

IBM NALAIYATHIRAN

IoT Based Safety Gadget For Child Safety Monitoring & Notification

Project Report

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INTRODUCTION

1.1 Project Overview

Internet of Things (IoT) plays a major role in every day-to-day life. 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 are able to 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 to act smart in emergency situations without human interventions.

So, IoT devices are applied in different fields such as agriculture, medical, industrial, security and communication applications. IoT systems are useful within a system to do deeper automation, analysis, and integration. IoT contributes to technology by advances in software, hardware and modern tools.

It even uses existing and upcoming technology in the fields of sensing, networking and robotics. IoT brings global changes by its advanced elements in the social, economic, and political impact of the users.

Child tracker helps the parents in continuously monitoring the child's location. They can simply leave their children in school or parks and create a geofence around the particular location. By continuously checking the child's location notifications will be generated if the child crosses the geofence.

Notifications will be sent according to the child's location to their parents or caretakers. The entire location data will be stored in the database.

1.2. Purpose

The main purpose 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 child’s location through geofence. The gadget allows us the guardian or parents to track their child’s whereabouts, ensuring they’re safe and within range. With the use of the parental control app, we have the ability to approve all watch contacts and block unknown numbers keeping your young one away from strangers. This system requires web UI, iot Watson platform, ibm cloud, node-red application and etc...

The child safety wearable system acts as a “smart device”. Child’s surroundings can be located with the help of accurate and precise real-time location. Surrounding environment temperature, SOS light along with Distress buzzers are provided in this system. 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.

The internet of things (IOT) refers to the set of devices and system that stay interconnected with real-world sensor and to the internet. During years’ Child safety is under threat and it is very important to provide a technology-based solution which will help them under panic situations and monitor them using a smart gadget. The proposed system is equipped with GSM and GPS modules for sending and receiving call and SMS between safety gadget and parental phone, the proposed system also consists of Wi-Fi module used to implement IoT and send all the monitoring parameters to the cloud for android app monitoring on parental phone.



Android application can be used to track the current location of safety gadget using its location coordinates on parental phone android app and also through SMS request from parent phone to safety gadget. Panic alert system is used during panic situations and automatic SMS alert and phone call is triggered from safety gadget to the parental phone seeking for help and also monitored for plug and

unplug from hand, as soon the gadget is unplugged from hand a SMS is triggered to parental phone and the alert parameter is also updated to the cloud.

LITERATURE SURVEY

2.1. Existing problem

Most kids who are reported missing have run away or there has been a misunderstanding with their parents about where they were supposed to be. Of the kids and teens who are truly abducted, most are taken by a family member or an acquaintance; 25% of kids are taken by strangers. Almost all kids kidnapped by strangers are taken by men, and about two thirds of stranger abductions involve female children. Most abducted kids are in their teens. Kids are rarely abducted from school grounds.

About 2,100 missing-children reports are filed each day in the U.S. Many cases can be solved more easily when parents can provide key information about their kids, like: height, weight, eye colour, and a clear recent photo. Make sure that the custody documents are in order. Make online safety a priority. The internet is a great tool, but it's also a place for predators to stalk kids. Be aware of your kids' internet activities and chat room "friends," and remind them never to give out personal information. Avoid posting identifying information or photos of your kids online.



Be sure your kids know whose cars they may ride in and whose they may not. Teach them to move away from any car that pulls up beside them and is driven by a stranger, even if that person looks lost or confused. Develop code words for caregivers other than mom or dad, and remind your kids never to tell anyone the code word. Teach them not to ride with anyone they don't know or with anyone who doesn't know the code word. If your kids are old enough to stay home alone, make sure they keep the door locked and never tell anyone who knocks or calls they are home alone.

IoT devices are applied in different fields such as agriculture, medical, industrial, security and communication applications [1]. IoT systems are useful within a system to do deeper automation,

analysis, and integration. IoT contributes to technology by advances in software, hardware and modern tools. It even uses existing and upcoming technology in the fields of sensing, networking and robotics. IoT brings global changes by its advanced elements in the social, economic, and political impact of the users.

The review of literature for child safety and location tracking devices are discussed below. In [2], the parent can send a message to the GSM module, according to the message information the GSM module reply back with particular details of the children. The location can be seen on the Google map. When a particular child is facing an emergency situation, device button should be pressed so that the device captures the image along with the user information to the enrolled mobile numbers. The life of the child can be saved within no time.

In [3], for the children point of view GPS, GPRS and GSM are used to monitor the speed and location tracking purpose. The system is fixed on the bus or car or in any vehicle so that the vehicle is going on routine route or not can be identified by the GPS tracker, the speed of the bus can also be extracted. Now-a-days the digital technology plays a major role for connecting persons via internet. For tracking the children, the android-based solution is provided to parents. Internet is the one that will connect different components through a single device and is connected to server. Parents track their children in real time of the location tracker by GSM and

[4] the microcontroller used is ARM-7 LPC2148. In day-to-day scenario, missing child cases are increasing gradually. Child caring is a major issue. Different types of methods are introduced to find good solutions. There have been many Methods and systems implemented to solve it.

In [5], to solve child caring problem global position system (GPS) based solution with two nodes was proposed. In these two nodes, one node is child node which contains a Bluetooth module and a GPS receiver. The parent node consists of a mobile that supports Bluetooth. The location of the child can be tracked by the GPS technology and can be displayed on the designed.

map in the mobile device, through the Bluetooth connection the distance between the child and parent can be calculated. Children below six years cannot explain in words directly to their parents about the problems, hence a wearable device is developed in [6]. This device procures information such as heart rate, physical body movements and send it to the parents in real time.

