

IOT BASED SAFETY GADGETS FOR CHILD SAFETY MONITORING & NOTIFICATIONS

BATCH : B5-5M1E

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PROJECT REPORT FORMAT

1.INTRODUCTION

- 1.1 Project Overview
- 1.2 Purpose

2.LITERATURE SURVEY

- 2.1 Existing problem
- 2.2 References
- 2.3 Problem Statement Definition

3.IDEATION & PROPOSED SOLUTION

- 3.1 Empathy Map Canvas
- 3.2 Ideation & Brainstorming
- 3.3 Proposed Solution
- 3.4 Problem Solution fit

4.REQUIREMENT ANALYSIS

- 4.1 Functional requirement
- 4.2 Non-Functional requirements

5.PROJECT DESIGN

- 5.1 Data Flow Diagrams
- 5.2 Solution & Technical Architecture
- 5.3 User Stories

6.PROJECT PLANNING & SCHEDULING

- 6.1 Sprint Planning & Estimation
- 6.2 Sprint Delivery Schedule

7.CODING & SOLUTIONING

- 7.1 Feature

8.TESTING

- 8.1 Test Cases

9.RESULTS

- 9.1 Performance Metrics

10.ADVANTAGES & DISADVANTAGES

11.CONCLUSION

12.FUTURE SCOPE

13.APPENDIX

- 13.1 Source Code
- 13.2 GitHub & Project Demo Link

1.INTRODUCTION

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

1.1 Project overview :

- ✓ Enable tracking of the child's location and capturing of data remotely such as where the child located distance etc.
- ✓ To show the child 's actual data with reference values.
- ✓ Enable sending of notification if the child is out of location or when the device realizes abnormal conditions/ situations.
- ✓ Develop a prototype of IOT wearable smart band connected to parents Mobile apps so that they can monitor the actual condition of children at anytime and anyplace.

1.2 Purpose :

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.

2.LITERATURE SURVEY

1.Smart Child Safety Wearable Device :

B.Srinivas Reddy ,Y. Manoj Kumar reddy

Bannuru ranjith ,S. Suchitra ,B. Pavithra

The Technical point of this task is to have an ordinary Correspondence between the kid and parent through the gadget which helps in finding the area, pulse and temperature of the kid utilizing the gadget empowered with the pulse sensor, temperature sensor and GPS tracker. This gadget empowers association between the youngster and parent through the WIFI module cooperation utilizing IoT. The parent can get to the kid data intermittently by interfacing through this gadget.

2.Intelligent Child Safety System using Machine Learning in IoT Devices

S. Abirami ,N. Divya ,R. Akshaya , Aparajith sirinivasan

This system is intended as an everyday wearable device on the child, in the form of a wrist band, hand glove, arm band or a belt. The system is designed to continuously monitor the location and body vitals of children. This electronic system comprises of an Arduino controller, a Raspberry-Pi and sensors to detect the changes in parameters such as temperature, BVP (Blood Volume Pulse) and GSR (Galvanic Skin Response). The system also uses a GSM and GPS module.

3.ChildGuard: A Child Safety Monitoring System

Huijuan , Zhigang Gao ,Hongyi Guo

To help guardians better monitor their children, the authors present Child Guard, a child safety system based on mobile devices. Child Guard provides an inpath safety function that monitors the real-time movement of children walking on the road. It also provides a region safety function that sets designated areas in which children can play. Children can be warned about potential risks, and their guardians can be informed of location or activity abnormalities.

2.1 Existing Problem :

- ✓ The main concept is to create a device that may be used to check health and as a safety system.
- ✓ When the panic button is touched, the system should send an SMS as well as a call alarm to the caregiver, along with a live GPS location.
- ✓ To create a dependable and secure system that can detect a fall and deliver a warning message using an accelerometer.
- ✓ It can monitor heart rate, spo2, and temperature, as well as deliver periodic updates.
- ✓ Another goal is to show the potential for increased productivity, efficiency, and cost savings, as well as to integrate optimised components into an existing design.

