IoT Based Safety Gadget for Child Safety Monitoring and Notification

Date	19 November 2022
Team ID	PNT2022TMID34017

Project Report

1. INTRODUCTION

a. Project Overview

The internet of things (IoT) refers to the set of devices and system that stay interconnected with real-world sensor and to the internet. 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 Wi-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 phone seeking for help and also monitored for plug and unplug from hand, as soon the gadget is unplugged from hand a SMS is triggered to parental phone and the alert parameter is also updated to the cloud.

b. Purpose

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

a. Existing problem

Real-Time Child Abuse and Reporting System

In the existing system, we use a voice recognition module in which the alert commands from the child
are stored and kept for further reference. If the same child delivers the same command, it will compare
with the alert command which was previously stored and sets an emergency level according to the alert
command. The GSM has a SIM which is used to send an alert message or an alert call to the trusted
peoples. GPS is used to track the live location and it is used when needed. The server will search the
respective device ID from the database and search for respective contacts according to that device ID
and helps in alerting the registered guardians.

i. The child could not produce
the exact alert command during a panic condition.

ii. The command produced may not match with the previously stored command.

iii. This project requires manual intervention.

b. References

[1] Authors: M Nandini Priyanka, S Murugan, K. N. H. Srinivas, T. D. S. Sarveswararao, E. Kusuma Kumari.

Title: Smart IoT Device for Child Safety and Tracking.

Published in: 2019 IEEE

The system is developed using Link-It 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.

Merits:

The parameters such as touch, temperature & heartbeat of the child are used for parametric analysis and results are plotted for the same.

Demerits:

To implement the IoT device which ensures the complete solution for child safety problems.

[2] Authors: Akash Moodbidri, Hamid Shahnasser

Title: Child safety wearable device.

Published in: 2017 IEEE.

The purpose of this device is to help the parents to locate their children with ease. At the moment there are many wearable's in the market which helps to track the daily activity of children and also helps to find the child using Wi-Fi and Bluetooth services present on the device.

Merits:

This wearable over other wearable is that it can be used in any phone and it is not necessary that an expensive smartphone is required and doesn't want to be very tech savvy individual to operate.

Demerits:

As, this device's battery gives short life-time.

High power efficient model will have to be used which can be capable of giving the battery life for a longer time.

[3] Authors: Aditi Gupta, Vibhor Harit.

Published in: 2016 IEEE.

Title: Child Safety & Tracking Management System by using GPS.

This paper proposed a model for child safety through smart phones that provides the option to track the location of their children as well as in case of emergency children is able to send a quick message and its current location via Short Message services.

Merits:

The advantages of smart phones which offers rich features like Google maps, GPS, SMS etc.

Demerits:

This system is unable to sense human behavior of child.

[4] Authors: Dheeraj Sunehera, Pottabhatini Laxmi Priya.

Title: Children Location Monitoring on Google Maps Using GPS and GSM.

Published in: 2016 IEEE.

This paper provides an Android based solution for the parents to track their children in real time. Different devices are connected with a single device through channels of internet. The concerned device is connected to server via internet. The device can be used by parents to track their children in real time or for women safety. The proposed solution takes the location services provided by GSM module. It allows the parents to get their child's current-location via SMS.

Merits:

A child tracking system using android terminal and hoc networks.

Demerits:

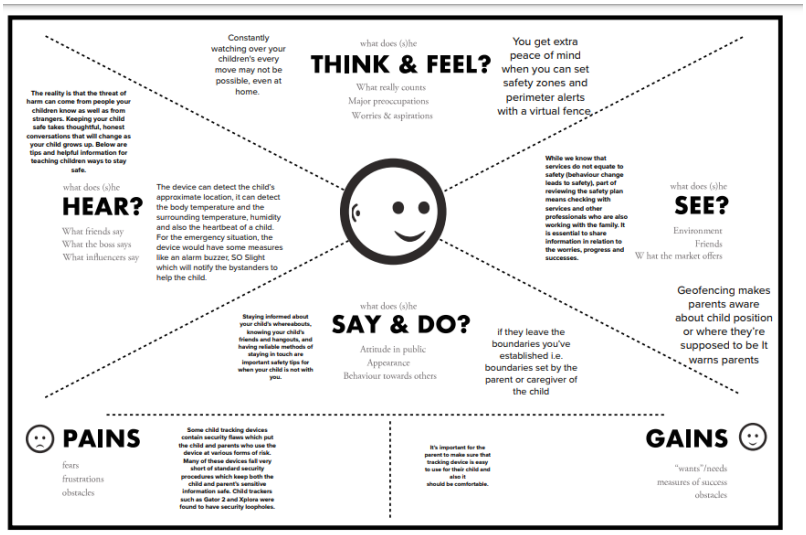
This device cannot be used in rural areas.

