Project Report

IoT Based Safety Gadget for Child Safety Monitoring and Notifications

TEAM ID:PNT2022TMID17569

TEAM LEAD: VETRIVEL K

TEAM MEMBER 1:

YOKESHWARAN M

TEAM MEMBER 2:

THIRUMOORTHY M

TEAM MEMBER 3: VIGNESH J

TABLE OF CONTENTS

1 INTRODUCTION

1.1 PROJECT OVERVIEW

This is a safety gadget project based on Internet of Things (IoT). Internet of Things (IoT) plays a significant role in every day today. 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 can take decisions by sensing the environment around the device. The development of sensors technology, availability of internet connected devices; data analysis algorithms make IoT devices act smart in emergency situations without human intervention. Child safety is a challenging problem nowadays due to antisocial elements in society. When children cannot complain about abuse which they face in their daily life to their parents.

In this project we have not used any Hardware. Instead of real-life conditions, sensors we used IBM IoT Simulator which acts as a digital child monitoring device as designed.

- **Project requirements:** Node-RED, IBM Cloud, IBM Watson IoT platform, Cloudant DB, IBM Device, geofence, Python 3.7, Open API platform.
- **Project Deliverables**: Application for IoT Based Safety Gadget for Child Safety Monitoring & Notification

1.2 PURPOSE

IoT based device improves the entire child safety system by monitoring the children in real-time. With the help of IoT in homes/day-cares not only protects the child but also reduces the pressure on parents using resources such as sensors and geofence.

As a working parent, a child needs to be monitored even at home in today's antisocial elements in society are capricious. Using IoT, a child's safety can be satisfied to a greater extent. The security of the child can be controlled from the application.

2   LITERATURE SURVEY

2.1   EXISTING PROBLEMS

Real-Time Child Abuse and Reporting System In the existing system, we use a voice recognition module in which the alert commands from the child are stored and kept for further reference. If the same child delivers the same command, it will compare with the alert command which was previously stored and set an emergency level according to the alert command. The device has a SIM used to send an alert message or call to trusted people. GPS is used to track live locations and it is used when needed. The server will search the respective device ID from the database and search for respective contacts according to that device ID and helps in alerting the registered guardians. The disadvantages in this project are,

i. The child could not produce the exact alert command during a panic condition.

ii. The command produced may not match with the previously stored command.

iii. This project requires manual intervention.

2.2   REFERENCES

Paper 1

Smart IOT (internet of things) Device for Child Safety and Tracking.

Child safety and tracking is a major concern as the number of crimes against children is 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 GPS, GSM & digital camera modules.

Paper 2

Child Safety Monitoring System Based on IoT.

The overall percentage of child abuse filed nowadays in the world is about 80%, out of which 74% are girls 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 were 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. Parents know what is happening remotely and can act if something goes wrong.

Paper 4

IoT Based Smart Gadget for Child Safety and Tracking.

This paper is towards child safety solutions by developing a gadget which can be tracked via its GPS locations and 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 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

To design a child monitoring device using Internet of Things. This application is focused on ensuring the safety of children. It helps parents or guardians to constantly track their child's whereabouts. It uses a geo-positioning system that sends a notification to the parent or guardian whenever the child crosses the geo-positioning system.