In [7], a wearable sensor badge is constructed from (hard) electronic components, which can sense perambulatory activities for context awareness. A wearable sensor jacket is used with latest techniques to form (soft) fabric. Stretch sensors are placed to measure upper limb and body movement. Worn as clothing, the sensors give the required information.[7].

In paper [8], wearable IoT device for the security and shielding of women and girl children was designed. The body temperature and galvanic skin resistance of the body is changed in abnormal conditions. This was used as input information and the alert signal is produced while it crosses the threshold value. This work deals with body temperature and stress, skin resistance and relationship between them. By applying these parameters activity of the person was analysed.

The device [9] an analysis of skin resistance and body temperature was made. Body position is determined by a triple axis accelerometer. After acquiring raw data activity recognition is done and a specialized machine learning algorithm is employed in this process. Real-time data is achieved by sending sensor data to a Cloud Platform. Then the data is analysed using MATLAB.

The jacket consists of different sensors for to detect the activity of the body. In paper [10], there are two modules namely Wi-Fi and audio play back module. The details of the baby can be sent to parents through Wi-Fi module. The audio play back module produces the recorded sound different sensors are accelerometer sensor, cry sensor, temperature sensor gas sensor, flame sensor and PIR sensor. The embedded system consists of microcontroller; accelerometer detects the angular position and movement of the baby.

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2.3. Problem Statement Definition

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

Child tracker helps the parents in continuously monitoring the child's location. They can simply leave their children in school or parks and create a geofence around the particular location. By continuously checking the child's location notifications will be generated if the child crosses the geofence. Notifications will be sent according to the child's location to their parents or caretakers. The entire location data will be stored in the database.

IDEATION AND PROPOSED SOLUTION

3.1. Empathy map canvas

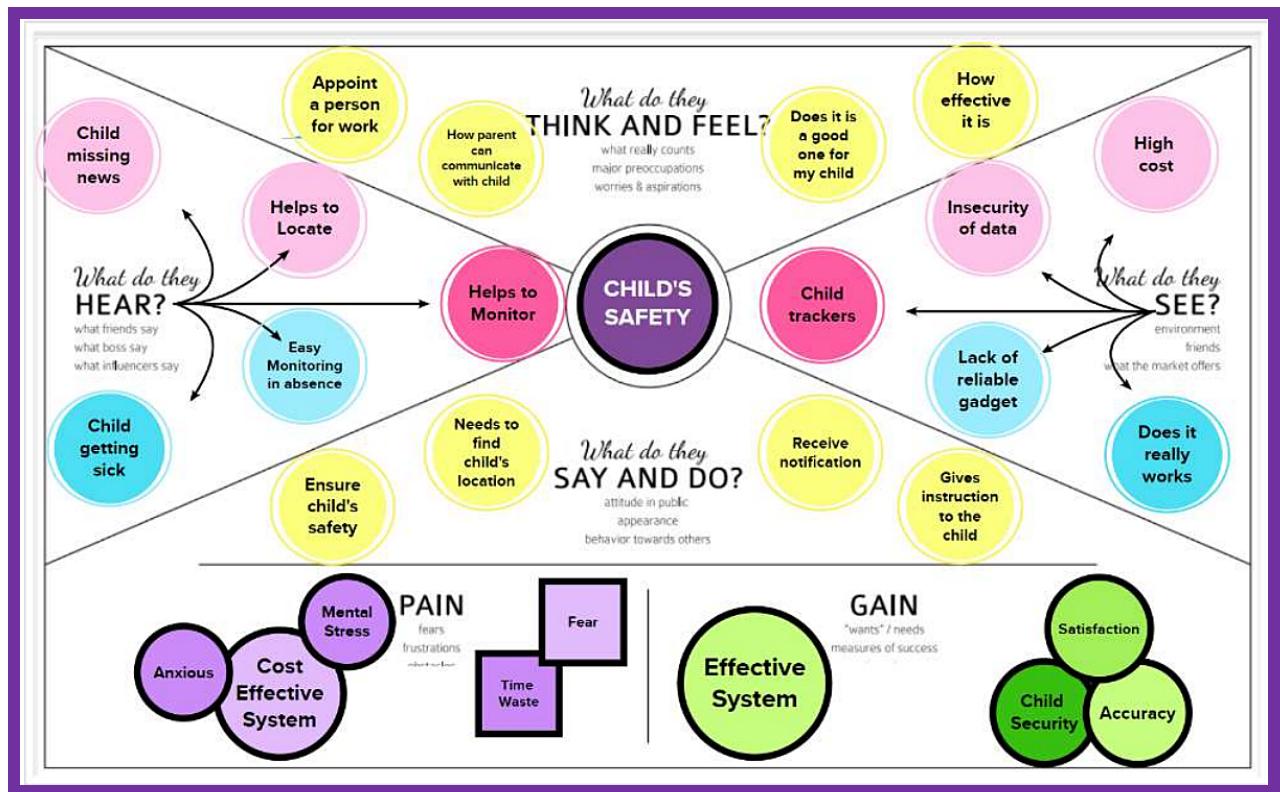
An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

An empathy map canvas is a more in-depth version of the original empathy map, which helps identify and describe the user's needs and pain points. And this is valuable information for improving the user experience. This information is then used to create personas that help teams visualize users and empathize with them as individuals, rather than just as a vague marketing demographic or account number.

Agile teams in a variety of departments use empathy map canvases to better understand how to meet their customers' needs. Design teams use them to help understand the various reasons why a user might interact with the product so they can design a user-friendly experience. Sales teams use them to

learn who customers are at an individual level so they can help them invest in a product that suits their needs, rather than leading with a sales pitch that might be off-putting or not appropriately tailored to customers. An empathy map canvas helps brands provide a better experience for users by helping teams understand the perspectives and mindset of their customers. Using a template to create an empathy map canvas reduces the preparation time and standardizes the process so you create empathy map canvases of similar quality.

