IoT Based Safety Gadget for Child Safety Monitoring and Notification

SUBMITTED BY

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CHAPTER 1
INTRODUCTION

1.1 PROJECT OVERVIEW

The project is IoT Based Safety Gadget for Child Safety Monitoring & Notification.It is mainly streamed towards child safety solutions by developing gadget that can be used to monitor the child.

1.2 PURPOSE

Child safety and tracking has been a huge concern due to the surge of the number of crimes on children.Hence the purpose of this project is to provide an application that can be used to ensure the safety of a child.

2. LITERATURE SURVEY

2.1 Existing problem

In today's world the crime rate associated with children keeps increasing on a large scaledue to which a lot of attention has to be given on child's safety.Reports say that for every 40 seconds, a child goes missing in this world.The crime rate associated with children has been constantly increasing.Hence there is a need to find a solution which monitors the child's activities.The application constantly tracks the child and notifies it's parent.

2.2 References

2.2.1 Paper 1;

Smart IOT Device for Child Safety and Tracking

Child safety and tracking is a major concern as the number of crimes on children are reported nowadays. With this motivation, a smart IoT device for child safety and tracking is developed to help the parents to locate and monitor their children. The system is developed using LinkIt ONE board programmed in embedded C and interfaced with temperature, heartbeat, touch sensors and also GPS, GSM & digital camera modules.

Paper 2:

Child Safety Monitoring System Based on IoT

The overall percentage of child abusements filed nowadays in the world is about 80%, out of which 74% are girl children and the rest are boys. For every 40 seconds, a child goes missing in this world. Children are the backbone of one's nation, if the future of children was affected, it would impact the entire growth of that nation.In our

system, we provide an environment where this problem can be resolved in an efficient manner. It allows 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.

Paper 3:

IoT-based Child Security Monitoring System

Nowadays, the crime rate associated with children keeps increasing due to which draws peoples' attention regarding child safety. This research is conducted to propose a child security smart band utilizing IoT technology.Online questionnaires and semi-structured interviews are methodologies used to collect data. Through information obtained, a smart

band has been proposed to monitor the safety of children. By this, parents know what is happening remotely and can take actions if something goes wrong.

Paper 4:

IoT Based Smart Gadget for Child Safety and Tracking This paper is mainly streamed towards child safety solutions by developing a gadget which can be tracked via its GPS locations and also a panic button on gadget is provided to alert the parent via GSM module calling for help. Parental android app is developed to manage and track the device anytime. Smart gadget device is always connected to parental phone which can receive and make phone calls and also receive SMS on gadget via GSM module, also a wireless technology is implemented on device which is useful to bound the device within a region of monitoring range, if device is moving out of monitoring range then an alert will be triggered on binding gadget, this helps you keep a virtual eye on child.

2.3 Problem Statement Definition

2.3.1 To design a child monitoring device using Internet of Things.This application is focussed on ensuring the safety of children.It helps parent or guardian to constantly track their child's whereabouts.It uses geo-positioning system that sends a notification to the parent or guardian whenever the child crosses the geofence.
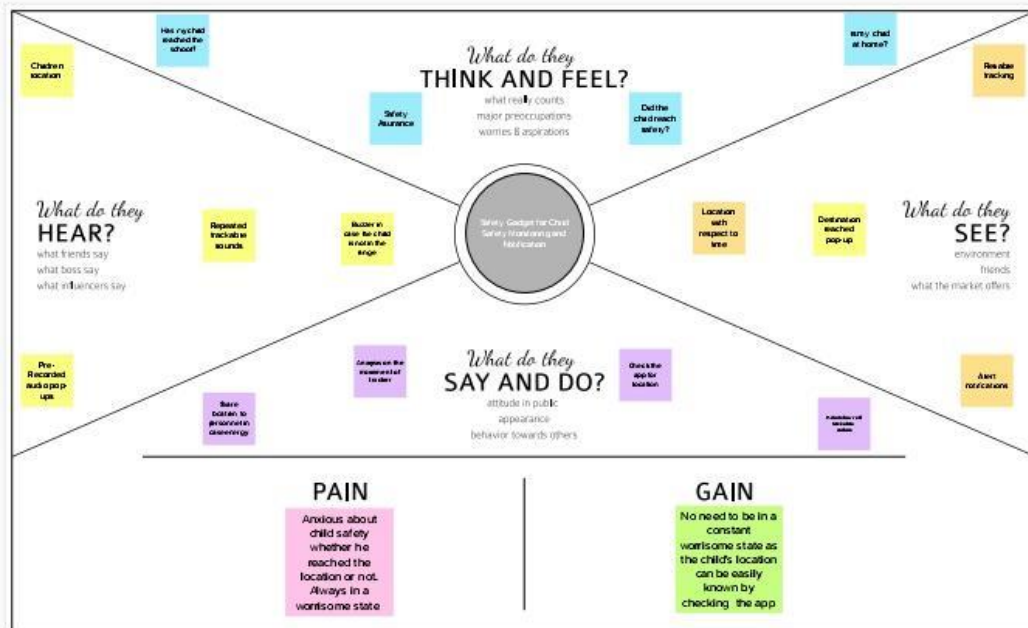
3. IDEATION & PROPOSED SOLUTION
3.1 Empathy Map Canvas