3   IDEATION & PROPOSED SOLUTION

3.1   EMPATHY MAP CANVAS
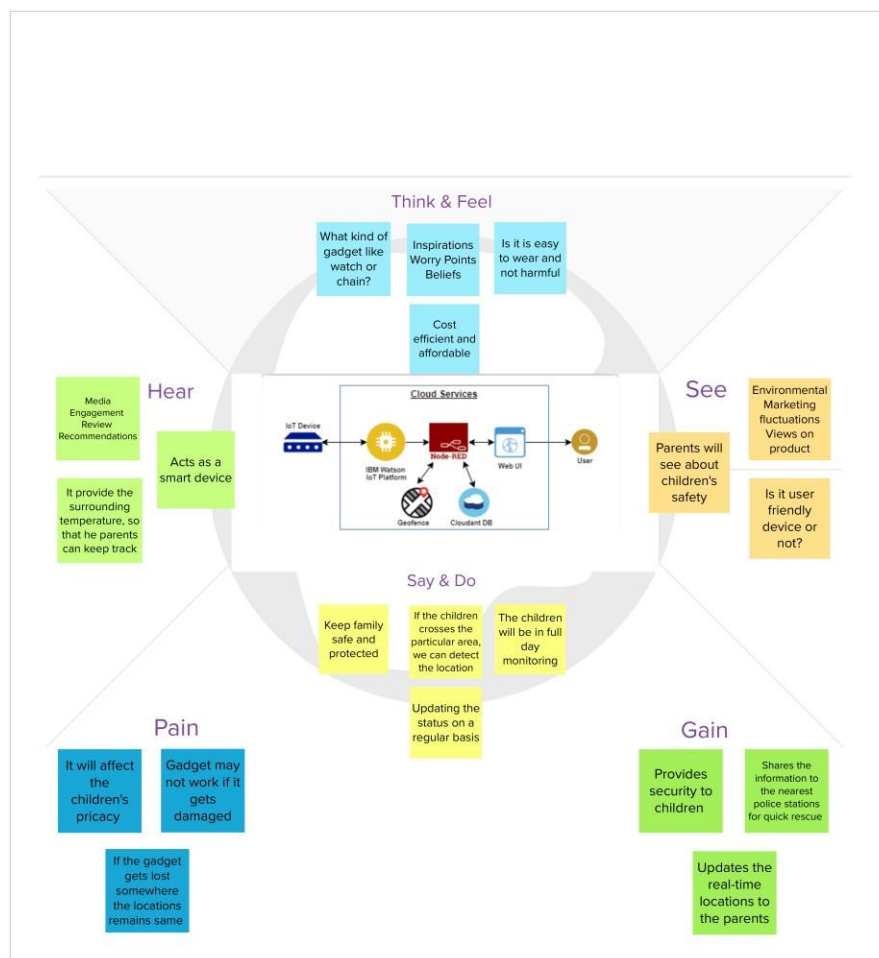
3.2   IDEATION & BRAINSTROMING
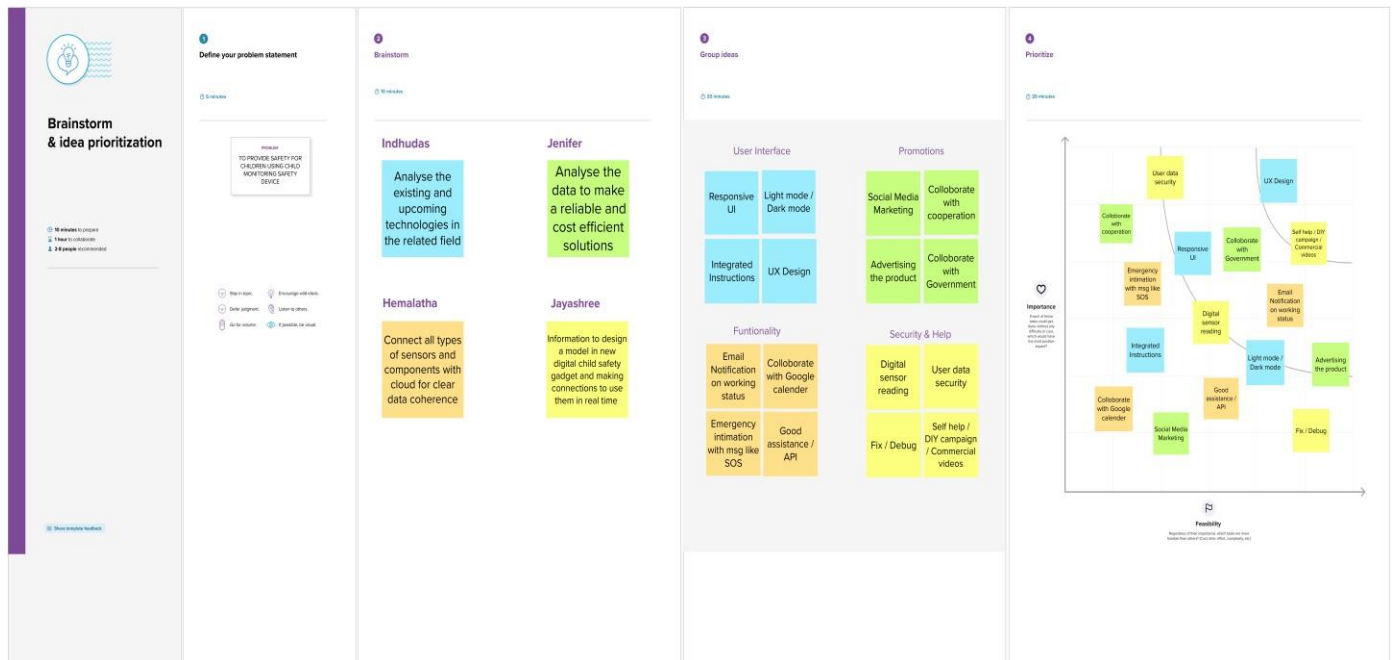
3.3 PROPOSED SOLUTION