Good canvases rely on insights from actual users, which help provide an accurate picture of how they feel about their experience with the product. This provides insight into which features are accessed



the most often and how they are used. And this knowledge empowers teams to make the improvements that most benefit the user and increase the product's value.

Revenue-driven design teams use an empathy map canvas to learn what factors most impact a user's decision to pay for the product or service. This can be particularly useful when teams want to push a new subscription plan and need to understand which features might prompt users to upgrade.

Understanding what users find the most valuable about the product can also help improve

marketing efforts by making it easier to identify why users think it is worth the price.

Empathy maps are divided into segments, which are typically defined by questions that teams work to answer one by one to complete the map. Using mural's template allows you to add color-coded sticky notes to help categorize answers visually. Brainstorm and identify user goals for the product. Consider any fears that might present a hurdle to the sales team, like if they worry about difficult-to-navigate interfaces that slow them down or make their job impossible. Understanding these nuances helps teams identify which features that users prioritize, which allows them to ensure what they offer aligns with users' needs.

User bases are varied, consisting of many individuals who might have different reasons for using the platform. Relying on a single persona won't provide an accurate picture of who the average users are or what they need. MURAL allows you to create your own templates and easily duplicate them, which means you can create as many customized personas as you want. The more personas your team creates, the better picture they'll have of what the user base looks like.

3.2. Ideation And BrainStorming

The device has IoT monitoring and a GSM module that allows the child to be monitored at all times. It also has numerous sensors that are connected to a CPU and are used to detect exact signals such as heart rate, temperature, and other dangers and alert the parents. In the event of a power outage, the wearable serves as a backup. On the device, there is an additional panic button. The purpose of this button is to notify parents and the police of a child's current location whenever they are in a perilous scenario. A GPS module is used to access their present location, and a GSM module assists in transmitting the information via SMS to designated contacts. In this approach, the device tries to provide child safety while remaining unobtrusive.

Our proposed system is based on the Internet of Things-based Smart Child Safety Wearable Device System designed as an efficient and low-cost IoT based system for monitoring infants in real-time. This system plays a key role in providing better care for the lost children until they reconvene with the parents. In this present era, most of the wearable devices today are designed based on the location , activity , temperature, pressure, etc of the child and inform the parents via GPS. Therefore it is intended to use voice call as the way of communication between the parent mobile and child's wearable device. The system operates on the microcontroller board and the functions of sending and receiving notifications , calls, voice messages via GPS.

A portable device which will have a pressure switch. As soon as an assailant is about to attack the person or when the person senses any insecurity from a stranger, he/she can then put pressure on the device by squeezing or compressing it. Instantly the pressure sensor senses this pressure and a

conventional SMS, with the victim's location will be sent to their parents/guardian cell phone numbers stored in the device while purchasing it, followed by a call. If the call is unanswered for a prolonged time, a call will be redirected to the police and the same message will be sent. Additionally, if the person crosses some area which is usually not accessed by the person then a message with the real-time location is sent to the parent/guardian's phone via conventional SMS.



3.3. Proposed Solution

The child safety wearable device is capable of acting as a smart IoT device. It provides parents with the real-time location, surrounding temperature, UV radiation index and SOS light along with Distress alarm buzzer for their child's surroundings and the ability to locate their child or alert bystanders in acting to rescue or comfort the child. The smart child safety wearable can be enhanced much more in the future by using highly compact Arduino modules such as the LilyPad, Arduino which can be sewed into fabrics.

Child safety is an unsolved issue. Many of the crimes are left without reported. Each day young children are being assaulted, molested and violated. The street, public transport, public spaces have became the territory of the hunters. Rape is the one of the major crime in India practice against children's. The crime rate is growing steadily since last few decade. Hence this device makes a step forward and safes victims from such situations. This device is designed in such a way that is easy to use as it works by detecting the abnormal vibrations. Kerala is the state that has the rate 455/1,00000 which is highest of crime reported in the year 2017-2018 says the NCRP (National Crime Records Bureau) and tamilnadu

holds the 3rd position with the rate of 294 /1,00,000 in the NCRP Report of the same year.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	With the increasing rate of child kidnapping and trafficking and lack of tracking technology for children, there is a limited application for child monitoring. Hence, an IoT based safety gadget for child safety is probably the need of the hour in today's world.
2.	Idea / Solution description	A good solution to this issue would be to design a smart wearable Internet of Things sensor based device for monitoring the environment of a child along with a mechanism for tracking the child. The gadget will make use of GPS and a python script to publish the location details to the IBM IoT platform. The wearable gadget also functions to send immediate alerts to the user in case if the child crosses the geofence.
3.	Novelty / Uniqueness	All the existing systems make use of GPS and a mobile app to track and receive alerts regarding the child's location, while this system makes use of the IBM Watson IOT Platform and IBM Cloud Services which is reliable and efficient to maintain the database of the child's location. The parent can set geofence and receive alerts through the web application which is user friendly and secure created using the Node Red Service.
4.	Social Impact / Customer Satisfaction	The main concern of any parent would be the safety and security of their kids. The design of this model does not mandate a lot of technical knowledge from the user to operate and it is simple. The purpose of this device is to facilitate the guardian or parents in locating their child with ease and ensuring its well-being.

The device when not in use locked so that the unnecessary signals are not sent. For unlocking it, a simple voice command is sufficient when the device is thrown with the force, using force sensor it will start functioning that is it will send the location to the police and distress message to the registered mobile number. The working of the device connected with the jewellery which sends a message to the person when the abnormal force is applied which is like a button, this records a voice message. This device is embedded with the jewellery. But accessing the button in danger and sending alert message through

recording audio are the main drawback.

