

**IOT BASED SAFETY GADGET FOR CHILD SAFETY MONITORING**  
**&**  
**NOTIFICATION**

**PROJECT REPORT**

**IBM-Project-35950-1660290717**

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## **ABSTRACT**

Nowadays, 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 questionnaire and semi-structured interview are methodologies used to collect data. The online questionnaire gains feedbacks by sending questions electronically, where answers need to be submitted online. In the semi structured interview, researcher meets and asks respondents some predetermined questions while other being asked are not planned in advanced. Through information obtained, a smart band have been proposed to monitor the safety of children. By this, parents know what is happening remotely and can take actions if something goes wrong. The future improvements of this device will be adding functions and software to make it works like a phone such as messaging, gallery, Google, YouTube, meanwhile, adding more child security features so that child safety is guaranteed. Keywords: Child security system, Child monitoring system, Internet of Things (IoT), IoT device, Smart band.

# **1.INTRODUCTION**

Internet of Things (IoT) is a set of systems and devices interconnected with real-world sensors and actuators to the Internet, according to It is able to make decisions via detecting the surrounding environment without human interaction. In this research, IoT is applied to propose a wearable smart band which helps parents to monitor and get known of their child's condition at anywhere and anytime even if they are not by their children side. Via the IoT smart band, children safety is guaranteed, and crime rate is reduced as immediate actions can be taken in case the child is in danger. Besides, unlike existing smart band, which is less focusing on child security aspect.

## **1.1 Project Overview**

The proposed system emphasizes in getting as much data as possible so that actual situation can be identified. The use of IoT in this device is motivated by the need of child security system in Malaysia due to child safety issues resulting from increasing cases on child related crime. In fact, IoT has been applied in domains such as smart home, smart city, smart factory, supply chain, retail, agriculture, lifestyle, transportation, emergency, health care, environment, energy, culture and tourism. However, it is seldom used to monitor child's safety in Malaysia. Actually, there is a need to use IoT-based child security system since the safety of children has become a major concern. In fact, crimes on children keep increasing despite actions have been taken by the government.

## **1.2 Purpose**

Revealed by, the overall percentage of child abasements worldwide is about 80% nowadays, out of which 74% are girls and the remaining are boys. For every 40 seconds, a child is gone missing in the world. Due to that, parents are worried for their children and perhaps, a hard challenge

for them to guarantee safety of their children when they are out. To cope with the issue, the system is proposed with these objectives:

Enable tracking of the child's location and capturing of data remotely such as temperature, pulse, respiratory rate, quality of sleep and many more.

To show the child's actual data with reference values Sending of notification if the child is out of location or when the device realizes abnormal conditions/situations.

To trigger the alarm and enable automatic video recording whenever the emergency button is pressed. Then, emergency notification along with real-time video will be sent to and display in the parents' mobile apps.

## **2. LITERATURE SURVEY**

The objective is to monitor the child safety of the system, that consists of Wi-Fi module used to implement IoT and send all the monitored parameters to the cloud for android app monitoring on parental phone. Panic alert system is used during panic situations alerts are sent to the parental phone, seeking for help also the alert parameters are updated to cloud.

### **2.1 Existing Problem**

The overall percentage of child abuse cases 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. Due to the abuse cases, the emotional and mental stability of the children gets affected which in turn ruins their career and future. These innocent children are not responsible for what happens to them. So, parents are responsible for taking care of their own children. But, due to economic condition and aims to focus on their child's future and career, parents are forced to crave for money. Hence, it becomes difficult to cling on to their children all the time. In our system, we provide an environment where this problem can be resolved in an efficient manner. It makes parents to easily monitor their children in real time just like staying beside them as well as focusing on their own career. 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 Link It ONE board programmed in embedded and interfaced with temperature, heartbeat, touch sensors and also GPS, GSM & digital camera modules.

## 2.2 References

1. Anderson, G. R. (1997). Introduction: Achieving permanency for all children in the child welfare system. In G. R. Anderson, A. Ryan, & B. Leashore (Eds.), *The challenge of permanency planning in a multicultural society* (pp. 1-8). New York: Haworth Press, Inc.
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3. Beeman, S., & Boisen, L. (1999). Child welfare professionals' attitudes toward kinship foster care. *Child Welfare*, 78 (3), 315- 338.
4. Benedict, M.I., Zuravin, S., & Stallings, R.Y. (1996). Adult functioning of children who lived in kin versus nonrelative family foster homes. *Child Welfare*, 75 (5), 529-549.
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7. Deater-Deckard, K., & Dodge, K. A. (1997). Externalizing behavior problems and discipline revisited: Nonlinear effects and variation by culture, context, and gender. *Psychological Inquiry*, 8, 161-175.



8. Eckenrode, J., Powers, J., Doris, J., Munsch, J., & Bolger, N. (1988). Substantiation of child abuse and neglect reports. *Journal of Consulting and Clinical Psychology*, 56 (1), 9-16.
9. Garcia Coll, C., & Magnuson, K. (1997). The psychological experience of immigration: A developmental perspective. In A. Booth, A. Crouter & N. Landale (Eds.) *Immigration and the family: Research and policy on U.S. immigrants*. Mahwah, NJ: Erlbaum.
10. Hill, R. B. (2001). The role of race in foster care placements. Paper presented at The Race Matters Forum sponsored by the University of Illinois at Urbana-Champaign, Chevy Chase, MD.

