

IoT Based Safety Gadget for Child Safety Monitoring & Notification

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Abstract

The children are less secure nowadays and have many issues concerning their security purpose. Many Family members spent more time in work and social accountability where they need to take care of their children. The current status in our country is not habitable for monitoring children. With the absence of a child monitoring system, it is hard to monitor the children every seconds. Where Under age children may be impulsive in the way they act and in places to be. Children are prone to many incidents and accidents. The safety of children is very indispensable as children cannot protect themselves.

The paper provides a smart solution for deflecting losing kids while going out alone or with their parents based on the Internet of Things(IOT). Our proposed system will ensures utmost security and ensure live tracking for kids. It proposes a model for child safety through smartphones that can track their children's location and provide the precise coordinates of the child's location in real-time Anywhere by monitoring the activities, the security state of the children are examined.

1.Introduction

1.1 Project Overview

The Internet of Things (IoT) plays a vital role in day-to-day life. The Internet of Things is increasingly finding a place at the heart of many business automation strategies. Companies are using sensors in the logistics chain to help them track where delivery is with extraordinary accuracy. The motivation for this wearable comes from the increasing need for safety for little children in contemporary times as there could be scenarios of the child getting a drift in a

major crowded sector. This paper focuses on the key aspect that a missing child can be assisted by the people around the child and can play a remarkable role in the child's safety until reunited with the parents. If any deviant readings are disclosed by the sensor, then an SMS and phone calls are set off to the parent's mobile. Also, it overhauls the parental app through the cloud. The technique is equipped with GSM and GPS modules for sending and receiving calls, and SMS between the safety gadget and the parental phones.

The system also consists of a Wi-Fi/cellular data module used to implement IoT and send all the monitored parameters to the cloud for android app monitoring on the parental phones. The panic alert system is used during panic situations alerts are sent to the parental phone, seeking help also the alert parameters are updated to the cloud. Most of the wearables available today are focused on providing the location, and activity of the child to the parents.

1.2 Purpose

The main goal of this project is to create a smart wearable device for children that uses refined technology to assure their safety. The paper provides a smart solution for deflecting losing kids while going out alone or with their parents based on the Internet of Things (IoT). Our proposed strategy ensures utmost security and ensures live tracking for their kids. This paper proposes a model for child safety through smartphones that can track their children's location and give the precise coordinates of the child's location in real-time anywhere. By monitoring the activities the security state of the child is examined.

2. LITERATURE SURVEY

2.1 Existing Problem

In today's world children are less secure and have many issues concerning their security purpose. More family's spent their time for work and social accountability but since Children are gifts of GOD they need the care of family. The current status of our country is not habitable for monitoring children in school. With the absence of a child monitoring system, it is hard to monitor the whereabouts of children. Underage children may be impulsive in the way they act and in places to be. Most of the human behaviour is shaped in the childhood stage, in order to get morally acceptable behaviour child monitoring system is necessary. Children are prone to many accidents. The safety of children is very indispensable as children cannot protect themselves.

Child abductors continually abduct children from parents/legally appointed guardians to get the ransom for their benefit. Parents have no supplementary choice but to view the exact scenario of children's intuitions. The crisis out-turn of kidnapping can be highly cynical and perpetual, more measures must be taken to protect children against abduction and its impacts.

2.2 References

SURVEY 1:

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

Title: Smart IoT Device for Child Safety and Tracking.

Published in: 2019 IEEE.

The system is developed using Link-It ONE board programmed in embedded C and interfaced with temperature, heartbeat, touch sensors and also GPS, GSM & digital camera modules. The novelty of the work is that the system automatically alerts the parent/caretaker by sending SMS, when immediate attention is required for the child during emergency.

Merits: The parameters such as touch, temperature & heartbeat of the child are used for parametric analysis and results are plotted for the same.

Demerits: To implement the IoT device which ensures the complete solution for child safety problems.

SURVEY 2:

Authors: Dheeraj Sunehera , Pottabhatini Laxmi Priya.

Title: Children Location Monitoring on Google Maps Using GPS and GSM. Published in: 2016 IEEE.

This paper provides an Android based solution for the parents to track their children in real time. Different devices are connected with a single device through channels of internet. The concerned device is connected to server via internet. The device can be used by parents to track their children in real time or for women safety. The proposed solution takes the location services provided by GSM module. It allows the parents to get their child's current-location via SMS. **Merits:** A child tracking system using android terminal and hoc networks. **Demerits:** This device cannot be used in rural areas.

SURVEY 3:

Authors: David Hanes, Gonzalo, Patrick Grosetete, Robert, Barton,

Jerome.

Title: Henry “IoT Fundamental and Networking Technologies, Protocols”.

During an emergency, mobile apps alert the control room of nearby police stations or caretakers of children. The literature shows that location tracking devices are available in the market but it does not provide a complete solution to the problem. The solution to this problem is to design an IoT device, which senses the child's location and environment and during an emergency, it should send the alert to the parents automatically.

SURVEY 4:

Authors: Aditi Gupta, Vibhor Harit.

Title: Child Safety & Tracking Management System by using GPS.
Published in: 2016 IEEE.

This paper proposed a model for child safety through smartphones that provide the option to track the location of their children as well as in case of emergency children are able to send a quick message and its current location via Short Message Services.

Merits: The advantages of smart phones they offer rich features like Google maps, GPS, SMS etc.

Demerits: This system is unable to sense the human behaviour of children.

SURVEY 5:

Authors: Akash Moodbidri, Hamid Shahnasser. Title: Child safety wearable device. Published in: 2017 IEEE.

The purpose of this device is to help parents to locate their children with ease. At the moment there are many wearables in the

market which help to track the daily activity of children and also help to find the child using Wi-Fi and Bluetooth services present on the device. **Merits:** This wearable over other wearables is that it can be used on any phone and it is not necessary that an expensive smartphone is required and doesn't want to be a very tech-savvy individual to operate. **Demerits:** This device's battery gives a short lifetime. High power efficient model will have to be used which can be capable of giving the battery life for a longer time.