2.2 Reference :

- [1] Akash Moodbidri, Hamid Shahnasser, "Child safety wearable device," in IEEE Xplore, June 2017
- [2] B. Dorsemayne, I. P. Gaulier, I. P. Wary, N. Kheir and P. Urien, "Internet of Things: A Definition and Taxonomy," Next Generation Mobile Applications, Services and Technologies, 2015 9th International Conference on, Cambridge, 2015, pp. 72- 77.
- [3] H. Moustafa, H. Kenn, K. Sayrafian, W. Scanlon and Y. Zhang, "Mobile wearable communications [Guest Editorial]," in IEEE Wireless Communications, vol. 22, no. 1, pp. 10-11, February 2015.
- [4] S. Nasrin and P. I. Radcliffe, "Novel protocol enables DIY home automation," Telecommunication Networks And Applications Conference (ATNAC), 2014 Australasian, Southbank, VIC, 2014, pp. 212-216.
- [5] F. A. Silva, "Industrial Wireless Sensor Networks: Applications, Protocols, and Standards [Book News]," in IEEE Industrial Electronics Magazine, vol. 8, no. 4, pp. 67-68, Dec. 2014.
- [6] Jun Zheng; Simplot-Ryl, D.; Bisdikian, c.; Mouftah, H.T., "The internet of things [Guest Editorial]," in Communications Magazine, IEEE , vol.49, no.11, pp.30-31, November 2011 doi: 10.1109/MCOM.2011.606970.
- [7] K. Braam, Tsung-Ching Huang, Chin-Hui Chen, E. Montgomery, S. Vo and R. Beausoleil, "Wristband Vital: A Wearable multi-sensor microsystem for real-time assistance via low-power Bluetooth link," Internet of Things (WFIoT), 2015 IEEE 2nd World Forum on, Milan, 2015, pp. 87-91. doi: 10.1109/WF-IoT.2015.7389032.
- [8] "Digital parenting: The best wearables and new smart baby monitors. The latest smart baby monitors and Connected tech for your peace of mind,'Tech. Rep., 2015.

