**A CHILD SAFETY MONITORING SYSTEM USING IOT**

**CHAPTER -1**

**INTRODUCTION**

* 1. **Project Overview**

An infant has a relatively large surface area, poor thermal insulation, and a small amount of mass to act as a heat sink. The new-born has little ability to conserve heat by changing posture and no ability to adjust their own clothing in a response to thermal stress. So these parameters are most important to control for saving the lives of infants. In developing country because the economy is very low so the cost of medical devices should be kept low. Thus there is a need to develop a low cost incubator which provides the facilities required for the infants. This proposed system which includes system structure, hardware circuits and software program of the incubator for premature infant. In this project we use a temperature sensor, GSR (galvanic skin response) sensor, Co2 sensor, HBR (Heart Beat Rate) sensor, SPO2 sensor and humidity sensor. The goal of this project is to bring a new incubator which will be cost effective with improved usability.

* 1. **Purpose**

As babies usually start walking between 9 and 16 months they are at risk of falling from furniture or stairs. As toddlers learn to climb, they are at risk of falling from windows and beds. Falls are a frequent cause of injury in children. Accident and emergency departments and outpatient surveillance systems show that falls are one of the most common mechanisms of injuries that require medical care, and the most to prevent child home accidents. Since the major causes of fall-related injuries change as a child grows and develops, fall prevention needs to be addressed. One of the most challenging issues in this context is to classify daily activities of children into safe and dangerous activities.

In our work a wearable safety shirt, which is part of the presented scenario, would automatically provide information about the position of the child from their location.

Moisture sensor is used to detect the urinal of the baby and Temperature sensor is used to detect the baby body temperature. GSR sensor is used to detect the function of the baby. All the parameters are monitor by the NodeMCU and the value will be displayed on the THINGSPEAK. In emergency case parents get the update through Wi-Fi and baby care taker get the notification via Buzzer.

**CHAPTER-2**

**LITERATURE SURVEY**

**2.1** **Existing problem**

Vital organs or enzymes of premature babies grow to the very lesser extent and thus requires special attention to cope with external physical condition like temperature, humidity, light etc. The infant has several disadvantages in terms of thermal regulation. An infant has a relatively large surface area, poor thermal insulation, and a small amount of mass to act as a heat sink.

**2.2References**

1. AkashMoodbidri, Hamid Shahnasser, ”Child Safety Wearable Device”, Department of Electrical and Computer Engineering San Francisco State University.
2. AnandJatti, MadhviKannan , Alisha RM, Vijayalakshmi P, ShresthaSinha, " Design and Development of an IOT based wearable device forthe Safety and Security of women and girl children “, IEEE International Conference On Recent Trends In Electronics Information Communication Technology, May 20-21, 2016, India.
3. Anwaar Al-Lawati, Shaikha Al-Jahdhami,
4. " RFID-based System for School Children Transportation Safety Enhancement ", Proceedings of the 8th IEEE GCC Conference and Exhibition, Muscat, Oman, 1-4 February 2015.
5. Dr. R. Kamalraj, ” A Hybrid Model on Child Security and Activities Monitoring System using IoT”, IEEE Xplore Compliant Part Number: CFP18N67-ART; ISBN:978-1-5386-2456-2.
6. Pooja.K.Biradar1, Prof S.B.Jamge2,” An Innovative Monitoring Application for Child Safety”, DOI:10.15680/IJIRSET.2015.0409093.
7. Prof. Sunil K Punjabi, Prof. Suvarna Chaure, "Smart Intelligent System for Women and Child Security” Department of Computer Engineering SIES Graduate School of Technology Nerul, Navi Mumbai, India.
8. Sarifah Putri Raflesia, Firdaus, Dinda Lestarini, “An Integrated Child Safety using Geo-fencing Information on Mobile Devices", INTERNATIONAL CONFERENCE ON ELECTRICAL ENGINEERING AND COMPUTER SCIENCE (ICECOS) 2018.
9. Zejun Huang1, ZhigangGao,” An Mobile Safety Monitoring System for Children”, 2014 10th

International Conference on Mobile Ad-hoc and Sensor Networks.-

**2.3Problem Statement Definition**

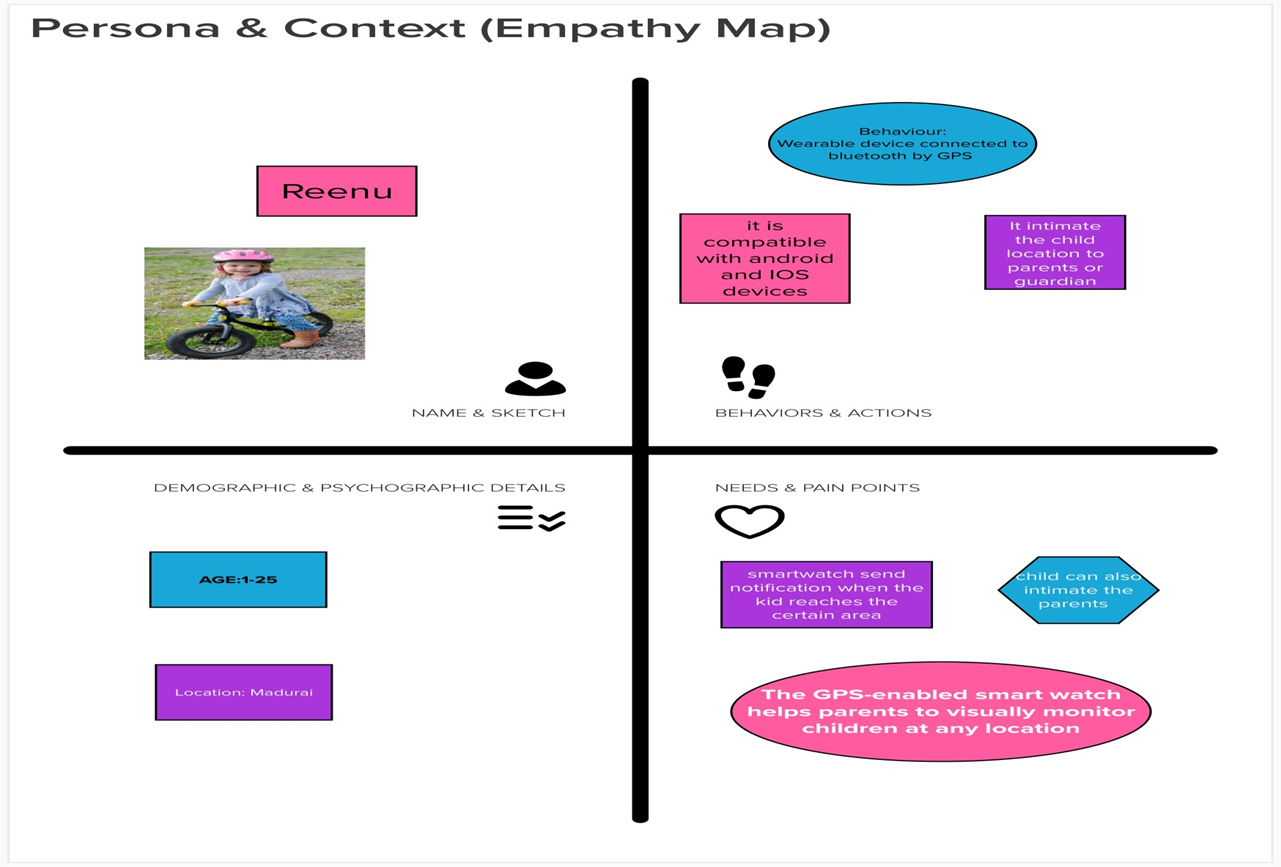
Preterm delivery is defined as the occurrence of birth at less than 37 weeks of the gestation period. In 2015, the World Health Organization (WHO) estimated that in 1 million among 15 million of preemies do not survive due to prematurity, making in turn preterm birth ranked as the second-leading reason for death for children who did not complete their fifth year and the number one fatal syndrome in the first month after birth.