2.3 Problem Statement Definition

It has been a major threat to children from or in opposition to any perceived real danger/risk. Most of the kids have been abducted by strangers, which is a more frequent event nowadays. Child abduction continues to be a major issue and it has an utmost impact on the affected families. Child abduction is a scorching subject all over the world. It is a complex crime that can impair a child's future. Parents should ensure that their little ones are secure and are been protected from the menace of injury. Child abductors often kidnap children from legally appointed guardians to get the ransom and for their personal benefit. The out-turn of abduction can be seriously pessimistic and enduring, more actions must be taken to protect children against abduction and its effects.

3.IDEATION PHASE & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 BRINSTROMING AND IDEA PRIORIZATION



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

To implement child safety monitoring by tracking children's surrounding activity using an IoT based child safety device



Key rules of brainstorming

To run a smooth and productive session



Stay in topic.



Encourage wild ideas.



Defer judgment.



Listen to others.



Go for volume.



If possible, be visual.

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

Develop an IoT based safety gadget	User-friendly device	Smart assistance for children
A solution for safe-society	Monitor the health condition of a child	Child safety monitoring

Person 2

Reduce the rate of child abuse	Track the location of children in case of emergency	Update the location of children to parents
Extra-safeness for children	To prevent child before being attacked	Prevention of child trafficking

Person 3

Enabling parents to use to gadget	Camera and mic access in the system	Make it user friendly device
Camera is for capturing someone with unusual activity towards the child	To design a wearable gadget	Attachment of sensors to sense in and around

Person 4

Usage of SOS System	Reducing the insecurities and worrying of parents	Development of an android app for monitoring
Reducing child-crime rate in society	Making awareness about child safety	Triggering alarm in case of emergency

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

Designed in a smart-gadget way for ease of access. Made with compactable components to wear and use easily. All components are integrated with each other

Location tracking through GPS for monitoring of children. GSM Module is used for sending messages/ notification. Camera and mic is attached

Notification is sent to parents in case of emergency. SOS System is used. Also health monitoring system is attached in it.

Camera is for capturing the one behaving with unusual activity towards the child. It provides smart assistance and periodic monitoring.



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

A

Share the mural

Share a view link to the mural with stakeholders to keep them in the loop about the outcomes of the session.

B

Export the mural

Export a copy of the mural as a PNG or PDF to attach to emails, include in slides, or save in your drive.

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 strengths, weaknesses, opportunities, and threats (SWOT) to develop a plan.

[Open the template →](#)



[Share template feedback](#)

3.3 Proposed Solution

<u>S.No.</u>	Parameter	Description
1.	Problem Statement (Problem to be solved)	To design a device regarding child safety monitoring based on IoT.
2.	Idea / Solution description	Designing a gadget that monitors the such as unusual activity around the child, and also health and location of him/her.
3.	Novelty / Uniqueness	Using a microchip device, parents can also be able to monitor the children using an android app and even during emergency cases, notifications will automatically be sent to them.
4.	Social Impact / Customer Satisfaction	Safety for the children from threats like kidnapping, trafficking and abuse.
5.	Business Model (Revenue Model)	Since it focuses on child safety that's a major concern in our society, this device will have a fair and good scalable commercialization.
6.	Scalability of the Solution	It is a cost-efficient device that can be easily affordable. Hence, it has a large scalability

3.4 Problem Fit Solution

Define CS, fit into CC	<div>1. CUSTOMER SEGMENT(S) Who is your customer? i.e. working parents of 0-5 y.o. kids</div> <div>CS</div> <div>Children mostly at the age of 1-12 as they're mostly prone to child abuses and attacks. Also, this project involves their parents as customers also, as they can be able to monitor their children in real time</div>	<div>6. CUSTOMER CONSTRAINTS 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.</div> <div>CC</div> <div>Though parents are concerned about their child's safety, they cannot be with them the whole time. Other than priorities, technology plays an important role in safety monitoring and cost of the device matters. This project will be a solution to all</div>	<div>5. AVAILABLE SOLUTIONS Which solutions are available to the customers when they face the problem?</div> <div>AS</div> <div>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 is an alternative to digital notetaking</div> <div>Children can carry this device always with them and during any case of emergency, using the tracking of GPS location, parents can come to know about the whereabouts of them</div>	Explore AS, differentiate
	<div>2. JOBS-TO-BE-DONE / PROBLEMS Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one, explore different sides.</div> <div>J&P</div> <div>a. The microchip present in the device facilitates the tracking of children in realtime. b. Notifications are sent to parents in case of emergency for their child c. Health-monitoring of children</div>	<div>9. PROBLEM ROOT CAUSE What is the real reason that this problem exists? What is the back story behind the need to do this job? i.e. customers have to do it because of the change in regulations.</div> <div>RC</div> <div>This is mostly because of unsafe problems for children in our society like child abuse, child trafficking and kidnapping and in such cases parents are unable to monitor them.</div>	<div>7. BEHAVIOUR What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)</div> <div>BE</div> <div>Click to notify the parents in case of any emergency. Never hesitate to contact parents if they find any doubtful strangers. Can also contact the nearby police station if they are in need of them. Charge the device regularly.</div>	
Focus on J&P, tap into BE, understand RC				Focus on J&P, tap into BE, understand RC