[9] “WiFi and WiMAX – break through in wireless access technologies,” Wireless, Mobile and Multimedia Networks, 2008. IET International Conference on, Beijing, 2008, pp. 141-145.

[10] P. Bhagwat, “Bluetooth: technology for short-range wireless apps,” in IEEE Internet Computing, vol. 5, no. 3, pp. 96-103, May/Jun 2001.

2.3 Problem Statement Definition :

1.Lack of information About child location

- ✓ Child care providers have a lot to consider when choosing a site for their program. There’s cost, location, suitable indoor and outdoor space, and so on. The issue of environmental contamination may not occur to them.
- ✓ There may be no visible problem or telltale smell, so it’s easy to overlook. But children deserve safe spaces to learn and play.
- ✓ Child care providers must make sure their facilities are free of environmental hazards.

2.Needfor child’s health condition.

- ✓ Common child health issues include allergies, colds, conjunctivitis, gastro, hand, foot and mouth disease, impetigo, lice and worms.
- ✓ You can treat mild health issues at home. But if you’re worried, see your GP.
- ✓ Handwashing is one of the best ways to prevent the spread of infection.

3.Need for real time information about abduction

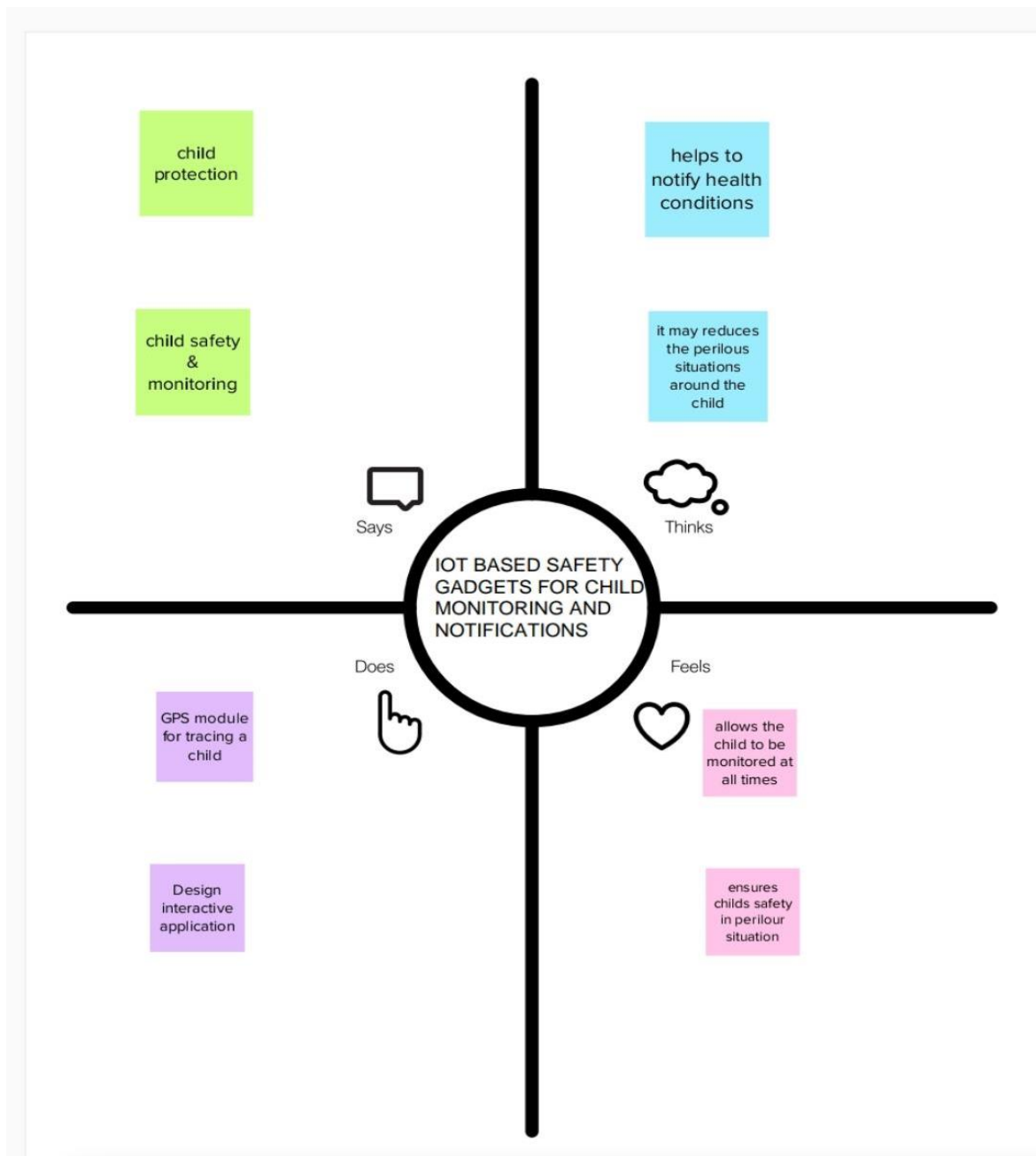
- ✓ Most kids who are reported missing have run away or there has been a misunderstanding with their parents about where they were supposed to be.
- ✓ Have ID-like photos taken of your kids every 6 months and have them fingerprinted. Many local police departments sponsor fingerprinting programs.
- ✓ Kids are rarely abducted from school grounds.

