19L039 - PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

IOT BASED SAFETY GADGET FOR CHILD SAFETY MONITORING ANDNOTIFICATION

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Dissertation submitted in partial fulfillment of the requirements for the degree of

BACHELOR OF ENGINEERING

Branch: ELECTRONICS AND COMMUNICATION ENGINEERING

NOVEMBER 2022

PSG COLLEGE OF TECHNOLOGY

(Autonomous Institution) COIMBATORE – 641 004

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Bonafide record of work done by

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of Anna University

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CHAPTERS

1. INTRODUCTION:

The Internet of Things (IoT) is a significant part of daily living. The main distinction between embedded systems and IoT is that embedded systems have a specific protocol or software embedded in the chip, whereas IoT devices are intelligent devices that can make decisions based on their surroundings. The advancement of sensor technology, the accessibility of internet-connected devices, and data analysis algorithms enable Internet of Things (IoT) devices to respond intelligently to emergencies without requiring human intervention. IoT devices are so used in a variety of industries, including agriculture, medicine, industry, security, and communications. IoT solutions are helpful for doing deeper automation, analysis, and integration inside a system. IoT advancements in software, hardware, and current tools contribute to technology. Even technology in the areas of robotics, networking, and sensing is utilized. By utilizing cutting-edge components that affect users' social, economic, and political impact, IoT brings about global changes.

1.1 Project Overview:

The increased number of recorded crimes against children nowadays raises serious concerns about kid protection and tracking. In order to assist parents in finding and keeping an eye on their kids, a smart Internet of Things (IoT) gadget for child safety and tracking has been developed. The work is innovative in that when a kid is in need of rapid treatment during an emergency, the system instantly notifies the parent or caregiver by sending an SMS. The child's touch, temperature, and heartbeat are employed as parameters for the parametric analysis, and the results are presented for the same. The aforementioned system makes sure that kids are safe and tracked.

1.2 Purpose:

Since there has been a threat to children's safety in recent years, it is critical to offer them a technology-based solution that will support them in emergency circumstances and allow for smart device monitoring. The proposed system includes a W-Fi module used to implement IoT and send all the monitoring parameters to the cloud for android app monitoring on the parental phone. The proposed system is also equipped with GSM and GPS modules for sending and receiving calls and SMS between the safety gadget and parental phone. Using its location coordinates on the Android app on the parent's phone as well as an SMS request from the parent's phone to the safety device, an Android application may be used to track the current position of the safety device. When a panic attack occurs, a panic alarm system is employed. When the parental 4gadget is disconnected from the hand, an SMS is triggered to the parental phone, and the alert parameters are also updated to the cloud.

Heartbeats and temperature are tracked, with the numbers being regularly sent to the cloud for parental app monitoring. With the aid of BEACON technology, a boundary monitoring system is created on the safety device. As soon as the safety device deviates from the binding device, an alarm is sent to the parent on the binding device. The technology is used to track locations when necessary in safety-related circumstances and to check health metrics.

2. LITERATURE SURVEY:

2.1 Existing problem:

In paper [1], it was discussed that approximately 80% of all child abuse instances reported now across the world involve girls, with the other 26% being males. In our world, a child goes missing every forty seconds. Children are the foundation of a country; if their future was threatened, it would have an effect on the development of the whole country. The emotional and mental health of the children is compromised as a result of the abuse, ruining their profession and future. The things that happen to these defenseless kids are not their fault. Therefore, parents are in charge of raising their own children. However, parents are compelled to want for money because of the state of the

economy and their desire to concentrate on their child's future and job. Consequently, it becomes challenging for them to constantly cling to their kids. We have created a setting in our system where this issue may be effectively handled. It enables parents to focus on their own careers and effortlessly keep an eye on their kids in real time, just like they would if they were right there with them.

In paper [2], it was proposed that given the prevalence of crimes against children in the news today, kid protection and tracking is a top priority. To assist parents in finding and keeping an eye on their kids, a smart IOT gadget for child safety and tracking was created. The system is built on a Link It ONE board that has embedded C programming and is interfaced with temperature, heartbeat, touch, GPS, GSM, and digital camera modules. The technology automatically notifies the parent or caregiver by sending an SMS when the youngster needs emergency attention and this is what makes the job innovative. The child's heartbeat, temperature, and touch are used as parameters in a parametric analysis, and the results are plotted. The aforementioned mechanism makes sure that kids are safe and tracked.

In paper [3], it was presented that the creation and deployment of a mobile IOT-based health monitoring system for children that combines safety and emergency services with a sensor-embedded health monitoring system. It is well known that technological development is accelerating. However, relatively little technology is used across a wide range of industries. We are aware that people in various age groups experience various challenges. However, children's security is very poor.
There are numerous cases that are reported involving child safety. Today's schools and parents are increasingly concerned about how their students will get to school and other locations.Thus, it is quite challenging to keep track of and ensure the safety of schoolchildren. We are introducing the embedded system that is IOT-based and employed in this project. We thus suggest a mechanism to continually monitor the child's characteristics as well as their whereabouts for security reasons. The technology offers sophisticated kid tracking.

In paper [4], it was stated that mobile networks will be used to link people with one another. In order to lessen parents' anxiety and give schools real-time access to student tracking data, this article suggests an SMS-based approach. One gadget transfers connections between several devices through. SMS is used to connect the impacted device to a mobile network. Stockholders may use the gadget to track kids and collect real-time data. The suggested system's primary benefit is the ability to convey location information over a mobile network (GSM). Here, a hardware-based prototype model (device) is developed. The project includes an ARDUINO UNO microcontroller, a GPS module, and a GSM module. By detecting the pace of a child's hand movement, this gadget will also be able to determine a child's state.

2.2 References:

[1] N. Senthamilarasi, N.Divya Bharathi, D.Ezhilarasi, R.B.Sangavi; Child Safety Monitoring System Based on IoT; International Conference on Physics and Photonics Processes in Nano Sciences, Journal of Physics: Conference Series; Conference Series. **1362** 012012**DOI** 10.1088/1742-6596/1362/1/012012, November 2019 https://www.researchgate.net/publication/337309815_Child_Safety_Monitoring_System_Based_on_IoT

[2] M Nandini Priyanka, S Murugan, K N H Srinivas, T D S Sarveswararao, E Kusuma Kumari; Smart IOT Device for Child Safety and Tracking; International Journal of Innovative Technology and Exploring Engineering (IJITEE); ISSN: 2278-3075, Volume: 8, Issue No:8, June 2019 https://www.ijitee.org/wp-content/uploads/papers/v8i8/H6836068819.pdf

[3] P.Poonkuzhlai, R.Aarthi,Yaazhini.V.M, Yuvashri.S, Vidhyalakshmi.G; Child Monitoring and Safety System Using Wsn and Iot Technology; Annals of R.S.C.B., ISSN:1583-6258, Volume: 25, Issue No: 4, 2021 https://www.annalsofrscb.ro/index.php/journal/article/download/3855/3160/7127

[4] Fitsum Tesfaye; IOT BASED CHILDREN MONITORING SYSTEM IN SCHOOL BASED ON ETHIOPIA; Wolaita Sodo University, October 2020 https://www.researchgate.net/publication/343712876_IOT_BASED_CHILDREN_MONITORING_SYSTEM_IN_SCHOOL

