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"IoT-based Object Locating System"

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In the Name of Allāh, the Most Gracious, the Most Merciful

إهداء

إلى من نفضِّلها على أنفسنا، ولِمَ لا؛ فلقد ضحَّت من أجلنا

ولم تدَّخر جُهدًا في سبيل إسعادنا على الدَّوام

(أُمِّي الحبيبة).

نسير في دروب الحياة، ويبقى من يُسيطر على أذهاننا في كل مسلك يسلكه

صاحب الوجه الطيب، والأفعال الحسنة.

فلم يبخل علينّا طيلة حياته

(والدي العزيز).

إلى أصدقائنا، وجميع من وقفوا بجوارنا وساعدونا بكل ما يملكون، وفي أصعدة كثيرة

نقدِّم لكم هذا البحث، وأتمنَّى أن يحوز على رضاكم.

شكر وتقدير

بكل الحب والوفاء أحاول أن أفيكم حقكم بأرق الكلمات والمعاني لكن لن أستطيع أبدًا،

لكنني بهذه الكلمات وإن كانت بسيطة أريد أن أبلغكم شيئًا من شكري وامتناني.

نقدر لك الوقت الذي قضيتهِ في بذل المجهود الكبير من أجلنا،

ونؤكد لك أننا سنكون عند حسن ظنكِ

وأنكِ لن تشعري فيما بعد أن مجهوداتكِ قد ضاعت في المكان الخاطئ،

شكرًا جزيلًا على ما قدمتيه لنا من دعم.

Abstract

Our health is our life, so our system seeks to locate Quarantine patients and find out where people and children are to keep them safe and protect them from danger. So, if a patient touches out of the non-designated places, it shows that and prevents it to keep patients safe and prevent the spread of diseases, and this system makes it easier for mothers to worry and stress on their children and reduces the time to monitor them.

The system is based on placing reference points within the appropriate buildings or places and the target pieces are with the person and then the signal is processed, positioned, and displayed on the user's phone app. The system also triggers an audio alert in case the mother does not pay attention to the application or the person in charge of the medical centers for safety.

As for what the system does, it determines the exact location of people as time changes and gives an alert in case of danger, which is useful in the case of monitoring children and patients where it prevents the spread of the disease among patients and reduces the mother's concern for her children where she can do her work comfortably from through of this system and monitor them where it can allow the use of this system by all people.

Keywords: IoT, Locating, Internet OF Things, SystemEsp32.

الملخص

تكمن المشكلة التي يعالجها نظامنا في الحالة التي نحتاج فيها الى الوصول لشخص وتحديد موقعه وحالته، شخص داخل الحجر الصحي أو طفل داخل المنزل، كما انه وفي الوضع الراهن فان مريض الكورونا يتحرك بحرية خارج منطقة المسموح له بالتجول فيها داخل المشفى لذلك قمنا بتطوير نظام يعمل على تحديد مواقعهم واعطاء انذار في حال خروجهم عن المنطقة المحددة لهم.

وقد تم اعتماد تقنية الوأي فأي لتحديد المواقع وذلك لعدة أسباب منها كونها متوفرة داخل المباني. بحيث كل شخص يستطيع الاتصال بالشبكة. حيث انه يتم تحديد موقع الشخص حسب قوة الاشارة الصادرة من نقطة وصول الشخص التي تتحكم في مدى قربه أو بعده عن النقاط المرجعية وبعد معالجة المسافة وتحديد الموقع يعالج ويرسل الى سيرفر من ثم يخزن في الداتا بيز ومن بعدها يظهر على التطبيق المثبت على هاتف المستخدم سواء كان الطبيب المسؤول او الابوين.

وخلال تطبيق هذه التقنية فإننا نتحكم في حركة الأشخاص داخل الحجر الصحي او الأبنية وبالتالي عدم السماح لهم بالخروج من المنطقة المخصصة لهم. وأيضا الحفاظ على سلامة أطفالنا من الاقتراب من الأماكن الخطرة.

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Chapter 1

Introduction

1.1 Overview

This part of the report contains the motivations that motivated us to implement this idea, as well as the basic objectives to be implemented, and a simple description of the system and how it works.

1.2 Motivation and importance

Our health is our life so we always strive to preserve it. Recently, the Coronavirus has spread widely. Monitoring people who are trapped is our priority, but GPS is not able to accurately locate the people trapped inside the buildings, therefore, the system allows you to monitor people inside the quarantine, Anther target, are the children inside homes or malls, the system can keep track of them inside a specific region, and as a result, the system provides the health center the pleasure to protect people inside the quarantine, and parents to monitor their children from being lost or approaching dangerous regions.

1.3 Objectives

Our aim through this project is to ensure:

- Locating the people's position whether inside quarantine areas or children inside homes or malls.
- Generate helpful messages and information that will help the user to take care of their children.
- Data analysis of system outputs.

1.4 Problem statement

In this section, we're going to talk about Problem Analysis, a list of Requirements, Expected Results, and Definitions.

1.4.1 Problem analysis

Recently, the Coronavirus has spread widely. Monitoring people in quarantine has become one of our top priorities for maintaining our health and those around us. Because GPS is inadequate within facilities, we have encountered multiple problems, including the departure of people from their designated quarantine areas and their mixing with other people from the community, which

accelerates the spread of the virus. Also in public places, especially malls, mothers lose their children and waste a lot of time looking for them, which leads to the mother's fatigue and the child's fear because it is in a large place and far from its mother. Our homes have become large and have high elevations, which leads to a risk to the child's health if he is approached from an open place such as a balcony.

1.4.2 List of requirements

The system requirements can be summarized as:

1. The system must constantly update the location of the people inside the quarantine, children inside homes, or malls.
2. The system should give a warning if persons within the quarantine or children inside homes or malls leave their specific area or exceed the specified distance either from the controller or the holder's watch to warn them.

1.4.3 Expected results

Expect to build an integrated system with the following specifications:

1. The system should be able to locate people if they change at any time.
2. Give a warning to the controller, administrator, or the watch holder on the system's mobile application when someone leaves the area assigned to them.

1.5 Short description of the system

We place the reference points of the system in the appropriate places within the building, home, or malls and establish the target points with the people to follow them inside the building where this system works as follows:

The signal is sent from the target node inside the building to a reference node located in the user's watch inside the quarantine, homes, or malls. Then, the system will process the signal and determine the exact location inside the reference node and send it via Wi-Fi to the server. Then a new location is stored and displayed on the mobile application, as shown in Figure 1.1. The system also analyzes the stored location data, which gives it the ability to predict the monitored person's movements and predict the occurrence of something dangerous or wrong when the movement of the monitored person changes. The hardware scans the available networks and determines the location of the child through the signal strength and then locates the child and sends it to a server, then the user enters the range of danger and safety to him, then compares the signal strength

specified by the hardware and the values of the range entered by me and Thus, it gives the degree of risk or safety, and through this comparison, it is determined whether the voice call is called or loyalty and the number of cases is treated, such as the mother is busy or loyal, accordingly, the period for updating the location of the requested person is reduced or increased.

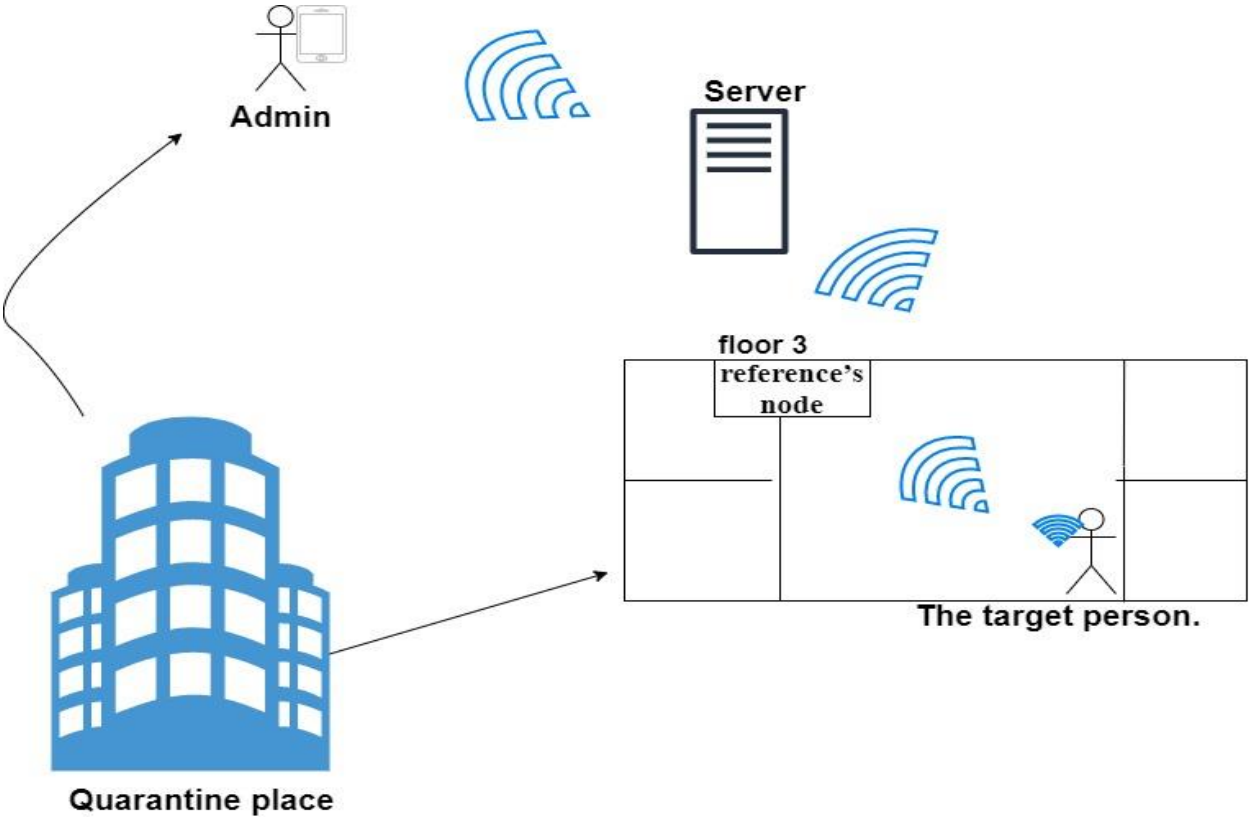


Figure 1.1: Communication diagram of IoT-based object locating system

1.6 Overview of the rest of the report

The rest of the report is organized as follows: Chapter 2 presents a theoretical background of the project a description of the hardware and software components is discussed in addition to the system specification and design constraints. Chapter 3 detailed design, block diagrams, flowcharts, Description of the software, Steps of the system, pseudo-code. Chapter 4 presents the description of the implementation, implementation challenges, and description of the method used to validate the system, validation results. Finally, chapter 5 contains a conclusion and future work. Then we have references, appendices.

Chapter 2

Theoretical background

2.1 Overview

This chapter introduces a theoretical background of the system, design options of the hardware and software components used in the system. Specifications of the design system and constraints are discussed too.

2.2 Theoretical background

This section introduces a theoretical background of the GPS and how it works.

2.2.1 GPS Background

GPS is the Global Positioning System, a satellite-based navigation system that provides location, velocity, and time synchronization. GPS technology transmits signals from each satellite to the receivers that locate them by calculating the difference between the time the signal is sent and when it is received. Timely information is placed in the icons transmitted by the satellite so that the future can constantly determine the time when the signal is transmitted. The signal contains data used by the receiver to calculate satellite locations and other necessary modifications for accurate positioning. The receiver uses the time difference between signal receiving time and broadcast time to calculate the distance, or range, from the receiver to the satellite. The recipient must consider the delays in the spread, or the low signal speed caused by the ionosphere and troposphere, physical obstructions such as mountains, buildings, trees, weather effects, and GPS jamming devices or spoofs. Thus, the receiver uses satellites to calculate latitude, longitude, altitude, and time [1] [2].

