IOT BASED SAFETY GADGET FOR CHILD SAFETY MONITORING & NOTIFICATION

PROJECT REPORT

Submitted by

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1.INTRODUCTION

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 using a smart gadget. Internet of things (IOT) refers to networked interconnection of objects featured with Immense intelligence. In IOT, objects are connected via internet for communication and interaction and also for exchanging the data and also for making decisions automatically correct at anywhere and anytime. IOT is a revolution in advancing technology causing transformation in IT, human's lifestyle, and also in businesses processes. The advancements of IOT make it possible to be used in organizations for automating and monitoring business processes .In term of society, IOT can be used for simplifying daily tasks, creating smart homes, smart cities, devices or application which improves the quality of life. However, security and privacy are the main challenges of IOT which need to be solved as it gathers much personal data capable of revealing sensitive information.

1.1 Project Overview

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 using a smart gadget. 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 geo-fence around the particular location. By continuously checking the child's location notifications will be generated if the child crosses the geo-fence. Notifications will be sent according to the child's location to their parents or caretakers. The entire location data will be stored in database.

1.2 Purpose

This IOT based child safety gadget for child safety monitoring and notification project makes parents to easily monitor their children in real time just like staying beside them as well as focusing on their own career without any manual intervention. And also it refers to protecting children from or any perceived or real danger/risk. It helps to reduce their vulnerability in harmful situations. It also means protecting children against social, psychological and emotional insecurity and distress. Basically, children cannot complain about abusement which they face in their daily life to their parents.

2.LITERATURE SURVEY

2.1 EXISTING PROBLEM

Safety for children has been on the rise at an unprecedented rate in recent years, with victims finding themselves in situations with little chances of contacting their families. This project is mainly streamed towards a child safety solution by developing a gadget which can be tracked by its GPS location and also a panic button on the gadget is provided to alert the parent via GSM module calling for help.

To Track the device anytime a parental android app is developed. Smart gadget is always connected to the parental device and this device can receive and make phone calls and also receive SMS on gadget via GSM module and also a wireless technology is implemented on the device which is useful to bind the device within a region of monitoring range

2.2 REFERENCES

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 smart phone is required and doesn't want to be very tech savvy individual to operate.

Demerits: As, this device's battery gives short life-time. High power efficient model will have to be used which can be capable of giving the battery life for a longer 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 Googlemaps, GPS, SMS etc.

Demerits: This system is unable to sense human behavior 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 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.
- 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
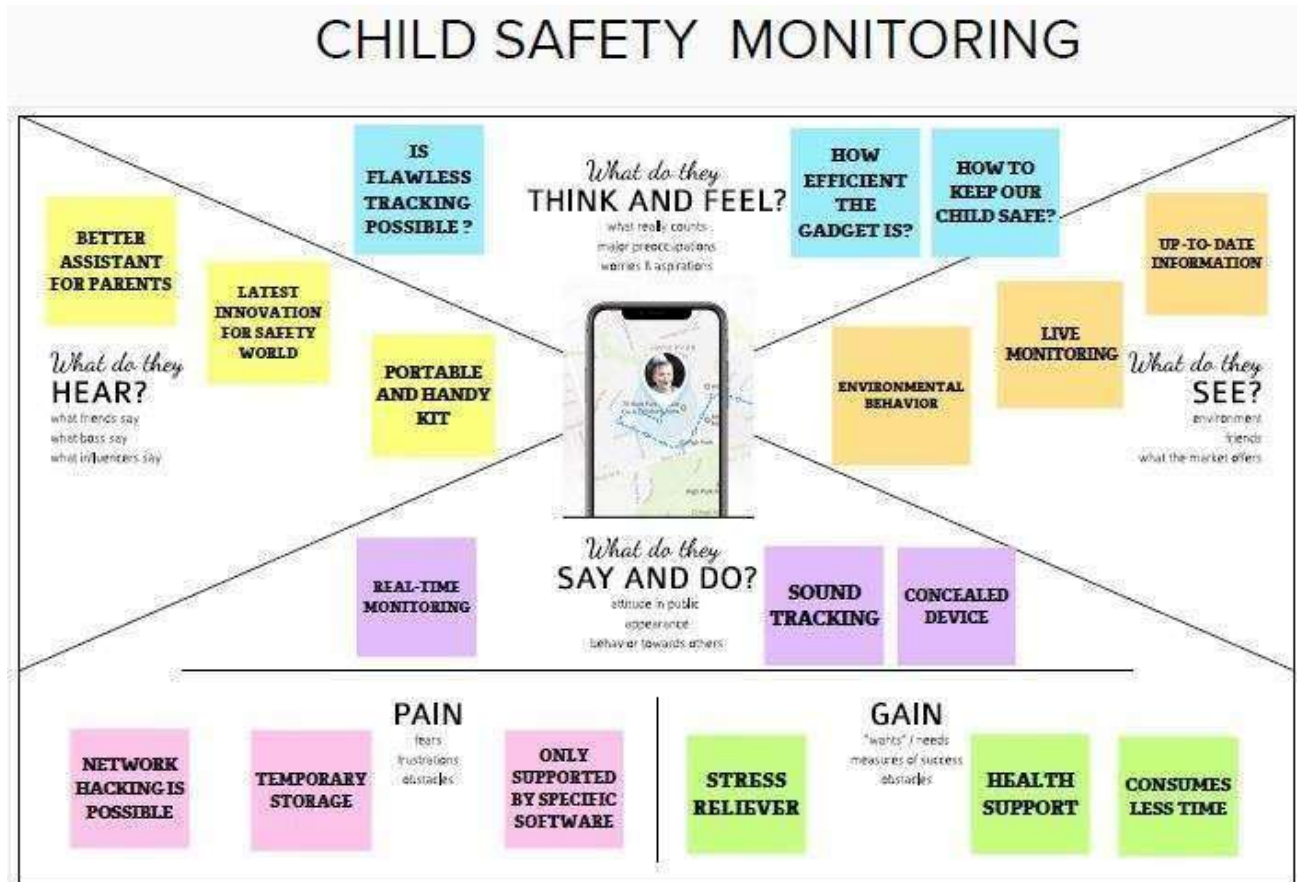
5