2.3 Problem Statement Definition:

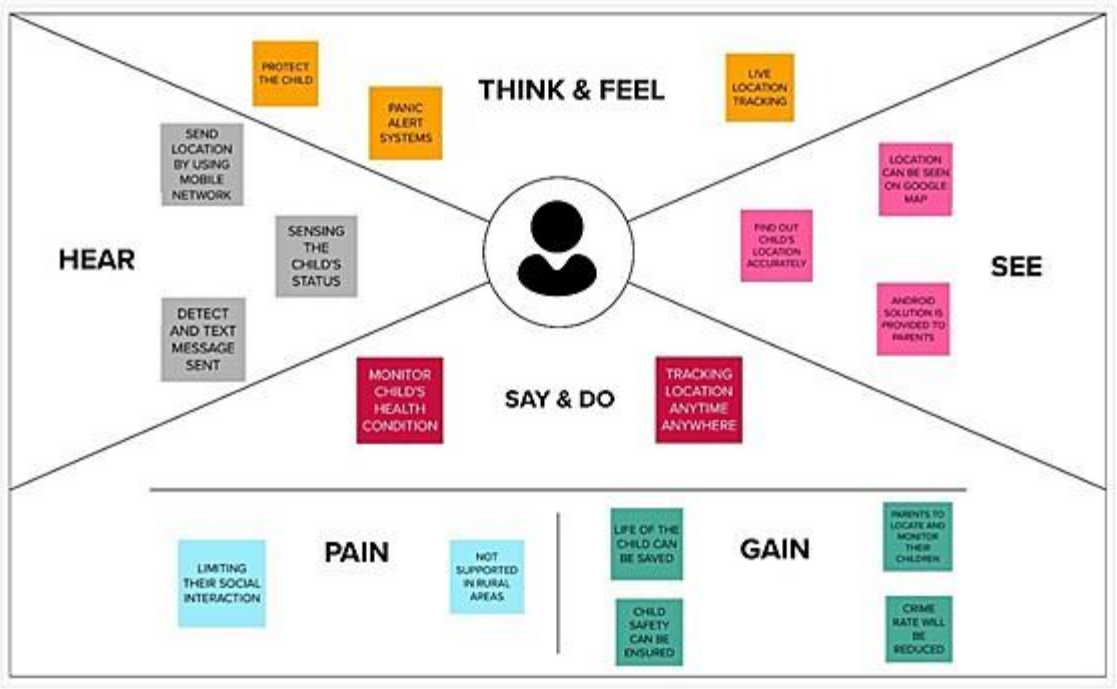
Every year, several kids go missing and are never discovered. Runaways, parental kidnappings, and third-party kidnappings are all difficult to stop and have serious negative effects on the children involved. Children's involvement in crime is on the rise today, which makes people more concerned about child safety.

3. IDEATION & PROPOSED SOLUTION:

3.1 Empathy Map Canvas:

An empathy map is a straightforward, simple-to-understand picture that summarizes information about a user's actions and views. It is a helpful tool to assist steams comprehend their users more fully.

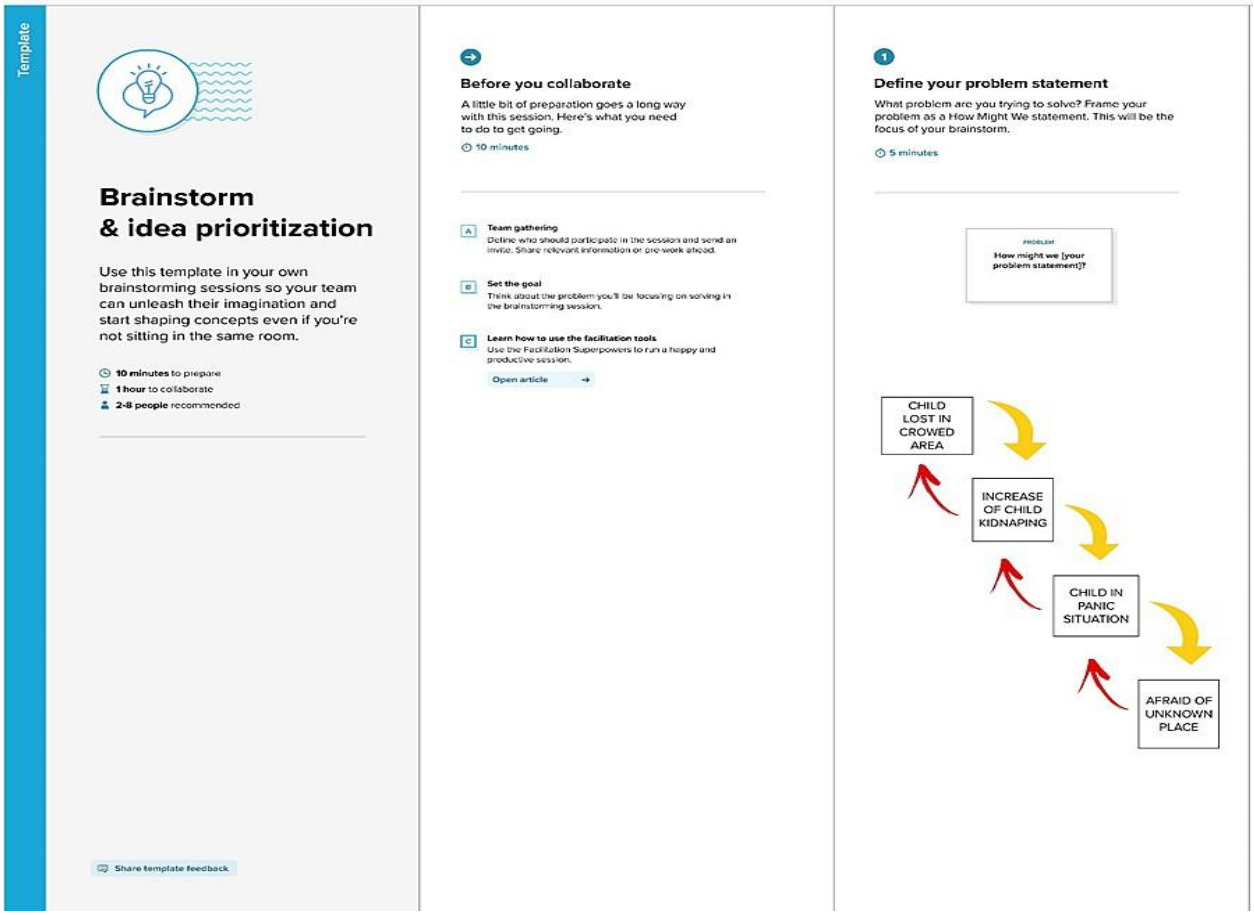
It's important to comprehend both the actual issue and the individual who is experiencing it in order to develop a workable solution. Participants learn to think about situations from the user's perspective, including goals and problems, via the process of constructing the map.



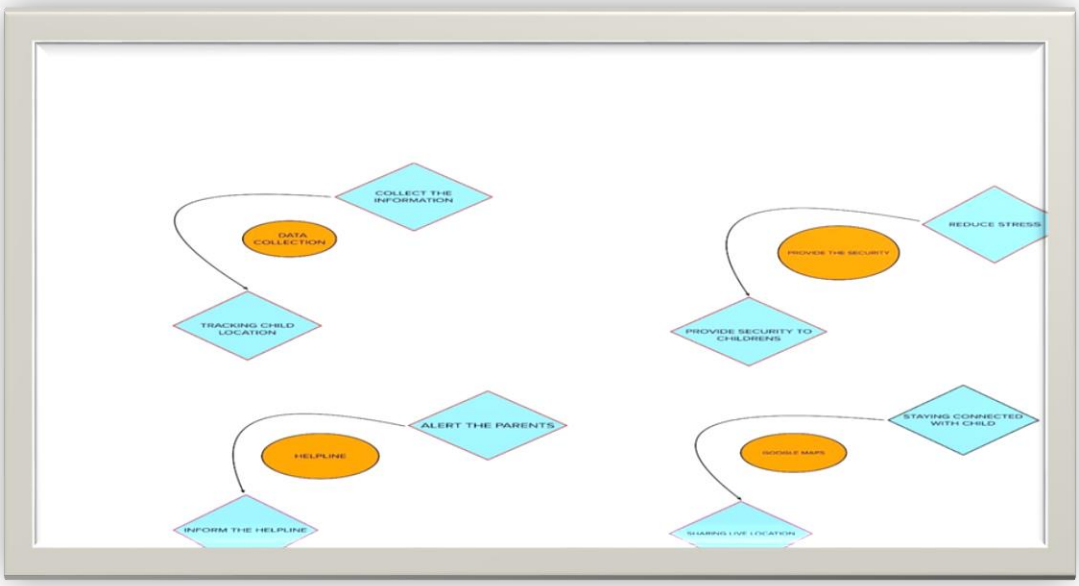
3.2 Ideation & Brainstorming:

During a brainstorming session, everyone on a team is encouraged to participate in the process of original thought that results in problem solving. Volume over quality is prioritized, unconventional ideas are welcomed and built upon, and everyone is urged to collaborate in order to develop a wealth of original solutions.