Infants who born before 37 weeks of the gestation period are known as preterm or premature babies. Study shows that in every month of birth around 4 million infants die in the world. 25% of the deaths are cause due to complications of prematurity, most often heat and water. Vital organs or enzymes of premature babies grow to the very lesser extent and thus requires special attention to cope with external physical condition like temperature, humidity, light etc. The infant has several disadvantages in terms of thermal regulation.

**CHAPTER-3**

**IDEATION & PROPOSED SOLUTION**

* 1. **Empathy Map Canvas**



* 1. **Ideation & Brainstorming:**

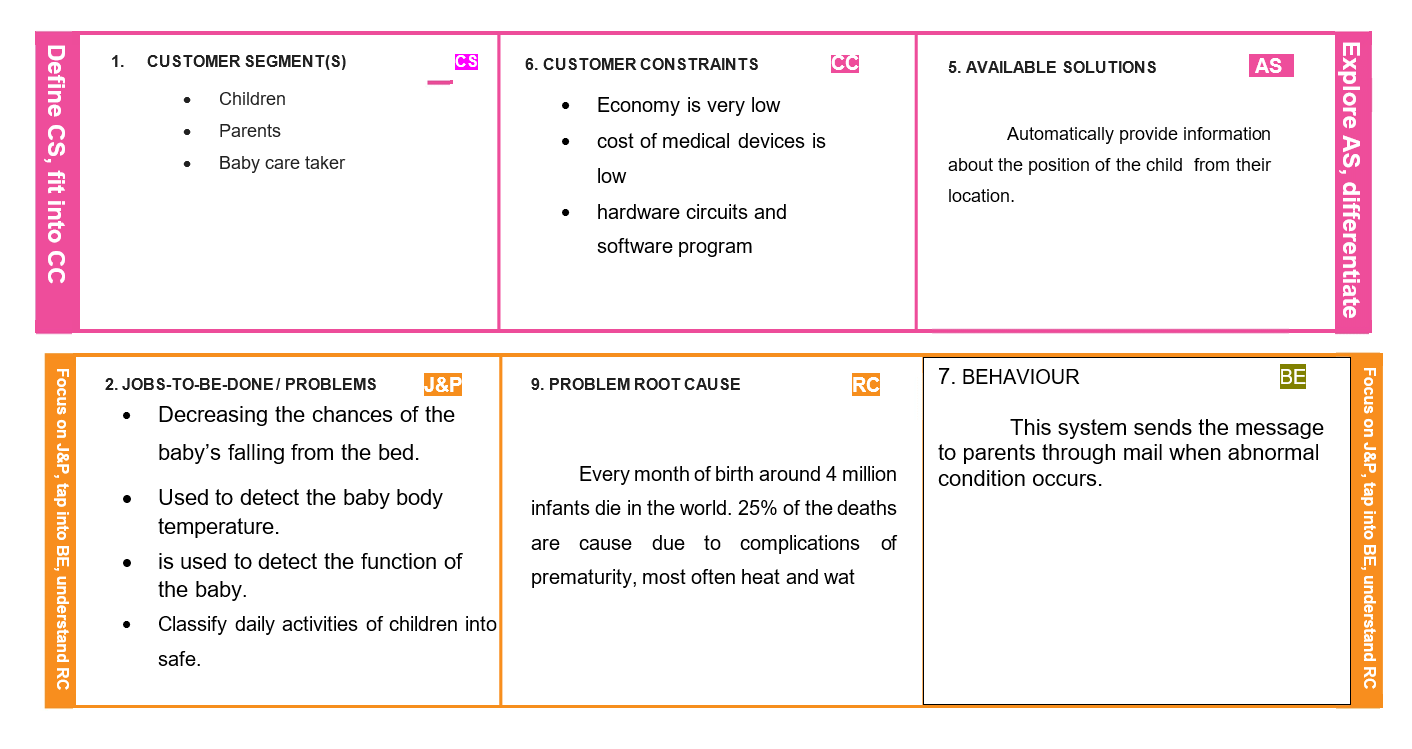
This is quite often the most exciting stage of a project because the goal of Ideation and brainstorming is to generate a large number of ideas that the team can then filter and cut down into the best, most practical, or most innovative ones to inspire new and better design solutions and products.

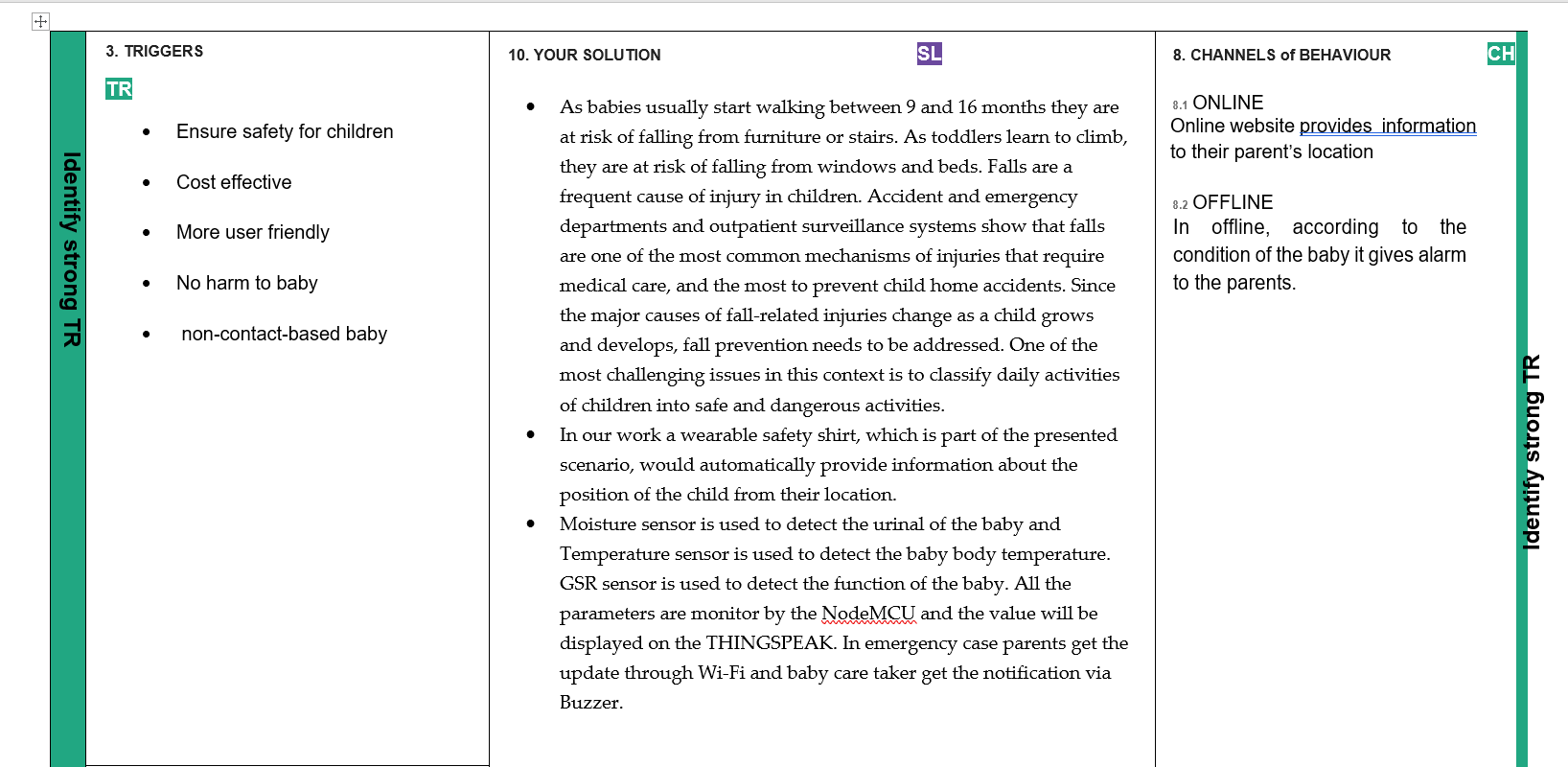
Imagine you’re in your office and you think of your child. Sure, you could not spend time with them on home, but you wanted to know their activities. In such situativation this device will be more efficient and time saving. This idea on child monitoring will be designed with the use of soil sensor , GSR sensor and temperature sensor. The transmitter and the receiver transmites the information to the parent. The parent can view the activities through their mobile phones.