2.3 PROBLEM STATEMENT

The world is becoming unsafe today. Lots of reasons are prevailing for a child to go missing. So, the responsibility for the number of parents taking care of their children has increased. This can be overcome by taking the aid of technology. The device should contain these capabilities.

- Creating a user-friendly device especially designed for children.
- Alerting parents in case of emergency.
- Geo fencing functionalities.
- Cost effective device.
- Mobile application that can control and monitor the device.
- Feature for adding guardians for the safety of their children.
- Parental controls for the app.
- Durability.
- Simple User interface with powerful functionality.

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Mother	Protect my child	Struggling between work and caring child	As working women I can't spent my whole time for caring child	Stressed
PS-2	Single parent	Protect my child	Difficult to protect my child	As a single parent its feel very difficult to manage my work and care my child	Depressed

3.IDEATION AND PROPOSED SOLUTION

3.1 Empathy map canvas

3.2 Ideation and brainstorming

Brainstorm:

G. THARUNYA

- Implement Child tracking mechanism
- Create a geo fence
- Develop ability of child to alert the parent
- Develop ability for parents to know if child crossed the geo fence

S. DHARANI

- Store and display the location history of child
- Create Faster and efficient application
- Develop the ability to know weather conditions of child location
- Buy Best fitted-low cost hardwares

M.RAMYA

- Make the product water proof
- Create a long lasting product
- Make the product rechargable
- See the child surrounding location via camera
- Develop web application using node - red

A.S SELVASUDHA

- Make product highly robust
- Develop ability of child to communicate with its parent
- Beeping sound if crossed geo location
- Develop the ability of parent to communicate with child

3.3 Proposed solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	To prevent children for abuse and make them safe
2.	Idea / Solution description	compact wearable gadget with pressure button which can the parents can find the hacker easier
3.	Novelty / Uniqueness	Pressure button with GSM
4.	Social Impact / Customer Satisfaction	It is useful to working parents when they are leaving children
5.	Business Model (Revenue Model)	wearable gadget
6.	Scalability of the Solution	compact and easy to use

3.4 Problem solution fit

Define CS, fit into CC	**CUSTOMER SEGMENTS** CS This helps the parents to track the daily activity of children and helps to find the child using GPS location.	**CUSTOMER LIMITATION** CC It is fully about safety and secured electronic system for child . Less tension to Parents.	**AVAILABLE SOLUTION** AS In Previous method, the model created which can be capable of handling the battery for long time. Nowadays, the system proposes a location tracking facilities and speeding monitoring using GPS, GSM with IOT technology for child safety at low cost which can be affordable by the people. **Explore AS**
Understand RC	**PROBLEMS/PAINS** PR The child safety is a complex far reaching health priority, which requires holistics ways of identifying safety issues.	**PROBLEM ROOT/CAUSE** RC It fears frustration obstacles and understanding the working of the system. Due to this solution, the kidnapping rate will be decreased.	**BEHAVIOUR** BE It mainly focus on improving parent-child interactions, home safety and child health care as well as monitoring. **Understand RC**
Identify strong TR & EM	**TRIGGERS TO ACT** TR The parents are working with new and various technology. So, they should monitor their child's activity daily. **EMOTIONS** EM Due to this, the emotional and mental stability of the children gets affected which in turn ruins their career and future.	**YOUR SOLUTION** SL The parents can monitor their child each and every second. If the child is in danger, they notified by SMS through their device and their parents can save them.	**CHANNELS OF BEHAVIOUR** CH Children and their parents are turning to digital solutions more than ever to support children's learning. While digital solutions provide huge opportunities for sustaining and promoting children's right **Extract online & offline CH of BE**