Utilize this template during your own brainstorming sessions to enable your team to let their creativity run wild and begin developing concepts even if they are not physically present



Step-1: Team Gathering, Collaboration and Select the Problem Statement

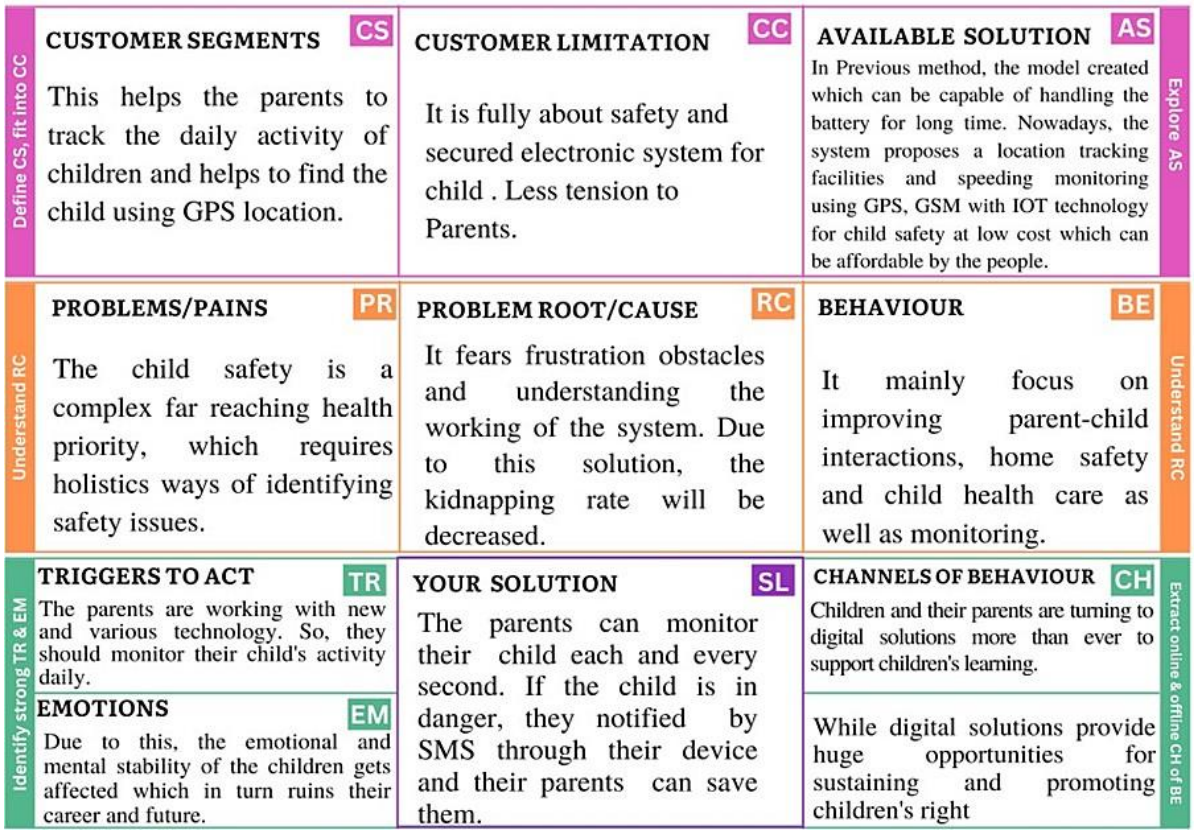


3.3 Proposed Solution:

S.No.	Parameter	Description
1	Problem Statement (Problem to be solved)	Every year, several kids go missing and are never discovered. Runaways, parental abductions, and third-party kidnappings are difficult to stop and have serious repercussions for the children involved. Children's involvement in crime is on the rise today, which makes adults more concerned about kid protection.
2	Idea / Solution description	To utilize the application, users must first sign up using their credentials. The kids will receive the gadget so that it may be used to routinely check on them. When building the system's code, it will include the boundary value, and it will use the device's GPS to control the Geo Fencing feature of the system. These information is kept on the server.
3	Novelty / Uniqueness	The objective of this endeavor is to create a wearable gadget for women and girls' protection and safety. By examining physiological signals in combination with bodily posture, this goal is accomplished. The body temperature and galvanic skin resistance are the physiological signs that are examined. The acquisition of raw accelerometer data from a triple axis accelerometer is used to calculate body position.

4	Social Impact / Customer Satisfaction	When a parent believes that their child is in danger, a tracking device may come in handy. Real-time location is provided by this gadget. These gadgets assist parents in establishing boundaries for their kids when they leave the house. The tracking system will notify the parent any time the child leaves a specific area. The system's goal is to limit the child's freedom while also keeping track of how far the child has traveled.
5	Business Model (Revenue Model)	The creative business model enlists sponsors and collaborators who share their dedication to providing kids with educational entertainment. The two most important elements are the development of a business concept using educational activities and architectural design.
6	Scalability of the Solution	In our system, we use the Internet of Things to automatically monitor the youngster in real time. Therefore, these problems can be resolved in the future by utilizing the Zambezi idea or by accessing the system without the use of the internet and via high-speed server transmission.

3.4 Problem Solution Fit:



4. REQUIREMENT ANALYSIS:

4.1 Functional requirement:

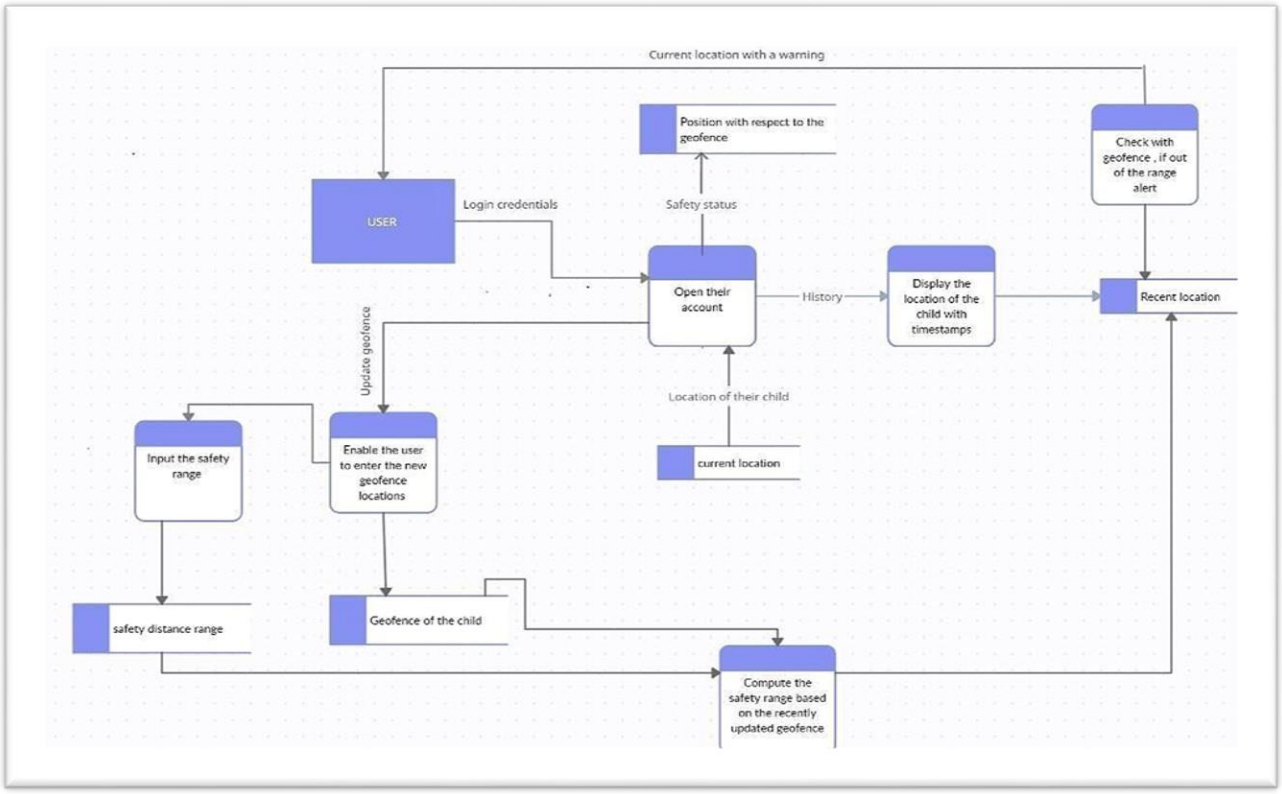
FR No.	Functional Requirement (Epic)	Sub Requirement (Story /Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail
FR-2	User Confirmation	Confirmation via Email and Confirmation via OTP
FR-3	Notification	Notification through Mobile Application
FR-4	User Interface	Mobile App – MIT App inventor, which used to see the location of children when they are out of geofence

