IOT BASED SAFETY GADGET FOR CHILD SAFETY MONITORING AND NOTIFICATION

PROJECT REPORT

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ABSTRACT

The main aim of the project is to provide security to the child. Nowadays, parents are working and are unable to manage and keep a track of various activities of their children. For this to be achieved, the proposed system will be very useful for parents. The Internet of Things refers to the set of devices and systems that stay interconnected with real world sensors and actuators to the internet. The main motive this wearable gadget comes from the increasing need of safety for little children as well as for special child in current times. Most of the wearable's available today are focused on providing the location, activity, health etc. of the child to the parents via Wi-Fi and Bluetooth. The platform on which this project will be running on is the IoT, Arduino uno and functions of sending and receiving SMS which id provided by the GSM module using the GSM network. Parental android app is developed to manage and track the device anytime. The GPS module will utilise to access their present location of the little child and special child. Wearable gadget which tracks the security and health conditions of the child using temperature, heartbeat and send notifications to parents. As a result, this strategy is perceived as sending an SMS from the children's wearable gadget to their parents or guardians. By this, parents know what is happening remotelyand can take actions if something goes wrong.

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1. INTRODUCTION

In this project, the main focus on implementing children tracking system for every children. 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 themunder panic situations and monitor them using a smart gadget.It plays a vital role in every day to day life. The major difference between IoT and embedded system is that a dedicated protocol/software is embedded in the chip in case of embedded system, whereas, IoT devices are smart devices, which are able to take decisions by sensing the environment around the device. The purpose of this device is to help parents locate their children with ease. Also to show the child's actual data with reference values. At the moment there are many wearables in the market which help track the daily activity of children and also help find the child using Wi-Fi and Bluetooth services present on the device.

The development of sensors technology, availability of internet connected devices; data analysis algorithms make IoT devices to act smart in emergency situations without human interventions.The development of sensors technology, availability of internet connected devices; data analysis algorithms make IoT devices to act smart in emergency situations without human interventions. So, IoT devices are applied in different fields such as agriculture, medical, industrial, securityand communication application.

1.2 PURPOSE

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

Title : Smart IoT Device for Child Safetyand Tracking. Published in : 2019

The system is developed using Link-It ONE board programmed in embeddedC 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/guardian by sending

SMS, when immediate attention is required for the child during emergency.

The parameters such as touch,temperature & heartbeatof the child are used for parametric analysis and results are plotted for the same. To implement the IoT device which ensures the complete solution for child safety problems

[2] Authors: Aditi Gupta,Vibhor Harit. Published in: 2016.

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. The advantages of smart phones which offers rich features like Google maps, GPS, SMS etc. This system is unable to sense human behaviorof child.

[3] Authors: Dheeraj Sunehera, Pottabhatini Laxmi Priya.

Title: ChildrenLocation 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 orfor women safety.

The proposed solution takes the location service provided by GSM module. It allows the parents to get their child's current-location via SMS. A child tracking system using android terminal and hoc networks.This device cannot be used in ruralareas.

[4] Authors: Pramod, M UdayBhaskar, Ch V and Shikha,K. (January 2018)

Title: IOT wearabledevice for the safety and security of women and girl.

A wearable IoT device for the security and shielding of women and girl children was designed. The body temperature and galvanic skin resistance of the body is changed in abnormal conditions. This was used as input information and the alert signal is produced while it crosses the threshold value. This work deals with body temperature and stress,skin resistance and relationship between them. By applying these parameters activity of the personwas analysed.

Authors: AkashMoodbidri, Hamid Shahnasser (Jan 2017)

Title: Child safety wearable device',International Journal for Research in Applied Science& Engineering Technology, Vol. 6 Issue II, IEEE, pp. 438-444.

The parent can send a message to the GSM module, according to the message information the GSM module reply back with particular details of the children. The location can be seen on the Google map. When a particular child is facing an emergency situation, device button should be pressed so that the device captures the image along with the

user information to the enrolled mobile numbers. The life of the child can be saved within no time.

