

IOT -BASED SAFETY GADGET FOR CHILD SAFETY MONITORING AND NOTIFICATION

SUBMITTED BY

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IN

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**RAJALAKSHMI
ENGINEERING COLLEGE**

An AUTONOMOUS Institution
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1. INTRODUCTION

1.1 Project Overview

To make ease of monitoring children remotely by parents, this system is proposed. Parents often worry about their children and they found difficulties in monitoring their children 24x7. To overcome this, we are going to design an application through which parents can monitor them, set geofence for them and notified when children go out of the range. This can be done using MIT app inventor, Node-Red, IBM cloud, python IDE etc. This system requires internet or WiFi connectivity, GPS to lively monitor.

1.2 Purpose

It assists parents to monitor their children remotely. In case situations happen, notifications will be sent to parents so that actions can be taken. Through this, child safety can be ensured and crime rate will be reduced. This is done by sharing the live location frequently and verifying it whether it is present inside the safe zone or not. Sharing live location can be done through smartphones using GPS and mobile network. Child's surroundings can be located with the help of accurate and precise real-time location.

2.

LITERATURE SURVEY

2.1 Existing problem

Having live location of children through whatsapp or any other apps is not efficient and satisfactory. The project aims to create a system that allows the parents to keep a track of their child when they are out of sight using geofence. Geofence is defined as geographical boundaries set up to watch out for the child's location. When the child goes out of geofence it sends the exact coordinates to the parent using the application. In this method there is no certain flow setup to watch out for the child's exact location.

2.2 References

- [1].Gao, Zhigang, Hongyi Guo, Yunfeng Xie, Yanjun Luo, Huijuan Lu, and Ke Yan. "ChildGuard: A child-safety monitoring system." IEEE MultiMedia 24, no. 4(2017): 48-57.

- [2]. Kaur, Deepinder, Ravita Chahar, and Jatinder Ashta. "IOT Based Women Security: A Contemplation." In 2020 International Conference on Emerging Smart Computing and Informatics (ESCI), pp. 257-262. IEEE, 2020.

- [3]. Nagamma, H. "IoT based smart security gadget for women's safety." In 2019 1st International Conference on Advances in Information Technology (ICAIT), pp. 348-352. IEEE, 2019.

- [4]. Kathiravan, M., M. Pavan Kumar Reddy, Muthukumaran Malarvel, A. Amrutha, P. Harshavardhan Reddy, and S. Kavitha. "IoT-based Vehicle Surveillance and Crash Detection System." In 2022 International Conference on Applied Artificial Intelligence and Computing (ICAAIC), pp. 1523-1529. IEEE, 2022.
- [5]. Roy, Sulochana. "IOT Enabled Security System for Android users." In 2018 International Conference on Recent Innovations in Electrical, Electronics & Communication Engineering (ICRIEECE), pp. 2312-2317. IEEE, 2018.
- [6]. Noorin, Maviya, and K. V. Suma. "IoT based wearable device using WSN technology for miners." In 2018 3rd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT), pp. 992-996. IEEE, 2018.
- [7]. Gull, Hina, Dalal Aljohar, Reem Alutaibi, Dalia Alqahtani, Muna Alarfaj, and Rahaf Alqahtani. "Smart School Bus Tracking: Requirements and Design of an IoTbased School Bus Tracking System." In 2021 5th International Conference on Trends in Electronics and Informatics (ICOEI), pp. 388-394. IEEE, 2021.

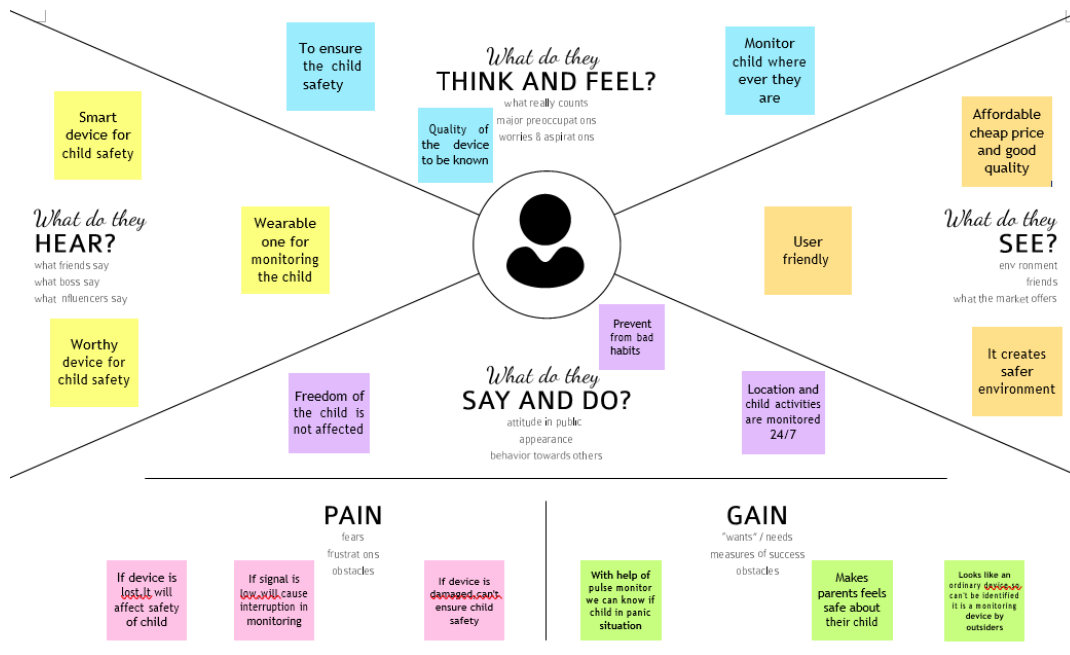
2.3 Problem statement Definition

The Problem Statement is, a parent who often worried about safety of their children. They trying to monitor their children for safety. But having their live location through WhatsApp is not satisfactory. Because it is not that much accurate and they should have a look whenever they want to have and so they maynot aware when they face any kind of danger.

If the kid is trying to inform their parents when they face any kind of danger. But communicating their parents through call or text is not possible in some situations. Because when someone restricts to communicate, they won't beable to call and there may be lost signal sometimes. Then which makes feel they are not much safer without their parents.


3. IDEATION & PROPOSED SOLUTION

3.1 Empathy map Canvas



An empathy map is a collaborative tool teams can use to gain a deeper insight into their customers. Much like a user persona, an empathy map can represent a group of users, such as a customer segment. To assist parents in keeping tabs on where their kids are at all times, this initiative was developed. Nowadays, kids are mostly easily swayed by their friends, and they could be tricked or kidnapped by strangers. Parents can even intervene if their children are unsteady or in an inappropriate location by pressing the special button that has been introduced. WFPS, a WIFI positioning system that doesn't connect to the internet but connects to Wi-Fi access points, will be used to track the child's whereabouts.

3.2 Ideation & Brainstorming



Brainstorm & idea prioritization

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

🕒 10 minutes to prepare
👥 1 hour to collaborate
👤 2-8 people recommended

Before you collaborate
A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

🕒 10 minutes

- A Team gathering**
Define who should participate in the session and send an invite. Share relevant information or pre-work ahead.
- B Set the goal**
Think about the problem you'll be focusing on solving in the brainstorming session.
- C Learn how to use the facilitation tools**
Use the Facilitation Superpowers to run a happy and productive session.

[Open article](#) →

1 Define your problem statement
What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

🕒 5 minutes

Problem

Measures for Child Safety Monitoring

EXPLANATION

Child safety monitoring has become a major concern everywhere. Parents cannot monitor their children 24x7. They need an external factor to take care over them. Children can't able communicate to their parents or police.

2 Brainstorm
Write down any ideas that come to mind that address your problem statement.

🕒 10 minutes

TIP

You can select a sticky note and hit the pencil (switch to sketch) icon to start drawing!