c. Problem Statement Definition

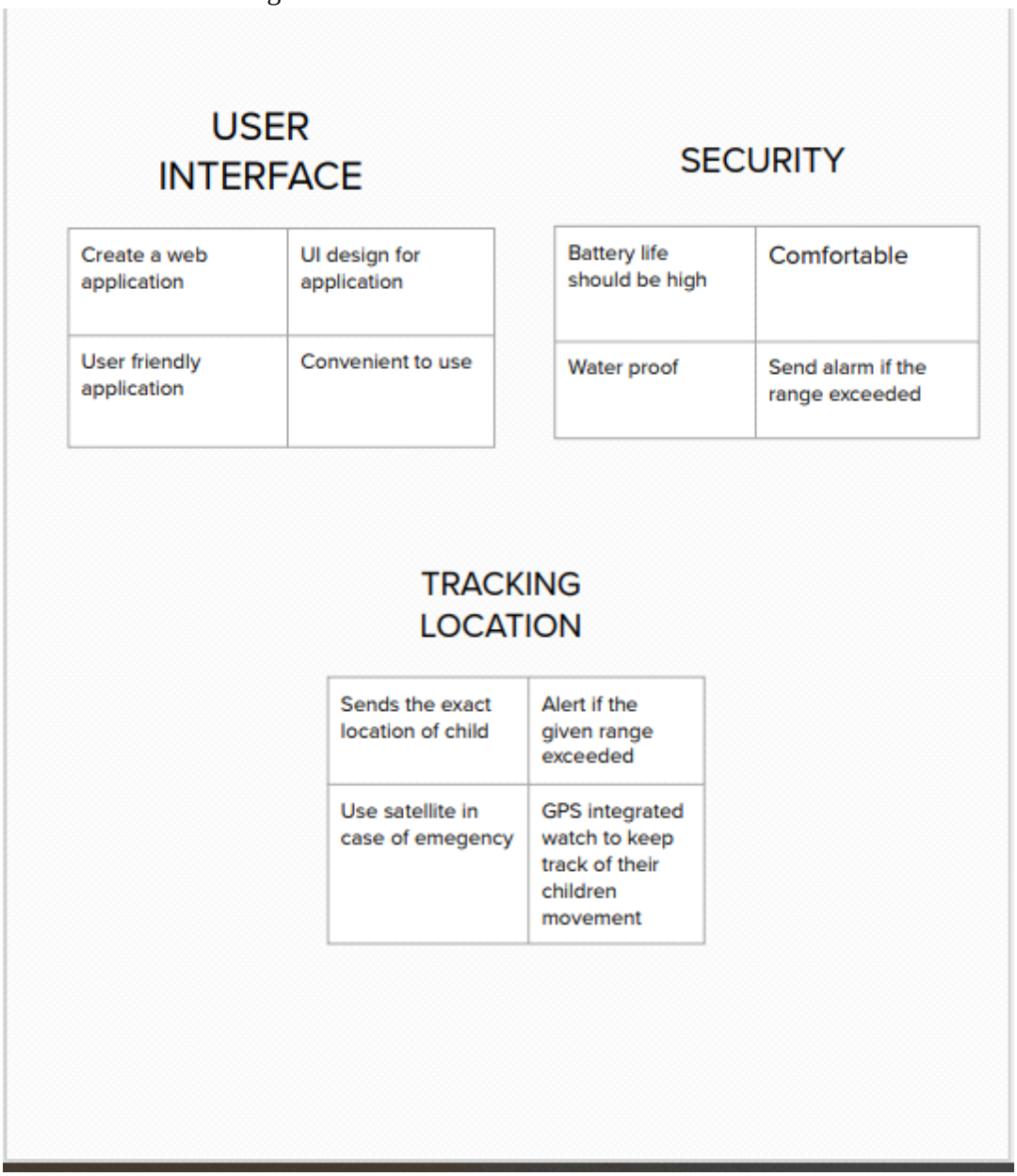
Child tracker helps the parents in continuously monitoring the child's location. They can simply leave their children in school or parks and create a geofence around the particular location. By continuously checking the child's location notifications will be generated if the child crosses the geofence. 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.