Empathy Map Canvas

Gain insight and understanding on solving customer problems.

1

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

Ideation & Brainstorming

Brainstorm & idea prioritization

3.2 Proposed Solution

3.2.1 Problem Statement

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

3.2.2 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.

3.2.3 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 softwares integrated together to maintain accuracy and ensure the safety of the child.

3.2.4 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.

3.2.5 Business Model (Revenue
Model)Business to
Consumer Model
Licensing model
Subscription
Model
Freemium
Model

3.2.6 Scalability of the Solution
By adopting multiple data storage technologies, controlling the IoT data pipeline, and using automated bootstrapping we ensure that the device is highly scalable.

3.3 Problem Solution fit

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

CUSTOMER SEGMENT	CUSTOMER CONSTRAINTS	AVAILABLE SOLUTION
Government and Industries	• Lack of accurate information • insufficient Technology	• Referring past experience/scenario • Statistics modelling by formula • Writing problem to find exact matching situation of past incidents
JOBS-TO-BE-DONE / PROBLEMS • Need to know fall or rise in crude oil price of fore coming days • Need to know approximated value of future crude oil price.	**PROBLEM ROOT CAUSE** Instability of crude oil price otherwise called uncertainty about its behaviour which leads to loss of revenue that affects growth in GDP and industry of respective country.	**BEHAVIOUR** Focus their major concentrate on precautions/ safety measure to make avoid unwanted losses
TRIGGERS Sudden loss due to crude oil price falling. **EMOTIONS** BEFORE : Insecure, Ambiguity, Confused AFTER : Anxiety, Sorrow, Hopeless	**YOUR SOLUTION** By building neural network model with high accuracy, it will give certain about fall or rise in crude oil prices and predicts its upcoming value	**CHANNELS of BEHAVIOUR** ONLINE : Information will be conveyed rapidly to avoid further loss OFFLINE : Situation will be out of control, it will be too difficult to avoid loss.

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Email Registration through Mobile number Registration in person
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	Notifications	Email and SMS message
FR-4	User Interface	Mobile app for parents Web interface for registrations, record tracking, information and payment

## 4.2 Non-Functional requirements

Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	To find out whether the child crosses the geofence or not, upon which the parent/guardian of the child gets an alert.
NFR-2	**Security**	Database security must meet HIPAA requirements. Extra security protocols and measures are also in place.
NFR-3	**Reliability**	Webpage gets automatically logged out unless password has been saved in the Google account. In case of server crash data gets backed up beforehand.
NFR-4	**Performance**	Site gets updated every 1 hour. Speed per transaction depends on the internet strength.
NFR-5	**Availability**	Available world wide, and requires an internet source.
NFR-6	**Scalability**	Short term scalability where memory is stored and erased, can be scaled to keep records in the future.