<div>3. TRIGGERS What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.</div> <div>TR</div> <div><ul style="list-style-type: none">The child is reported missingWhen the child is in dangerWhen the child has poor or abnormal health condition.</div>	<div>10. YOUR SOLUTION 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 up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.</div> <div>SL</div> <div>An IoT based device containing gps and gsm modules to record and monitor the data such as location, health conditions, surrounding movements and updates it to the customer. It is cost efficient and easily accessible. It also has a SOS button through which automatic alarm will be sent to the parents and the nearby police in case of emergencies. It also monitors the health condition of the children. Thus, this gadget serves well in child-safety monitoring purpose.</div>	<div>8. CHANNELS of BEHAVIOUR 8.1 ONLINE What kind of actions do customers take online? Extract online channels from #7 8.2 OFFLINE What kind of actions do customers take offline? Extract offline channels from #7 and use them for customer development.</div> <div>CH</div> <div><div>ONLINE:</div><ul style="list-style-type: none">Keep track of their locationKeep monitoring their health conditionNotify to the parents<div>OFFLINE:</div><ul style="list-style-type: none">Contact the nearby police stationContact the parents in case of abnormal situations.</div>
<div>4. EMOTIONS: BEFORE / AFTER 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.</div> <div>EM</div> <div><div>Before:</div><div>1. Parents will definitely be worried. 2. They'll feel insecure 3. Not only parents, children also will be afraid of communication with their parents in case of emergencies.</div><div>After:</div><div>1. Parents will be free of worry as they will be able to monitor their children 2. Insecurity will not be there. 3. Children will also be able to alert their parents in such times and fear of communication can be avoided,</div></div>		

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

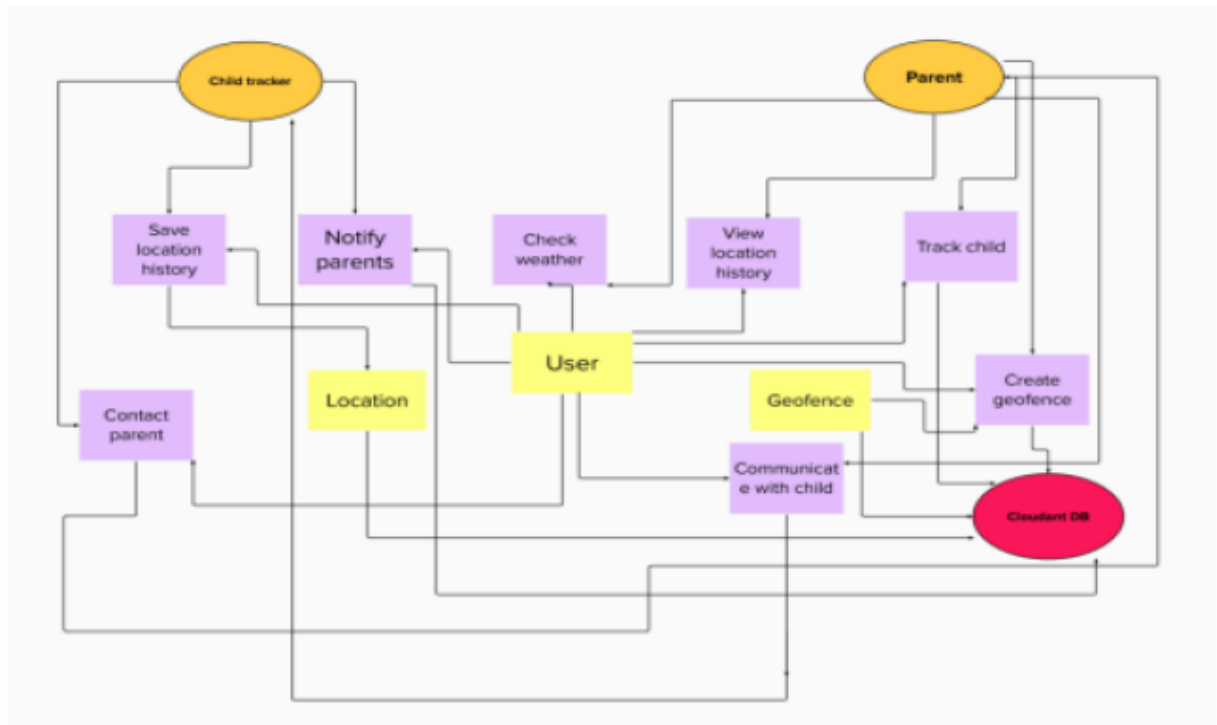
FR No.	Functional Requirement (Epic)	Sub Requirement (Story/Sub-Task)
FR - 1	User Registration	Registration through account Registration through Gmail
FR - 2	User Confirmation	Confirmation via Email Confirmation via OTP
FR - 3	User Notification	Notification to registered mobile number Notification via message
FR - 4	User location check	Check through account

4.2 Non-Functional requirements

FR No.	Non-Functional Requirement	Description
NFR – 1	Usability	Allows parents to keep a track of their child's location and also, help them raise an alarm in case of an emergency.
NFR – 2	Security	Creates a secure environment for children to move around.
NFR – 3	Reliability	Increased reliability towards technology and reduced reliability towards guardians.
NFR – 4	Performance	High performance in terms of simple usage and security.
NFR – 5	Availability	Any time usage backed up by power supply.
NFR - 6	Scalability	High level with increase in performance.