[5] Authors: Jonny Farringdon, Andrew J. Moore, Nancy Tilbury,James Church & PieterBiemond.D (october 1999).

Title: Wearable Sensor Badge & Sensor Jacket for Context Awareness', International symposium onWearable computers, ISWC 99proceedings of the 3rd IEEE pp107.

A wearable sensor badge is constructed from (hard) electronic components, which can sense perambulatory activities for context awareness. A wearable sensor jacket is used with latest techniques to form (soft) fabric. Stretch sensors are placed to measure upper limb and body movement. Worn as clothing,the sensors give the required information.

[6] Authors: Akash Moodbidri, Hamid Shahnasser

Title: Child safetywearable device. Published in: 2017 IEEE.

There are two modules namely Wi-Fi and audio play back module. The details of the baby can be sent to parents through Wi-Fi module. The audio play back module produces the recorded sound different sensors are accelerometer sensor, cry sensor, temperature sensor gas sensor, flame sensor and PIR sensor. The embedded system consists of microcontroller; accelerometer detects the angular positionand movement of the baby..

[7] Author: Dustin T. Weiler, Stefanie O. Villajuan, Laura Edkins, Sean Cleary and Jason J. Saleem.

Title: "Wearable Heart Rate MonitorTechnology Accuracy in Research: A Comparative Study between PPG and ECG Technology. Proceedings of the Human Factors and Ergonomics Society 2017 Annual Meeting.

The main purpose of this article is to use a GSM module to enable SMS communication between the child's wearableand the parent. Parents can text particular phrases such as "LOCATION," "TEMPERATURE," "SOS," "BUZZ," "UV," and so on, and the wearable device will answer with a text outlining the child's current location, which when pressed will show the child's exact location on Google maps. It also shows the temperature and UV radiation index so that parents can keep an eye on their children's surroundings.

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 ExploringEngineering, Volume 8, Issue 8, June 2019.

[2] Aditi Gupta, Vibhor Harit, ‘Child Safety & Tracking Management System by using GPS, Geo- Fencing& Android Application: An Analysis,’ 2016 Second International Conference on Computational Intelligence & Communication Technology.

[3] Dheeraj Sunehera, Pottabhatini Laxmi Priya, ‘Children Location Monitoring on Google Maps Using GPS and GSM,’ 2016 IEEE 6th

International Conference on Advanced Computing.

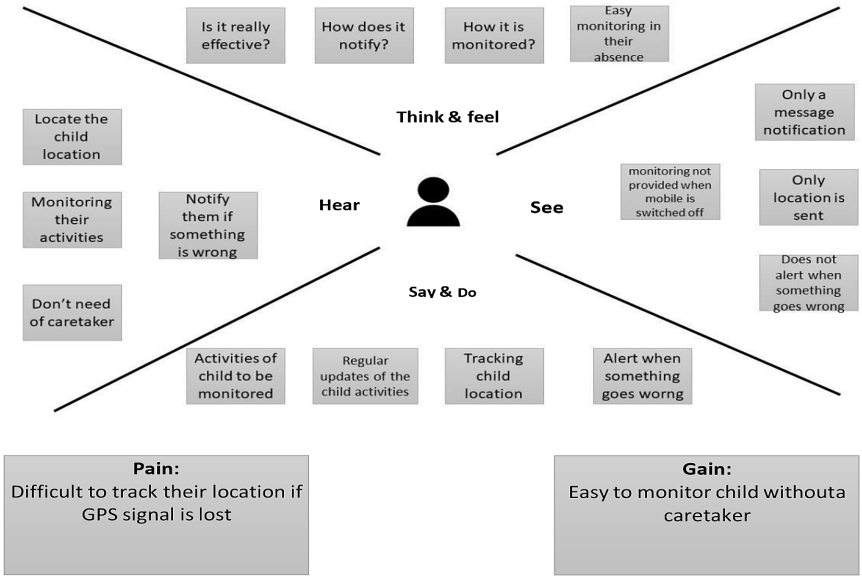
[4] Pramod, M Uday Bhaskar, Ch. V and Shikha, K. (January 2018) 'IoT wearable device for the safety and securityof women and girl' International Journal of Mechanical Engineering and Technology, Vol. 9, Issue 1, pp. 83-88.