4.To detect child fall.

- ✓ Never leave infants and young children on a bed or any other furniture unsupervised.
- ✓ Childproof against falls with gates and don’t use walkers
- ✓ Make sure kids always wear helmets when biking, skating, and using skateboards or scooters.

3.IDEATION AND PROPOSED SOLUTIONS

3.1 Empathy map canvas :

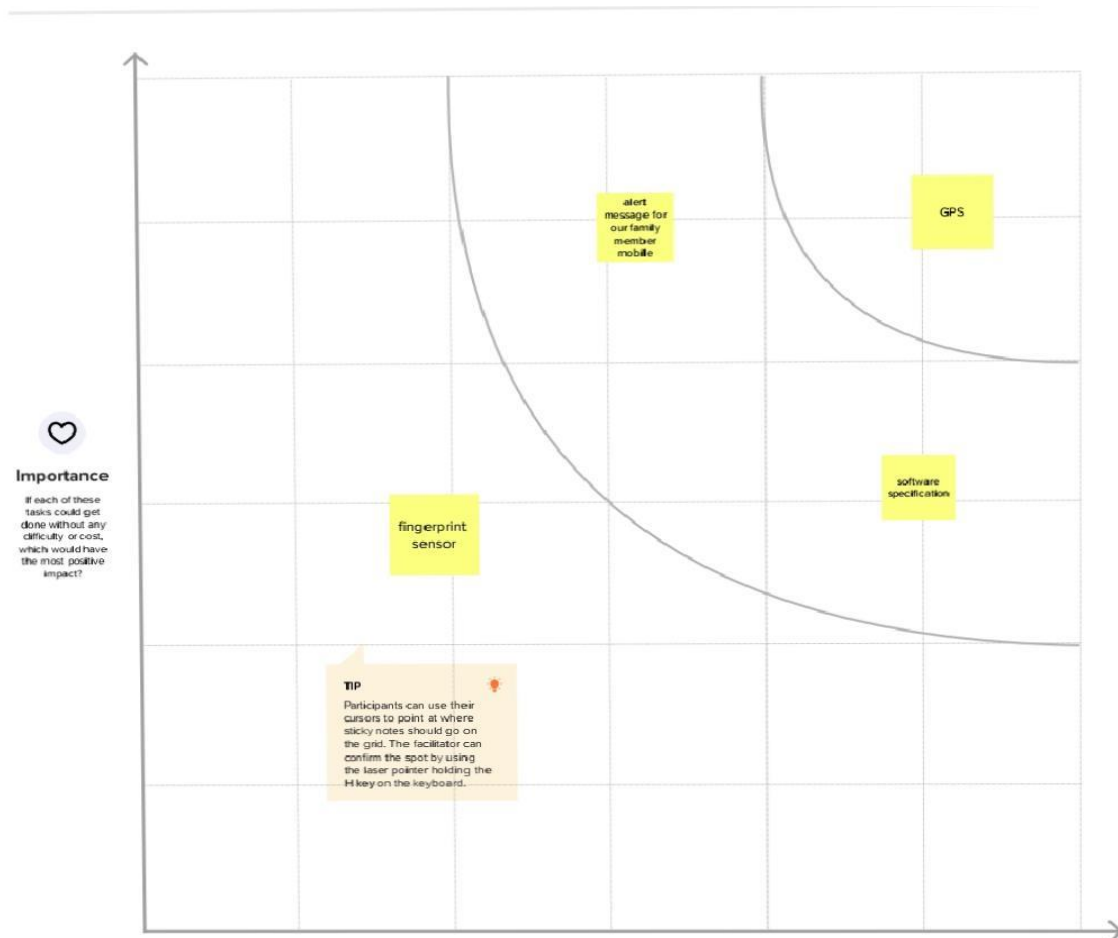


3.2 Ideations & Brainstorming:

In our system, we automatically monitor the child in real time using following ideas,

1. GPS, GSM Module
2. Panic alert system
3. Stay connected features
4. Gadget plug & unplug
5. Boundary monitoring system
6. Software specifications
7. Heart beat sensor
8. Temperature sensor
9. Fall detection device
10. Real time information about child
11. Alert message to our family member mobile
12. Pulse sensor
13. Environmental impact
14. Eye detection
15. Aadhar verification
16. Finger print sensor

Prioritization :



3.3 Proposed Solution :

1.Problem Statement (Problem to be solved) :

- ✓ No child should have to worry about his or her safety and welfare. Unfortunately, millions of children around the world are at risk for violence, abuse, and exploitation. There are several threats to the safety of children, most of which are interconnected. Read on to learn about these specific issues, how they are related to one another, and how they might be alleviated.
- ✓ Parents cannot know the previous location history of their children to find any lost belongings of them.
- ✓ Parents can neither contact nor instruct their children when they are far away from them.

2.Idea / Solution description

- ✓ 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 location.

- ✓ By continuously checking the child's location notifications will be provided 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.Novelty / Uniqueness

- ✓ Security
- ✓ Economical
- ✓ 24/7 monitoring Waterproof
- ✓ Fast tracking

4.Social Impact / Customer Satisfaction

- ✓ Brief and correct information about child.

5.Business Model (Revenue Model)

- ✓ Selling the product to child care organizations or centers.
- ✓ Selling the product via e-commerce.

6.Scalability of the Solution

- ✓ Reliable and cost effective.

3.4 Problem Solution Fit:

Define CS, fit into CC	1. CUSTOMER SEGMENT (S) CS Working parents and physically challenges parents of 0-12 years kids	6. CUSTOMER CONSTRAINS CC Customer may face the constrains like Battery lifetime, device damage due to children's activities, carrying inability.	5. AVAILABLE SOLUTIONS AS ✓ Tracking their child is difficult in past. After the installation of our device tracking and monitoring children is easy for users. Pros: *Children safety *Energy saving *Inhuman Cons: *possibility of product damage *Battery lifetime
	2. JOBS-TO-BE-DONE / PROBLEMS J&P The main job of the device is the tracing and monitoring the child when the device is switched on and sending notifications to the respected person.	9P.ROBLEM ROOT CAUSE RC ✓ The main problem causing factor is the carelessness of parents. ✓ The insecure environment of society.	7. BEHAVIOUR BE ✓ Linking their mobile to the tracking device and attaching the device on their child for monitoring. ✓ This will be help to safeguard our child.
3. TRIGGERS TR Seeing the neighbors using the safeguard product for their children safety.	10. YOUR SOLUTION SL Hand held gadgets with integrated mobile application with Temperature, Heart rate, Sensor, Location tracking.	8. CHANNELS of BEHAVIOUR CH 8.1 ONLINE ✓ Create Geo fence 8.2 OFFLINE ✓ Searching the missing child after the realization of missing. ✓ Inform police about child's location in case of emergency.	
4. EMOTIONS: BEFORE / AFTER EM Panic, Insecure, worried.		Focus on J&P, tap into BE, understand	

4.REQUIREMENT ANALYSIS

4.1 Functional Requirements:

Following are the functional requirements of the proposed solution.

