

# **IOT BASED SAFETY GADGETS FOR CHILD SAFETY MONITORING & NOTIFICATIONS**

**BATCH : B2-2M4E**

**TEAM ID : PNT2022TMID50197**

Submitted by

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# 1. INTRODUCTION

Basically, children cannot complain about abuses 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 parent's 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:**

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**

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**

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 9<sup>th</sup> 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 2<sup>nd</sup> 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

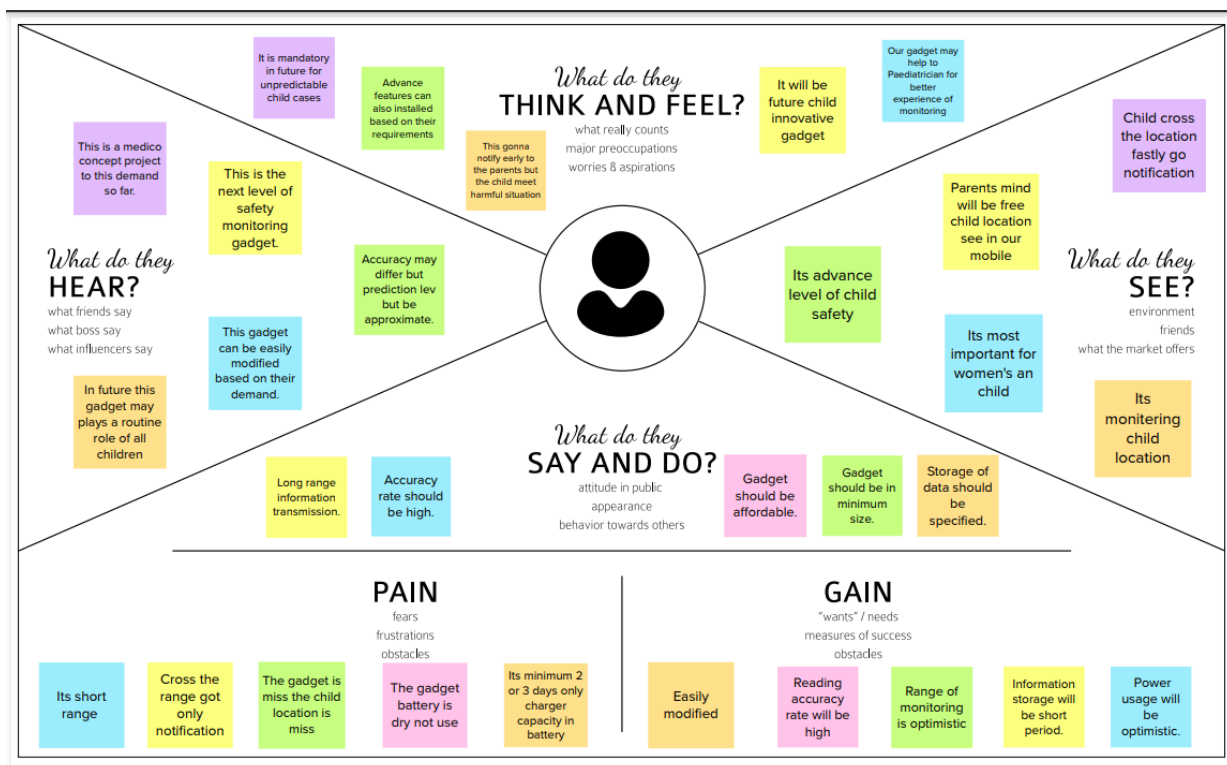
- Most kids who are reported missing have run away or there has been a misunderstanding with their parents about where they were supposed to be.
- Have ID-like photos taken of your kids every 6 months and have them fingerprinted.
- Many local police departments sponsor fingerprinting programs.
- Kids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

