

# **NALAIYA THIRAN PROJECT REPORT**

**TITLE : IoT Based Safety Gadget for Child  
Safety Monitoring & Notification.**

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**TEAM ID : PNT2022TMID22281**

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SWETHA P**

# **TABLE OF CONTENTS**

## **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

6.3 Reports from JIRA

## **7. CODING & SOLUTIONING**

7.1 Feature 1

7.2 Feature 2

## **8. TESTING**

8.1 Test Cases

8.2 User Acceptance Testing

## **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**

## **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 child is a creature that makes their life become more joyful and meaningful. However, parents cannot take care of their child from every moment. As the days went past, the child will be grown up and starting their school life. The parent is not possible to always stay beside of them as most of the parents needs to go for work to earn some income to sustain a family. Today's child is easier influenced by their friends, and they might even get cheated or kidnapped by any of the strangers. This project focused on how parents can keep track their children movement to avoid child missing, kidnapping and etc. By using the application parents can see the exact location (longitude and latitude) of the children anytime.

## **2. LITERATURE SURVEY**

### **2.1 Existing Problem:**

This literature survey is a summary and explanation of the complete and current state of knowledge on limited topics as found in journal articles. In this chapter, only three system are compared for tracking system. There are a large number of studies of the tracking system in the different areas. However, since the focus of this research is on the child tracking system, these will not be reviewed in detail and will only be referred to as appropriate. Studies are performed on three existing system. In the existing system there is a voice recognition module in which the alert commands from the children are stored. These are kept for future reference. If the same child delivers the same command, it will compare with the alert command which is 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 to their parents.

## 2.2 References:

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

"Smart IOT Device for Child Safety and Tracking". Published in 2019.

- Shows a savvy IoT gadget proposed for youngster security and following, created to assist guardians with observing and find their kids. The framework is intended to consequently alarm the watchman/parent by sending SMS when quick consideration is required during a crisis.

- **M. Haghi, R. Stoll and K. Thurow.**

"Pervasive and Personalized Ambient Parameters Monitoring". Published in 2019.

- The model uses a multi-layer and multi-sensor approach and can quantify an assortment of risky gases, gives movement following and checks physical encompassing parameters.

- **Z. Gao, H. Guo, Y. Xie, Y. Luo, H. Lu and K. Yan.**

"A Child-Safety Monitoring System". Published in 2017.

- Gives a demonstration of the Child Guard system that tracks the movement of unsupervised children in real-time using mobile devices. Notifications in the form of alarms and reminders are sent to the child, and the guardians are alerted of abnormalities in the child's daily routine. Child Guard operates as

a security method for monitoring children by using emergent technologies like wearable devices or simple smartphones.

➤ **Akash Moodbidri, Hamid Shahnasser.**

"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.

➤ **Dheeraj Sunehera, Pottabhatini Laxmi Priya.**

"Children Location Monitoring on Google Maps Using GPS and GSM". Published in 2016.

- 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.

## **2.3 Problem Statement Definition:**

More families are now spending time on work and social duties, hence away from their children. This causes increased concerns towards their safety and whereabouts, and has made keeping a track of their activities quite challenging.

### **1] Increasing rate of child kidnapping.**

- There is an assumption that every 10 minutes, a child goes missing. Mumbai and Delhi have the highest rate when compared to other metro cities. With the lack of availability of affordable child monitoring systems it is hard to monitor the whereabouts of children.

### **2] Lack of tracking technology for child.**

- The parent is hardly to keep a watch on their child without the use of technology, especially when the child is in the outdoor. The parent even cannot avoid the negligence that will make by children in the future day.

### **3] Limited application for child monitoring.**

- There are very limited application available for tracking child when they are out of parents control and let kidnapping or missing cases occurred.

Therefore, it is necessary for the proposed system to alert the parents when the child walks away from the geofence. If in case the child does go missing or has a fall, the aid of technology can increase efficiency and decrease the time necessary to locate and reach the child.



## 3. IDEATION & PROPOSED SOLUTION

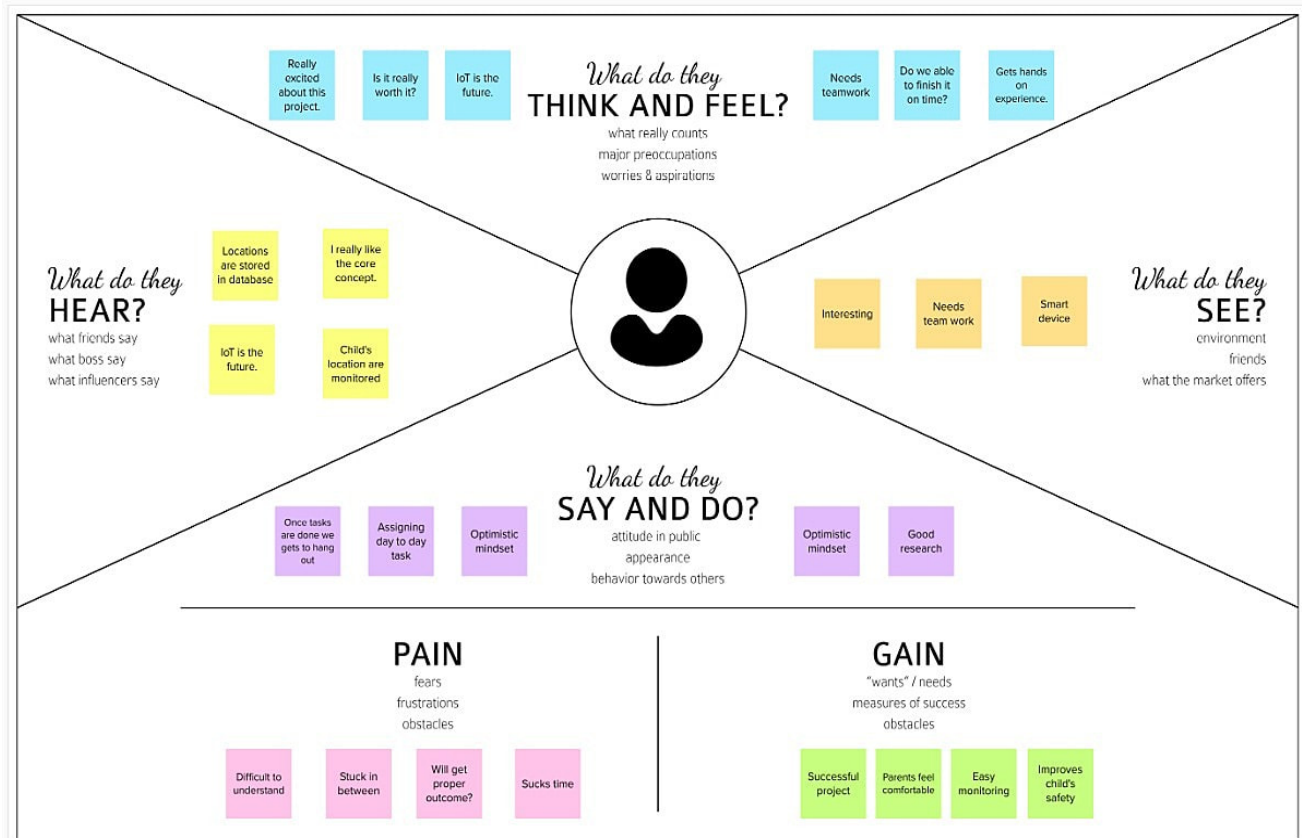
### 3.1 Empathy Map Canvas

# Empathy Map Canvas

Gain insight and understanding on solving customer problems.

1


Build empathy and keep your focus on the user by putting yourself in their shoes.



Edit this template  
Right-click to unlock

Share your feedback

## 3.2 Ideation & Brainstorming



### Brainstorm & Idea prioritization

Use this template to generate ideas and prioritize them. You can use this template to generate ideas and prioritize them. You can use this template to generate ideas and prioritize them.

- Brainstorming
- Idea selection
- Idea prioritization

#### Define the challenge

What is the challenge you are trying to solve? What is the challenge you are trying to solve? What is the challenge you are trying to solve?

Define the challenge

#### Define the solution

What is the solution you are trying to develop? What is the solution you are trying to develop? What is the solution you are trying to develop?

Define the solution

#### Define the metrics

What are the metrics you are trying to measure? What are the metrics you are trying to measure? What are the metrics you are trying to measure?

Define the metrics

#### Define the team

Who is the team you are trying to form? Who is the team you are trying to form? Who is the team you are trying to form?

Define the team

#### Define the process

What is the process you are trying to follow? What is the process you are trying to follow? What is the process you are trying to follow?

Define the process

#### Define the results

What are the results you are trying to achieve? What are the results you are trying to achieve? What are the results you are trying to achieve?

Define the results

[Brainstorming link uploaded in github](#)

### 3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Child safety plays a vital role in today's world. But parents are really busy with their works and it's a challenging task for them to monitor their child. So, with our safety gadget we can actually monitor the child's location and can also set the geo fence. If the child crosses the geofence the notification is sent to their respective parents.
2.	Idea / Solution description	For monitoring the child's location we are using IoT approach. Using that the child's locations is stored in the database. Parents or caretakers are allowed to set the geofence. If the child tends to cross the geofence the device will send the notification.
3.	Novelty / Uniqueness	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.
4.	Social Impact / Customer Satisfaction	When child crosses the geofence the notifications are generated and sent which will be the main area of the customer satisfaction.
5.	Business Model (Revenue Model)	Business to Customer (B To C)
6.	Scalability of the Solution	With businesses and processes changing daily, there will always be demand for new features, products and services for your business. With this safety gadget parents can track their child anytime and anywhere.

## 3.4 Problem Solution fit

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

Project Design Phase-I - Solution Fit

Team ID: PNT2022TMID22281

Define CS, fit into CC	<b>1. CUSTOMER SEGMENT(S)</b> Who is your customer? Working parents of 0-10 year old kids. <b>CS</b>	<b>6. CUSTOMER CONSTRAINTS</b> What constraints prevent your customers from taking action or limit their choices of solutions? Budget, no cash, network connection, available devices. <b>CC</b>	<b>5. AVAILABLE SOLUTIONS</b> Which solutions are available to the customers when they face problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? Proper bandwidth, tracking the kids through this smart gadget is a best alternative for monitoring them in a mandatory way. <b>AS</b>	Explore AS, differential
	<b>2. JOBS-TO-BE-DONE / PROBLEMS</b> Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides. Locations of the child is monitored continuously. If the child crosses the geofence the notification is sent to their respective parents or caretakers. <b>J&amp;P</b>	<b>9. PROBLEM ROOT CAUSE</b> What is the real reason that this problem exists? What is the back story behind the need to do this job? It is really a challenging task for working parents to go behind their children to check where they are going. <b>RC</b>	<b>7. BEHAVIOUR</b> What does your customer do to address the problem and get the job done? Parents can set the geofence and the locations of their children is stored in the database. If the child crosses the geofence the notification is sent to the parents. <b>BE</b>	

Identify strong TR & EM	<b>3. TRIGGERS</b> What triggers customers to act? i.e. seeing their neighbours using smart safety gadgets to monitor their child, reading about a more efficient solution in the news. <b>TR</b>	<b>10. YOUR SOLUTION</b> 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. <b>SL</b>	<b>8. CHANNELS of BEHAVIOUR</b> <b>8.1 ONLINE</b> What kind of actions do customers take online? Parents can see their child's locations. <b>8.2 OFFLINE</b> What kind of actions do customers take offline? If the child crosses the geofence the notifications are sent to the parents even if they are not online. So, they can take further steps according to that. <b>CH</b>	Identify strong TR & EM
	<b>4. EMOTIONS: BEFORE / AFTER</b> How do customers feel when they face a problem or a job and afterwards? lost, insecure, worrying → confident, in control, feel comfortable. <b>EM</b>			

[Problem Solution Fit link uploaded in github](#)

## 4. REQUIREMENT ANALYSIS

### 4.1 Functional requirement

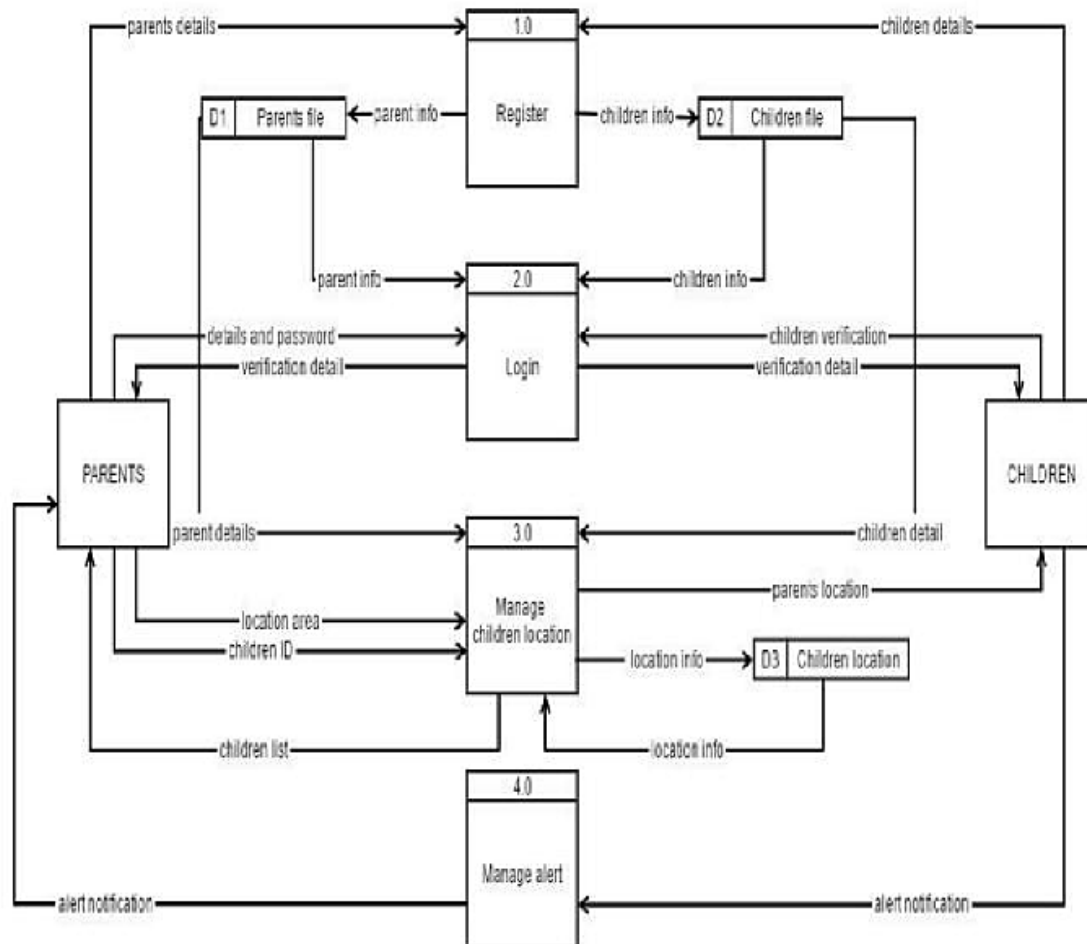
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Notification	Notification send to Mobile Number Notification send through message/ call
FR-4	User Location Check	Check through Account

### 4.2 Non-Functional requirements

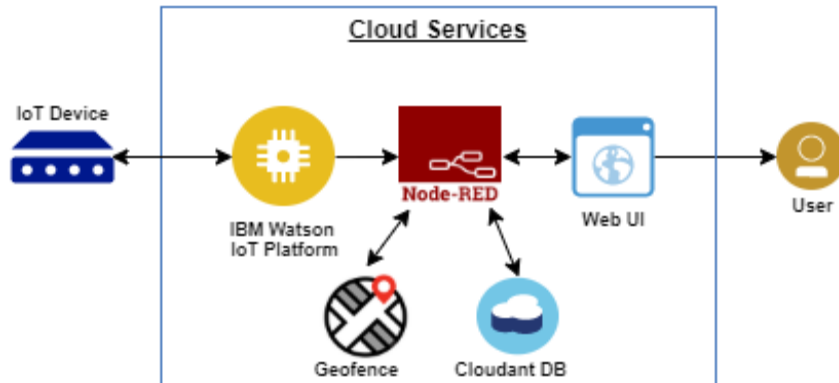
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Allow parents to track their child's location and also monitor them.
NFR-2	Security	Creates a secure environment for children to monitor around
NFR-3	Reliability	Increased reliability towards technology
NFR-4	Performance	High performance in terms of simple usage and security
NFR-5	Availability	Backup power supply
NFR-6	Scalability	Increase in scalability

## 5. PROJECT DESIGN

### 5.1 Data Flow Diagrams



## 5.2 Solution & Technical Architecture



## 5.3 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
		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
	Login	USN-4	As a user, I can register for the application through Gmail		Medium	Sprint-1
		USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard					
Customer (Web user)	Login		When I enter I can view the working of applications, scan and monitor the operations and check if all the users are authorized	I can only login with my own credentials.	Medium	Sprint -3
Customer Care Executive	Login		Maintaining and accessing the database containing the locations are secure and accurate and update constantly	I can only login with my own credentials.	High	Sprint - 4
Administrator	Login		As a user I can register for the application by entering my correct credentials	I can able to access my account/dashboard	High	Sprint - 2

## 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 user, I can register for the application by entering my email, password.	1	High	Asvitha V S
Sprint-1		USN-2	As a user, I will receive verification email once I have registered for the application	2	High	Swetha P
Sprint-1	Login	USN-3	As a user, I can log into the application by entering email & password.	1	High	Silviya D
Sprint-2	Integrate and code	USN-4	Integrating the IBM Watson IoT Platform, cloudant DB and application with the node red .	2	High	Niranjana S
Sprint - 2		USN- 5	Developing the code for connecting with IBM Watson IoT platform.	1	High	Asvitha V S, Niranjana S, Silviya D
Sprint-3	Cloud	USN- 6	The child locations are stored in cloud	1	Medium	Asvitha V S
Sprint-4	Notification	USN- 7	Allowing the parent or guardian to see the current location status of the children.	1	High	Swetha P
Sprint-4		USN-8	Notification message is sent to the parent or guardian if the child crosses the geofence.	1	High	Mufasarunisa M

### 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	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	5 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



## 6.3 Reports from JIRA

### ● Backlog

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IoT Based Safety Gadg... Software project

PLANNING

- Roadmap
- Backlog
- Board

DEVELOPMENT

- Code

Project pages

- Add shortcut
- Project settings

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Projects / IoT Based Safety Gadget for Child Safety Monitoring & Notification

### Backlog

Search | [Icons] Epic

IBSGFCMN Sprint 1 24 Oct – 31 Oct (3 issues) 0 0 0 Complete sprint

- IBSGFCMN-6 As a user, I can register for the application by entering my email, password. REGISTRATION TO DO
- IBSGFCMN-7 As a user, I will receive verification email once I have registered for the application REGISTRATION TO DO
- IBSGFCMN-8 As a user, I can log into the application by entering email & password. LOGIN TO DO

+ Create issue

IBSGFCMN Sprint 2 31 Oct – 7 Nov (2 issues) 0 0 0 Complete sprint

- IBSGFCMN-9 Integrating the IBM Watson IoT Platform, cloudant DB and application with the node red. INTEGRATE AND CODE TO DO

Quickstart

### ● Board

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- Roadmap
- Backlog
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Projects / IoT Based Safety Gadget for Child Safety Monitoring & Notification

### All sprints

Search | [Icons] Epic Sprint

GROUP BY None Insights

TO DO 8 ISSUES

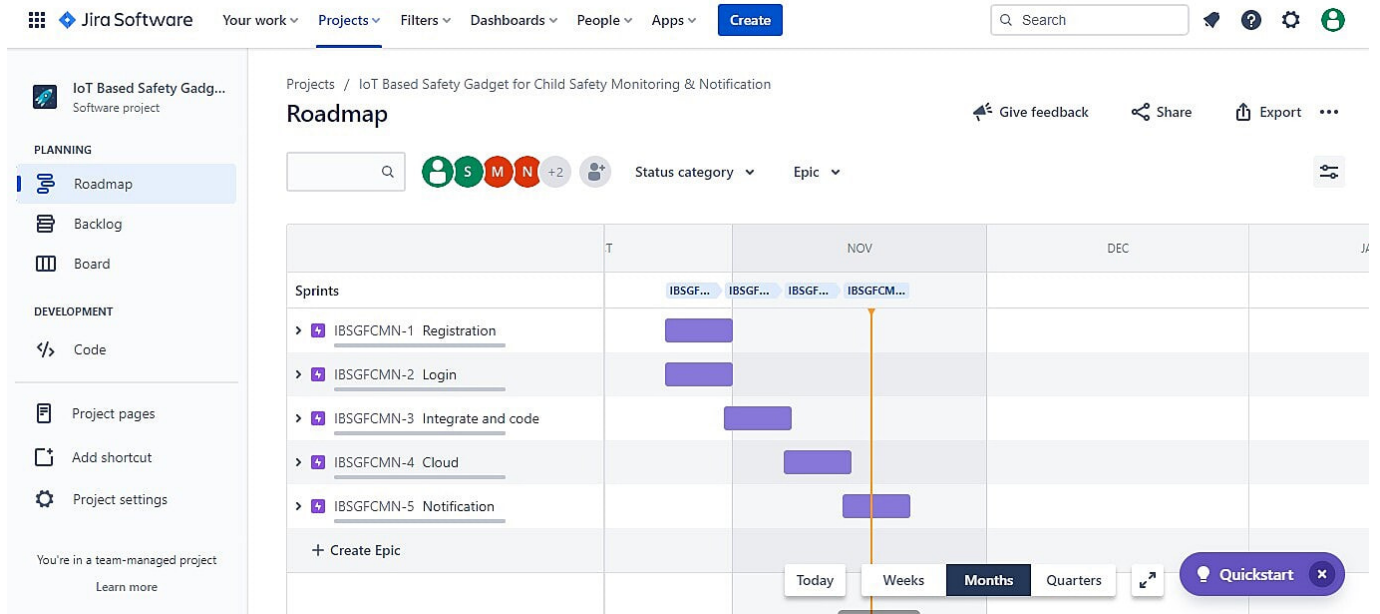
- As a user, I can register for the application by entering my email, password. REGISTRATION IBSGFCMN-6
- As a user, I will receive verification email once I have registered for the application REGISTRATION IBSGFCMN-7

IN PROGRESS

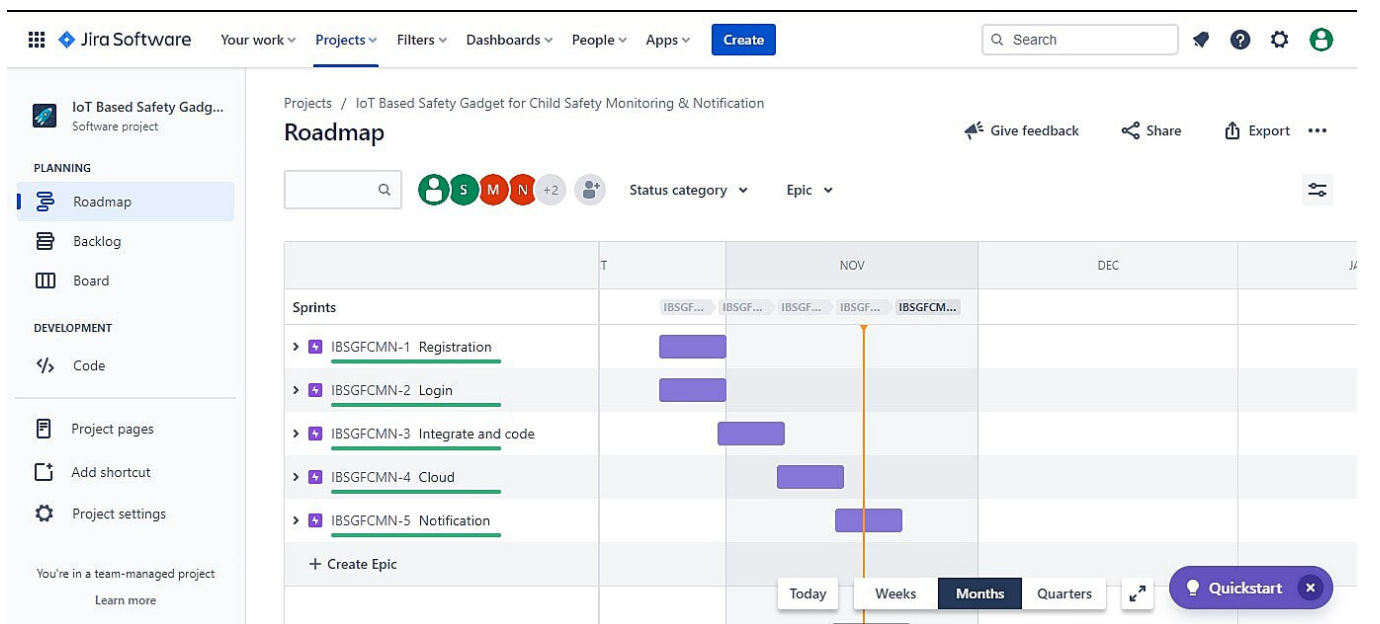
DONE

Quickstart

## ● Roadmap



## ● Completed Roadmap



## 7. CODING & SOLUTIONING

### 7.1 Feature 1

- In our project we added a feature of sending an alert message.
- The alert message will send through SMS.
- So, the parents can view the message even without the internet connection.
- Through the alert message parents can come to know that their child had crossed the geofence location.