[5] 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.

[6] Jonny Farringdon, Andrew J. Moore, Nancy Tilbury, James Church & Pieter Biemond .D (october 1999) 'Wearable Sensor Badge & Sensor Jacket for Context Awareness', International symposium on Wearablecomputers, ISWC 99 proceedings of the 3rd IEEE pp107.

3. Ideation and Proposed Solution

3.1 Empathy Map Canvas



3.2 Ideation and Brainstroming

Idea 1 :

A compact wearable device with a pressure switch. The user can apply pressure to the device by squeezing or compressing it as soon as an attacker is preparing to attack a person or as soon as the person

perceives any insecurity from a stranger. Instantaneously the pressure sensor detects the pressure, and a call is placed to the victims parent's mobile numbers that were put in the device at purchase, along with the regular SMS that includes the victim's location.

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. Smart gadget device is always connected to parent's phone, which can receive and make phone calls as well as SMS on gadget via GSM module. An alert will be sent to a boundary device if the device moves outside of the monitoring range, allowing you to keep a virtual check on the child. Device come with a health monitoring system that checks for factors including heart rate, pulse and temperature. Using a contact switch, the device also keep track of the whether or not it is plugged in and notifies the parent 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

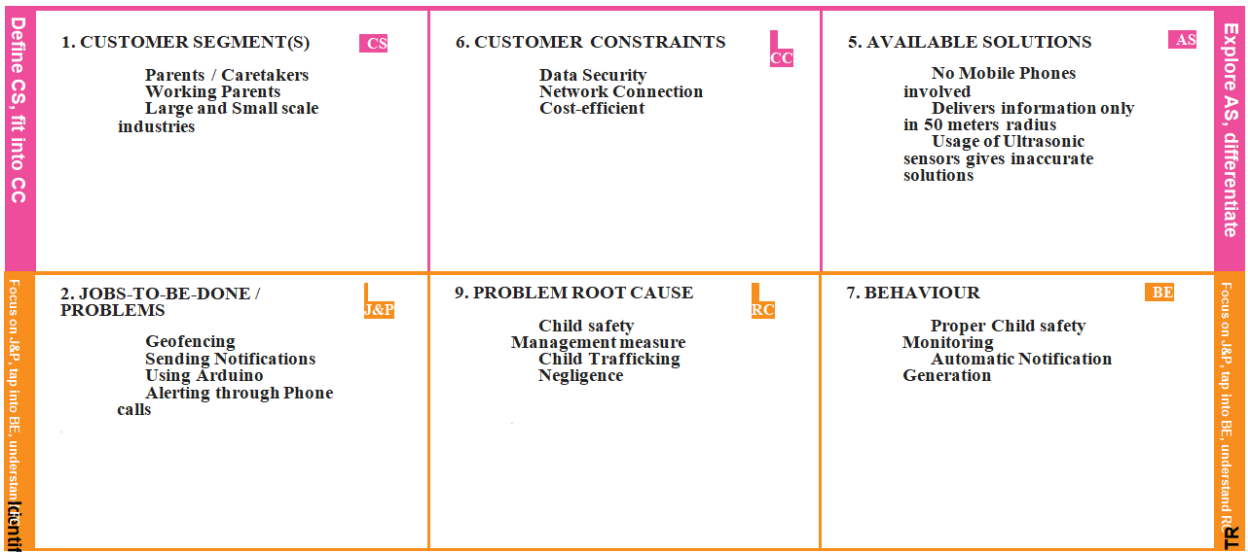
buses and outside of school premesis, the suggested system makes an effort to give kids securing features using new techniques that are introduced to the current safety system for better defence. The android program has the user interface that displays the child's location on a map, the path they took and their rate of moment. The child's heart rate is also continously tracked by the application.