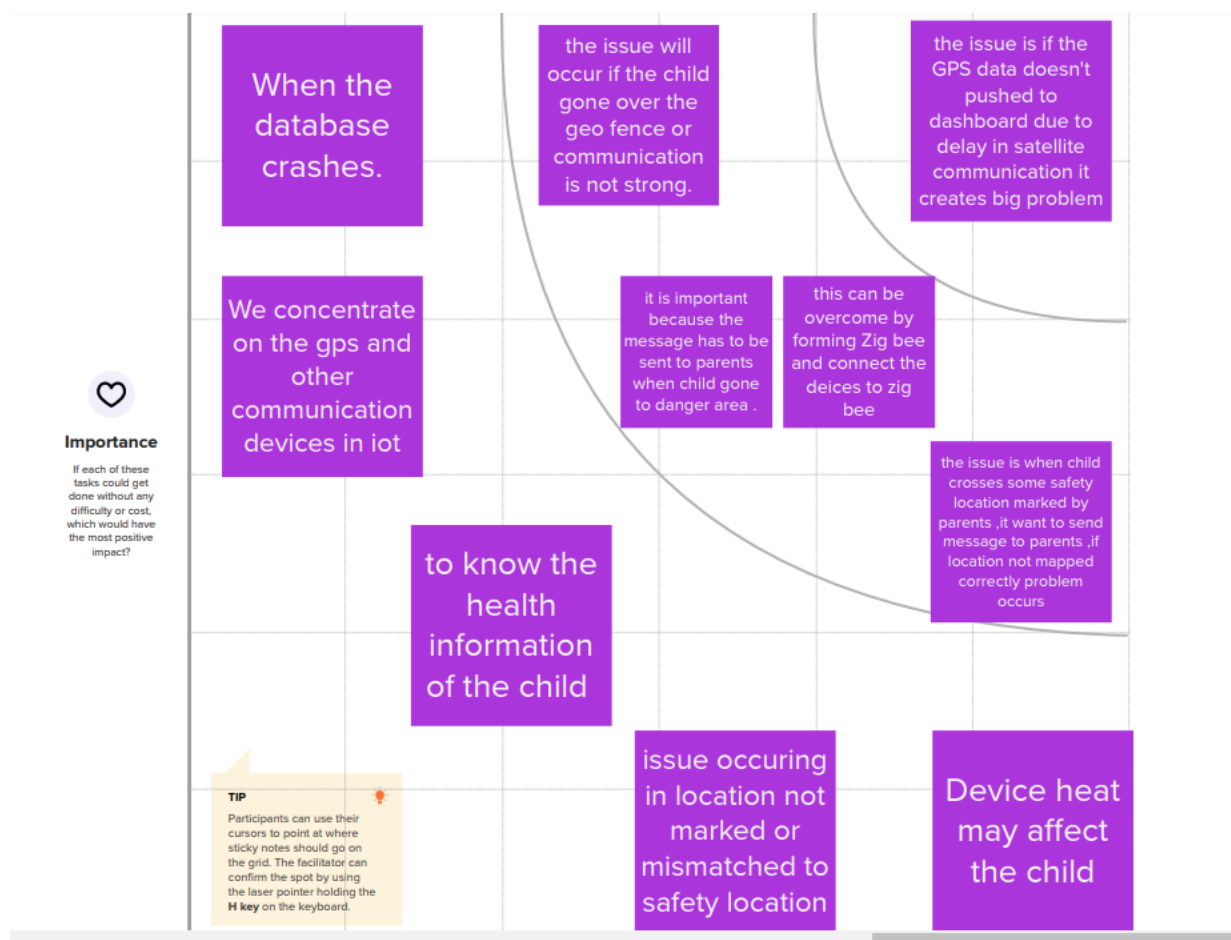


### 3.2 Ideations & Brainstorming:

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:

Project Title: IoT Based Safety Gadget for Child Safety Monitoring and Notification

Project Design Phase-I - Solution Fit Template

Team ID: PNT2022TMID50197

Define CS, fit into CC	<div>1. CUSTOMER SEGMENT(S) <small>Who is your customer? i.e. working parents of 0-5 y.o. kids</small></div> <div><ul style="list-style-type: none"><li>Caretaker</li><li>Parent</li></ul></div>	<div>6. CUSTOMER CONSTRAINTS <small>What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.</small></div> <div>Customer expects to save time, money, power consumption and quality of work</div>	<div>5. AVAILABLE SOLUTIONS <small>Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros &amp; cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking</small></div> <div>There are many solutions and it will be expensive in all time. Poor people and middle class people can't afford the cost soo this gadget may help them to reduce the cost and set a peaceful mind.</div>	Explore AS, differentiate
	<div>2. JOBS-TO-BE-DONE / PROBLEMS <small>Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.</small></div> <div>It is difficult to monitor the child for 24/7 and today we can't trust any caretaker.</div>	<div>9. PROBLEM ROOT CAUSE <small>What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations.</small></div> <div>Modern world is fulfilled with crime and insecure soo parents should be alert with safety measures</div>	<div>7. BEHAVIOUR <small>What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer, calculate usage and</small></div> <div>It is impossible to monitor the child for 24/7. This will increases the work pressure</div>	
Identify string TR & EM	<div>3. TRIGGERS <small>What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.</small></div> <div>In this modern world we should be advanced and should be socialized with the neighbors this idea make sure and develop a curiosity among the customers.</div>	<div>10. YOUR SOLUTION <small>If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.</small></div> <div>We are developing an circuit and web application for transmitting the alert message to parents</div>	<div>8. CHANNELS of BEHAVIOUR <small>8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7 8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.</small></div> <div>ONLINE: Web application GPS module communication.  OFFLINE: Distance calculations gadget using time.</div>	
	<div>4. EMOTIONS: BEFORE / AFTER <small>How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure -&gt; confident, in control - use it in your communication strategy &amp; design.</small></div> <div>Before: Parents was always in a divergent thinking and generates negative thoughts After: Set up a peace of mind and positivity enhances</div>			