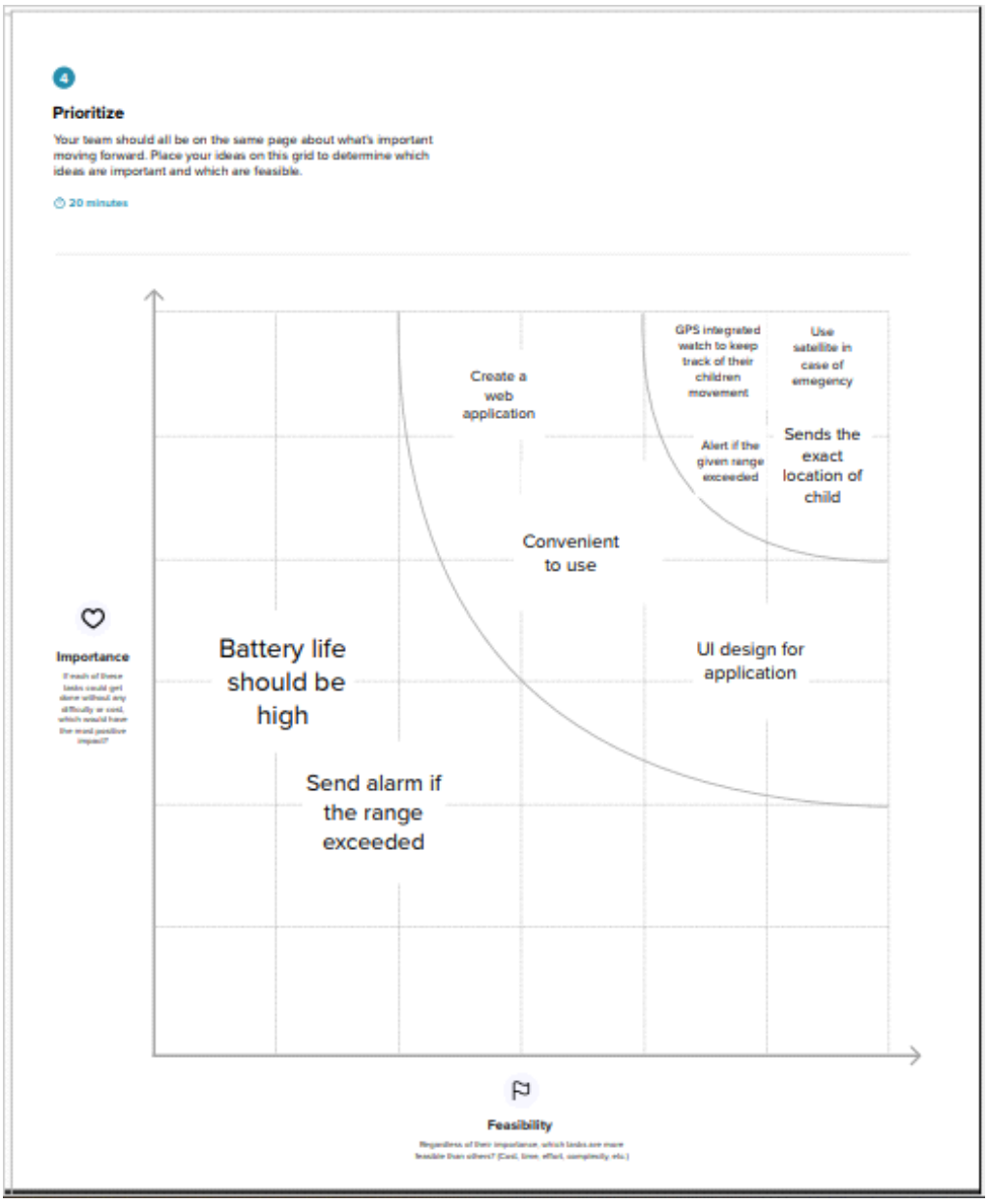
3. IDEATION & PROPOSED SOLUTION

a. Empathy Map Canvas



b. Ideation&Brainstorming



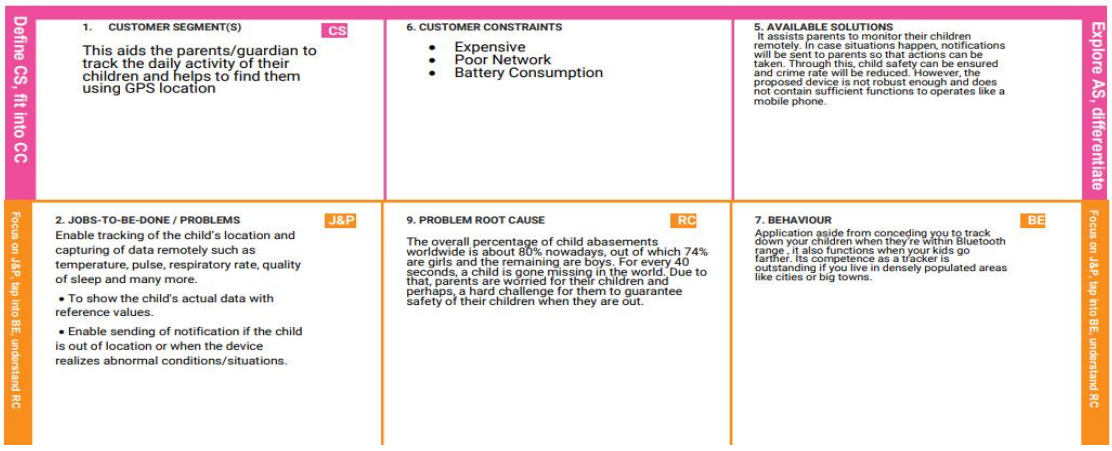


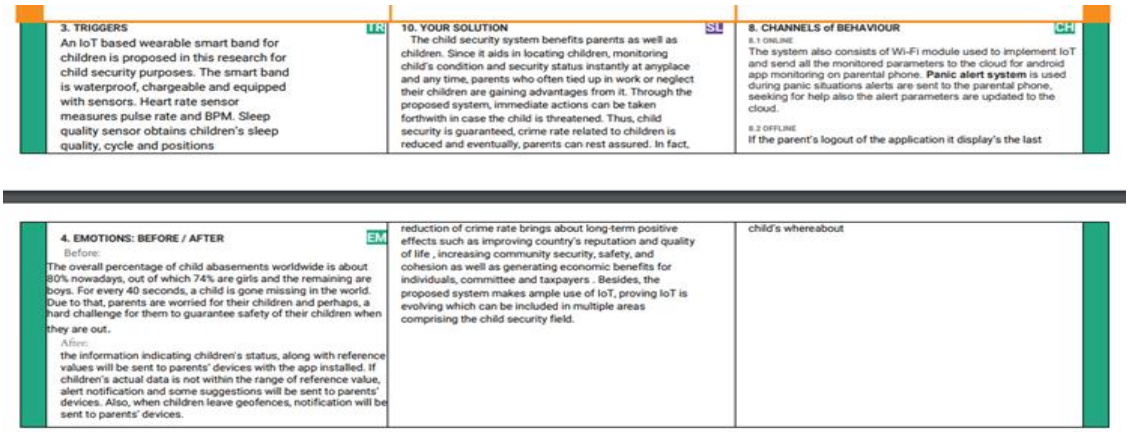
c. Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	The aim of this project is to help parents to monitor their children's location and to see whether their child is safe or not. This system provides a tracking solution for the parent to keep tracking their child's location outdoors by using GPS as it allows them to determine the exact location of the child.

