PROJECT REPORT

IOT BASED SAFETY GADGET FOR CHILD SAFETY MONITORING AND NOTIFICATION

Team ID : PNT2022TMID31875

Team Size : 4

Team Leader : NIVETHA P

Team member : VIJAYASARATHI I

Team member : KEERTHICK VASA M

Team member : SUJITHA R

1.INTRODUCTION:

Internet of Things (IoT) plays a major role in every day to day life. The major difference between IoT and embedded system is that a dedicated protocol/software is embedded in the chip in case of embedded system, whereas, IoT devices are smart devices, which are able to take decisions by sensing the environment around the device. The development of sensors technology, availability of internet connected devices; data analysis algorithms make IoT devices to act smart in emergency situations without human interventions. So, IoT devices are applied in different fields such as agriculture, medical, industrial, security and communication applications. IoT systems are useful within a system to do deeper automation, analysis, and integration. IoT contributes to technology by advances in software, hardware and modern tools. It even uses existing and upcoming technology in the fields of sensing, networking and robotics. IoT brings

global changes by its advanced elements in the social, economic, and political impact of the users.

1.1 PROJECT OVERVIEW:

Child safety and tracking is a major concern as the more number of crimes on children are reported nowadays. With this motivation, a smart IoT device for child safety and tracking is developed to help the parents to locate and monitor their children. The system is developed using LinkIt ONE board programmed in embedded C and interfaced with temperature, heartbeat, touch sensors and also GPS, GSM & digital camera modules. The novelty of the work is that the system automatically alerts the parent/caretaker by sending SMS, when immediate attention is required for the child during emergency. The parameters such as touch, temperature &heartbeat of the child are used for parametric analysis and results are plotted for the same. The above system ensures the safety and tracking of children.

1.2 PURPOSE:

During years' Child safety is under threat and it is very important to provide a technology-based solution which will help them under panic situations and monitor them using a smart gadget. The proposed system is equipped with GSM and GPS modules for sending and receiving call and SMS between safety gadget and parental phone, the proposed system also consists of W-Fi module used to implement IoT and send all the monitoring parameters to the cloud for android app monitoring on parental phone. Android application can be used to track the current location of safety gadget using its location coordinates on parental phone android app and also via SMS request from parent phone to safety gadget. Panic alert system is used during panic situations and automatic SMS alert and phone call is triggered from safety gadget to the parental 4gadget is unplugged from hand a SMS is triggered to parental phone and the alert parameter is also updated to the cloud.

Heart-beats, temperature is monitored and the values are updated to cloud continuously for parent app monitoring. Boundary monitoring system is implemented on safety gadget with the help of BEACON technology, as soon as the safety gadget moves far away from the binding gadget an alert is provided to parent on binding gadget. the system is used to monitor the health parameters and also used for location tracking during necessary situations in safety concern.

2. LITERATURE SURVEY:

2.1 Existing problem:

Child tracker helps the parents in continuously monitoring the child's location. They can simply leave their children in school or parks and create a geo fence around the particular location. By continuously checking the child's location notifications will be generated if the child crosses the geo fence. Notifications will be sent according to the child's location to their parents or caretakers. The entire location data will be stored in the database.

2.2 References:

https://www.ijresm.com/Vol.3_2020/Vol3_Iss6_June20/IJRESM_V3_I6_79.pdf
https://www.academia.edu/37353956/IOT_Based_Child_Safety_Device
https://www.ijitee.org/wp-content/uploads/papers/v8i8/H6836068819.pdf

2.3 Problem Statement Definition:

Around the world, many children disappear each year and are not found. Runaways, parental abductions or kidnappings by others, these acts are difficult to prevent and have dire consequences on the children involved. Nowadays, crime rate associated with childrenkeeps increasing due to which draws people attention regarding child safety.

| I am	I'm trying to	But	Because	Which makes me feel
A parent	Ensure my child's safety	There are issues of child abuse, kidnapping and accident	Due to lack of proper usage of technology and safety awareness	Unsafe & frightened

miro

3. IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes.

It is a useful tool to help steams better understand their users.
Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.
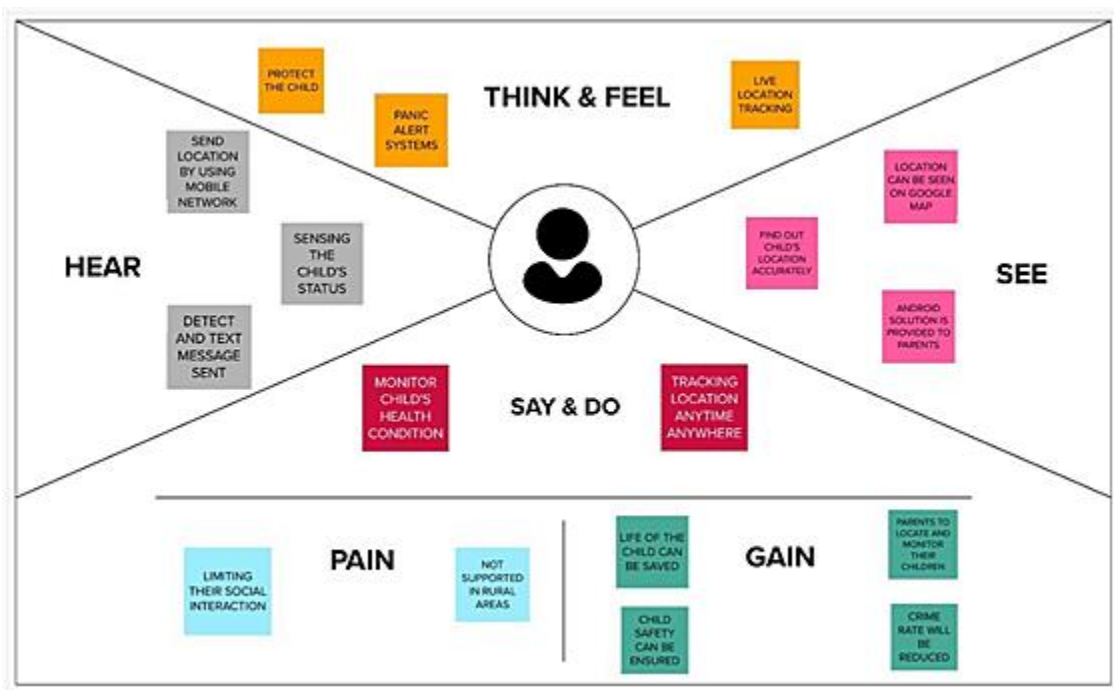
3.2 Ideation & Brainstorming:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

Step-1: Team Gathering, Collaboration and Select the ProblemStatement

Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

- **10 minutes** to prepare
- **1 hour** to collaborate
- **2-8 people** recommended

Share template feedback

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

⏱ 10 minutes

A **Team gathering**
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.

B **Set the goal**
Think about the problem you'll be focusing on solving in the brainstorming session.

C **Learn how to use the facilitation tools**
Use the Facilitation Superpowers to run a happy and productive session.
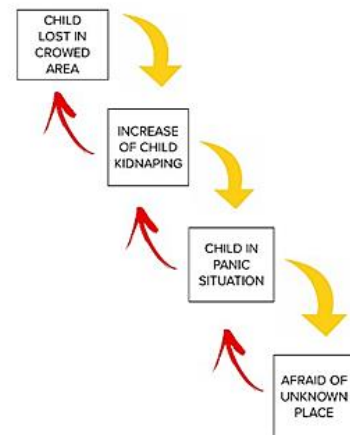
Open article →

1 Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

⏱ 5 minutes

PROBLEM
How might we [your problem statement]?