## 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:

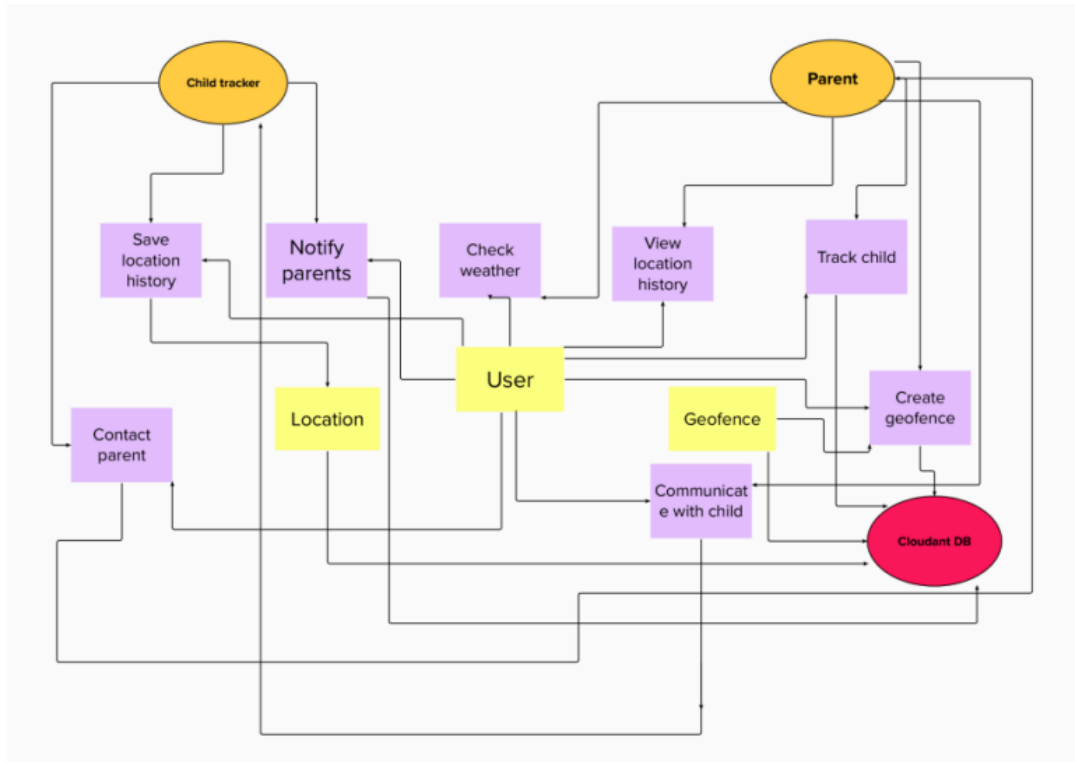
Following are the non-functional requirements of the proposed solution.

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

## 5. PROJECT DESIGN

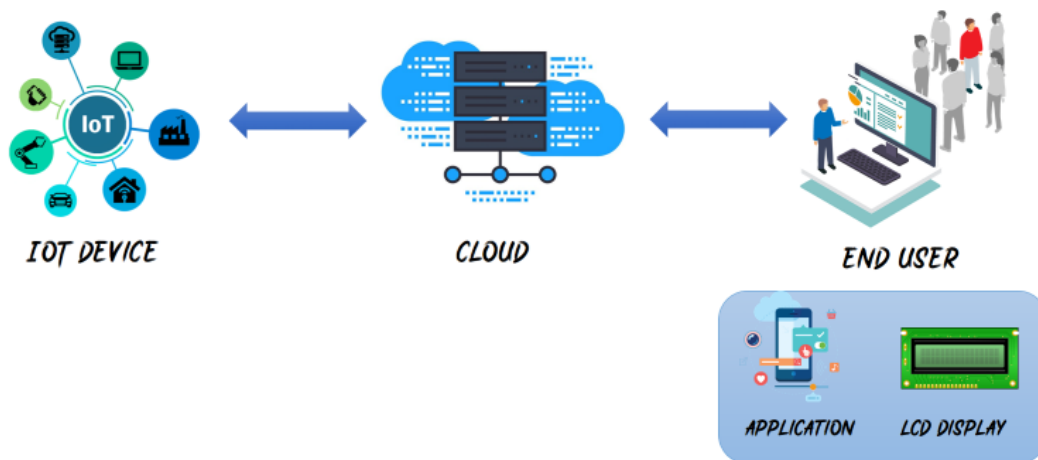
### 5.1 Data Flow Diagram:

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

#### IoT Device:



## 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.	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.	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.	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.	High	Sprint-3
				I can access all the customer details, payment details and complaints received.		