- Sometimes as a new parent they forget to monitor the babies at the correct time. And by using this monitoring device it is easy to monitor the babies accordingly. And it is difficult sometimes to monitor the babies around the clock.
- The monitoring device reminds the parents when the baby woke up and if babies are sleeping or not. Parents can monitor them by using the monitoring device Connected with a camera.
- Reminds the parents to take care of the babies at correct time, Portable and easier for the caretakers to monitor using the monitoring Device.
- Easier for parents to monitor their babies using the monitoring device.
- Since it is a protocoled one, users can access it and maintain it properly.

3.4 PROBLEM SOLUTION FIT

1. CUSTOMER SEGMENT(S)	CS
Our customer refers to the parent or guardian of child. Demographic, psychographic, behavioral and geographic segmentation-divides customer(parents) into groups so that it is used to identify different groups within your target audience so that you can deliver more targeted and valuable messaging for them	

6. CUSTOMER CONSTRAINTS	CC
The cost of wearable technology must be cost effective ,large capability and should work in wide area range it should have a better battery life, the internet stability is important and it should have a strong secured feature like sensors that monitors the child and the device must maintain privacy and security	

5. AVAILABLE SOLUTIONS	AS
Merits: Through Wearable gadgets, parents may locate the youngster exactly. These wearable devices are used to monitor the child's surroundings, including audio and video, in an emergency. The wearable device continuously stores the data. Demerits: Wearable technology shouldn't be used all the time. Sometimes there is poor weather, possibly with thunder, and there may be serious environmental problems. The main causes of improper wearable device to user communication are network problems.	

2. PROBLEMS	J&P
The safety of children and women is a difficult issue in today's society because of the antisocial elements. The number of crimes is rising daily. High levels of surveillance are required in workplaces and schools to ensure the safety of children and women. A big part of ensuring safety is being played by smartphones, as various mobile-based applications offer alarm notifications.	

9. PROBLEM ROOT CAUSE	RC
• There is a present need for increased child security due to the rise in child kidnapping and missing child instances. Wearable technology is a type of security gadget. • Customers (Parents & Guardians) have their children in a safe and secure environment because there are several opportunities for child insecurity	

7. BEHAVIOUR	BE
Parents carry out their own security plans for their children. They always consider how to keep their child safe and secure.	

3. TRIGGERS	TR
Trigger The wearable device has some featuresin the present child position and continuously shards data. Because the parents chose this type of device for the safety of their children, these facilities make it simple to know the precise activities of the child and are also safe. This form of wearable technology is thus upsetting the customers.	
4. EMOTIONS: BEFORE / AFTER	EM
Before: The parents regularly come out or roam to observe their children's activities and characteristics because they feel anxious about them. After: The parents are reassured that their youngster is safe and concurrently scan the area for any unusual activities or inclinations.	