5. PROJECT DESIGN

5.1 Data Flow Diagrams

DATA FLOW DIAGRAM:

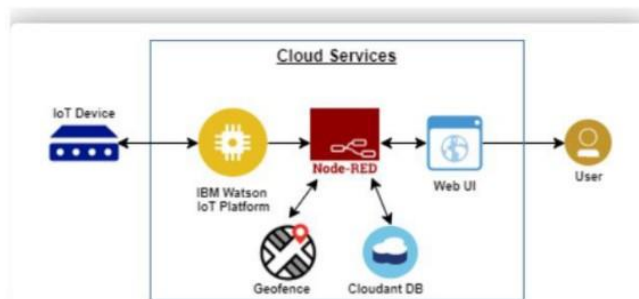IoT Based Safety Gadget for Child Safety Monitoring & Notification
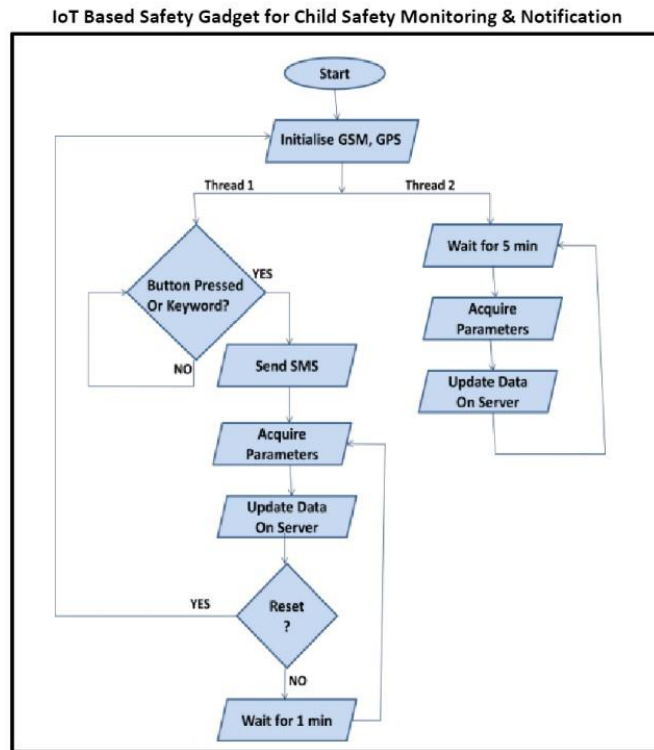
5.2   5.2

5.3 Solution & Technical Architecture

Technical Architecture:

The Deliverable shall include the architectural diagram as below and the information as per the table1 & table 2

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.	HTML, CSS, JavaScript / Angular Js / React Js etc.
2.	Application Logic-1	Logic for a process in the application	Java / Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
9.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
10.	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model, etc.
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration :	Local, Cloud Foundry, Kubernetes, etc.

Table-2: Application Characteristics:

S.No	Characteristics	Description	Technology
1.	Open-Source Frameworks	List the open-source frameworks used	Technology of Opensource framework
2.	Security Implementations	List all the security / access controls implemented, use of firewalls etc.	e.g. SHA-256, Encryptions, IAM Controls, OWASP etc.

S.No	Characteristics	Description	Technology
3.	Scalable Architecture	Justify the scalability of architecture (3 – tier, Micro-services)	Technology used
4.	Availability	Justify the availability of application (e.g. use of load balancers, distributed servers etc.)	Technology used
5.	Performance	Design consideration for the performance of the application (number of requests per sec, use of Cache, use of CDN's) etc.	Technology used

5.4 User Stories

User Stories

Use the below template to list all the user stories for the product.

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, password, and confirming my password. I can access the location of my children using the credentials provided as a Father.	I can access my account / dashboard and receive confirmation email & click confirm	High	Sprint-1
		USN-2 (MOTHER)	As a user, I can register by entering my email, password, and confirming my password. I can access the location of my children using the credentials provided as a Mother.	I can access my account / dashboard and receive confirmation email & click confirm	High	Sprint-1
		USN-3 (GUARDIAN/ CARETAKER)	As a user, I can also 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 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 that I will receive alerts if my child crosses the geofence.	I can monitor the current location of my child.	High	Sprint-2
Customer (Web user)	Registration	USN-1 (FATHER)	As a user, I can register by entering my email, password, and confirming my password. I can access the location of my children using the credentials provided as a Father.	I can access my account / dashboard and receive confirmation email & click confirm	High	Sprint-1
		USN-2 (MOTHER)	As a user, I can register by entering my email, password, and confirming my password. I can access the location of my children using the credentials provided as a Mother.	I can access my account / dashboard and receive confirmation email & click confirm	High	Sprint-1
		USN-3 (GUARDIAN/ CARETAKER)	As a user, I can also 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