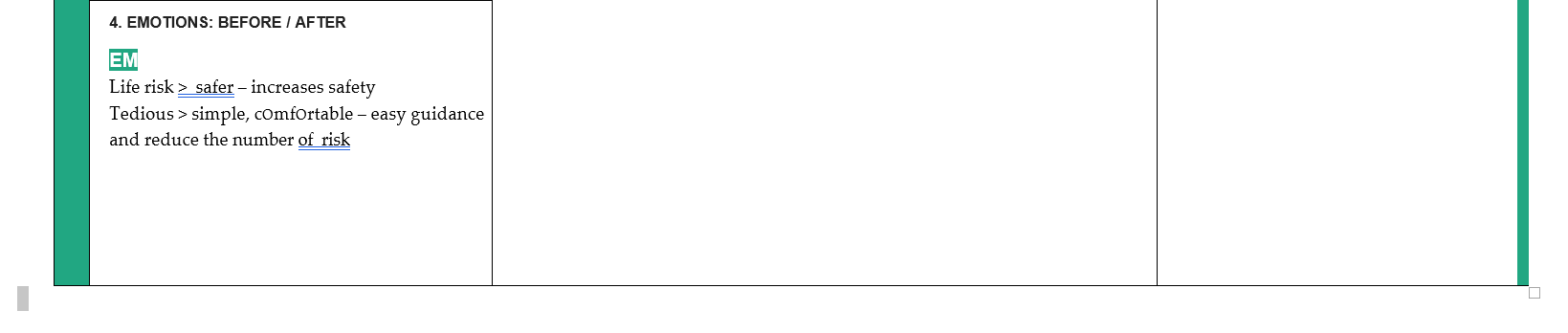
* 1. **Proposed Solution**

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Parameter** | **Description** |
|  | Problem Statement (Problem to be solved) | To bring a new incubator which will be cost effective with improved usability |
|  | Idea / Solution description | This system sends the message to parents through mail when abnormal condition occurs. It might be used in hospitals by the nurses to monitor the baby. This system will help in decreasing the chances of the baby’s falling from the bed. |
|  | Novelty / Uniqueness | An automatic non-contact-based baby monitoring system using NodeMCU processing is proposed in this project. We used ESP8266 module as it provides more advantage comparatively Arduino and Microcontroller. |
|  | Social Impact / Customer Satisfaction | The main advantage of this is that it is more user friendly, cost-effective and no harm to baby as it is non-contact-based baby monitoring system. |
|  | Business Model (Revenue Model) | In our work a wearable safety shirt, which is part of the presented scenario, would automatically provide information about the position of the child from their location. |
|  | Scalability of the Solution | Since the major causes of fall-related injuries change as a child grows and develops, fall prevention needs to be addressed. In emergency case parents get the update through Wi-Fi and baby care taker get the notification via Buzzer. |

**3.4Problem Solution fit**







**CHAPTER-4**

**REQUIREMENT ANALYSIS**

* 1. **Functional requirement**

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Functional Requirement (Epic)** | **Sub Requirement (Story / Sub-Task)** |
| FR-1 | User Registration | Registration through Form Registration through Gmail |
| FR-2 | User Confirmation | Confirmation via Email Confirmation via OTP |
| FR-3 | Notification | Notified via Mobile App |
| FR-4 | User Interface | Mobile App- MIT App Inventor  Able to see location of children when they are out of geofence |

* 1. **Non-Functional requirements**

|  |  |  |
| --- | --- | --- |
| **FR No.** | **Non-Functional Requirement** | **Description** |
| NFR-1 | **Usability** | Accessed through Mobile App  Showing location (latitude and longitude) of child |
| NFR-2 | **Security** | Database security must meet HIPAA requirements |
| NFR-3 | **Reliability and Availability** | Once logged in, webpage is available until logging out of the app |
| NFR-4 | **Performance** | Each page must load within 2 seconds |
| NFR-6 | **Scalability** | The process must finish within 3 hours so data is available by 8 a.m. local time after an overnight update |

**CHAPTER-5**

**PROJECT DESIGN**

**5.1Data Flow Diagrams**



**5.2 Solution & Technical Architecture**



**USER STORIES**

**Table-1: Components & Technologies:**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Component** | **Description** | **Technology** |
| 1. | User Interface | The communication protocol being used in the proposed solution might act as an interface the way like WiFi and Bluetooth. | MIT app |
| 2. | Application Logic | The data to be collected and sent to the  authenticator’s(parent) via GSM providing the GPS to easily locate and monitor the child | Python |
| 3. | Database | Data to be segregated and secured in the form of relational DBMS | My SQL |
| 4. | Cloud Database | IBM | IBM Cloudant |
| 5. | File Storage | File storage requirements | IBM Block Storage and Local Filesystem |
| 6. | External API | To identify the child location | GPS Tracking System. |
| 7. | Infrastructure (Server / Cloud) | Cloud Local Server Configuration and Local System Server. | Cloud Foundry |

**Table-2: Application Characteristics:**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Characteristics** | **Description** | **Technology** |
| 1. | Open-Source Frameworks | It is used in Android System foe easy accessability and GPS is used to locate the child | UI design development |
| 2. | Security Implementations | The developed application should be accessible in the way it can only respond to the comments of the relevant users | Encryptions |
| 3. | Scalable Architecture | The app is easy to operate. | Not yet determined |