2.	Idea / Solution description	This system sends a notification message to parents and stores the data of the child's movement and geo space periodically. We aim to develop and provide a good interface that would give a tremendous output. The technology used here is PYTHON IDLE and CLOUD for storing data.
3.	Novelty / Uniqueness	This project is basically for the parents who cannot balance their children and work at the same time and also for nonworking parents. The uniqueness of our project is about geo fencing, high noise alert, alarm buzzer , temperature sensor and location monitoring.
4.	Social Impact / Customer Satisfaction	The parents will have the satisfaction that their child is safe and not involved in any critical situation even in their absence. Child abduction is a scorching subject all over the world. It is a complex crime that can impair a child's future. It will be great helpful to parents who are busy workers not having time to watch over their children, and easy to operate so anyone can handle it.
5.	Business Model (Revenue Model)	There is no need of buying any external components instead they can use their mobile phones to track. The business model is in such a way that everyone can afford it. It is very cost-efficient. We are cutting the cost in external components. It is a device with numerous subscriptions for tracing and notification assistance.
6.	Scalability of the Solution	Child safety monitoring is a guardian angel for the parents who can have the exact location of their child which helps to protect the child from any critical situations. So we resolve the problems like low noise notification, high standard geo fencing and since we store data in the cloud it can be retrieved when needed.

d. Problem Solution fit





4. REQUIREMENT ANALYSIS

a. Functional requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Gmail Registration through message Registration through website Registration through App Registration through Call Registration through Social Media
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	App Installation	Installation through Link Installation through Play Store/App Store
FR-4	User Interface	User login form Admin login form
FR-5	Detecting Child Location	Detecting location via app Detecting location via SMS Detecting location through Website Detecting location through GPS
FR-6	User Notification	Notification through Message Notification through Gmail

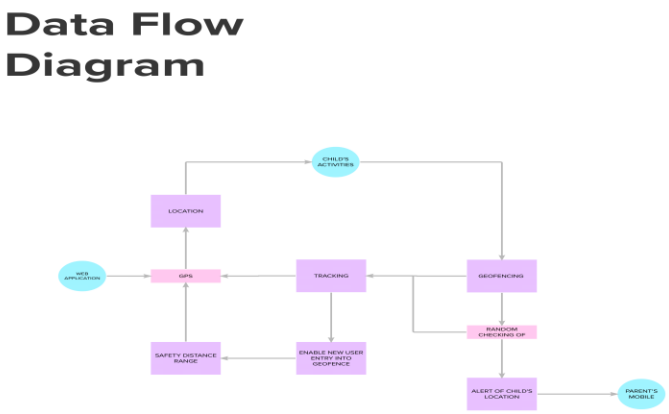
b. Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	• A midget setup via the application is made in the mobile that helps to send SMS to parents. • The gadget has a GSM that aids in informing the parents/guardian about the current location of their kids which in turn helps the parents/guardians take immediate action when any crisis occurs. • The gadget is compact and effortless to operate and its applications are fool proof.
NFR-2	**Security**	• The device is designed in such a way that it builds a safe environment for children to go outside. • It gives a sense of assurance to parents about

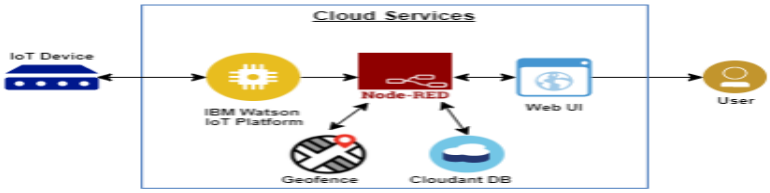
		their children's security as the gadget uses GPS and GSM to track their live location
NFR-3	**Reliability**	• Inflated reliability towards the mechanism and curtail reliability towards parents/guardians. • It is transportable, Easy to access, and also tensile. • We can use the cloud to accumulate the surveillance data of the children. • The wifi modules are of assistance in sending the monitoring particulars, the user will be notified with an update if any errors are found, for the efficient functioning of the device
NFR-4	**Performance**	The device is used to keep tab son your child even in a horde. It also provides the current location along with travel details.
NFR-5	**Availability**	The web page' s load time should be no more than one second for the user's elevate performance concerning simple aidance and security.
NFR-6	**Scalability**	If an intricacy arises parent scan see some of the at tributes like the location , temperature , and heartbeat of the child along with living perspective around the children without deterrence.

5. PROJECT DESIGN

a. Data Flow Diagrams



b. Solution & Technical Architecture



c. User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
	Confirmation	USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can register & access the dashboard with a Gmail account Login	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password	I can receive a Verification Mail and Verify it	High	Sprint-1
	Dashboard	USN-6	As a User, I can Navigate to the Dashboard after successfully Login to the Application.	I can view the locations which are accumulated in the database	High	Sprint-2
Customer (Web user)	Notification	USN-7	As a user when there is an suspisious situation with the child, a notification will be received through the fencing application.	An alert message is sent to the parent's mobile	Medium	Sprint - 3
Customer Care Executive	Support	USN-8	As a User, I can connect with experts to clear Queries, they assist to overcome challenges.Checking if all the users are authorized.	I can login with my given credentials	High	Sprint-2
Administrator	Login	USN-9	As an Administrator, I can set the Geofence Location Limit	I can log in with my provided credentials	High	Sprint - 3