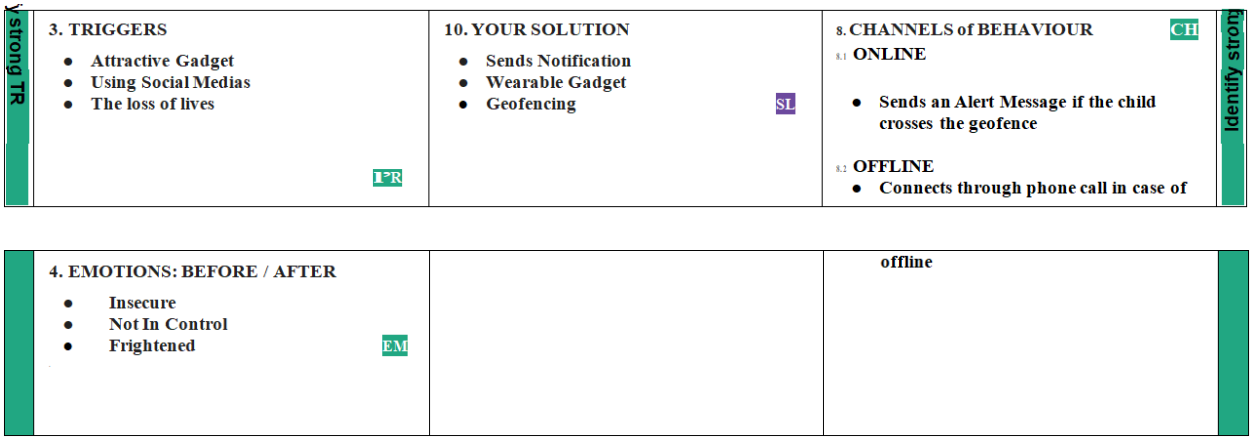
3.3 Proposed Solution

S. No	Parameter	Description
1.	Problem Statement (Problem to be solved)	In today's world with lots of ongoing crime related to children, parents wanta reliable way through which they can ensure theirchild's safety.
2.	Idea / Solution description	To create an IOT device through whichthe parentscan set geofence for their child.
3.	Novelty / Uniqueness	To send accurate location data and send notification as soon as child goes out of the safezone.
4.	Social Impact / CustomerSatisfaction	• Reduce in crime rate related tochildren.

		• Peace of mind for parents.
5.	Business Model (RevenueModel)	• This device can be used forschool goingchildren. • The device can also be used fortracking a vehicle in case of a theft. • The device can be modified forthe use of women.
6.	Scalability of the Solution	• The battery life of the device canbe improved by a lot. • The location accuracy can beimproved. • The size of the device can bereduced.

3.4 Problem Soltion Fit





4. Requirement Analysis

4.1 Functional Requirements

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Communicate and exchange information to provide server for user	To monitor the children's location in house or public places. Alert the parent if the child misuse the wearable device through SMS.
FR-2	Continuous requirement	Create a geofence around child location. Continuously Monitoring the child location.
FR-3	User Requirement	Easily upgrade to any environments. Easy to handle. Gives more accuracy. Low more consumption.