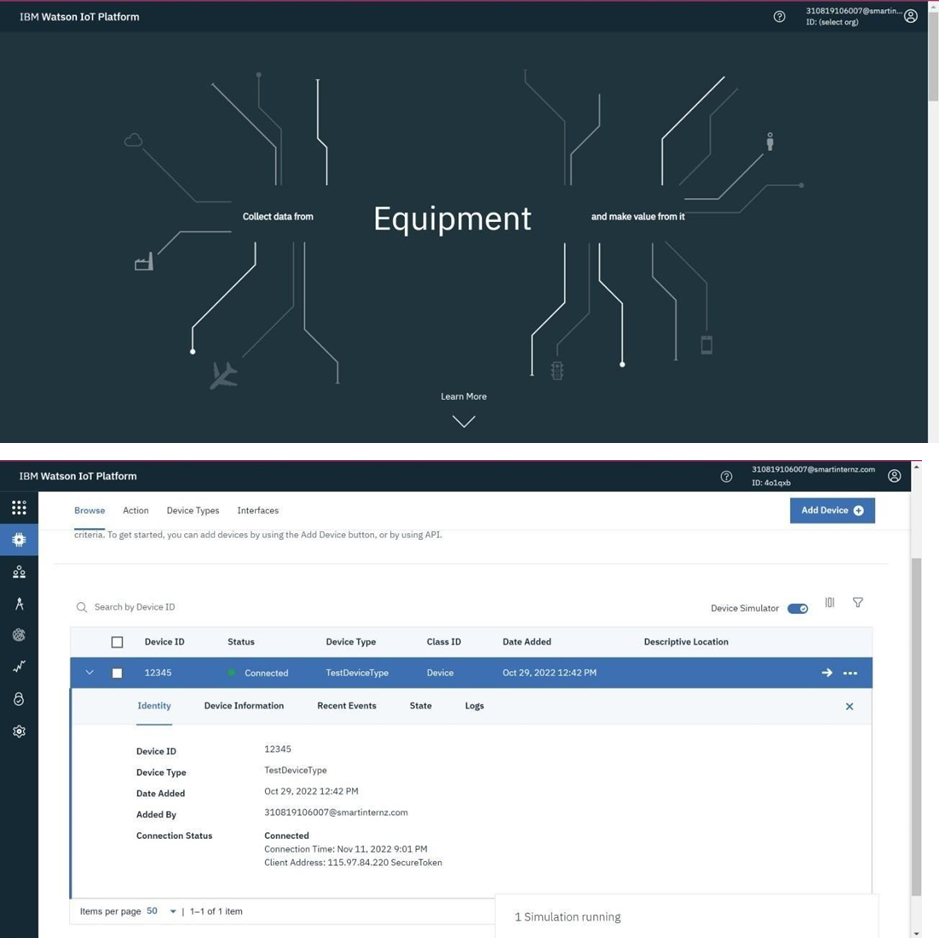
|  |  |  |  |
| --- | --- | --- | --- |
| 4. | Availability | The developed solution tends to be available in the market at anytime | Not yet determined |
| 5. | Performance | Highly proper and functionalities are to be ensured in the designed solution. | Not yet determined |

**CHAPTER-6**

**PROJECT PLANNING & SCHEDULIN**

**6.1Sprint Planning & Estimation**

# Creating and Connecting IBM cloud for Project and Python Code :



**Creating Python Code:**

import json import wiotp.sdk.device import time import random myConfig = {

"identity":{

"orgId": "4o1qxb",

"typeId": "TestDeviceType",

"deviceId": "12345"

},

"auth": {

"token":"pnhXvzN-sWMKv&hxyi"

}

}

client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None) client.connect()

while True:

name= "Smartbridge"

#in area location

latitude= 17.4225176 longitude= 78.5458842 #out area location

#latitude= 17.4219272 #longitude= 78.5488783

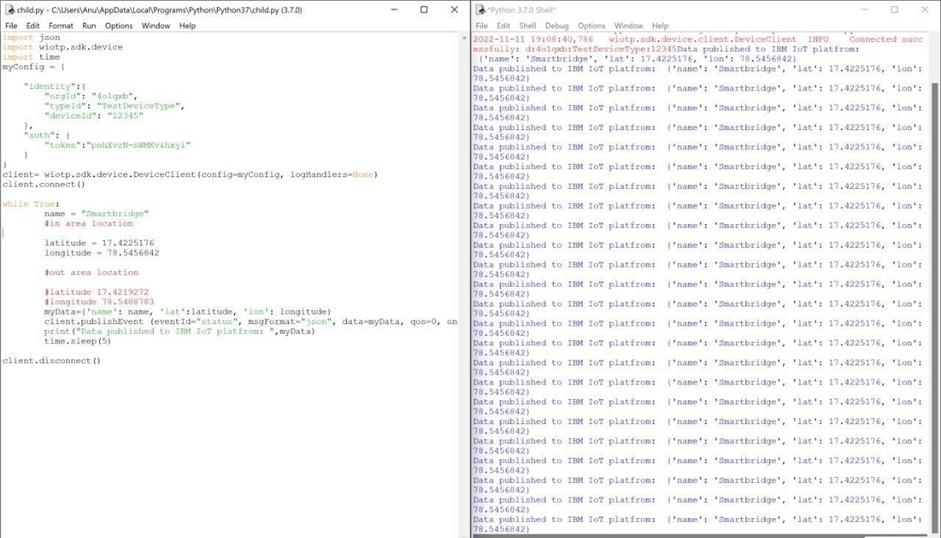
myData={'name': name,'lat':latitude, 'lon' :longitude}

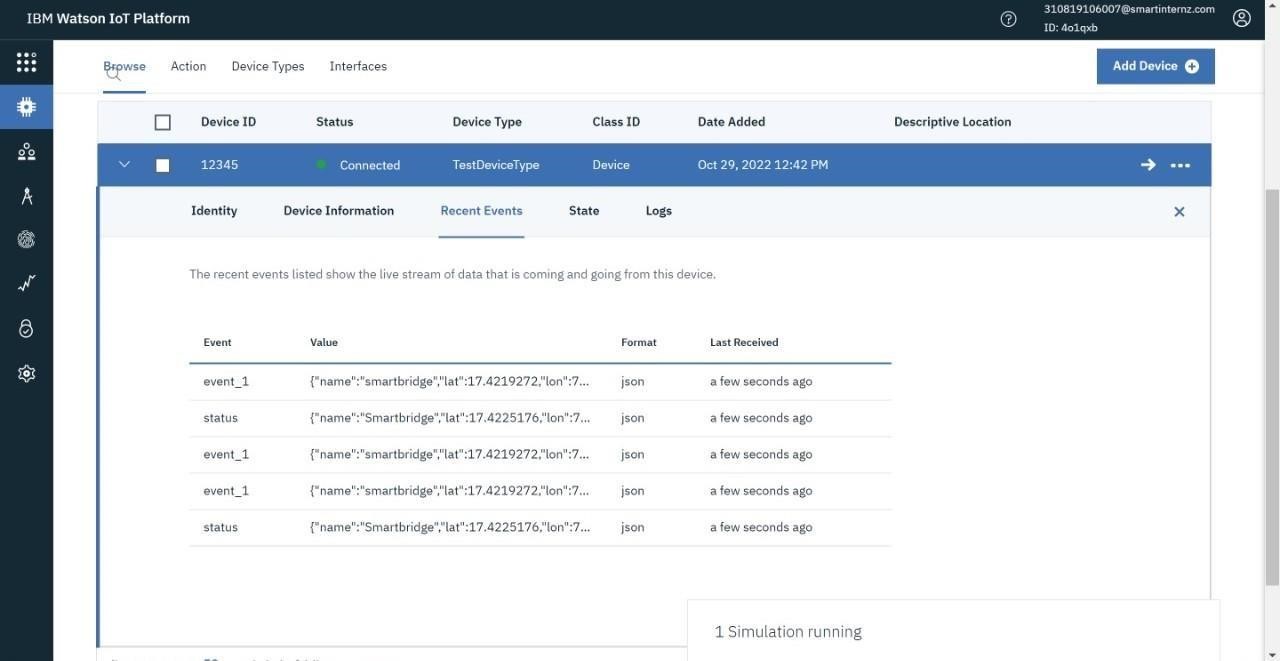
client.publishEvent(eventId="status", msgFormat="json", data=myData,

qos=0, onPublish=None) print("Data Published to IBM IoT platfrom: ", myData) time.sleep(5)