5.5   5.5

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
	Login	USN-4	As a user, I can log into the application by entering 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 that I will receive alerts if my child crosses the geofence.	I can monitor the current location of my child.	High	Sprint-2
Customer Care	Dashboard	USN-6	As a customer care service person, whenever I receive a complaint, I forward the complaint and ensure that the complaint is resolved.	I can keep track of all the complaints and the status of the complaints received.	Medium	Sprint-3
Administrator	Admin Dashboard	USN-7	As an administrator, I will take care of all the payment processes, queries and complaints and login credentials.	I can access all the customer details, payment details and complaints received.	High	Sprint-4

5.6   5.6

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

TITLE	DESCRIPTION	DATE
Literature Survey & Information Gathering	Gather/collect the relevant information on project use case, refer the existing solutions, technical papers, research publications etc.	30 AUGUST 2022
Prepare Empathy Map	Prepare the empathy map canvas to capture the user Pains & Gains, Prepare list of problem statements	5 SEPTEMBER 2022
Ideation	List the by organizing the brainstorming session and prioritize the top 3 ideas based on the feasibility & importance.	12 SEPTEMBER 2022
Proposed Solution	Prepare the proposed solution document, which includes the novelty, feasibility of idea, business model, social impact, scalability of solution, etc.	23 SEPTEMBER 2022

6.2   6.2

Problem Solution Fit	Prepare problem - solution fit document.	25 SEPTEMBER 2022
Solution Architecture	Prepare solution architecture document.	29 SEPTEMBER 2022

Customer Journey	Prepare the customer journey maps to understand the user interactions & experiences with the application (entry to	03 OCTOBER 2022

6.3   6.3

Functional Requirement	Prepare the functional requirement document.	16 OCTOBER 2022
Data Flow Diagrams	Prepare the data flow diagrams and submit for review.	18 OCTOBER 2022
Technology Architecture	Draw the technology architecture diagram.	13 OCTOBER 2022
Prepare Milestone & Activity List	Prepare the milestones & activity list of the project.	20 OCTOBER 2022
Project Development - Delivery Of Sprint-1, 2, 3 & 4	Develop & submit the developed code by testing it.	IN PROGRESS

Sprint Delivery Schedule

Project Planning Phase
Project Planning Template (Product Backlog, Sprint Planning, Stories, Story points)

Date	18 October 2022
Team ID	IBM-Project-17289-1659633579
Project Name	IoT Based Safety Gadget for Child Safety Monitoring & Notification
Maximum Marks	8 Marks

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Use the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1 (FATHER)	As a user, I can register by entering my email, password, and confirming my password. I can access the location of my children using the credentials provided as a Father.	2	High	Keerthi Priya
Sprint-1		USN-2 (MOTHER)	As a user, I can register by entering my email, password, and confirming my password. I can access the location of my children using the credentials provided as a Mother.	1	High	Namshika
Sprint-1		USN-3 (GUARDIAN/CA RETAKER)	As a user, I can also monitor the children's activities using a safety gadget monitoring system.	2	Medium	Aadithya Hariharan
Sprint-2	Login	USN-4	As a user, I can log into the application by entering email & password	1	Medium	Manickam
Sprint-2	Dashboard	USN-5	As a user, I can fix the geofence for my child's location so that I will receive alerts if my child crosses the geofence.		High	Keerthi Priya Namshika Aadithya Hariharan Manickam