2.3 Literature review

In this section we will talk about some projects similar to the idea of our project summarized below:

1. **ZigBee-Based monitoring system for people with mental disabilities:**

   This work was done by Deema Herbawi, Sa'di Al-Tamimi, Luma Sharabati, and Yusra Al-Qaisi, in "2013". The main idea of this work was to build an indoor monitoring system based on a location determination. It was designed especially for hospitals and treatment centers. The system exploits ZigBee technology to enable patient monitoring. The location of each patient was determined using artificial neural networks measured from ZigBee transceivers attached to each patient. Results are displayed on a pre-uninstalled map and

are stored together in a secured database. The system was able to localize patients at room level in real-time with an accuracy of 97% [3].

2. **Object locator using RFID technology for blind people:**

   This work was done by Hiba Qasrawi, Yaman Awawdeh, in "2017". The main idea of this work was to locate objects using RFID technology. It is a practical method aimed to find lost things for blind people. The RFID technology works on the principle of sending electromagnetic waves from the reader to tags, this tag was attached to the objects that the blind person wanted to find. The design of the system depends on the raspberry pi that is used for processing and controlling the reader. The blind is informed by an audio response indicating that the object has been found. They have installed another raspberry pi-connected reader elsewhere to detect the object that has been placed outside the range of the first reader and the readers will communicate with each other [4].

3. **Marketing using mobile via Wi-Fi:**

   This work was done by Ayat Najjar, Dalal Baradeieh, Marwa Al-Muhtaseb, and Lubna Nairoukh, in "2012". The main idea of this work was to provide an application that makes shopping easier and smoother, by using a Wi-Fi localization system, where the location is determined by the network infrastructure. The location is based on the received signal strength (RSS) measured at Access Point (AP); RSS values are stored in the database on the server. The server accepts requests from clients, determines the location by matching the values in the database with new values due to the client's current location, then it will send back the suitable map which helps the shoppers reach the services they need [5].

In the following table 2.1, we'll present a simple comparison between the previous studies and the IoT-based Object Locating System:

Table 2.1: previous study VS IOT-based Object Locating System

Work	ZigBee-Based monitoring System	Object locator using RFID technology for blind people	Marketing using mobile via Wi-Fi	IoT based locating system
Idea	ZigBee-Based monitoring system for people with mental disabilities.	Object locator using RFID technology for blind people.	Marketing application by using a Wi-Fi localization system.	System to locate the people inside building by using Wi-Fi
Success	The system was able to localize patients at room level in real-time.	The system was able to help blind people to find their lost things using voice.	The system can provide a map to the shopper indicating the location of the object he searched for it.	The system was able to locate the people when the administrator searched for them. Get the alarm in the application when the fire happens.
Failure & Challenge	Extracting RSSI data wasn't as easy. localization engine CC2431 wasn't available, which forced them to build a system from scratch. Another limitation was in software, that it was unable to store any measured data or received packets.	They couldn't bring the Cottonwood RFID reader whose reading range is 6 m. dealing with new technology (RFID technology). Make an RFID network.	Challenges faced them: How to navigate between floors in the market, how to place the access points on floors, surveying and power level measurement, And Errors and interference between zones.	The problem of the difference in the value of the RSSI, which can be considered within the danger, normal, or security zone, according to different places and circumstances and the appearance of. Choosing an appropriate method for data analysis to suit the nature of the data
Accuracy	97%	95%	95%	90%

When reviewing the weaknesses of the frameworks mentioned above, we suggest an "IOT-based Object Locating System" where the system can locate humans (e.g., people in quarantine areas, children in homes or malls, etc.) inside buildings. where the system differs from the first and second work, in that it uses Wi-Fi positioning technology when the first work uses artificial neural networks measured from ZigBee positioning transceivers and the second work locates objects using RFID technology on the principle of sending electromagnetic waves from the reader to the tags. As for the third project, it intersects significantly with our project as it uses the internet technology to locate the user, but the main difference between the two projects is the goal of determining the location where their project aims to locate the user to provide him with a road map to the service or commodity he searched for.

2.4 Design options

To make the proposed system we need an ESP32 (for human use) to locate people inside the building and we need a Server and Database to store data also and we need an ESP32 as a reference node, and API will be used to control access to hardware devices and software functions, and power supply to feed the system and run it, and mobile application for the user interface.
Localization techniques can be categorized into different families depending on several factors that include: technology (ZigBee, RFID, Wi-Fi or Bluetooth), algorithm (Trilateration, Triangulation, Fingerprinting), or even the physical quantity that varies with the position (Radiofrequency waves, Photonic energy, Sonic waves, Mechanical energy (inertial or contact)) [6].

The following tables show the different design options for the main components, we'll present in Table 2.2 the reference node options, in Table 2.3 we'll present the target node options, and in Table 2.4, Table 2.5, and Table 2.6 we'll present the sensors and software options:

Table 2.2: Reference node options

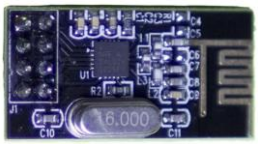
Specifications:	**Reference node options**		**Analyses:**
	nRF24L01 Wireless Modules 	ESP32 NodeMCU 	**We, Will, choose the ESP32 NodeMCU because:** ● **It has multiple features so that it receives signals and redirects them.** ● **Also has a special Internet that can be used and many features attached to the table.**
Performance	Normal microprocessor, high performance	microcontroller unit, high performance, powerful Wi-Fi Module	
PIN	4 pins	36 pins	
Cost	Low	Low	
Memory	Max 8Mbps	448 KB ROM 520 KB SRAM 16 KB SRAM in RTC QSPI supports multiple flash/SRAM chips	
Supports antenna diversity	No	Yes	

Table 2.3: Target node options

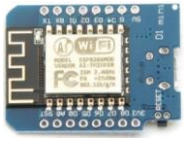
Specifications:	Target node options		Analyses:
	Mini node MCU 	ESP32 NodeMCU 	**We will choose ESP32 Node MCU because:** ● **It has a suitable size and is available in markets abundantly.** ● **And is suitable for carrying with the person to be followed and also for the features attached to the table.**
Pin Number	16 pins	36 pins	
Cost	Low	Low	
Weight	8.26 g	10g	
Size	Smallest	Small	

Table 2.4: Temperature and humidity sensor

Specifications:	Target node options		Analyses:
	SHT31-D 	DHT11 	● **We chose the digital and explains this, MongoDB Logins Because it is also available in the Palestinian market because of the properties mentioned in the table**
Operating Voltage	2.4 to 5.5V	3.5V to 5.5V	
Cost	Low	Low	
Operating temperature range	-40° to 125°C	0°C to 50°C	
Output	voltage output	Serial data	

Table 2.5: Software options

Specifications:	Software options		Analysis:
	Arduino IDE 	KEIL Software 	**We chose Arduino IDE because:** ● **Easy to edit and debug the code to be uploaded on the microcontrollers.** ● **It has all the libraries and tools specialized to program it.**
Open-source	✓	✓	
Easy to use	✓	✓	
Suitable to be used	✓	✗	

Table 2.6: Gas sensor

Specifications:	Target node options		Analyses:
	Smoke detectors	**MQ2** 	**We chose mq2 because:** **It has low cost and it is also available in the Palestinian market.**
Operating Voltage	12-24 V	+5V	
Cost	High	Low	
Preheat duration	30-60 second	20 seconds	
Can be used as a digital or analog sensor?	Yes	YES	

2.5 Design constraints

1. Bad internet connection in some areas, where internet speed changes and network loads increase and signal strength values are affected in all regions.
2. The battery should be fully charged at all times in case of any emergencies so that the user needs to replace the batteries with a new one from time to time.
3. The need for [system hardware] at each point of work, so we will just consider two operating points as a prototype.

Chapter 3

System design

3.1 Overview

During this Chapter, the detailed system description, how it is determined for the location of the person, the features of the selected pieces, the platforms used for programming, and the Schematic diagram, which shows how to send and receive data and signals, are all introduced.

3.2 Detailed conceptual description

Technology has been used in the RSSI "Received Signal Strength Indicator is meant by the strength of the signal received from wireless. It symbolizes the received energy level by receiving radio waves after the loss of power in the cables, Therefore, the higher its value, the greater the signal strength in negative because it symbolizes loss, the energy you will receive is the same as you will lose It is negative because it symbolizes a loss of energy from the cable or antenna", which means a measurement of how well your device can hear a signal from an access point or router. It's a value that is useful for determining if you have enough signal to get a good wireless connection.

RSSI is a term used to measure the relative quality of a received signal to a client device but has no absolute value. The IEEE 802.11 standard specifies that RSSI can be on a scale of 0 to -120dBm, but you can infer that the higher the RSSI value is, the better the signal is. The user determines the range of the signal according to the location he has.

The signal is sent from the target node to the reference node and this signal is processed within the reference node and then the location of the target is determined and stored in the server, the results are then displayed in the mobile application, shown in Figure 3.1.

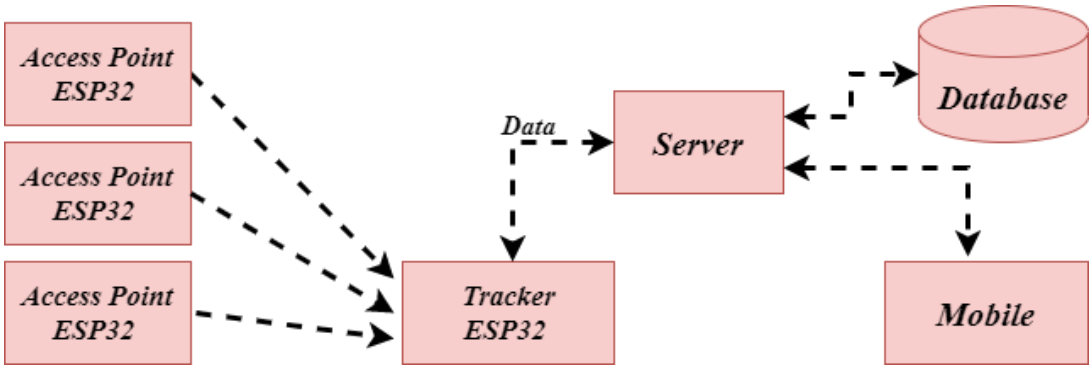


Figure 3.1: Block diagram of IoT-based object locating system

This is a simple diagram of the system so that the ESP32 NodeMCU is installed inside the building, and also having with everyone inside the quarantine or children inside homes or molls Wi-Fi module (ESP32 NodeMCU), the Wi-Fi signals sent to the Target node from the Reference's node, The data is processed and the target location is determined, then stores the location in the server, then displays the data on a mobile application thus appear precise to the administrator or mothers. And the data displayed on the application continuously changes according to the movement of the person on the reality continuously that is shown in Figure 3.2.