Person 1	Person 2	Person 3	Person 4
To create an application that updates location of their children 24x7	Send notifications to the caretakers when users are in danger	To create a boundary similar to geofence	Online security should also be provided
Children should be able to use it at ease and there shouldn't be any malfunction	Also can record mobile activity time for digital wellbeing of children	A application that shows the precise activity of the child	Notify parents when their children are going to new places

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

🕒 20 minutes

To create an application that provides live location of children 24x7.

Online security and digital wellbeing should be provided.

Notifications to be sent to parents when they are in danger or when they do abnormal activities

Notify when they are out of their geofence

TIP



Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

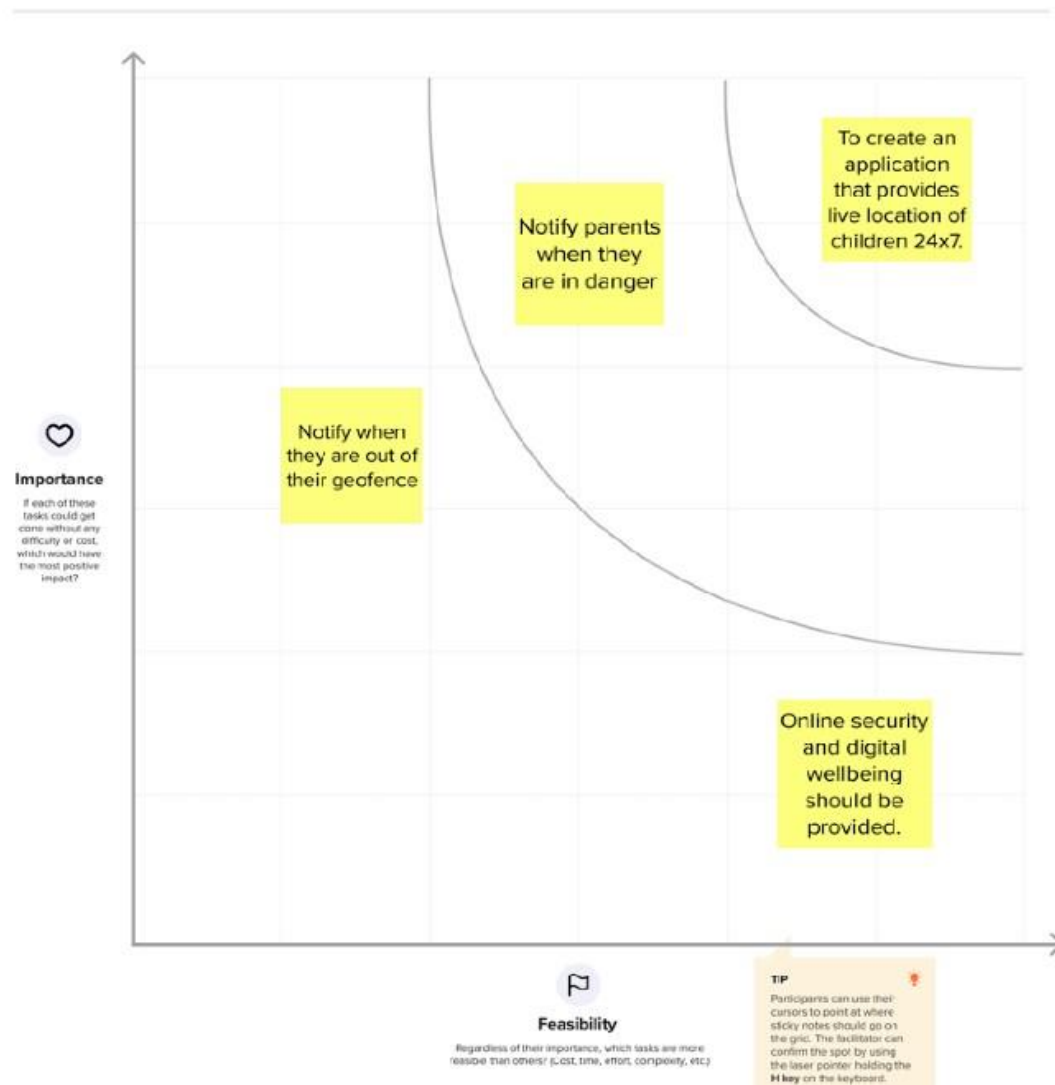
Step-3: Idea Prioritization

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

⌚ 20 minutes



3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	When someone near the child this device alerts the parents whereas the parents in another distanced place.
2.	Idea/Solution description	The aim of this device is to provide safety to the child by allowing the parent to locate the child and view their surroundings. This device can be used to monitor the temperature and motion of the child. The other features of the device are emergency light and alarm buzzer which are activated when the ultrasonic sensor sense something near child. After automatically send the SMS to parents and Call also received to the parents.
3.	Novelty/Uniqueness	The enhancements will be adding more features, software, applications, hardware to make the proposed system.
4.	Social Impact/ Customer Satisfaction	The feedbacks of parents and children were highly promising. Results showed that 86.4% of the parents are satisfied with the time controller, around 91.1% of the children are satisfied with the proposed interface and 100% of the children are satisfied with the multiple sessions of the time Allowed and video algorithm
5.	Business Model (Revenue Model)	IOT based risk monitoring device for child is done through smart device i.e., smart watch Through this device their spectral parameters are monitored by The connected person.
6.	Scalability of the Solution	It can be given up to 4 out of 5.

In this proposed solution the parents about activity of their children to ensure their safety. A Iot based safety location tracking gadget backed with IBM cloud which sends their current location status to their parents. Then IBM cloud is used to save the priority location of children where the children are allowed to go. By using IOT its totally done in online and parents no need to worry about their child's safety.

3.4 Problem Solution Fit

Project Title: IoT Based Safety Gadget for Child Safety Monitoring and Notification

**Project Design Phase-I Solution Fit Template
PNT2022TMID19077**

Team ID:

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS Who is your customer? working parents who are not able to safely their child (0-5) willing to use these.	6. CUSTOMER CONSTRAINTS CC What constraints prevent your customers from taking action or limit their choices of solutions? i.e., spending power, budget, no cash, network connection, available devices. For predictive analytics to make the most impact on child protection practice and outcomes, it must embrace established criteria of validity, equity, reliability, and usefulness.	5. AVAILABLE SOLUTIONS AS Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e., pen and paper. The most important reason for monitoring each child's development is to determine whether the child's is on track. Looking for developmental milestones is important to understand each child's development and behaviour.	Explore AS, differentiate
	2. JOBS-TO-BE-DONE / PROBLEMS J&P Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one, explored different sides. Parents can't be able to save their child from their workplace and over parenting tends to deprive children of bad and negative experiences, which are crucial to a child's emotional growth. One form of overparenting is excessive monitoring.	9. PROBLEM ROOT CAUSE RC What is the real reason that this problem exists? What is the backlit's exactly what it sounds like—an exercise to determine the root cause for a failure or issue, so that the solution is based on the true problem, not just addressing the symptoms.	7. BEHAVIOUR BE What does your customer do to address the problem and get the job done? The parents can monitor their child from their workplace when children have frequent emotional outbursts, it can be a sign that they haven't yet developed the skills they need to cope with feelings like frustration, anxiety and anger. Handling big emotion in a healthy, mature way requires a variety of skills, including.	
3. TRIGGERS T What triggers customer to act? i.e., seeing their neighbour installing solar panels, reading about a more efficient solution in the news. It's not the situation or the feeling that the problem, it's how kids think about these things and what they say to themselves that causes problems and child (0-2) years didn't know about anything this will trigger	10. YOUR SOLUTION S If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality. If you are working on a new business proposition, then keep it blank until you fill in the canvas and come	8. CHANNELS of BEHAVIOUR C 8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7 8.2 OFFLINE	Identify strong TR & EM	
4. EMOTIONS: BEFORE/ AFTER EM How do customers feel when they face a problem or a job and afterwards? i.e., lost, insecure > confident, in control, use it in your communication strategy & design. BEFORE: Divergent thinking is a style of thinking that generates a range of alternative solutions or ideas to a problem that has multiple answers. AFTER: Feeling protective of your child is often manifested in the form of motherly instincts. The feeling of protecting and wanting the best for your child is the ultimate parenting goal	eup with a solution that fits with customer limitations, solves a problem and matches customer behaviour. • The most important reason for monitoring each child's activities is to determine whether a child's activities is on track. Using ultrasonic sensors senses something near child and activate piezo buzz and SMS and dialling function to parents will be done immediately.	What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development. Understanding how children perceive and interact with the point of sale has been the focus of various studies in the past decade. It is well documented that children have preferences in terms of shopping destinations. For working parents necessarily needed one.		