6. PROJECT PLANNING & SCHEDULING

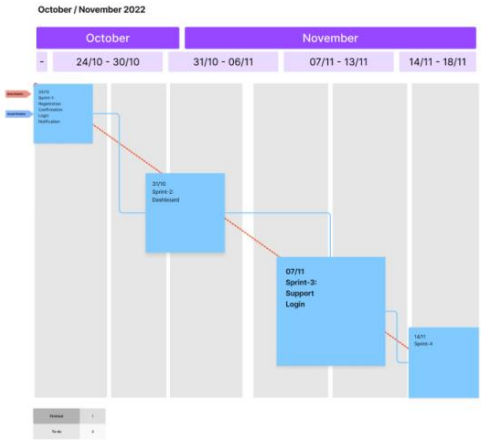
a. Sprint Planning & Estimation

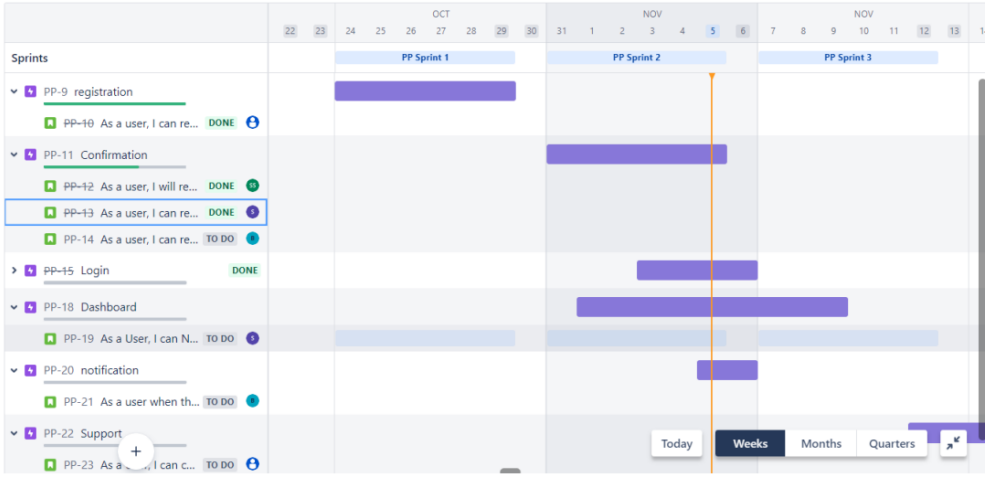
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	4	High	J.Joshiya
Sprint-1	Confirmation	USN-2	As a user, I will receive confirmation email once I have registered for the application	4	High	S.Sabnam Shajitha
Sprint-2		USN-3	As a user, I can register for the application through Facebook	10	Low	S.Sheric Shalini
Sprint-1		USN-4	As a user, I can register for the application through Gmail	4	Medium	A.Vithya Bharathi
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	4	High	J.Joshiya
Sprint-2	Dashboard	USN-6	As a User, I can Navigate to the Dashboard after successfully Login to the Application.	10	High	S.Sabnam Shajitha
Sprint-1	Notification	USN-7	As a user when there is an anomalous situation with the child, a notification will be received through the fencing application.	4	High	S.Sabnam Shajitha
Sprint-3	Support	USN-8	As a User, I can connect with experts to clear Queries. they assist to overcome challenges by scanning for any glitches and monitoring the operation and by checking if all the users are authorized	10	Medium	A.Vithya Bharathi
Sprint-3	Login	USN-9	As an Administrator, I can set the Geofence Location Limit and make sure the database encompassing the locations is secure, factual and updated constantly.	10	High	J.Joshiya

b. Sprint Delivery Schedule

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	20	6 Days	24 Oct 2022	29 Oct 2022	20	3 Nov 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

c. Reports from JIRA





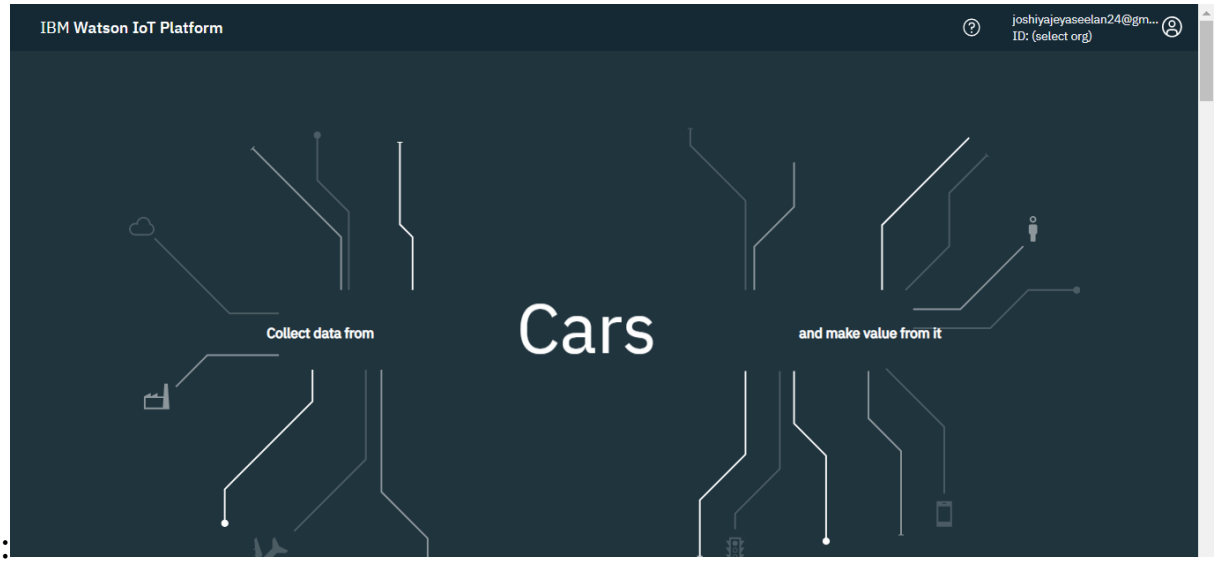
7. CODING & SOLUTIONING (Explain the features added in the project along with code)