3.4. Problem Solution Fit

Problem-solution fit is a term used to describe the point validating that the base problem resulting in a business idea really exists and the proposed solution actually solves that problem. The problem-solution fit is when you-

Validate that the problem exists: When you validate your problem hypothesis using real-world data and feedback. That is, you gather information from real users to determine whether or not they care about the pain point you're trying to solve.

Validate that your solution solves the problem: When you validate that the target audience appreciates the value your solution delivers to them.

The problem-solution fit precedes the product development and forms the foundation upon which a company is built. It helps you answer the basics startup-related questions before you even start your startup.

Problem-Solution fit			
1. CUSTOMER SEGMENT(S)	CS	6. CUSTOMER CONSTRAINTS	CC
Our customers are mainly parents who are unable to monitor their children as they need to go to work. Some of our customers includes the guardians of children of age 0-7 with specific needs whose activities must be monitored every now and then for their safety.	Our customers are mainly parents who are unable to monitor their children as they need to go to work. Some of our customers includes the guardians of children of age 0-7 with specific needs whose activities must be monitored every now and then for their safety.	The constraints of the customers includes the high cost of these devices, the knowledge about these gadgets that are available in the market, the connectivity issues and its inefficiencies due to various reasons leading to low sales performance.	The available solutions provide some benefits like real time tracking, safe zone alerts, panic button, etc. Though these devices come with such advantages, the increasing costs of such devices and the lack of proper knowledge about these gadgets leads to low sales of these items in the market.
2. JOBS-TO-BE-DONE / PROBLEMS	J&P	9. PROBLEM ROOT CAUSE	RC
The parents must be able to track the child's location every now and then and receive notifications if her/he is in an emergency situation. Parents should also be able to access the device to know the location of their child at any time. This requires tracking the child's location and forecasting the weather for safety measures.	The parents must be able to track the child's location every now and then and receive notifications if her/he is in an emergency situation. Parents should also be able to access the device to know the location of their child at any time. This requires tracking the child's location and forecasting the weather for safety measures.	The root cause for the need of child tracking devices in the market is the rising rates of child disappearances, abuses, kidnappings and accidents. To prevent these unfortunate incidents, parents are now aware of devices like these that enhances the protection of their children.	Some of the customers behaviours that leads to buying these child tracking gadgets includes the insecurity they suffer when their children are left alone in their house when parents are not around. Parents are also concerned about their child's environment and the weather conditions and the use of these devices can reduce their tension in their working place.
3. TRIGGERS	TR	10. YOUR SOLUTION	SL
The increasing cases of child disappearances, child abuses, kidnappings and accidents triggers the parents to use child tracking gadgets for their child safety and to work peacefully.	The increasing cases of child disappearances, child abuses, kidnappings and accidents triggers the parents to use child tracking gadgets for their child safety and to work peacefully.	A child tracking device which is capable of monitoring the child's location, the weather conditions, notifications features to make sure their children does not move out of his/her safe zone and the panic button feature which can be used in case of emergency. These child tracking gadgets, the parents can keep an eye about their child's conditions and his activities and can always keep an eye on their location.	When the parents are online they can always keep an eye on their children using their live location. They can also check for the weather conditions using the child's location.
4. EMOTIONS: BEFORE / AFTER	EM	8. CHANNELS of BEHAVIOUR	CH
The parents are very anxious about the condition of their children when they are all alone in a house or playing with their friends in some places. The growing insecurity leads them to constantly worry about their child's safety. With the help of child tracking gadgets, the parents can keep an eye about their child's conditions and his activities and can always keep an eye on their location.	The parents are very anxious about the condition of their children when they are all alone in a house or playing with their friends in some places. The growing insecurity leads them to constantly worry about their child's safety. With the help of child tracking gadgets, the parents can keep an eye about their child's conditions and his activities and can always keep an eye on their location.	8.1 ONLINE When the parents are online they can always keep an eye on their children using their live location. They can also check for the weather conditions using the child's location.	8.2 OFFLINE When the parents are present physically they can often visit their child's location to ensure they are safe and the climate feels optimal.

REQUIREMENT ANALYSIS

4.1. Functional Requirements

- Notification system
- secure personal information(privacy & encryption)
- local ranging/positioning(within the domain of the venue)

They must have an early alarm notification to help and to keep the child in range of variable sensitivity and it must have local ranging or positioning that is in the sense that the range of the child should be within the domain of the venue and it must have information privacy securitied information and end-to-end encryption and it also should have child node with child friendly design engage or interest the child and the respective child node with alternative function to be embedded into clothing or locked to child and the absolute outdoor gps style positioning.