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

7.1 Feature 1

7.1.1 It is a website application.

7.2 Feature 2

7.2.1 It can be used as a mobile application by scanning the QR Code available on the website.

7.3 Feature 3

7.3.1 Using an account, a parent can create multiple accounts for their multiple children.
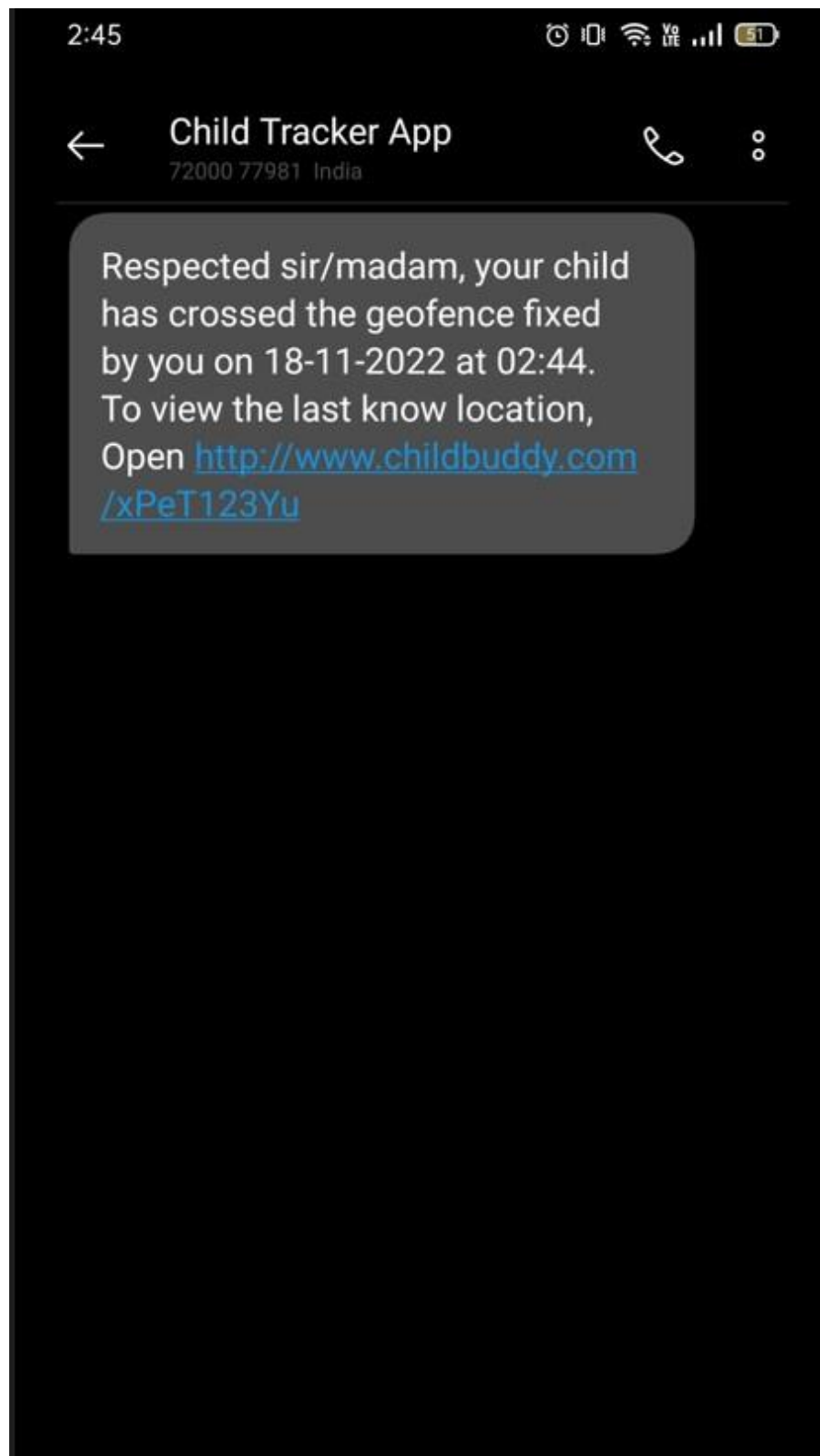
8. TESTING

8.1 Test Cases

8.1.1

Test ID	Test Case Description	Test Steps	Test Data	Expected Results	Actual Results	Pass/Fail

T01	The child resides within the geofence.	Log in to the application. Click on any of the trackers that the parent has set for a specific child.	['pramodsrk120@gmail.com',' OmSai Ram0025']	The child stays within the geofence.	The child stays within the geofence.	Pass

		Upon clicking on any tracker the child's location can be seen and tracked.				
T02	The child is outside the geofence.	Log in to the application. Click on any of the trackers that the parent has set for a specific child. Upon clicking on any tracker the child's location can be seen and tracked.	['rajin ik anthm ur alidha ra n@gm ai l.com' ,' Sept @2 022']	The child is not within the geofenc e.	The child is not within the geofenc e	Pass

8.2User Acceptance Testing

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 24x7.

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. APPENDI

X Source

Code :-

GitHub

Link:-

https://github.com/IBM-EPBL/IBM-Project-17289-1659633579

Project Demo Link :-

https://drive.google.com/file/d/1avAEVGkd5VMSJ0KSg0lKI6_g6TPiEu-Z/view?usp=sharing