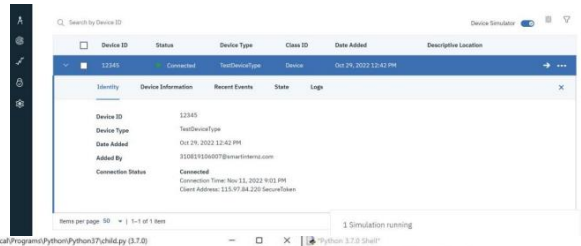
a. Feature 1

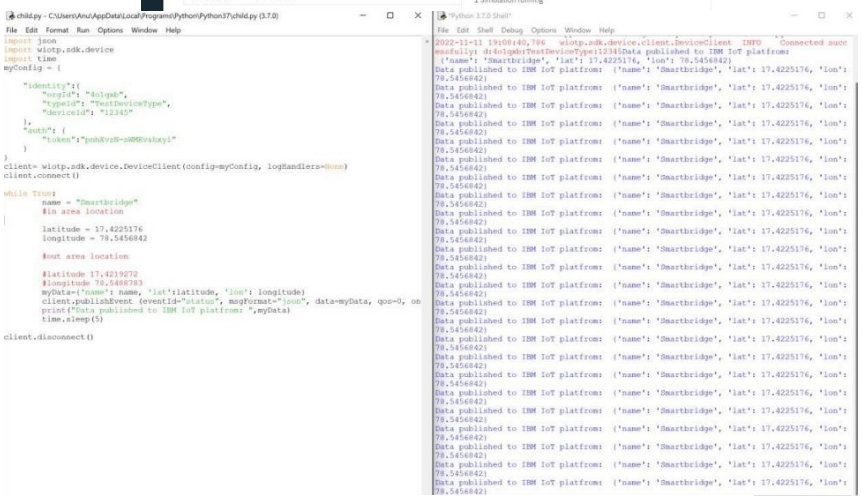
Python code:

```
import json
import ibmiotf.application
import ibmiotf.device
import time
myconfig = {
   "identity": {
      "orgId": "a701la",
      "typeId": "CHILD",
      "deviceId": "CHILD1234"
   },
   "auth": {
       "token": "_Mp*MFiQ7WSSoH6Cps"
   }
}
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 platform :",myData)
    time.sleep(5)
client.disconnect()
```

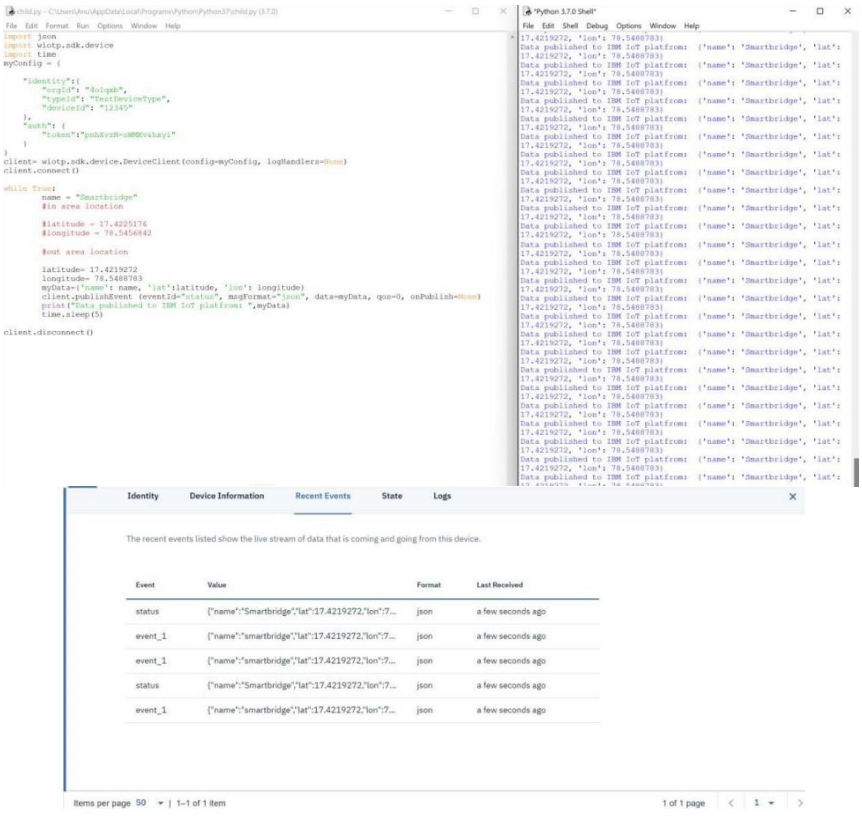
Output:





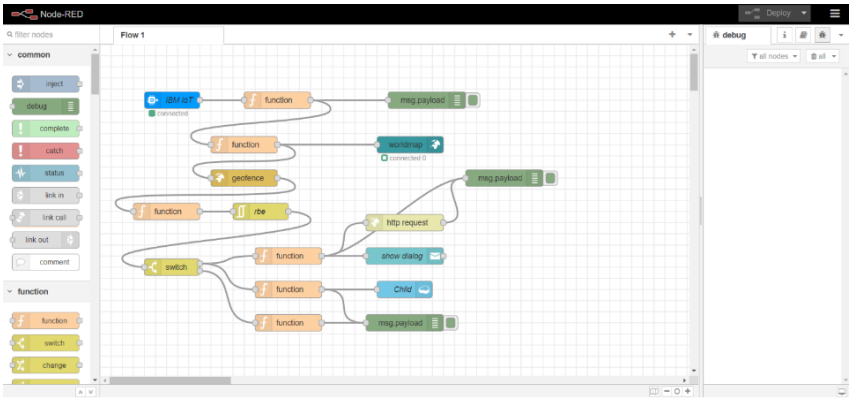


Event	Value	Format	Last Received
event_1	{"name":"smartbridge","lat":17.4219272,"lon":7...	json	a few seconds ago
status	{"name":"Smartbridge","lat":17.4225176,"lon":7...	json	a few seconds ago
event_1	{"name":"smartbridge","lat":17.4219272,"lon":7...	json	a few seconds ago
event_1	{"name":"smartbridge","lat":17.4219272,"lon":7...	json	a few seconds ago
status	{"name":"Smartbridge","lat":17.4225176,"lon":7...	json	a few seconds ago

