

IoT BASED SAFETY GADGETS FOR CHILD SAFETY MONITORING AND NOTIFICATION

NALAIYATHIRAN PROJECT REPORT

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IoT BASED SAFETY GADGETS FOR CHILD SAFETY MONITORING AND NOTIFICATION

1. INTRODUCTION

1.1 Project Overview

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.

1.2 Purpose

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.

2. LITERATURE SURVEY

2.1 Existing Problem

Some previous studies have been included for designing the IoT-based child security smart band. It assists parents to monitor their children remotely. In case situations happen, notifications will be sent to parents so that actions can be taken.

2.2 References

Prakriti Agarwal, R Ramya, Rachana Ravikumar, Sabarish G, Sreenivasa Setty

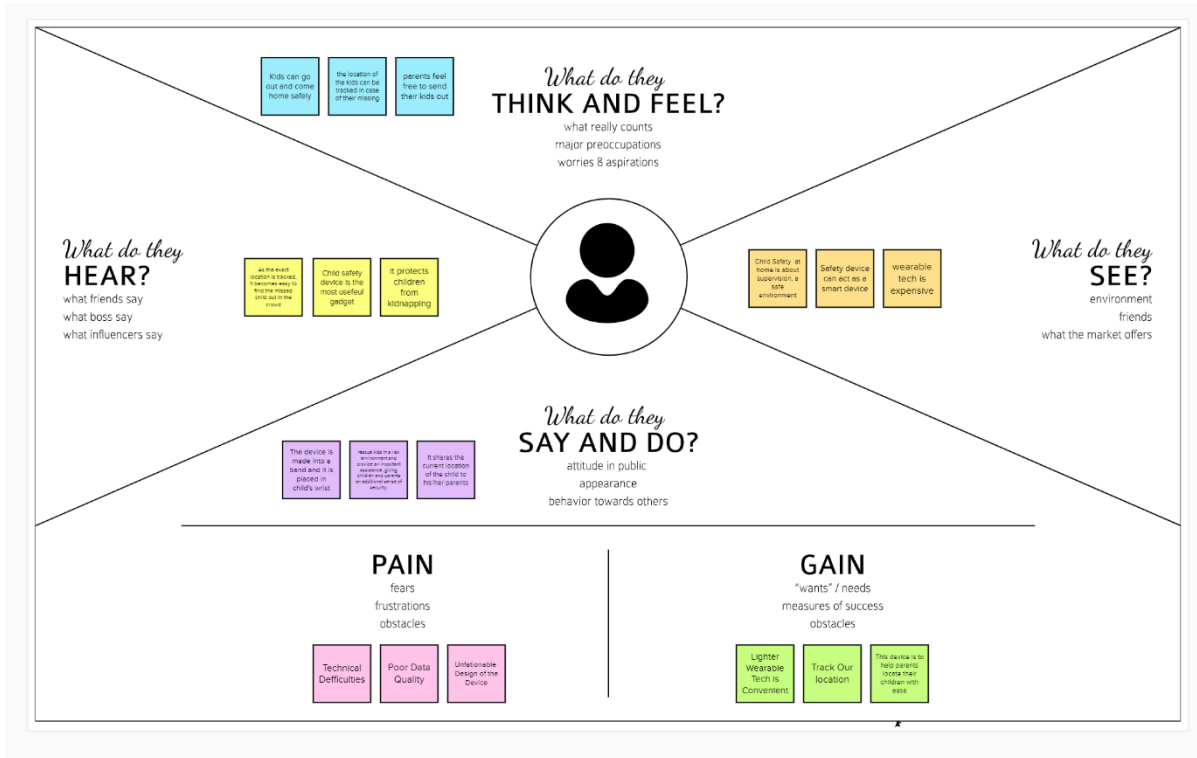
M Nandini Priyanka, S Murugan, K N H Srinivas, T D S Sarveswararao, E Kusuma Kumari.