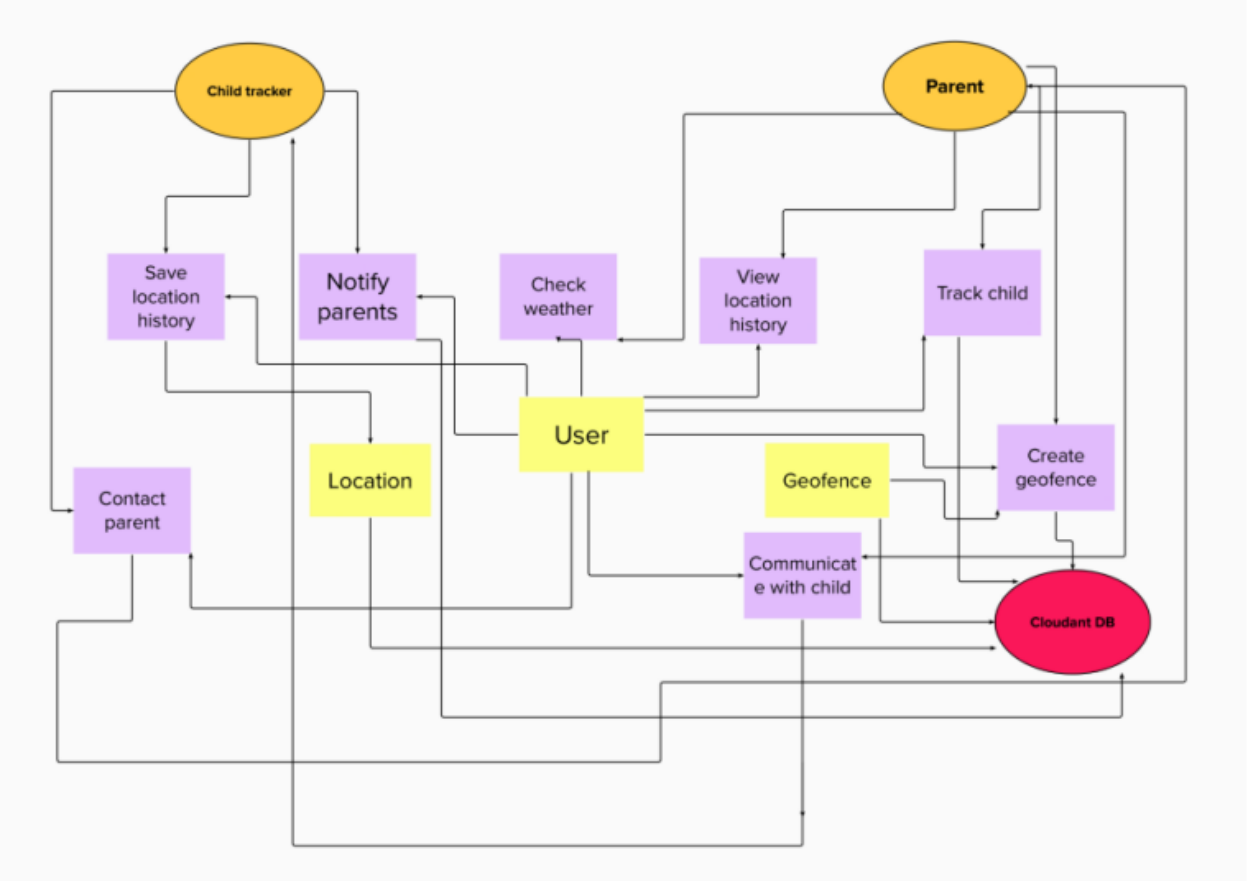
FR-4	Mandatory	The system will send the detail of location information the system via 3G network or Wi-Fi. Accuracy of location is important. The system should be scalable. The entire location data will be stored.
FR-5	Testing set the geofence.	The device is kept together with the children. Create geofence around the child location in school or parks, if child crosses the geofence notify to the parents Notifications sent in the forms of SMS.

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	High usability of user experience design for user, Which is usable for finding the children if they lost.
NFR-2	**Security**	The system can accessed by authorized persons only.
NFR-3	**Reliability**	Monitoring the location continuously and easy to upgrade the system .
NFR-4	**Performance**	The performance should be more effective and efficient. The location data will be stored.
NFR-5	**Availability**	If we are going to upgrade the system or make any changes in the the system it will not take much time to recovery.
NFR-6	**Scalability**	The website traffic limit must be scalable enough to support users at a time.