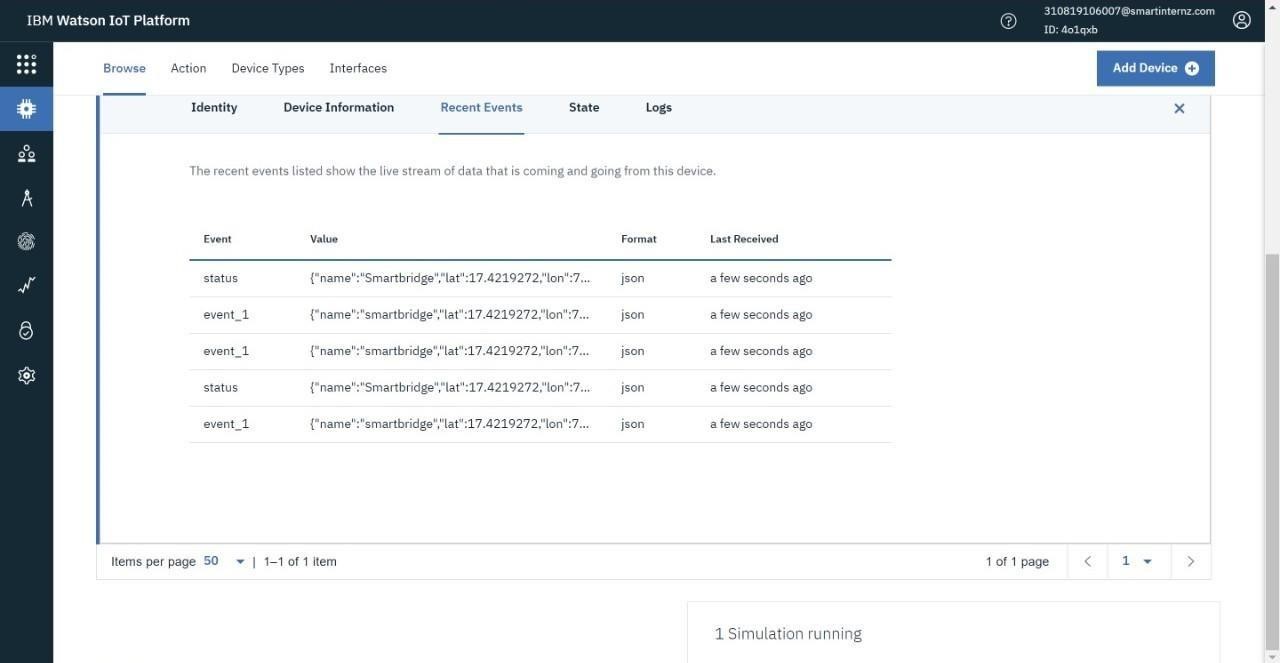
client.disconnect()