4.2. Non Functional Requirements

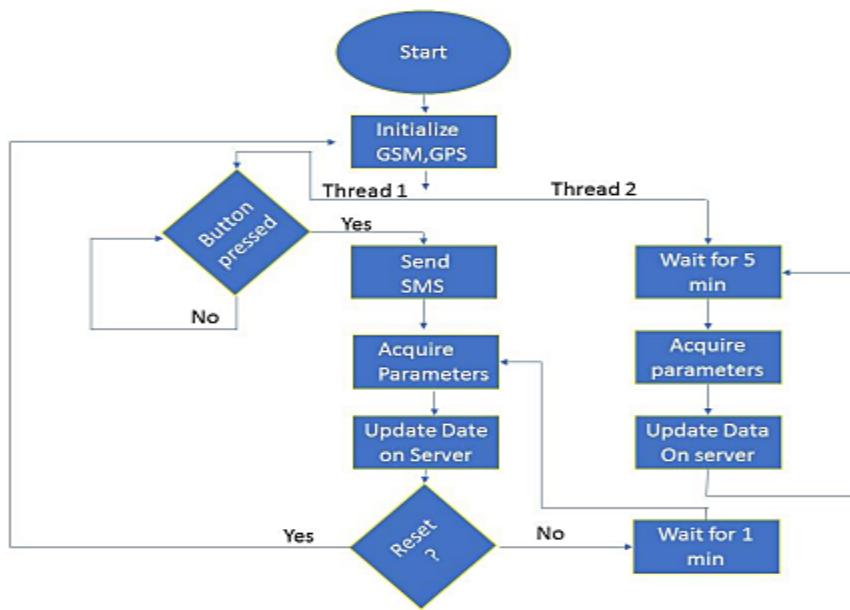
- Reliability
- Scalability

They must have reliability and with their respective transparency and the reusability. the main non functional requirements must meet the quality such as the performance with their efficiency of the energy and the properties must meet its scalability features. Nonfunctional Requirements (NFRs) define system attributes such as security, reliability, performance, maintainability, scalability, and usability. They serve as constraints or restrictions on the design of the system across the different backlogs.

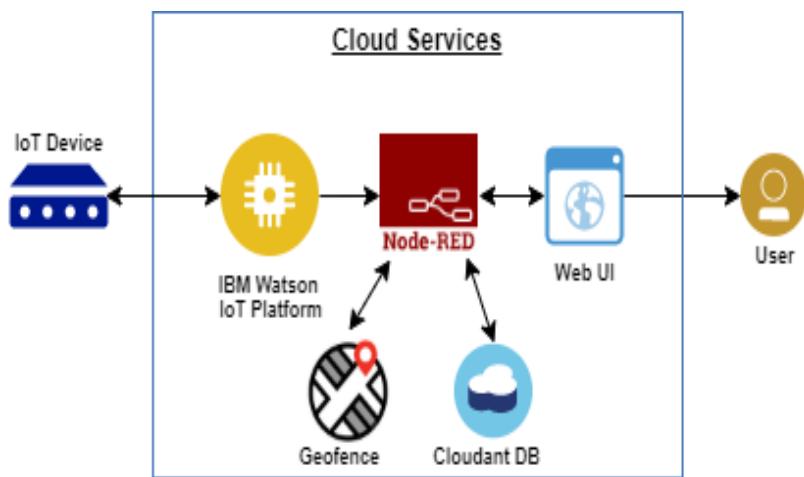
PROJECT DESIGN

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



Following are the functional requirements of the proposed solution.

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

Non-functional Requirements:

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

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

S.No	Component	Description	Technology
1.	User Interface	How user interacts with application e.g., Web UI, Mobile App, Chatbot etc.	HTML, CSS, JavaScript / Angular Js /React Js etc.
2.	Application Logic-1	Logic for a process in the application	Java / Python
3.	Application Logic-2	Logic for a process in the application	IBM Watson STT service
4.	Application Logic-3	Logic for a process in the application	IBM Watson Assistant
5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	External API-1	Purpose of External API used in the application	IBM Weather API, etc.
9.	External API-2	Purpose of External API used in the application	Aadhar API, etc.
10.	Machine Learning Model	Purpose of Machine Learning Model	Object Recognition Model, etc.
11.	Infrastructure (Server / Cloud)	Application Deployment on Local System / Cloud Local Server Configuration: Cloud Server Configuration:	Local, Cloud Foundry, Kubernetes, etc.

5.3. User Stories

User Stories

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

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Mobile user)	Registration	USN-1 (Father)	As a user, I can register by entering my email, password, and confirming my password. I can access the location of my children using the credentials provided as a Father.	I can access my account / dashboard and receive confirmation email & click confirm	High	Sprint-1
		USN-2 (MOTHER)	As a user, I can register by entering my email, password, and confirming my password. I can access the location of my children using the credentials provided as a Mother	I can access my account / dashboard and receive confirmation email & click confirm	High	Sprint-1
		USN-3 (GUARDIAN/ CARETAKER)	As a user, I can also monitor the children's activities using a safety gadget monitoring system.	I can access my account / dashboard and receive confirmation email & click confirm	Medium	Sprint-2
	Login	USN-4	As a user, I can log into the application by entering email & password.	I can access my account / dashboard.	Medium	Sprint-1
	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-1
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

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
		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	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 -1
	Dashboard	USN-5	As a user, I can fix the geofence for my child's location so that I will receive alerts if my child crosses the geofence.	I can monitor the current location of my child.	High	Sprint-2
Customer Care	Dashboard	USN-6	As a customer care service person, whenever I receive a complaint, I forward the complaint and ensure that the complaint is resolved.	I can keep track of all the complaints and the status of the complaints received.	Medium	Sprint-1
Administrator	Admin Dashboard	USN-7	As an administrator, I will take care of all the payment processes, queries and complaints and login credentials.	I can access all the customer details, payment details and complaints received.	High	Sprint-4

PROJECT PLANNING AND SCHEDULING

6.1. Sprint Planning and Estimation

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 email, password, and assuring the same password.	4	High	VARSHA.AJ
Sprint-1	Confirmation of Email	USN-1	As a user, I will receive a confirmation email once I have registered for the application	4	High	MOGHANAPRIYA
Sprint-1	Authentication	USN-3	As a user, I can register for the application through Gmail and mobile app.	4	Medium	HARIKRISHNAN
Sprint-1	Login	USN-4	As a user, I can log into the application by entering mail id & password	4	High	PAVITHRA
Sprint-1	Dashboard	USN-5	As a user, I need to enable the view the functions that I can perform	4	High	KEERTHANA
Sprint-2	Notification	USN-1	As a user, I should be able to notify my parent and guardian in emergency situations	10	High	VARSHA.AJ
Sprint-2	Storedata	USN-2	As a user, I need to continuously store my location data into the database.	10	Medium	MOGHANAPRIYA
Sprint-3	Communication	USN-3,1	I should be able to communicate with my parents	6	Low	VARSHA.AJ, HARIKRISHNAN