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

4.2 Non- Functional Requirements:

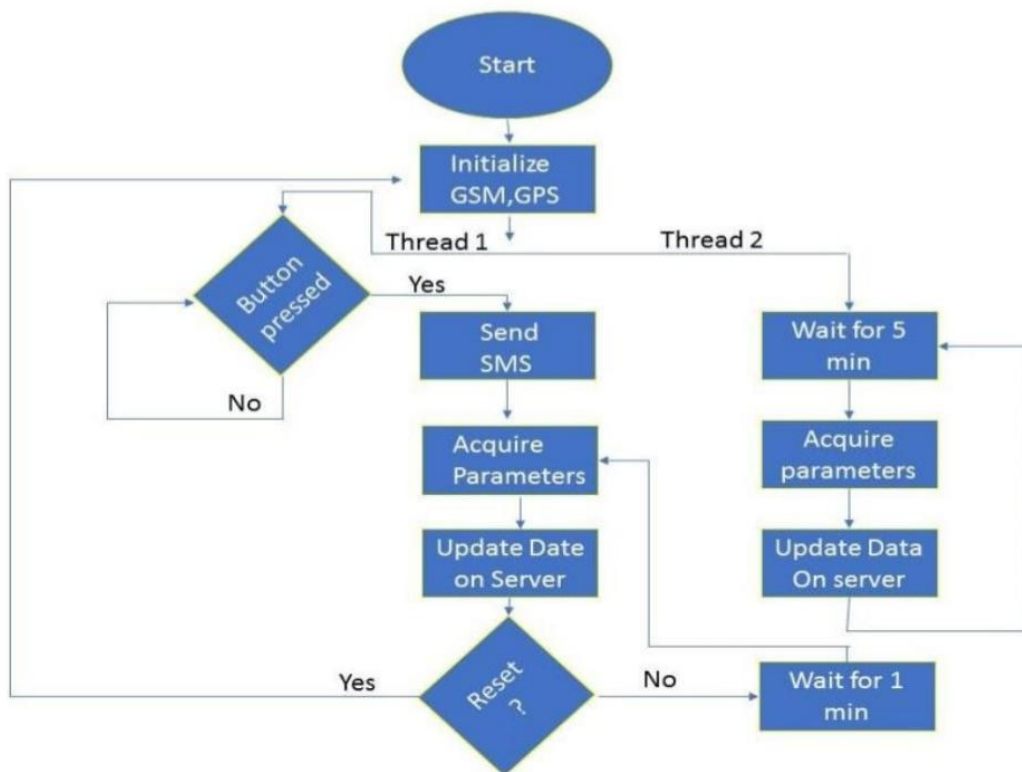
Following are the non-functional requirements of the proposed solution.

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Accessed through Mobile App Showing location (latitude and longitude) of child
NFR-2	Security	Database security must meet HIPAA requirements
NFR-3	Reliability and Availability	Once logged in ,webpage is available until logging out of the app
NFR-4	Performance	Each page must load within 2 seconds
NFR-6	Scalability	The process must finish within 3 hours so data is available by 9am local time after an overnight update

5. PROJECT DESIGN

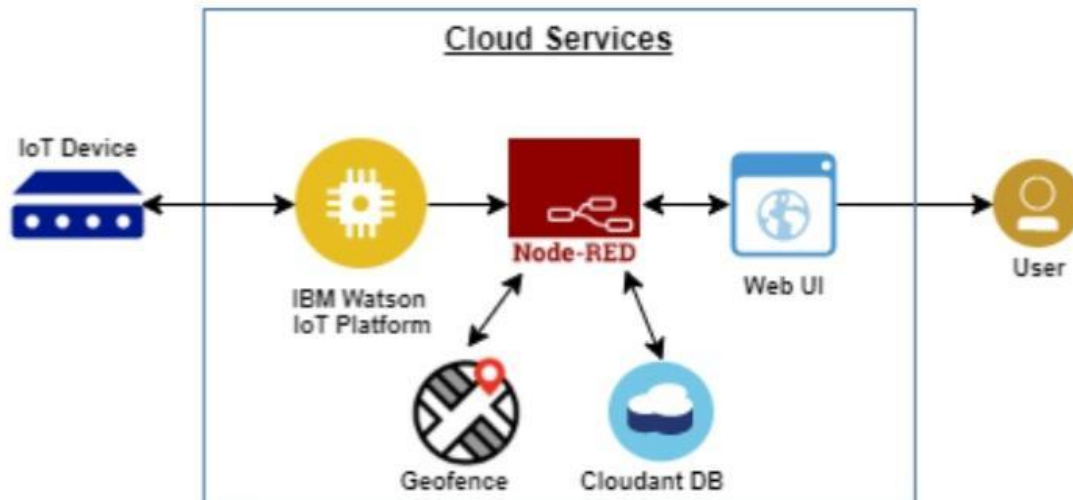
5.1 Data Flow Diagram:

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.



