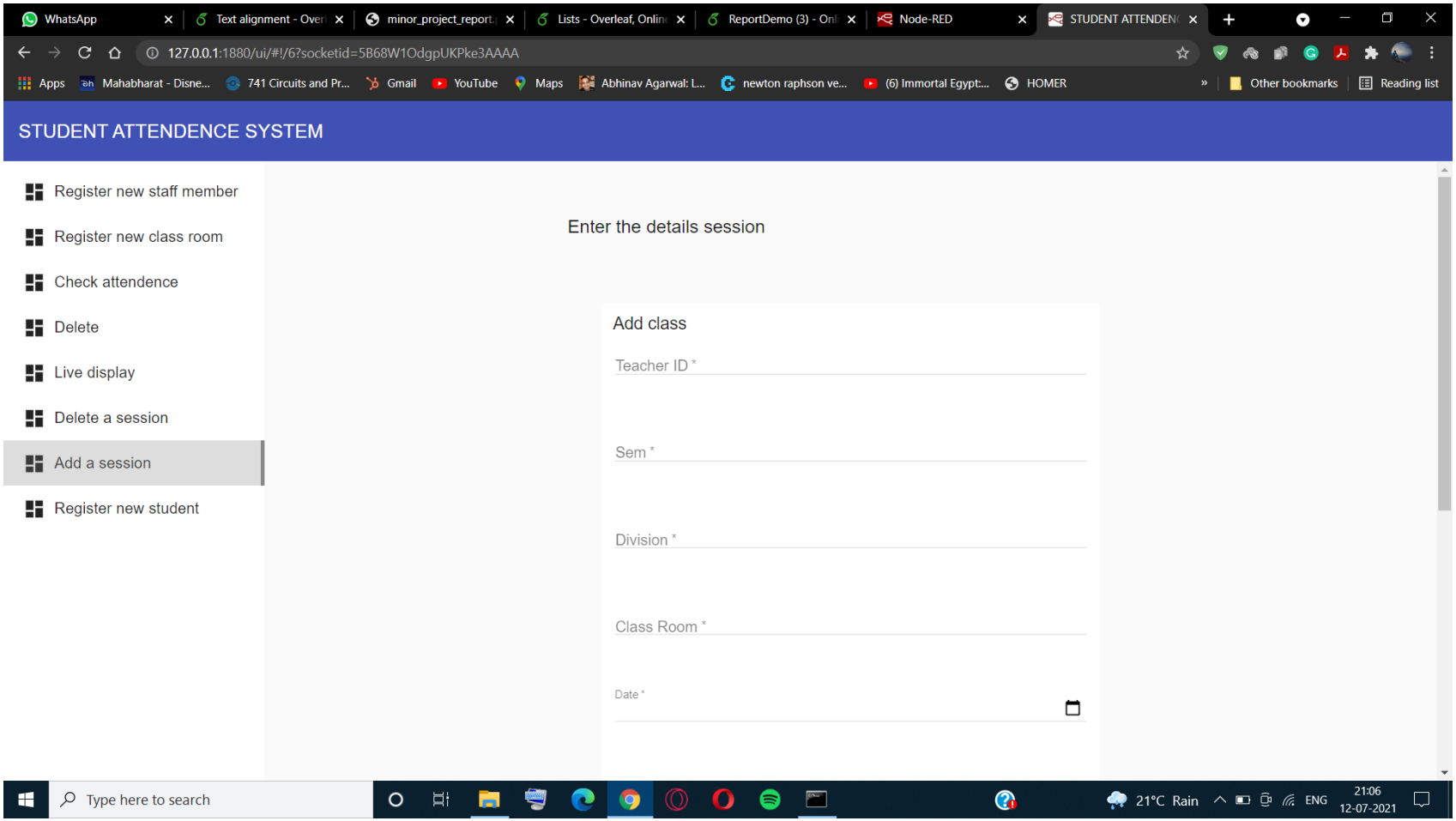


Figure: final UI

Results

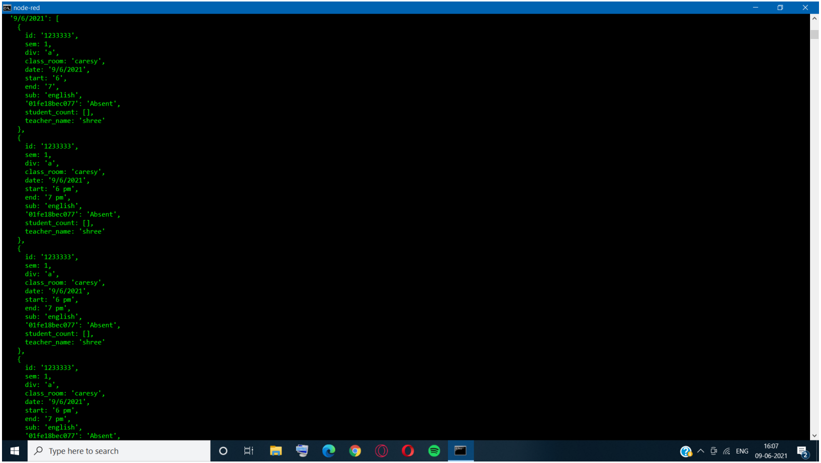


Figure: Results of the data entered from the command line

Results

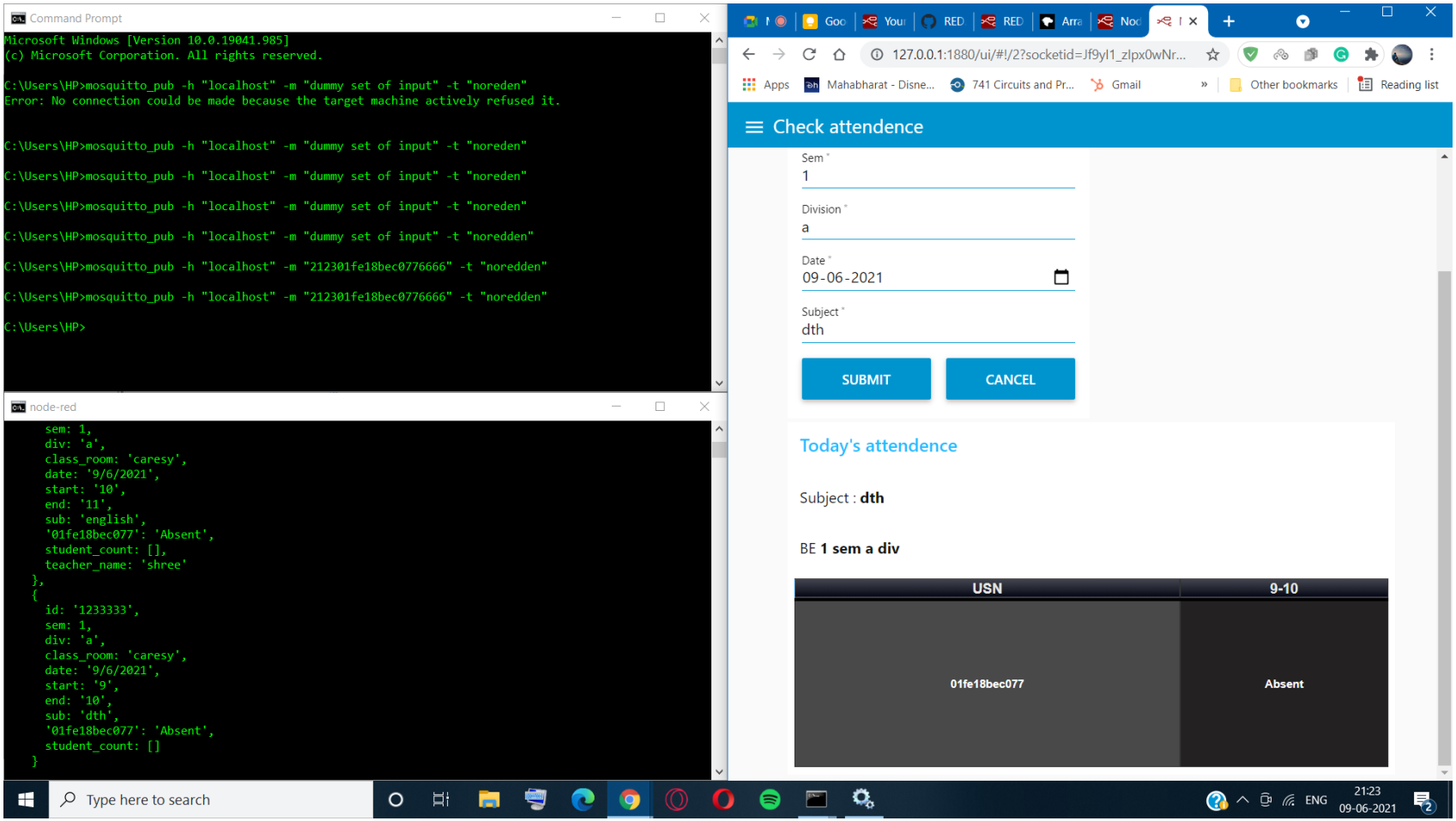


Figure: Attendance report of USN-01FE18BEC077

Discussion on results

Input description	**Expected output**	**Actual output**
Anchor Registration	Registration window must take anchor data (MAC id) correctly.	Works as per the expected output requirements
Beacon Registration.	A registration window will appear ask for beacon id for registration if the id is unique it confirms registration.	Works as per the expected output requirements
Individual Status	A window that serves as output describing when user has entered the room with the logged time and date	Works as per the expected output requirements

Conclusion

- Attendance monitoring system is modeled using android simulated hardware i.e.. anchor and the beacon.
- The system took signal inputs and based on that as it went through various blocks of the system such as anchors, node-red server for further processing.
- Date and Time of entry and exit of the student is logged, hence also marking the attendance of the system.

Future Scope

- This system is realised for the scenario of a school/college classroom. However this can be scaled across a campus. The development stages to scale the system to required specifications will be more of an on-site project.
- A central server to manage such an network can be developed.
- A secure, larger database can be built to store data of large no of students, making it fairly big data which can further open study into the analysis of big data and its applications.
- Adding features to the system and converting into a suite of application services suitable for different environments such as Schools, Colleges, Offices, Tech Parks can be a higher level IoT design worth investing resources into.

Thank-You