**Connecting IBM Watson and python Code:**

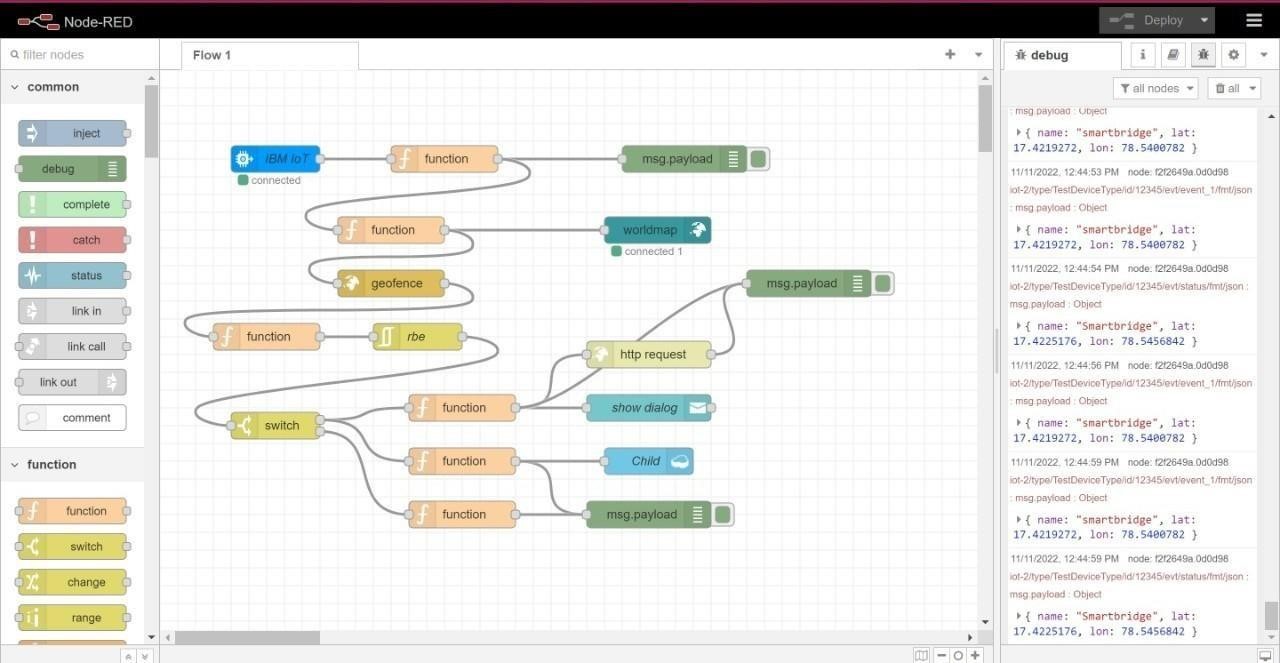




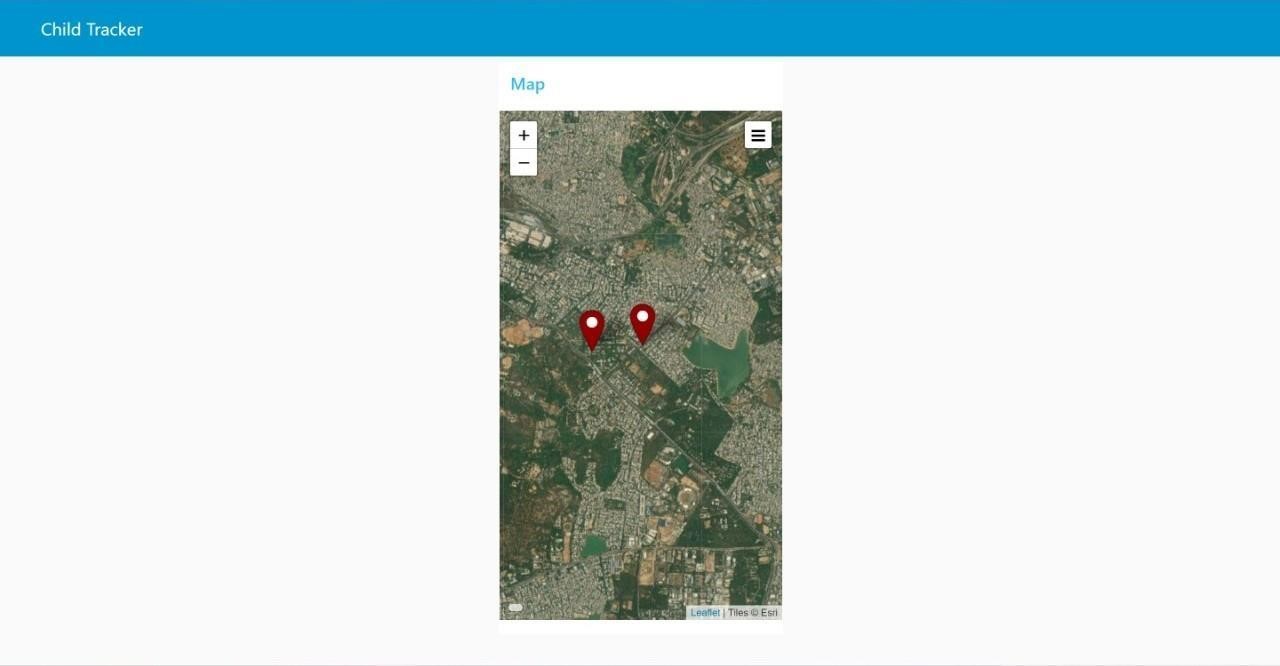
**Out-Area Location:**



**Node-Red Service with Cloudant Database:**



**Node-Red Dashboard(Web UI):**



**6.2Sprint Delivery Schedule:**

**SOFTWARE PREREQUISITES**

**Python IDE** :

IDE stands for Integrated Development Environment. It’s a coding tool which allows you to write, test, and debug your code in an easier way, as they typically offer code completion or code insight by highlighting, resource management, debugging tools,… And even though the IDE is a strictly defined concept, it’s starting to be redefined as other tools such as notebooks start gaining more and more features that traditionally belong to IDEs. For example, debugging your code is also possible in Jupyter Notebook. You can probably most clearly see this evolution in the results of the Stack Overflow Developer Survey below, which also includes these new tools, next to the traditional IDEs that you might already know; They all fall under the section “development environment”. Because of all the features that IDEs have to offer, they are extremely useful for development: they make your coding more comfortable and this is no different for data science. However, given the fact that there aren’t only the traditional IDEs to consider, but also new tools, such as notebooks, you might be wondering which development environment to use when you’re just starting out with data science. List of Best Python IDE

1. **PyCharm**

In industries most professional developers use PyCharm and it has been considered the best IDE for python developers. It was developed by the Czech company JetBrains and it’s a cross-platform IDE. It gives daily tips to improve your knowledge of how you can use it more efficiently which is a very good feature. It comes in two versions community version and a professional version where the community version is free but the professional version is paid. Below are some other features of this IDE.

It is considered an intelligent code editor, fast and safe refactoring, and smart code.

Features for debugging, profiling, remote development, testing the code, auto code completion, quick fixing, error detection, and tools of the database.

Support for Popular web technologies, web frameworks, scientific libraries, and version control.

1. **Spyder**

Spyder is another good open-source and cross-platform IDE written in Python. It is also called Scientific Python Development IDE and it is the most lightweight IDE for Python. It is mainly used by data scientists who can integrate with Matplotlib, SciPy, NumPy, Pandas, Cython, IPython, SymPy, and other open-source software. It comes with the Anaconda package manager distribution and it has some good advanced features such as edit, debug, and data exploration. Below are some other features of this IDE.

Auto code completion and syntax highlighting.

Ability to search and edit the variables from the graphical user interface itself.

Static code analysis

It is very efficient in tracing each step of the script execution by a powerful debugger.

1. **Eclipse PyDev**

Eclipse is one of the most popular IDE among developers which is written in Java but you can install the Pydev plugin in eclipse and use it for Python as well. The primary focus of this IDE is the analysis of code, debugging in the graphical pattern, refactoring of python code, etc. Eclipse PyDev is stable and provides good performance for most of the python project life cycle. Below are some other features of this IDE.

Pydev supports Django integration, Unittest integration, PyLint integration

Code folding and code completion with auto import

Good syntax high lighting and remote debugger

Interactive console

Allows you to create a Google App Engine (GAE) Python project

1. **IDLE**

IDLE is a cross-platform open-source IDE that comes by default with Python so you don’t need to worry about the installation or setup. IDLE is written in Python and this IDE is suitable for beginnerlevel developers who want to practice python development. IDLE is lightweight and simple to use so you can build simple projects such as web browser game automation, basic web scraping applications, and office automation. This IDE is not good for larger projects so move to some advanced IDEs after learning the basics from IDLE.

Python shell with syntax highlighting

Call stack’s clear visibility

A multi-window code editor that allows features like smart indentation, autocomplete, etc It has an interactive interpreter with colorizing of input, output, and error messages. Program animation or stepping.

**5. Wing**

Wing IDE is created by Wingware and it is a faster, stable, and extremely lightweight cross-platform Python IDE

**IOT Python SDK:**

The AWS IoT Device SDK for Python allows developers to write Python script to use their devices to access the AWS IoT platform through MQTT or MQTT over the WebSocket protocol. By connecting their devices to AWS IoT, users can securely work with the message broker, rules, and the device shadow (sometimes referred to as a thing shadow) provided by AWS IoT and with other AWS services like AWS Lambda, Amazon Kinesis, Amazon S3, and more.

**Overview**:

This document provides instructions for installing and configuring the AWS IoT Device SDK for Python. It includes examples demonstrating the use of the SDK APIs.

MQTT Connections

The SDK is built on top of a modified Paho MQTT Python client library. Developers can choose from two types of connections to connect to AWS IoT:

MQTT (over TLS 1.2) with X.509 certificate-based mutual authentication.

MQTT over the WebSocket protocol with AWS Signature Version 4 authentication.

MQTT (over TLS 1.2) with X.509 certificate-based mutual authentication with TLS ALPN extension. For MQTT over TLS (port 8883 and port 443), a valid certificate and a private key are required for authentication. For MQTT over the WebSocket protocol (port 443), a valid AWS Identity and Access Management (IAM) access key ID and secret access key pair are required for authentication.

**Device Shadow:**

A device shadow, or thing shadow, is a JSON document that is used to store and retrieve current state information for a thing (device, app, and so on). A shadow can be created and maintained for each thing or device so that its state can be get and set regardless of whether the thing or device is connected to the Internet. The SDK implements the protocol for applications to retrieve, update, and delete shadow documents. The SDK allows operations on shadow documents of single or multiple shadow instances in one MQTT connection. The SDK also allows the use of the same connection for shadow operations and non-shadow, simple MQTT operations.

**Node.js to use Node-Red services:**

Node.js is a cross platform, open source JavaScript runtime environment (JRE) which allows building JavaScript programs for the server-side. Node.js is more than a decade old now and runs on V8 engine.

While many consider Node.js to be only a backend framework, this technology also can be wont to build front-end.

Most software engineers consider Node the most exciting single piece of software within the current JavaScript universe.

**Key benefits of using Node.js:**

1. Node.js is superb for calling other services. For the bulk of apps it’s critical to form communication with the database and platform API seamless.
2. Node.js increases performance and handles tons of requests. For the client side it’s very useful, practical and fast because it demands users to form fewer clicks and have everything loaded directly .
3. Node.js overcomes large processing challenges.
4. Node.js enables development teams to use JavaScript both for the server and therefore the browser.
5. Smooth, fast UI and customization is feasible with Node.js. And Netflix here may be a true winner with one among the foremost successful UI ever.
6. Node.js features a large and active community of engineers who constantly contribute and improve the technology.
7. Extensive NPM offers tons of ready-made solutions engineers can use.
8. Node.js is straightforward.
9. It’sgreat for startups as they will enjoy faster development and faster entering the market with their products.