CHILD LOST IN CROWED AREA

INCREASE OF CHILD KIDNAPING

CHILD IN PANIC SITUATION

AFRAID OF UNKNOWN PLACE

Step-2: Brainstorm, Idea Listing and Grouping

②

Brainstorm

Write down any ideas that come to mind
that address your problem statement.

⏱ 10 minutes

TIP
You can select a sticky note
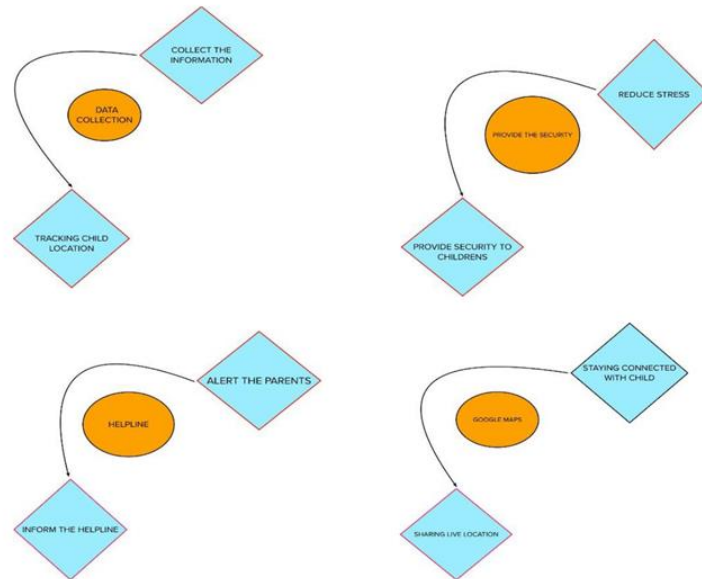and hit the pencil (switch to
sketch) icon to start drawing!

Nivetha P

Monitoring child activity	Tracking child location
Gathering information about child physical behavior	Communicate with child

Vijayasarathi I

Monitorint the current activity of child	Monitoring health condition of child
Track the location and movement of child	Providing instruction to the child

Keerthick Vasa M

Inform to childcare	Information Shared to parents or caretakers
Monitoring location	Gather information about child situation

Sujitha R

Track the daily activity	Staying connected with child
Parents with real-time location	Send information to police

Step 3 – Group ideas

3.3 Proposed Solution:

S.No.	Parameter	Description
1	Problem Statement (Problem to besolved)	Around the world, many children disappear each year and are not found. Runaways, parental abductions or kidnappings by others, these acts are difficult to prevent and have dire consequences on the children involved. Nowadays, crime rate associated with children keeps increasing due to which draws people attention regarding child safety.
2	Idea / Solution description	The users are required to register using their credentials to use the application. The device will be given to the children for monitoring them regularly. We will feed the boundary value while writing code for the system and we control it using GPS for that device which is alsoknown as Geo Fencing. These data are stored in the server.
3	Novelty / Uniqueness	The aim of this work is to develop a wearable device for the safety and protection of women and girls. This objective is achieved by the analysis of physiological signals in conjunction with body position. The physiological signals that are analyzed are galvanic skin resistance and body temperature. Body position is determined by acquiring raw accelerometer data from a triple axis accelerometer.
4	Social Impact/ Customer Satisfaction	● A tracking device can be useful inthe

		case when the parent feels that his or her child is in danger. This device provides real-timelocation. ● These kinds of devices also help parents to set a parameter for their children when they leave the house. Whenever the child steps beyond a defined area,the tracking system will alert the parent. The idea of the system is to restrict the child's freedom but to know how far the child has gone.
5	Business Model(Revenue Model)	The innovative business model involves sponsors and partners who share their commitment to edutainment to kids. The two key factors are architectural design and business concept development by involving edutainment activities.
6	Scalability of the Solution	In our system, we automatically monitor the child in real time using Internet of Things. Hence in the future, these issues can be overcome by using Zambezi concept or accessingthe system without internet and using high-speed server transmission.

3.4 Problem Solution fit:

CUSTOMER SEGMENTS **CS**	CUSTOMER LIMITATION **CC**	AVAILABLE SOLUTION **AS**
This helps the parents to track the daily activity of children and helps to find the child using GPS location.	It is fully about safety and secured electronic system for child . Less tension to Parents.	In Previous method, the model created which can be capable of handling the battery for long time. Nowadays, the system proposes a location tracking facilities and speeding monitoring using GPS, GSM with IOT technology for child safety at low cost which can be affordable by the people.
PROBLEMS/PAINS **PR**	PROBLEM ROOT/CAUSE **RC**	BEHAVIOUR **BE**
The child safety is a complex far reaching health priority, which requires holistics ways of identifying safety issues.	It fears frustration obstacles and understanding the working of the system. Due to this solution, the kidnapping rate will be decreased.	It mainly focus on improving parent-child interactions, home safety and child health care as well as monitoring.
TRIGGERS TO ACT **TR**	YOUR SOLUTION **SL**	CHANNELS OF BEHAVIOUR **CH**
The parents are working with new and various technology. So, they should monitor their child's activity daily. **EMOTIONS** **EM** Due to this, the emotional and mental stability of the children gets affected which in turn ruins their career and future.	The parents can monitor their child each and every second. If the child is in danger, they notified by SMS through their device and their parents can save them.	Children and their parents are turning to digital solutions more than ever to support children's learning. While digital solutions provide huge opportunities for sustaining and promoting children's right

Side labels: Define CS, fit into CC · Explore AS · Understand RC · Understand RC · Identify strong TR & EM · Extract online & offline CH of BE

4. REQUIREMENT ANALYSIS:

4.1 Functional requirement:

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	• Registration throughGmail • Registration through phone number
FR-2	User Confirmation	• Confirmation via Email • Confirmation via OTP
FR-3	App installation	• Installation through link • Installation through play store
FR-4	Settings geo fence	• Setting by user to find child location

FR-5	Detecting child location	- Detecting location via app - Detecting location via SMS
FR-6	User Interface	- User Login Form. - Admin Login Form.
FR-7	Database	- Stored in cloud for seamless connectivity. - Parents and kids link with the distance and the location values obtained from the mobile devices are stored here. - The values include parent id, kidid, distance, longitude, latitude etc.
FR-8	Server	- It connects the database and the frontend application. - The backend server has been implemented to run as a service and is deployed in an IBM cloud instance. - The backend server has been implementedto run as a service and is deployed in an IBM cloud instance.
FR-9	GPS tracking	The system is implemented with a GPS module,which acquires the location information of the user and stores it to thedatabase.
FR-10	API	The value collected is sent to the database using an API.
FR-11	React JS	- We are using react is as front end for us project. - Node JS for the back end we are usingnode .
FR-12	GPS modules	It receives data directly from satellites

FR-13	Battery Life	• If the child or parent forgets to charge the device for a whole day then also the devicewill work. That's why we aim to make this device last the whole day with one charge. • It should be long-lasting.
FR-14	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 gets missing with the help of location history the aren't can track down their child's activity and also canfind their child.