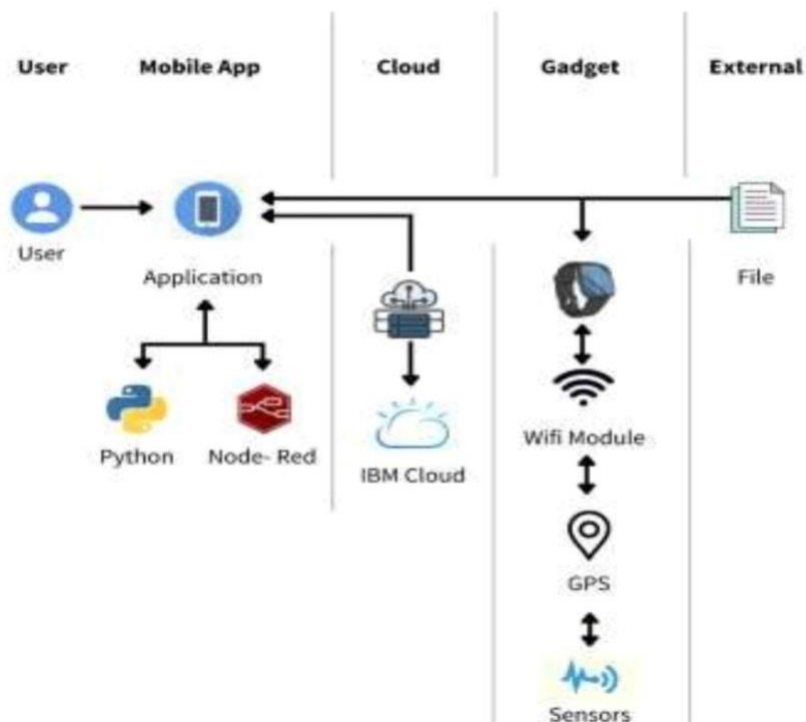
5.2 Solution and Technical Architecture:

Solution Architecture:



Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the diagram



5.3 User Stories:

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release	
Customer (Only in Mobile & Gadgets user)	Registration	USN-1 (Father)	As a user, I can register by entering my email, password, and confirming my password. I can access the location of my children using the credentials provided as a Father.	I can access my account / dashboard and receive confirmation email & click confirm	High	Sprint-1	
		USN-2 (MOTHER)	As a user, I can register by entering my email, password, and confirming my password. I can access the location of my children using the credentials provided as a Mother	I can access my account / dashboard and receive confirmation email & click confirm	High	Sprint-1	
		USN-3 (GUARDIAN/ CARETAKER)	As a user, I can also monitor the children's activities using a safety gadget monitoring system.	I can access my account / dashboard and receive confirmation email & click confirm	Low	Sprint-2	
	Login	USN-4	As a user, I can log into the application by entering email & password.	I can access my account / dashboard.	Medium	Sprint-1	
	Dashboard	USN-5	As a user, I can fix the geofence for my child's location so that I will receive alerts if my child crosses the geofence.	I can monitor the current location of my child.	High	Sprint-1	
Customer (Web user)	Registration	USN-1 (FATHER)	As a user, I can register by entering my email, password, and confirming my password. I can access the location of my children using the credentials provided as a Father.	I can access my account / dashboard and receive confirmation email & click confirm	High	Sprint-1	
		USN-2 (MOTHER)	As a user, I can register by entering my email, password, and confirming my password. I can access the location of my children using the credentials provided as a Mother.	I can access my account / dashboard and receive confirmation email & click confirm	High	Sprint-1	
		USN-3 (GUARDIAN/ CARETAKER)	As a user, I can also monitor the children's activities using a safety gadget monitoring system	I can access my account / dashboard and receive	Medium	Sprint-1	
		Login	USN-4	As a user, I can log into the application by entering email & password.	I can access my account / dashboard.	Medium	Sprint -1
		Dashboard	USN-5	As a user, I can fix the geofence for my child's location so that I will receive alerts if my child crosses the geofence.	I can monitor the current location of my child.	High	Sprint-2
Customer Care	Dashboard	USN-6	As a customer care service person, whenever I receive a complaint, I forward the complaint and ensure that the complaint is resolved.	I can keep track of all the complaints and the status of the complaints received.	Medium	Sprint-1	
Administrator	Admin Dashboard	USN-7	As an administrator, I will take care of all the payment processes, queries and complaints and login credentials.	I can access all the customer details, payment det pails and complaints received.	High	Sprint-3	