4. REQUIREMENT ANALYSIS

4.1 Functional Requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Register through Number or email
FR-2	User Confirmation	Confirmation via Email or message with generated OTP
FR-3	User Login	login through User Id and Password or through facebook
FR-4	Network Connectivity	Internet connection via wifi / mobile data
FR-5	IBM IoT Platform	Location coordinates are extracted from cloud
FR-6	Node-RED	Coordinates are converted into map location Geofence (Virtual boundary) to be set
FR-7	Fast2sms	Popup Notification sent through message

4.2 Non-Functional Requirements

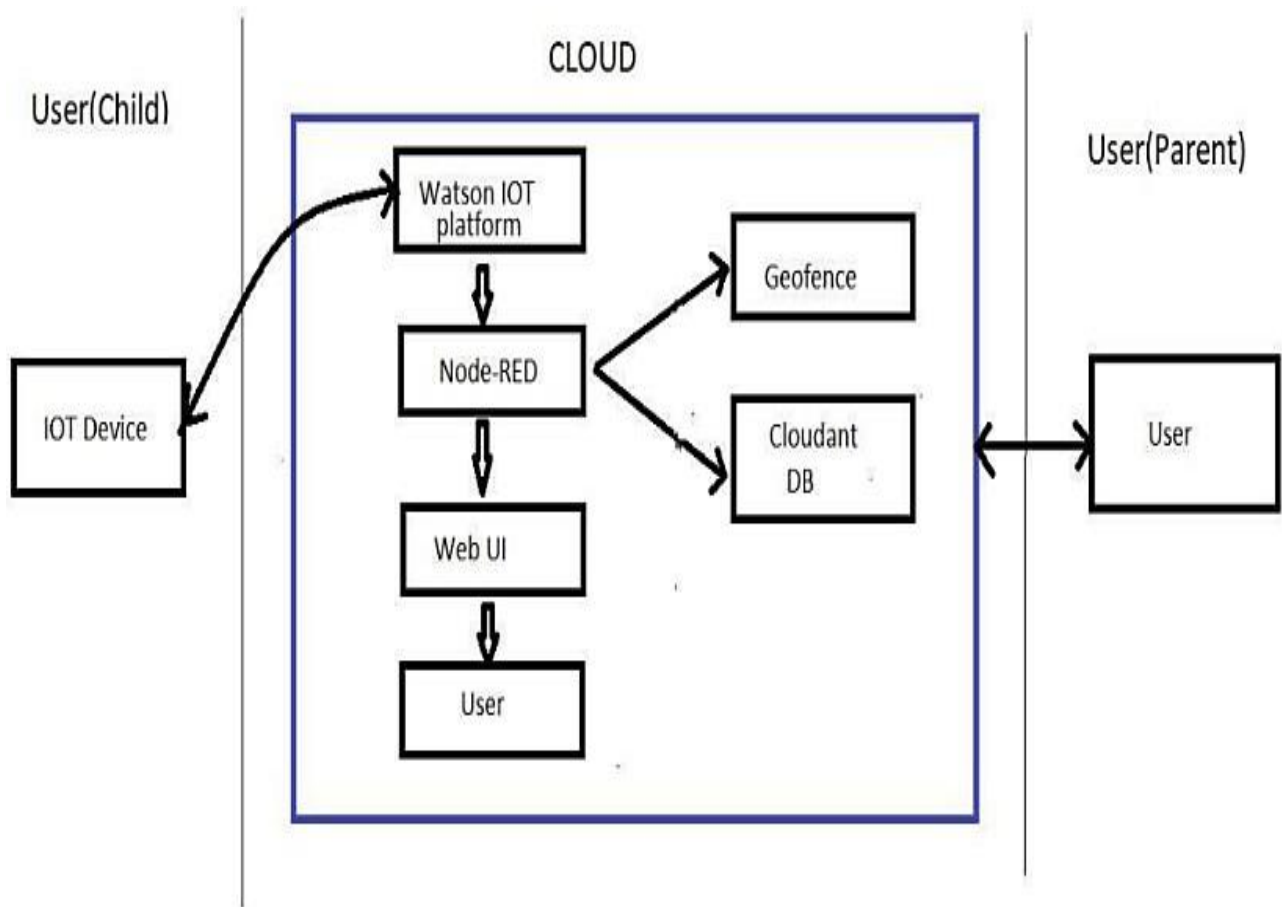
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Locating and monitoring children and sending notification to parents at ease
NFR-2	Security	Secured data in the cloud database and prevention of data from hackers
NFR-3	Reliability	Safety of the children is always ensured
NFR-4	Performance	Notifies when the children go out of geofence
NFR-5	Availability	Check whether the children are present or within the geofence
NFR-6	Scalability	Area can be either local or larger areas based on the caretaker's preference

5.