5 . Project Design

5.1 Data Flows Diagrams



5.2 Solution and Technical Architecture

Solution architecture is a complex process – with many sub processes – that bridges the gap between business problems and technology

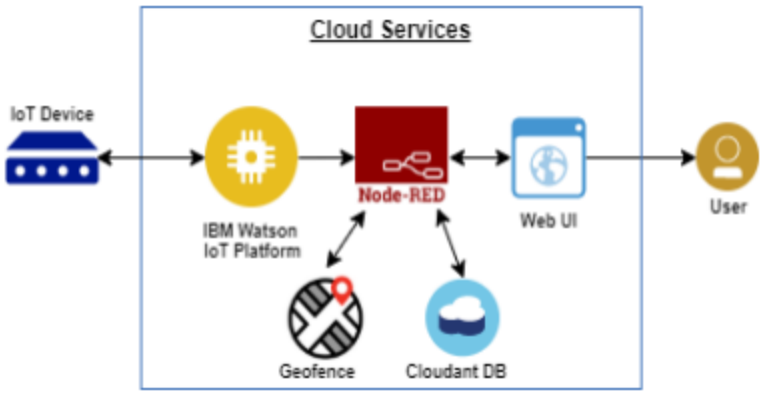
solutions. Its goals are to:

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

● Describe the structure, characteristics, behavior, and other aspects of thesoftware to project stakeholders.

● Define features, development phases, and solution requirements.

● Provide specifications according to which the solution is defined, managed, and delivered.

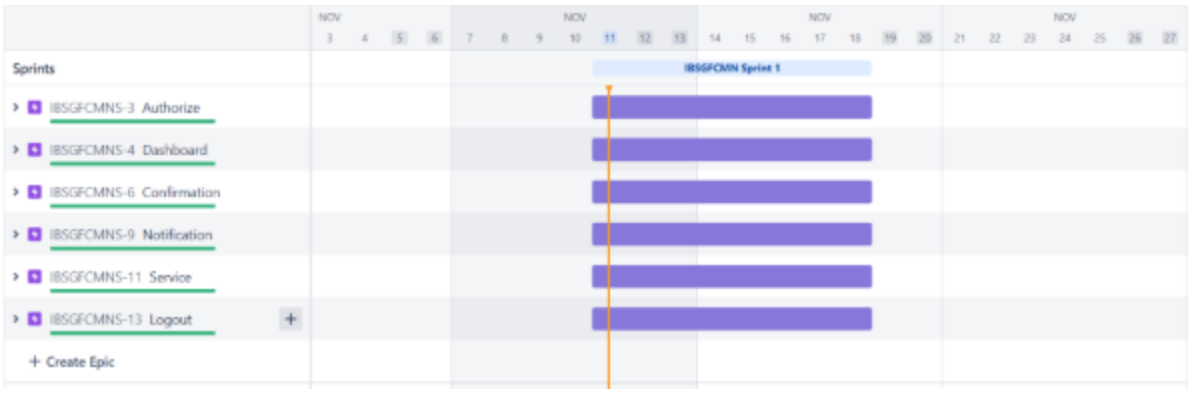


5.3 User Stories

Parent	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 Gmail		Medium	Sprint-1
	Login	USN-4	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard	USN-5	As a user, I need to be able to view the functions that I can perform		High	Sprint-1
Child	Notification	USN-1	As a user, I should be able to notify my parent in emergency situations		High	Sprint-2
	Store data	USN-2	As a user, I need to continuously store my location data into the db.		Medium	Sprint-2
	Communication	USN-3	I should be able to communicate with my parents		Low	Sprint-3

6. Project Scheduling and planning

6.1 Sprint Planning and Estimation



6.2 Sprint Delivery Schedule

7. CODING & SOLUTIONING

7.1 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();

7.2 Feature 2 (Alert Notification)

● Once geofence is added , when the child enters the geofence an notification willbe sent 22