4.2 Non-Functional requirements:

NFR NO	Non-functional Requirements	DESCRIPTION
NFR-1	Usability	• Device have GSM can help to inform the parents or relatives about the current situations of the child by deliver the message immediately to save the child.
NFR-2	Security	• Make children parents more assure about their kid's security, we have a feature in

		our device called Geo- Fence. ● Whenever your child crosses that specific area, you will get an instant notification on your phone.
NFR-3	Reliability	● Portable ● Easy to use ● Flexibility
NFR-4	Performance	● Create a Child tracker which helps the parents with continuously monitoring the translocation. ● The notification will be sent according to the child's location to their parents or caretakers. ● The entire location data will be stored in the database.
NFR-5	Availability	● Track your child even in a crowd ● Get travel details of kids at any time Know the current location
NFR-6	Scalability	● Gadget ensures the safety and tracking of the children. ● Parents need not worry about their children.

NFR-7	Availability	- The system should be able to deliver promptly to the financing authority. - In the case of non-profit organizations, the solution should be 'advancing the mission'.
NFR-8	Dynamic	IoT devices may have the capability toadapt dynamically and change based on their conditions
NFR-9	Desirability	- Navigation should be made easy. - The user should be able to search and find the information he needs without much hassle.

5. PROJECT DESIGN:

5.1 Data Flow Diagram:
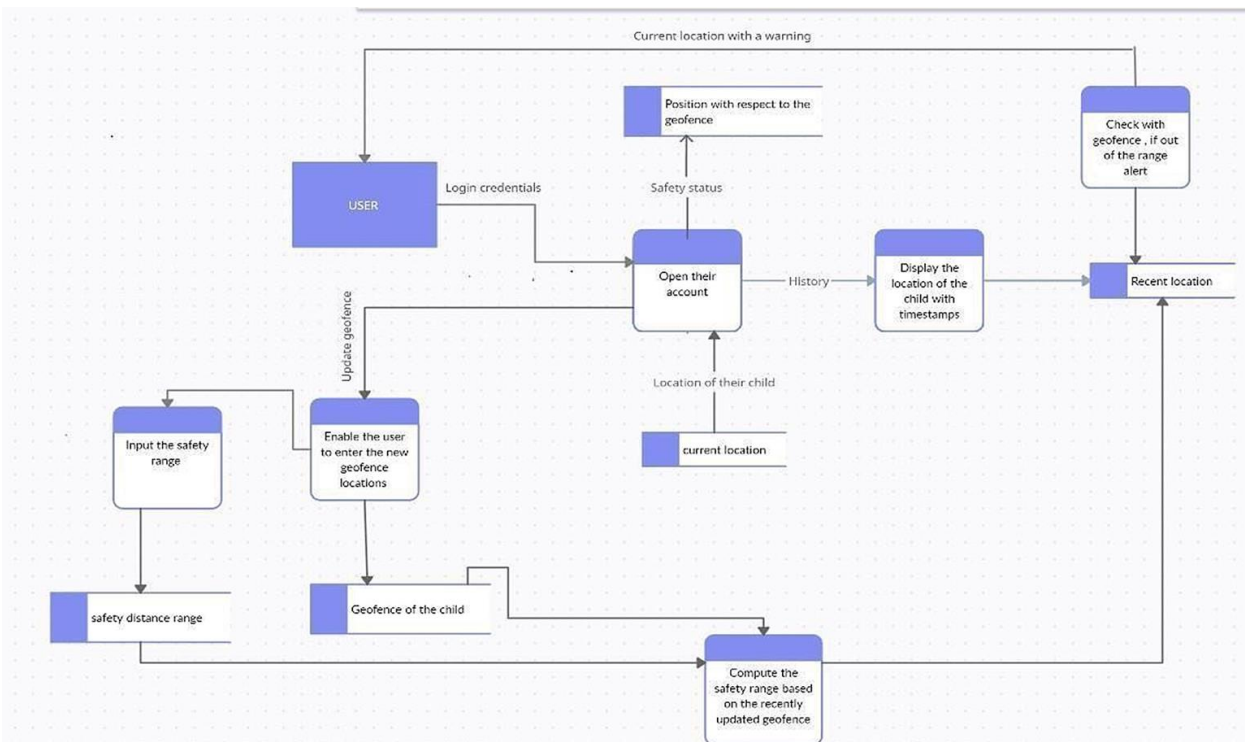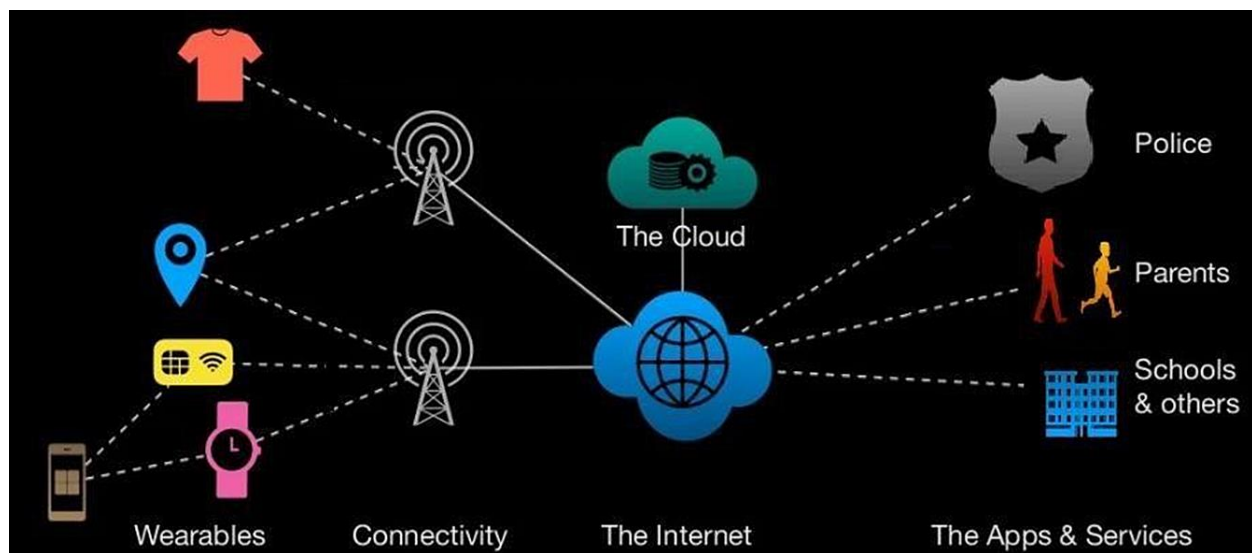
5.2 Solution & Technical Architecture:

Table-1 : Components & Technologies:

Component	Description	Technology
User Interface	Web UI, Mobile App.	HTML, CSS, JavaScript
Application Logic-1	Code Development Phase	Python
Application Logic-2	Interfacing purposes	IBM WatsonAssistant
Browser-based flow editor	Visual Programming	Node Red
Cloud Database	Database Service on Cloud	IBM Cloud
File Storage	Usage of IBM Cloud Storage	IBM Block Storage
Infrastructure (Server/ Cloud)	Application Deployment on Local Server	Cloud Platform

Table-2: Application Characteristics:

Characteristics	Description	Technology
Open-Source Frameworks	A template for software development that is designed bya social network.	IBM Watson Platform, NodeRed.
Security Implementations	Each and every parent should take care of their own children, without letting them to fall into the dark world of abuses,which entirely ruin them physically, mentally and emotionally destroying our future. Hence,	Notifications and Alerts

	considering the importance of our future, our project makes it easy for parents to track their children and to visually monitor them on regularbasis, which makes them ensure the safety of their children and reduces the rate of incidents of child abuse.	
Scalable Architecture	If any abnormal values are read by the sensor, then an SMS is sent to theparents mobile and an MMS indicating an image captured by the serial camera is also sent. The future scope of the work is to implement the IoT device which ensures the complete solution for child safety problems.	Implementation usingSoftware.
Availability	The solution represented takes advantages of Open-source platforms.	NODE RED, IBM cloud, IBM IoT platform.