5. PROJECT DESIGN

5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture

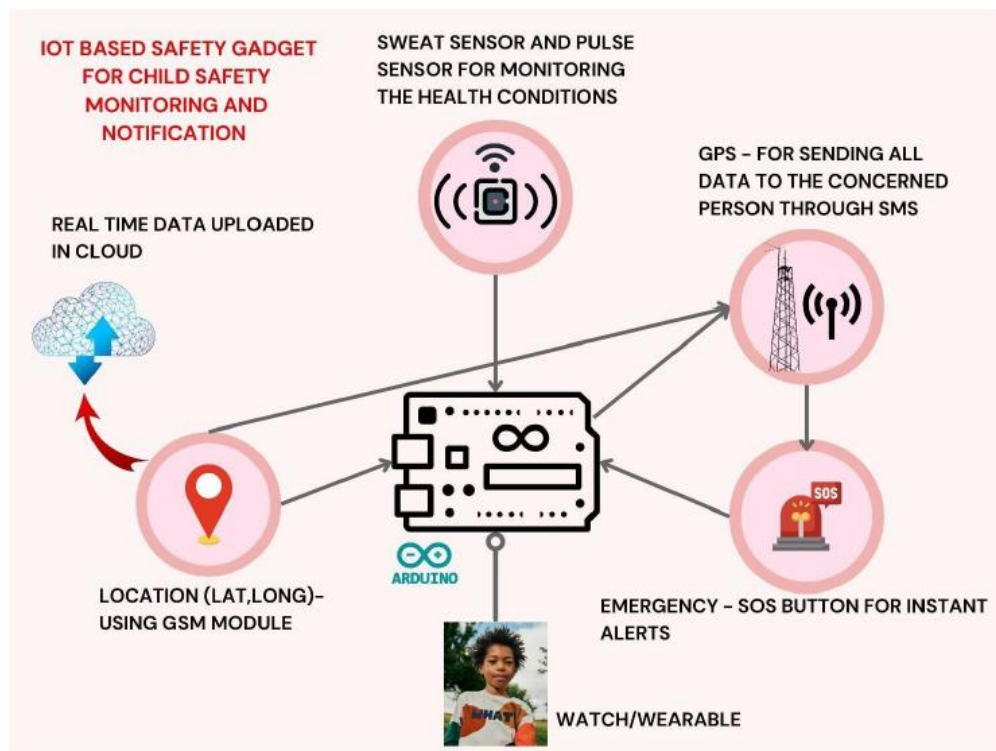
Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions.

Its goals are to:

- ~ Find the best tech solution to solve existing business problems.
- ~ Describe the structure, characteristics, behaviour, and other aspects of the software to project stakeholders.
- ~ Define features, development phases, and solution requirements.

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

Solution Architecture Diagram:



5.3 User Stories

Parent	Registration	USN-1	As a user, I can register for the application by entering my email, password, and confirming my password.	I can access my account / dashboard	High	Sprint-1
		USN-2	As a user, I will receive confirmation email once I have registered for the application	I can receive confirmation email & click confirm	High	Sprint-1
		USN-3	As a user, I can register for the application through Gmail		Medium	Sprint-1
	Login	USN-4	As a user, I can log into the application by entering email & password		High	Sprint-1
	Dashboard	USN-5	As a user, I need to be able to view the functions that I can perform		High	Sprint-1
Child	Notification	USN-1	As a user, I should be able to notify my parent in emergency situations		High	Sprint-2
	Store data	USN-2	As a user, I need to continuously store my location data into the db.		Medium	Sprint-2

6. CODING & SOLUTIONING

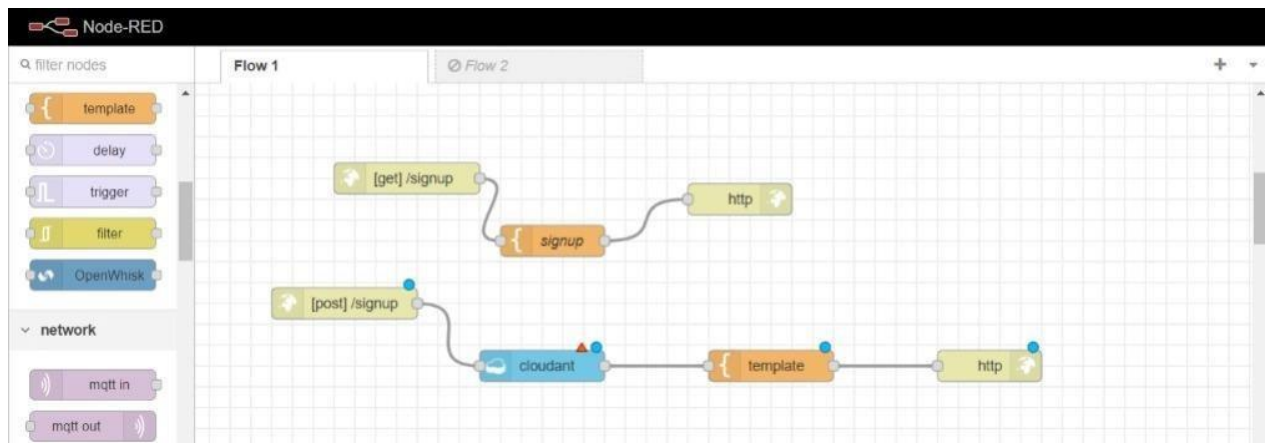
DATA GENERATION:

The screenshot displays a web application interface for managing devices. The top navigation bar includes 'Browse', 'Action', 'Device Types', and 'Interfaces'. A sidebar on the left contains various icons. The main content area shows details for a device named 'weather_today', which is currently 'Disconnected'. The 'Recent Events' tab is active, displaying a table of live data events.

Event	Value	Format	Last Received
event_1	{"Temperature":44,"humidity":94}	json	a few seconds ago
event_1	{"Temperature":58,"humidity":90}	json	a few seconds ago
event_1	{"Temperature":30,"humidity":95}	json	a few seconds ago
event_1	{"Temperature":46,"humidity":74}	json	a few seconds ago
event_1	{"Temperature":46,"humidity":96}	json	a few seconds ago

At the bottom right, a status indicator shows '1 Simulation running'.