10. YOUR SOLUTION	SL
Child safety monitoring and alerting IOT-based safety gadget. When a youngster presses the emergency button in a life-threatening circumstance, audio and video are immediately taken and forwarded to the parents as a location-specific alert message	

8. CHANNELS of BEHAVIOUR	CH
1. ONLINE We update the child's information in the web application 8.2 Offline Since you are not online, the application displays the most recent location data for the child under observation.	

4 REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENTS

Following are the functional requirements of the proposed solution.

FR NO.	FUNCTIONAL REQUIRMENTS(EPIC)	SUB REQUIREMENT (STORY/SUB-TASK)
FR-1	User Registration	• Enlistment through account and through Gmail • Registration through Form • Registration through Gmail Registration through LinkedIn
FR - 2	User Confirmation	• Email confirmation and confirmation by OTP

		• Confirmation via Email
FR - 3	User Notification	• Notification to registered mobile number via message • Notified through mobile and mail
FR - 4	User location check	• Location check through account
FR - 5	Authentication	• Only the authorized person for that product will know Ensures security
FR - 6	User Interface	• The Inventor Able to see the location of children when they are out of geofence will also track the exact information about the children

Non-functional Requirements: Following are the non-functional requirements of the proposed solution. FR No. Non-Functional Requirement Description NFR – 1 Usability • Allows parents to track and assist their child's location. Sound the alarm in an emergency. • Accessed through Mobile App Showing location (latitude and longitude) of child and other measures to ensure safety like notification. Portable and comfortable to use. NFR – 2 Security • Creates a secure environment when the child moves around. • Database security and ensuring the safety of the product while in use. NFR – 3 Reliability • Increased reliability towards technology and reduced reliability towards guardians. • Once logged in, the webpage is available until logging out of the app, and a comfortable platform or creates a good environment for users to use. NFR – 4 Performance • High performance in the sense usage and security. • Each page must load within 4 seconds and database needs to be updated every few seconds and a notification must be sent immediately

if a change in the child's location is seen. NFR – 5 Availability • Reliable use of electricity and all-time delivery. • The data must be available whenever needed and the product should be able to be used at any time. NFR – 6 Scalability • High stage with growth in performance. • The process must be flexible to use at any time and versatile.

4.2   NON-FUNCTIONAL EQUIREMENTS

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

FR No.	Non-Functional Requirement	Description
NFR – 1	Usability	• Allows parents to track and assist their child's location. Sound the alarm in an emergency. • Accessed through Mobile App Showing location (latitude and longitude) of child and other measures to ensure safety like notification. Portable and comfortable to use.
NFR – 2	Security	• Creates a secure environment when the child moves around. • Database security and ensuring the safety of the product while in use.
NFR – 3	Reliability	• Increased reliability towards technology and reduced reliability towards guardians. • Once logged in, the webpage is available until logging out of the app, and a comfortable platform or creates a good environment for users to use.
NFR – 4	Performance	• High performance in the sense usage and security. • Each page must load within 4 seconds and database needs to be updated every few seconds and a notification must be sent immediately if a change in the child's location is seen.
NFR – 5	Availability	• Reliable use of electricity and all-time delivery.

		• The data must be available whenever needed and the product should be able to be used at any time.
NFR – 6	Scalability	• High stage with growth in performance. • The process must be flexible to use at any time and versatile.