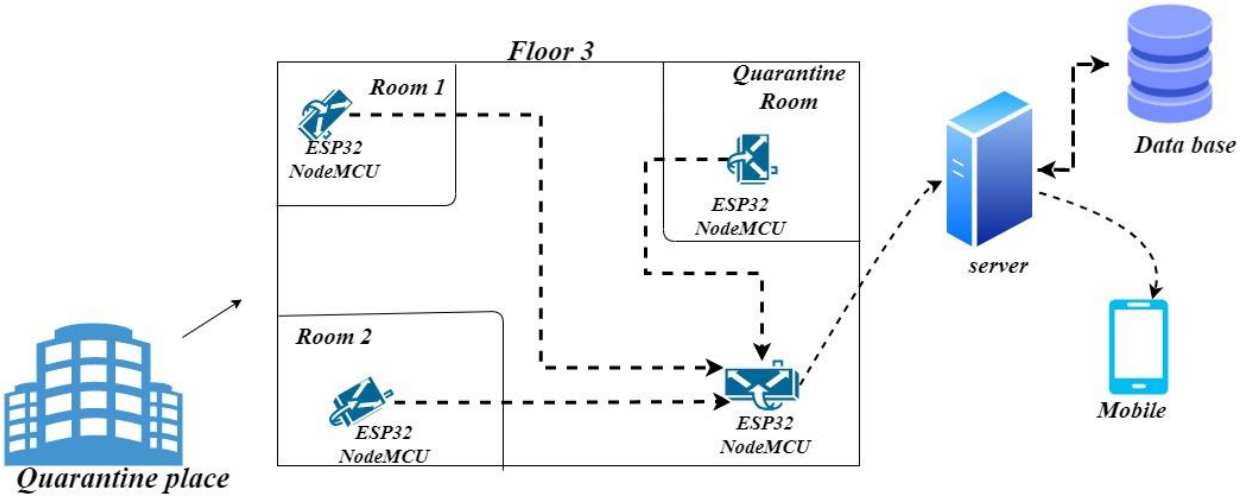


Figure 3.2: Conceptual description diagram of IoT-based object locating system

3.3 Detailed design

In this section, we will talk about Hardware components and Software components be used in our project that summarized below:

3.3.1 Hardware components

1. NodeMCU. We will choose ESP32, specifications for this:

   ESP32 is a low-cost, low-power system on a chip (SoC) series with Wi-Fi & dual-mode Bluetooth capabilities! Main processor: Tensilica Xtensa 32-bit LX6 microprocessor, Clock frequency: up to 240 MHz, Performance: up to 600 DMIPS, Wireless connectivity: Wi-Fi: 802.11 b/g/n/e/i (802.11n @ 2.4 GHz up to 150 Mbit/s)

Memory:

- Internal memory:
  - ROM: 448 KiB: For booting and core functions.
  - SRAM: 520 KiB: For data and instruction.
  - RTC fast SRAM: 8 KiB: For data storage and main CPU during RTC Boot from the deep-sleep mode.
  - RTC slow SRAM: 8 KiB: For co-processor accessing during the deep-sleep mode.
  - eFuse: 1 Kibitz: Of which 256 bits are used for the system (MAC address and chip configuration) and the remaining 768 bits are reserved for customer applications, including Flash-Encryption and Chip-ID.
  - Embedded flash: Flash is connected internally via IO16, IO17, SD_CMD, SD_CLK, SD_DATA_0, and SD_DATA_1 on ESP32-D2WD and ESP32-PICO-D4.

ESP32 NodeMCU, [7]

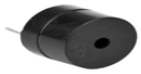
2. Power Supply:

We will use a power range of 5V, for NodeMCU ESP32 as a power bank.

3. Buzzer:

Is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric Typical uses of buzzers include alarm devices, timers When the system detects the fire, a warning will be issued?

First design option: active buzzer; This buzzer is an active buzzer, which, pseudo-code, will buzz at a predefined frequency (2300 ±300 Hz) on its own even when you just apply steady DC power.



Active buzzer,[8]

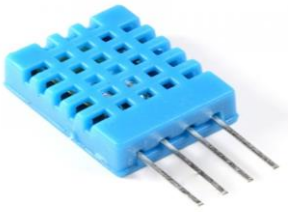
4. MQ2 Gas Sensor:

Operating Voltage is +5V, can be used to measure or detect LPG, Alcohol, Propane, Hydrogen, CO, explained and even methane, Analog output voltage: 0V to 5V, Digital Output Voltage: 0V or 5V (TTL Logic), Preheat duration 20 seconds, can be used as a digital or analog sensor, The Sensitivity of Digital pin can be varied using the potentiometer.

Mq2 gas sensor,[9]

5. DHT11–Temperature and Humidity Sensor:

Operating Voltage: 3.5V to 5.5V, Operating current: 0.3mA (measuring) 60uA (standby), Output: Serial data, Temperature Range: 0°C to 50°C, Humidity Range: 20% to 90%, Resolution: Temperature and Humidity both are 16-bit, Accuracy: ±1°C and ±1%.



DH11 sensor.[10]

3.3.2 Software components

1. The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions, and a series of menus. It connects to the Arduino and Genuine hardware to upload programs and communicate with them.

Arduino IDE logo, [11]

2. We have used VS Code to program the backend and app/frontend. We also used Ionic/HTML/CSS/Typescript and MongoDB to work databases. We also used Heroku to build and run full applications in the cloud. We used Nodejs/Expressjs/js to build applications.

3.4 Schematic diagram

In this simple diagram Figure 3.3, we show how to connect the sensors with the tracker, and then connect the tracker and the Access Point via Wi-Fi in one room.

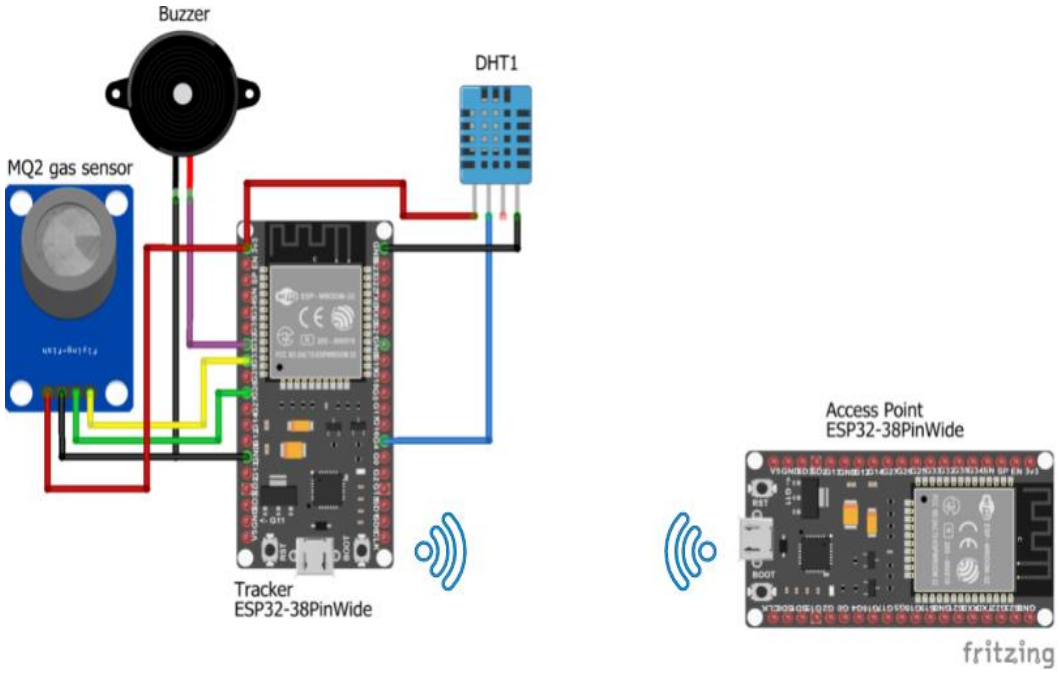


Figure 3.3: Schematic diagram of IoT-based object locating system

3.5 Software

In this section, there is a description of the software, the steps of the system, pseudo-code, Technology used, and flowcharts.

3.5.1 Description of the software

A people inside the quarantine, children inside homes, or malls locating system, where children are provided with a piece that broadcasts a Wi-Fi signal and there is a piece on the danger extinguisher that select this signal and according to the signal strength that is located for the child or the body to be tracked his movement is warned the parents of the child or the body responsible for locating where this signal is tracked through a mobile application can track the body to be tracked remotely and easily.

3.5.2 Steps of the system

- Create a user in Database
- Add children to be monitored for the created user.
- Putting a movement monitoring piece in the place of danger and operating it to receive the signal and send it to the server.
- Putting the piece with the child whose movement is to be monitored.
- The piece that monitors the movement monitors the signal strength of the child whose movement is to be tracked and raises it to the server every 20 seconds in addition to sensors to measure temperature and humidity and detect the fire and then upload it to the server
- The server stores the data coming from the tracking pieces for use by the mobile application.
- Log in to the application to monitor the child's movement, temperature, humidity, and fires with your username and password
- Watching the child's condition, temperature, and humidity, and checking whether there is a fire or not.

3.5.3 Pseudocode

1. Collect the readings from ESP32 to the server.
    a. Get the user's children.
    b. Scan for the around networks.
    c. If the detected networks contain children, send the data to the server to store it.
    d. Analysis of the data by calculating the standard deviation for RSSI values for the children.
    e. If the standard deviation is explained in his digital less than 2.7 then the server will take a rest and send data with a longer time.
    f. Get the temperature, humidity, and if there is a fire or not.
    g. Send this data to the server.
    h. Calculate the standard deviation
2. Store the values that come from the ESP32.
    a. Accept post requests contain the data to store it in MongoDB.
    b. Accept the request to fetch the data for a child.
3. Display the information on the mobile app.
    a. Log in to the app.
    b. Select the user’s child to monitor his state.

3.5.4 Technology used

Used a lot of technology to achieve goals shown in table 3.1:

Table 3.1: Technology Used

Purpose	Technology
ESP32 Major and minor	C/C++/Arduino
Backend	Nodejs/Expressjs/js
Serve hosting	Heroku
Database	MongoDB
Hosting the database	MongoDB Atlas Database
app/frontend	Ionic/HTML/CSS/Typescript

3.6 Flow Chart

The following Flow Chart explains how to locate a person inside the quarantine or child inside home or moll, and how to know who's out of his designated area or not. shown in Figure 3.4.