6.PROJECT PLANNING AND SCHEDULING

6.1 Sprint Planning and Estimation:

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

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	INDHUJA NISHAPRIYA
Sprint-1	Confirmation Email	USN-2	As a user, I will receive confirmation email and SMS once I have registered for the application	3	High	RAJKUMAR
Sprint-2	Authentication	USN-3	As a user, I can register for the application through Email ID and Mobile App.	2	Low	SANGAMESHWARAR
Sprint-1	Login	USN-4	As a user, I can log into the application by entering email & password.	2	Medium	INDHUJA
Sprint-1	Dashboard	USN-5	As a user, I can monitor, measure, analyze relevant data in key areas.	8	High	NISHAPRIYA
Sprint-2	Notification	USN-1	As a user, I should be able to receive notification when the child is in emergency situations.	9	High	RAJKUMAR
Sprint-2	Store data	USN-2	As a user, I need to store the location data and child information into the database.	10	High	SANGAMESHWARAR
Sprint-2	Communication	USN-3,1	The child and the parent should be able to communicate.	7	Medium	NISHAPRIYA INDHUJA
Sprint-3	IOT Device	USN-1,4	We automatically monitor the child in real time using Internet of Things, with the help of GPS, GSM, and Raspberry Pi.	6	Medium	SANGAMESHWARAR RAJKUMAR NISHAPRIYA
Sprint-3	Node RED	USN-5,2	The data stored in IBM Cloud should be integrated properly.	8	High	SANGAMESHWARAR INDHUJA NISHAPRIYA
Sprint-4	User Interface	USN-1,4	The point of human-computer interaction and communication in a device.	7	Medium	INDHUJA RAJKUMAR
Sprint-4	Geofencing	USN-2,3,5	The geofencing of the child should be done based on the geographical coordinates.	8	High	INDHUJA NISHAPRIYA RAJKUMAR

6.2 Sprint Delivery & Schedule:

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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	30 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	06 Nov 2022	20	06 Nov 2022
Sprint-3	20	6 Days	09 Nov 2022	16 Nov 2022	20	16 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

7. CODING AND SOLUTIONING

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

myConfig = {
    "identity": {
        "orgId": "qm8fs3",
        "typeId": "Nodemcu",
        "deviceId": "56432"
    },
    "auth": {
        "token": "i42n22r23s"
    }
}

Def myCommandCallback(cmd):
    Print("Command received: %s" % cmd.data['command'])
    Status=cmd.data['command']
    If status=="locationon":
        Print ("location is on")
    Elif status == "locationoff":
        Print ("location is off")
    Else :
        Print ("please send proper command")

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

While True:

 Name= "indhunisha"

 #in area location

 #latitude= 17.4225176

 #longitude= 78.5458842

 #out area location

 Latitude= 9.28

 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(20)

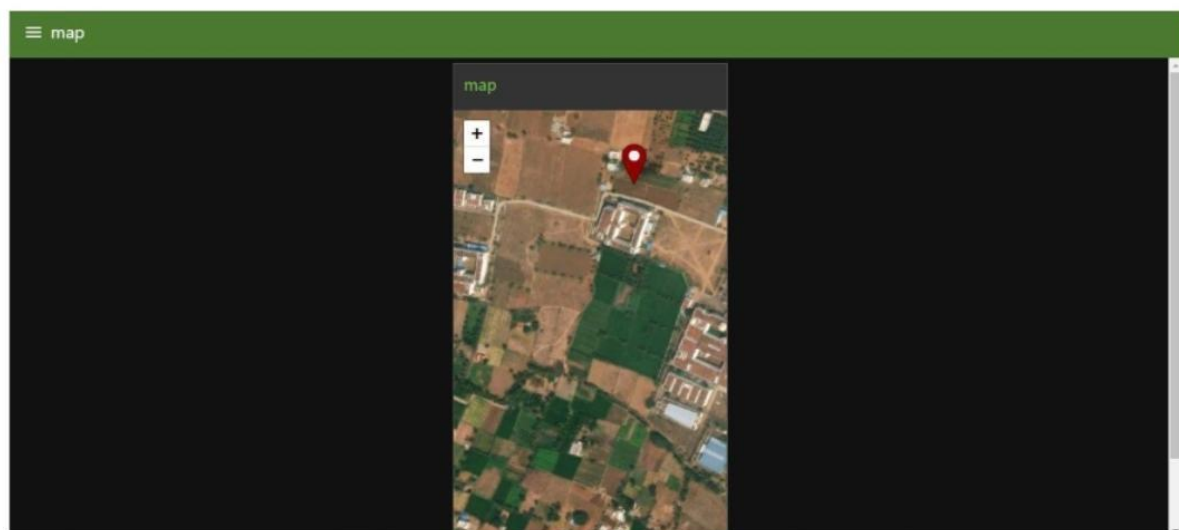
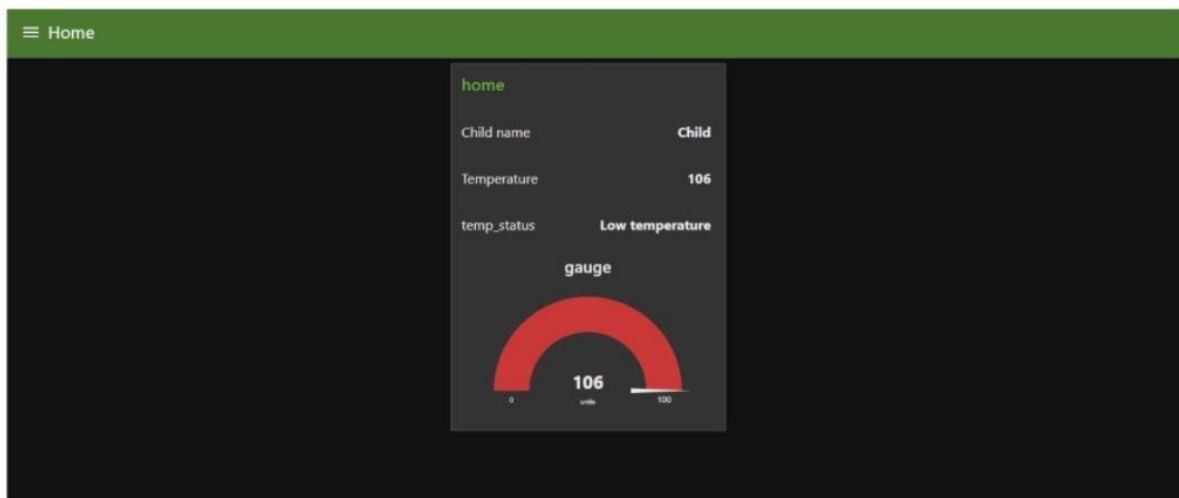
 Client.commandCallback = myCommandCallback