5   PROJECT DESIGN

5.1   DATA FLOW DIAGRAMS
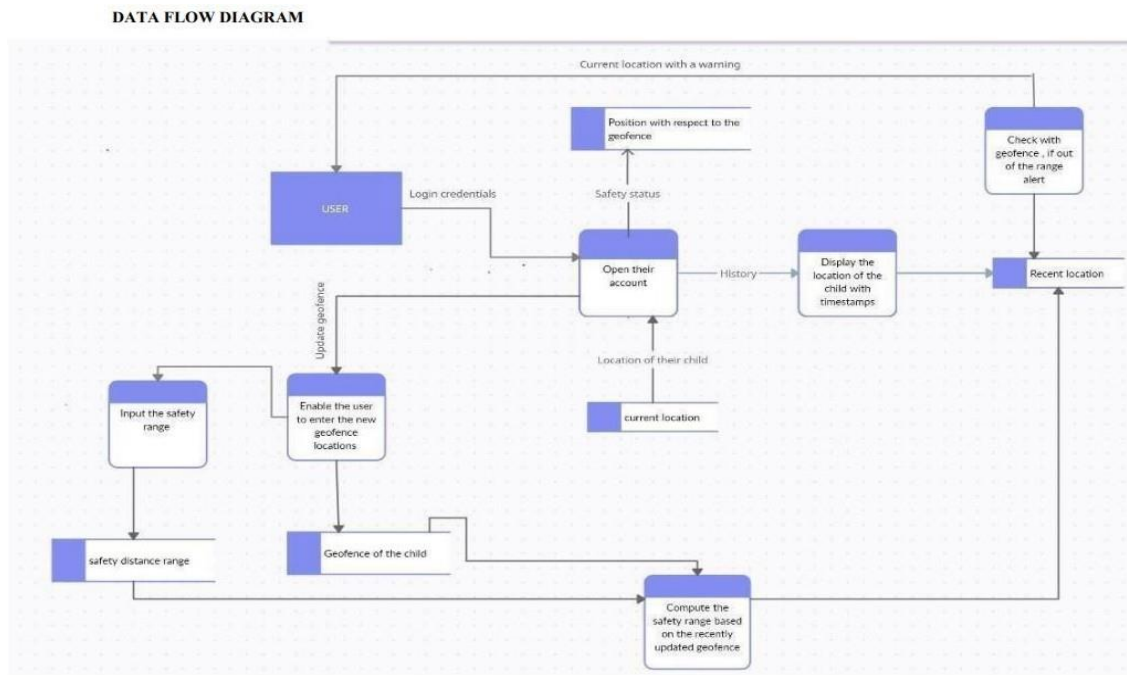
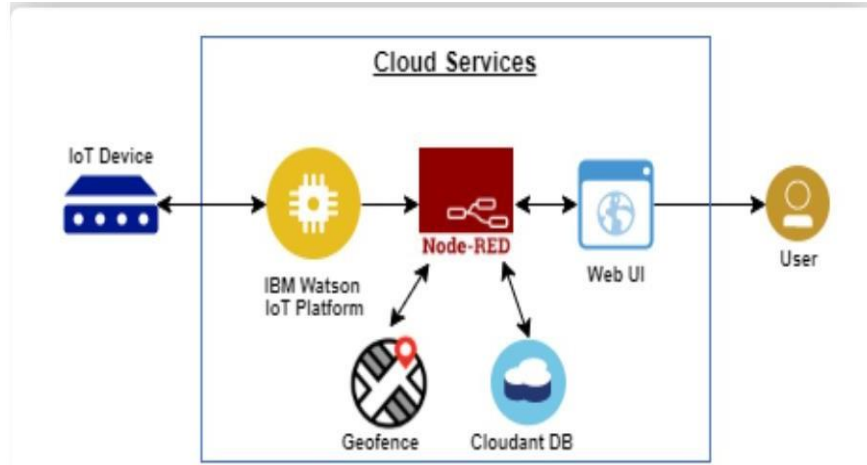## 5.2   SOLUTION & TECHNICAL ARCHITECTURE

TABLE-1; COMPONENTS & TECHNOLOGIES

S.NO	COMPONENT	DESCRIPTION	TECHNOLOGY
1.	User Interface	How a user interacts with an 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 Development on Local system / Cloud Local 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

5.3   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, 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

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 pain & gains, Prepare the list of problem statements	5 September 2022
Ideation	List 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
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.	03 October 2022
Functional Requirement	Prepare the functional requirement document.	16 October 2022