Performance	GPS is useful for tracking child and also provides the information where the child is currently located as well as it also informs the parents how long his child is far away from his parents. SMS services used when smart phones do not support internet connectivity in this case child is able to send a text message or exact location in the parents. This system is going to help the parents to track the location of their children without informing them because their movement is displayed on the parent's phone.	GPS

5.3 User Stories:

User Type	Functional Requirement	User Story Number	User Story / Task	Acceptance criteria	Priority	Release

Customer (Mobile user) and (Web user)	Registration	USN-1	As a user, I can register my account by entering my email, password,and confirming my password	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation emailonce I have registered myself	I can receive confirmation Email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through google account	I can register& access the dashboard with google account Login	High	Sprint-2
	Login	USN-4	As a user, I can log into the application by entering user id & password		High	Sprint-1
	Dashboard					
Customer Care Executive	Login		As I enter I can view the working of the application and scan for any glitches and monitor the operation and check if all the users are authorized	I can login only with my provided credentials	Medium	Sprint - 3
Administrator	Login		Maintaining and making sure the database containing the locations are secure and accurate and	I can login only with my provided credentials	High	sprint-3

			updated constantly.			

6. PROJECT PLANNING & SCHEDULING:

6.1 Sprint Planning & Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a Parent/Guardian,I can register for the application by entering my email, password, and confirming my password.	2	High	**Nivetha P**
Sprint-2		USN-2	As a Parent/ Guardian, I can register for the application through Gmail	1	Medium	Sujitha R
Sprint-3	User Confirmation	USN-3	As a parent I will receive connection , location in sms / mail once I have entered this application	1	High	**Vijayasarathi I**
Sprint-4	Login,Dashboard	USN-4	As a parent/ guardian , I can log into the application by	2	High	**Keerthick Vasa M**

			entering mail and password			

6.2 Sprint Delivery Schedule:

Project Tracker, Velocity &Burndown Chart:

Sprint	Total Story Points	Duration	Sprint StartDate	Sprint End Date (Planned)	Story PointsCompleted (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	4	6 Days	24 Oct 2022	29 Oct 2022	4	29 Oct 2022
Sprint-2	7	6 Days	31 Oct 2022	05 Nov 2022	7	05 Nov 2022
Sprint-3	6	6 Days	07 Nov 2022	12 Nov 2022	6	12 Nov 2022
Sprint-4	3	6 Days	14 Nov 2022	19 Nov 2022	3	