4.2 Non-Functional requirements:

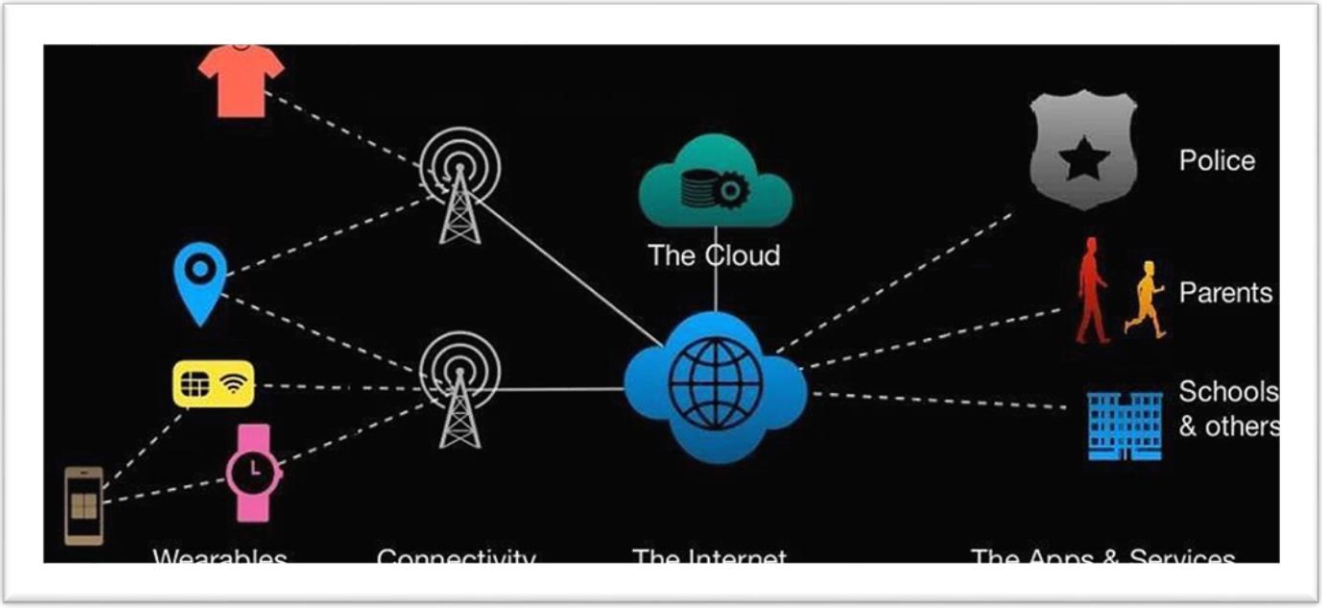
NFR NO	Non-functional Requirements	DESCRIPTION
NFR-1	Usability	Accessed via Mobile App which give information about the location (i.e.) latitude and longitude of the child
NFR-2	Security	Security of the Database must meet the The Health Insurance Portability and Accountability Act of 1996 (HIPAA) requirements
NFR-3	Availability and Reliability	Once logged in, webpage is available until logging out of the application
NFR-4	Performance	Each page must load within a couple of seconds
NFR-5	Scalability	The process must finish within 3 hours so data is available by 8 a.m. local time after an overnight update

5. PROJECT DESIGN:

5.1 Data Flow Diagram:



5.2 Solution & Technical Architecture:



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 Watson Assistant
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

Application Characteristics:

Characteristics	Description	Technology
Open-Source Frameworks	A software development template created by a social network	IBM Watson Platform, NodeRed.
Security Implementations	Every parent owes it to their own children to take care of them and protect them from the dark world of abuse that will completely ruin them physically, mentally, and emotionally and ruin our future. Due to the significance of our future, our project makes it simple for parents to track their kids and regularly visually monitor them, enabling them to ensure their safety and lowering the incidence of child abuse.	Notifications and Alerts

Scalable Architecture	An SMS is sent to the parents' mobile phone and an MMS with an image from the serial camera is also sent if the sensor detects any abnormal values. Future work will involve implementing an IoT device that will provide a comprehensive answer to all child safety issues.	Implementation using Software
Availability	The proposed solution makes use of open-source platforms.	NODE RED, IBM cloud, IBM IoT platform

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 registermy 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 email once I have registered myself	I can receive Confirmation Email & click confirm	High	Sprint-1

		USN-3	As a user, Ican registerfor the application through google account	I can register& access the dashboard with google account Login	High	Sprint-2
	Login	USN-4	As a user, Ican log intothe application by entering user id & password		High	Sprint-1
Customer Care Executive	Login		As I enterI can view theworking of the application on 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		Maintainingand makingsure the database containing the locations are secure and accurate and updated constantly.	I can login only with my provided credentials	High	sprint-3

6. PROJECT PLANNING & SCHEDULING:

6.1 Sprint Planning & Estimation:

Sprint	Functional Requirement (Epic)	User Story Number	User Story /Task	Priority	Team Members
Sprint-1	Registration	USN-1	As a Parent/Guar dian, I can register for the application by entering my email, password, and confirming my password.	High	ARAVIND T
Sprint-2		USN-2	As a Parent/ Guardian, I can register for the application through Gmail	Medium	BASKAR R
Sprint-3	User Confirmation	USN-3	As a parent I will receive connection ,location in sms / mail once I have entered this application	High	GOKULAARASAN K
Sprint-4	Login, Dash board	USN-4	As a parent/ guardian , I can log into the application by entering mail and password	High	SATHISH S

6.2 Sprint Delivery Schedule:

Project Tracker, Velocity & Burn down Chart:

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (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	19 Nov 2022

6.3 Reports from JIRA:

1. **Image showing the Backlogs created in the Jira Software (PETA Sprint1,PETASprint2, PETA Sprint3,PETA Sprint4):**