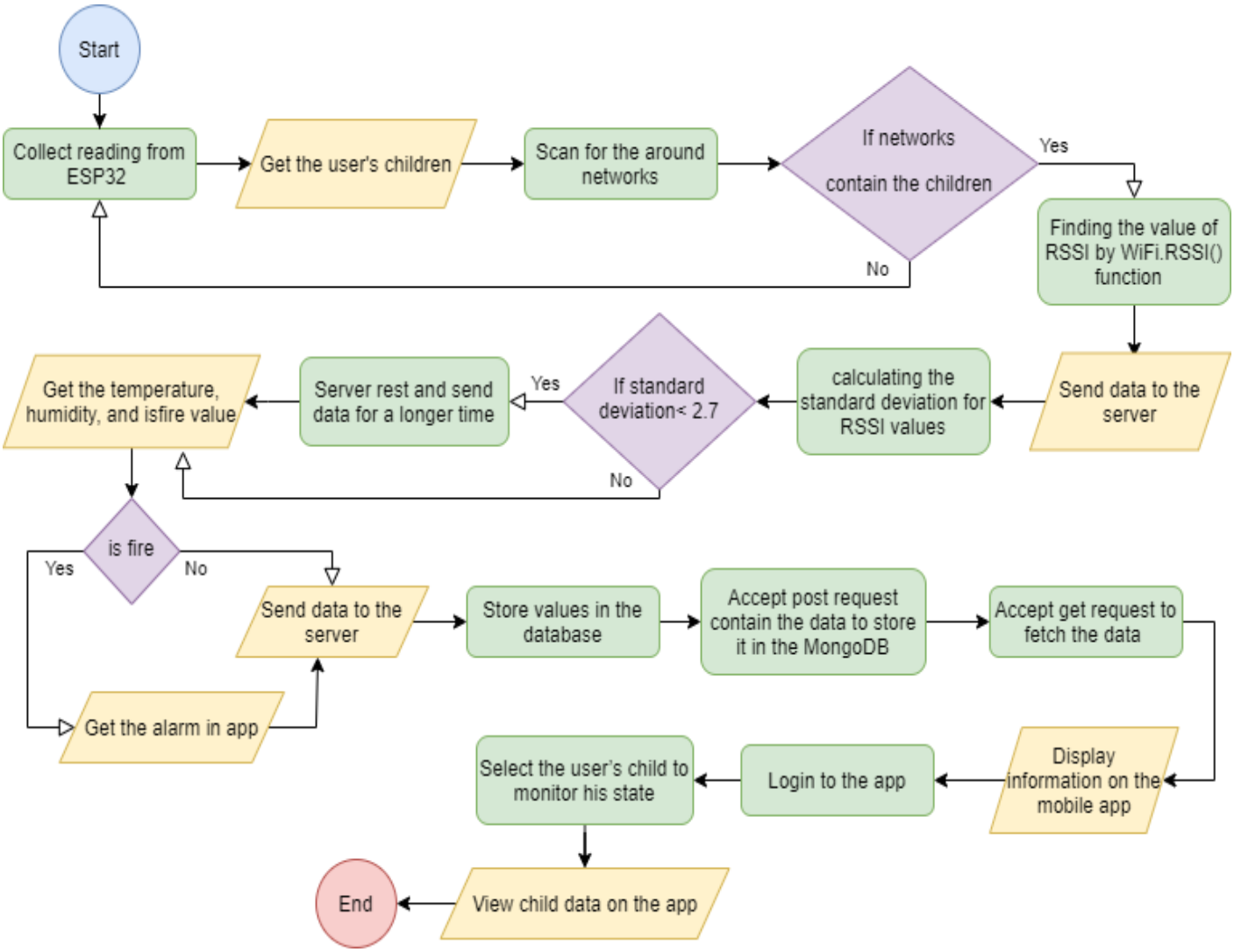


Figure 3.4: flow chart to IoT-based Object Locating System

Chapter 4

System implementation, system testing, and discussion

4.1 Overview

This chapter introduces a Description of the implementation, implementation issues, implementation challenges, description of the method used to validate the system, validation results include an analysis and discussion about the result, and Recommendations based on the result.

4.2 Description of the implementation

- The user is registered with the database in addition to his children to be monitored so that the system recognizes the children and the user.
- Through the API registry for the user and then the registry for the children of this user using the API assets in the postman
- Configure the main ESP32 settings to send information to the specified user and install it on the site to be monitored (door, window: ... etc.)
- By adding the user ID in the request sent from the ESP32
- Set the ESP32 sub-settings for each child and put them with them.
- The master ESP32 scans the surrounding networks and checks the network if it is for one of the children to be monitored or not.
- As the ESP32 in the first run sends a requisite to fetch the children to the user and stores them for the scan process
- If the network is for a child to be monitored, the main ESP32 checks the signal strength if it differs from its old value. If it differs, the old value of the signal strength is renewed to the new value and a request is uploaded to the server to store the new value, but if it is the same old value, it is not uploaded to the server.
- Data analysis is done for the RSSI values so that the standard deviation is calculated. If its value is greater than 2.7- where this value was obtained by experimental work and repeat the calculation -, the pieces send the data to the server for longer periods so that the system takes a break, otherwise, it returns to the normal situation.
- Check temperature, humidity, and the presence of fire

- The server stores the signal strength values for each child of the user and sorts them by date so that the application can display the last reading of the values, and stores temperature, humidity, and fire.
- Log in with your username and password in the app
- Via a special login API
- After logging in successfully to the application, the user will be shown the temperature, humidity, and the status of a fire with a message of danger if there is a fire and the children to be monitored, in addition to the settings through which the child's condition is determined (danger, normal, safety) and the logout button.
- When a child is clicked on the home page, the child's status, signal strength, and location are displayed (which is required). We used static data analysis to conclude some cases like:
- When the child is sleeping (13:00 to 15:00 and 20:00 to 8:00).
- When the child is out (When the RSSI is small or there is no signal from this child).

4.3 Implementation issues and challenges

1. Determining the location of the child and his proximity to danger: We solved it by examining the strength of the signal. The area from which a stronger signal comes, the child is closer to it.
2. The number of requests emitted from the main ESP32 is large: we solve it by storing the old values of the signal strength and every time the old values are checked if there is a change if it happens, the stored values are updated and the new values are uploaded to the server, otherwise the request is not made because the stored data is the same.
3. The problem of the difference in the value of the RSSI, which can be considered within the dangerous, normal, relieves the parents' stress and anxiety it's inns or security area in different places and circumstances and its inns, MongoDB clearance. We solved it by controlling these values through the setting button in the application, through which the user can specify the danger range, the normal situation, and safety and change it with the change of the region and conditions
4. Choosing a suitable method for the data analysis to suit the nature of the data, we solved it by using the standard deviation.

4.6 Validation result

4.6.1 Analysis and discussion about the result and testing

- Hardware testing: firstly, we tested the Tracker Node with a buzzer and connected it directly with the power bank as shown in figure 4.1, and in figure 4.2 we tested the access Point Node.

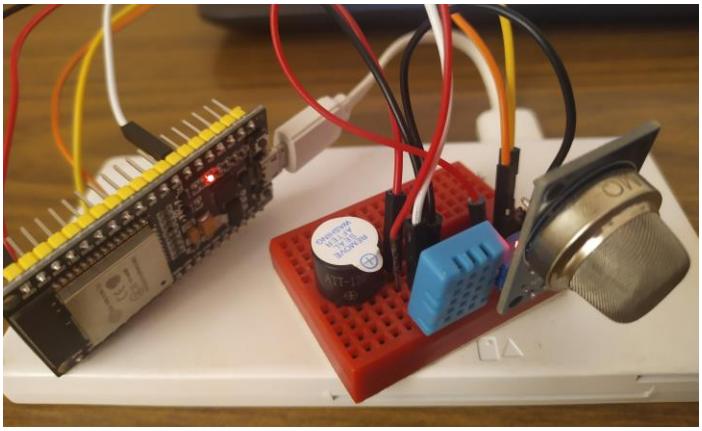


Figure 4.1: Tracker NodeMCU ESP32

Figure 4.2: Access Point NodeMCU ESP32

The data is stored in the Database in the fields shown in the following figures on the Atlas Mongo dB website:

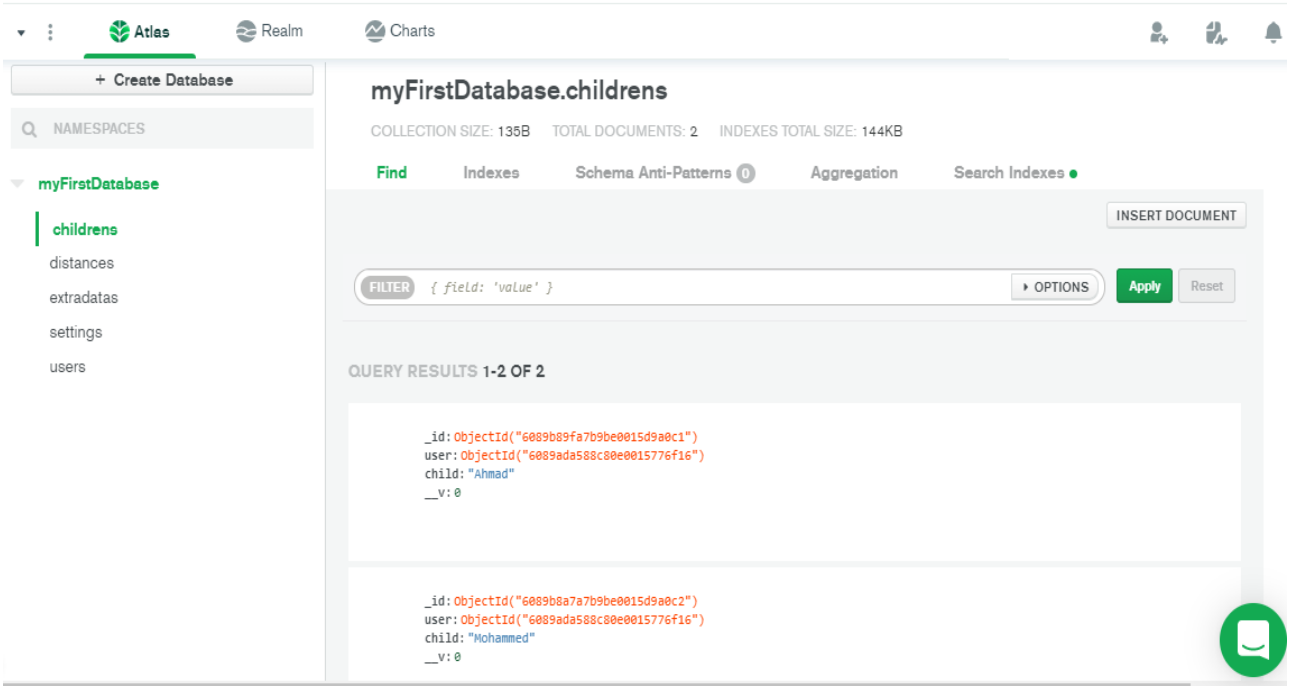


Figure 4.3: Children Query

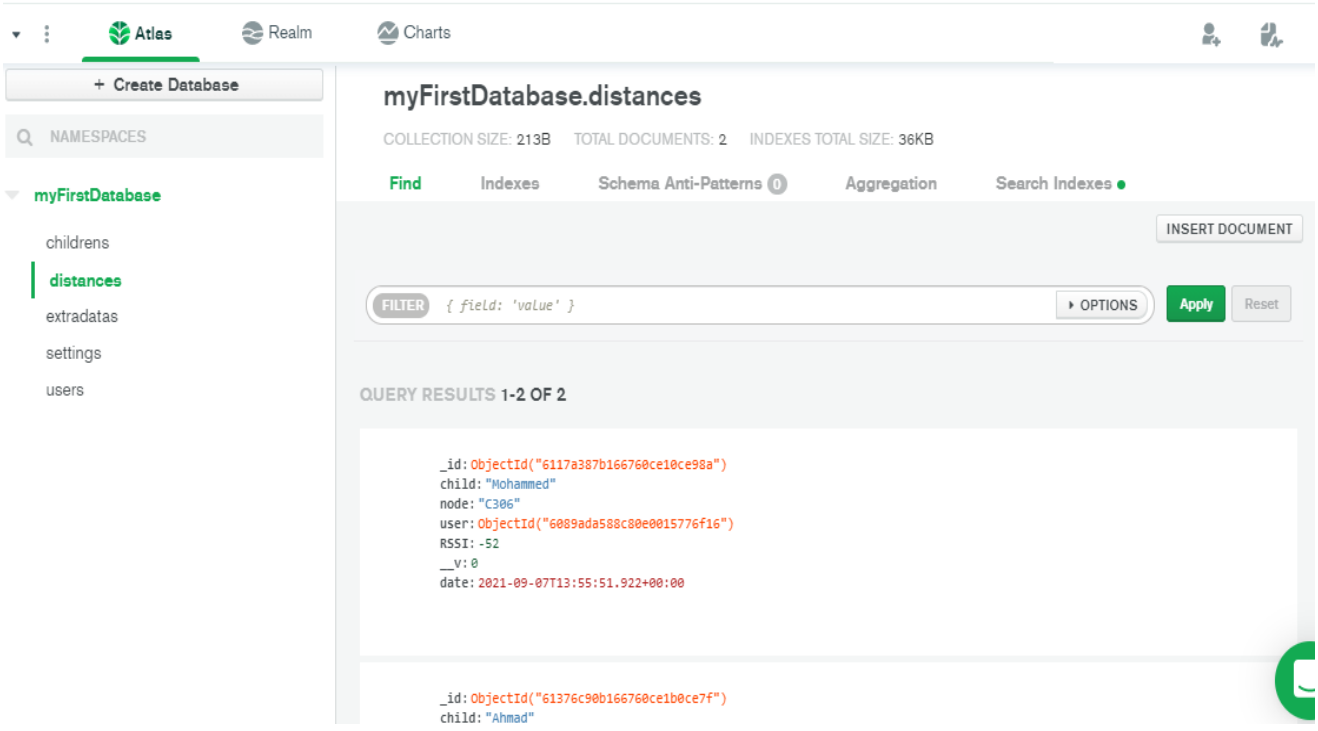


Figure 4.4: Distances Query

Figure 4.5: ExtraDatas Query

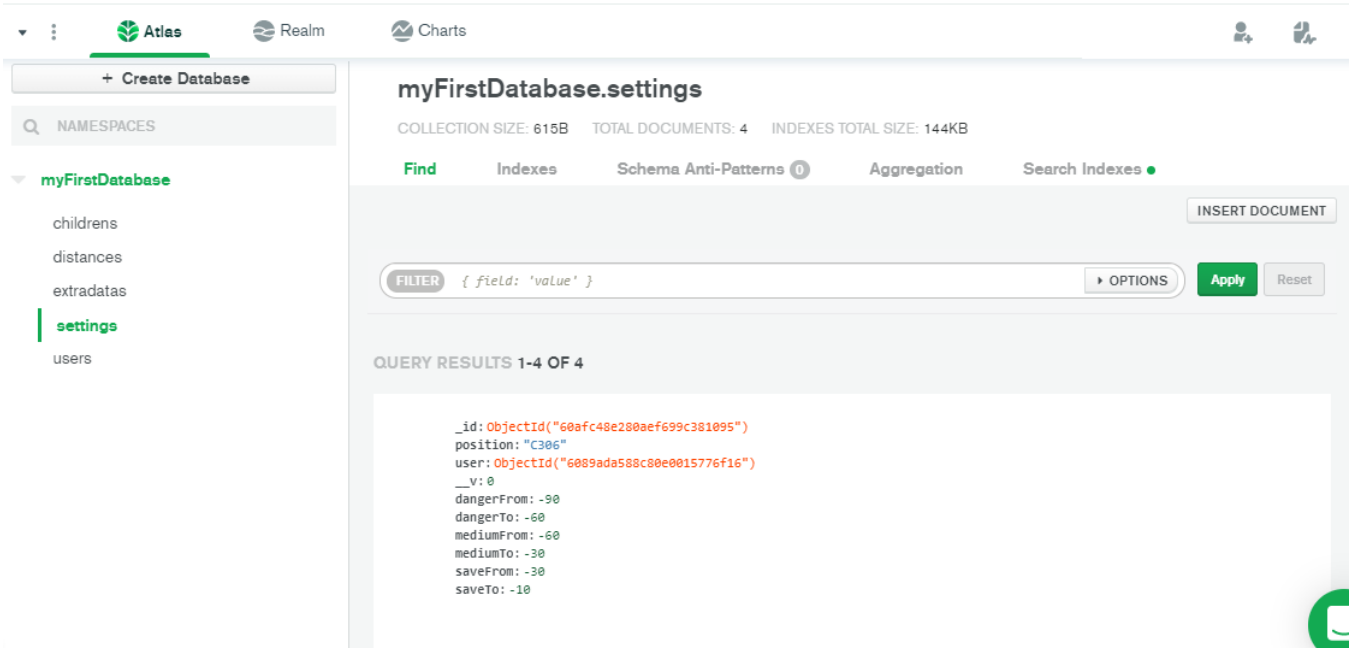


Figure 4.6: Setting Query

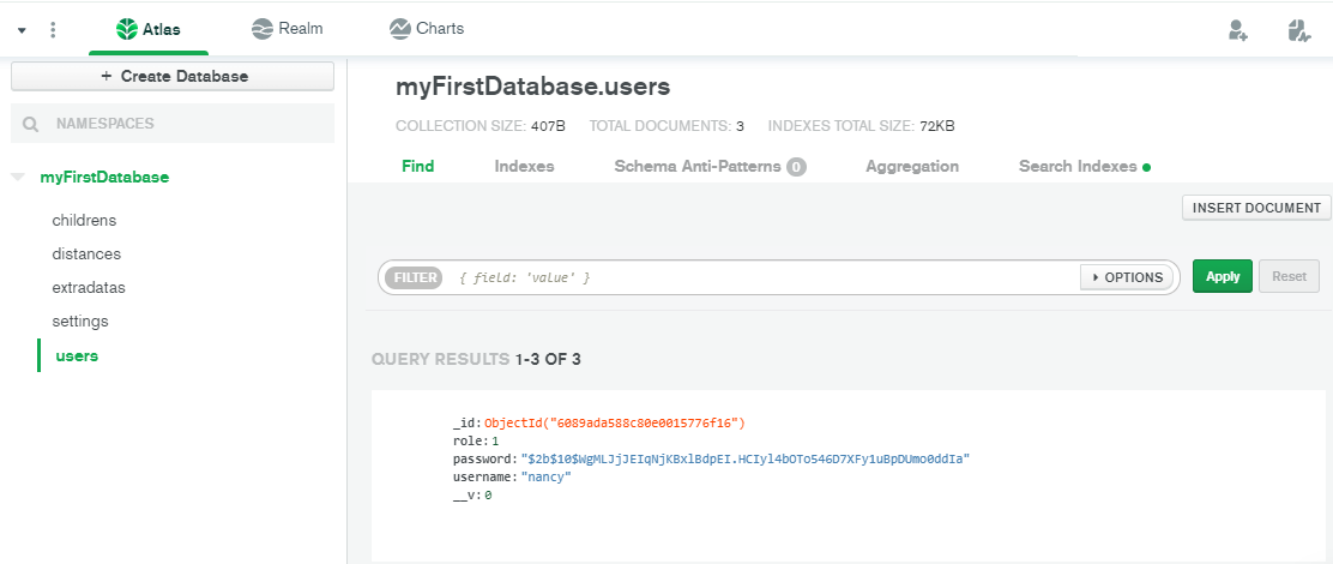


Figure 4.7: Users Query

- Software testing: In figure 4.8, shows you the login interface of the system, where each user ID and password, and are given permission depending on the type of ID.

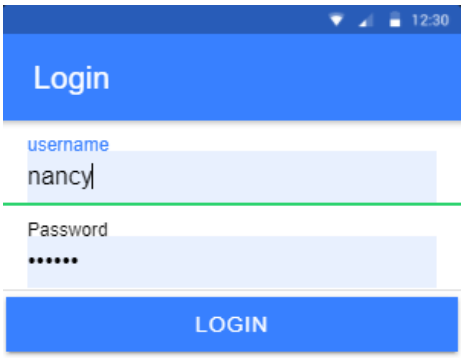


Figure 4.8: login interface

In figure 4.9, the user can choose the status by the selection, in which the duration of the request to update the values coming from the Hardware is changed.

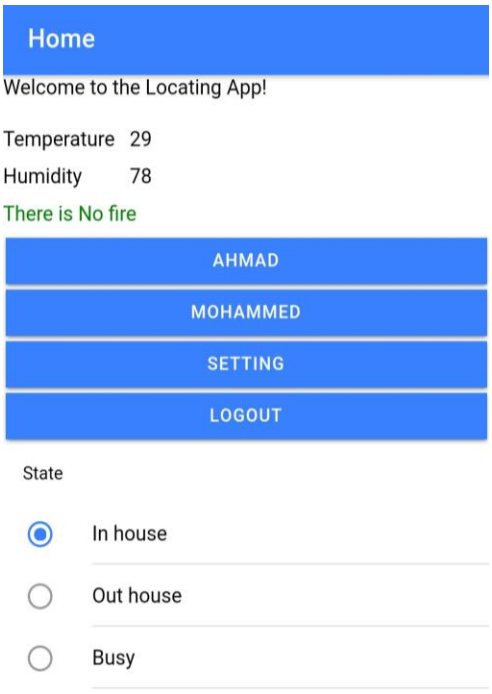


Figure 4.9: User interface

In figure 4.10, The user sees a warning on the screen in case of a fire in home page.

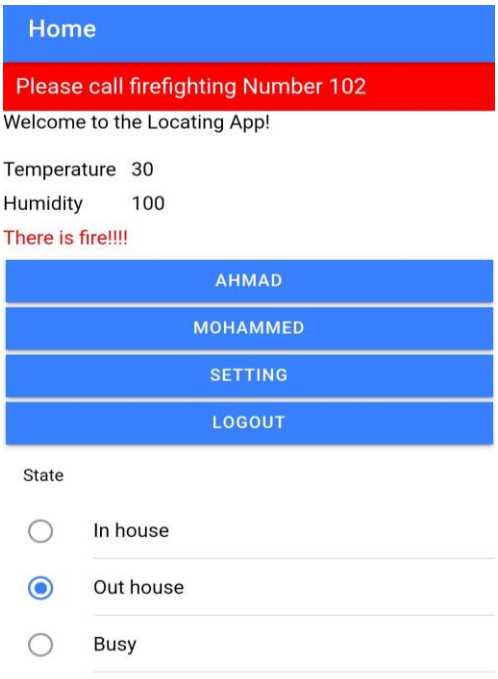


Figure 4.10: User interface with fire

In figure 4.11, it shows how the user enters the extent of danger and safety.

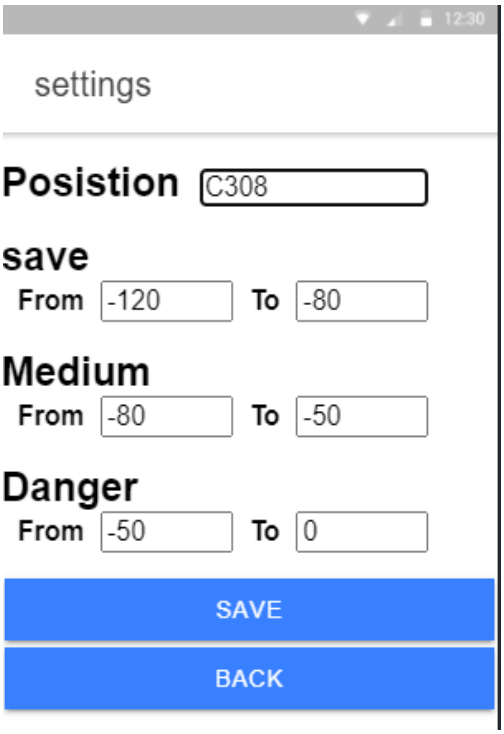


Figure 4.11: Settings interface

In this figure4.12, how the data appears, the percentage of risk, and where it is located

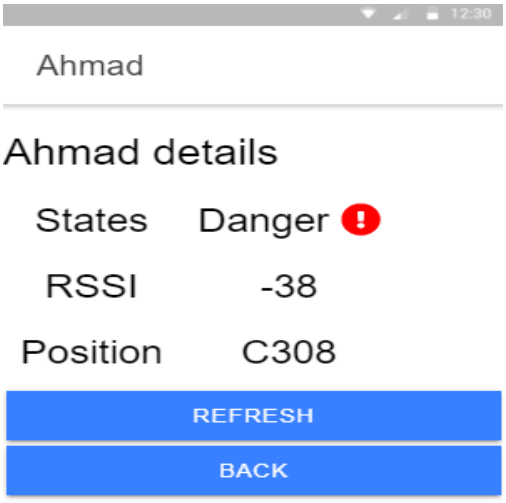


Figure 4.12: Result interface

In figure 4.13, The user sees a warning on the screen in case of a fire in child page.

