Project Report

Date	12 November 2022
Team ID	PNT2022TMID04092
Project Name	Project - IoT Based Safety Gadget for Child Safety Monitoring and Notification

1. INTRODUCTION

1.1 Project Overview

A tracker that helps parents track a child'slocation so that the child does not get into dangerous situations.

1.2 Purpose

Now a day's Parents have more responsibility than older about their children's. Because Crimes rates are increasing day by day in our country, Crimes such as Child Amusement, Rapes, Murders, Illegal Relationship to avoid these kind of crimes parents must watch their children every step. Eventually mobile phones cause major allegations on our society. Many teens must be noticed by their own parents, it is our duty. But sometimes children are arguing with their parents for watching their steps, to overcome these issues, we need to watch them through online

2. LITERATURE SURVEY

2.1 Existing Solution and Problem

[1] Authors: M Nandini Priyanka, S Murugan, K. N. H. Srinivas, T. D. S. Sarveswararao, E. Kusuma Kumari. Title: Smart IoT Device for Child Safety and Tracking. Published in: 2019 IEEE. The system is developed using Link-It ONE board programmed in embedded C and interfaced with temperature, heartbeat, touch sensors and also GPS, GSM & digital camera modules. The novelty of the work is that the system automatically alerts the parent/caretaker by sending SMS, when immediate attention is required for the child during emergency.

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

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

[2] Authors: Akash Moodbidri, Hamid Shahnasser Title: Child safety wearable device. Published in: 2017 IEEE. The purpose of this device is to help the parents to locate their children with ease. At the moment there are many wearable's in the market which helps to track the daily activity of children and also helps to find the child using Wi-Fi and Bluetooth services present on the device.

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

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

[3] Authors: Aditi Gupta, Vibhor Harit. Published in: 2016 IEEE. Title: Child Safety & Tracking Management System by using GPS. This paper proposed a model for child safety through smart phones that provides the option to track the location of their children as well as in case of emergency children is able to send a quick message and its current location via Short Message services.

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

Demerits: This system is unable to sense human behaviour of child.

[4] Authors: Dheeraj Sunehera, Pottabhatini Laxmi Priya. Title: Children Location Monitoring on Google Maps Using GPS and GSM. Published in: 2016 IEEE. This paper provides an Android based solution for the parents to track their children in real time. Different devices relate to a single device through channels of internet. The concerned device is connected to server via internet. The device can be used by parents to track their children in real time or for women safety. The proposed solution takes the location services provided by GSM module. It allows the parents to get their child's current-location via SMS. Merits: A child tracking system using android terminal and hoc networks.

Demerits: This device cannot be used in rural areas.

2.2 References

[1] M Nandini Priyanka, S Murugan, K. N. H. Srinivas, T. D. S. Sarveswararao, E. Kusuma Kumari, 'Smart IoT Device for Child Safety and Tracking' International Journal of Innovative Technology and Exploring Engineering, Volume 8, Issue 8, June 2019.

[2] Akash Moodbidri, Hamid Shahnasser (Jan. 2017) 'Child safety wearable device', International Journal for Research in Applied Science & Engineering Technology, Vol. 6 Issue 2, pp. 438-444.

[3] Aditi Gupta, Vibhor Harit, 'Child Safety & Tracking Management System by using GPS, GeoFencing & Android Application: An Analysis,' 2016 Second International Conference on Computational Intelligence & Communication Technology.

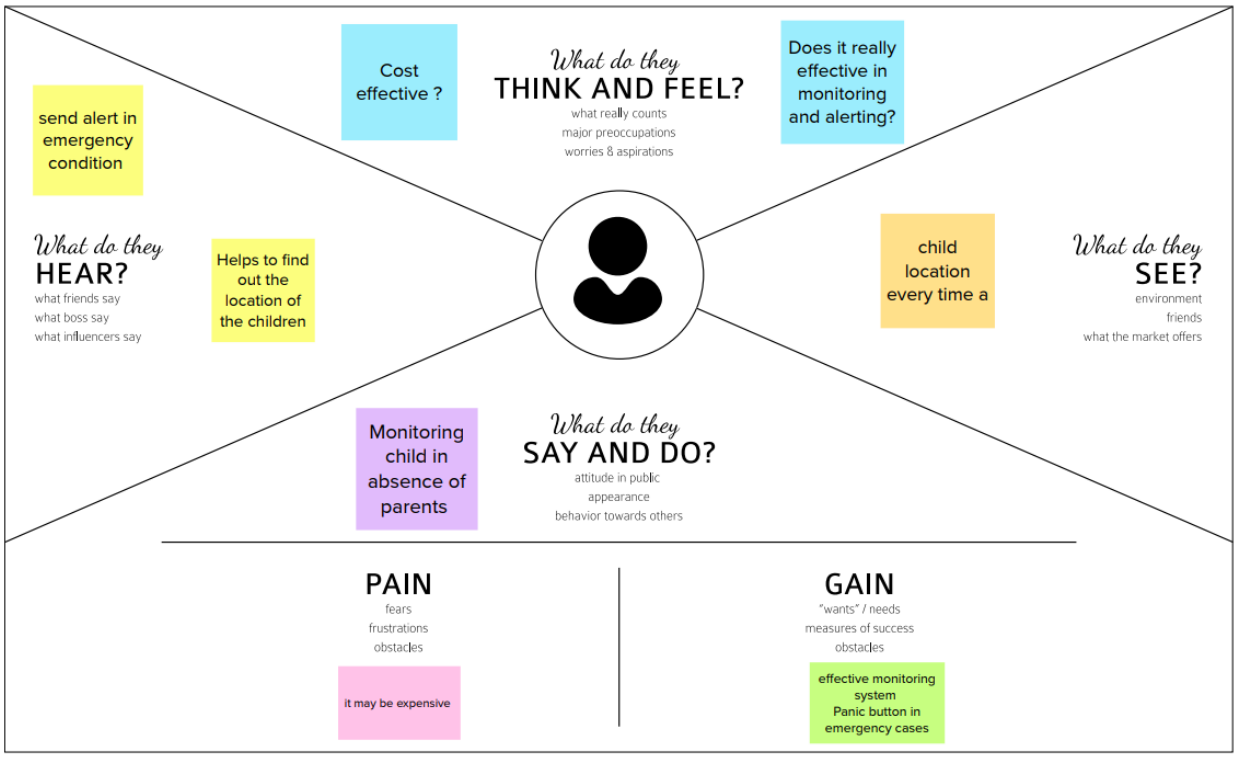
[4] Dheeraj Sunehera, Pottabhatini Laxmi Priya, 'Children Location Monitoring on Google Maps Using GPS and GSM,' 2016 IEEE 6th International Conference on Advanced Computing.

2.3 Problem Statement Definition

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

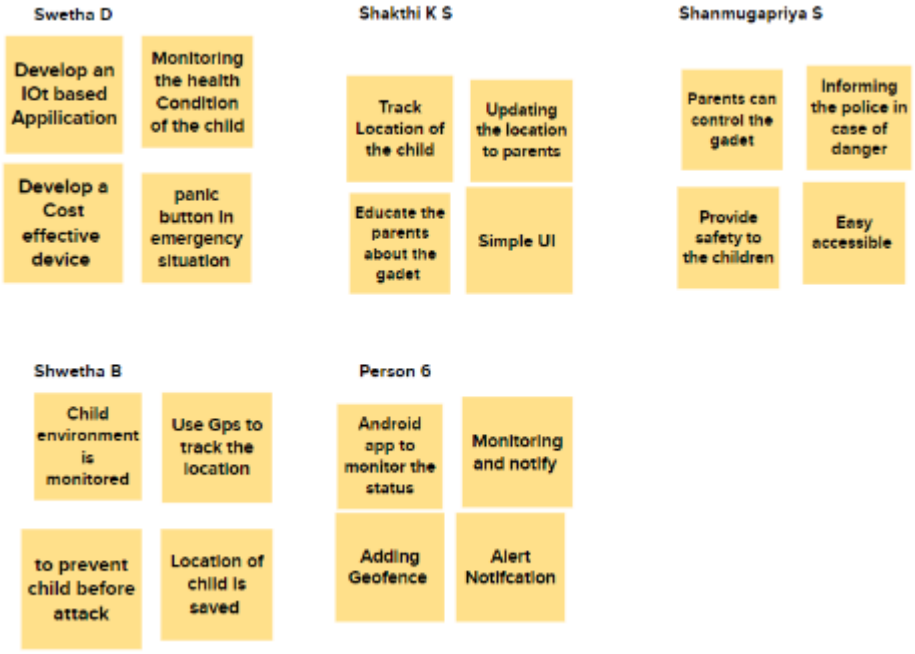
3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

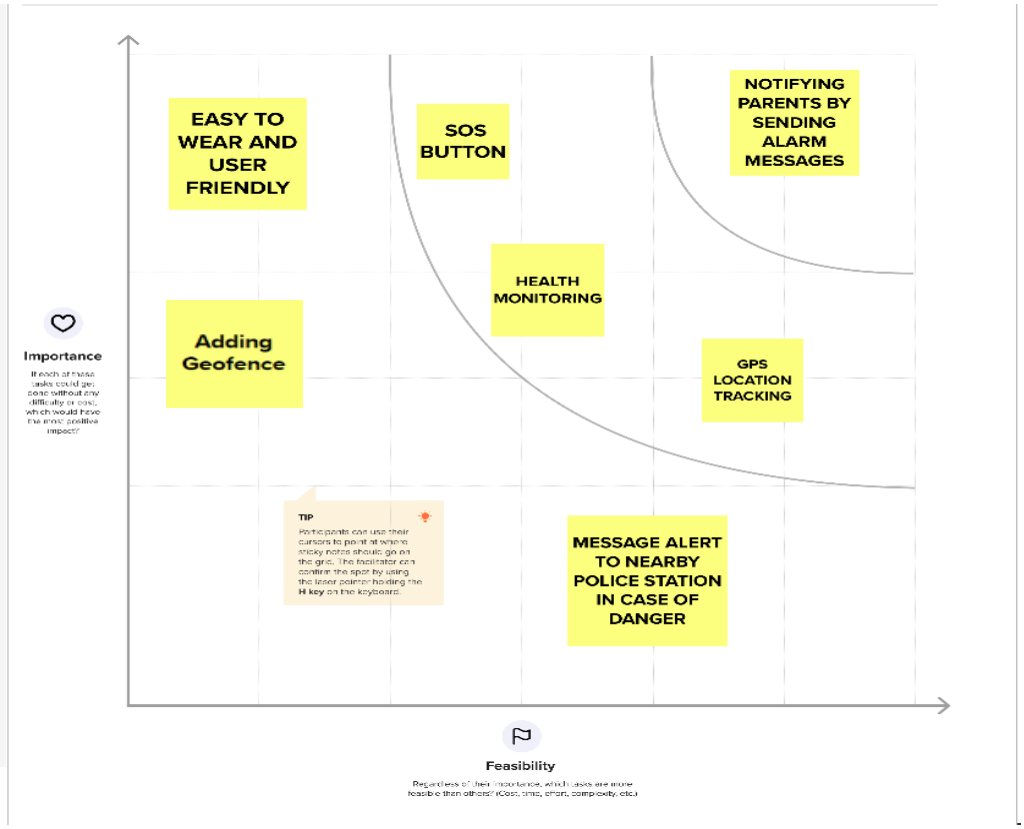


3.2 Ideation & Brainstorming

Brainstorming



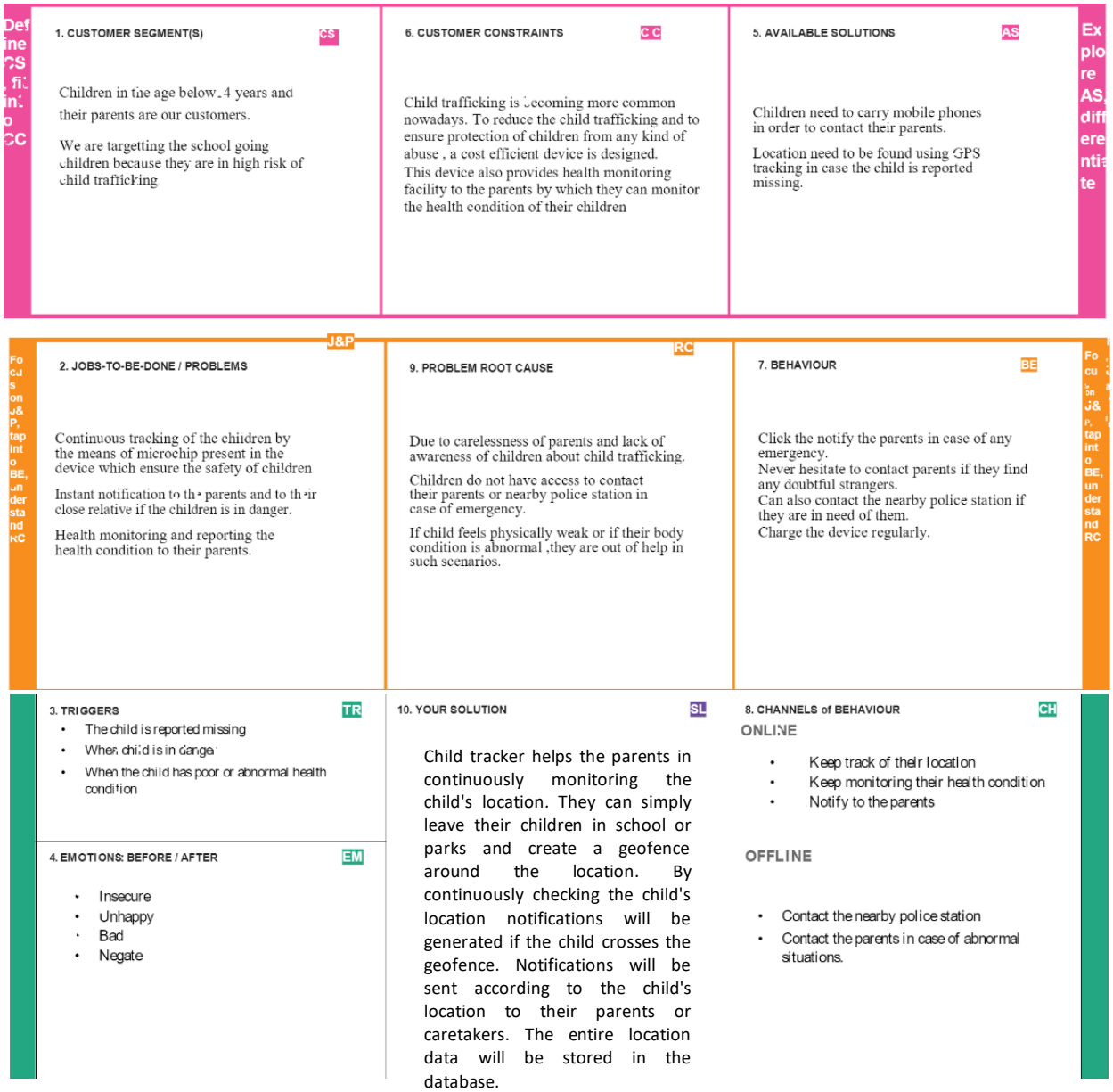
Ideation Prioritization



3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	A tracker that helps parents track a child's location so that the child does not get into dangerous situations.
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 particular location. • By continuously checking the child's location notifications will be generated if the child crosses the geofence. Notifications will be sent according to the child's location to their parents or caretakers. The entire location data will be stored in the database.
3.	Novelty / Uniqueness	• A tracker used for child's safety and protection, such that it won't interfere with the day-to-day life of the child as well as be a very easy to use interface for parents has not been developed yet. • Hence, the proposed solution will ensure that there is a device that can be used in all areas, and uses different sorts of software's integrated together to maintain accuracy and ensure the safety of the child.
4.	Social Impact / Customer Satisfaction	• Reduce the anxiety, worry and nervousness of a parent when they are not around the child. Having a peace of mind on the child's whereabouts will increase customer satisfaction, as well as the inclusion of an easy to use and interactive user interface. • The reduction of child kidnappings, injuries, accidents, and missing children in the country
5.	Business Model (Revenue Model)	• Business to Consumer Model Licensing Model Subscription Model Freemium Model
6.	Scalability of the Solution	• By adopting multiple data storage technologies,controlling the IoT data pipeline, and using automated bootstrapping we ensure that thedevice is highly scalable.

3.4 Problem Solution fit



4. REQUIREMENT ANALYSIS

4.1 Functional requirement

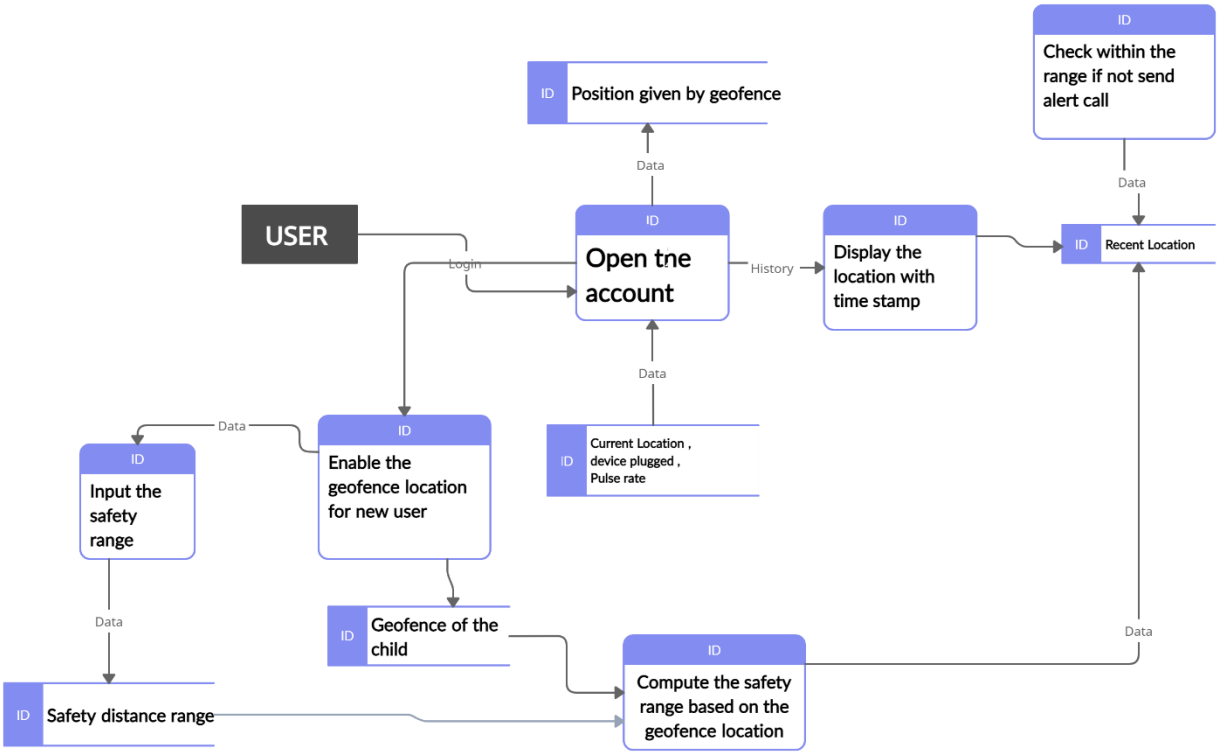
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Notification	Notification Via Mobile App and normal message
FR-4	Monitoring	App to monitor the child location

4.2 Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	This model can help to notify the parents in case of emergency
NFR-2	**Security**	Parents can feel secure because if the child leave the desired location and immediately a notification will be sent
NFR-3	**Reliability**	✓ Easy to use ✓ Portable ✓ Flexible ✓ Cost effective
NFR-4	**Performance**	✓ Create a Child tracker which helps the parents with continuously monitoring the child's location. ✓ The notification will be sent according to the ✓ child's location to their parents or caretakers.
NFR-5	**Availability**	✓ Track your child even in a crowd ✓ Know the current location
NFR-6	**Scalability**	This model ensures the safety and tracking of the children. Parents need not worry about their children.

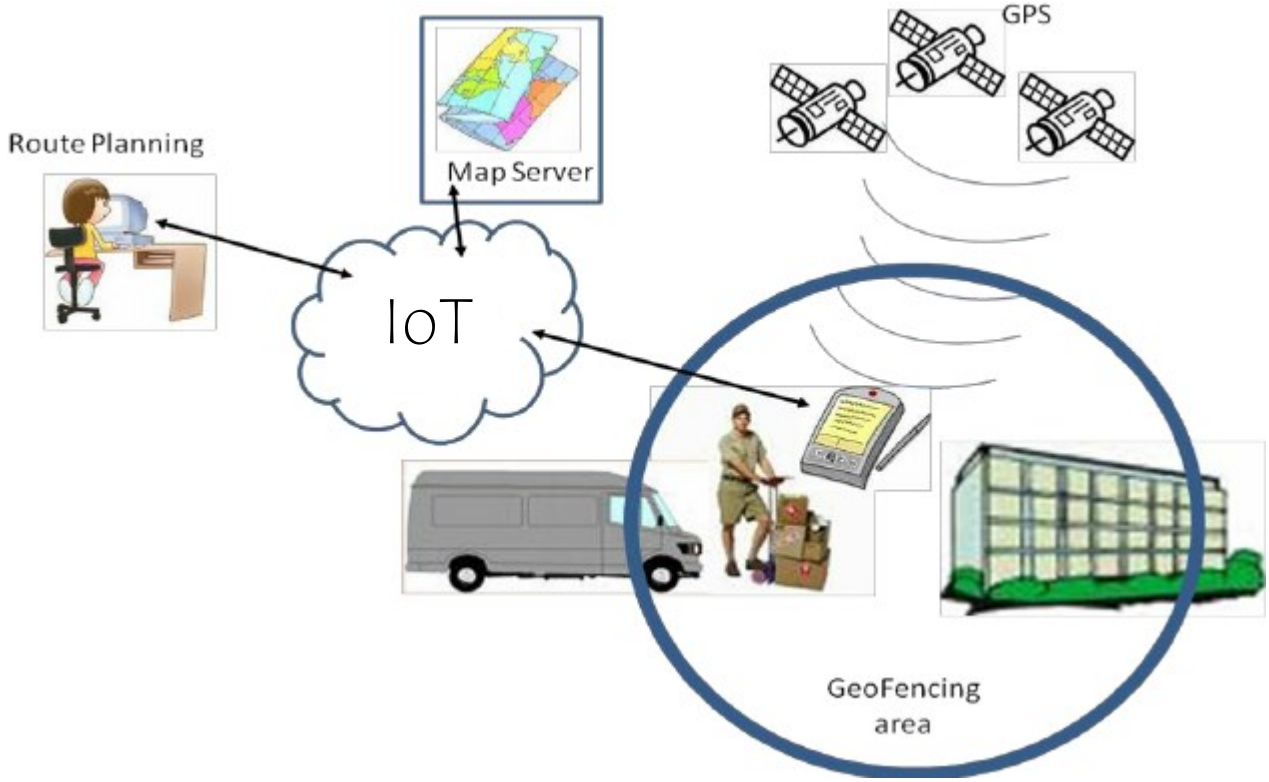
5. PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture

➔ **Solution Architecture**



➔ Technical Architecture

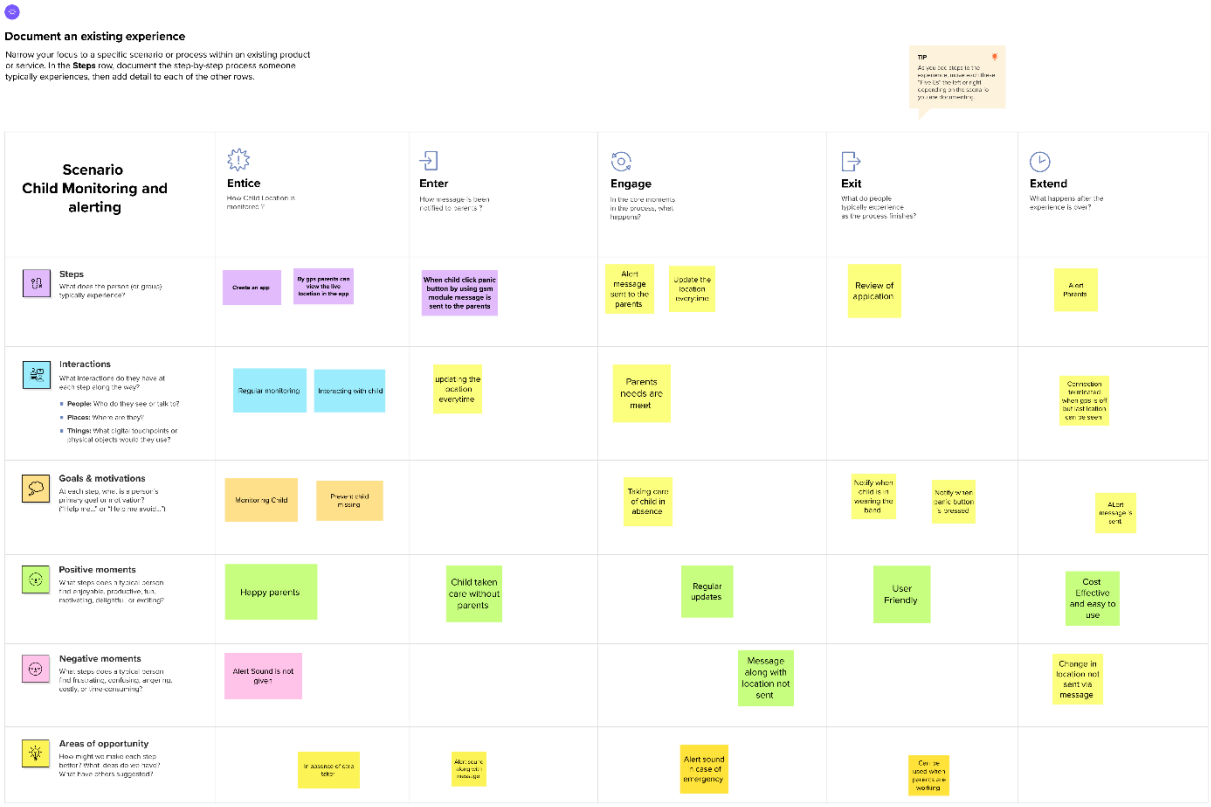
Table-1: Components & Technologies:

S. No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g.Web UI, Mobile App, Chatbot etc.	Java
2.	Application Logic-1	Logic for a process in the application	Java
3.	Database	Data Type, Configurations etc.	Firebase
4.	External API-1	Purpose of External API used in the application	Google Maps API
5.	Notification	Alert Notification when exited the geofence	Firebase Cloud Messaging

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	We are using the Google Maps API , so for every instance of time it updates the current location of the children to their parents/caretakers.
2.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	The technology is used to monitor and send alert notification.
3.	Availability	Justify the availability of applications (e.g. use of load balancers, distributed servers etc.)	We are using the geofence, a service that triggers an action when a device enters a set location
4.	Performance	Design consideration for the performance of the application	We are using Firebase , to send the notification

5.3 User Stories



6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

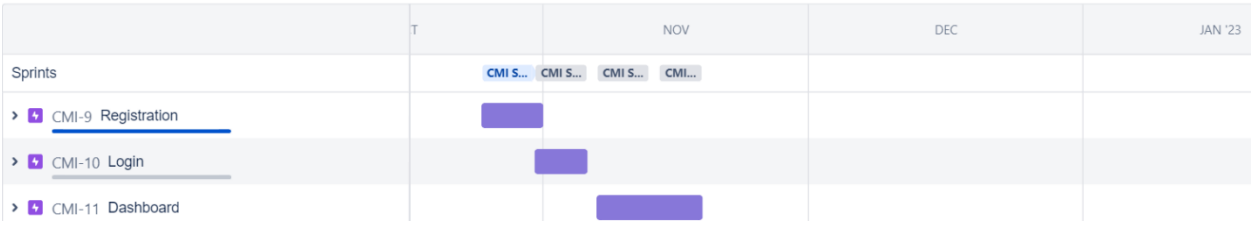
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	3	High	Swetha D
Sprint-1		USN-2	As a user, I will receive verification email once I have registered for the application.	3	High	Shakthi K S
Sprint-1		USN-4	As a user, I can register for the application	3	Medium	SoehaShri S
Sprint-2	Login	USN-3	As a user, I can log into the application by entering email & password	5	High	Shanmugapriya S Shwetha B
Sprint-4	Dashboard	USN-6	As a user, I can receive alert notifications if the movement is beyond the geofence.	13	High	Swetha D Shwetha B
Sprint-3		USN-7	As a user I can add the geofence	10	Medium	Shakthi K S Shanmugapriya S
Sprint-3		USN-8	As a user I can update the geofence whenever necessary.	13	Medium	Soehashri S

6.2 Sprint Delivery Schedule

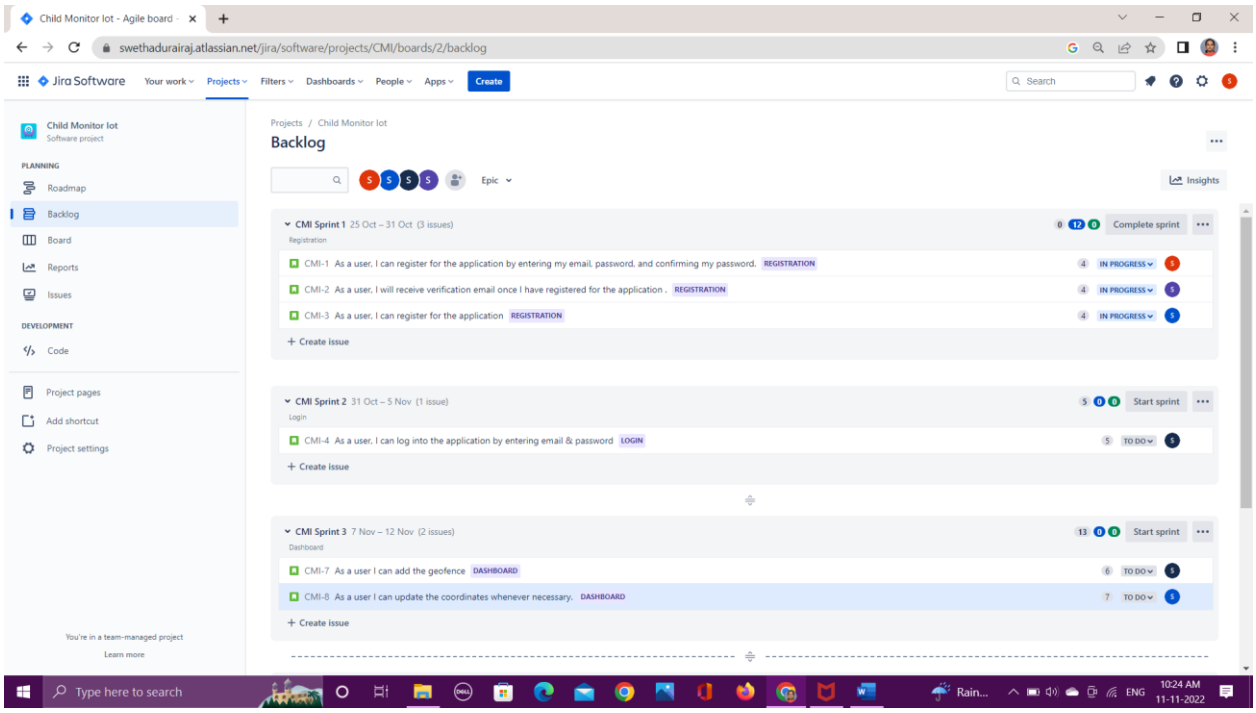
Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	12	6 Days	24 Oct 2022	29 Oct 2022	12	29 Oct 2022
Sprint-2	10	6 Days	31 Oct 2022	05 Nov 2022	10	05 Nov 2022
Sprint-3	13	6 Days	07 Nov 2022	12 Nov 2022	13	12 Nov 2022
Sprint-4	13	6 Days	14 Nov 2022	19 Nov 2022	13	19 Nov 2022

6.3 Reports from JIRA

➔ RoadMap



➔ Backlog



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

7.1 Feature 1(Adding Geofence)

➔ Geofence is like a round wall covering the given location. So parents can use them to mark the location where their children is going .

➔ Multiple Geofence can be added.

```
8. package com.example.geofence;
   import android.app.PendingIntent;
   import android.content.Context;
   import android.content.ContextWrapper;
   import android.content.Intent;
   import android.widget.Toast;

   import com.google.android.gms.common.api.ApiException;
   import com.google.android.gms.location.Geofence;
   import com.google.android.gms.location.GeofenceStatusCodes;
   import com.google.android.gms.location.GeofencingRequest;
   import com.google.android.gms.maps.model.LatLng;

   public class GeofenceHelper extends ContextWrapper {

       private static final String TAG = "GeofenceHelper";
       PendingIntent pendingIntent;

       public GeofenceHelper(Context base) {
           super(base);
       }

       public GeofencingRequest getGeofencingRequest(Geofence geofence) {
           return new GeofencingRequest.Builder()
                   .addGeofence(geofence)
```

```
    .setInitialTrigger(GeofencingRequest.INITIAL_TRIGGER_ENTER)
                    .build();
        }

        public Geofence getGeofence(String ID, LatLng latLng, float radius,
    int transitionTypes) {
            return new Geofence.Builder()
                    .setCircularRegion(latLng.latitude, latLng.longitude,
    radius)
                    .setRequestId(ID)
                    .setTransitionTypes(transitionTypes)
                    .setLoiteringDelay(5000)
                    .setExpirationDuration(Geofence.NEVER_EXPIRE)
                    .build();
        }

        public PendingIntent getPendingIntent() {
            if (pendingIntent != null) {
                return pendingIntent;
            }
            Intent intent = new Intent(this, GeofenceBroadcastReceiver.class);
            pendingIntent = PendingIntent.getBroadcast(this, 2607, intent,
    PendingIntent.FLAG_IMMUTABLE);

            return pendingIntent;
        }

        public String getErrorString(Exception e) {
            if (e instanceof ApiException) {
                ApiException apiException = (ApiException) e;
                switch (apiException.getStatusCode()) {
                    case GeofenceStatusCodes
                            .GEOFENCE_NOT_AVAILABLE:
                        return "GEOFENCE_NOT_AVAILABLE";
                    case GeofenceStatusCodes
                            .GEOFENCE_TOO_MANY_GEOFENCES:
                        return "GEOFENCE_TOO_MANY_GEOFENCES";
                    case GeofenceStatusCodes
                            .GEOFENCE_TOO_MANY_PENDING_INTENTS:
                        return "GEOFENCE_TOO_MANY_PENDING_INTENTS";
                }
            }
            return e.getLocalizedMessage();
        }
    }
```

7.2 Feature 2 (Alert Notification)

- ➔ Once geofence is added , when the child enters the geofence a notification will be sent
- ➔ When the child leaves the geofence a notification will be sent .

```
8   package com.example.geofence;

    import android.content.BroadcastReceiver;
    import android.content.Context;
    import android.content.Intent;
    import android.location.Location;
    import android.os.CountDownTimer;
```

```
import android.util.Log;
import android.widget.Toast;

import com.google.android.gms.location.Geofence;
import com.google.android.gms.location.GeofencingEvent;

import java.util.List;
import android.os.Handler;


public class GeofenceBroadcastReceiver extends BroadcastReceiver {

    private static final String TAG = "GeofenceBroadcastReceiv";

    @Override
    public void onReceive(Context context, Intent intent) {
        // TODO: This method is called when the BroadcastReceiver is
receiving
        // an Intent broadcast
        //.
     /*Toast.makeText(context, "GEOFENCE_ENTERED",
Toast.LENGTH_SHORT).show();

        final Toast mToastToShow;
        int toastDurationInMilliSeconds = 1200000;
        mToastToShow = Toast.makeText(context, "GEOFENCE_EXITED",
Toast.LENGTH_LONG);


        // Set the countdown to display the toast
        CountDownTimer toastCountDown;
        toastCountDown = new CountDownTimer(toastDurationInMilliSeconds,
100000) {
            public void onTick(long millisUntilFinished) {
                mToastToShow.show();
            }

            public void onFinish() {
                mToastToShow.cancel();
            }
        };

        // Show the toast and starts the countdown
        mToastToShow.show();
        toastCountDown.start();*/


    NotificationHelper notificationHelper = new
NotificationHelper(context);

notificationHelper.sendHighPriorityNotification("GEOFENCE_TRANSITION_ENTER
", "", MapsActivity.class);

     GeofencingEvent geofencingEvent = GeofencingEvent.fromIntent(intent);

       if (geofencingEvent.hasError()) {
            Log.d(TAG, "onReceive: Error receiving geofence event...");
```

```
            return;
        }

        List<Geofence> geofenceList =
geofencingEvent.getTriggeringGeofences();
        for (Geofence geofence: geofenceList) {
            Log.d(TAG, "onReceive: " + geofence.getRequestId());
        }
//        Location location = geofencingEvent.getTriggeringLocation();
        int transitionType = geofencingEvent.getGeofenceTransition();

        switch (transitionType) {
            case Geofence.GEOFENCE_TRANSITION_ENTER:

                notificationHelper.sendHighPriorityNotification("Entered
the Location", "", MapsActivity.class);
                break;

            case Geofence.GEOFENCE_TRANSITION_EXIT:

                notificationHelper.sendHighPriorityNotification("Exited
the Location ", "", MapsActivity.class);
                break;
        }

    }
}
```

8. TESTING

8.1 Test Cases

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
LoginPage_TC_001	Functional	Home Page	Verify user is able to see the Login/Signup popup when user clicked on App		1.Enter App 3.Verify login/Singup popup displayed or not		Login/Signup popup should display	Working as expected	Pass		Y		SnehaShri , Swetha
LoginPage_TC_002	UI	Home Page	Verify the UI elements in Login/Signup popup		1.Enter App 2.Verify login/Singup popup with below UI elements: a.email text box b.password text box c.Login button d.New customer? Register		Application should show below UI elements: a.email text box b.password text box c.Login button with orange colour d.New customer? Register	Working as expected	Pass		Y		Shanmugapriya , Shwetha
LoginPage_TC_003	Functional	Home page	Verify user is able to log into application with Valid credentials		1.Enter App 2..Enter Valid username/email in Email text box 3.Enter valid password in password text box 4..Click on login button	Username: abcd@gmail.com password: Testing123	User should navigate to user account homepage	Working as expected	Pass		Y		Shakthi
LoginPage_TC_004	Functional	Login page	Verify user is able to log into application with InValid credentials		1.Enter App 2..Enter InValid username/email in Email text box 3.Enter valid password in password text box 4..Click on login button	Username: abcd@gmail password: Testing123	Application should show "Login error. There is no user record corresponding to the identifier"	Working as expected	pass		Y		Shakthi , Shanmugapriya
LoginPage_TC_004	Functional	Login page	Verify user is able to log into application with Valid credentials		1.Enter App 2..Enter Valid username/email in Email text box 3.Enter Invalid password in password text box 4..Click on login button	Username: sec19sc020@sairamtap.edu.in password: Testing123678686786876876	Application should show "the Password is invalid "	Working as expected	Pass		Y		Shwetha B, SnehaShri
LoginPage_TC_005	Functional	Login page	Verify user is able to log into application with InValid credentials		1.Enter App 2..Enter InValid username/email in Email text box 3.Enter Invalid password in password text box 4..Click on login button	Username: abcd password: Testing123678686786876876	Application should show "Login error. There is no user record corresponding to the identifier"	Working as expected	Pass		Y		Swetha
Dashboard	Funcational	Dashboard	Adding geofecne in the location need		1.Enter App 2.Enter the valid username and password		Application show a red circle around the location	Working as expected	Pass		Y		Sneha Shri
Alert Notification	Funcational	Notification	Notification when the user entered the geofence		1.Enter App 2.Enter the valid username and password 3.Add the Geofence		Application sent the notifcation " Entered the location"	Working as expected	Pass		Y		Shanmugapriya , Shwetha
Alert Notification	Funcational	Notification	Notification when the user exited the geofence		1.Enter App 2.Enter the valid username and password		Application sent the notifcation " Exited the location"	Working as expected	Pass		Y		Shakthi , Swetha

8.2 User Acceptance Testing

1. Defect Analysis

Resolution	Severity1	Severity2	Severity3	Severity4	Subtotal
By Design	11	4	2	2	19
Duplicate	1	1	2	0	4
External	2	3	0	1	6
Fixed	10	2	3	20	35
Not Reproduced	0	0	2	0	2
Skipped	0	0	2	1	3
Won't Fix	0	5	2	1	8
Totals	24	15	13	25	77

2. ***Test Case Analysis***

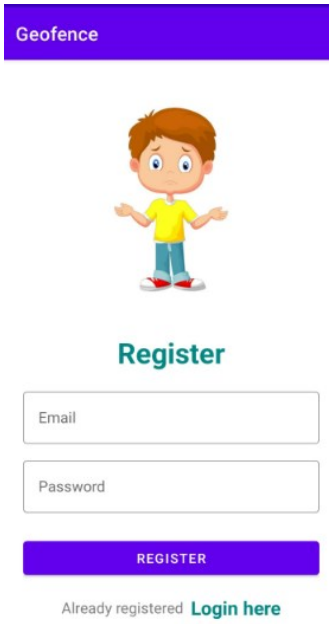
Section	Total Cases	Not Tested	Fail	Pass
Print Engine	5	0	1	4
Client Application	47	0	2	45
Security	3	0	0	3
Outsource Shipping	2	0	0	2
Exception Reporting	11	0	2	9
Final Report Output	5	0	0	5
Version Control	3	0	1	2

9 RESULTS

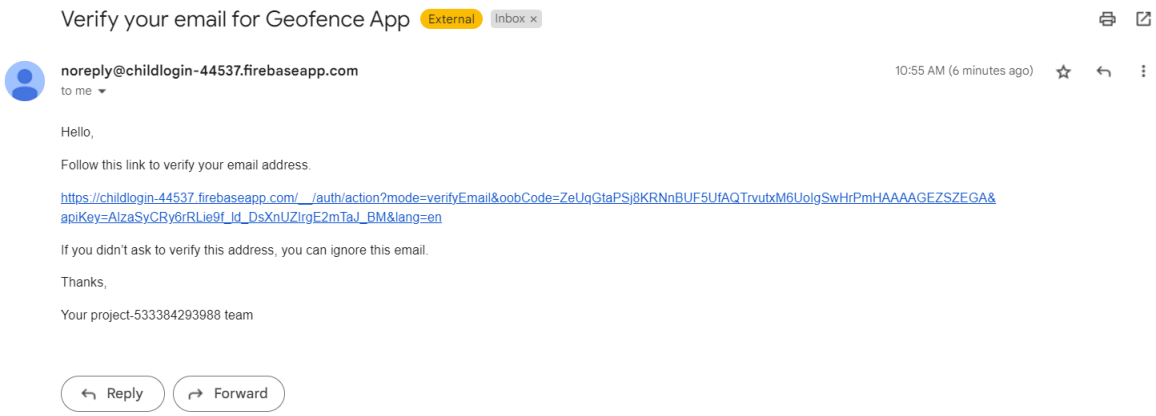
1. User Registration :

User gets registered to the app using their mail and create their password. On the user is registered a verification mail will be sent to the user mail id. The user needs to verify the account. All user details are stored in the firebase and verification mail is sent by firebase authentication .

Registration Page :



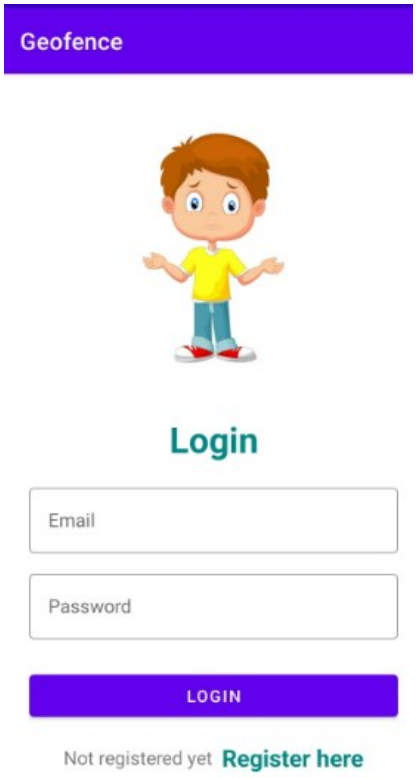
Verification mail



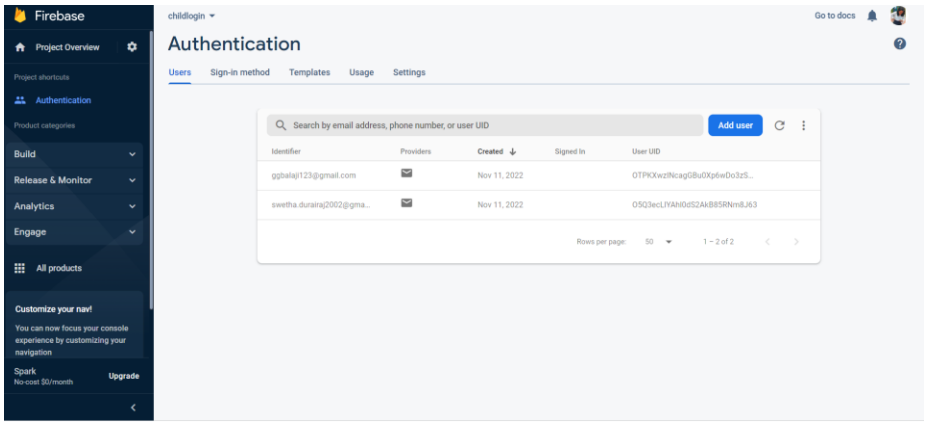
2. **User Login**

User with their registered mail and password will login to the account . As the details are stored in firebase, when invalid mail or password is entered a message say invalid mail or password occur

Login page :



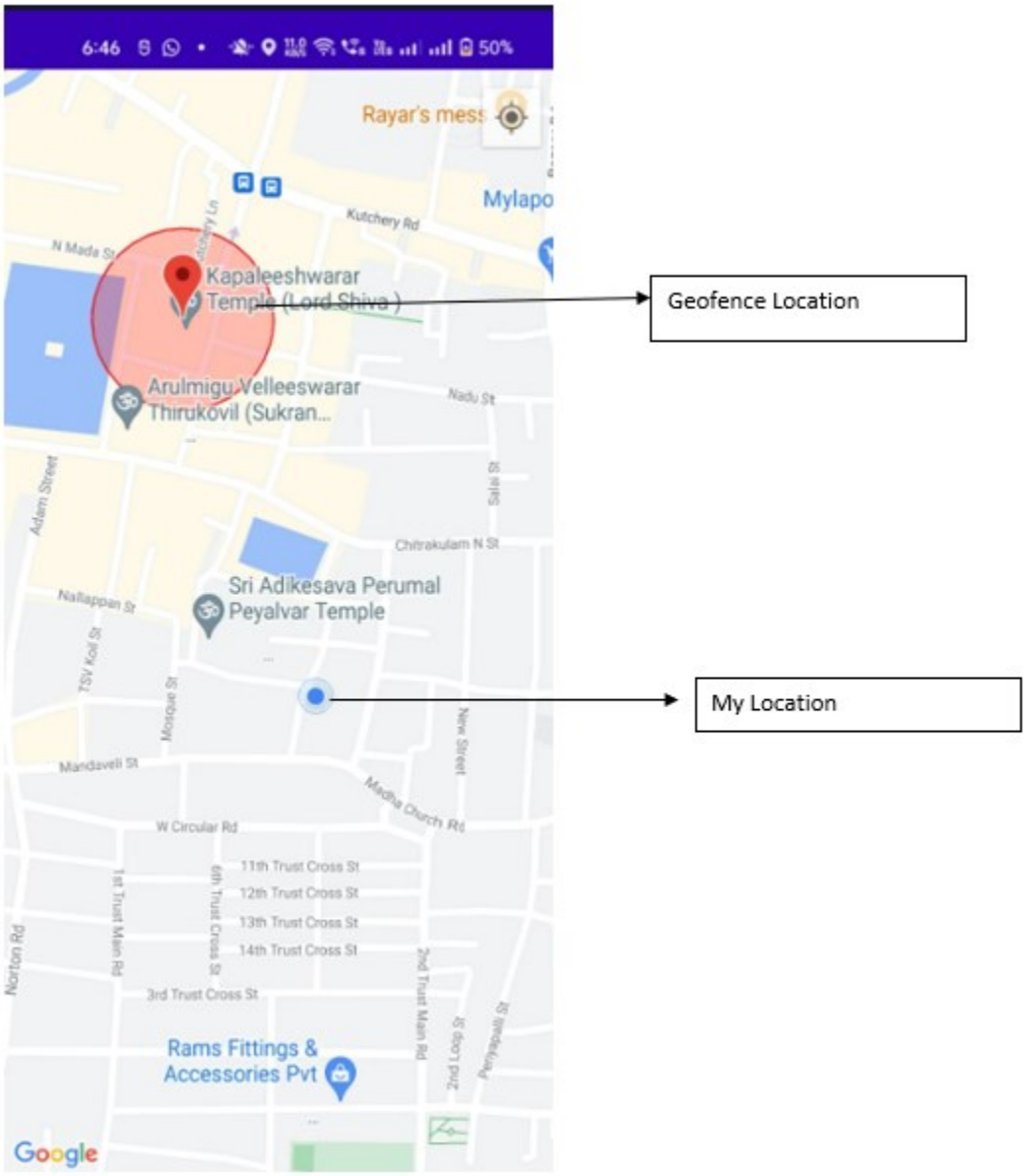
User Details



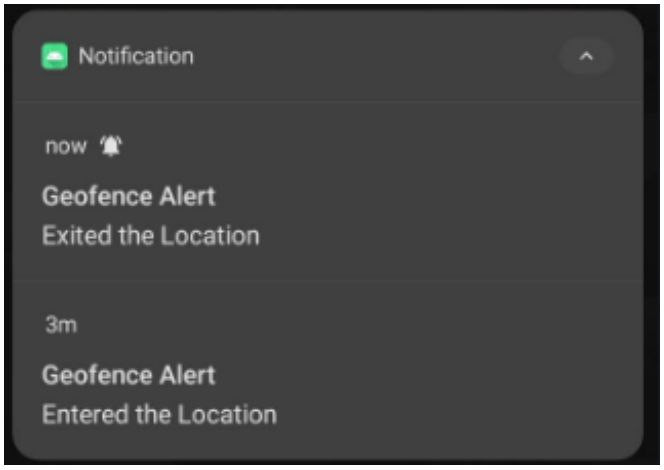
3. Adding Geofence and Alert Notification

User can add geofence in the location where they want to add or where their child is going play so they can monitor the child location . Once the child enter the geofence alert notification says entered the location will be displayed . When the child leaves the geofence alert notification says exited the location will displayed.

Geofence



Notification



10 ADVANTAGES & DISADVANTAGES

ADVANTAGES:

- ✓ Simple and easy to use
- ✓ Parents can feel secure because if the child leave the desired location and immediately a notification will be sent
- ✓ Geofence can be added easily

DISADVANTAGES:

- ✓ Multiple geofence can be a problem

11 CONCLUSION

This research demonstrates Smart IoT device for child safety and tracking, to help the parents to locate and monitor their children. Through this device, the parent can track and monitor their child with just a simple app. It is not possible to always stay beside children as most of the parents need to go for work. With this project, parents can track the location of their children and get alerts whenever the child out of the geofence. It becomes easy for parents to look after their child while working. This device is efficient to use. 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.

12 FUTURE SCOPE

The future work would be to further develop and implement the safety wearable device so that it could be watch or sown into a fabric that could be worn, using synthetic fibers.

13 APPENDIX

Source Code

https://github.com/SWETHA-DURAIRAJ/childapp

GitHub

https://github.com/IBM-EPBL/IBM-Project-27349-1660054403

Project Demo Link

https://youtu.be/GqJgny8PW64