PROJECT DESIGN

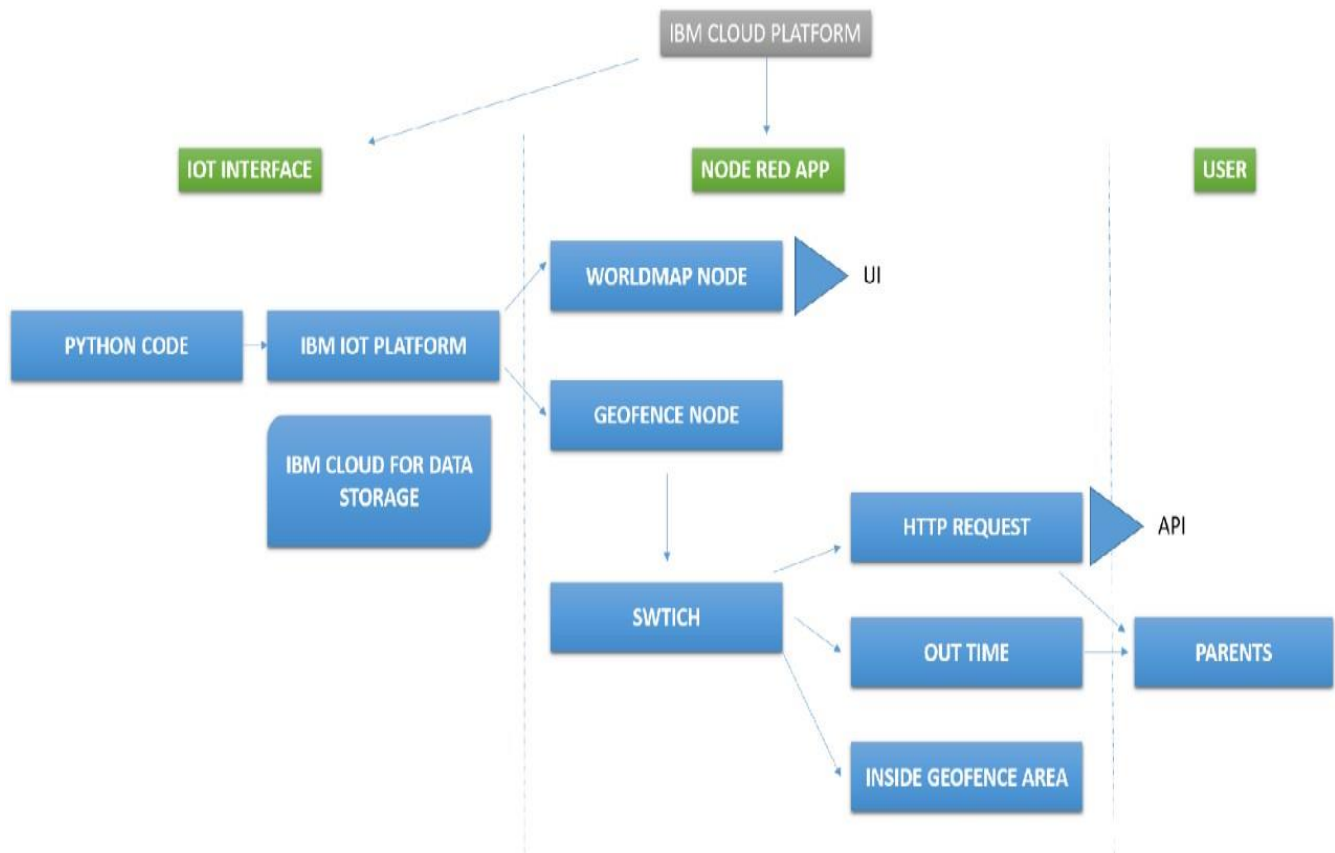
5.1 Data Flow Diagrams

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically, It shows how data enters and leaves the system, what changes the information, and where data is stored.



5.2 Solutions & Technical Architecture

Technical Architecture:



5.3 User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Web user)	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 Facebook	I can register & access the dashboard with Facebook Login	Low	Sprint-2
		USN-4	As a user, I can register for the application through Gmail	I can Check back whether the application is recieved	Medium	Sprint-1
	Login	USN-5	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard	USN-6	As a User, I can view the Dashboard	I can view the locations which is stored in the database of the child via dashboard	High	Sprint-2
Customer Care Executive		USN-7	As a customer care executive, I will detect the problems	I will detect the problems and correct them if the device face any	Medium	Sprint-3
Administrator		USN-8	As an administrator, I ensure the efficiency of the device	I will ensure efficiency, cost, etc	High	Sprint-4

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Simulation creation	USN-1	Connect Sensors and Arduino with python code	2	High	ABDUR RAHMAN A ADHITHYA NER PV DEV ADHITHYA M ASHWIN BALAJI B
Sprint-2	Software	USN-2	Creating device in the IBM Watson IoT platform, workflow for IoT scenarios using Node-Red	2	High	ABDUR RAHMAN A ADHITHYA NER PV DEV ADHITHYA M ASHWIN BALAJI B
Sprint-3	MIT App Inventor	USN-3	Develop an application for the Smart Gadget for Child Safety using MIT App Inventor	2	High	ABDUR RAHMAN A ADHITHYA NER PV DEV ADHITHYA M ASHWIN BALAJI B
Sprint-3	Dashboard	USN-3	Design the Modules and test the connect to data base.	2	High	ABDUR RAHMAN A ADHITHYA NER PV DEV ADHITHYA M ASHWIN BALAJI B
Sprint-4	Web UI	USN-4	To make the user to interact with software and find the Location	2	High	ABDUR RAHMAN A ADHITHYA NER PV DEV ADHITHYA M ASHWIN BALAJI B

6.2 Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	30 Oct 2022	20	30 Oct 2022
Sprint-2	20	6 Days	31 oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	08 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

7.

CODING & SOLUTIONING

7.1 Feature

```
import time

import random

#import ibmiotf.application

import ibmiotf.device import

sys

config= {"org":" 6l9i71",

"type":" IoT ",

"id":"12344321",

"auth-method":"use-token-auth",

"auth-token":"12345678"}

client= ibmiotf.device.Client (config)

client.connect()

def myCommandCallback (cmd):

a=cmd.data

if len(a["command"])==0:

pass

else:

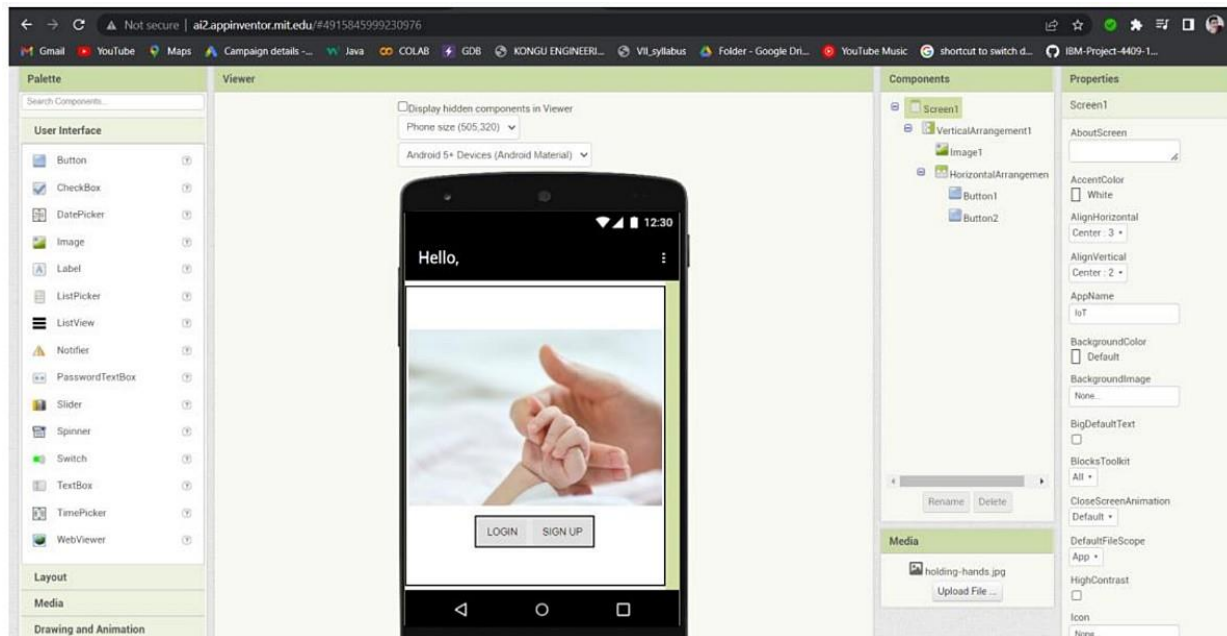
print(a["command"]) def

pub (data):
```