4. REQUIREMENT ANALYSIS

4.1 Functional requirements

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
FR-5	Health monitoring	Heart beat rate , Temperature

4.2 Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	This model has GSM that can help to notify the parents in case of emergency or the smart band not connected
NFR-2	**Security**	Parents can feel secure because if the child forget or not connect the band it

		will notify the parents and if panic Button is pressed it will send alert message and parents able to track the location
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
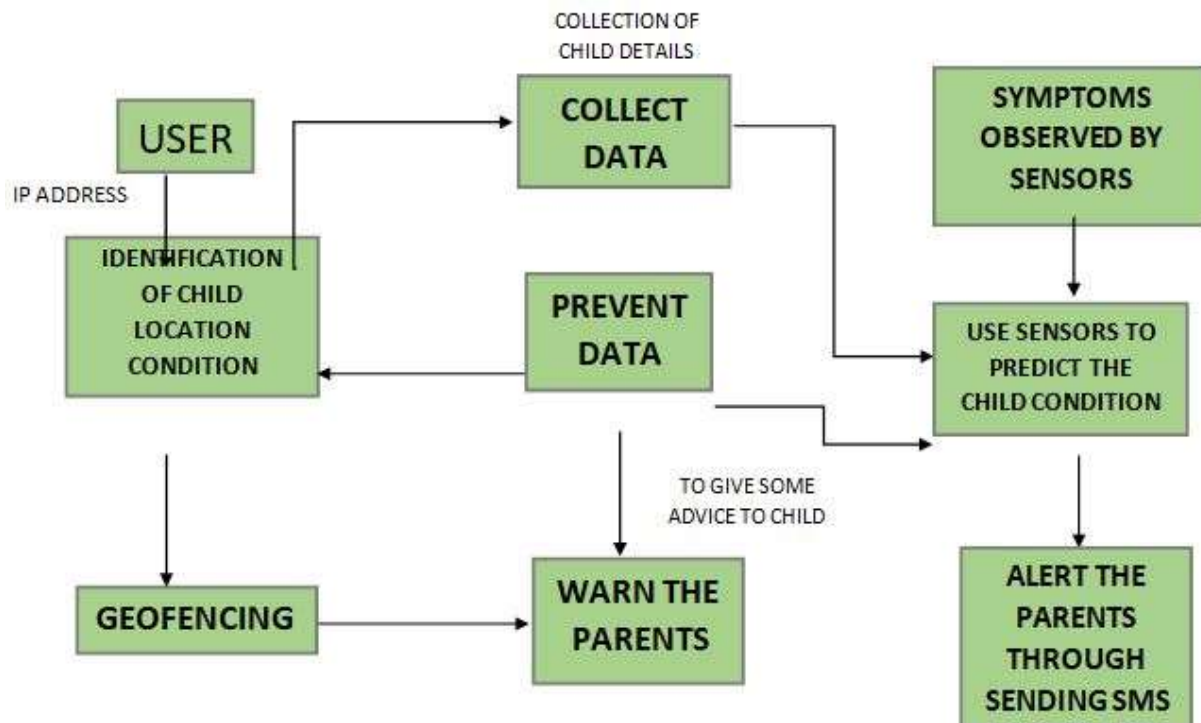
5.2 Solution & Technical Architecture

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

- Find the test tech solution to solve existing business problems.

- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.

Technology Architecture
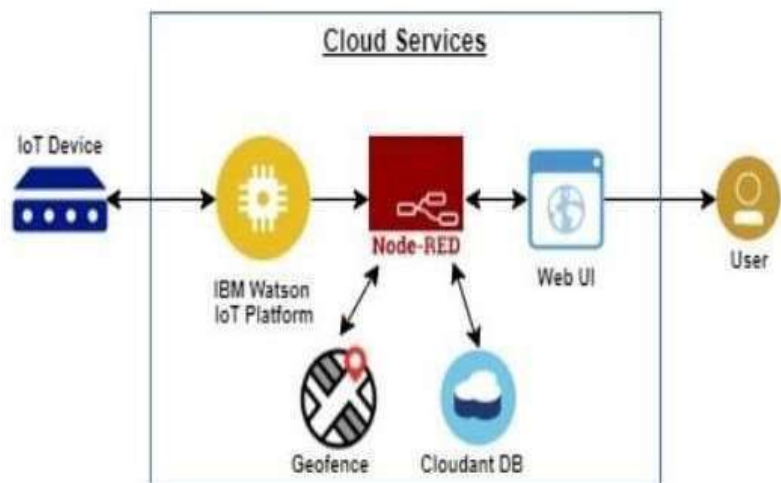
5.2 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration -	USN-1 (FATHER)	As a user, I can register by entering my email, and password , and Confirming my password. I can access the location of the	I can access my account/ Dashboard and receive a confirmation mail and confirm	High	Sprint-1