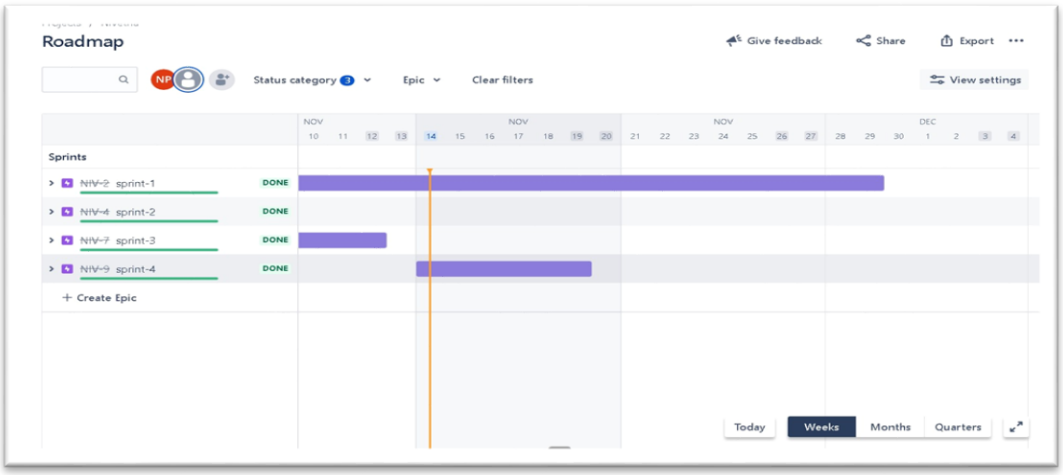
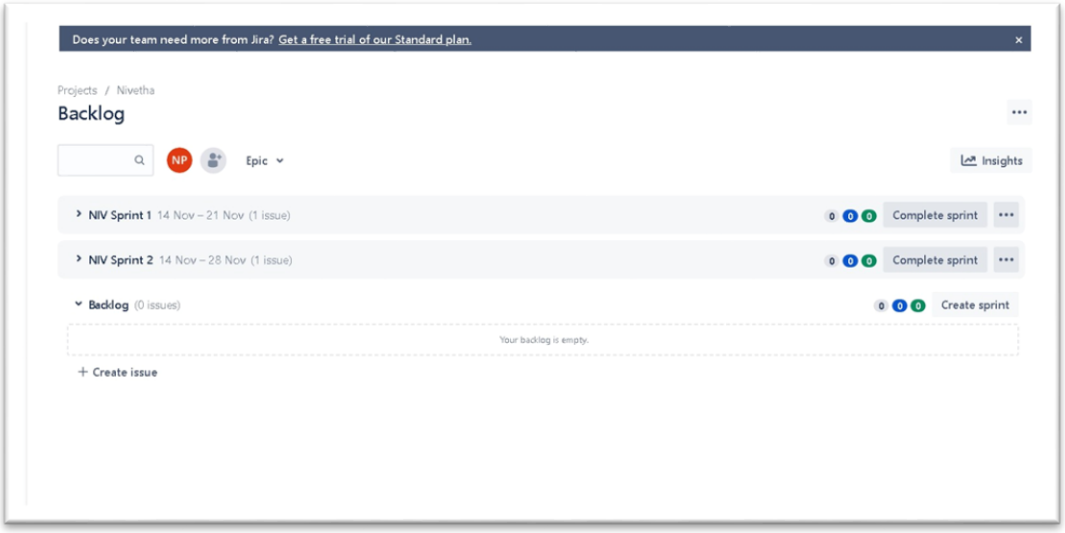
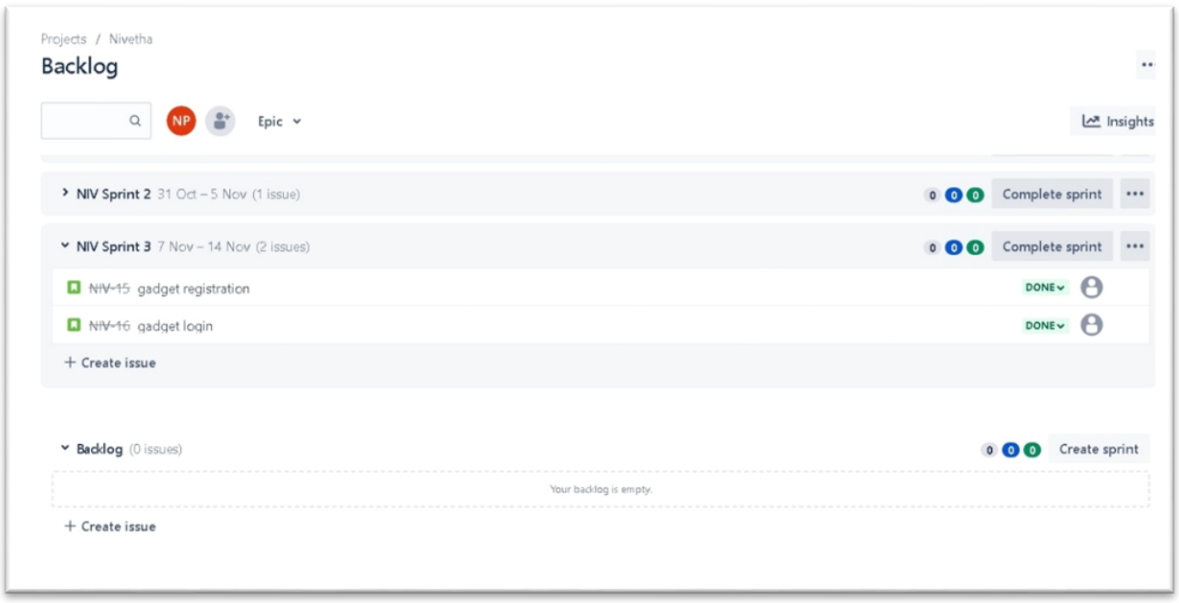
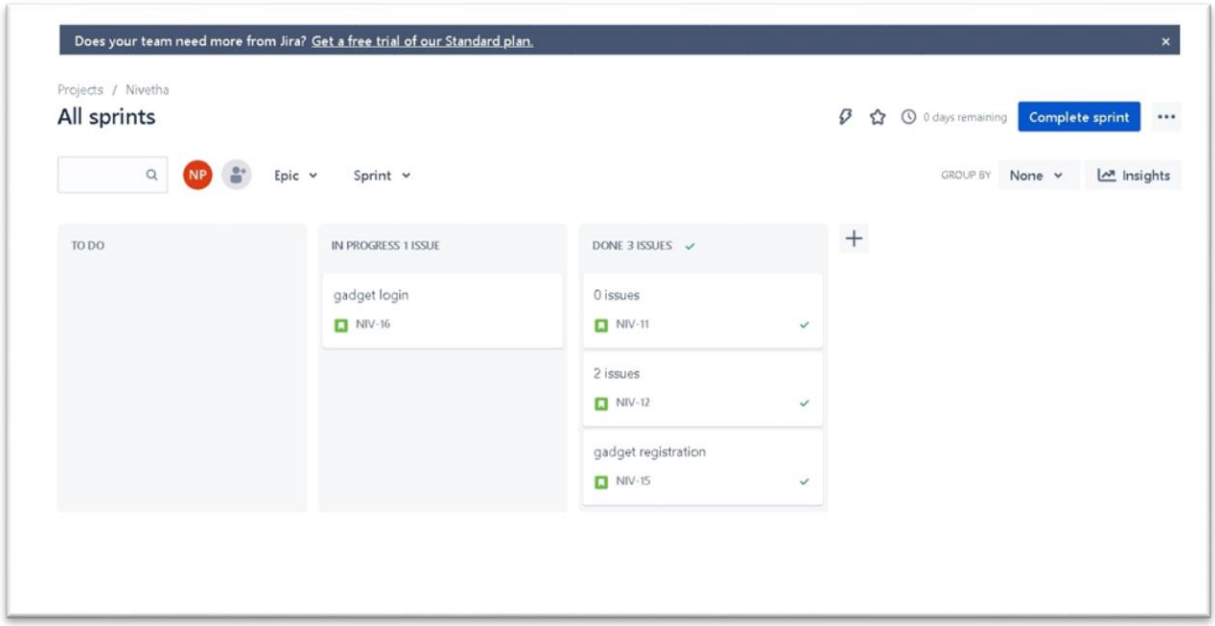


Image showing the User Stories in the respective sprints:




Projects / Nivetha
Backlog
NP
Epic
Insights
NIV Sprint 2 31 Oct – 5 Nov (1 issue)
0 0 0
Complete sprint
NIV Sprint 3 7 Nov – 14 Nov (2 issues)
0 0 0
Complete sprint
NIV-15 gadget registration
DONE
NIV-16 gadget login
DONE
Create issue
Backlog (0 issues)
0 0 0
Create sprint
Your backlog is empty.
Create issue


Does your team need more from Jira? Get a free trial of our Standard plan.
Projects / Nivetha
All sprints
0 days remaining
Complete sprint
NP
Epic
Sprint
GROUP BY
None
Insights
TO DO
IN PROGRESS 1 ISSUE
DONE 3 ISSUES
gadget login
NIV-16
0 issues
NIV-11
2 issues
NIV-12
gadget registration
NIV-15

7. CODING & SOLUTIONING:

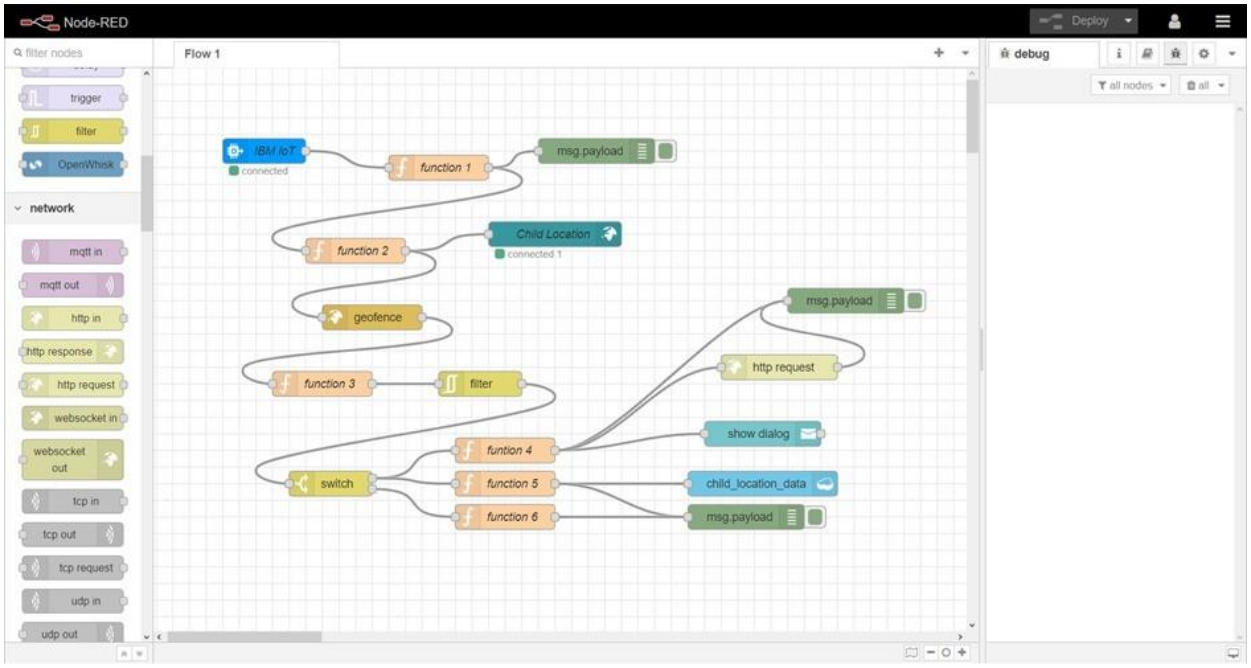
7.1 Feature 1:

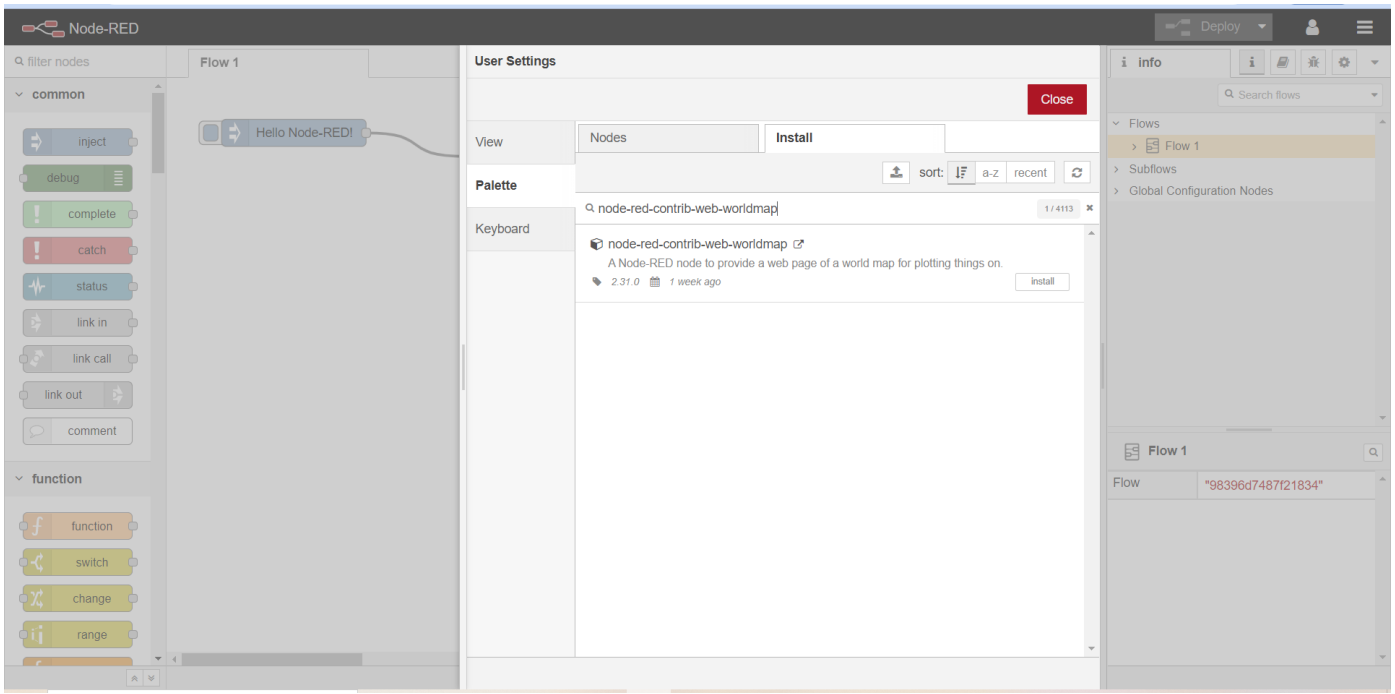
```
import json
import wiotp.sdk.device
import time

myConfig = {
   "identity":{
      "orgId": "cr4s7d",
      "typeId": "NodeMCU",
      "deviceId": "2461"
      },
      "auth": {
         "token": "12345678"
       }
   }
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

while 1:
   name="Aravind"
   #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 platform: ",myData)
   time.sleep(5)

client.disconnet()
```

7.2 Feature 2:

Step 1:

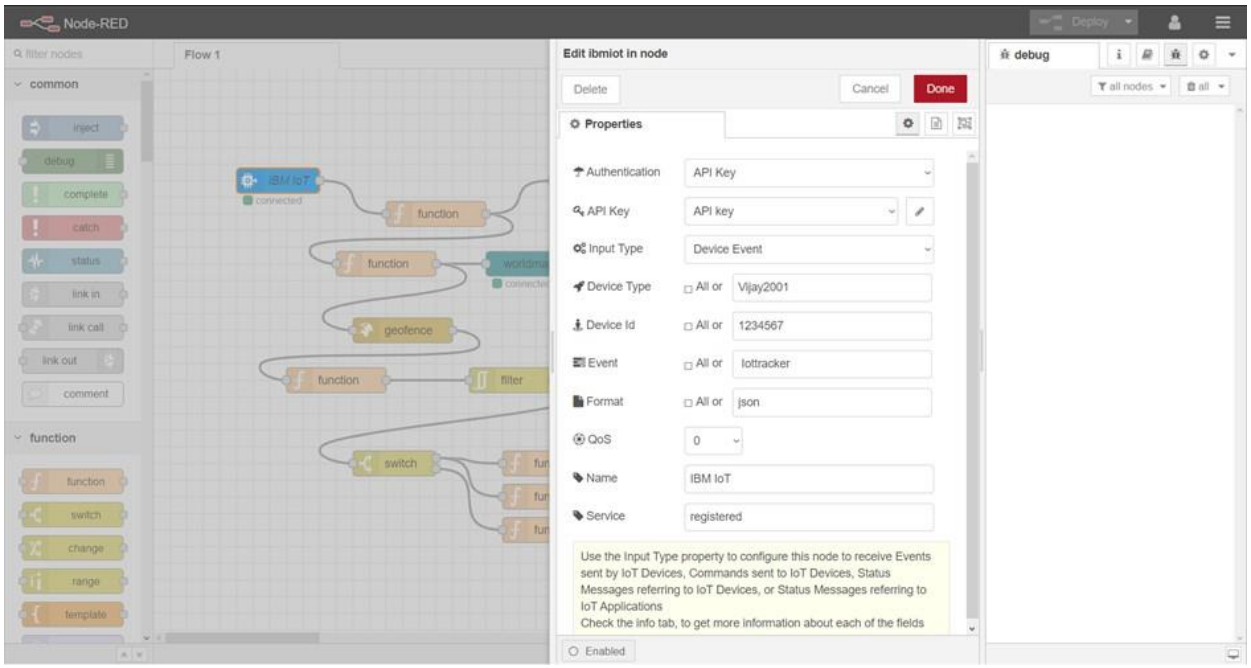
- Created node-red flow using world map, geofence, cloudant, and http request to locate the child by installing corresponding required modules





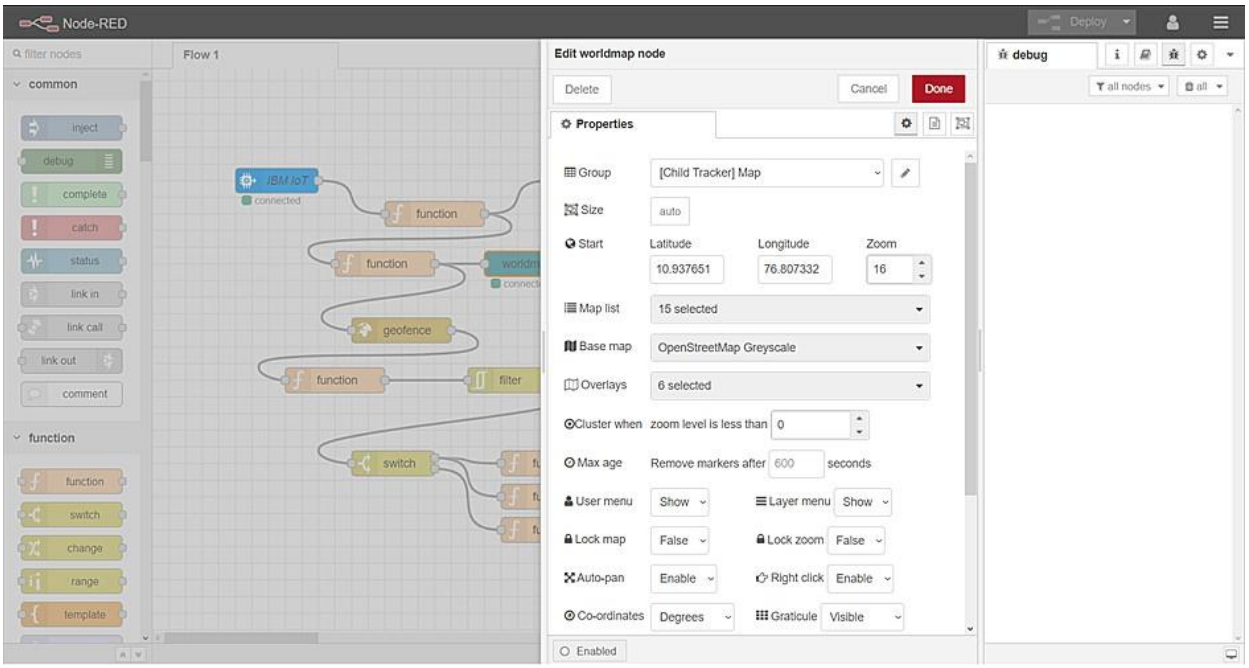
Step 2:

Connected IBM IoT node in node-red to IBM Watson IoT using device credentials



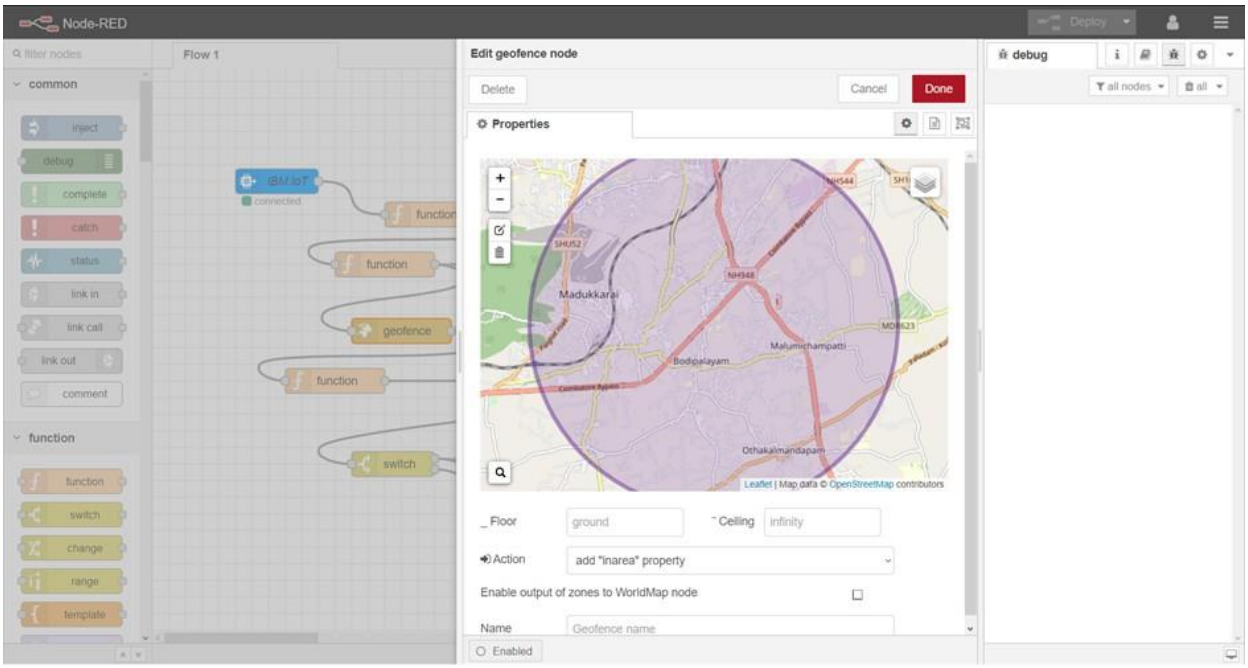
STEP 3:

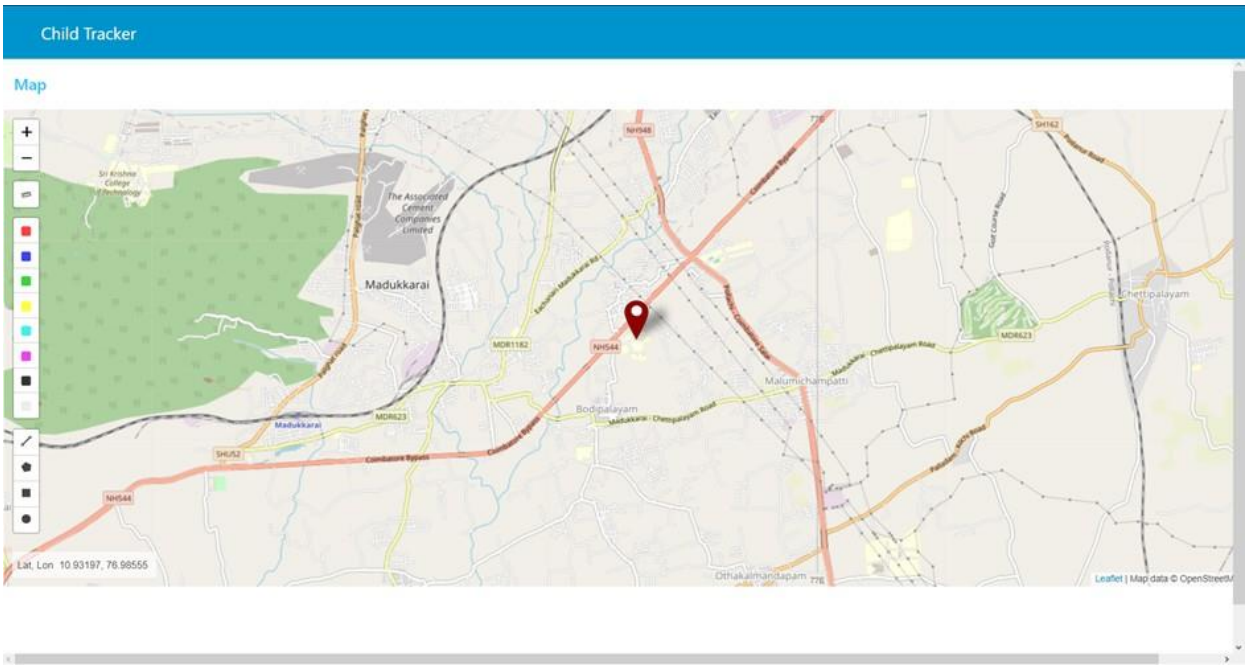
Created world map UI to show the child location in user interface page of node-red



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:

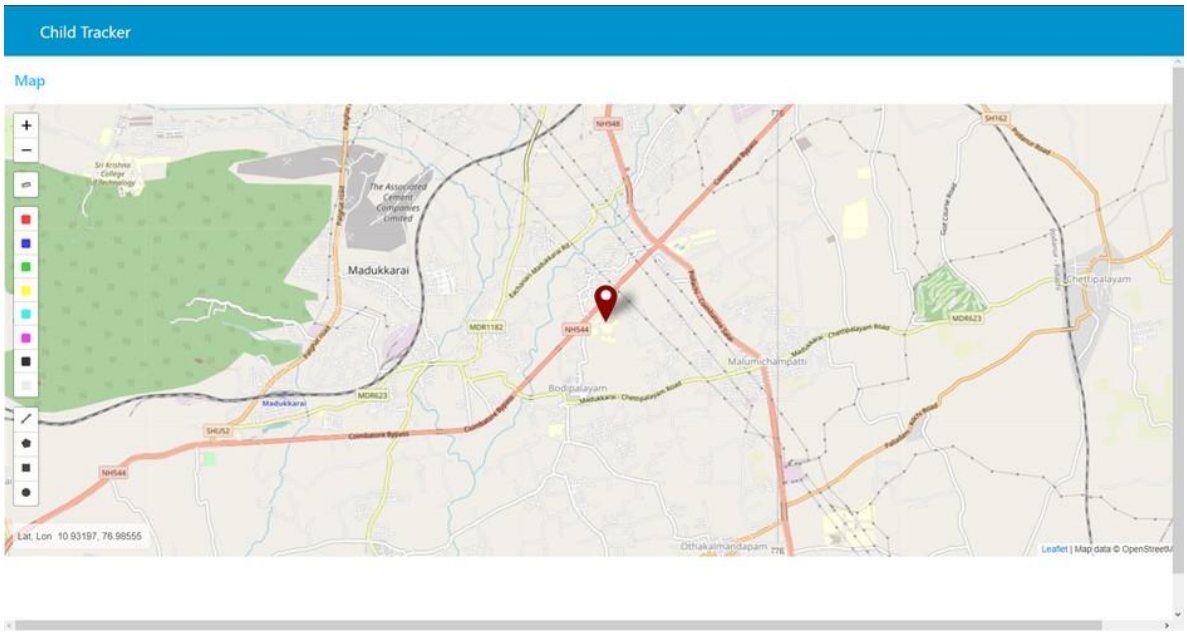
8.2.1 Performance Testing:

- 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

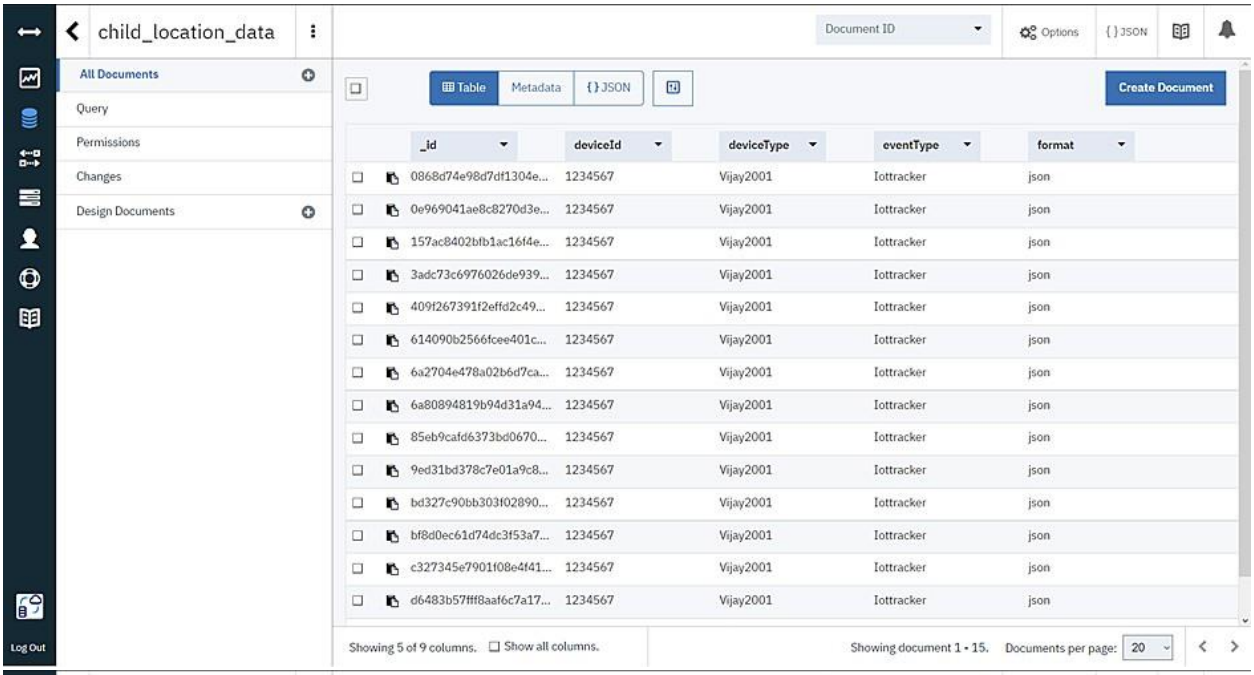
9. RESULTS:

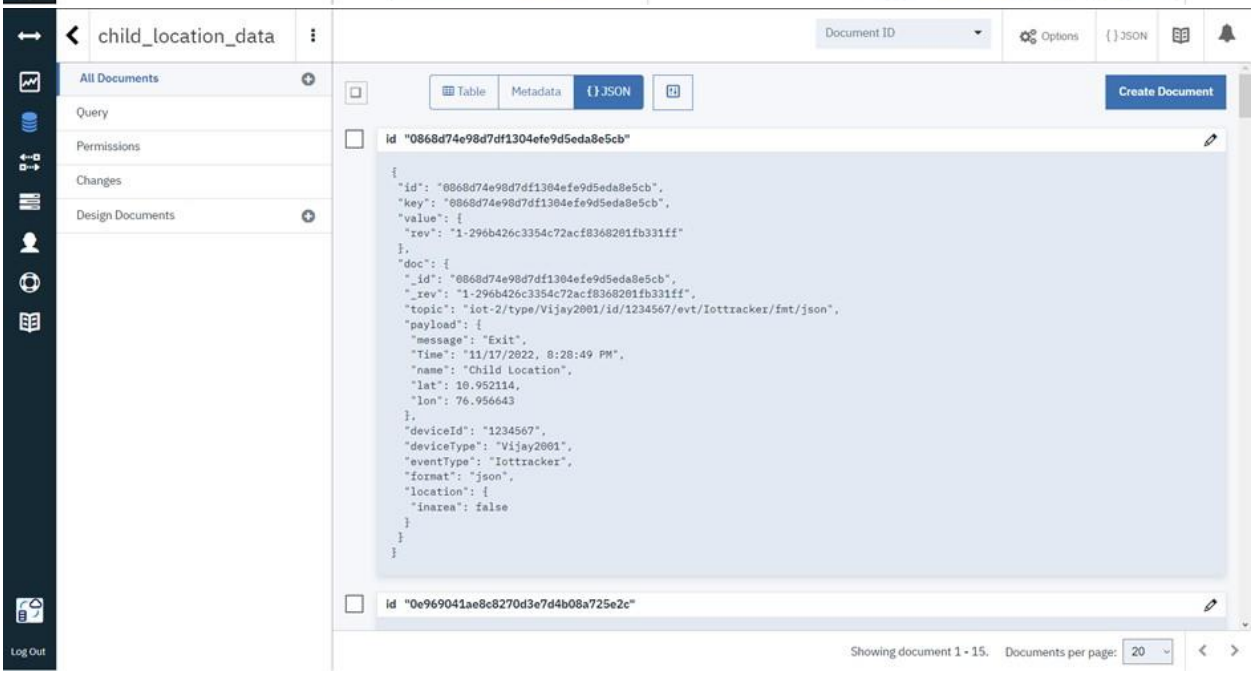
9.1 Performance Metrics:

Child tracking

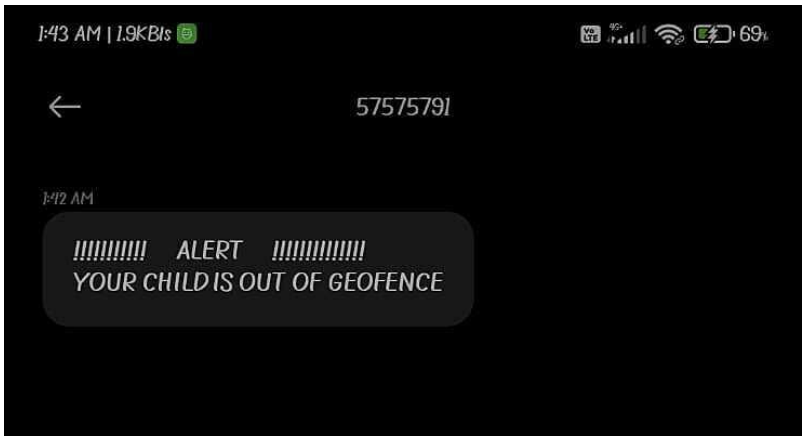


- Store the location coordinates in database





- Alert message to parent



10. ADVANTAGES & DISADVANTAGES:

Advantages:

- The child's touch, temperature, and heartbeat are used as parameters in a parametric analysis, and the results are plotted for the same.
- The benefits of smart phones, which offer a wealth of features like GPS, SMS, Google Maps, etc...

Disadvantages:

- This system cannot detect children's human behavior
- The actions of children cannot be detected by this system.

11. CONCLUSION:

The Internet of Things (IoT) gadget for child safety and tracking aids parents in finding and keeping an eye on their kids. An SMS and phone call are sent to the parents' mobile phones if the sensor detects any unusual values. Additionally, a cloud-based update to the parental control app. For communication between the safety device and the parent's phone, the system has GSM and GPS modules. In order to implement IoT, the system also includes a Wi-Fi module that transmits all of the monitored parameters to the cloud for parental phone android app monitoring. When using a panic alert system, alerts are sent to the parent's phone to request assistance and the alert parameters are updated in the cloud.

With the help of BEACON technology, a boundary monitoring system is implemented on safety equipment. As soon as the safety equipment departs from the BLE listener equipment, an alert is sent to the equipment itself.

12. FUTURE SCOPE:

Installing a mini camera inside a smart device would improve the security of the system and allow parents to view live video during emergency scenarios on their phone. Small solar panels may be added to the system to increase battery backup by charging the smart device's battery.

13. APPENDIX:

Source Code:

```
import json
import wiotp.sdk.device
import time

myConfig = {
   "identity":{
      "orgId": "cr4s7d",
      "typeId": "NodeMCU",
      "deviceId": "2461"
      },
      "auth": {
         "token": "12345678"
       }
   }
client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
client.connect()

while 1:
   name="Aravind"
   #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 platform: ",myData)
        time.sleep(5)

    client.disconnet()
```

GitHub Link:

https://github.com/IBM-EPBL/IBM-Project-37215-1660301717

Project Demo Link:

https://youtu.be/vHh59kBhajY

User Interface Link:

https://node-red-ukcsw-2022-11-13.eu-de.mybluemix.net/ui/#!/0?socketid=LHa_WV3eJWyzC8QVAAB_