6.3 Reports from JIRA:

1. **Image showing the Backlogs created in the Jira Software(PETA Sprint1,PETASprint2, PETA Sprint3,PETA Sprint4):**
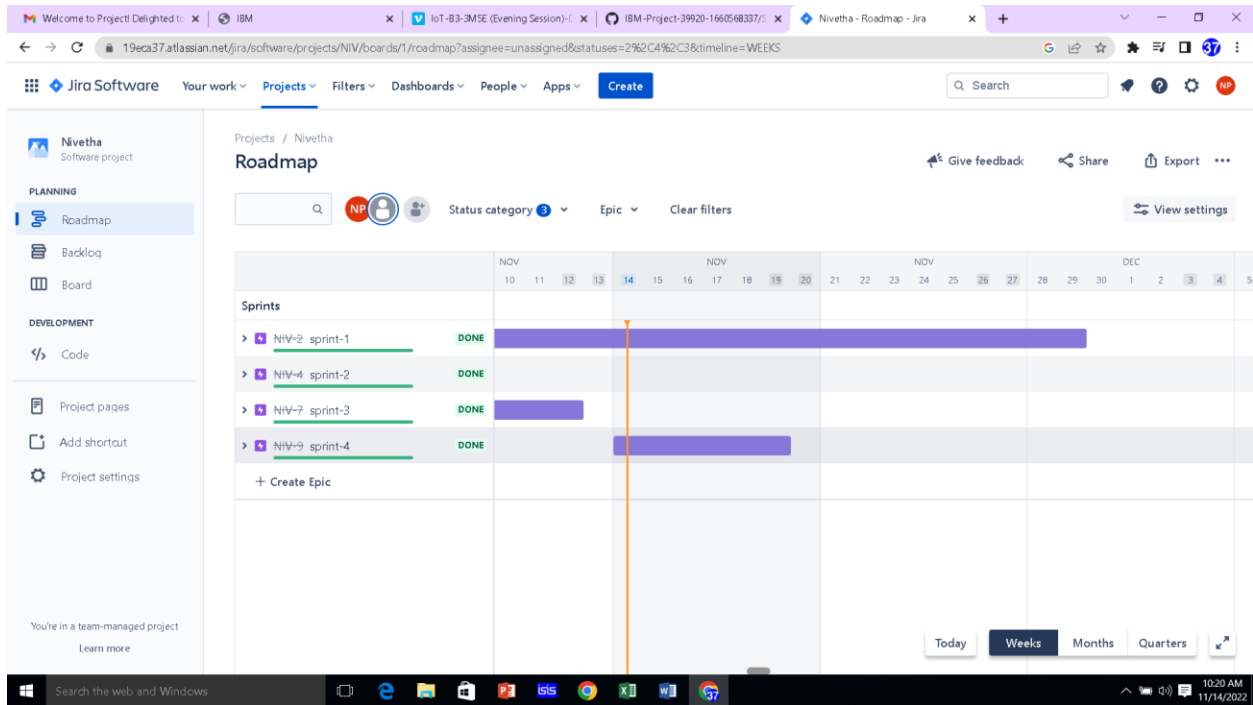
Image showing the User Stories in the respective sprints:
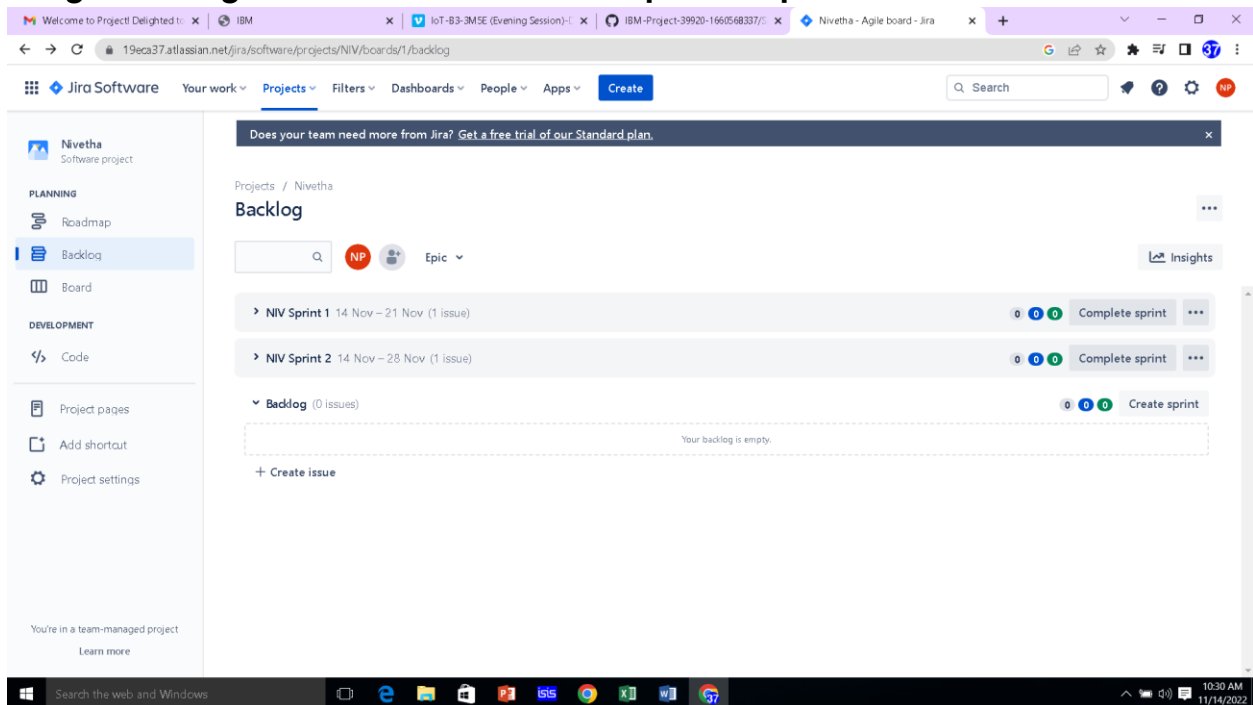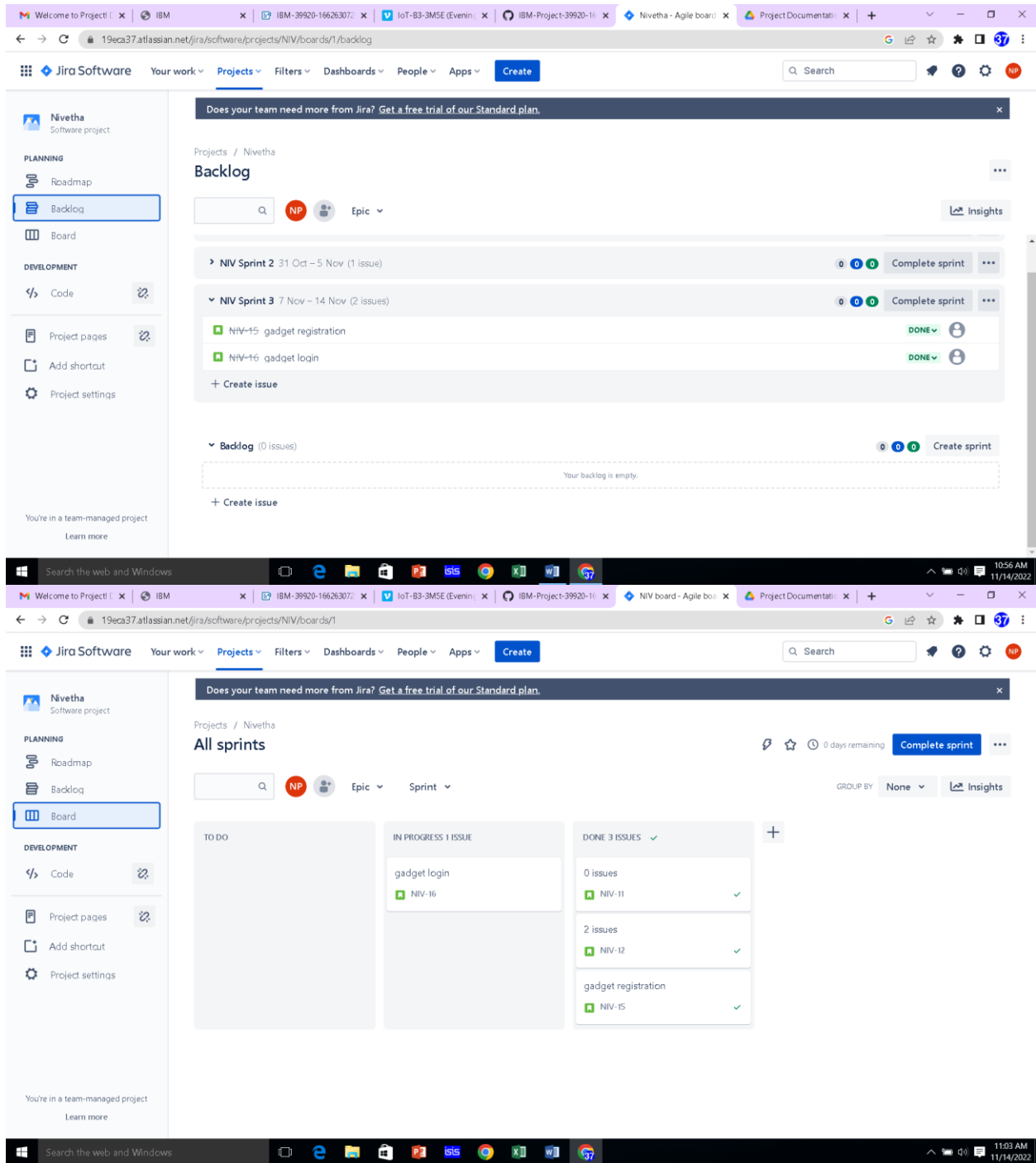
7. CODING & SOLUTIONING:

7.1 Feature 1:

```
#include <TinyGPSPlus.h>
```

```
TinyGPSPlus GPS;
void setup()
{
    Serial.begin(9600);
    Serial2.begin(9600);
    delay(3000);
}
void loop()
{
   while (Serial2.available() > 0)
   if (gps.encode(Serial2.read()))
       displayInfo();
   if (mill is() > 5000 && gps.charsProcessed() < 10)
   {
       Serial.println(F("No GPS detected: check wiring."));
      while (true);
   }
 }
void displayInfo()
{
   Serial.print(F("Location: "));
   if (gps.location.isValid())
   {
      Serial.print("Lat: ");
      Serial.print(gps.location.lat(), 6);
      Serial.print(F(","));
      Serial.print("Lng: ");
      Serial.print(gps.location.lng(), 6);
      Serial.println();
   }
    else
    {
      Serial.print(F("INVALID"));
    }
}
void updateSerial()
{
   delay(500);
   while (Serial.available())
   {
      Serial2.write(Serial.read());//Forward what Serial received to Software Serial Port
   }
   while (Serial2.available())
   {
      Serial.write(Serial2.read());//Forward what Software Serial received to Serial Port
   }
}
```
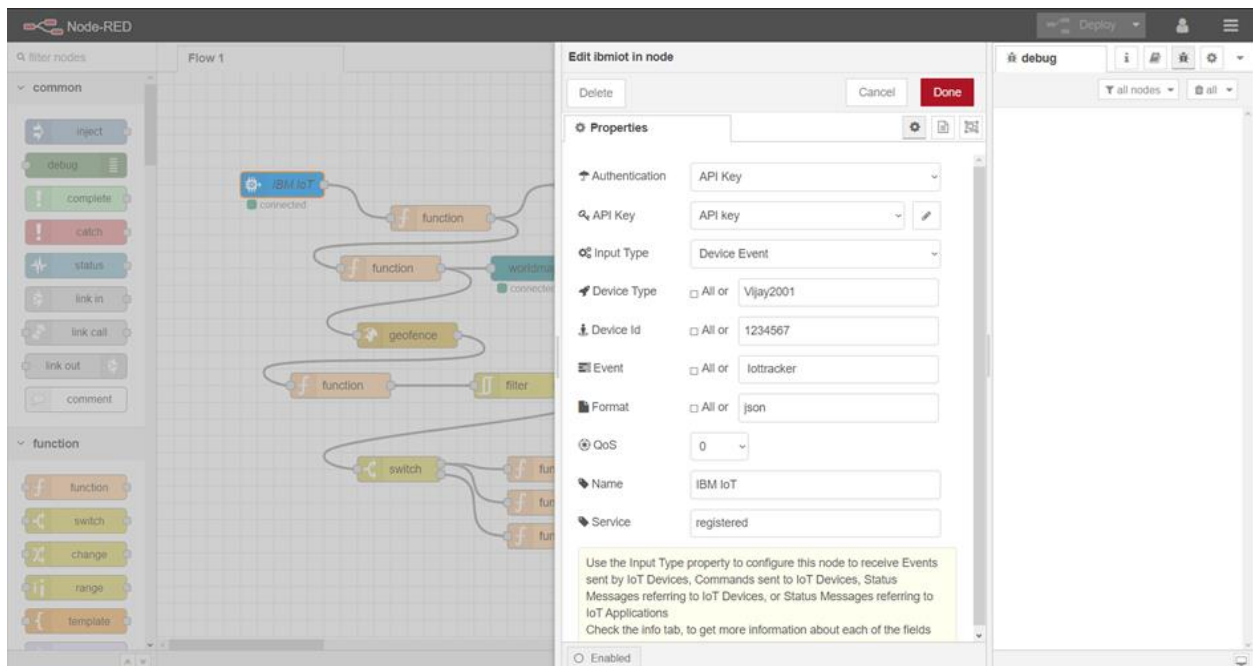
7.2 Feature 2:
__Step 1:__

- Created node-red flow using worldmap, geofence, cloudant, and http request to locate the child.
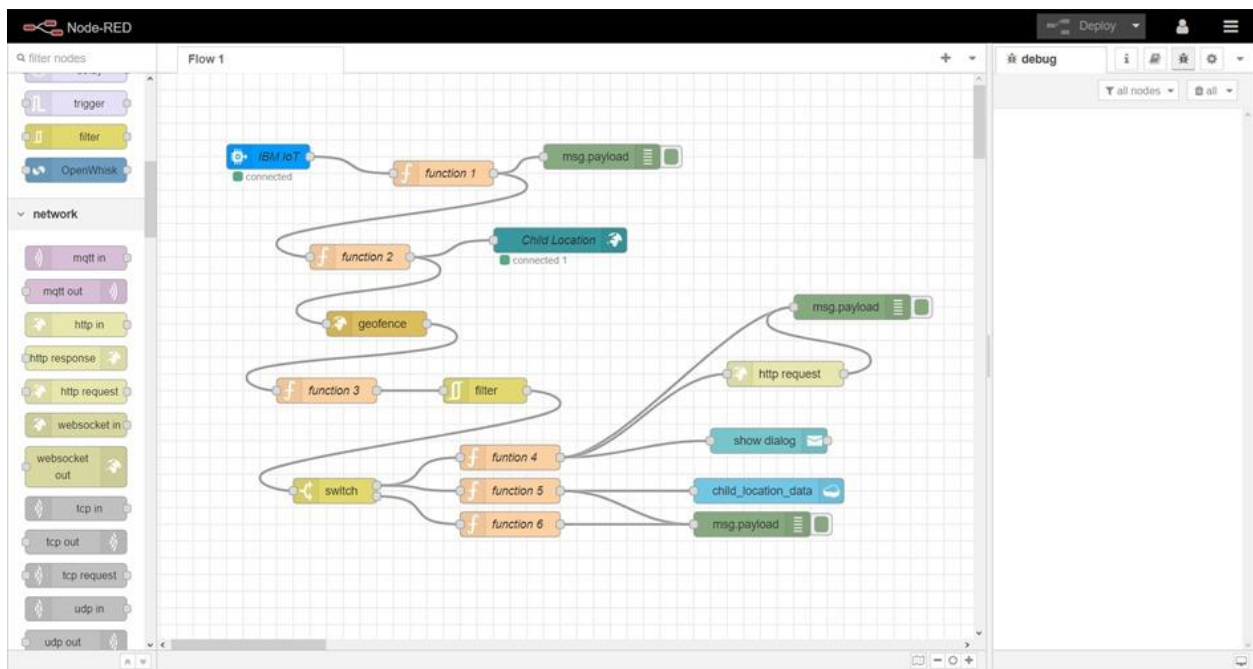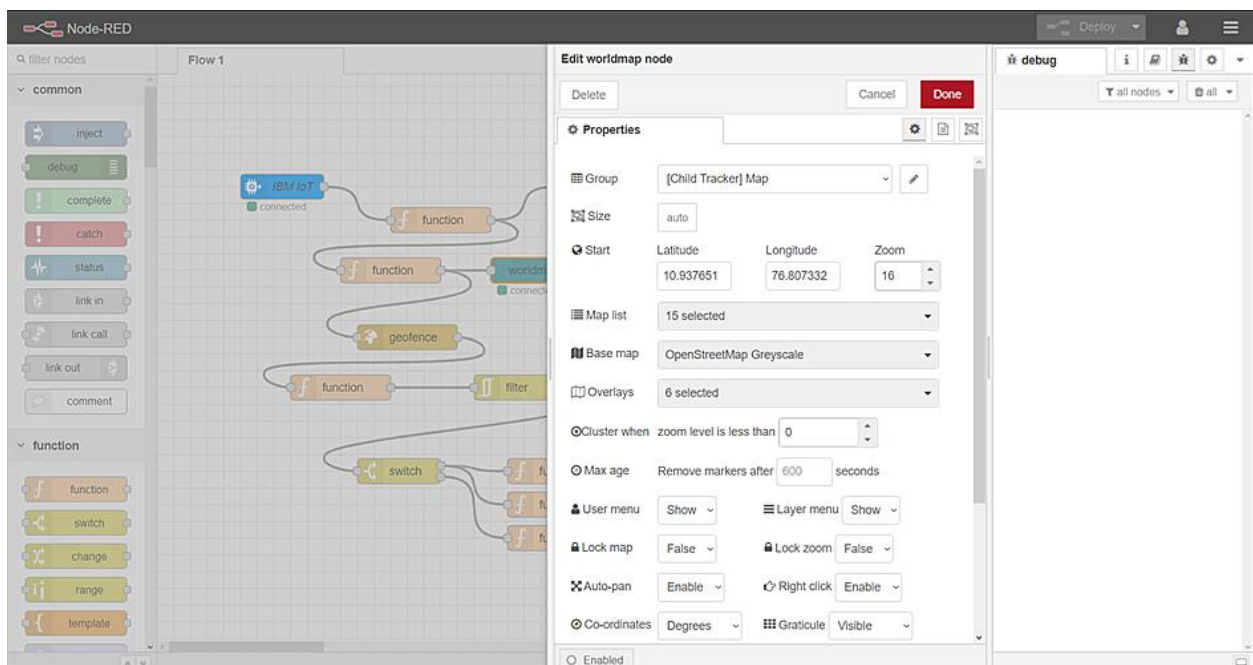