2.3 Problem statement Definition

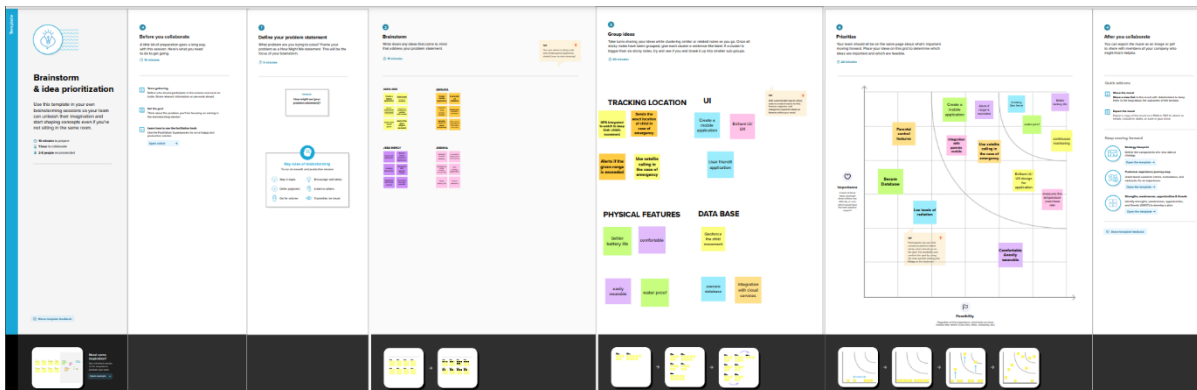
Create a problem statement to understand your customer's point of view. The Customer Problem Statement template helps you focus on what matters to create experiences people will love. A well-articulated customer problem statement allows you and your team to find the ideal solution for the challenges your customers face. Throughout the process, you'll also be able to empathize with your customers, which helps you better understand how they perceive your product or service.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming



3.3 Proposed Solution

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) Working parents or busy parents of 0-10 year old kids	6. CUSTOMER CONSTRAINTS Lack of affordable, reliable and hassle free technology, Lack of availability of secure and easy Ui.	5. AVAILABLE SOLUTIONS There are existing solutions that offer location tracking for kids but they are not very efficient, cost effective and reliable all at the same time. This trade off should be addressed.	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS Instantaneous tracking and updation of child's location, geo-fencing and notifying parents of any abnormalities	9. PROBLEM ROOT CAUSE Customers have to do this to protect their children from potential threats and to ensure the safety while being far away from them.	7. BEHAVIOUR Customers panic, prevent their children from going out on their own , try using easily available technologies	
Focus on J&P, tap into BE, understand RC				Focus on J&P, tap into BE, understand RC

Identify strong TR & EM	3. TRIGGERS Coming across news about children being kidnapped and abducted, missing cases being reported.	10. YOUR SOLUTION Building a reliable technology that can address all the customer needs while being reliable and secure ensuring efficient functioning.	8.CHANNELS of BEHAVIOUR 8.1 ONLINE Tracking their kids location with their mobile phones' GPS, reading news about child safety and other child missing cases. 8.2 OFFLINE Customers accompany their children to ensure safety, send them together with other reliable people, seek for protection in public places.	Identify strong TR & EM
	4. EMOTIONS: BEFORE / AFTER Before : Feel insecure , worried , scared and confused. After : Relieved , calm , confident , happy.			

3.4 Problem Solution fit

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	With the increasing rate of child kidnapping and trafficking and lack of tracking technology for child, there is limited application for child monitoring. Hence an IoT based safety gadget for child safety is probably the need of the hour today.
2.	Idea / Solution description	A good solution to this issue would be to design a smart wearable Internet of Things sensor based device for monitoring the environment of a child along with a mechanism for tracking the child. The gadget will make use of GPS and a python script to publish the location details to the IBM IoT platform. The wearable also functions to send immediate alerts to the user through in case if the child crosses the geo-fence.
3.	Novelty / Uniqueness	All the existing systems make use of GPS and a mobile app to track and receive alerts regarding the child's location, while this system make use of the IBM Watson IOT Platform and IBM Cloud Services which is reliable and efficient to maintain the database of the child's location. The parent can set geo-fence and receive alerts through the web application which is user friendly and secure created using the Node Red Service.
4.	Social Impact / Customer Satisfaction	The main concern of any parent would be the safety and security of their kids. The design of this model does not mandate a lot of technical knowledge from the user to operate and it is simple. The purpose of this device is to facilitate the guardian or parents in locating their child with ease and ensuring its well-being.

5.	Business Model (Revenue Model)	The target audience of this device is majorly the parents. Considering the Tracking ability of the device, Hardware quality, used technology and sensors, the starting range of price would go from Rs. 6000 and above. This type of wearable safety system is of utmost importance today and would be a must buy gadget in the market today.
6.	Scalability of the Solution	With the present needs for monitoring the child, the system is designed. It has a location database to maintain the entire location history of the child and the parent can set the geo- fence to determine the safer boundary of the child. If there is a need for integrating additional sensors to improve accuracy, it can be done to make the system efficient in the long run.