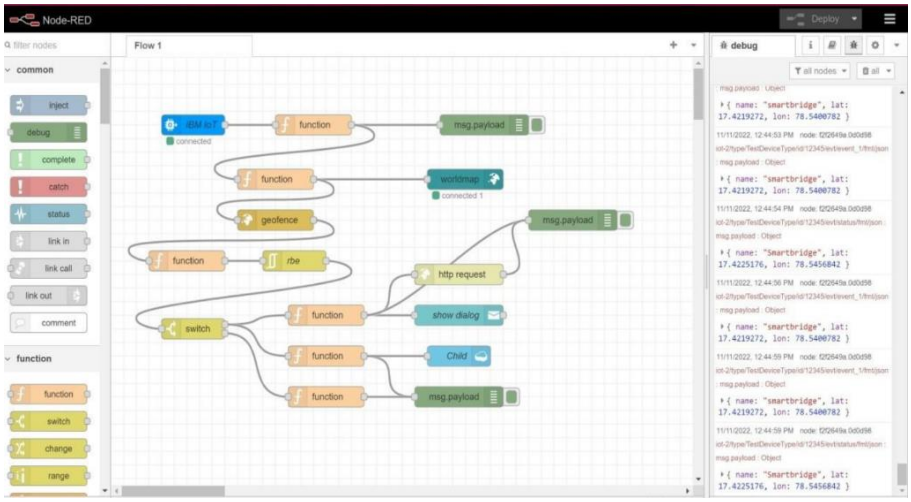


b. Feature 2

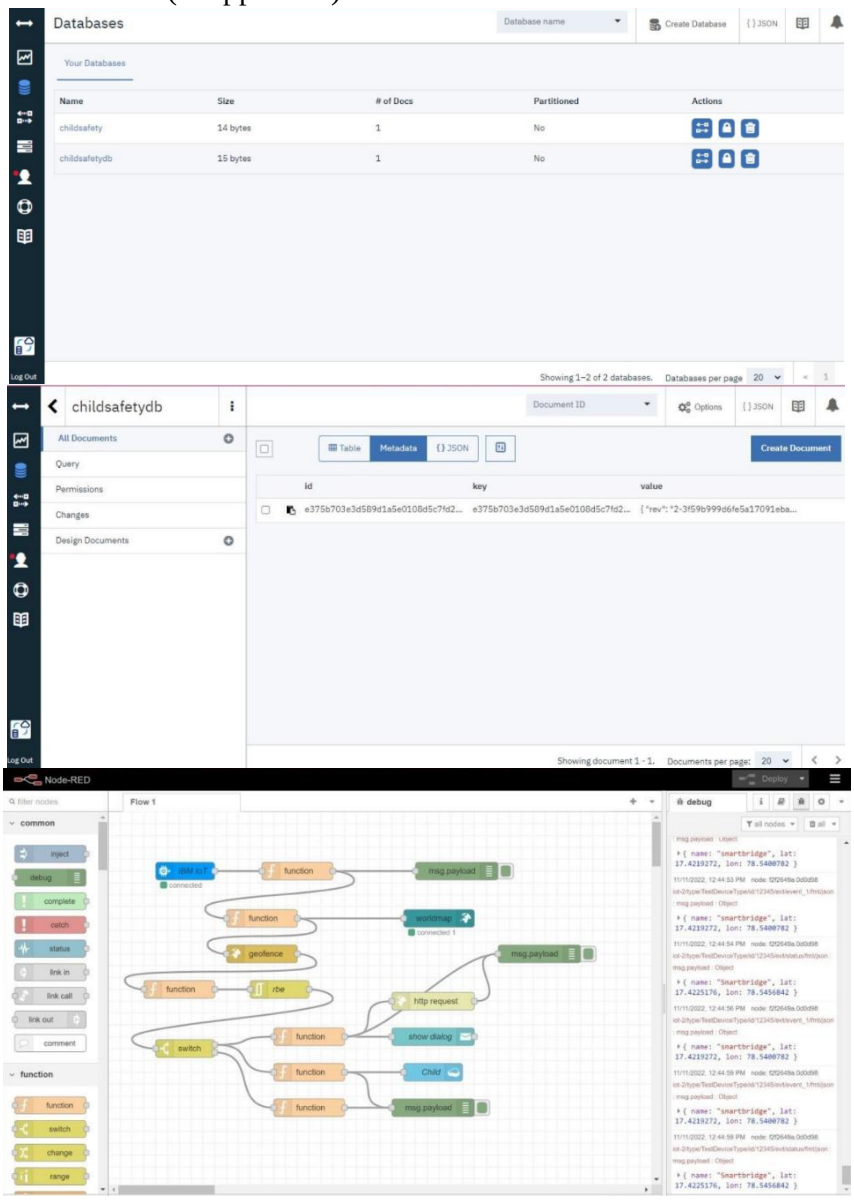
Node -red:



Output:

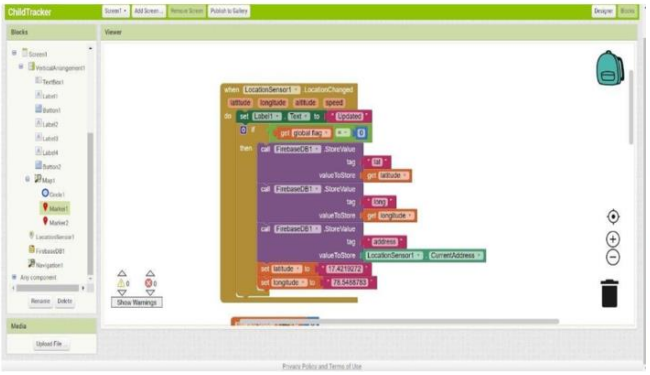


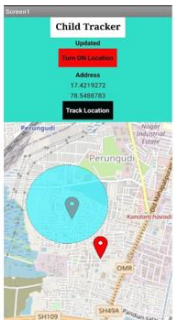
c. Database Schema (if Applicable)



8. TESTING

a. Test Cases





b. User Acceptance Testing

- **Purpose of Document**

The purpose of this document is to briefly explain the test coverage and open issues of the IoT Based Safety Gadget For Child Safety Monitoring & Notification project at the time of the release to User Acceptance Testing (UAT).

- **Defect Analysis**

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2

Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

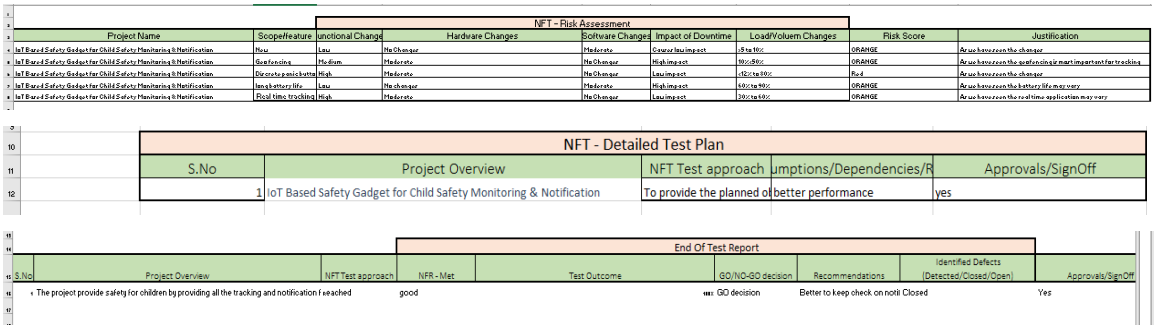
- **Test Case Analysis**

This report shows the number of test cases that have passed, failed, and untested

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9. RESULTS

a. Performance Metrics



	NFT - Risk Assessment							
Project Name	Scope/Feature	unctional Change	Hardware Changes	Software Changes	Impact of Downtime	Load/Voluem Changes	Risk Score	Justification
IoT Based Safety Gadget for Child Safety Monitoring & Notification	New	Low	No Change	Moderate	Course low impact	≤5 to 10%	ORANGE	As we have seen the changes
IoT Based Safety Gadget for Child Safety Monitoring & Notification	Geofencing	Medium	Moderate	No Change	High impact	10%≤5%	ORANGE	As we have seen the geofencing is mart important for tracking
IoT Based Safety Gadget for Child Safety Monitoring & Notification	Discrete panic butto	High	Moderate	No Change	Low impact	≤12≤ to 10%	Red	As we have seen the changes
IoT Based Safety Gadget for Child Safety Monitoring & Notification	long battery life	Low	No change	Moderate	High impact	10%≤ to 10%	ORANGE	As we have seen the battery life may vary
IoT Based Safety Gadget for Child Safety Monitoring & Notification	Real time tracking	High	Moderate	No Change	Low impact	10%≤ to 10%	ORANGE	As we have seen the real time application may vary

	NFT - Detailed Test Plan			
S.No	Project Overview	NFT Test approach	umptions/Dependencies/R	Approvals/SignOff
1	IoT Based Safety Gadget for Child Safety Monitoring & Notification	To provide the planned ot	better performance	yes

	End Of Test Report						
S.No	Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	Recommendations	Identified Defects (Detected/Closed/Open)	Approvals/SignOff
1	The project provide safety for children by providing all the tracking and notification f eached		good		GO decision	Better to keep check on notifi	Closed	Yes

10. ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- Track location

This system is already used by many of the emergency services throughout the country, but there is no reason why it can't work for your business too.

- Security Benefits

Vehicles and plants are probably the most valuable assets that a business has in terms of cost, therefore they are often the targets for unscrupulous thieves.

- Increase Customer Service

Many businesses rely on a speedy response to ensure that their customers are happy with the service that they receive.

- Benefits to the Environment

  The environment is a hot topic throughout the world. Most companies are bowing to public pressure to decrease the amount of damage that they do to the earth every single day.

DISADVANTAGES:

- Battery life

  Gadgets battery life may run out, so it is the major disadvantage.

- Stalking

  GPS tracker allow user to share their location with friends and family,they also allow users to inadvertently share their whereabouts with stalkers.

11.CONCLUSION

This research demonstrates Smart 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 tothe 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

Python code:

```
import json
import ibmiotf.application
import ibmiotf.device
import time
myconfig = {
   "identity": {
      "orgId": "a701la",
      "typeId": "CHILD",
      "deviceId": "CHILD1234"
   },
   "auth": {
       "token": "_Mp*MFiQ7WSSoH6Cps"
   }
}
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 platform :",myData)
    time.sleep(5)
client.disconnect()
```

GitHub & Project Demo Link

Github link:

https://github.com/IBM-EPBL/IBM-Project-43367-1660716377

Project demo link:

https://youtu.be/P0h5MdKhTx8 (or)

https://drive.google.com/drive/folders/1f-m905KPRCuU9QWgC1UkSClB0NzI3dfY