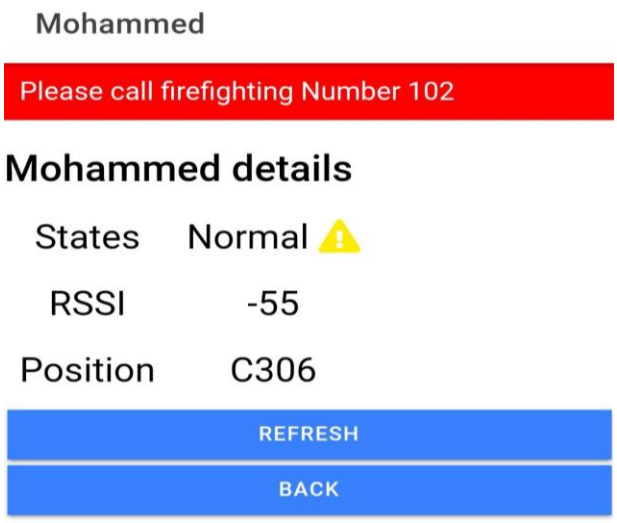


Figure 4.13: Result interface with fire

In figure 4.14, The user sees a warning on the screen in the case when a child is out of the room.

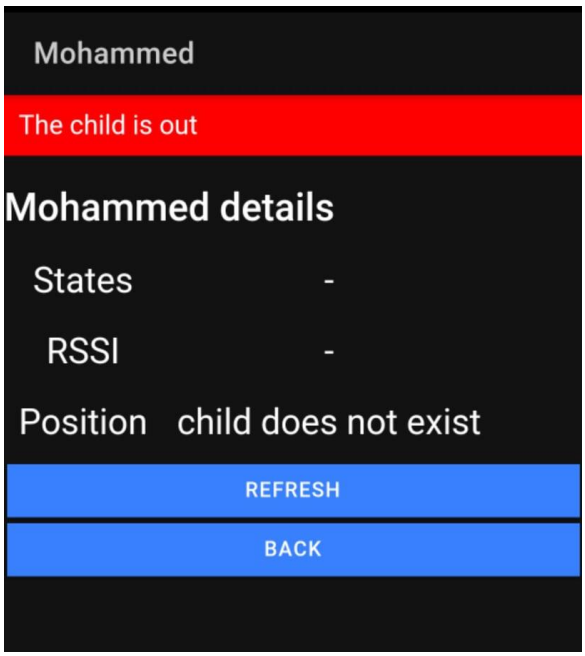


Figure 4.14: Result interface when child out

In Figure 4.15, the user sees a warning on the screen in case the child exits the room, at bedtime, and a fire occurs at the same time.

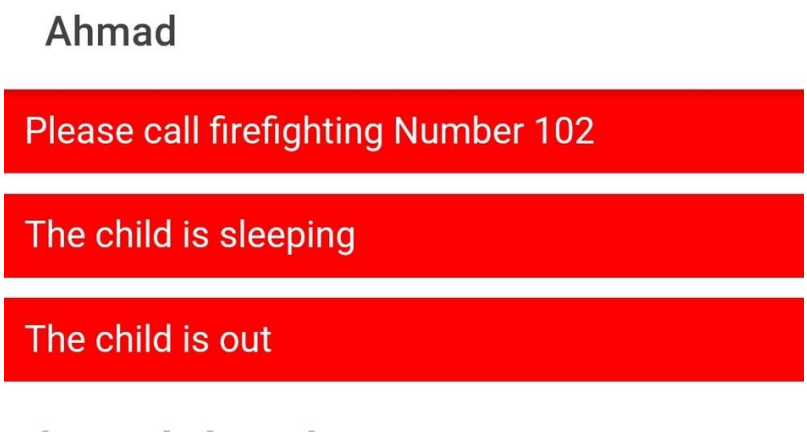


Figure 4.15: Result interface alarm

4.7 Server testing

We used the postman to test the APIs -Backend Testing- that provided by the server like the following:

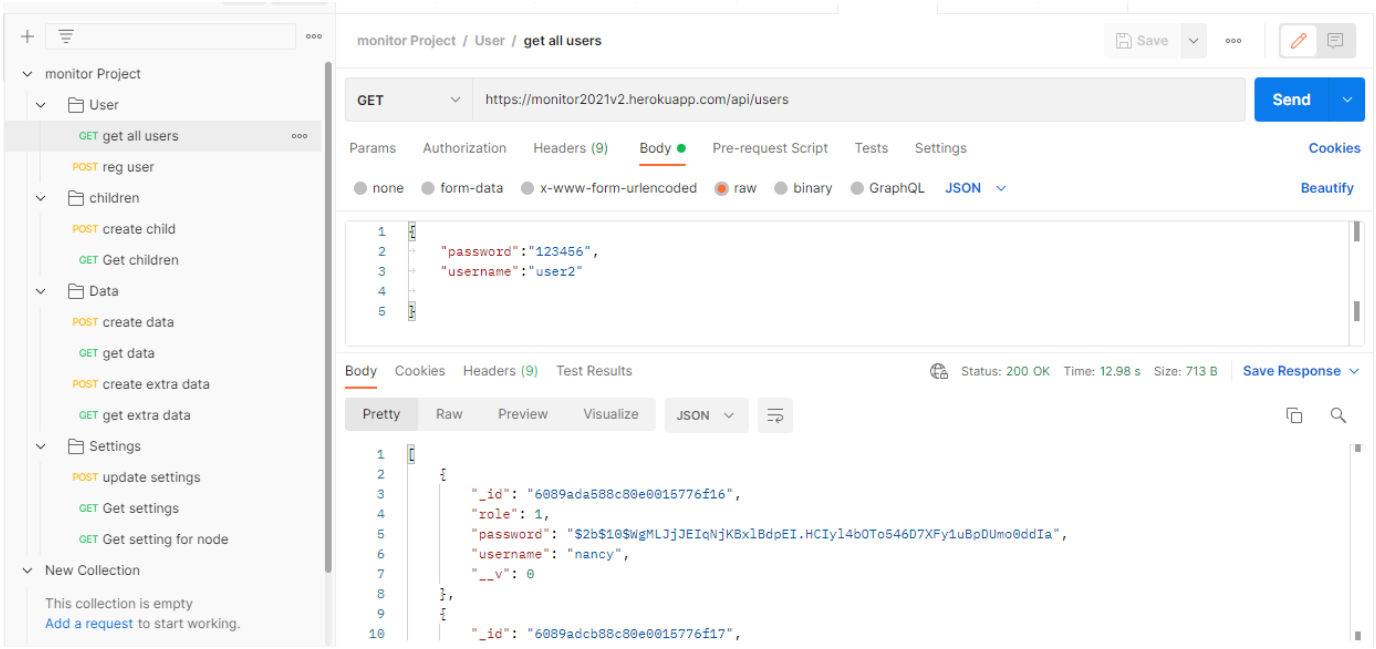


Figure 4.16: Get all users requests

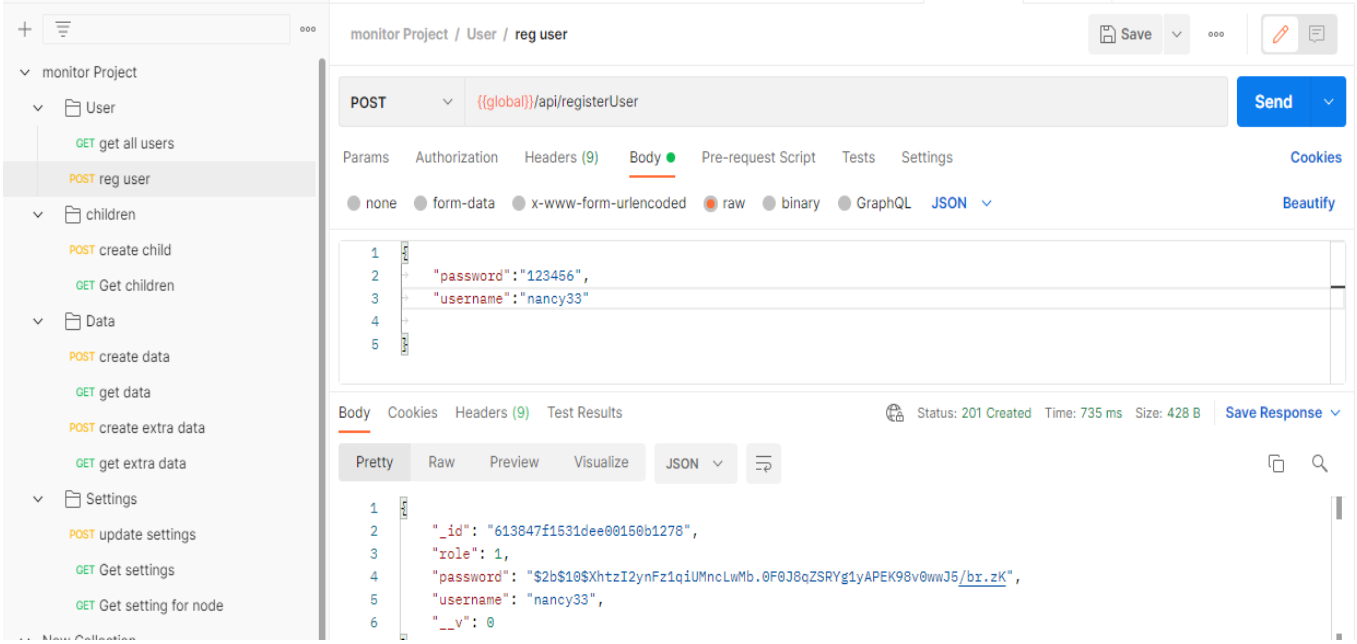


Figure 4.17: register user request

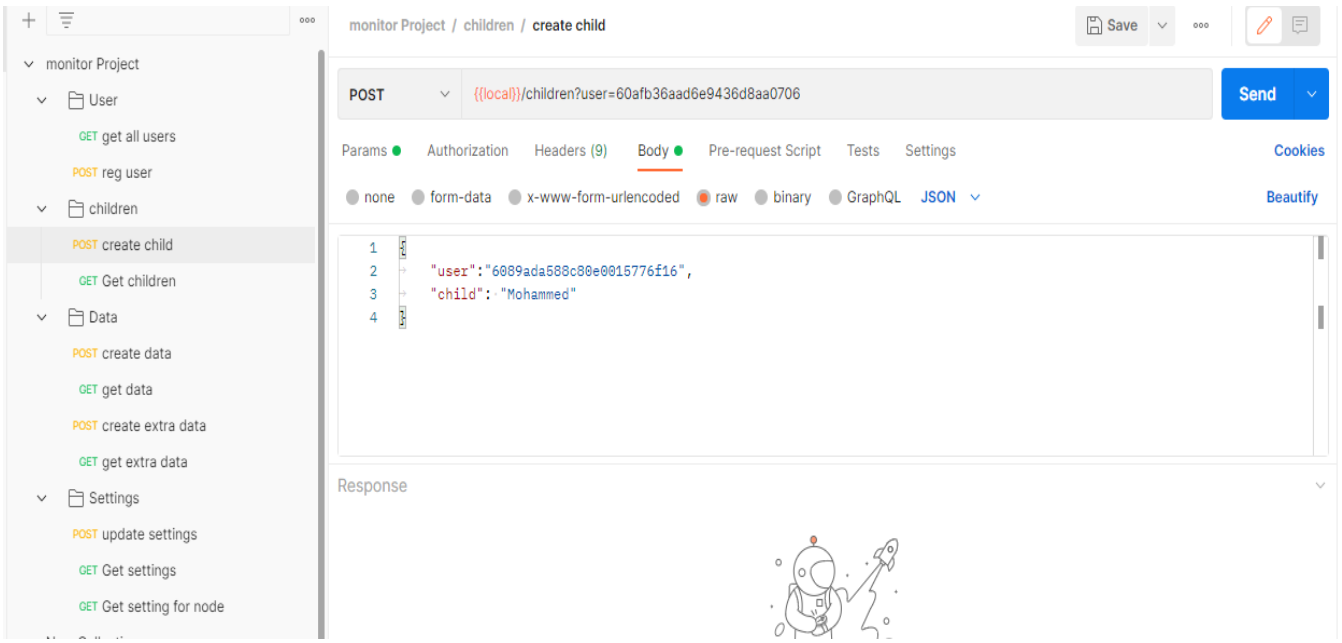


Figure 4.18: Create child request

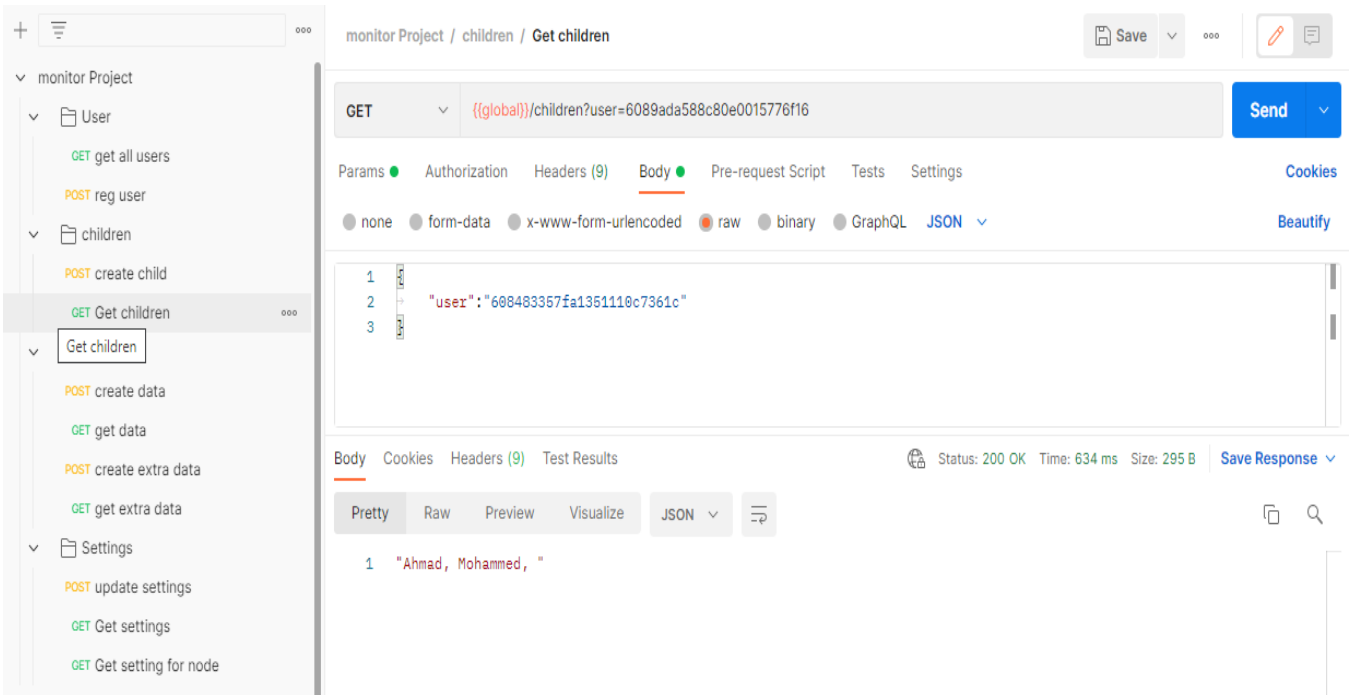


Figure 4.19: Get children request

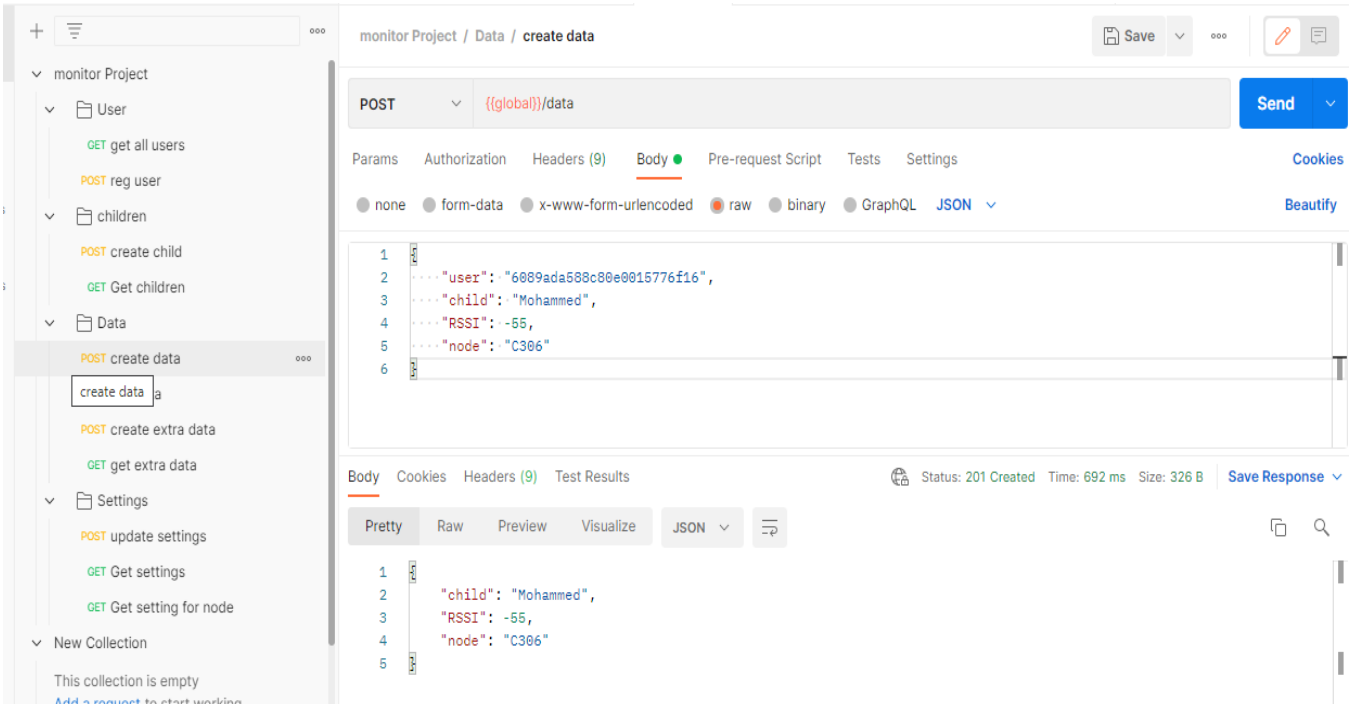


Figure 4.20: Create data -RSSI and Room- request

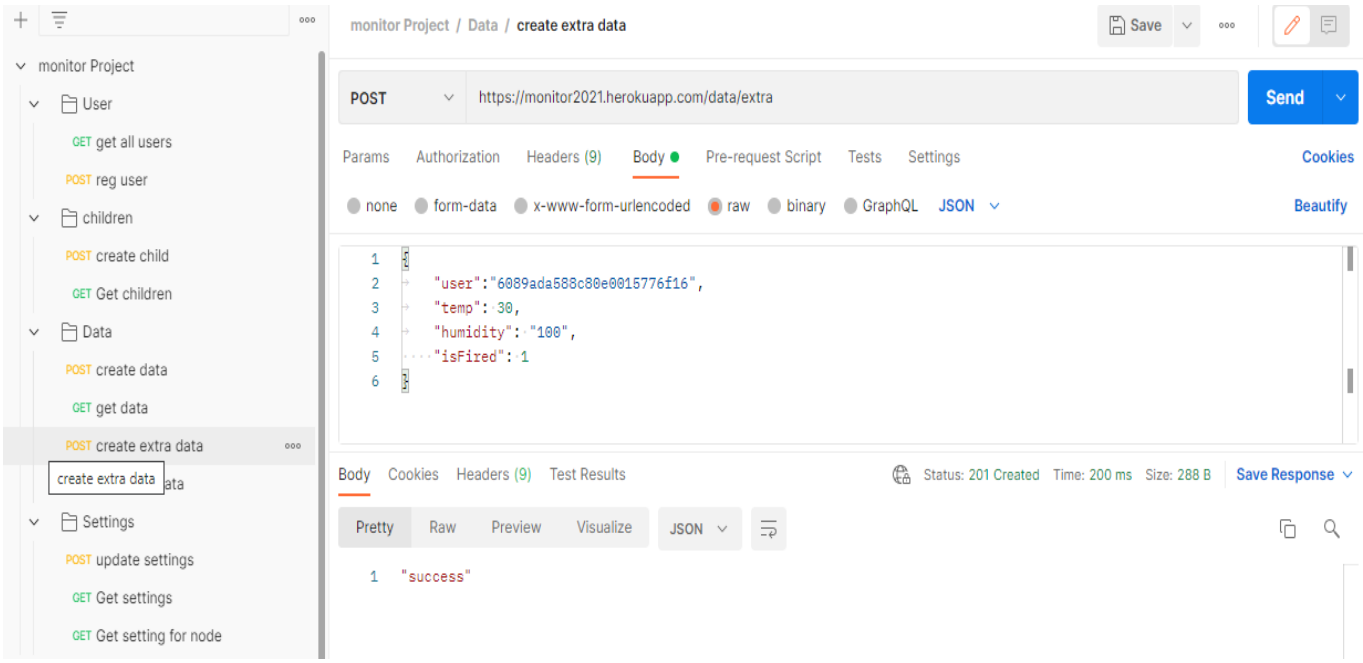


Figure 4.21: Create extra data -Temp, Humidity and Fire- request

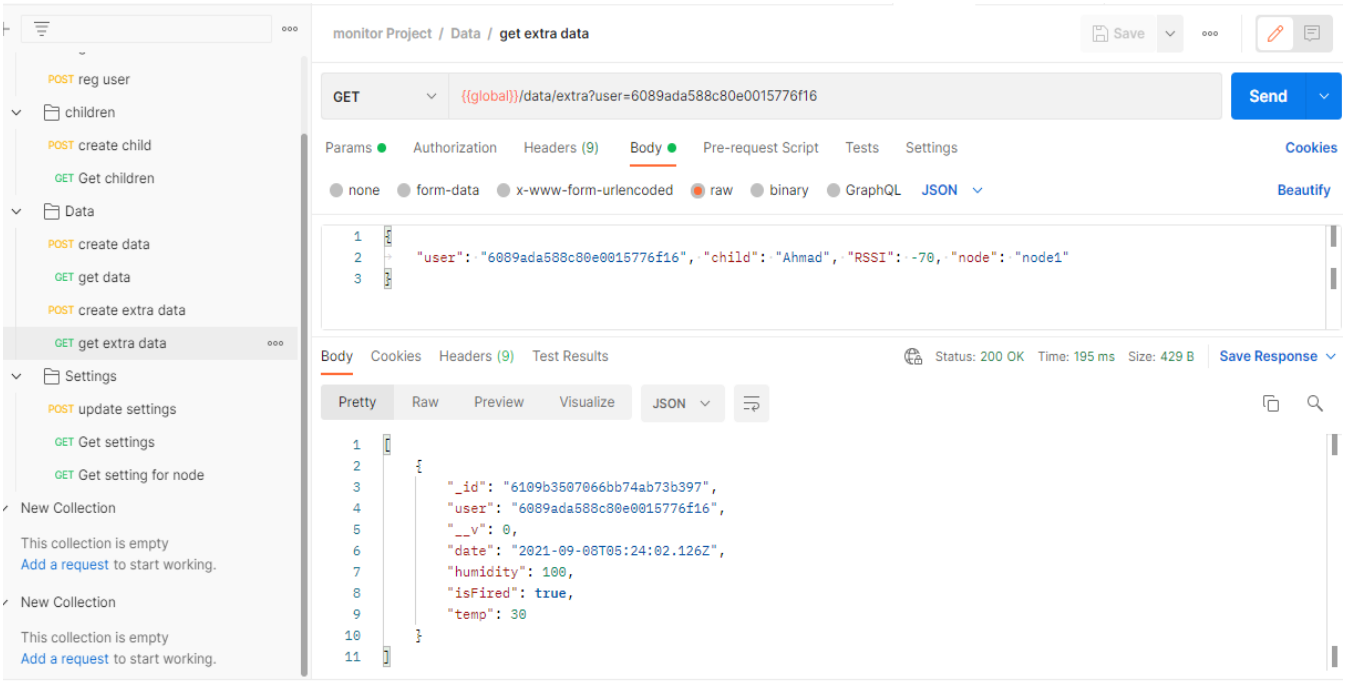


Figure 4.22: Get extra data request

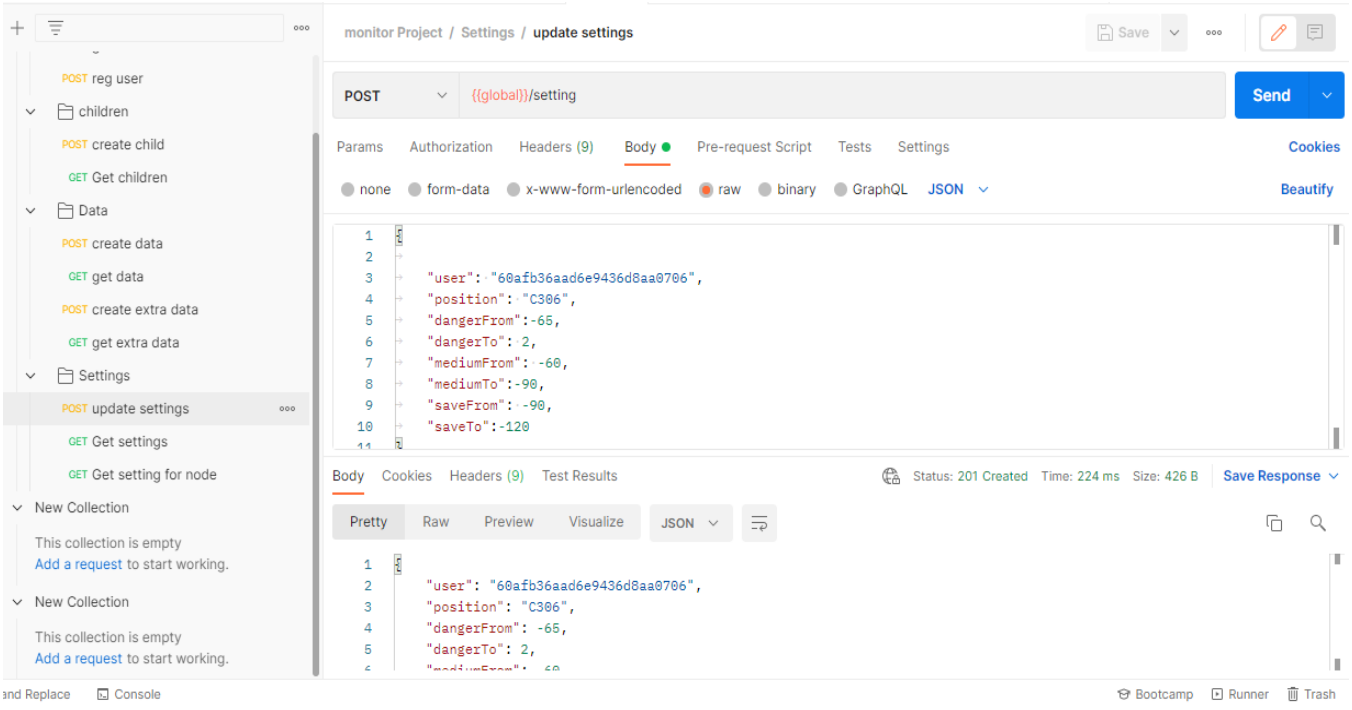


Figure 4.23: Update settings – range for the room- request

Chapter 5

Conclusion

5.1 Overview

Tack in this part about the summary of all parts, future directions, and future work.

5.2 Conclusion

We have proposed an IOT based object locating system to locate people such as knowing where children and people who are in quarantine to keep them safe. In this system, it is possible to access location information and to know the places of danger during the movement of people to make it easier for the official, whether the family or the director of the health center, to know their location through the implementation of this proposed system. This system reduces the period to search for people's locations and also relieves the stress and anxiety of the parents about their children or the director of the health center and that maintain their safety and the safety of others. And know who interdicted person that left his their designated area.