4. REQUIREMENT ANALYSIS

4.1 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

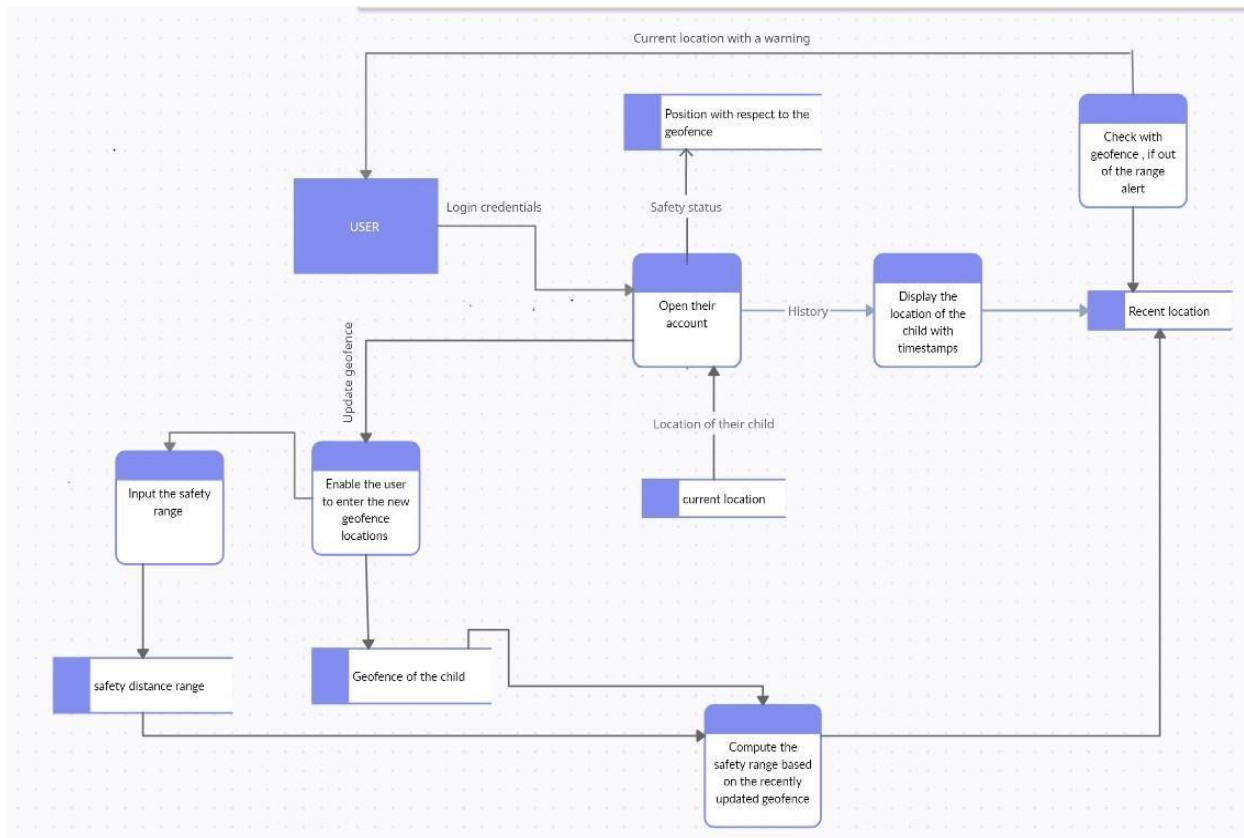
4.2 Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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	<p>The device is used to keep tab son your child even in a horde.</p> <p>It also provides the current location along with travel details.</p>
NFR-5	Availability	<p>The web page' s load time should be no more than one second for the user's elevate performance concerning simple aidance and security.</p>
NFR-6	Scalability	<p>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.</p>

5. PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture

SOLUTION ARCHITECTURE:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behaviour, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.

FEATURES:

Development of a safety gadget for children to ensure their protection without direct monitoring of their parents. The various features involve:

- GPS
- Geo fence
- Notify alert signal

SOLUTION:

Track current location of the child using GPS and continuous monitoring of the same is done. When the gadget detects the activity to be outside the given geo fence (as mentioned by the parent or guardian), alert messages or notifications are sent to the registered device, appropriately. Additional features such as recording of messages could be done if any kind of danger is sensed.