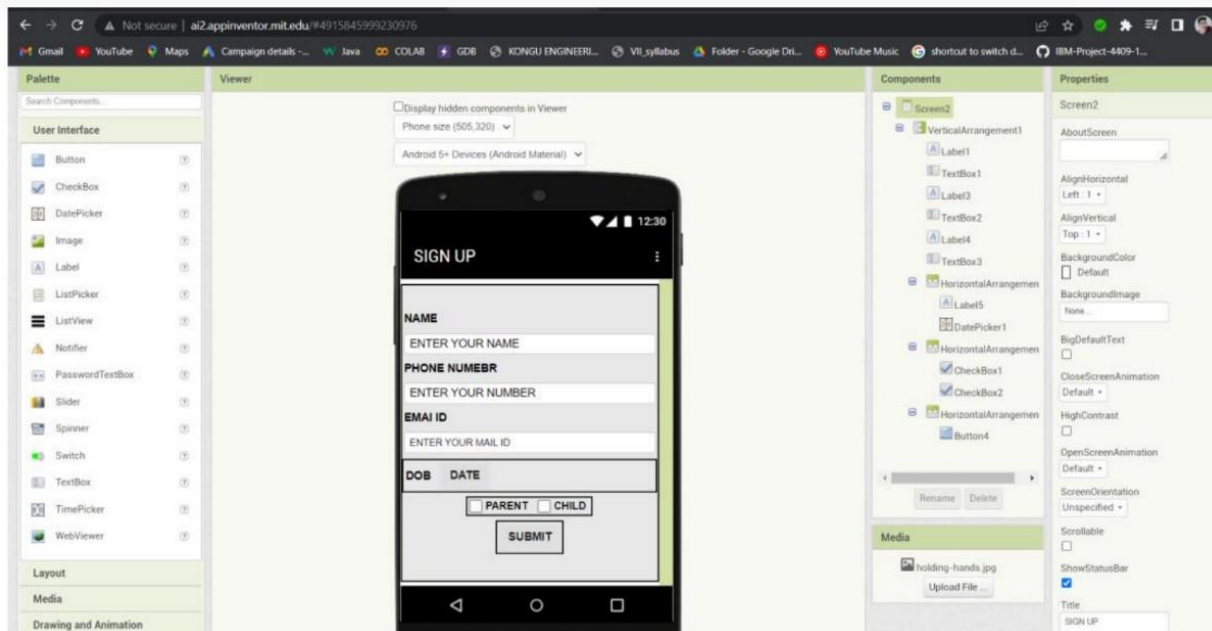
```
client.publishEvent (event="status", msgFormat="json",data=data, qos=0)print("Published data  
Successfully: %s",data)  
  
while True:  
  
    name= "Childtracker"#in  
  
    area  
  
    #latitude= 9.8796  
  
    #longitude= 78.0810  
  
    #out area latitude= 9.95143 longitude= 78.1158  
  
    data={'name': name, 'lat':latitude,'lon':longitude}  
  
    pub(data)  
  
    client.commandCallback = myCommandCallback  
  
    time.sleep(2)  
  
    client.disconnect()
```

7.2 Solutioning

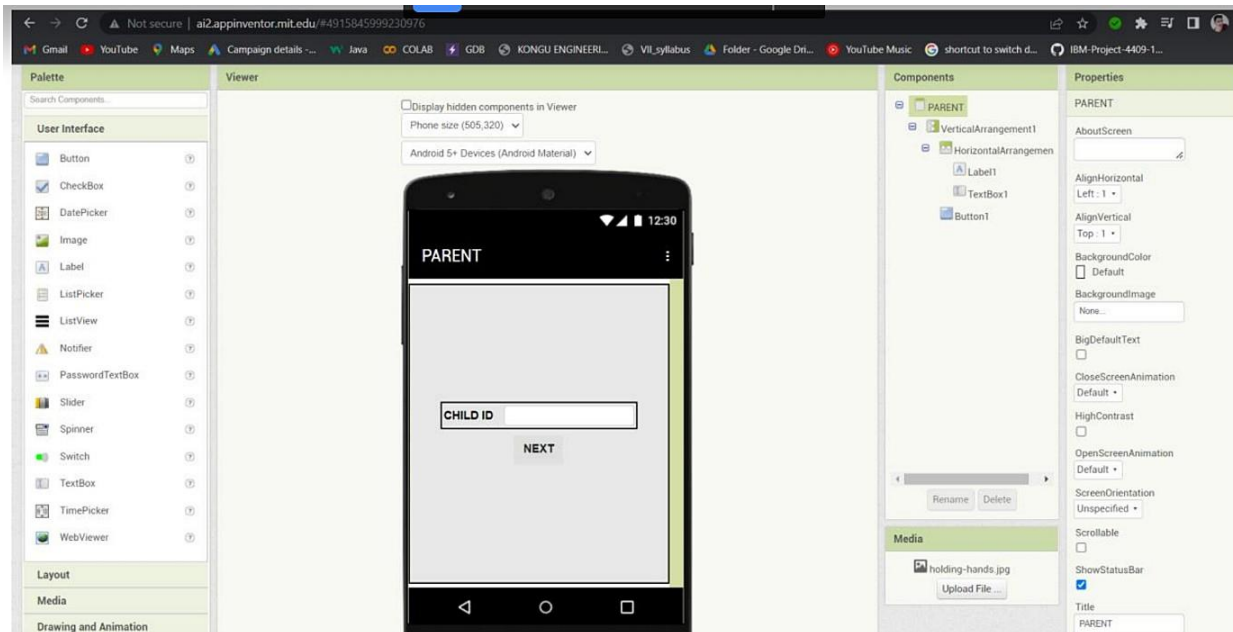
SPRINT 1



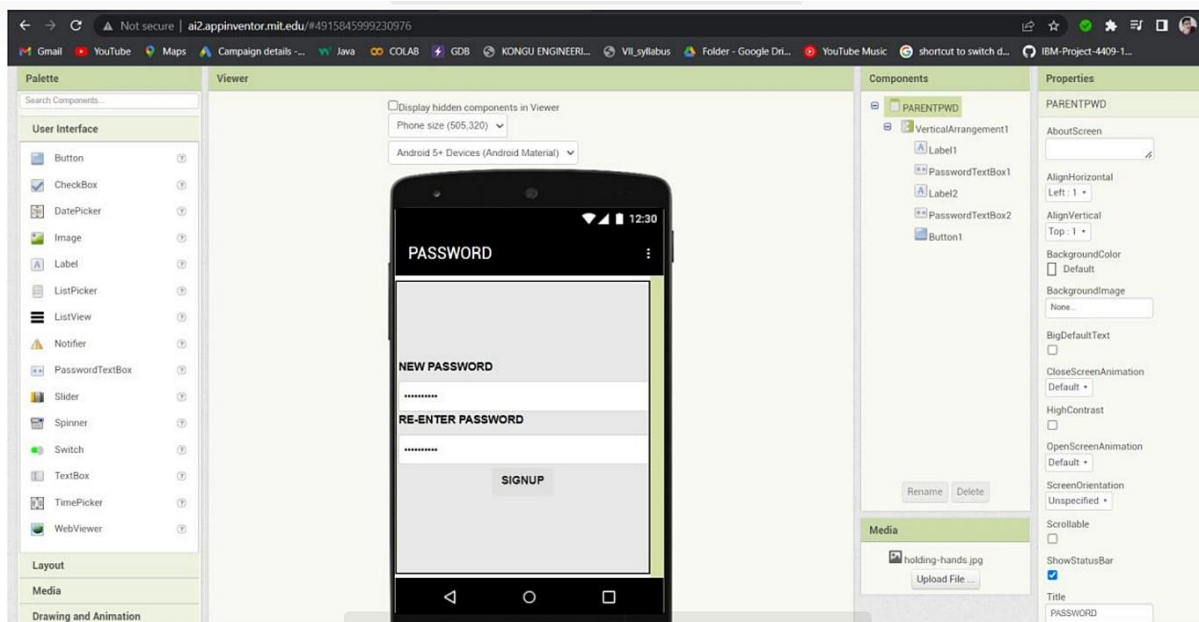
Sign up page:



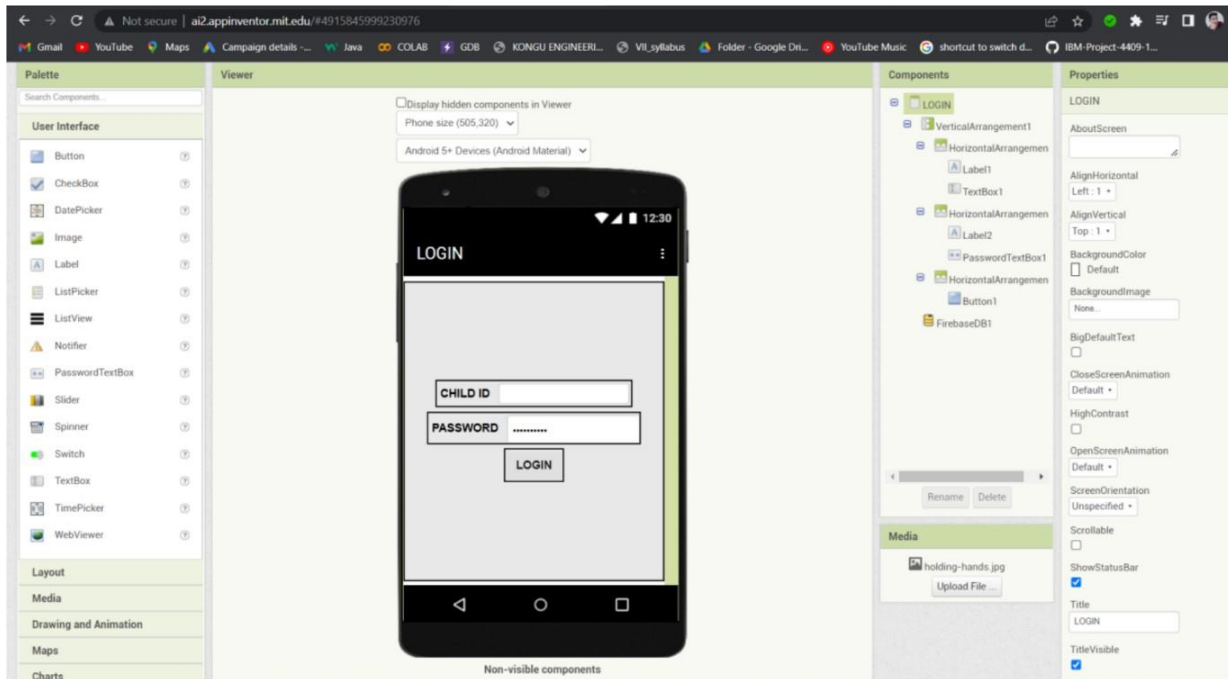
Parent application screen:



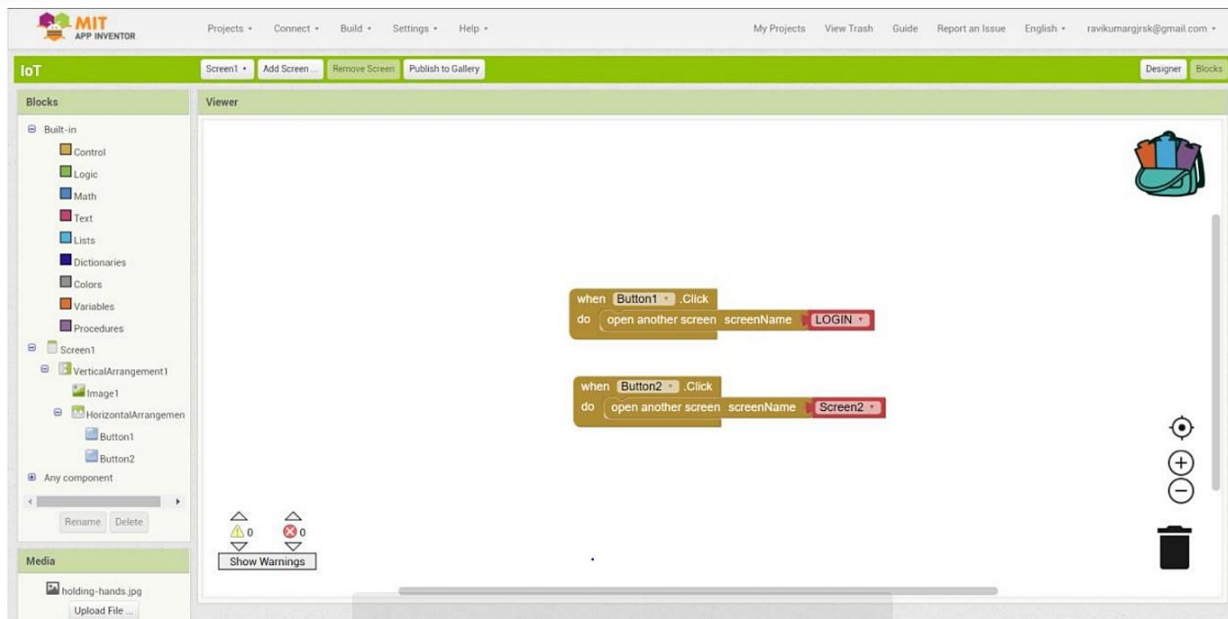
Password setup:

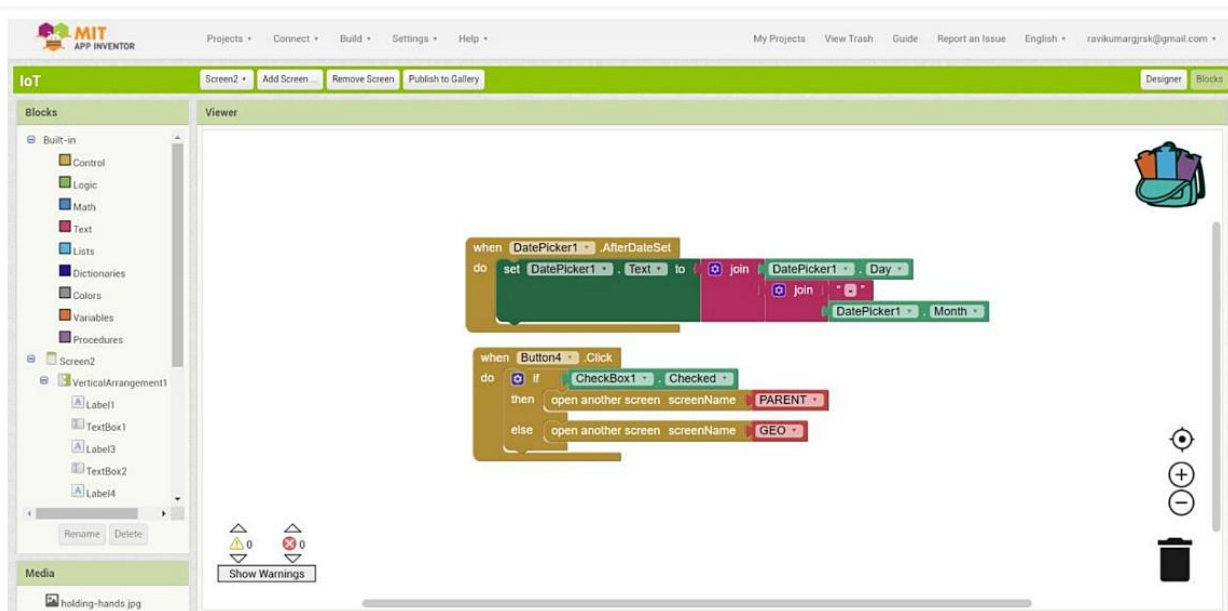


Login page:



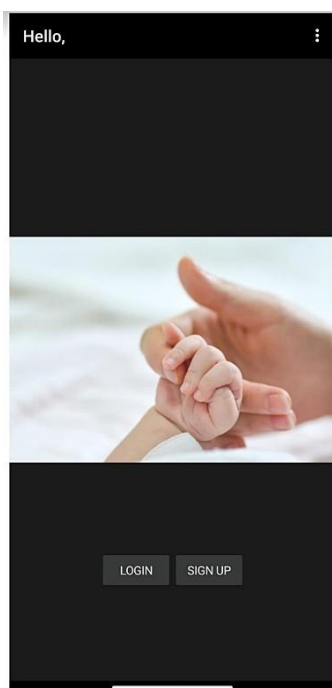
Back end:



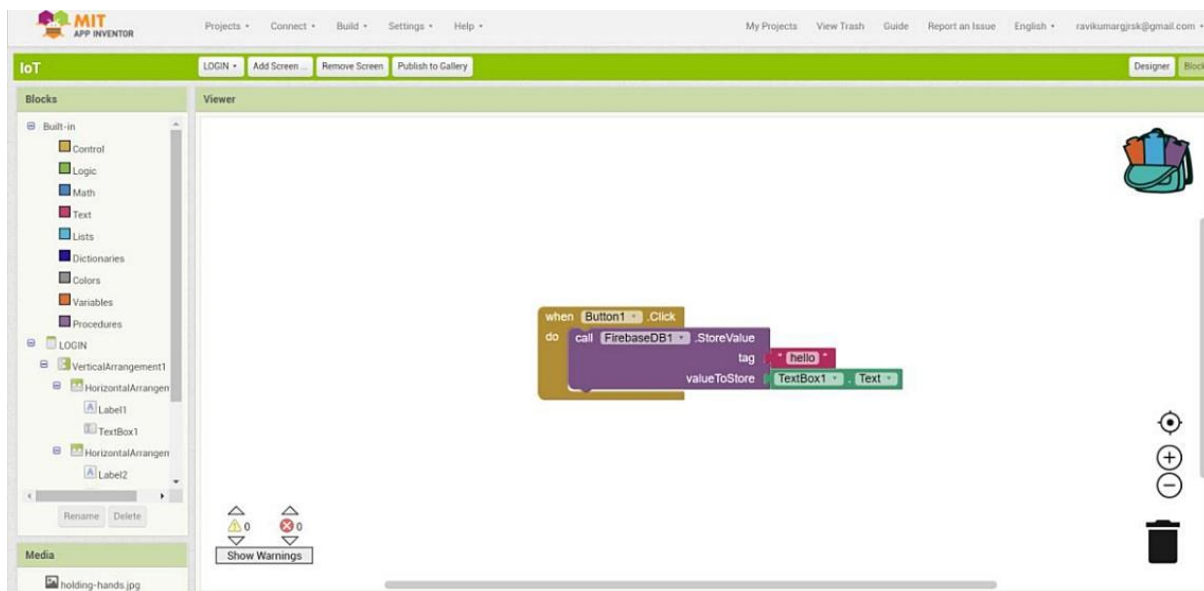
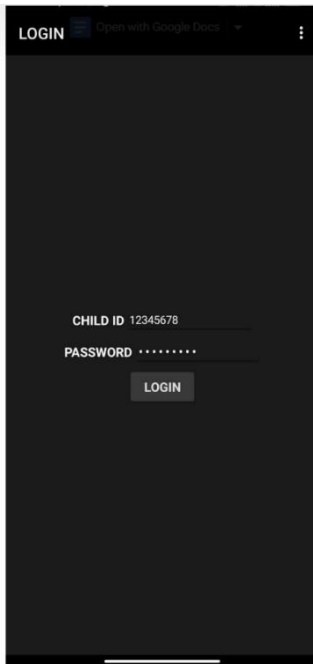


SPRINT 2

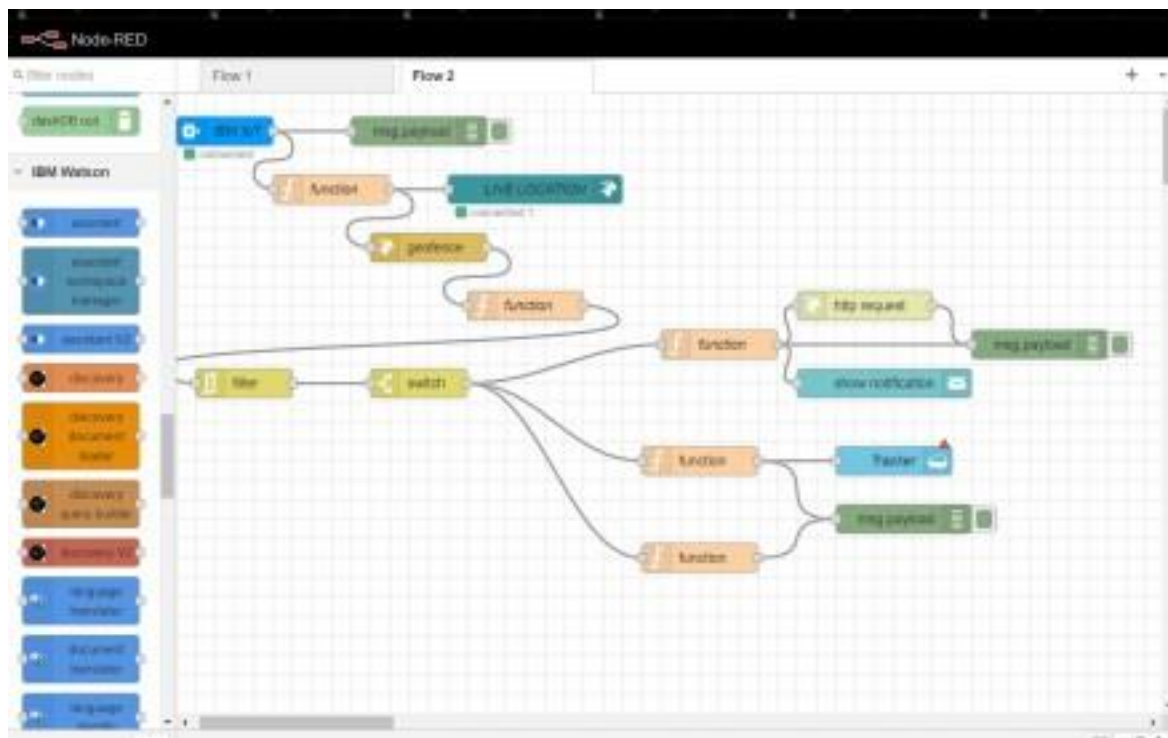
Mobile app screen 1:



Mobile app screen 2:



Node red flow:



IoTCHILD

Go to docs

Realtime Database

Data

Rules

Backups

Usage

Edit rules

Monitor rules

Rules playground

1

2

3

4

5

6

```
{
  "rules": {
    ".read": true,
    ".write": true
  }
}
```

IoTCHILD

Go to docs

Realtime Database

Data

Rules

Backups

Usage

Protect your Realtime Database resources from abuse, such as billing fraud or phishing

Configure App Check

https://iotchild-default-rtdb.firebaseio.com

https://iotchild-default-rtdb.firebaseio.com/

IoT

hello: "12345678"

Database location: United States (us-central1)

8 TESTING

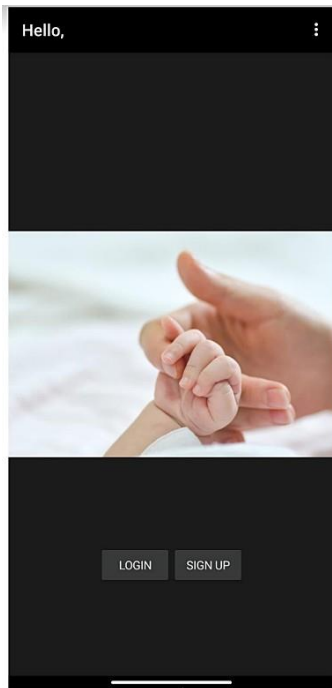
8.1 Test cases

STEPS TO GET LIVE LOCATION OF THE CHILDREN:

1. Press Login
2. It navigates to login page.
3. Enter child ID
4. And then enter the Password.
5. Press shortly to store data in the cloud.
6. Long press the login button in login page to navigate to live location tracking.
7. Finally, it navigates to the Live location tracking page.
8. Then in the bottom the click “GET LOCATION” button.
9. And the live location of the child is tracked.