**Use Node-Red services:**

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways.

It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click.

**Fast2sms**:

Mobile plays a vital role in communication and we cannot deny the importance of SMS. Short Messaging Service or SMS as it is popularly known as, has become an integral part of our lives. Imagine having a phone without SMS feature. How we will communicate with others, don’t you think our lives would become quite monotonous and boring. We are totally dependent on messaging and for short and urgent talks we prefer messaging rather than calling.

SMS is also in great use for mobile marketing and according to recent surveys and reports, the global

SMS messaging business is estimated to be around $100 billion and it is a proven fact that almost 50% of revenue is generated by mobile messaging. At times when we have to communicate urgently we all would prefer SMS because it does not require an internet connection.

Fast2SMS.com is a popular bulk SMS service provider in India. It was started in 21st July 2011. Due to its simplicity and ease of use it has become one of the mostly used SMS portals and has 2 million users.

**Features of Fast2SMS:**

* Bulk SMS – Bulk SMS refers to business sending SMS to one or more recipients and can scale up to millions of persons at the same time. It refers to sending large number of messages to a predefined set of customers.
* Quick SMS feature – Fast2SMS provides a very unique and useful feature which is not available in any other bulk SMS service provider. You can send SMS to DND and Non DND numbers even if you are not registered in the DLT portal.

**CHAPTER-7**

**CODING & SOLUTIONING**

**7.1Feature 1**

**Real Time Tracking**

Tracking system is used so that the child’s location and activities can be tracked and reported to the parent’s device. We have used WFPS which means Wi-Fi Positioning System. It means it does not connect to the internet but takes the signal of the networks around it. It triangulates the signals of the network and shows us the location of the child with latitude and longitude.

**Safe Zone Alerts :**In this function the parents can mark the safe zone for their children. For example if the child is going to school, the school is the safe zone as he would be in the school premises with guided people so the parent can mark the school as the safe zone. And as the child leaves the school or tries to leave the school premises the parent would be notified on their webapp that their child has left the premises. The parent can add multiple safe zones.

**Location History**

The location history will help to track the child's activity so that the aren’t will be updated.Location history will be there for 30 days. For example if the child’s gets missing with the help of location history the aren’t can track down their child's activity and also can find their child.

**Long Battery Life**

This feature is one of the important features as battery life should be long lasting. For example, if the child or parent forgets to charge the device for a whole one day then also the device will work. That's why we aim to make this device last the whole day with one charge