Data Flow Diagrams	Prepare the data flow diagrams and submit them for review.	18 October 2022
Technology Architecture	Draw the technology architecture diagram.	19 October 2022
Prepare Milestone & Activity List	Prepare the milestones & activity list of the project.	20 October 2022
Prepare Development – Delivery od Sprint – 1,2,3 & 4	Develop & submit the developed code by testing it.	In Progress

6.2   SPRINT DELIVERY SCHEDULE

SPRINT	FUNCTIONAL REQUIREMENTS (EPIC)	USER STORY NUMBER	USER STORY/ TASK	STORY POINTS	PRIORITY	TAM MEMBERS
Sprint-1	Registration	USN-1(MOTHER)	As a user, I can register by entering my email, password and confirming my password. I can access the location of the children using the credentials provided	2	High	VETRIVEL

Sprint						
			as a mother.			
Sprint-1		USN-2(FATHER)	As a user, I can register by entering my email, password and confirming my password. I can access the location of the children using the credentials provided as a father.	1	High	Yokeshwaran
Sprint-1		USN-3(GUARDIAN/CARETAKER)	As a user, I can also monitor the children's activities using a safety gadget monitoring system.	2	Medium	Thirumoorthy
Sprint-2	Login	USN-4	As a user, I can log into the applicatio	1	Medium	Vetrivel

			n by entering email & password.			
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	Vetrivel Yokeshwaran Vignesh

6.3   REPORTS FROM JIRA

7   CODING & SOLUTIONING

7.1   FEATURE 1

website application.

7.2   FEATURE 2

Used as a mobile application by scanning the QR Code available on the website.

8   TESTING

8.1   TEST CASES

Test ID	Description	Test Steps	Testing Data	Expected Results	Actual Results	Work Status

| 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. Upon clicking on any tracker the child's location can be seen and tracked. | [vetrivelk 61161910 6102@g mail.com Vetri@12 3] | The child stays within the geofence. | The child stays within the geofence. | Working |
| 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. | [yogaling a007@g mail.com , Thavama ni@123] | The child is not within the geofence. | The child is not within the geofence | Working |

8.2   USER ACCEPTANCE TESTING

9 RESULTS

9.1 PERFORMANCE METRICS

- Fast updating of child's location
- User Friendly interface
- Low data involvement
-

10 ADVANTAGES & DISADVANTAGES

10.1 ADVANTAGES

- Easy Availability and Affordability.
- It is sharing the information with the nearest police stations.
- It guarantees peace of mind for parents.
- It provides security for the children and secures the feeling of parents.
- Tracking of missing kids can be made easily.

- Geofencing child's movements through APIs.
- It provides parents with a real-time location.

10.2 DISVANTAGES

- If the gadget gets lost somewhere then the location remains the same.
- It will affect the children's privacy.
- If the gadget is damaged, it will not work here then the location remains the same

11 CONCLUSION

An IoT Web Application is built for smart security system using Watson IoT platform, Geofence, Cloudant DB, IBM cloud and Node-RED.

12 FUTURE SCOPE

- The application can be made offline for people to access their child's Location without internet connection.
- 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

SOURCE CODE

```
import json

import wiotp.sdk.device

import time

myConfig = {
    "identity": {
        "orgId": "43j9ja",
        "typeId": "NODE",
```

```
      "deviceId": "1501"
   },
   "auth": {
      "token": "012345678"
      }
}


client = wiotp.sdk.device.DeviceClient(config=myConfig,
logHandlers=None)
client.connect()


while True:
   name= "diviya"

   #in area location


   #latitude=9.262304
   #longitude= 78.875537


   #out area location


   latitude= 20.3452
   longitude= 78.5488783
   mydata={'name': name, 'lat':latitude,'lon':longitude}
```

```
    client.publishEvent(eventId="status", msgFormat="json",
data=mydata, qos=0, onPublish=None)

    print("Data published to IBM IoT platform: ",mydata)

    time.sleep(20)

client.disconnect()
```

GitHub
https://github.com/IBM-EPBL/IBM-Project-31365-1660199867

Project Demo Link