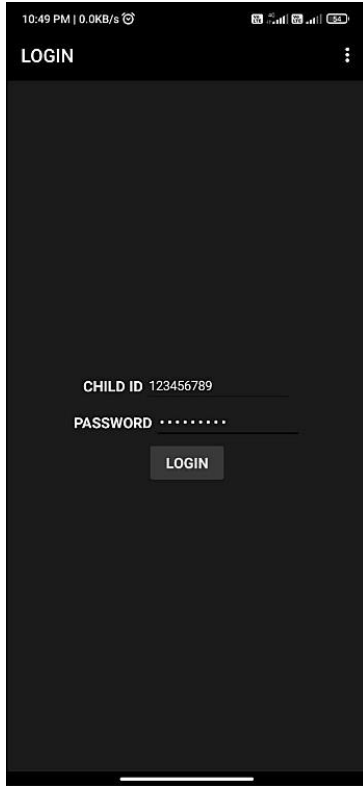
HOME PAGE:

1. Click on “Login” to navigate to login page.



LOGIN PAGE:

1. Enter child ID and password.
2. Small press on login button is used to store data in cloud and long press is used to navigate to “GEO” page.



LIVE TRACKING PAGE (GEO):

1. Initial display without clicking “GET LOCATION” button
2. After clicking “GET LOCATION” but is shows the actual location of the child.



9. RESULT

9.1 PERFORMANCE METRICS

Python Code:

```
python 3.10.6 (tags/v3.10.6:9c7b4bd, Aug 1 2022, 21:53:49) [MSC v.1932
Type "help", "copyright", "credits" or "license()" for more information.
>>> import time
... import random
... #import ibmiotf.application
... import ibmiotf.device
... import sys
... config= {"org": "619i71",
...          "type": "IoT ",
...          "id": "12344321",
...          "auth-method": "use-token-auth",
...          "auth-token": "12345678"}
... client= ibmiotf.device.Client (config)
... client.connect()
... def myCommandCallback (cmd):
...     a=cmd.data
...     if len(a["command"])==0:
...         pass
...     else:
...         print(a["command"])
...     def pub (data):
...         client.publishEvent (event="status", msgFormat="json",data=data, qos=0)
...         print("Published data Successfully: %s",data)
...     while True:
...         name= "Childtracker"
...         #in area
...         #latitude= 9.8794
...         #longitude= 78.0810
...         #out area latitude= 9.95143 longitude= 78.1158
...         data={"name": name, 'lat':latitude,'lon':longitude}
...         pub(data)
...         client.commandCallback = myCommandCallback
...         time.sleep(2)
...         client.disconnect()
```


Geo fence:



- Edit HTTP request URL:

Edit http request node

Delete Cancel Done

Properties

Method GET

URL %20Web%20Application%20Using%20Node-RED

Payload ignore

☐ Enable secure (SSL/TLS) connection

☐ Use authentication

☐ Enable connection keep-alive

☐ Use proxy

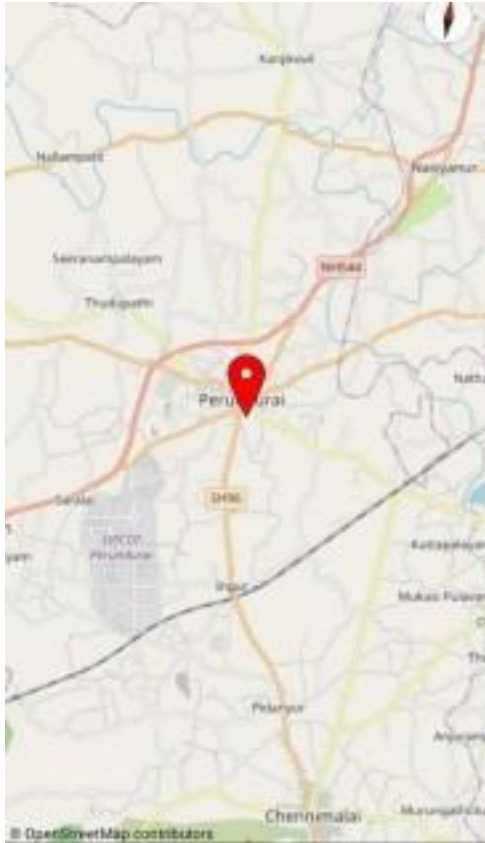
☐ Only send non-2xx responses to Catch node

Return a UTF-8 string

Name Name

Enabled

- Locate the child:



- Python script sending request to cloud:

```
Python 3.10.6 [tags/v3.10.6:9c7b4bd, Aug 1 2022, 21:53:49] [MSC v.1932
Type "help", "copyright", "credits" or "license()" for more information.
>>> import time
... import random
... #import ibmiotf.application
... import ibmiotf.device
... import sys
... config = {"org": "61b171",
...           "type": "IoT ",
...           "id": "12345678",
...           "auth-method": "use-token-auth",
...           "auth-token": "12345678"}
... client = ibmiotf.device.Client (config)
... client.connect()
... def myCommandCallback (cmd):
...     a=cmd.data
...     if len(a["command"])==2:
...         pass
...     else:
...         print(a["command"])
...     def pub (data):
...         client.publishEvent (event="status", msgFormat="json",data=data, qos=0)
...         print("Published data successfully: %s",data)
...     while True:
...         name= "Childtracker"
...         #in area
...         #latitude= 9.8796
...         #longitude= 78.0810
...         #out area latitude= 9.95143 longitude= 78.1158
...         data={"name": name, 'lat':latitude,'lon':longitude}
...         pub(data)
...         client.commandCallback = myCommandCallback
...         time.sleep(2)
...     client.disconnect()
```

After verifying, pop up will indicate whether child is in geofence or not



10. ADVANTAGES & DISADVANTAGES

ADVANTAGES

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

DISADVANTAGES

- The child could not produce the exact alert command during a panic condition
- This project requires manual intervention

11.

CONCLUSION

The word Future resembles the word Children. As Dr. A.P.J Abdul Kalam's words "Youngsters are the future pillars of one's nation", today's children are tomorrow's youngsters, preserving their dreams and life for a better future is necessary. Therefore, each and every parent should take care of their own children, without letting them to fall into the dark world of amusements, which entirely ruin them physically, mentally and emotionally destroying our future. Hence, considering the importance of our future, our project makes it easy for parents to track their children and to visually monitor them on regular basis, which makes them ensure the safety of their children and reduces the rate of incidents of child abuse.

12. FUTURE SCOPE

In our system, we automatically monitor the child in real time using Internet of Things, with the help of GPS, GSM, and Raspberry Pi. This system requires network connectivity, satellite communication, and high-speed data connection when we use web camera and GPS to lively monitor. It is difficult to monitor when there occurs any hindrance to satellite communication or any network issue. There also occurs time delay in video streaming through the server. Hence in the future, these issues can be overcome by using Zigbee concept or accessing the system without internet and using high-speed server transmission.

13.

APPENDIX

Source code:

```
import time

import random

#import ibmiotf.application

import ibmiotf.device import

sys

config= {"org":" 6l9i71",

         "type":" IoT ",

         "id":"12344321",

         "auth-method":"use-token-auth",

         "auth-token":"12345678"}

client= ibmiotf.device.Client (config)

client.connect()

def myCommandCallback (cmd):

    a=cmd.data

    if len(a["command"])==0:

        pass

    else:

        print(a["command"]) def

pub (data):
```

```
client.publishEvent (event="status", msgFormat="json",data=data, qos=0)print("Published data  
Successfully: %s",data)  
  
while True:  
  
name= "Childtracker"#in  
  
area  
  
#latitude= 9.8796  
  
#longitude= 78.0810  
  
#out area latitude= 9.95143 longitude= 78.1158 data={'name':  
name, 'lat':latitude,'lon':longitude} pub(data)client.commandCallback  
= myCommandCallback  
  
time.sleep(2)  
  
client.disconnect()
```

GitHub link: <https://github.com/IBM-EPBL/IBM-Project-20879-1659765883>