SOLUTION ARCHITECTURE DIAGRAM:

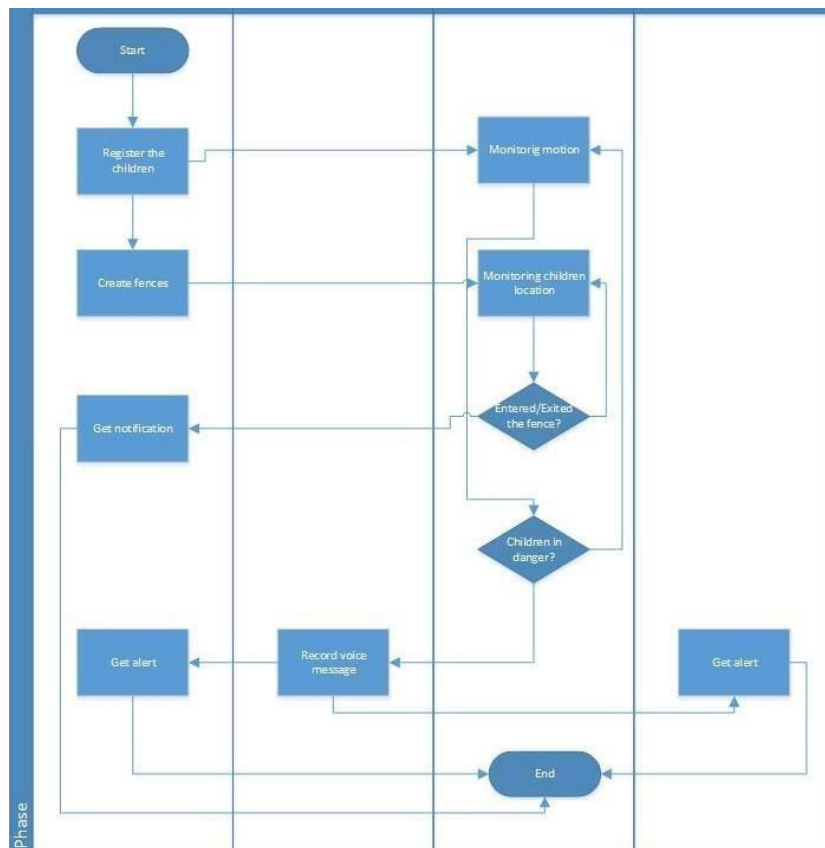
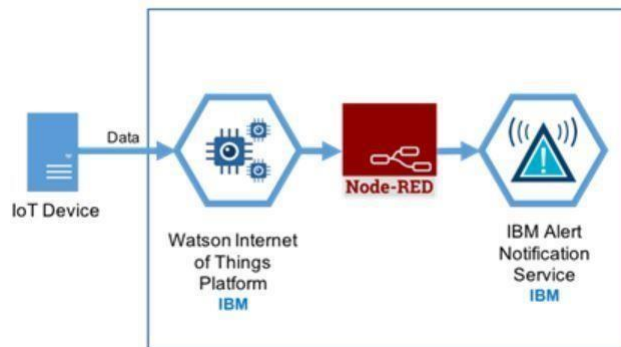


Figure : Architecture and data flow of the child safety gadget system

TECHNICAL ARCHITECTURE

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

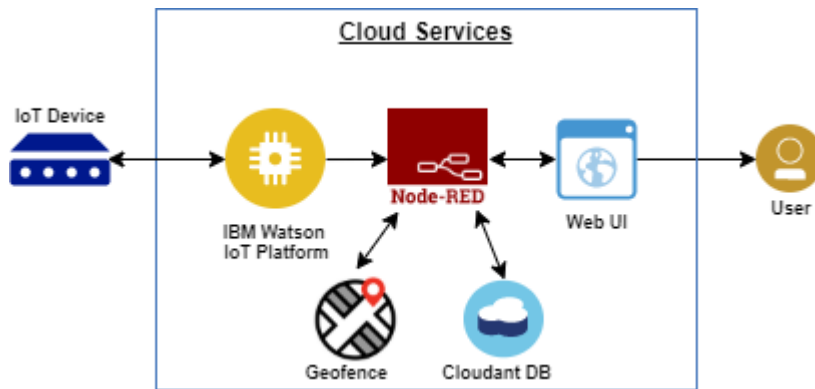


Table 1: Components & Technologies:

S.No	Component	Description	Technology
•	User Interface	The user interface (UI) is the point of human-computer interaction and communication in a device.	HTML, CSS, JavaScript / Angular Js / React Js etc.
•	Application Logic-1	Registration of child's and parent's device in each other device.	Python
•	Application Logic-2	The GPS receiver calculates its own four-dimensional position in spacetime based on data received from multiple GPS satellites.	IBM Watson STT service
•	Application Logic-3	The information is to be collected and dispatched to the authenticator via GSM equipping the GPS coordinates to efficiently locate access and monitor the child.	IBM Watson Assistant

•	Database	A database is an organized collection of structured information, or data, typically stored electronically in a computer system. A database is usually controlled by a database management system(DBMS).	MySQL, NoSQL, etc.
•	Cloud Database	Data organization on the cloud A cloud database is a databaseservice built and accessed through a cloud platform. It serves many of the same functions as a traditional database with the added flexibility of cloud computing.	IBM DB2, IBM Cloudant etc.
•	File Storage	File storage, also called file- level or file-based storage, stores data in a hierarchical structure. The data is saved in files and folders, and presented to both the system storing it and the system retrieving it in the same format.	IBM Block Storage or Other Storage Serviceor Local Filesystem
•	IBM Watson IOT platform	Watson IoT Platform features Analytics and Watson APIs Completely manage your IoT landscape and make better business decisions.	IBM Weather API, etc.
•	Node RED	Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways.	Aadhar API, etc.
•	Geofence	a virtual geographic boundary, defined by GPS or RFID technology, that enables software to trigger a response when a mobile device enters or leaves a particular area	Object Recognition Model, etc.
•	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: IBM Watson IOT Cloud Server Configuration: cloudant DB	Local, Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
•	Open-Source Frameworks	The framework for child safety utilizing a Sensor and IoT. The Key attribute of the system is the deployment of a smart detector for the collection of Data, cloud-based analysis, and decision-based on Monitoring for children's Safety.	Thinger.io, and Zetta
•	Security Implementations	To activate the alarm and facilitate video recording whenever the emergency button is pressed. We can use the cloud to accumulate the surveillance data of the children.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.
•	Scalable Architecture	enhanced by the installation of the mini camera inside a smart gadget for exemplary security and protection	Data Storage Technologies, Reliable Microservices
•	Availability	It also provides the current location along with travel details. It is a site that is available online.	Temperature, Pulse sensor, GPS, GSM, Web camera, Raspberry pi microprocessor.
•	Performance	The complete data of the children's location will be stocked in the repository and the execution of the device diminishes in a less network area	GSM tracker, Device Battery

5.3 User Stories

User Type	Functional Requirement (Epic)	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 email once 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 apple account	I can register & access the dashboard with apple 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
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 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	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	3
Sprint-1		USN-2	As a Parent/Guardian, I can register for the application through Gmail	1	Medium	2
Sprint-1	User Confirmation	USN-3	As a parent I will receive connection, location in sms / mail once I have entered this application	1	High	3
Sprint-1	Login	USN-4	As a parent/guardian, I can log into the application by entering mail and password.	2	High	3

6.2 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	4 Days	24 Oct 2022	27 Oct 2022	20	29 Oct 2022

Sprint-2	20	5 Days	28 Oct 2022	01 Nov 2022	20	04 Nov 2022
Sprint-3	20	8 Days	02 Nov 2022	09 Nov 2022	20	11 Nov 2022
Sprint-4	20	8 Days	10 Nov 2022	18 Nov 2022	20	18 Nov 2022