## 6.PROJECT PLANNING AND SCHEDULING

### 6.1 Sprint Planning and Estimation:

Use the below template to create product backlog and sprint schedule

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	Sam Daniel, Premkumar
Sprint-1	Confirmation Email	USN-2	As a user, I will receive confirmation email once I have registered for the application	4	High	Vanaselvam, Sam Daniel
Sprint-1	Authentication	USN-3	As a user, I can register for the application through Gmail and mobile app	4	Medium	Premkumar, Rajeshkumar
Sprint-1	Login	USN-4	As a user, I can log into the application by entering email and password	4	High	Samuel, Sam Daniel
Sprint-1	Dashboard	USN-5	As a user, I need to be able to view the functions that I can perform	4	High	Vanaselvam
Sprint-2	Notification	USN-1	As a user, I should be able to notify my parent and guardian in an emergency situation	10	High	Premkumar, Vanaselvam

Sprint-2	Store data	USN-2	As a user, I need to continuously store my location data into the database	10	High	Sam Daniel, Vanaselvam, Premkumar
Sprint-3	Communication	USN-3,1	I should be able to communicate with my parent	6	Low	Samuel, Vanaselvam
Sprint-3	IoT Device- Watson communication	USN-1,4	The data from IoT device should reach IBM Cloud	7	Medium	Premkumar
Sprint-3	Node Red- Cloudant DB communication	USN-5,2	The data stored in IBM Cloud should be properly integrated with Cloudant DB	7	High	Samuel, Sam Daniel, Rajeshkumar
Sprint-4	User - WebUI Interface	USN-1,4	The Web UI should get inputs from the user	10	High	Sam Daniel, Vanaselvam
Sprint-4	Geofencing	USN-2,3,5	The geofencing of the child should be done based on the geographical location	10	High	Sam Daniel, Vanaselvam, Premkumar

### 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	29 Oct 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

## 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

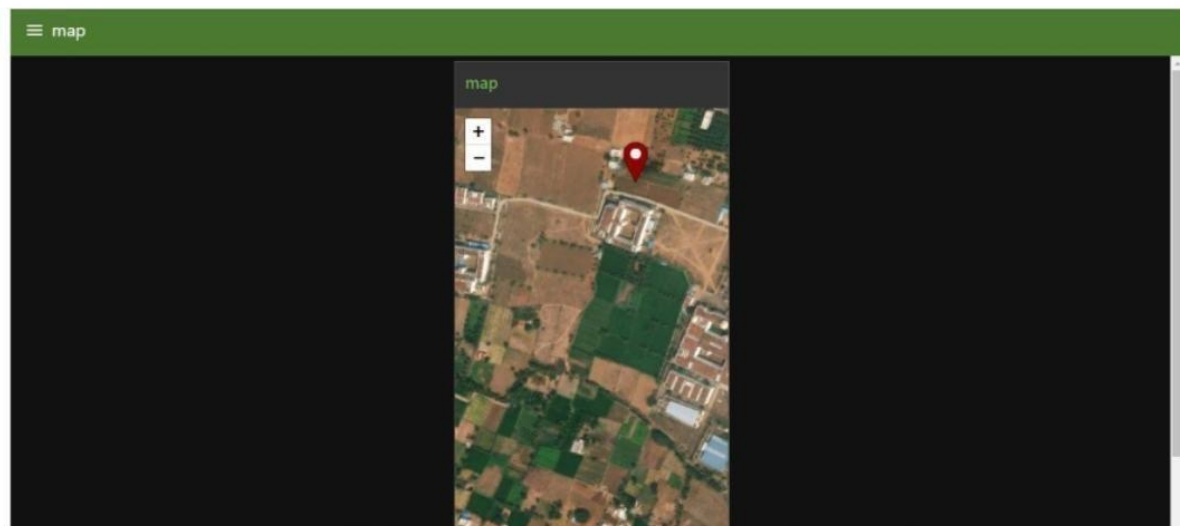
Client.disconnect()



# 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-43525-1660717570>

**Project Demo link:**

[https://drive.google.com/file/d/1uKc6ezfJwTYR9j9lONyrQJkCl\\_Qzn02/view?usp=drivesdk](https://drive.google.com/file/d/1uKc6ezfJwTYR9j9lONyrQJkCl_Qzn02/view?usp=drivesdk)