#### Code

- This is the code we used in our project to send an alert message.

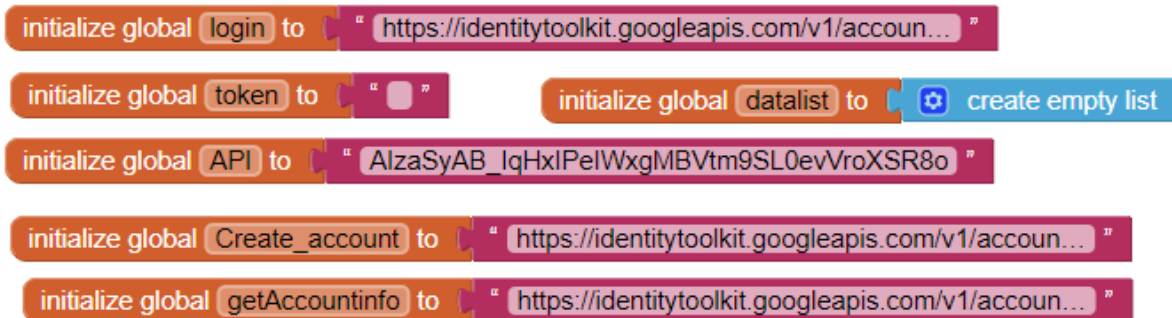
```
if (latitude != 17.4219272) and (longitude != 78.5488783):  
    client1 = Client(twilio_keys.account_sid, twilio_keys.auth_token)  
    message = client1.messages.create(  
        body="Dear Parent/Guardian,"  
        "\nYour child is out of range!!!",  
        from_=twilio_keys.twilio_number,  
        to=twilio_keys.target_number  
    )
```

## 7.2 Feature 2

- In our project we added a special feature of authentication while looking the child's location in the application.
- Parents need to authenticate themselves before seeing the child's location.
- If they are new user they need to register themselves.
- In addition with they also need to verify their email.

### Code

- This is the code block we used to implement the authentication mechanism.
- We build this in MIT App Inventor.



```
initialize global login to "https://identitytoolkit.googleapis.com/v1/accoun..."
initialize global token to ""
initialize global datalist to create empty list
initialize global API to "AlzaSyAB_IqHxIPeIWxgMBVtm9SL0evVroXSR8o"
initialize global Create_account to "https://identitytoolkit.googleapis.com/v1/accoun..."
initialize global getAccountinfo to "https://identitytoolkit.googleapis.com/v1/accoun..."
```

The image shows a sequence of MIT App Inventor code blocks for authentication. The first block initializes a global variable 'login' to a Google Identity Toolkit endpoint. The second block initializes 'token' to an empty string and 'datalist' to a new empty list. The third block initializes 'API' to a specific API key. The fourth block initializes 'Create\_account' to another Google Identity Toolkit endpoint. The fifth block initializes 'getAccountinfo' to a third Google Identity Toolkit endpoint.

```

when registerbtn .Click
do
  set Web1 . Url to join
    get global Create_account
    get global API
  call Web1 .PostText
    text join
      "email="
      TextBox1 . Text
      "&password="
      PasswordTextBox1 . Text
      "returnSecureToken=true"
  call Notifier1 .ShowAlert
    notice "An email has been sent to your registered mail i..."

```

```

when Web3 .GotText
  url responseCode responseType responseContent
do
  set Label3 . Text to get responseContent
  if contains text Label3 . Text
    piece "true"
  then open another screen screenName Screen2
  else call Notifier1 .ShowMessageDialog
    message "Please verify your email"
    title "Notification"
    buttonText "OK"

```

```

when Web2 .GotText
  url responseCode responseType responseContent
do
  set Label3 . Text to get responseContent

```

## 8. TESTING

### 8.1 Test Cases

Count	Inputs	Outputs	Results
1	Latitude:17.4219272 Longitude:78.5488783	Parents can view the child's location in the application.	Normal condition
2	Latitude: 17.5442272 Longitude:78.7687831	Parents can view the child's location in the application.	Normal condition
3	Latitude:30.4219272 Longitude:108.5488783	Parents can view the child's location in the application and also alert message sent and data stored in cloud.	Critical condition
4	Latitude:17.0987654 Longitude:78.6542789	Parents can view the child's location in the application.	Normal condition
5	Latitude:60.8376428 Longitude:190.6524781	Parents can view the child's location in the application and also alert message sent and data stored in cloud.	Critical condition

## 8.2 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 resolve.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By design	12	5	3	20	40
External	5	3	12	10	30
Fixed	8	2	0	20	30
Not Reproduced	3	7	8	15	25
Skipped	3	5	2	1	11
Won't Fix	2	1	7	5	15
Totals	33	23	32	71	159

### Test Case Analysis

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

Section	Total cases	Not Tested	Fail	Pass
Client Application	4	0	0	4
Security	2	0	0	2
Exception Reporting	11	0	0	11
Final Report Output	5	0	0	5

## **9. RESULTS**

### **9.1 Performance Metrics**

#### **CPU usage**

- The Python V3.7.0 is make the best use of the CPU. For every loop the program runs in  $O(1)$  time, neglecting the network and communication. The program sleeps for every 1 second for better communication with MQTT. As the program takes  $O(1)$  time and the compiler optimizes the program during compilation there is less CPU load for each cycle. The upcoming instructions are on the stack memory, so they can be popped after execution.

#### **Memory usage**

- The sensor values, networking data are stored in sram of the ESP32 . It's a lot of data because ESP32 has only limited amount of memory (520 KB) .For each memory cycle the exact addresses are overwritten with new values to save memory and optimal execution of the program

#### **Garbage collection**

- In the server-side garbage collection is done by the Node framework. In the IoT device, python does not have any garbage collection features. But it is not necessary in this scenario as the memory is used again for storing the data. Any dangling pointer or poorly handled address space is not allocated



## **10. ADVANTAGES & DISADVANTAGES**

### **Advantages**

- The child's entire location are stored in database.
- Parents can set the geofence according to their needs.
- It can be used in any cell phone and doesn't necessarily require an expensive smart phone.
- Minimizes the human work, effort and also saves time.

### **Disadvantages**

- The child could not produce the exact alert command during a panic situation.
- The command produced may not match with the previously stored command.
- So, this may fails to send the notification to child's parents.

## **11. CONCLUSION**

Parents especially who live in urban area, needed to work day and night to sustain the family which causes them cannot know where their child is going during the working hour. However, with the child tracking app, parent can track and monitor their child with just a simple app. The parent is not possible to always stay beside of children as most of the parents needs to go for work. By having this child tracking system, parents can track the location of their children. In order to avoid the kidnapping cases, the child tracking system is needed. This project demonstrates Smart IoT device for child safety and tracking which will help the parents to locate and monitor their children. If the child crosses the geofence the notifications are sent to the parents or caretakers. Our project is easy for parents to track their children which ensures the safety of their children.

## **12. FUTURE SCOPE**

In the conclusion of project was designed for the locating missing children. This project was given depth information about child tracking system with the help of geofence and SMS services the application is built in. Finally for this application has room for the enhancement. Emergency alerts such features can be added to enhance system. This system requires proper network connectivity. The system won't work if there is no internet connection. Hence in the future, these issues can be overcome by accessing the system without internet and using high-speed server transmission. Also, we would like to include some advanced authentication mechanism. The proposed system will be improved in the later work.

## 13. APPENDIX

### 13.1 Source Code

```
import time

import wiotp.sdk.application

from twilio.rest import Client

import twilio_keys
```

```
myConfig = {
    "identity": {
        "orgId": "fjde2i",
        "typeId": "Tracker",
        "deviceId": "28",
    },
    "auth": {
        "token": "123456789"
    }
}
```

```
}
```

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

```
client.connect()
```

```
# in area location
```

```
#latitude = 17.4219272
```

```
#longitude = 78.5488783
```

```
# out area location
```

```
latitude = 30.4219272
```

```
longitude = 108.5488783
```

```
if (latitude != 17.4219272) and (longitude != 78.5488783):
```

```
    client1 = Client(twilio_keys.account_sid, twilio_keys.auth_token)
```

```
    message = client1.messages.create(
```

```

        body="Dear Parent/Guardian,"

        "\nYour child is out of range!!!",

        from_=twilio_keys.twilio_number,

        to=twilio_keys.target_number

    )

while True:

    name = "Child"

    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()

```

## **13.2 GitHub & Project Demo Link**

**GitHub - [Our Github Repository IBM-Project-21765-1659790948](#)**

**Project Demo Link - [IoT Based Safety Gadget for Child Safety Monitoring & Notification Demo Video](#)**