__Step 2:__

- Connected IBM IoT node in node-red to IBM Watson IoT using device credentials.
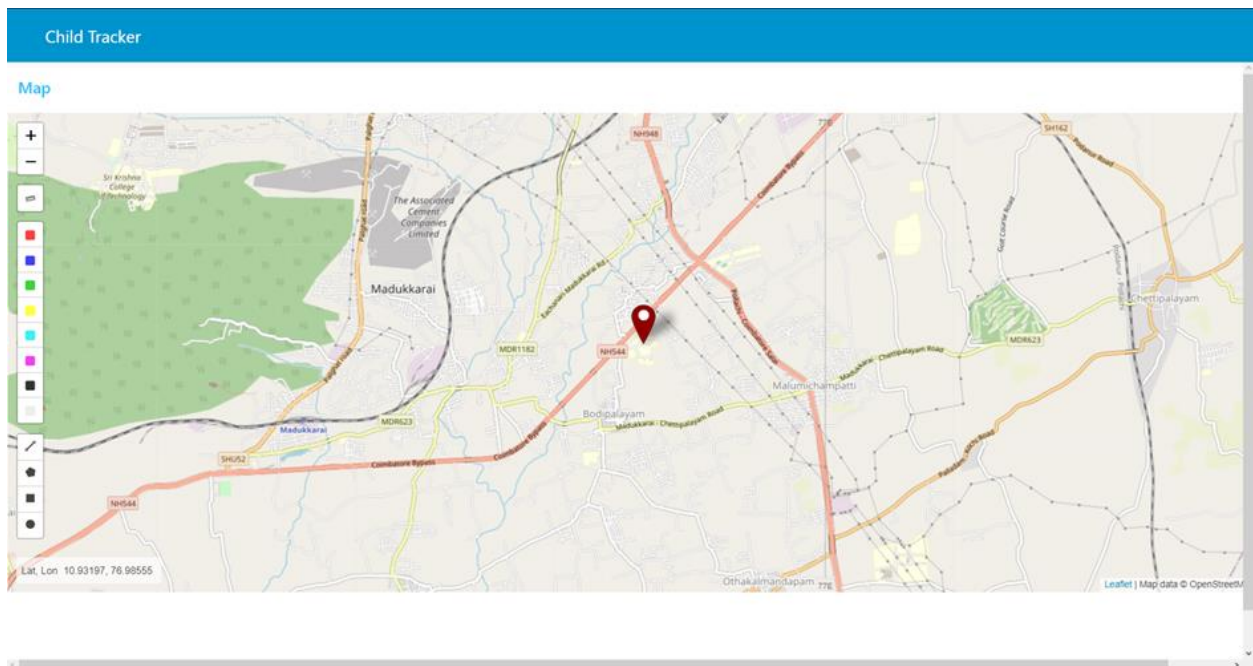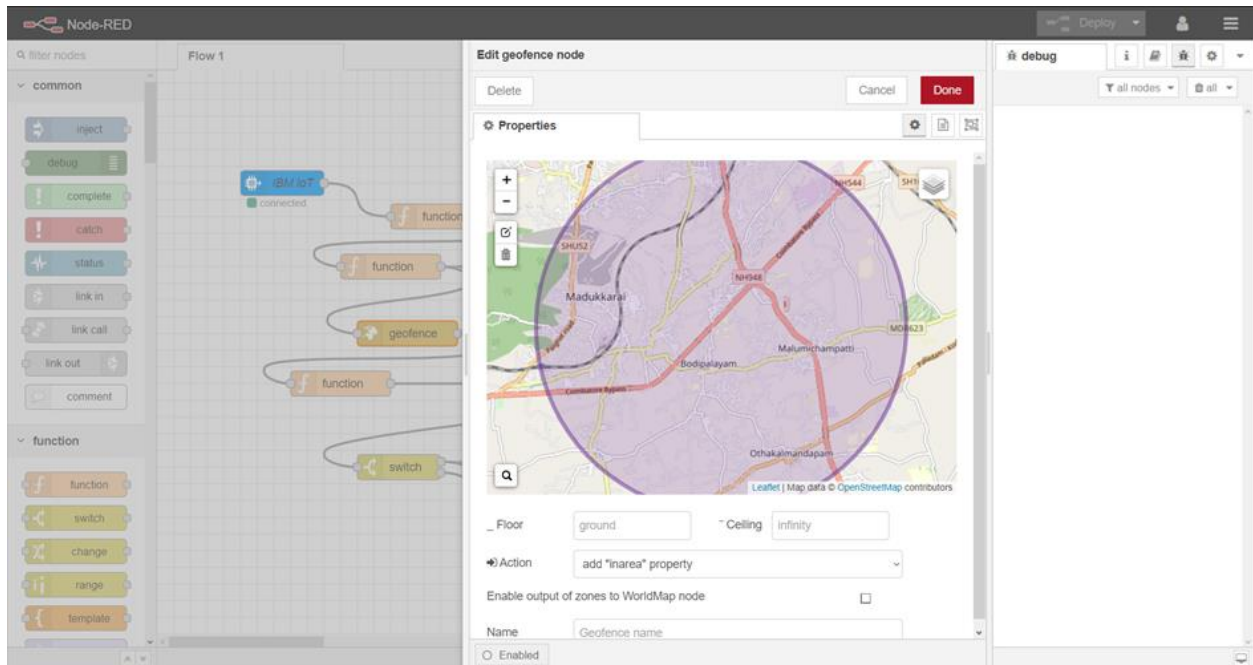
STEP 3:

- Created worldmap_ui to show the child location in user interface page of node-red

Step 4:

- Connected geofence to keep the child safe inside the parent or caretaker's monitoring