Client.disconnect()

TESTING

8.1 Test cases

Node-Red Dashboard:



9.RESULTS

9.1 Performance Metrics :



10. ADVANTAGES AND DISADVANTAGES

Advantages:

- ✓ 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.
- ✓ Thus by keeping in mind the advantages and applications we are developing a child monitoring device. In Order to avoid kidnapping cases, the child monitoring system is needed.

Disadvantages:

- ✓ The system is dependent on communication signal/network signal for the smart gadget to trigger automatic phone call/SMS during panic situation.
- ✓ It can be difficult to detect when network signal is not reachable/weak/when the smart gadget moves outside the boundary range.
- ✓ Hence, it can be improved by increasing the range.

11.CONCLUSION

It provides parents with the real-time location, surrounding temperature, SOS light along with Distress alarm buzzer for their child's surroundings and the ability to locate their child or alert bystanders in acting to rescue or comfort the child. This research has designed, developed and evaluated a prototype which can be implemented in a real-life scenario. However, any application can be enhanced for better performance and accuracy. 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.

12.FUTURE SCOPE

- ✓ In our system, we automatically monitor the child in real time using Internet of Things, with the help of GPS, GSM, and Raspberry Pi.
- ✓ This system requires network connectivity, satellite communication, and high-speed data connection when we use web camera and GPS to lively monitor.
- ✓ It is difficult to monitor when there occurs any hindrance to satellite communication or any network issue.
- ✓ There also occurs time delay in video streaming through the server. Hence in the future, these issues can be overcome by using Zigbee concept or accessing the system without internet and using high-speed server transmission.
- ✓ As future work, the trilateration data can be plotted as a real-time map to keep the track of the child's movement.
- ✓ The current implementation plots the location information in GPS when the child moves from the set distance.
- ✓ By plotting a real time graph will make the field trip experience.

13.APPENDIX

13.1 Source Code:

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

myConfig = {
    "identity": {
        "orgId": "qm8fs3",
        "typeId": "Nodemcu",
        "deviceId": "56432"
    },
    "auth": {
        "token": "i42n22r23s"
    }
}

Def myCommandCallback(cmd):
    Print("Command received: %s" % cmd.data['command'])
    Status=cmd.data['command']
```

```
If status=="locationon":
```

```
    Print ("location is on")
```

```
Elif status == "locationoff":
```

```
    Print ("location is off")
```

```
Else :
```

```
    Print ("please send proper command")
```

```
Client = wiotp.sdk.device.DeviceClient(config=myConfig, logHandlers=None)
```

```
Client.connect()
```

```
While True:
```

```
    Name= "indhunisha"
```

```
    #in area location
```

```
    #latitude= 17.4225176
```

```
    #longitude= 78.5458842
```

```
    #out area location
```

```
    Latitude= 9.28
```

```
    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(20)
```



```
Client.commandCallback = myCommandCallback
```

```
Client.disconnect()
```

GitHub link:

<https://github.com/IBM-EPBL/IBM-Project-48772-1660812817>

Project Demo link:

https://drive.google.com/file/d/1uKc6ezfJwTY-R9j9lONyrQJkCl_Qzn02/view?usp=drivesdk