			children using the credentials provided as Father.			
		USN-2 (MOTHER)	As a user, I can register by entering my email, and password, and confirming my password. I can access the location of my children using the credentials provided as Mother.	I can access my account/dashboard and receive a confirmation email & click confirm	High	Sprint-1

		USN-3 (GUARDIAN /CARETAKER)	As a user, I can monitor the children's activities Using a safety gadget monitoring system.	I can access my account/dashboard and receive confirmation email & click confirm	Medium	Sprint-1
	Login	USN-4	As a user, I can log into the application by entering my email & password.	I can access my account/dashboard.	Medium	Sprint-2
	Dashboard	USN-5	As a user, I can fix the geofence for my child's location so	I can monitor current location of my child.	High	Sprint-2

			that I will receive alerts if my child crosses the geo-fence and monitor the child's pulse and check whether the device Is plugged in or not.			

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint planning and estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration (Parent Mobile User)	USN-1	Registering for an application, as a user we can register by entering our email, password and again, we need to confirm the password	3	High	Tharunya.G
Sprint-1	Login	USN-2	If we have register for the application as a user a confirmation mail will be received to our mail	3	High	Dharani S
Sprint-2	User Interface	USN-3	Using facebook,we can register for this application	3	Low	Ramya.M
Sprint-1	Data Visualization	USN-4	We can also register for the application through Gmail	3	Medium	Selva sudha.A.S
Sprint-3	Login	USN-5	As a user, I can log into the applicationby entering email	3	Low	Tharunya G

Sprint-1	Dashboard	USN-5	We need to be ableto view thefunction that can perform	4	High	Dharani S
Sprint-2	Notification	USN-1	Using minimumtime, we should be able to notify their parentand guardian	4	High	Ramya.M
Sprint-1	Store data	USN-2	We need to continuously store location data into the database	3	Medium	Selva sudha.A. S
Sprint-4	Web UI	USN-3	We all will need a friendly interface to view and access the resource easily	3	Medium	Tharunya G
Sprint-3	Registration (Parent Web User)	USN-1	By entering emailand password we can log into the application as auser	3	High	Dharani S
Sprint-2	Login	USN-2	Using minimumtime, we need to login to registered account via web page	3	High	Ramya.M
Sprint-4	Web UI	USN-3	To easily view andaccess the resources we need a user-friendly interface application	3	Medium	Selva sudha.A. S

6.2 SPRINT DELIVERY PLAN

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

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$ AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2 $$

Burndown Chart:

A burn down chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies suchas Scrum.However, burn down charts can be applied to any project containing measurable progress over time.

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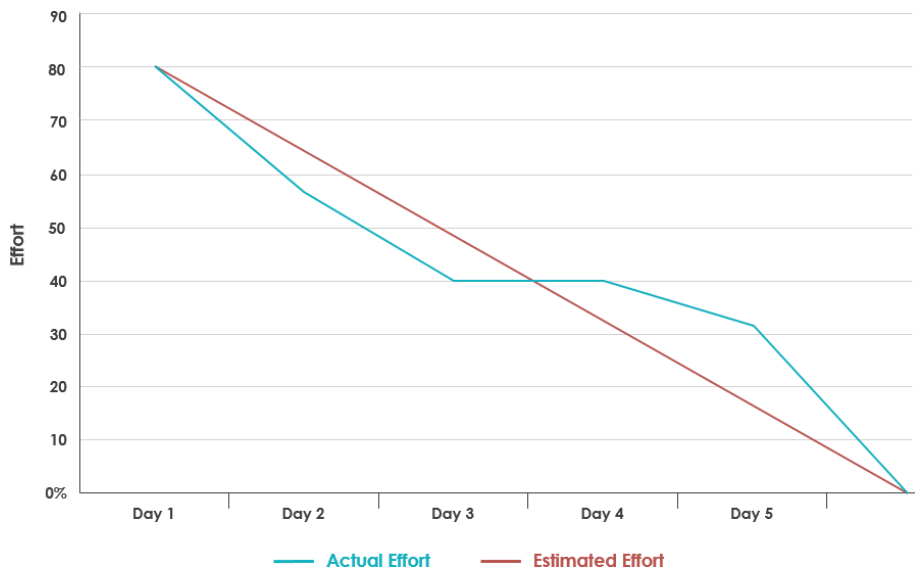
7.CODING & SOLUTIONING
(Explain the features added in the project along with code)

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 are going.