Sign-up in Node-red:

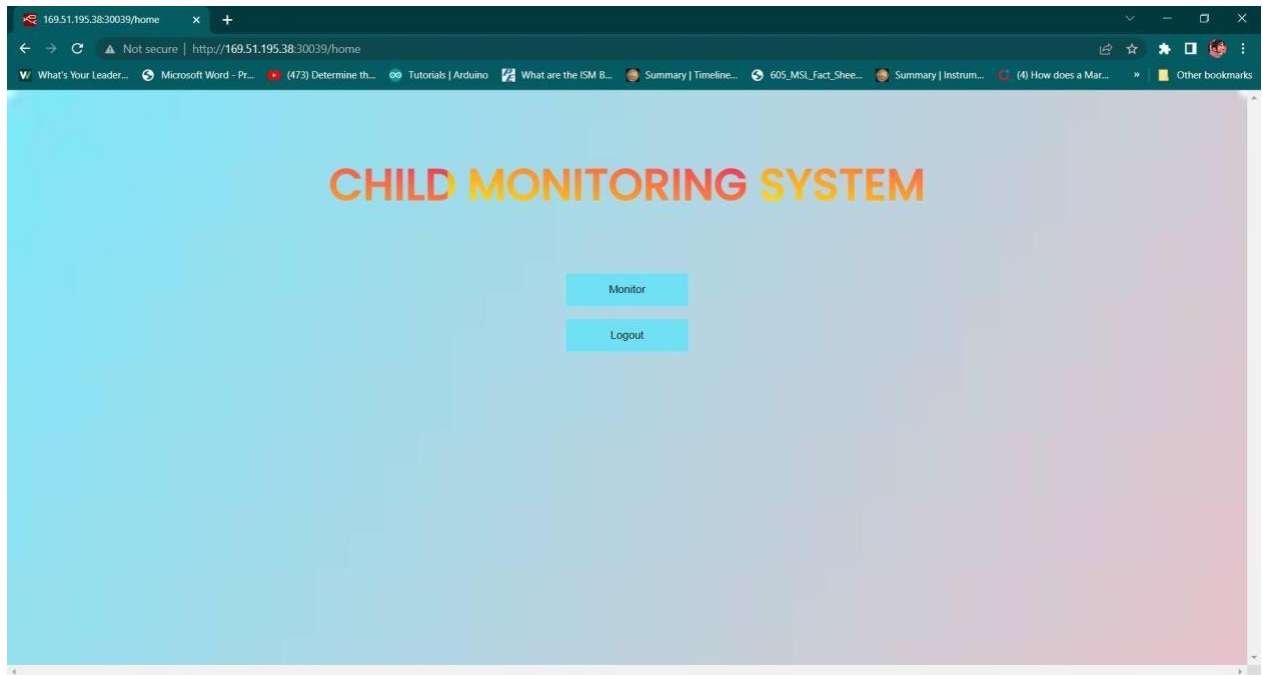


Sign up page created:

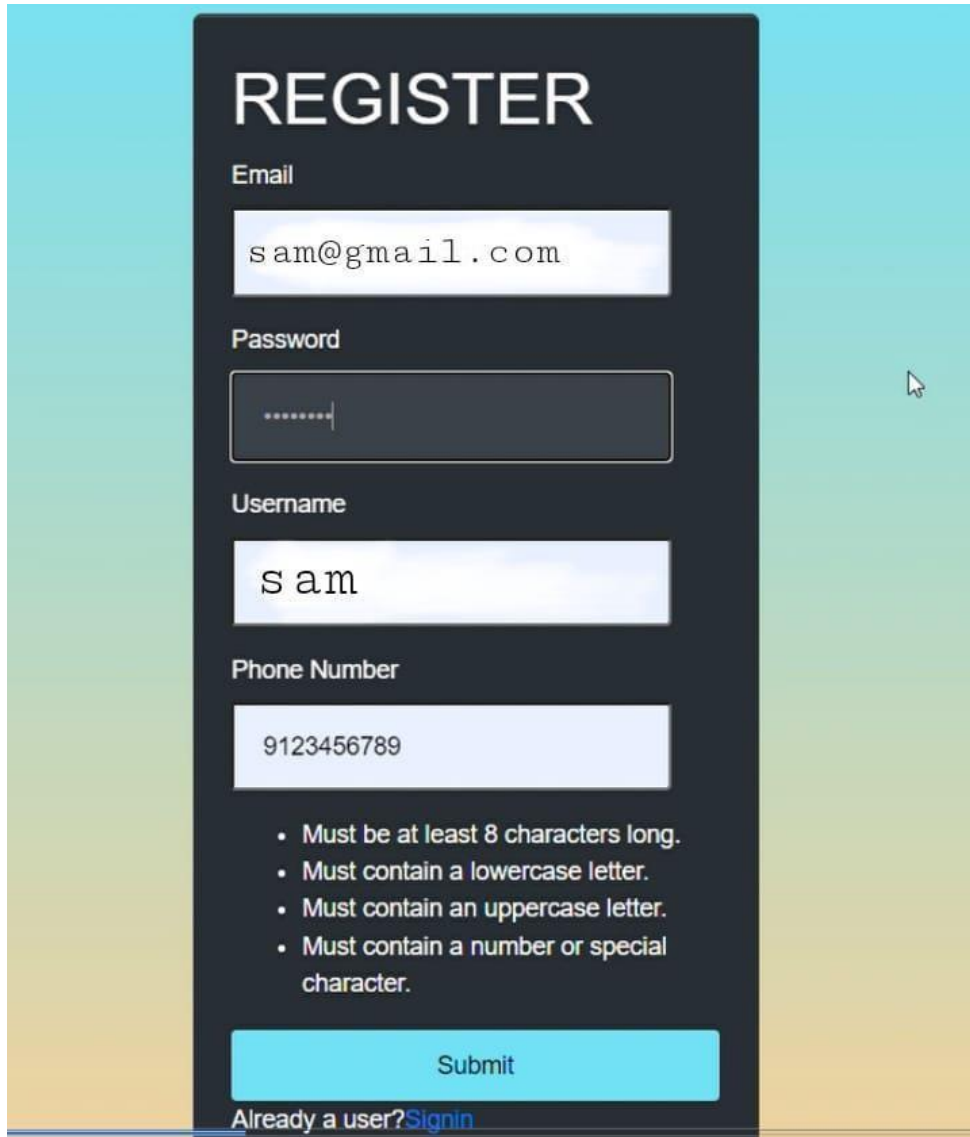
The screenshot shows a web browser window with the address bar displaying `http://169.51.195.38:30039/signup`. The page has a light blue background with a dark blue header. A dark blue registration form is centered on the page. The form contains the following fields and elements:

- REGISTER** (Title)
- Email** (Label)
-
- Password** (Label)
-
- Username** (Label)
-
- Phone Number** (Label)
-
- Must be at least 8 characters long.
 - Must contain a lowercase letter.
 - Must contain an uppercase letter.
 - Must contain a number or special character.
-
- [Already a user? Signin](#)

Home Page Creation:



Login credential:



REGISTER

Email

Password

Username

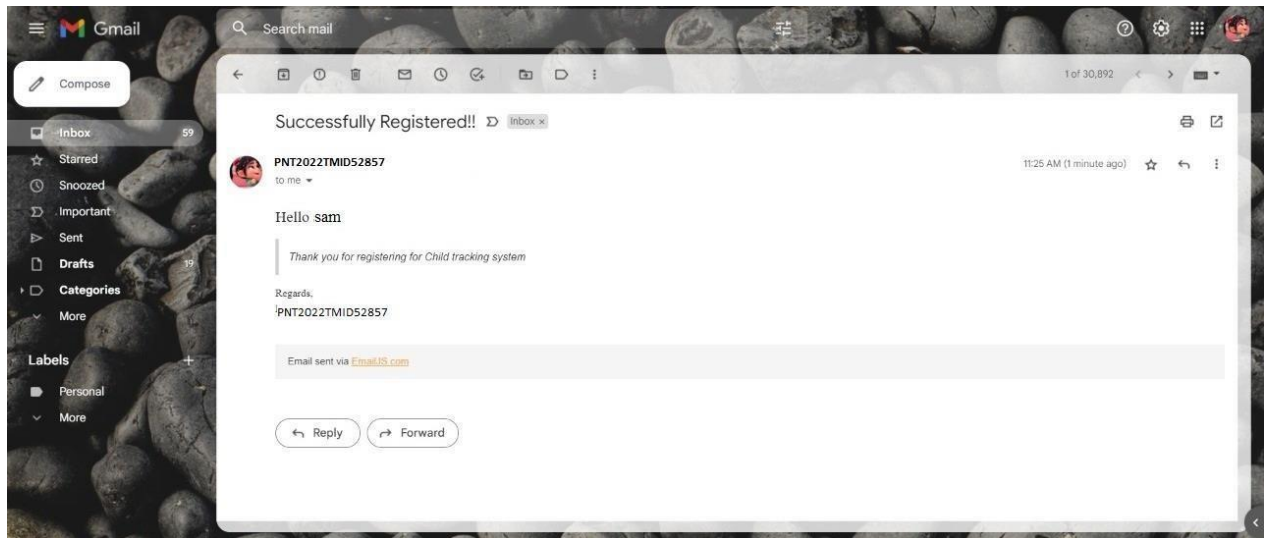
Phone Number

- Must be at least 8 characters long.
- Must contain a lowercase letter.
- Must contain an uppercase letter.
- Must contain a number or special character.

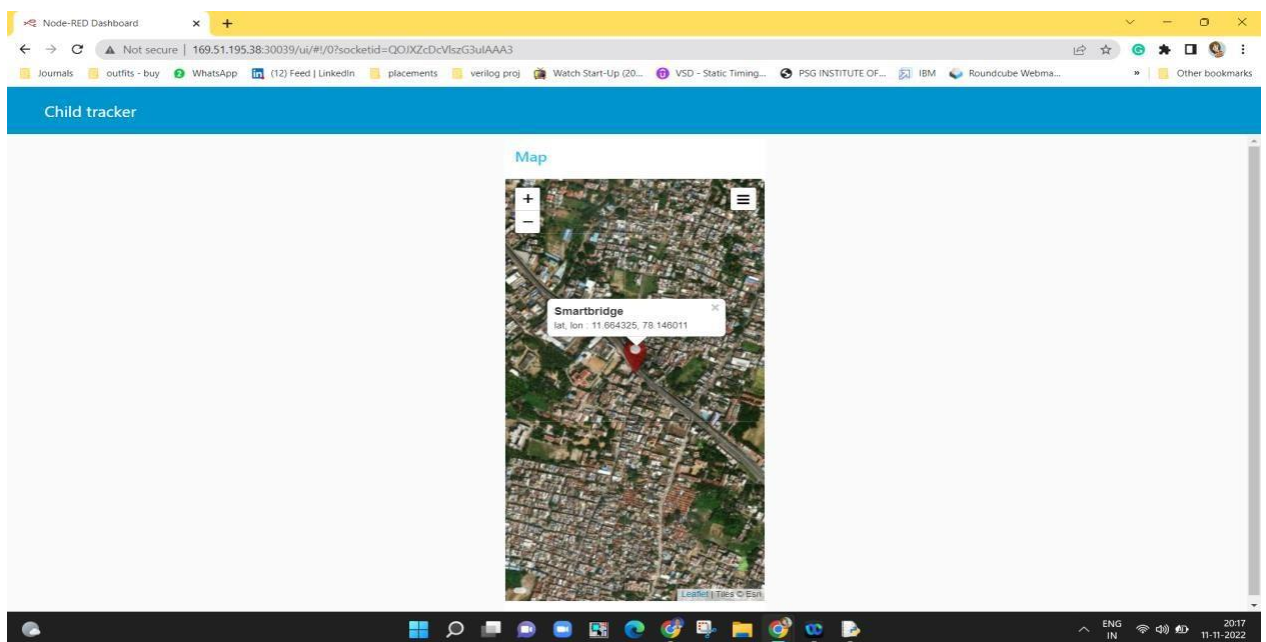
Submit

Already a user? [Signin](#)

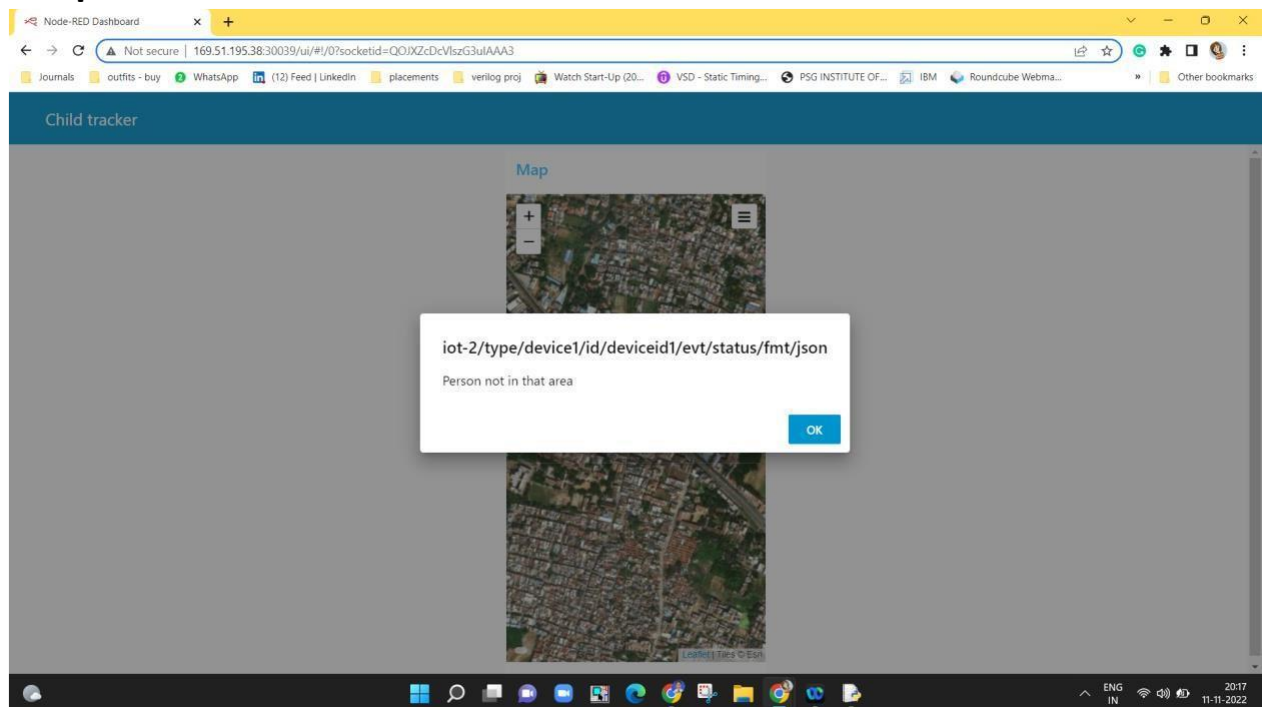
Confirmation mail:



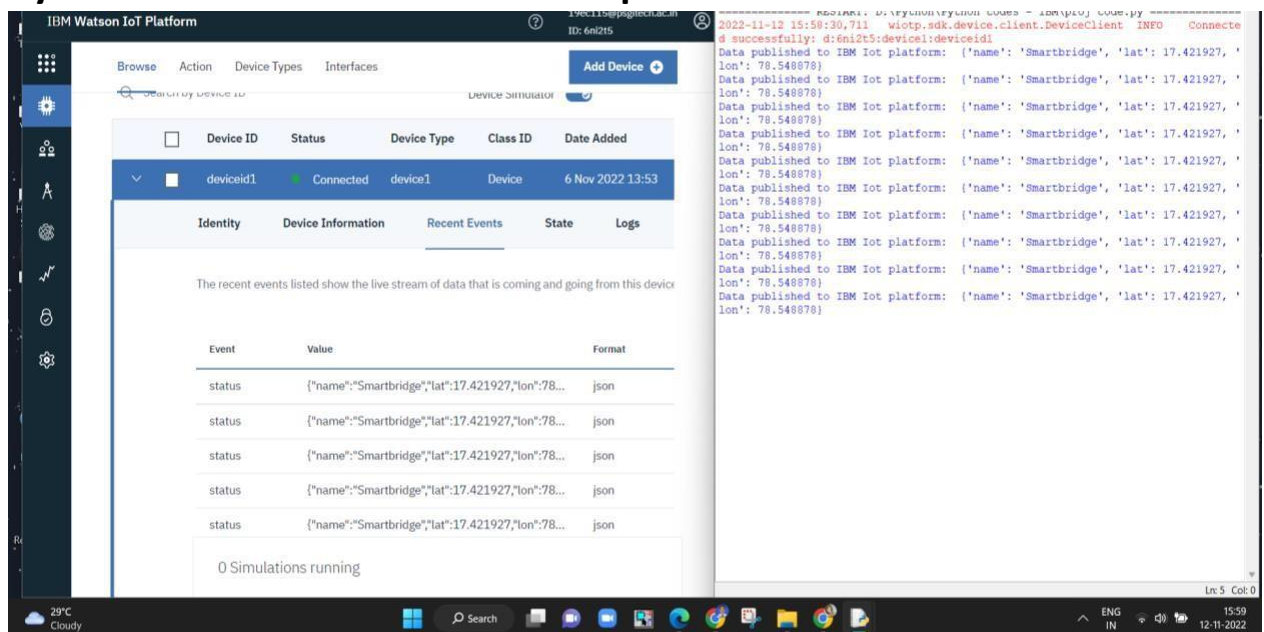
Child within the Geo fence:



Output for child outside fence:



Python and Watson interfaced output:



Child inside Geofence:

CHILD TRACKER APPLICATION

LATITUDE:

LONGITUDE:

Person is inside the area

Child outside Geofence:

CHILD TRACKER APPLICATION

LATITUDE:

17.42192

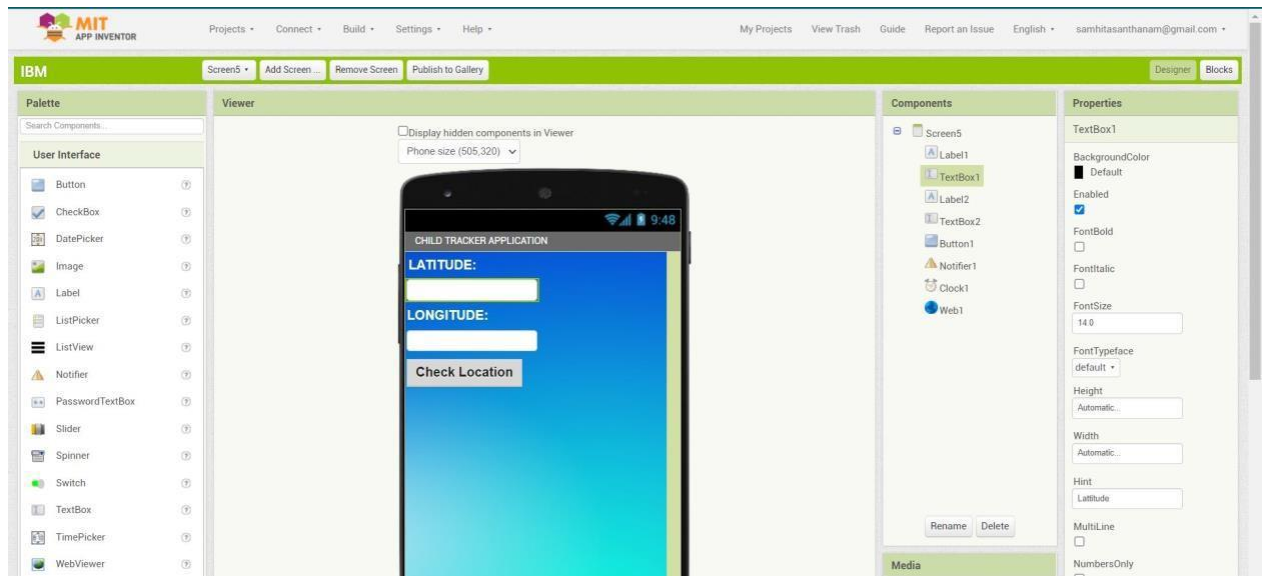
LONGITUDE:

78.54887

Check Location

Person is outside the area

MIT app design:



7. ADVANTAGES

- 1.) Trace whereabouts and Minimise the Tragedy
- 2.) Create unassailable environment
- 3.) Toddlers in hamlet and metropolis can be saved
- 4.) ceaseless Surveillance and instantaneous notification regime
- 5.) High dependability and data accuracy
- 6.) Eradicates ambiguity and Pays way for a tech-driven community

DISADVANTAGES

- 1.) Inadequate battery supply leads to switching off the device
- 2.) Impractical to use the device forever
- 3.) Improper weather condition

- 4.) Improper connectivity
- 5.) Misplacement or losing the tag
- 6.) Over usage of data

8. CONCLUSION

The System put forward this paper to ensure the safety of children and increase their confidence. Many experimenters are operating in this area and have formulated different technologies to aid children. The key represented in this paper takes the advantage of smartphones which proposes affluent elements like Google maps, SMS, etc. The child safety and protection device is proficient in acting as a smart IoT device. It equips parents with real-time location, the surrounding temperature, and along with an alarm buzzer for their child's circumstances and the capability to locate their child. This paper depicts the fundamental design concept and functionality along with the anticipated consequence.

The application aside from conceding you to track down your children when they're within Bluetooth range, it also functions when your kids go farther afield. Its competence as a tracker is outstanding and if you live in densely populated areas like cities or big towns. This means you will be able to see the identity of the participating devices and It helps to diminish their vulnerability in harmful situations and also protects the children in emergency situations.

Parents take measures both at home and outdoors to safeguard their kids from hurting themselves. But sometimes, it's impossible to pre-empt what can cause a treacherous encounter. However, it's possible to prevent such hazards with some forethought and simple measures using these safety gadgets.

9. FUTURE SCOPE

Ceaseless Surveillance :

If any deviant readings are disclosed by the sensor, then an SMS and phone calls are set off to the parent's mobile.

Create unassailable environment :

Precisely predicting the circumstances of the children and swiftly sensing the problems around children will make parents at ease. It helps to diminish their vulnerability in harmful situations and also protects the children in emergency situations.

Pays way for a tech-driven community :

Children and their parents are veering around to digital solutions more than ever to support children's cognition and it notifies the information about the child in a web application

10. APPENDIX

Source Code :

```
Import json
```

```
Import wiotp.sdk.device
```

```
Import time
```

```

myConfig = {
    "identity": {
        "orgId": "9o869i",
        "typeId": "manimd",
        "deviceId": "manimd12"
    }.
    "auth": {
        "token": "manimd07"
    }
}

client=wiotp.sdk.device.DeviceClient(config=myConfig,
logHandlers=None)
client.connect()
While True:
name="mani"
latitude+11.225894
longitutde=76.980855
latitude=11.226767
longitude=76.988299
mydata={'name':name, 'lat':latitude, 'lon':longitude}
client.publishEvent("lotSensor", "json", data=mydata, qos=0,
onPublish=None)
print("Data published to IBM IoT platform :",mydata)
time.sleep(5)

```

client.disconnect()

GitHub:

<https://github.com/IBM-EPBL/IBM-Project-33817-1660227376>