## **2.3 Problem Statement Definition**

Create a problem statement to understand your customer's point of view. The Customer Problem Statement template helps you focus on what matters to create experiences people will love.

A well-articulated customer problem statement allows you and your team to find the ideal solution for the challenges your customers face. Throughout the process, you'll also be able to empathize with your customers, which helps you better understand how they perceive your product or service.

## 3.IDEATION & PROPOSED SOLUTION

### 3.1 Empathy Map Canvas

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes.

It is a useful tool to helps teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

### Empathy Map:

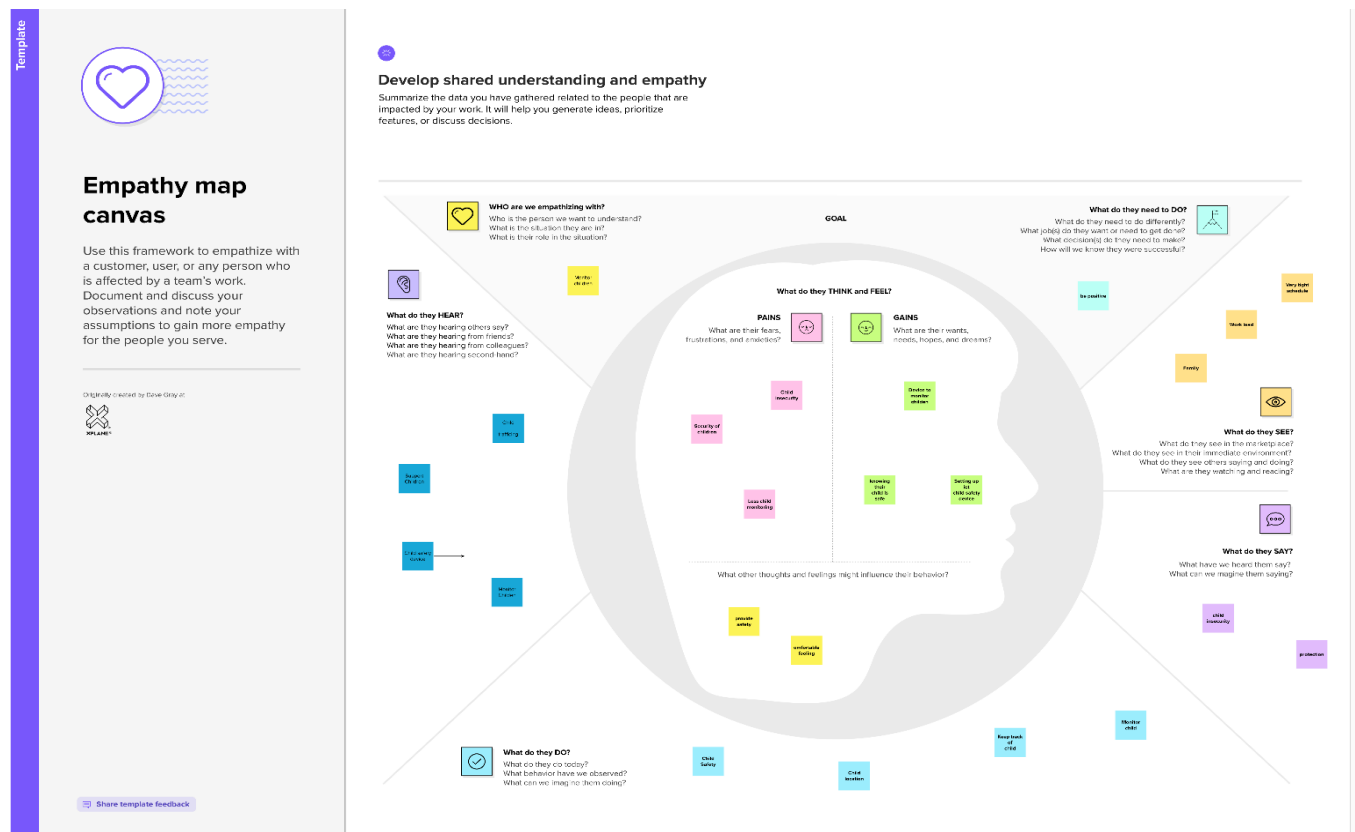



Figure 1: Empathy Map

## 3.2 Ideation and Brainstorming

Step:1 Team gathering, collaboration and select the problem statement.

Template



### 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

[Share template feedback](#)

➔

#### 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

How might we provide Child Safety Monitoring & Notification system using IOT?



#### Key rules of brainstorming

To run an smooth and productive session

🗣️ Stay in topic.	💡 Encourage wild ideas.
🕒 Defer judgment.	👂 Listen to others.
🗣️ Go for volume.	👁️ If possible, be visual.

## Step:2 Brainstorming, idea listing and grouping

### 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 "pin" icon to fix it to the wall.

**SETHURAMAN.K**

- create a mobile application
- Sends the exact location of child in case of emergency
- Continuous tracking and updating child's location
- Water and sweat proof
- Alert's if the given range exceeds

**SANTHOSH KUMAR.A**

- create mobile application
- gps integrated track of their child's movements
- use the child locator gadget
- geofencing the child's movement
- accurate sensors to detect temperature, heart rate
- low levels of radiation

**SASIKUMAR.S**

- Create web Application
- Brilliant UI/UX design for Application
- Creating Geo Fence
- Integration with Cloud Services
- Comfortable & easily wearable
- Integration with Parent's mobile

**SHARATH.K**

- Parental control feature
- Use satellite calling in case of emergency
- Intimating the child's location through GPS
- user friendly application
- Better Battery life
- Secure database

### 3 Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, 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

**Tip** After a brainstorming session, group sticky notes to create a cluster of 6-10, depending on the session. Grouping sticky notes to 6-10 is ideal.

## 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

### 5 After you collaborate

You can export the mural as an image or pdf to share with members of your company who might find it helpful.

**Quick add-ons**

- Share the mural**  
Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.
- Export the mural**  
Export a copy of this mural as a PNG or PDF to attach to emails, include in slides, or save in your office.

**Keep moving forward**

- Strategy blueprint**  
Define the components of a new idea or strategy.  
[Open the template →](#)
- Customer experience journey map**  
Understand customer needs, motivations, and obstacles for an experience.  
[Open the template →](#)
- Strengths, weaknesses, opportunities & threats**  
Identify a company's weaknesses, opportunities, and threats (SWOT) to develop a plan.  
[Open the template →](#)

[Share template feedback](#)

### 3.3 Proposed Solution

Project team shall fill the following information in proposed solution template.

S.No	Parameter	Description
1.	Problem Statement (Problem to be solved)	The aim of this project is to help parents to monitor their children's location and to see whether their child is safe or not. This system provides a tracking solution for the parent to keep tracking their child's location outdoors by using GPS as it allows them to determine the exact location of the child.
2.	Idea / Solution description	This system sends a notification message to parents and stores the data of the child's movement and geo space periodically. We aim to develop and provide a good interface that would give a tremendous output. The technology used here is PYTHON IDLE and CLOUD for storing data.
3.	Novelty / Uniqueness	This project is basically for the parents who cannot balance their children and work at the same time and also for nonworking parents. The uniqueness of our project is about geo fencing, high noise alert, alarm buzzer, temperature sensor and location monitoring.
4.	Social Impact / Customer Satisfaction	The parents will have the satisfaction that their child is safe and not involved in any critical situation even in their absence. Child abduction is a scorching subject all over the world. It is a complex crime that can impair a

		child's future. It will be great helpful to parents who are busy workers not having time to watch over their children, and easy to operate so anyone can handle it.
5.	Business Model (Revenue Model)	There is no need of buying any external components instead they can use their mobile phones to track. The business model is in such a way that everyone can afford it. It is very cost-efficient. We are cutting the cost in external components. It is a device with numerous subscriptions for tracing and notification assistance.

### 3.4 Problem Solution Fit

Define CS, fit into	1. CUSTOMER SEGMENT(S) <b>CS</b>  This aids the parents/guardian to track the daily activity of their children and helps to find them using GPS location	6. CUSTOMER <b>CC</b>  <ul style="list-style-type: none"> <li>• Expensive</li> <li>• Poor Network</li> <li>• Battery Consumption</li> </ul>	5. AVAILABLE SOLUTIONS <b>AS</b>  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. However, the proposed device is not robust enough and does not contain sufficient functions to operates like a mobile phone.	Explore AS.
	2. Enable tracking of the child's location and capturing of data remotely such as temperature, pulse, respiratory rate, quality of sleep and many more. <ul style="list-style-type: none"> <li>• To show the child's actual data with reference values.</li> <li>• Enable sending of notification if the child is out of location or when the device realizes abnormal conditions/situations.</li> </ul> <b>J&amp;P</b>	9. The overall percentage of child abasements worldwide is about 80% nowadays, out of which 74% are girls and the remaining are boys. For every 40 seconds, a child is gone missing in the world. Due to that, parents are worried for their children and perhaps, a hard challenge for them to guarantee safety of their children when they are out. <b>RC</b>	7. Application aside from conceding you to track down your children when they're within Bluetooth range, it also functions when your kids go farther. Its competence as a tracker is outstanding if you live in densely populated areas like cities or big towns.	
Focus on J&P, tap into BE, understand	3. TRIGGERS <b>TR</b>  An IoT based wearable smart band for children is proposed in this research for child security purposes. The smart band is waterproof, chargeable and equipped with sensors. Heart rate sensor measures pulse rate and BPM. Sleep quality sensor obtains children's sleep quality, cycle and positions	10. YOUR SOLUTION <b>SL</b>  The child security system benefits parents as well as children. Since it aids in locating children, monitoring child's condition and security status instantly at anyplace and any time, parents who often tied up in work or neglect their children are gaining advantages from it. Through the proposed system, immediate actions can be taken	8. CHANNELS of BEHAVIOUR <b>CH</b>  8.1 ONLINE The system also consists of Wi-Fi module used to implement IoT and send all the monitored parameters to the cloud for android app monitoring on parental phone. <b>Panic alert system</b> is used during panic situations alerts are sent to the parental phone, seeking for help also the alert parameters are updated to the cloud.  8.2 OFFLINE If the parent's logout of the application it display's the last child's whereabouts	Focus on R&P, tap into BE, understand
	Identify strong TR & EM		Extract online & offline CH of BE	

## 4.REQUIREMENTS ANALYSIS

### 4.1 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 Gmail Registration through LinkedIn.
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP.
FR-3	Notification	Notified via Mobile App
FR-4	User Interface	Mobile App- MIT App Inventor Able to see location of children when they are out of geofence

## 4.2 Non-Functional Requirements

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

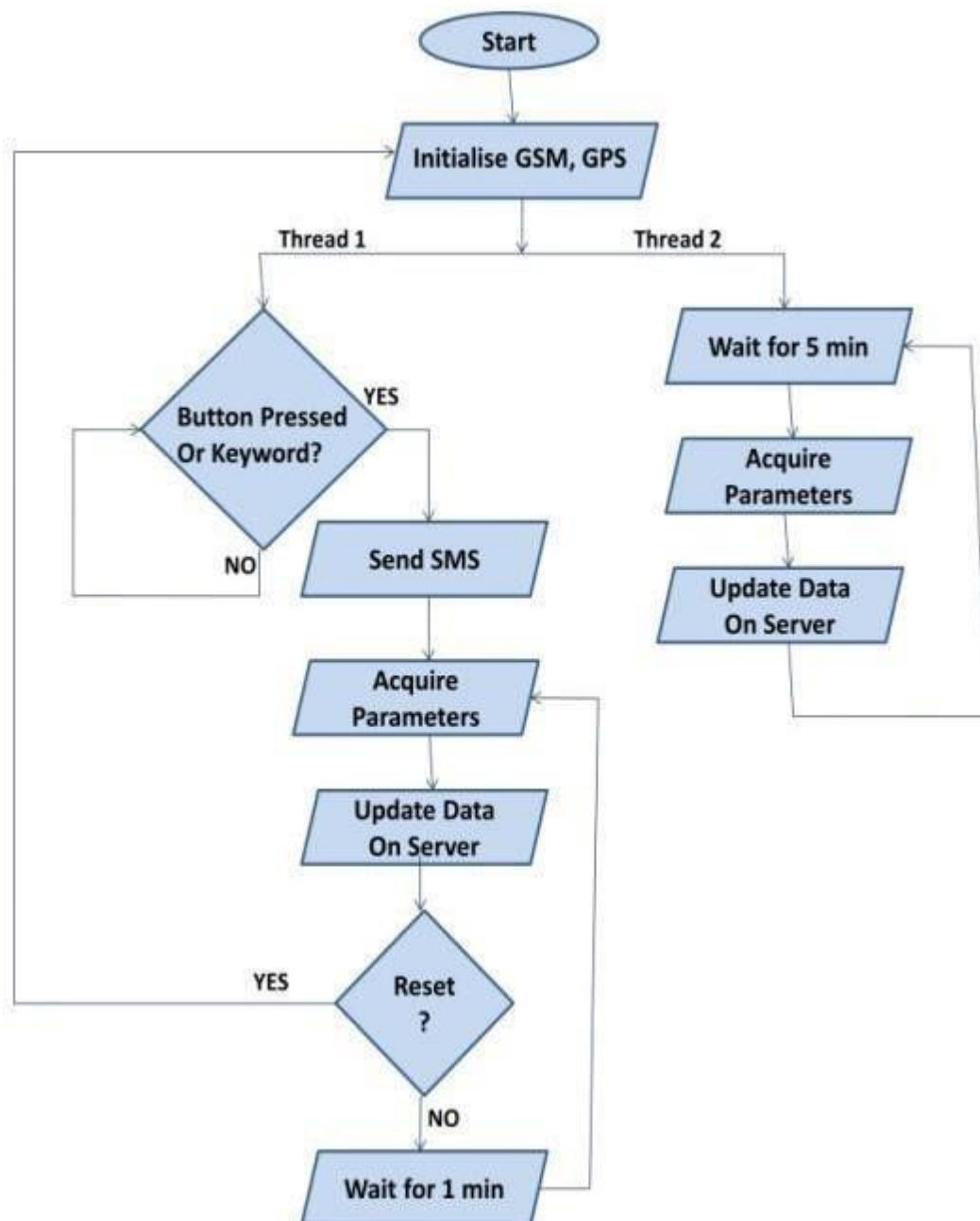
<b>FR No.</b>	<b>Non-Functional Requirement</b>	<b>Description</b>
NFR-1	<b>Usability</b>	Accessed through Mobile App Showing location (latitude and longitude) of child.
NFR-2	<b>Security</b>	Database security must meet HIPAA requirements
NFR-3	<b>Reliability</b>	Once logged in, webpage is available until logging out.
NFR-4	<b>Performance</b>	Each page must load within 2 seconds
NFR-5	<b>Availability</b>	Once logged in webpage is available until logging out.
NFR-6	<b>Scalability</b>	The process must finish within 3 hours so data is available by 8 a.m. local time after an overnight update.



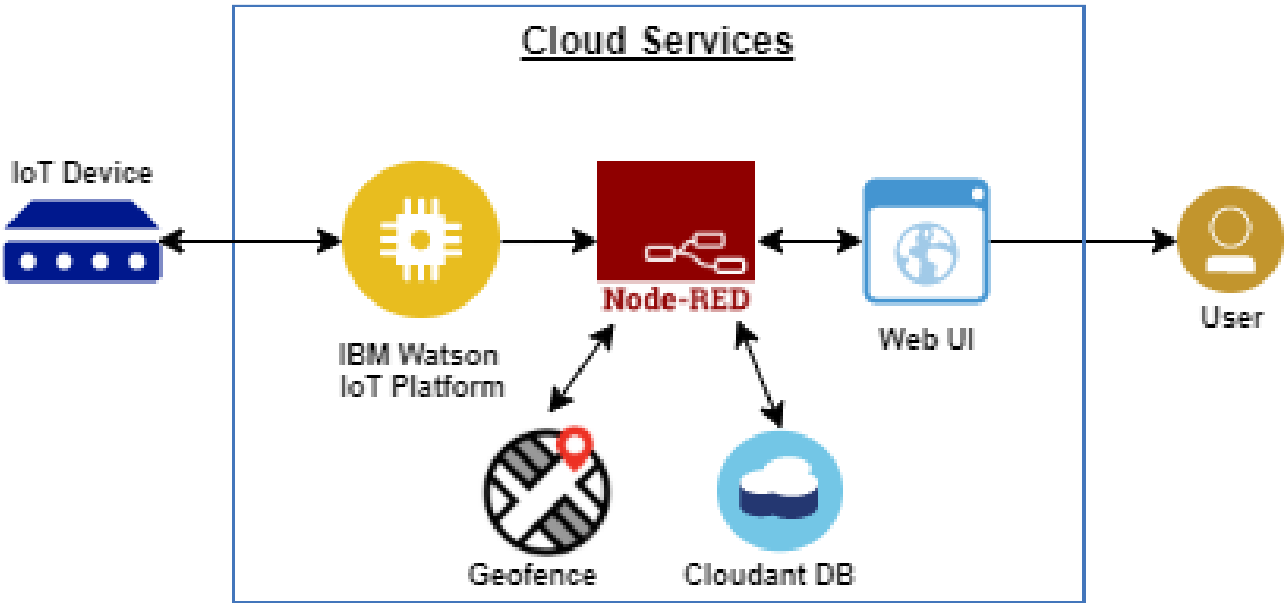
## 5. PROJECT DESIGN

### 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 Solution and Technical Architecture



## 5.3 User Stories

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Interfacing sensors and Motor Pump and IBM colud	USN-1	Develop a python Code to Interface Sensors and Motor Pump and IBM cloud.	20	High	K.Sethuraman
Sprint-2	Node-Red	USN-2	Develop a web Application Using a NodeRed	20	High	A.Santhosh kumar

Sprint-3	Mobile Application	USN-3	Develop a mobile Application using MIT-App	20	High	S.Sasikumar
Sprint-4	Integration & Testing	USN-4	Integrating Python Script, Web application & Mobile App	20	High	K.Bharath

## 6.PROJECT PLANNING AND SCHEDULING

### 6.1 Sprint Planning and Estimation

Sprint planning is an event in scrum that defines what can be delivered in the upcoming sprint and how that work will be achieved.

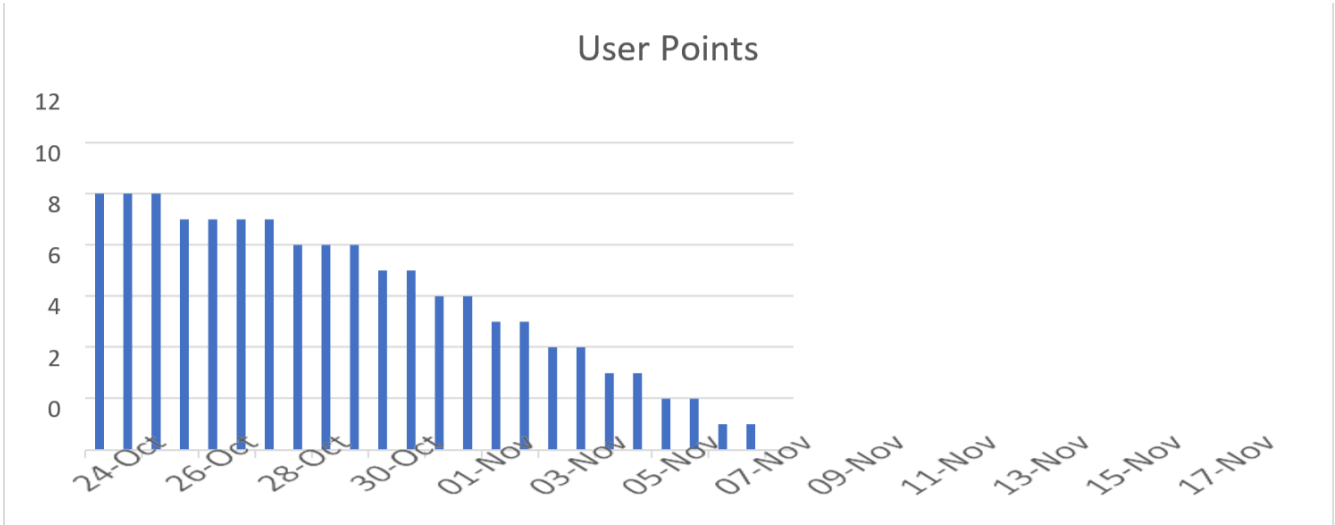
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can Register for the application by entering my email Password and confirming my password.	4	High	SETHURAMAN
Sprint-1	Confirmat ionemail	USN-2	As a user I will receive Confirmation email once Have registered for the application.	4	High	SANTHOSH KUMAR
Sprint-1	Authentication	USN-3	As a user I can Register for the application through gmail and mobileapp.	4	Medi um	SASIKUMAR
Sprint-1	Login	USN-4	As a user can log into the application by entering email &password	4	High	BHARATH
Sprint-1	Dashboard	USN-5	As a user I need to be Able to view the functions that I can perform.	4	High	SETHURAMAN
Sprint-2	Notifications	USN-6	As a user, I should be able to notify my parent and guardian in emergency situtations.	1	Medi um	SANTHOSH KUMAR

Sprint-2	Store data	USN-1	As a user I need to continuously store my location data into the database.	1	Low	SASIKUMAR
Sprint-3	Communication	USN-4	As a user I should be able to communicate with myparents.	1	Medium	BHARATH

## 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	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	17 Nov 2022

## 6.3 Report from JIRA



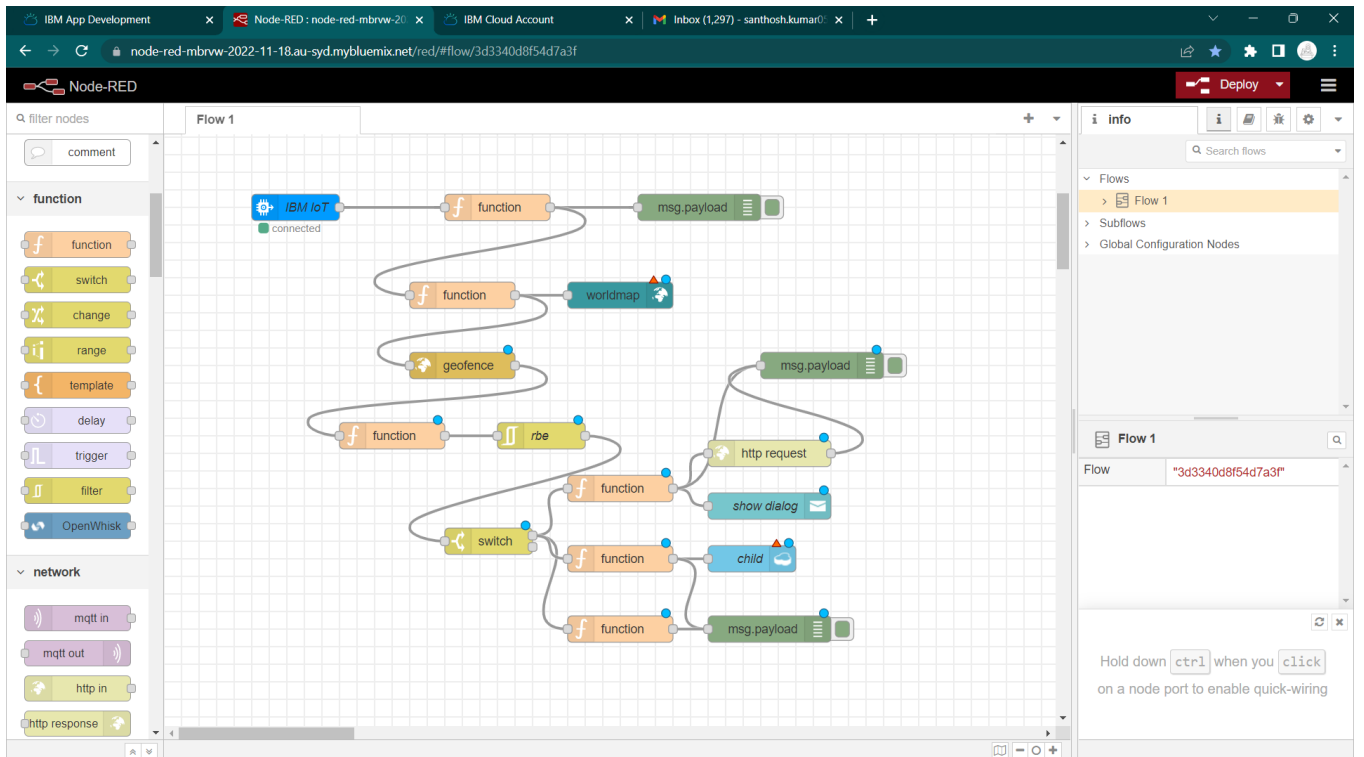
# 7.CODING AND SOLUTIONING

## 7.1 Feature 1

```
Python 3.7.4 Shell*
File Edit Shell Debug Options Window Help
Python 3.7.4 (tags/v3.7.4:e09359112e, Jul 8 2019, 20:34:20) [MSC v.1916 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>> import json
import wiotp.sdk.device
import time
myconfig={
    "identity":{
        "orgid": "hj5fmy",
        "typeid": "NodeMCU",
        "deviceid": "12345"
    },
    "auth": {
        "token": "12345678"
    }
}
clinte = wiotp.sdk.device.Deviceclient(config=myconfig, logHandlers=None)
clinte.connect()

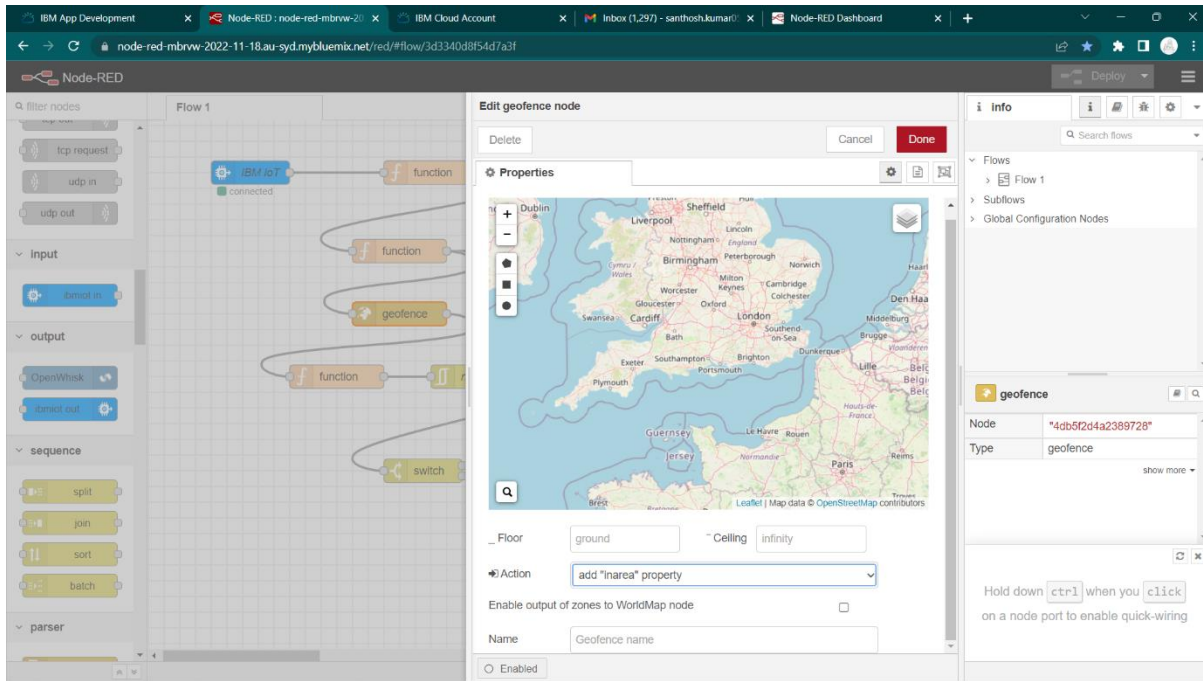
while True:
    name="smatbridge"
    latitude=17.4219272
    longitude=78.5488783
    myData={'name': name, 'lat':latitude, 'lon':longitude}
    clinte.publishEvent(eventid="status", msgFormat="json", data=myData, qos=0, onpublish=None)
    print("Data published to IBM IOT platform:",myData)
    time.sleep(5)
clinte.disconnect()
```

## 7.2 Feature 2



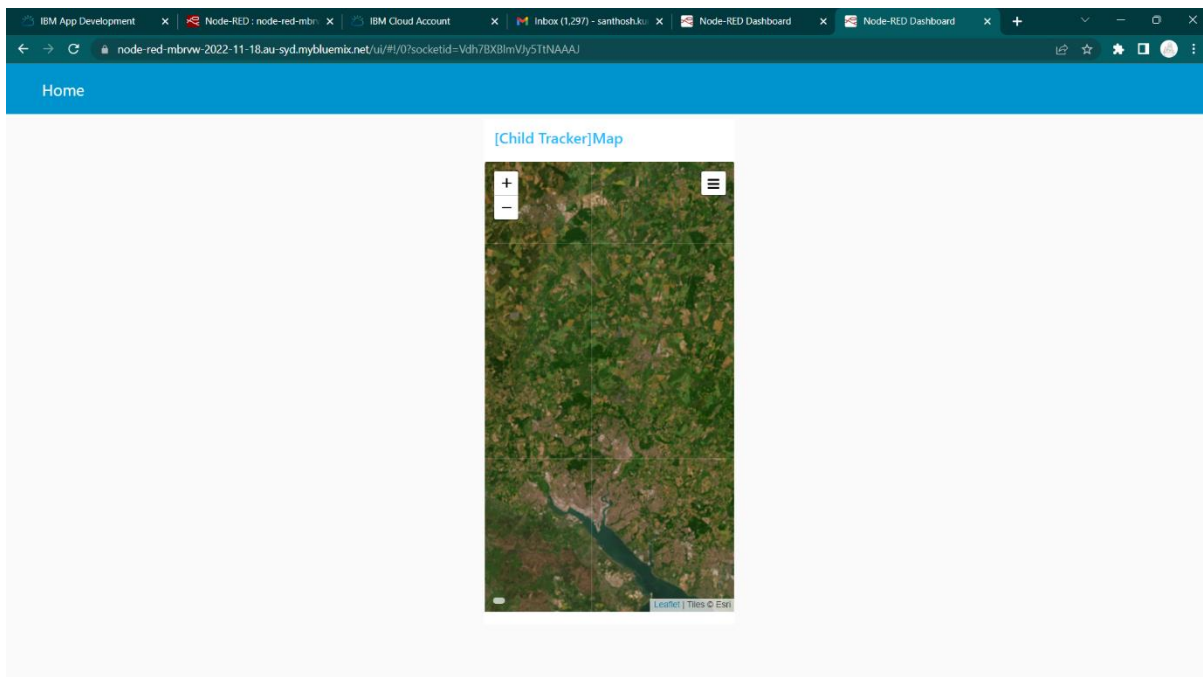
## 8.TESTING

### 8.1 Test Cases



### 8.2 User Acceptance Testing

Locate the Child:





## **9.RESULT**

### **9.1 Performance Metrics**

So finally when we run the python code it is going to connect the IBM Watson platform and connecting to the node-red. Then we can locate the location of child so we can see output in the fourth window.

## **10.ADVANTAGES AND DISADVANTAGES**

### **ADVANTAGES**

- It can assist in the smarter control of homes and cities via mobile phones. It enhances security and offers personal protection.
- By automating activities, it saves us a lot of time.
- Information is easily accessible, even if we are far away from our actual location, and it is updated frequently in real time.
- Electric Devices are directly connected and communicate with a controller computer, such as a cell phone, resulting in efficient electricity use. As a result, there will be no unnecessary use of electricity equipment.

### **DISADVANTAGES**

- Hackers may gain access to the system and steal personal information. Since we add so many devices to the internet, there is a risk that our information as it can be misused.
- They rely heavily on the internet and are unable to function effectively without it.
- With the complexity of systems, there are many ways for them to fail.
- We lose control of our lives—our lives will be fully controlled and reliant on technology.

## **11.CONCLUSION**

Early childhood development is crucial to how a person develops later on in life. Reasons for a how a person acts, behaves, and thinks can be traced back to their childhood circumstances and environment. Parents also play a very important role in a child's development. Parents not only need to love and understand their child, but also bear the responsibility for 'the upbringing and development of the child' (Article 18). The child's material standard of living should be adequate for 'the child's physical, mental, spiritual, moral and social development' (Article 27)

## **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

```
<!DOCTYPE html>
```

```
<html lang="en">
```

```
<head>
```

```
<meta charset="UTF-8">
```

```
<meta http-equiv="X-UA-Compatible" content="IE=edge">
```

```
<meta name="viewport" content="width=device-width, initial-scale=1.0">
```

```
<link rel="stylesheet" href="/css/login.css">
```

```
<title>Sign Up</title>
```

```
<script>
```

```
if (window.location.hostname !== "localhost") {
```

```
if (location.protocol !== "https:") {
```

```
location.replace(
```

```
https:${location.href.substring(
```

```
location.protocol.length
```

```
}})
```

```
}
```

```
}
```

```
</script>
```

```
<script src="./localforage.js"></script>
```

```
</head>
```

```
<body>
```

```
<div class="wrapper">
```

```
<div class="loginContainer">
```

```
<span>Login to Continue</span>
```

```
<div class="traditional LoginContainer">
```

```
<form class="signupForm" action="/" method="post">
```

```
<input type="text" name="firstName" placeholder="First Name"  
id="firstName">
```

```
<input type="text" name="lastName" placeholder="Last Name"  
id="lastName">
```

```
<input type="text" name="username" placeholder="User Name"  
id="username">
```

Github link:

<https://github.com/IBM-EPBL/IBM-Project-35950-1660290717>

Project Demo Link:

[https://www.youtube.com/watch?v=L\\_kO6FYGJtM](https://www.youtube.com/watch?v=L_kO6FYGJtM)