- Multiple Geofence can be added

CODING:

```
        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 {
```

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

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

public GeofencingRequest getGeofencingRequest
(Geofencegeofence) { 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) {
```

```java
        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";
       }
    }
```

7.2 Feature 2
(Alert Notification)

- Once geofence is added , when the child enters the geofence a notification willbe sent

- When the child leaves the geofence a notification will be sent .

```
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
```

```java
        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_ENT ER",
        "",   MapsActivity.class);   GeofencingEvent

        geofencingEvent =
```

```java
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_
ENT
notificationHelper.sendHighPriorityNotification

        ("Entered    the    Location",    "",
MapsActivity.class);
```

```java
                break;

        case    Geofence.GEOFENCE_TRANSITION_EXIT:

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

                break;
    }
  }
  }
```

8.TESTING

8.1 Test Cases

I. **Test case for checking the functionality of the Child Safety Monitoring & Notification project:**

The test case should check the various functionalities of the project such as monitoring the child's location, sending notifications to the parents in case of any unusual activity, etc.

II. **Test case for checking the accuracy of the monitoring:**

The test case should check the accuracy of the monitoring system in terms ofdetecting the child's location and sending notifications to the parents.

- Verify python code is run without error.

- Verify the login the cloud service

- Verify, create a device in the IBM Watson IoT platform and get the device credentials.

- Verify the events are shown in the card.

- Verify the events is stored in the database,

- Verify to create a node-red service.

- To create a web UI to interact with users.

- To send SMS to the particular child's guardian.

- Verified users are able to log into the app with valid credentials.

- Verify it show the location in app

8.2User Acceptance Testing
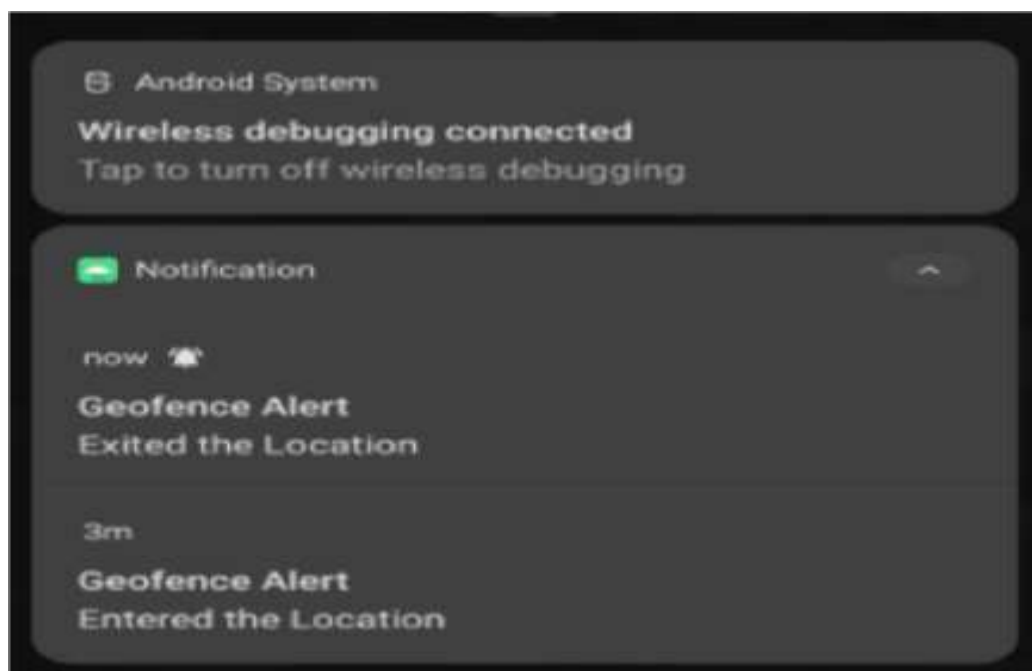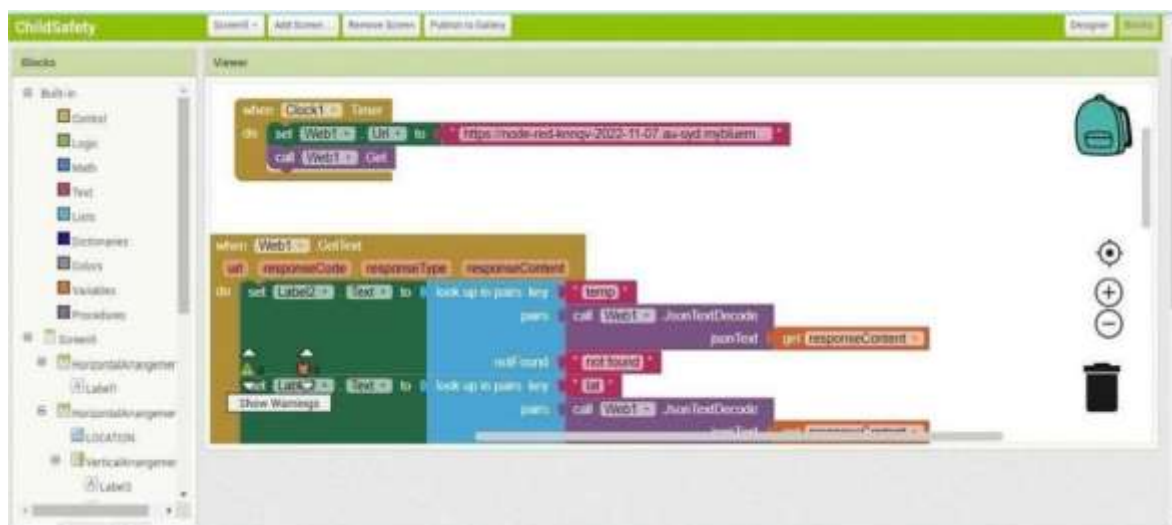
Count	Inputs	Outputs	Results
1	Latitude:17.4219272 Longitude:78.5488783	Parents can view the child's location in the application.	Normal condition
2	Latitude: 17.5442272 Longitude:78.7687831	Parents can view the child's location in the application.	Normal condition
3	Latitude:30.4219272 Longitude:108.5488783	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