5.3 Future work

In the future, we look forward to adding important features to the system, the most important of which are:

1. Add some sensors to the system that determines where or where the person is required with the time distance and expected time to reach it.
2. It is possible to put some surveillance cameras that can be used for the mother to monitor her child by seeing him and knowing his behavior.
3. Expand the system to become international if possible.
4. A notification system is linked to maps so that more than one place appears and locates them at the same time.

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9. Mq2 gas Picture. (2017). Visited on Saturday, 20/6/2021, 8:50 pm. Available from: https://images.search.yahoo.com/search/images;_ylt=A0geK.SF.S1hO60AzIJXNyoA;_ylu=Y29sbwNiZjEEcG9zAzEEdnRpZAMEc2VjA3BpdnM-?p=Mq2+gas&fr2=piv-web&type=E210US91215G0&fr=mcafee#id=0&iurl=https%3A%2F%2Fi.ebayimg.com%2F00%2Fs%2FODAwWDgwMA%3D%3D%2Fz%2FaOMAAOSweiFcGKUf%2F%24_57.JPG%3Fset_id%3D880000500F&action=click

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Appendices

Appendix A

Data Sheets for needed components:

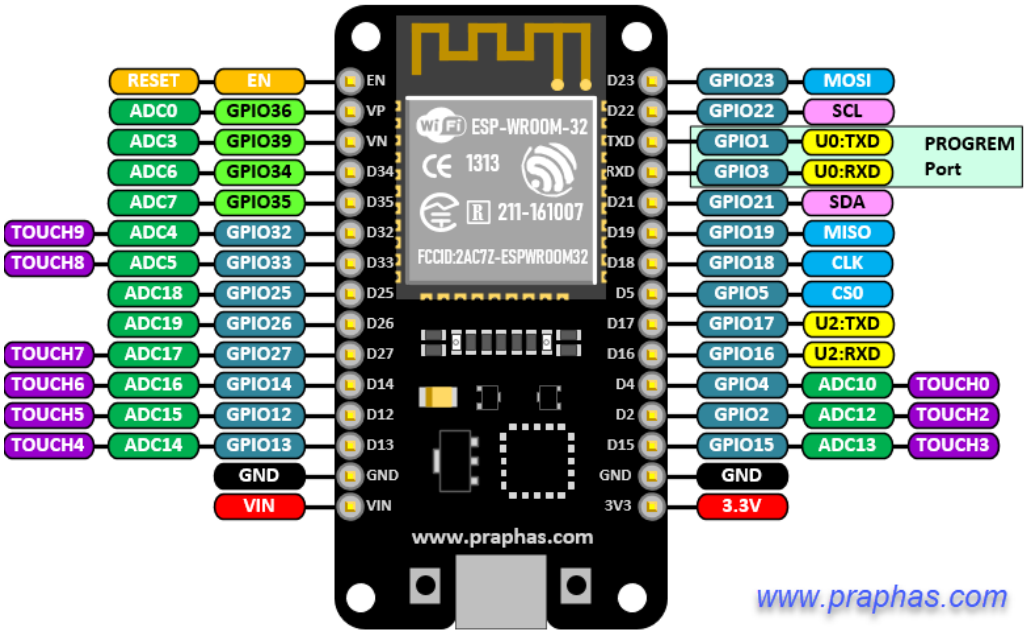

Figure 1: NodeMCU ESP32 Pinout

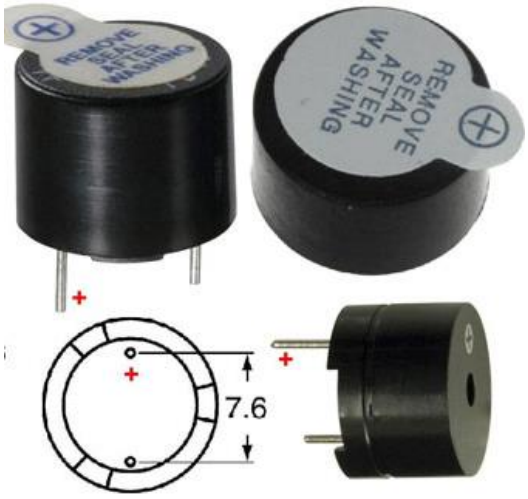

Figure 2: Buzzer Pinout

Figure 3: MQ2 Pinout

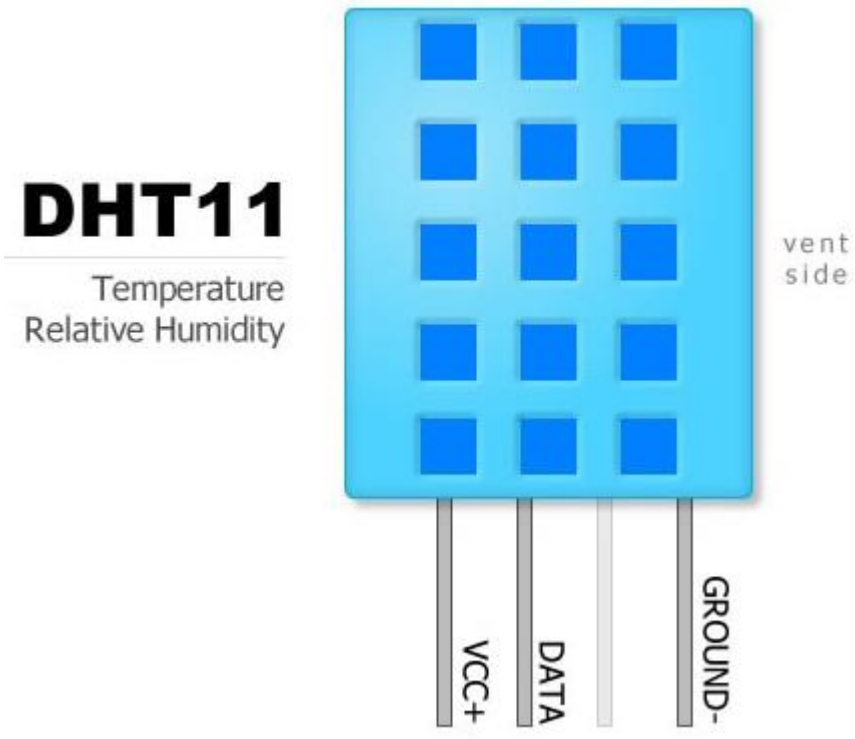

Figure 4: DHT11 Pinout