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

```

import json
import wiotp.sdk.device
import time
myconfig = {
    "identity": {
        "orgId": "a7011a",
        "typeId": "IOT",
        "deviceId": "123"
    },
    "auth": {
        "token": "y-WFmI45YEkmF2ic2g"
    }
}
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)

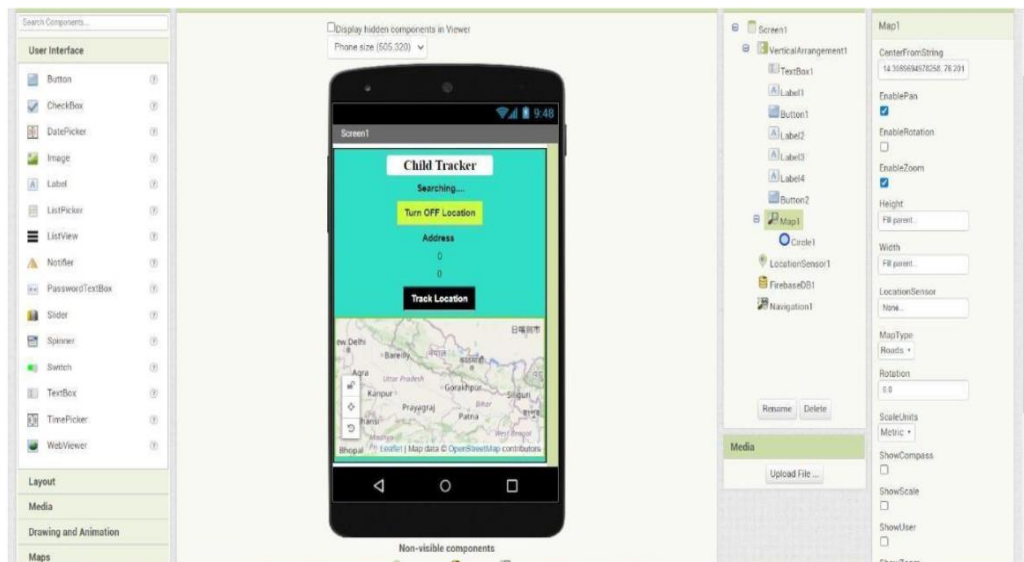
time.sleep(5)

client.disconnect()

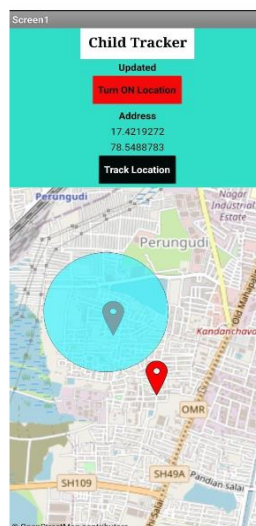
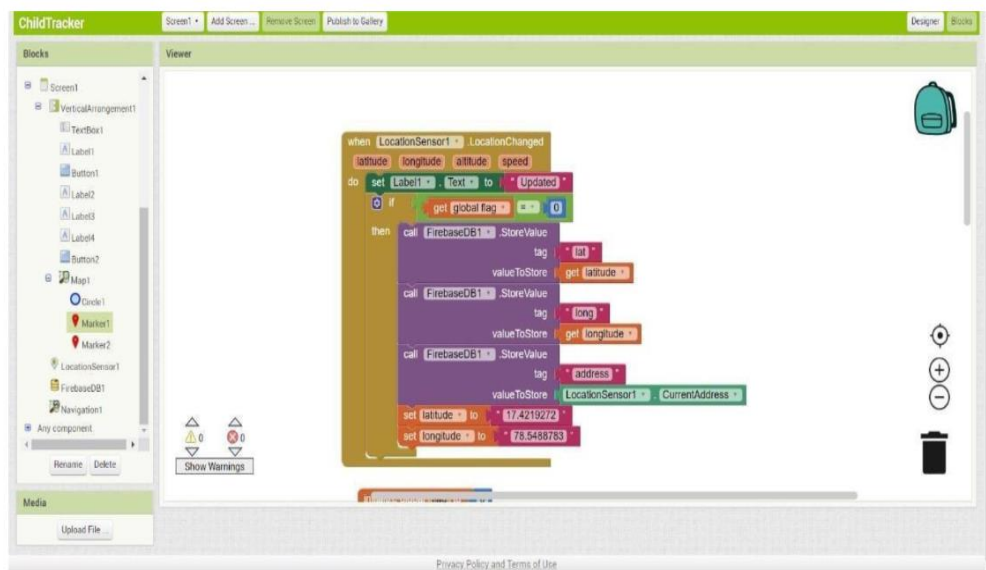
```

8. TESTING

8.1 Test Cases



9. RESULTS



10. ADVANTAGES & DISADVANTAGES

Advantages:

It assists parents to monitor their children remotely. In case situations happen, notifications will be sent to parents so that actions can be taken. Through this, child safety can be ensured and crime rate will be reduced.

Disadvantages:

This device cannot be used in rural areas. Figure 1 shows the block diagram of the proposed child safety device. It consists of inbuilt Wi-Fi, GSM, GPS and Bluetooth modules.

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 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.

SOURCE CODE

```
from http import client
import json
import wiotp.sdk.device
import time
myconfig = {
    "identity": {
        "orgId": "a7011a",
        "typeId": "IOT",
        "deviceId": "123"
```

```

    },
    "auth": {
        "token": "y-WFmI45YEKMF2ic2g"
    }
}

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-40498-1660630352>

Project Demo Link

https://drive.google.com/file/d/1JM_D0nL4oGUDq00Tqeb68YC5wlSmEck/view?usp=drivesdk