8. TESTING:
8.1 Test Cases:
8.1.1 Functional test cases:

- To verify the performance to create a Child tracker which helps the parents with continuously monitoring the translocation.
- To verify scalability testing.
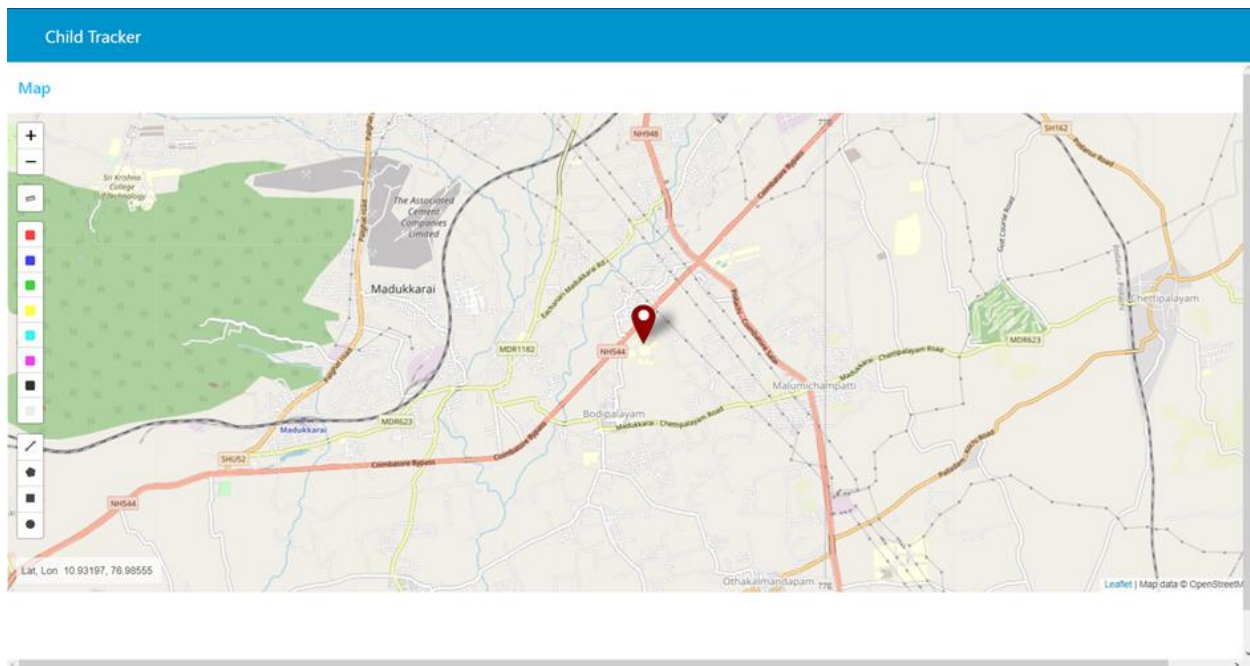- To verify security testing.
- To verify usability testing.

8.2 User Acceptance Testing:

8.2.1 Performance Testing:

- To verify the settings for geo fence.
- To verify the user interface.
- To verify detecting child location.
- To verify API key is correct or not.

9. RESULTS:
9.1 Performance Metrics:

- Store the location coordinates in database

All Documents
Query
Permissions
Changes
Design Documents

_id	deviceId	deviceType	eventType	format
0868d74e98d7df1304e...	1234567	Vijay2001	Iottracker	json
0e969041ae8c8270d3e...	1234567	Vijay2001	Iottracker	json
157ac8402bfb1ac16f4e...	1234567	Vijay2001	Iottracker	json
3adc73c6976026de939...	1234567	Vijay2001	Iottracker	json
409f267391f2effd2c49...	1234567	Vijay2001	Iottracker	json
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6a2704e478a02b6d7ca...	1234567	Vijay2001	Iottracker	json
6a80894819b94d31a94...	1234567	Vijay2001	Iottracker	json
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9ed31bd378c7e01a9c8...	1234567	Vijay2001	Iottracker	json
bd327c90bb303f02890...	1234567	Vijay2001	Iottracker	json
bf8d0ec61d74dc3f53a7...	1234567	Vijay2001	Iottracker	json
c327345e7901f08e4f41...	1234567	Vijay2001	Iottracker	json
d6483b57fff8aaf6c7a17...	1234567	Vijay2001	Iottracker	json

Showing 5 of 9 columns. Show all columns.   Showing document 1 - 15.   Documents per page: 20

id "0868d74e98d7df1304efe9d5eda8e5cb"

{
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  "key": "0868d74e98d7df1304efe9d5eda8e5cb",
  "value": {
    "rev": "1-296b426c3354c72acf8368201fb331ff"
  },
  "doc": {
    "_id": "0868d74e98d7df1304efe9d5eda8e5cb",
    "_rev": "1-296b426c3354c72acf8368201fb331ff",
    "topic": "iot-2/type/Vijay2001/id/1234567/evt/Iottracker/fmt/json",
    "payload": {
      "message": "Exit",
      "Time": "11/17/2022, 8:28:49 PM",
      "name": "Child Location",
      "lat": 10.952114,
      "lon": 76.956643
    },
    "deviceId": "1234567",
    "deviceType": "Vijay2001",
    "eventType": "Iottracker",
    "format": "json",
    "location": {
      "inarea": false
    }
  }
}

id "0e969041ae8c8270d3e7d4b08a725e2c"

Showing document 1 - 15.   Documents per page: 20

- Child tracking
- Location history

10. ADVANTAGES & DISADVANTAGES:

ADVANTAGES:
- The parameters such as touch, temperature & heartbeat of the child are used for parametric   analysis and results are plotted for the same.
- The advantages of smart phones which offers rich features like Google maps, GPS, SMS etc.

DISADVANTAGES:
- This system is unable to sense human behavior of child.
- To implement the IoT device which ensures the complete solution for child safety problems.

11. CONCLUSION:

The IoT device for child safety and tracking, to help the parents to locate and monitor their children. If any abnormal readings are detected by the sensor, then an SMS and phone call is triggered to the parents mobile. Also, updated to the parental app through the cloud. The system is equipped with GSM and GPS modules for sending and receiving call, SMS between safety gadget and parental phone. The system also consists of Wi-Fi module used to implement IoT and send all the monitored parameters to the cloud for android app monitoring on parental phone. Panic alert system is used during panic situations alerts are sent to the parental phone, seeking for help also the alert parameters are updated to the cloud. Boundary monitoring system is implemented on safety gadget with the help of BEACON technology, as soon as the safety gadget moves far away from the BLE listener gadget an alert is provided to itself.

12. FUTURE SCOPE:
This system can be further enhanced by installation of minicamera inside smart gadget for better security so that live footage can be seen on parental phone during panic situations. The system can be modified by installation of small solar panels for charging the battery of smart gadget to gain maximum battery backup.

13. APPENDIX:

Source Code:
```
import random as rand
import time
import ibmiotf.application
import ibmiotf.device
import sys
import imdb

#defining credentials of device
organization = "aa13kc"
deviceType = "Vijay2001"
deviceId = "1234567"
authMethod = "token"
authToken = "Yd-6ozY-S6BLhM0vkw"
```

```python
def myCommandCallback(cmd):
    print("Command received: %s" % cmd.data['command'])
try:
    deviceOptions = {"org" : organization, "type": deviceType, "id" : deviceId, "auth-method"
: authMethod, "auth-token" : authToken}
    deviceCli = ibmiotf.device.Client(deviceOptions)

except Exception as e:
    print("Caught exception connecting device: %s" %str(e))
    sys.exit()
deviceCli.connect()
while True:
    name= "Child Location"
    #latitude= 10.908532
    #longitude= 76.979312

    latitude= 10.952114
    longitude= 76.956643

    data = {'name':name,'lat' : latitude,
        'lon': longitude}
    def myOnPublishCallback():
        print("Published all data to IBM Watson :",latitude," ,",longitude)
    success =
deviceCli.publishEvent("Iottracker","json",data,qos=0,on_publish=myOnPublishCallback)
    if not success:
        print("Not connected to IoT Device")
    time.sleep(10)

    deviceCli.commandCallback = myCommandCallback

deviceCli.disconnect()
```

GitHub & Project Demo Link: