IoT BASED SAFETY GADGET FOR CHILD SAFETY MONITORING & NOTIFICATION

IBM NAALAIYA THIRAN
(TEAM ID:PNT2022TMID37442)

A PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report **"IOT BASED SAFETY GADGET FOR CHILD SAFETY MONITORING & NOTIFICATION"** is the bonafide work of **AHAMED ALI H (311819106001), MOHAMED ABDULLAH M (311819106010), MOHAMED SALAHUDEEN M (311819106011), RIZWAN AHAMED M (311819106018)** who carried out the **IBM NAALAIYA THIRAN** project work under our supervision.

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1. Introduction

Project Overview

Creating a device that can be followed using GPS location sand has a panic button to inform the parent via a GSM module, this invention is primarily focused on improving child safety. An Android app for parents is created to control and monitor the device at any time. Smart gadget devices are always connected to parents' phones, which can receive and make phone calls as well as SMS gadget via a GSM module. Additionally, wireless technology is implemented on the device, which is useful to bind the device within a region of monitoring range; if the device is moving out of monitoring range, an alert will be triggered on a binding gadget, helping you maintain a virtual watch over the child. An alert will be sent to a bound device if the device moves outside of the monitoring range, allowing you to keep a virtual check on the child.

Devices come with a health monitoring system that checks for factors including heart rate, pulse, and temperature. The parental app allows for the monitoring of these indicators. Using a contact switch, the device also keeps track of whether or not it is plugged in and notifies the parent the moment it is unplugged.

Purpose

Approximately 80% of all reports of child abuse are made nowadays, with 74% of the victims being girls and the remaining 20% being males. In this world, a child goes missing every forty seconds. Children are the foundation of a country; if their future was threatened, it would have an effect on the development of the whole country.

The emotional and mental stability of the children is compromised as a result of the abuse, ruining their futures and careers. The things that happen to these defenseless kids are not their fault. Therefore, parents are in charge of raising their own children. However, parents are compelled to seek money because of the state of the economy and their desire to concentrate on their child's future and job. Consequently, it becomes challenging for them to constantly cling to their kids. We have created a setting in our system where this issue can be effectively solved. It enables parents to keep a close eye on their kids in real time while concentrating on their own careers without having to take any physical action. In essence, kids cannot tell their parents about the abuse they experience on a regular basis. They are too young to really comprehend what truly occurs to them. Parents find it challenging to recognize when their children are being abused. So, the main objective of this module is to help

working parents to be free from worry about their children by tracking their movements at any time. An autonomous real-time monitoring system is required for every child worldwide in order to stop attacks on children.

2. Literature Survey

[1] **Authors:** Akash Moodbidri, Hamid Shahnasser
Title: Child safety wearable device.
Published in: 2017 IEEE. This gadget is designed to make it easier for parents to find their kids.
There are already a lot of wearables available on the market that may be used to track children's daily activity as well as to locate them utilizing the Wi-Fi and Bluetooth capabilities of the device.
Merits: The advantage of this wearable over others is that it can be operated with any phone; a high-end smartphone is not necessary, and it doesn't require a person to be highly tech knowledgeable.
Demerits: Due to its low battery life, this device.

[2] **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 Link-It ONE board, programmed in embedded C, is used to construct the system. It is connected to temperature, heartbeat, touch, GPS, GSM, and digital camera modules. The work is innovative in that when a child is in need of rapid attention during an emergency, the system instantly notifies the parent or caregiver by sending an SMS.
Merits: The child's heartbeat, temperature, and touch are employed as parameters in a parametric analysis, and the results are shown.
Demerits: To put in place an IoT gadget that offers a comprehensive remedy for issues with child safety.

[3] **Authors:** Dheeraj Sunehera, Pottabhatini Laxmi Priya.
Title: Children Location Monitoring on Google Maps Using GPS and GSM.
Published in: 2016 IEEE.
This study offers parents an Android-based tool to follow their kids in real-time. Through internet-connected channels, various gadgets can communicate with one another. The concerned gadget has an internet connection to the server. Parents can use the gadget to keep track of their kids in real-time or to protect ladies. The location services offered by the GSM module are used in the suggested solution. It enables parents to receive an SMS with their child's location information.
Merits: Uses an Android terminal and ad hoc networks, a child tracking system.
Demerits: This device cannot be used in rural areas.

[4] **Authors:** Aditi Gupta, Vibhor Harit.
Published in: 2016 IEEE.
Title: Child Safety & Tracking Management System by using GPS.
This study offered a model for child safety using smartphones that give parents the option to track their children's whereabouts as well as the ability for kids to send a fast message and their current location in case of an emergency via Short Message Services.

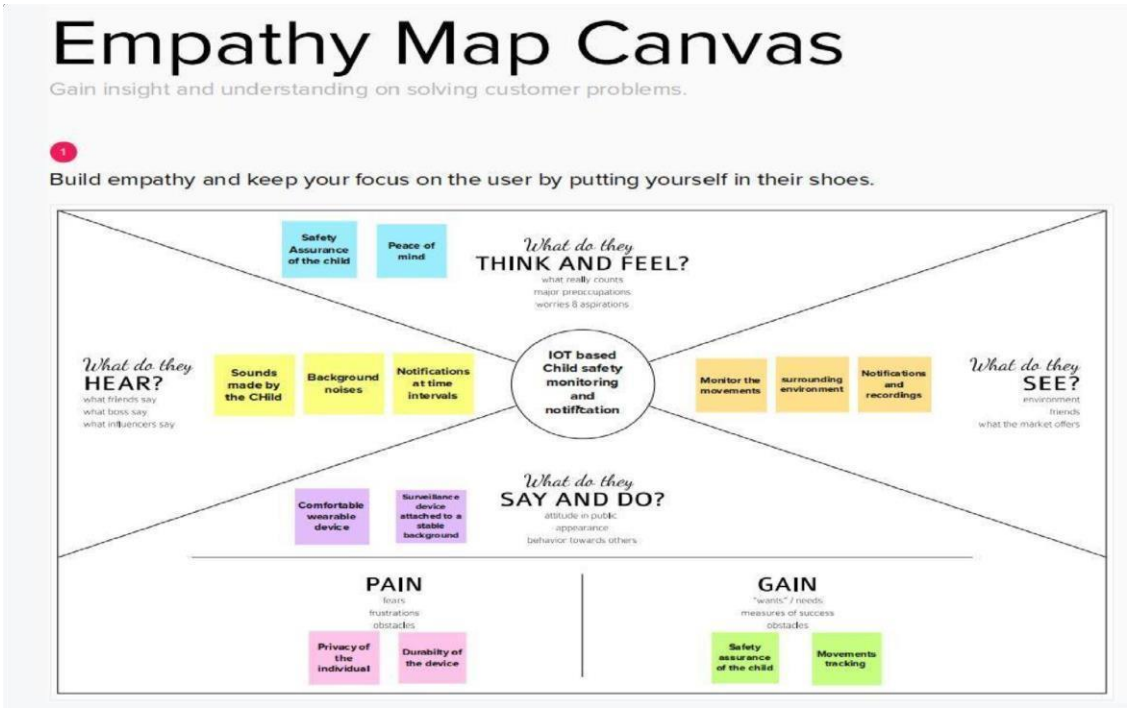
Merits: The benefits of smartphones that offer a wealth of capabilities like GPS, SMS, Google Maps, etc.
Demerits: This system is unable to detect child-like human behavior.

References:

[1] 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.
[2] Dheeraj Sunehera, Pottabhatini Laxmi Priya, 'Children Location Monitoring on Google Maps Using GPS and GSM,' 2016 IEEE 6th International Conference on Advanced Computing.
[3] 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.
[4] 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.Ideation and Proposed Solution

3.1Empathy map canvas



Ideation and brainstorming

Idea 1:

A compact wearable gadget with a pressure switch. The user can apply pressure to the device by squeezing or compressing itas soon as an attacker is preparing to attack the person or as soon as the person perceives any insecurity from a stranger. Instantaneouslythe pressure sensor detects this pressure, and a call is placed to the victim's parents' or guardian's mobile phone numbers that were pu in the device at purchase, along with a regular SMS that includes the victim's location. The identical message will be delivered to the police if the call goes unanswered for an extended period of time. Further, a message with the person's current location is sent to the parent or guardian's phone by standard SMS if the person enters an area that is typically offlimits to them.

Idea 2:

By creating a device that can be followed using GPS locations and has a panic button to inform the parent via a GSM module, this invention is primarily focused on improving child safety.An Android app for parents is created to control and monitor the device at any time. Smart gadget device is always connected to parents' phone, which can receive and make phone calls as well as SMS on gadget via GSM module. Additionally, wireless technology is implemented on the device, which is useful to bind the devicewithin a region of monitoring range; if the device is moving out of monitoring range, an alert will be triggered on a binding gadget, helping you maintain a virtual watch over the child. An alert will be sent to a bound device if the device moves outside of the monitoring range, allowing you to keep a virtual check on the child. Devices come with a health monitoring system that checks for factorsincluding heart rate, pulse, and temperature. The parental app allowsfor the monitoring of these indicators. Using a contact switch, the device also keeps track of whether or not it is plugged in and notifies the parent the moment it is unplugged.

Idea 3:

According to the latest surveys, the number of cases of child abduction and missing children in India is steadily rising. One of the primary worries for parents today is the safety of their children on school buses and outside of school premises, The suggested system makes an effort to give kids security features using new techniques that are introduced to the current safety system for better defense. Aportable unit, a cloud platform, and an Android application make up the proposed system. A raspberry pi 2 model B, a GPS receiver with antenna, and a pulse rate sensor make up the portable device. Using a GPS receiver and a heartbeat sensor, this device will track the child's location in terms of latitude, longitude, and altitude. These data are transmitted to a raspberry pi module, which uses internet connectivity to inject them into elasticsearch. The android program has a user interface that displays the child's location on a map, the path they took, and their rate of movement. The child's heart rate is also continuously tracked by the application.

Proposed solution

S.No.	Parameter	Descrip on
1.	Problem Statement (Problem to be solved)	To prevent children for abuse and make them safe
2.	Idea / Solu on descrip on	compact wearable gadget with pressure bu on which can the parents can find the a acker easier
3.	Novelty / Uniqueness	Pressure bu on with Gsm
4.	Social Impact / Customer Sa sfac on	It is useful to working parents when they are leaving children
5.	Business Model (Revenue Model)	wearable gadget
6.	Scalability of the Solu on	compact and easy to use

7

Problem solution fit

4. Requirement analysis

Functional requirements

FR No.	Func onal Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User n Registra o	Registra on through Form Registra on through Gmail
FR-2	User on Confirma	Confirma on via Email Confirma on via OTP
FR-3	No fica on	No fica on Via Mobile App and normal message
FR-4	Monitorin g	App to monitor the child loca on
FR-5	Health monitoring	Heart beat rate , Temperature

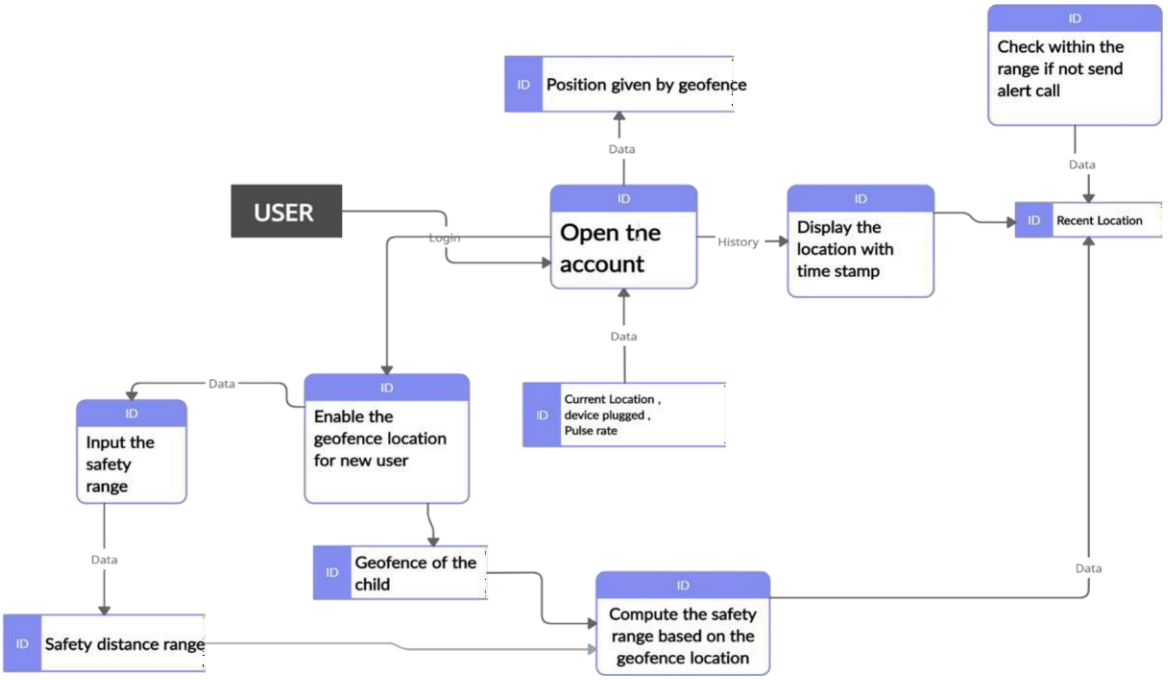
Non-Functional requirements:

FR No.	Non-Func onal Requirement	Descrip on
NFR -1	**Usability**	This model has GSM that can help to no fy 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 no fy the parents and if panic bu on is pressed it will send alert message and parents able to track the loca on
NFR -3	**Reliability**	● Easy to use ● Portable ● Flexible ● Cost effec ve
NFR -4	**Performance**	● Create a Child tracker which helps the parents with con nuously monitoring the child's loca on. ● The no fica on will be sent according to the ● child's loca on to their parents or caretakers.
NFR -5	**Availability**	● Track your child even in a crowd ● Know the current loca on
NFR -6	**Scalability**	● This model ensures the safety and tracking of the children. Parents need not worry about their children.

5. PROJECT DESIGN

Data Flow Diagrams



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
- est tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of thesoftware to project stakeholders.
- Define features, development phases, and solution requirements.

- Provide specifications according to which the solu on is defined, managed, and delivered.

User Stories

User Type	Func onal Requirem e nt (Epic)	User Story Number	User Story / Task	Acceptance criteria

Cus tom er (Mob ile user)	Registraon	USN-1 (FATHER)	As a user, I can register by entering my email, and password, and confirming my password. I can access the loca on 	I can access my account/dashboar d and receiv confirma on email & click confirm
			children using the creden als provided as a Father.	

		USN-2 (MOTHER)	As a user, I can register by entering my email, and password, and confirming my password. I can access the loca on of my children using the creden als provided as a Mother.	I can access my account/dashboar d and receive a confirma on email & click confirm	High	Sprint-1

		USN-3 (GUARDIAN/ CARETAKER)	As a user, I can monitor the children's ac vi es using a safety gadget monitoring system.	I can access my account/dashboar d and receive a confirma on email & click confirm	Mediu m	Sprint-1
	Login	USN-4	As a user, I can log into the applica on by entering my email & password.	I can access my account/dashboard.	Mediu m	Sprint-2
	Dashboard	USN-5	As a user, I can fix the geofence for my child's loca on so	I can monitor the current loca on 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

Sprint planning and estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a Parent/Guardian,I can register for the Application by entering my email, password, and confirming my password.	2	High	Ahamed ali Mohamed abdullah
Sprint-1		USN-2	As a Parent/ Guardian, I can register for the application through Gmail	1	Medium	Mohamed salahudeen

Sprin t-1	User Confirmation	USN-3	As a parent I will receive connection , location in sms / email once I have entered this	1	High	Rizwan ahamed
			application			
Sprin t-1	Login	USN-4	As a parent/ guardian , I can log into the application by entering email and password.	2	High	Mohamed salahudeen

Sprint delivery schedule

Sprint	**Total Story Points**	**Duratio n**	**Sprint Start Date**	**Sprint End Date (Planned)**	**Story Poin ts Complete d on Planned Date)**	**(as E nd**	**Sprint Release Date (Actual)**

Sprint - 1	20	4 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint - 2	20	5 Days	28 Oct 2022	05 Nov 2022	20	04 Nov 2022
Sprint - 3	20	8 Days	02 Nov 2022	12 Nov 2022	20	11 Nov 2022
Sprint - 4	20	9 Days	10 Nov 2022	19 Nov 2022	20	19 Nov 2022

7. CODING & SOLUTIONING (Explain the features added in theproject along with code) Feature 1 :

(Adding Geofence)

- Geofence is like a round wall covering the given location. So parents canuse 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 {
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();

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

//.

```
/*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_E
NT ER",
```

"", 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

Test Cases

S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Voluem Changes	Risk Score	Justification
1	IoT Based Safety Gadget for Child Safety Monitoring and Notification	New	Moderate	Moderate	Moderate	Not Much	No Changes	RED	Since our project is new the scope is new
									We can have chnages in the future so the Functional, Hardware and Software changes are Moderate
									Since the project is new here is no Load changes
									The risk is no high since we aren't sure if it will be up to the mark

NFT - Detailed Test Plan

S.No	Project Overview	NFT Test approach	Assumptions/Dependencies/Risks	Approvals/SignOff
1	IoT Based Safety Gadget for Child Safety Monitoring and Notification	Load Test	There are lots of invalid users trying to log in/We need more machine learning engineers/The valid users may not be able to log in.	Approved

End Of Test Report

S.No	Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	Recommendations	Identified Defects (Detected/Closed/Open)	Approvals/SignOff
1	IoT Based Safety Gadget for Child	Load Test	Yes	No. of users: 100	Go	Aviod using global variables	Closed	Approved
				Run time: 60s		import libraries only just before using it		
				RPS: 9.7				
				Failure: 1%				
				Average: 785ms				
				Storage space: 50MiB				

User Acceptance Testing

1 .Defect Analysis

Resolu on	Severity 1	Severit y2	Severit y3	Severit y4	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

Sec on	**Total Cases**	**Not Tested**	**Fail**	**Pass**
Print Engine	5	0	1	4
Client Applica on	47	0	2	45

Security	3	0	0	3

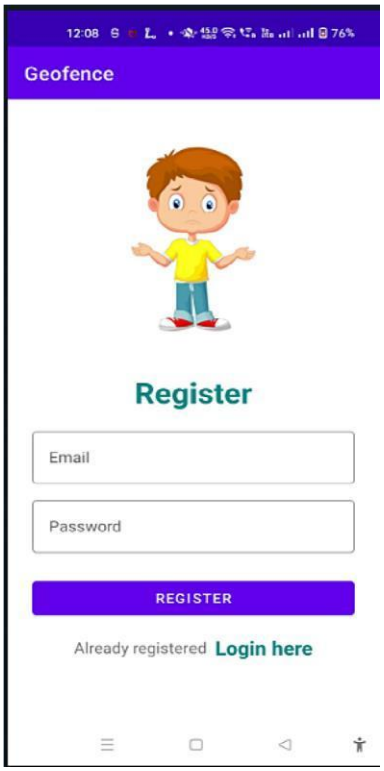
Outsource Shipping	2	0	0	2
Excep on Repor ng	11	0	2	9
Final Report Output	5	0	0	5
Version Control	3	0	1	2

9. RESULTS

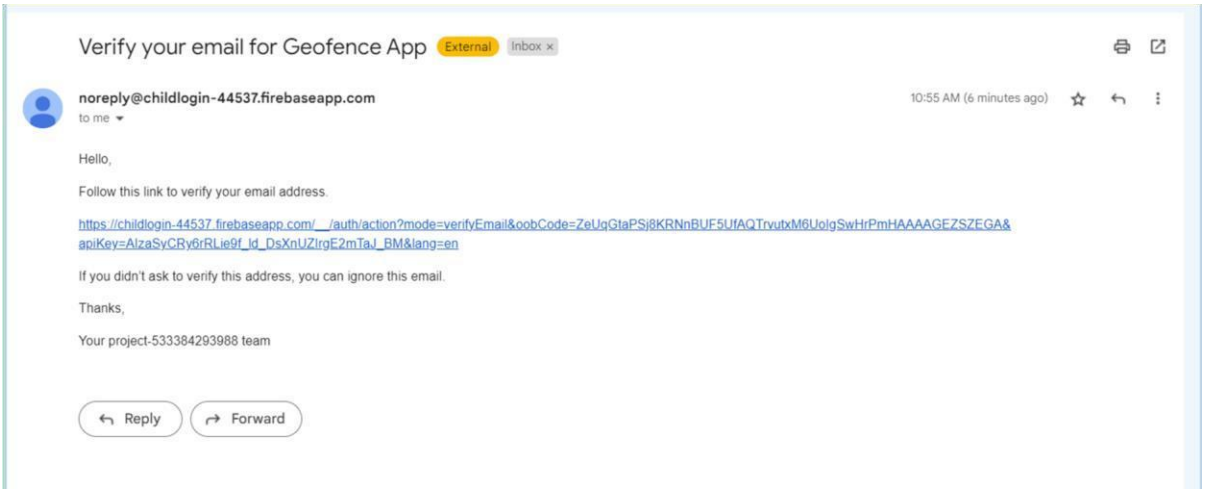
1. User Registration :

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 .

Registration Page :



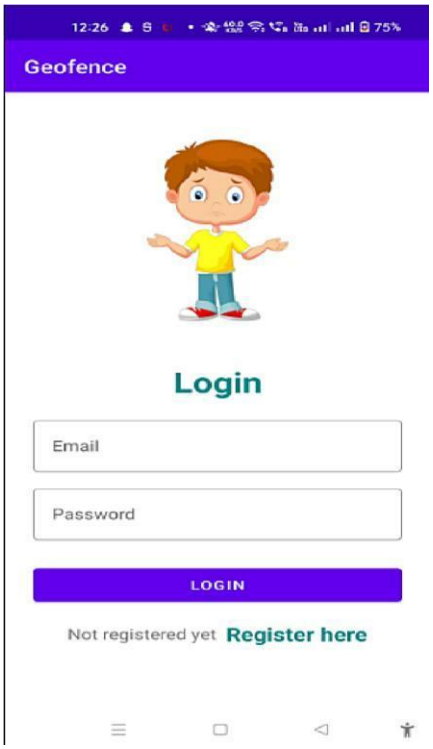
Verification mail



2. 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 occur .

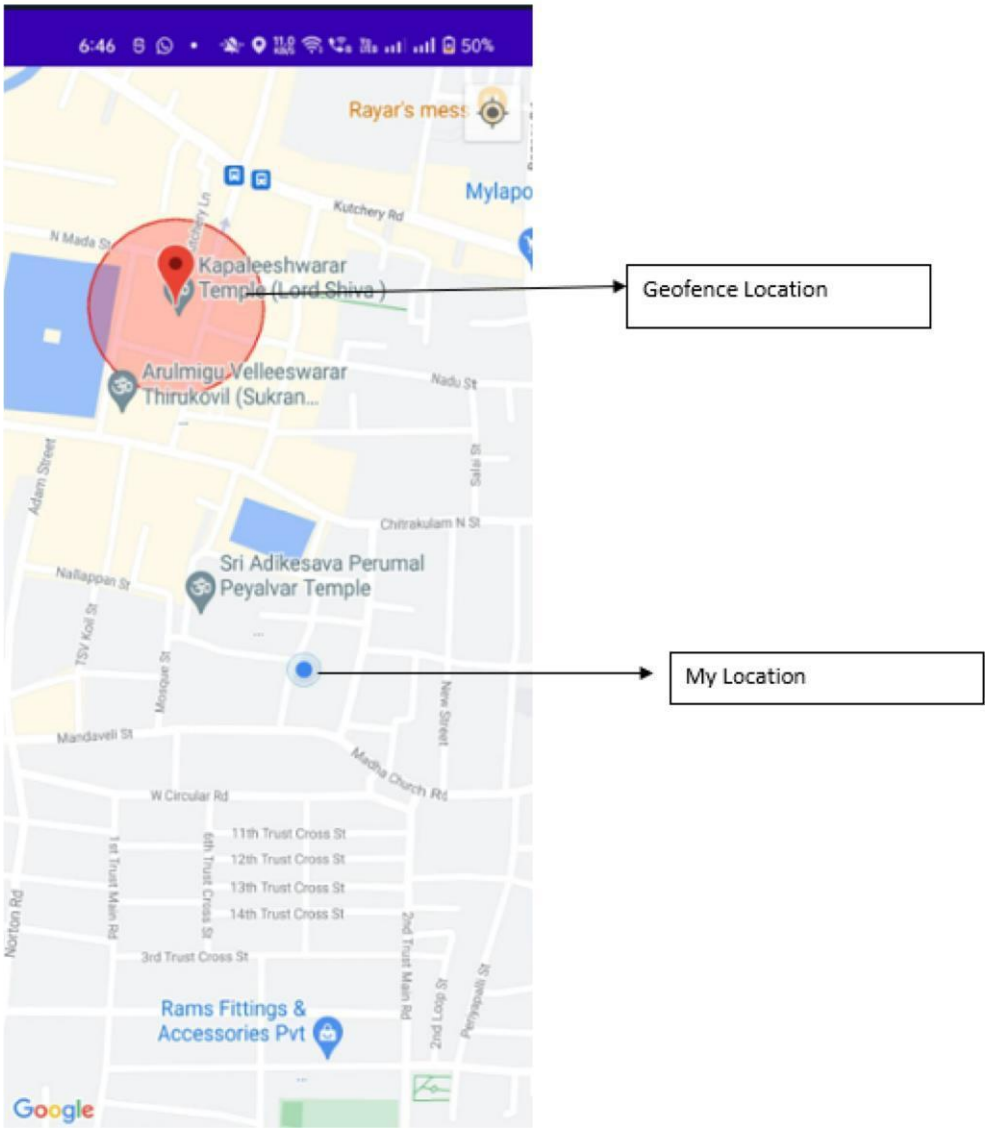
Login page :



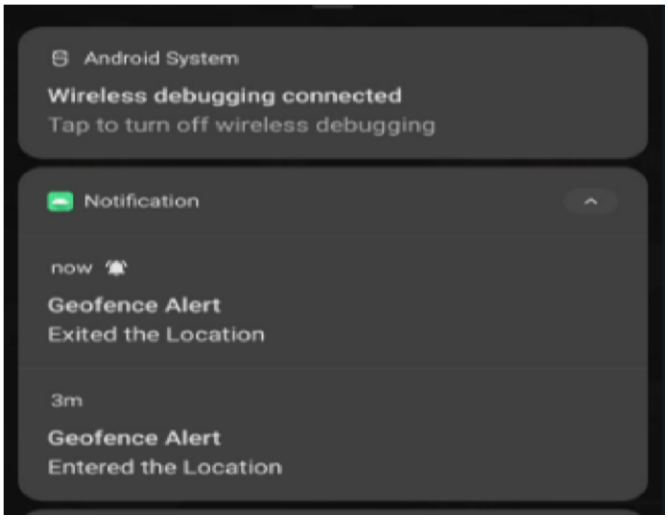
3. Adding Geofence and Alert Notification

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


6:46
50%
Rayar's mess
Mylapo
Kutchery Rd
N Mada St
Kapaleeshwarar Temple (Lord Shiva)
Geofence Location
Arulmigu Velleeswarar Thirukovil (Sukran...
Nadu St
Adam Street
Chitrakulam N St
Sri Adikesava Perumal Peyalvar Temple
Nallappan St
TSV Koil St
Mosque St
My Location
New Street
Mandaveli St
Madha Church Rd
W Circular Rd
11th Trust Cross St
12th Trust Cross St
13th Trust Cross St
14th Trust Cross St
1st Trust Main Rd
6th Trust Cross St
2nd Trust Main Rd
Norton Rd
3rd Trust Cross St
Rams Fittings & Accessories Pvt
Google

Notification



10. Advantages and Disadvantages

The parent can monitor their child from anywhere at any time, and also get a notification when the child goes away from the permitted radius. It also allows the parent to know if their child is in any dangerous situation. The disadvantages of this system are that the child could not produce the exact alert command during a panic condition. The command produced maynot match the previously stored command. This project requires manual intervention.

11. Future Scope

In our system, we use the Internet of Things, GPS, GSM, and Nodemcu to automatically monitor the youngster in real time.

When we utilize a web camera and GPS to actively monitor, this system needs network

connections, satellite communication, and a high-speed data connection. It is challenging to keep an eye out for any network problems or satellite connection problems. Additionally, there is a lag when streaming videos through the server. The Zigbee concept or accessing the system without the internet and employing high-speed server transmission can therefore be used in the future to solve these problems.

12. Conclusion

Future is similar to the word children. Young people are the future pillars of one's nation, as Dr. A.P.J. Abdul Kalam once said, thus it is important to protect today's children's dreams and lives in order to give them a better future. Therefore, every parent should take good care of their own children to prevent them from being victims of abuse that will completely harm them on a physical, mental, and emotional level, wrecking our future. Due to the significance of our future, our product makes it simple for parents to track their kids and regularly visually monitor them, enablingthem to assure their safety and lowering the incidence of child abuse.

13 Appendix

Source code

Source code link: https://github.com/IBM-EPBL/IBM-Project-48684-1660811449

GitHub and Project demo link: : https://github.com/IBM-EPBL/IBM-Project-48684-1660811449

Demolink: https://drive.google.com/file/d/1r62fMdGZF9Xj210GdBdTLLc5H9SIfb8/view?usp=share_link