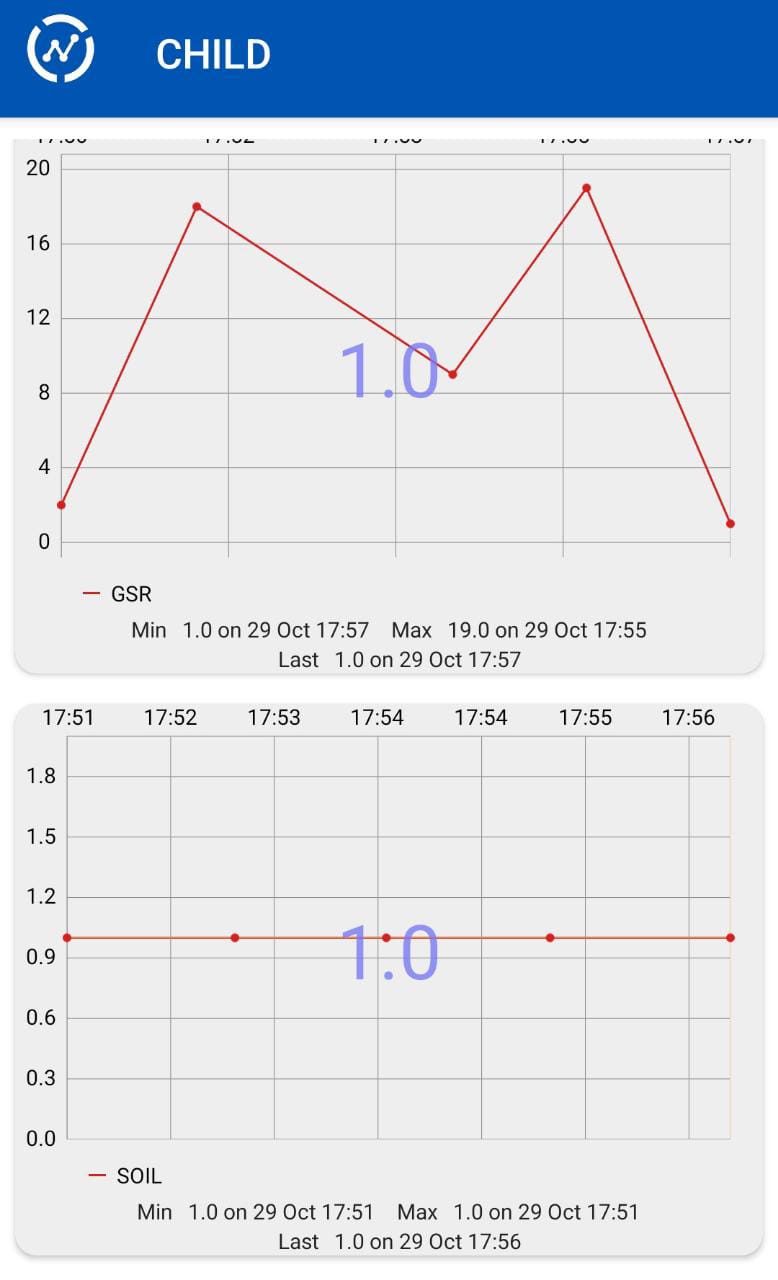
**7.2Feature 2**

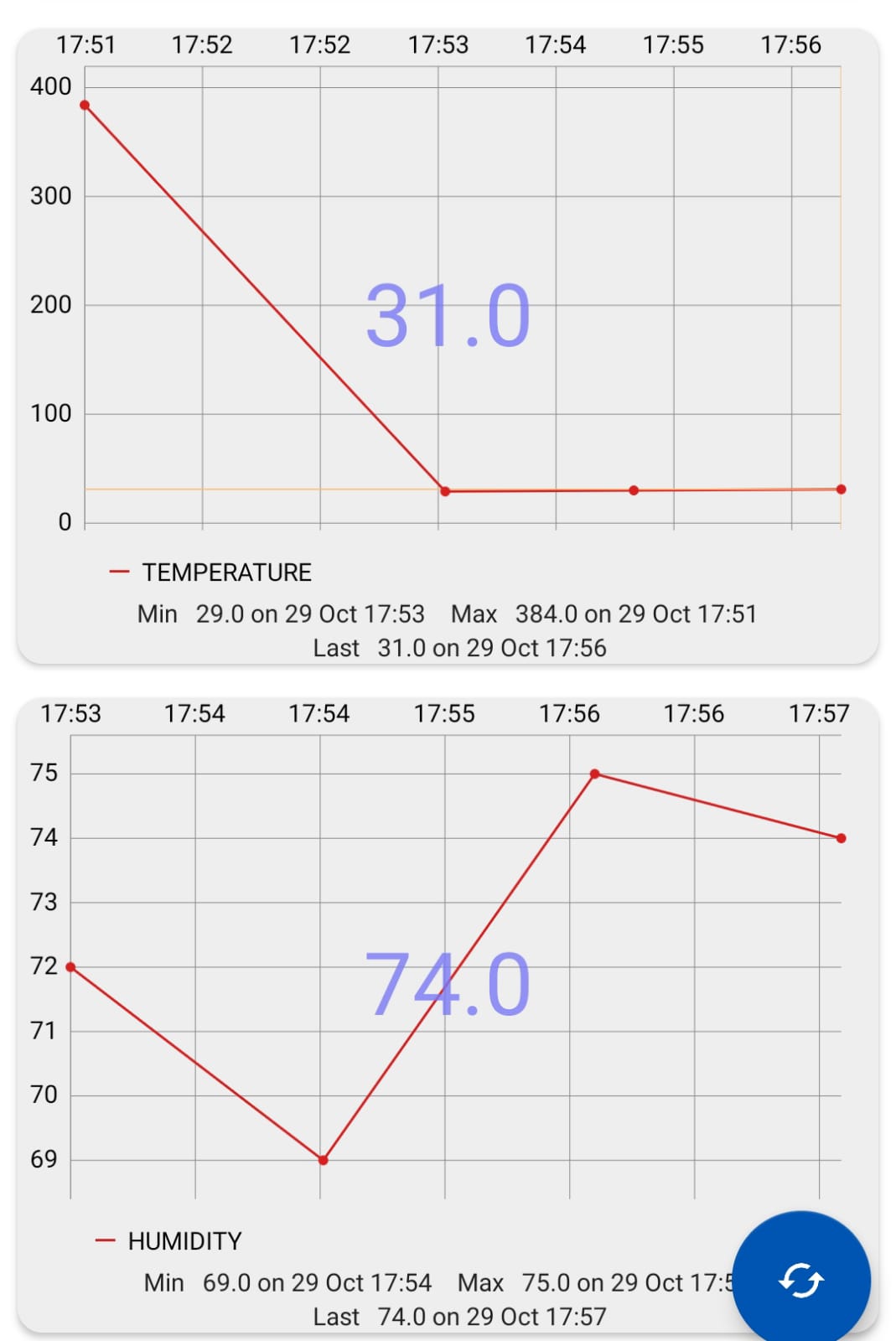
The application will deal with the device and the parent's web app and is mindful to keep track of the location of the device. The child's account can also be edited by parents. The programme will have a route history trace which will show the parent the path their child took over a period of time. After a specific period, the Web application on the device will update the location of the kid to the application. By pushing the distinct button that has been introduced, parents may even take action if their kid is unstable or in an inappropriate area. WFPS, a WIFI positioning system that doesn't connect to the internet but connects to Wi-Fi access points, will be used to track the child's whereabouts. As a result, the position of the child is shown on the parents' web app

**CHAPTER-8**

**TESTING**

**8.1RESULTS**





**CHAPTER-10**

**ADVANTAGES & DISADVANTAGES**

**ADVANTAGES**

The main advantage of this is that it is more user friendly, cost-effective and no harm to baby as it is non-contact-based baby monitoring system.

**DISADVANTAGES**

The new-born has little ability to conserve heat by changing posture and no ability to adjust their own clothing in a response to thermal stress. So these parameters are most important to control for saving the lives of infants. In developing country because the economy is very low so the cost of medical devices should be kept low.

**CHAPTER-11**

**CONCLUSION**

An automatic non-contact-based baby monitoring system using NodeMCU processing is proposed in this project. This system sends the message to parents through mail when abnormal condition occurs. It might be used in hospitals by the nurses to monitor the baby. We used ESP8266 module as it provides more advantage comparatively Arduino and Microcontroller. It can detect whether the baby is sleeping or awake. This system will help in decreasing the chances of the baby’s falling from the bed.

Through this device, the parent can track and monitor their child with just a simple app and one hardware device which will be with the child. It is not possible to always stay beside children as most of the parents need to go for work. With this project, parents can track the location of their children and get alerts whenever the child is in danger. It becomes easy for parents to look after their child while working. This device is efficient to use. Thus by keeping in mind the advantages and applications we are developing a child monitoring device. In order to avoid kidnapping cases, the child monitoring system is needed

**CHAPTER-12**

**FUTURE SCOPE**

Basically, children cannot complain about abusements which they face in their daily life to their parents. They can’t even realize what actually happens to them at their age. It is also difficult for parents to identify their children are being abused. Since to prevent children before being attacked, an autonomous real-time monitoring system is necessary for every child out there. In this system, the collected values from every sensor like temperature sensor, pulse rate detection sensor, metal detection sensor, and the location value from GPS are used to detect the status of the child and alerts the respective guardians using GSM accordingly

In our system we can add additional functional that is automatically monitor the child in real time using Internet of Things, with the help of GPS, GSM, and Raspberry Pi. This system requires network connectivity, satellite communication, and high-speed data connection when we use web camera and GPS to lively monitor. It is difficult to monitor when there occurs any hindrance to satellite communication or any network issue. There also occurs time delay in video streaming through the server. Hence in the future, these issues can be overcome by using Zigbee concept or accessing the system without internet and using high-speed server transmission.

**RESULTS**

child as well as the surrounding temperature. If there occurs any abnormal rise or fall in temperature in

the body of the child or in the surrounding it will notify the user as per the coded time delay as shown

in the picture. It will show the temperature and humidity values notifies the user based on the

predefined value abnormal fall or rise scenarios.

child as well as the surrounding temperature. If there occurs any abnormal rise or fall in temperature in

the body of the child or in the surrounding it will notify the user as per the coded time delay as shown

in the picture. It will show the temperature and humidity values notifies the user based on the

predefined value abnormal fall or rise scenarios.

One of the module in our project is temperature sensor which is used to detect the temperature of the child as well as the surrounding temperature. If there occurs any abnormal rise or fall in temperature in the body of the child or in the surrounding it will notify the user as per the coded time delay as shown in the picture. It will show the temperature and humidity values notifies the user based on the predefined value abnormal fall or rise scenarios.

1. **APPENDIX**

**Source Code**

#include <LiquidCrystal.h>

LiquidCrystal lcd(8,9,10,11,12,13);

void setup()

{

lcd.begin(16, 2);

lcd.setCursor(0, 0);

lcd.print("Smart System");

delay(2500);

lcd.clear();

Serial.begin(9600);

pinMode(7,OUTPUT);

void loop()

{

int SM = analogRead(A4);

int DHT = analogRead(A5);

int GSR = analogRead(A1); GSR=GSR/100;

lcd.setCursor(0, 0); lcd.print("SM:"); lcd.print(SM);lcd.print(","); lcd.print("GSR:"); lcd.print(GSR);

lcd.setCursor(0, 1);

int Temp=DHT/10;

lcd.print("Temp:"); lcd.print(Temp); lcd.print(",");

if(Temp>98)

{

Serial.println("High Temperature detected");

float Humidity=DHT/18.56;lcd.print("Hu:"); lcd.print(Humidity);

}

if(Temp<88)

{

Serial.println("Low Temperature detected");

float Humidity=DHT/6.56;lcd.print("Hu:"); lcd.print(Humidity);

}

if(GSR>8)

{

Serial.println("High GSR detected");

digitalWrite(7,1);

}

else

{

digitalWrite(7,0);

}

delay(1500);

lcd.clear();

}

**GitHub & Project Demo Link**

https://github.com/IBM-EPBL/IBM-Project-23697-1659894605/blob/main/design.PWI