9. RESULTS

PERFORMANCE METRICS

It is being used as it allows the correct sample of respondents to be selected due to which becomes convenient to obtain results. Besides, the results offered are affordable and usable. Since the respondents are properly chosen, the results tendto be more accurate, precise and reliable

User Registration:

Users get 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.

1. **Registration Page:**

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2. Verification mail
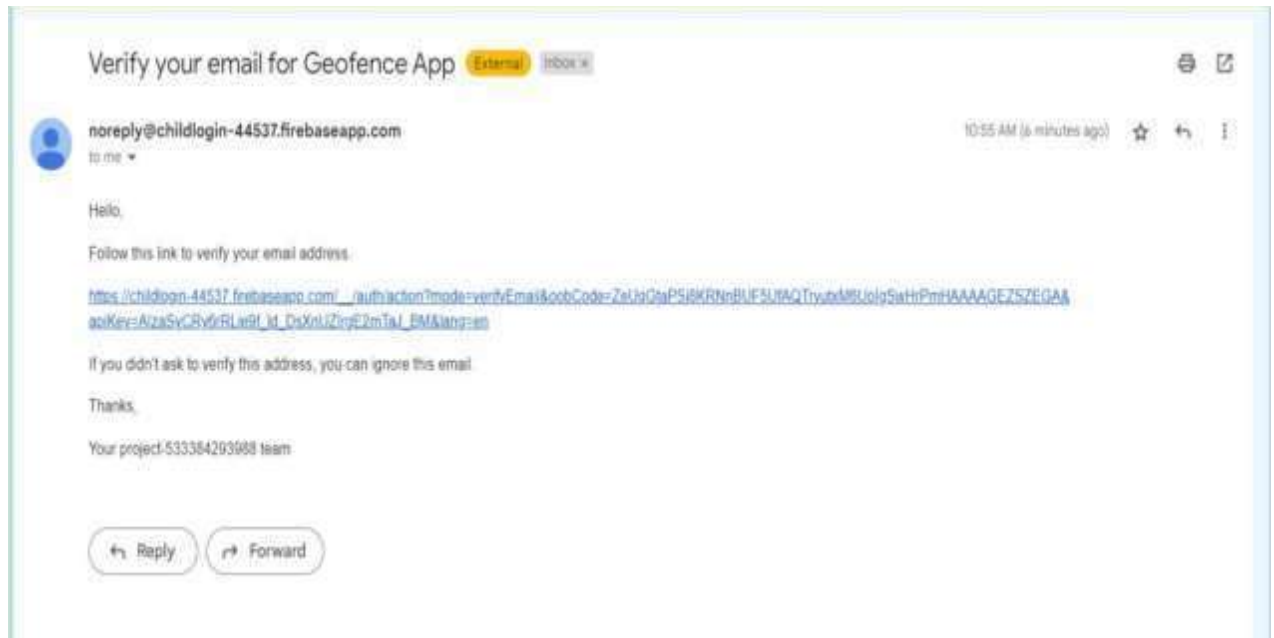
1. User Login
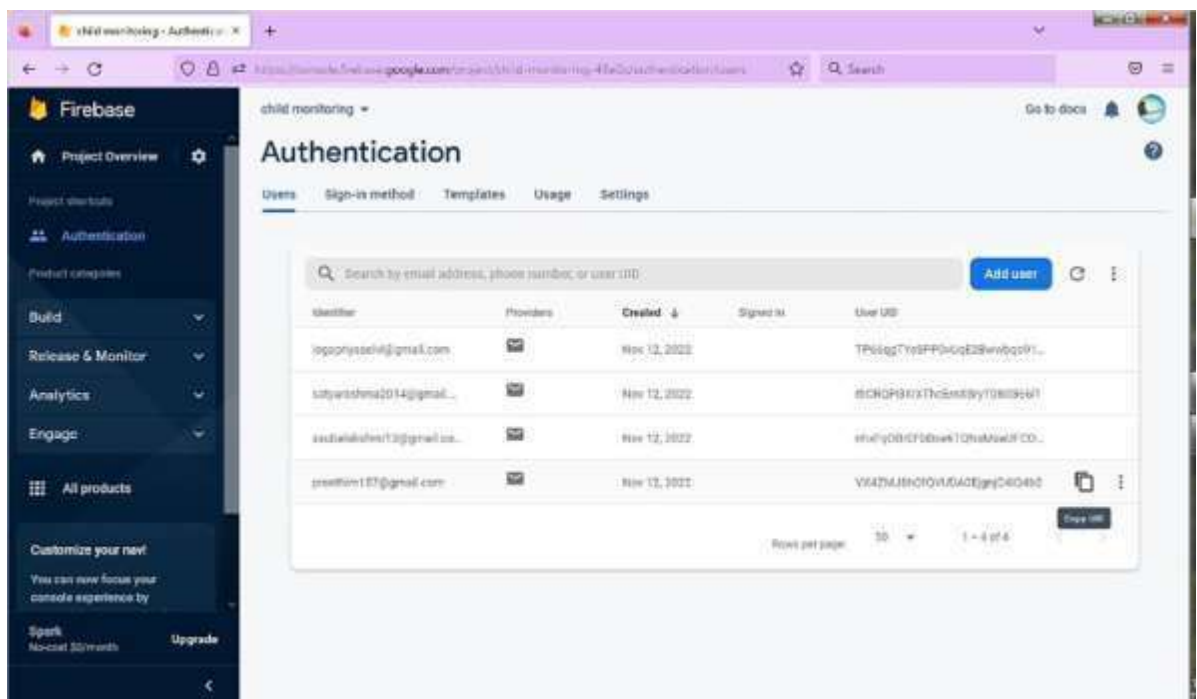
Users with their registered mail and password will login to the account . As the details are stored in firebase, when invalid email or password is entered a message say invalid email or password occurs.

2. Login page:

User Details

1. **Adding Geofence and Alert Notification**

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

Geofence
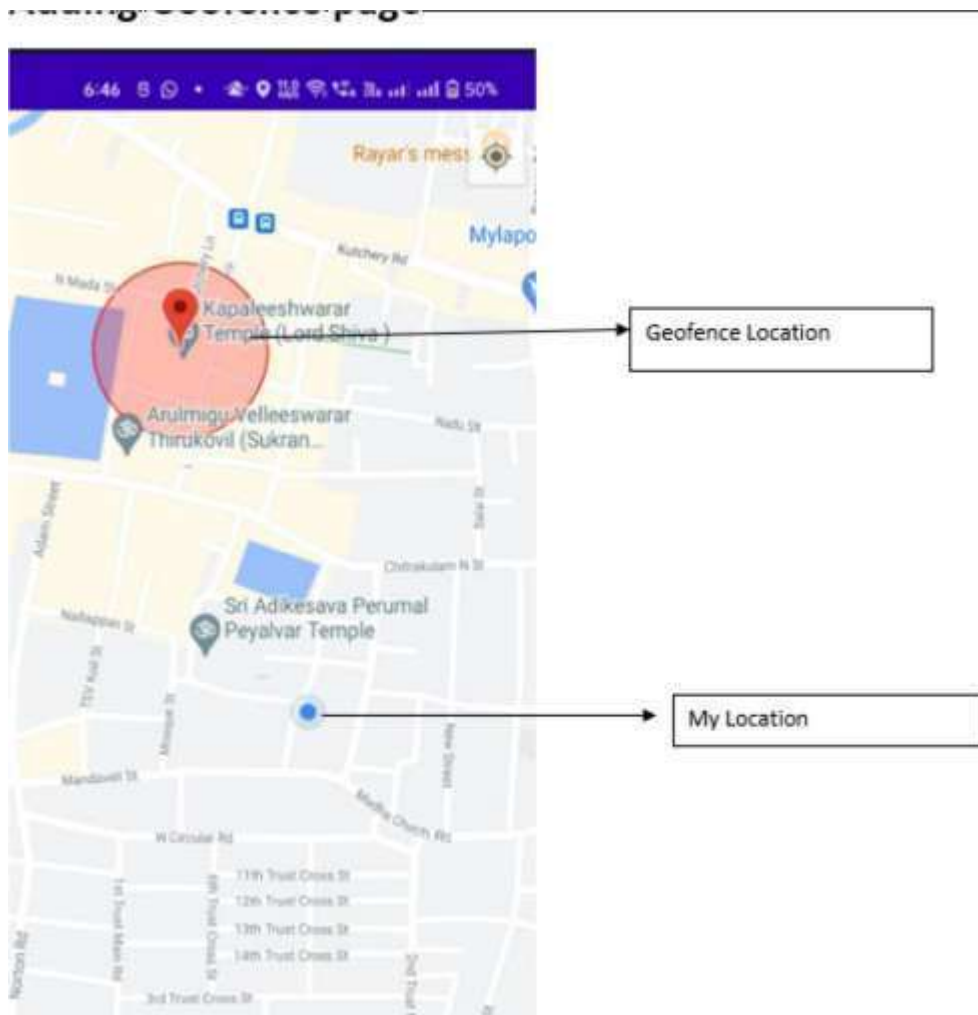
Notification
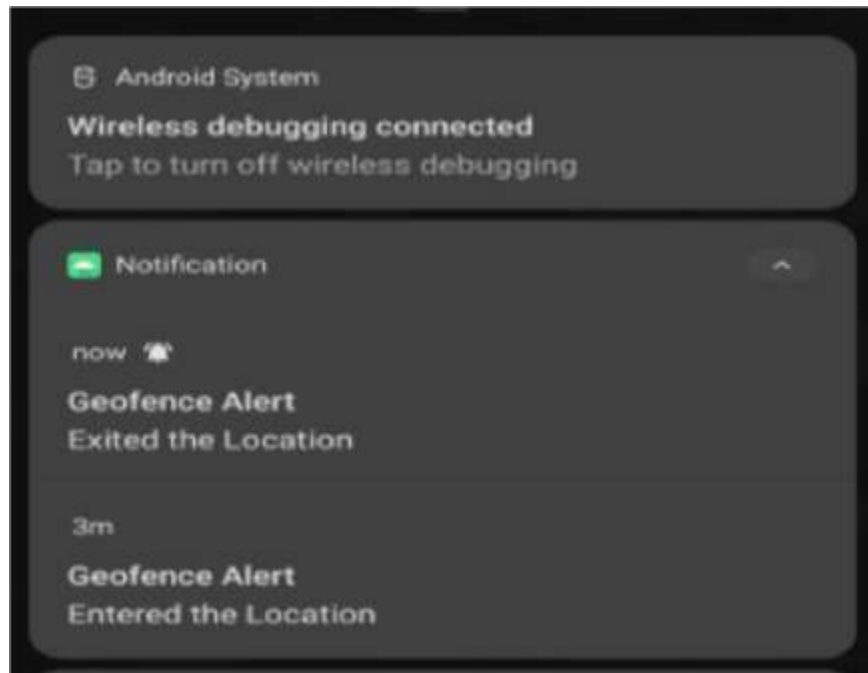
10.ADVANTAGES AND DISADVANTAGES

MERITS:

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

DEMERITS:

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.

10.CONCLUSION

Throughout the research, it is clearly explained the IoT concept, child safety issues and the need of using child security system. Some previous studies have been included for designing the IoT-based child security smart band. It assists parents to monitor their children remotely. In case situations happen, notifications will be sent to parents so that actions can be taken. Through this, child safety can be ensured and crime rate will be reduced. However, the proposed device is not robust enough and does not contain sufficient functions to operates like a mobile phone. Hence, the future enchantments will be adding more features, software, applications, hardware to make the proposed system capable of working more intelligently, meanwhile guarantee the safety of children

13.FUTURE SCOPE

The future scope of the work is to implement the IoT device which ensures the complete solution for child safety problems. This system can be further enhanced by installation of mini- camera inside smart gadget for better security so that live footage can be seen on parental phone during panic situations. The system can be modified by installation of small solar panels for charging the battery of smart gadget to gain maximum battery backup.

13 .APPENDIX

Source code

Source code link:
https://github.com/IBM-EPBL/IBM-Project-22042-1659801817

GitHub link:
https://github.com/IBM-EPBL/IBM-Project-22042-1659801817

Demo link:
https://vimeo.com/772691938