● 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"; receiving @Override public void onReceive(Context context, Intent intent){ // TODO: This method is called when the BroadcastReceiver is // an Intent broadcast //. /*Toast.makeText(context, "GEOFENCE_ENTERED", Toast.LENGTH_SHORT).show(); final Toast mToastToShow; 23 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 =GeofencingEvent.fromIntent(intent); if (geofencingEvent.hasError()) Log.d(TAG, "onReceive: Error receiving geofence event..."); return; } List 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: 25 notificationHelper.sendHighPriorityNotification("Exited the Location ", "", MapsActivity.class); break; } } }

8. TESTING

8.1 Test Cases

Test case ID	Feature Type	Compon ent	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Stat us	Comments	TC for Automation(Y/N)	BUG ID	Executed By
LoginPage_TC_C 01	Functional	Home Page	Verify user is able to see the Login/Signup popup when user clicked on App		1.Enter App 2.Verify login/Signup popup displayed or not		Login/Signup popup should display	Working as expected	Pass		Y		Sruthi Bali , Sweta
LoginPage_TC_C 02	UI	Home Page	Verify the UI elements in Login/Signup popup		1.Enter App 2.Verify login/Signup 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.emailText box b.password text box c.Login button with orange colour d.New customer? Register	Working as expected	Pass		Y		Shanmugapriya , Sweta
LoginPage_TC_C 03	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: sbsd@gmail.com password: Testing123	User should navigate to user account homepage	Working as expected	Pass		Y		Shalini
LoginPage_TC_C 04	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: sbsd@gmail password: Testing123	Application should show "Login error. There is no user record corresponding to this identifier"	Working as expected	pass		Y		Shalini , Shanmugapriya
LoginPage_TC_C 04	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: ravi19sc2020@visvesvaya.edu.in password: Testing@2361555555555555555	Application should show "the Password is invalid"	Working as expected	Pass		Y		Sharmila D, Sindhuja
LoginPage_TC_C 05	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: sbsd password: Testing@2361555555555555555	Application should show "Login error. There is no user record corresponding to this identifier"	Working as expected	Pass		Y		Sweta
Dashboard	Functional	Dashboard	Adding geofence in the location wind		1.Enter App 2.Enter the valid username and password		Application show send alerts around the location	Working as expected	Pass		Y		Sruthi Bali
Alert Notification	Functional	Notification	Notification when the user entered the geofence		1.Enter App 2.Enter the valid username and password 3.Add the Geofence		Application start the notification " Entered the location"	Working as expected	Pass		Y		Shanmugapriya , Sweta
Alert Notification	Functional	Notification	Notification when the user exited the geofence		1.Enter App 2.Enter the valid username and password		Application start the notification " Exited the location"	Working as expected	Pass		Y		Shalini , Sweta

8.2 User Acceptance Testing

1 .Defect Analysis

Resolution	Severity 1	Severiy 2	Severity 3	Severity 4	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. RESULT

9.1 Performance Metrics

● Fast updation of child's location ● User Friendly interface ● Low data involvement

10. ADVANTAGES & DISADVANTAGES

10.1 Advantages

10.1.1 A parent can access the child's location 24x7.

10.1.2 It provides real time detection.

10.1.3 Parent receives instant notification when the child crosses the geofence

. 10.1.4 Easy to use interface.

10.1.5 A parent can create as many as nodes for multiple children.

10.2 Disadvantages

10.2.1 Our application cannot be used without internet connection.

10.2.2 To access the child's location the parent has to access the web application.

11. CONCLUSION

11.1 A parent can access their child's location in a realtime way.The child tracker frequently updates the location of the child.Any parent can make use of this application to track their child after establishing a geofence around their child.Hence, this application serves as a platform that can be used to monitor a child and ensure safety of the child .

12. FUTURE SCOPE

12.1 The application can be made an offline application inorder for people to access their child's

location in the absence of internet connection.
12.2 The application is currently a web based application.It has scope to be made into a hybrid application by making it into a native application.

13. APPENDIX

GitHub link: https://github.com/IBM-EPBL/IBM-Project-28286-1660109901