Sprint	Functional Requirement(Epic)	User Story Number	User Story/Task	Story Points	Priority	Team Members
Sprint-3	IoT Device – Watson communication	USN-1,4	The data from IoT device should reach IBM Cloud	7	Medium	VARSHA.AJ, PAVITHRA
Sprint-3	Node RED- Cloudant DB communication	USN-5,2	The data stored in IBM Cloud should be properly integrated with Cloudant DB	7	High	KEERTHANA, MOGHANAPRIYA
Sprint-4	User – Web UI interface	USN-1,4	The Web UI should get inputs from the user	6	High	VARSHA.AJ, PAVITHRA
Sprint-4	Geofencing	USN-2,3,5	The geofencing of the child should be done based on the geographical coordinates	7	High	MOGHANAPRIYA, HARIKRISHNAN, KEERTHANA

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	08 Nov 2022	20	08 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	14 Nov 2022	20	14 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

Velocity:

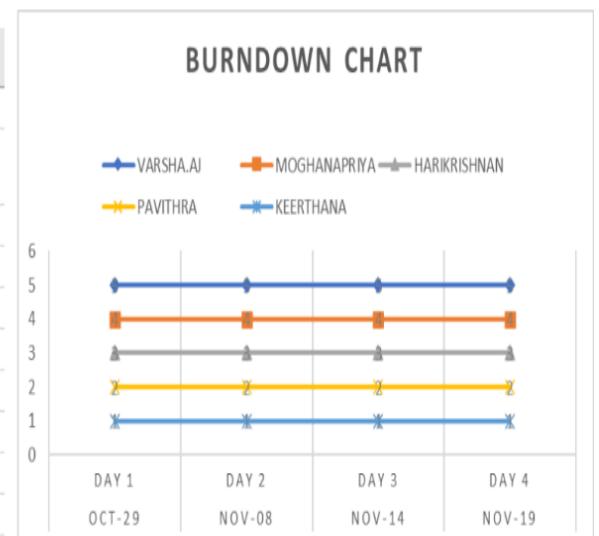
Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{\text{sprint duration}}{\text{velocity}} = \frac{20}{10} = 2$$

6.2. Sprint Delivery Schedule

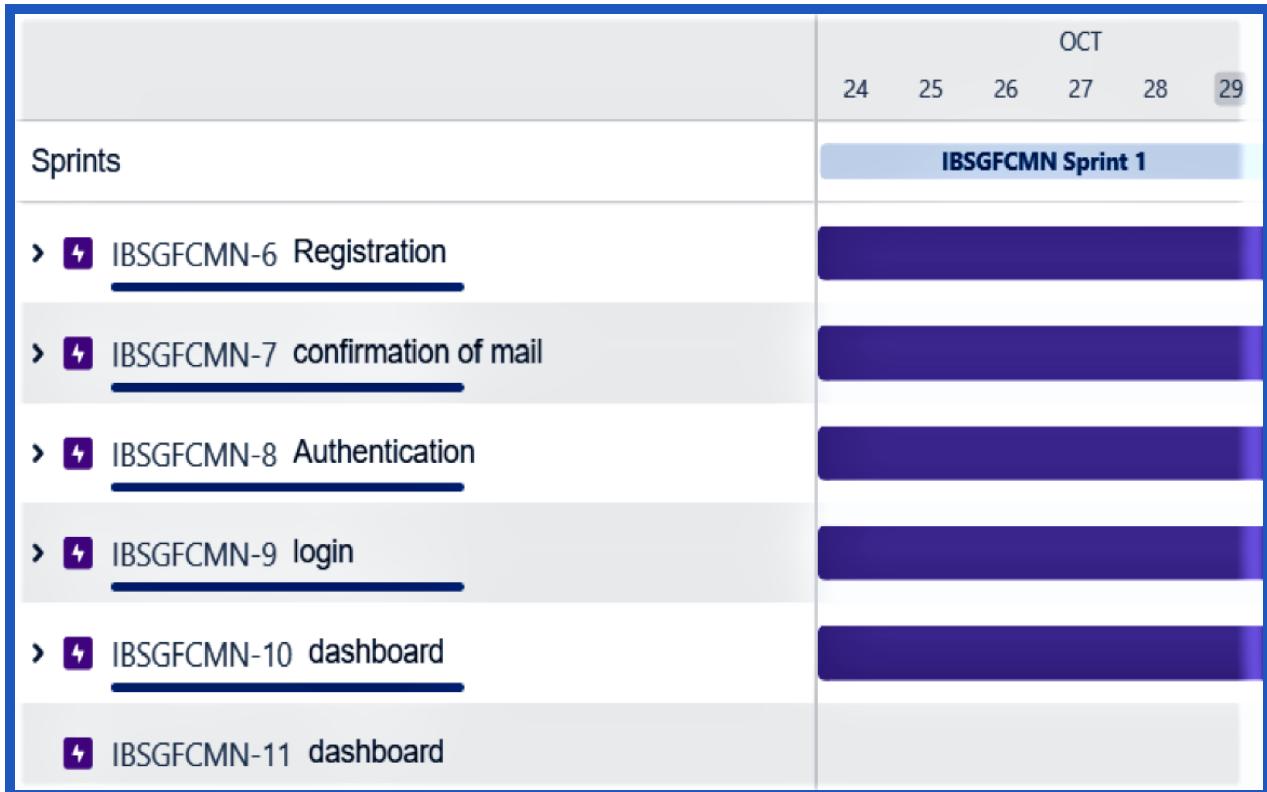
Burndown Chart:

H	I	J	K	L	M	N
Burndown Chart						
Team Member	User Name	Oct-29	Nov-08	Nov-14	Nov-19	
		Day 1	Day 2	Day 3	Day 4	
1	VARSHA.AJ	5	5	5	5	
2	MOGHANAPRIYA	4	4	4	4	
3	HARIKRISHNAN	3	3	3	3	
4	PAVITHRA	2	2	2	2	
5	KEERTHANA	1	1	1	1	



6.3. Reports From JIRA

Sprint 1



Sprint 2



Sprint 3

		NOV							
		7	8	9	10	11	12	13	14
Sprints		IBSGFCMN Sprint 3							
		⚡ IBSGFCMN-2 Node red cloudant DB communication							
		⚡ IBSGFCMN-3 Node red cloudant DB communication							

Sprint 4

		NOV							
		14	15	16	17	18	19		
Sprints		IBSGFCMN Sprint 4							
	› ⚡	IBSGFCMN-2 Geofencing							

CODING AND SOLUTIONING

7.1. Feature 1

Code:

```
#include <WiFi.h>
#include <PubSubClient.h>
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);
#define ORG "xd91di"
```

```

#define DEVICE_TYPE "nodeajv"
#define DEVICE_ID "123"
#define TOKEN "uR1S+yJLg+Sa+)B!zQ"
String data3;
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";
char publishTopic[] = "iot-2/evt/Data/fmt/json";
char subscribetopic[] = "iot-2/cmd/test/fmt/String";
char authMethod[] = "use-token-auth";
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;
WiFiClient wifiClient;
PubSubClient client(server, 1883, callback ,wifiClient);
const int trigPin = 5;
const int echoPin = 18;
#define SOUND_SPEED 0.034
long duration;
float distance;
void setup() {
Serial.begin(115200);
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
wificonnect();
mqttconnect();
}
void loop()
{
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);

```

```

distance = duration * SOUND_SPEED/2;
Serial.print("Distance (cm): ");
Serial.println(distance);
if(distance<100)
{
Serial.println("ALERT!!!");
delay(1000);
PublishData(distance);
delay(1000);
if (!client.loop()) {
mqttconnect();
}
}
delay(1000);
}

void PublishData(float dist) {
mqttconnect();
String payload = "{\"Distance\":";
payload += dist;
payload += ",\"ALERT!!\":\"\"\"\"Distance less than 100cms\"\"\"}";
payload += "}";
Serial.print("Child is not safe: ");
Serial.println(payload);

if (client.publish(publishTopic, (char*) payload.c_str())) {
Serial.println("Publish ok");
} else {
Serial.println("Publish failed");
}
}

void mqttconnect() {
if (!client.connected()) {

```

```
Serial.print("Reconnecting client to ");
Serial.println(server);
while (!!client.connect(clientId, authMethod, token)) {
Serial.print(".");
delay(500);
}
initManagedDevice();
Serial.println();
}
}

void wificonnect()
{
Serial.println();
Serial.print("Connecting to ");
WiFi.begin("Wokwi-GUEST", "", 6);
while (WiFi.status() != WL_CONNECTED) {
delay(500);
Serial.print(".");
}
Serial.println("");
Serial.println("WiFi connected");
Serial.println("IP address: ");
Serial.println(WiFi.localIP());
}

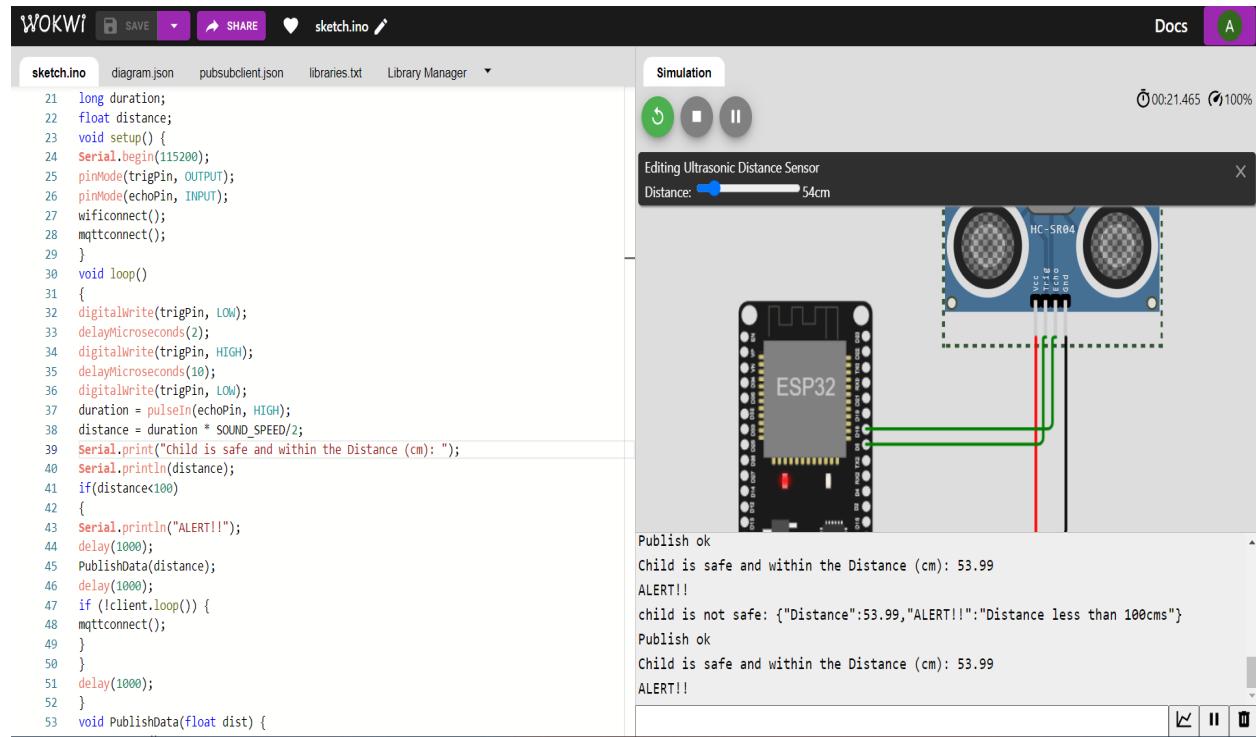
void initManagedDevice() {
if (client.subscribe(subscribetopic)) {
Serial.println((subscribetopic));
Serial.println("subscribe to cmd OK");
} else {
Serial.println("subscribe to cmd FAILED");
}
}
```

```

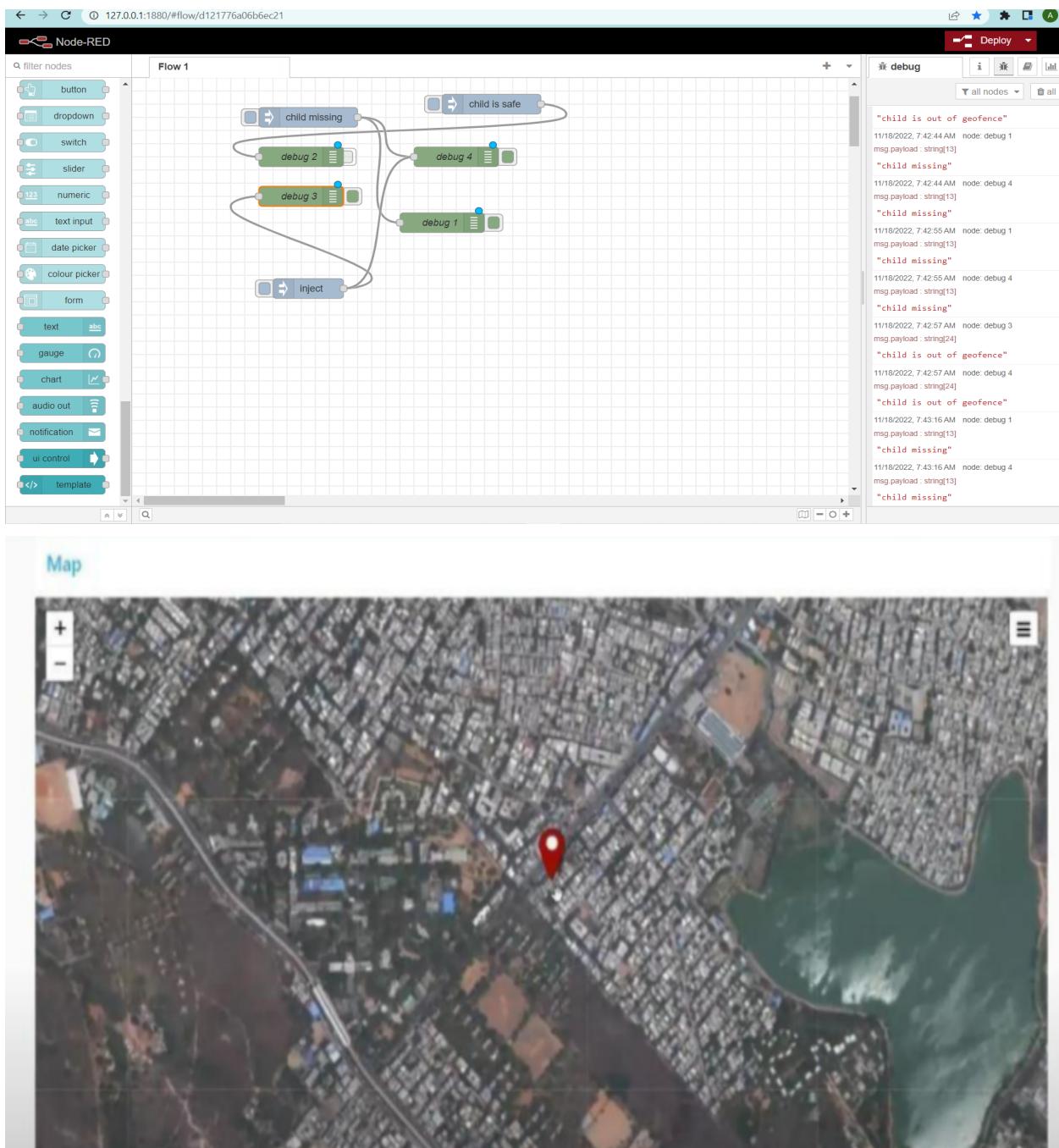
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength)
{
    Serial.print("callback invoked for topic: ");
    Serial.println(subscribetopic);
    for (int i = 0; i < payloadLength; i++) {
        data3 += (char)payload[i];
    }
    Serial.println("data: "+ data3);
    data3="";
}

```

Output



7.2. Feature 2



7.3. Database Schema

The screenshot shows a database schema interface with a header row containing columns: Device ID, Status, Device Type, Class ID, Date Added, and Descriptive Location. A single row is selected, showing values: 123, Connected, nodeajv, Device, 12 Nov 2022 21:53, and a set of three dots. Below this is a navigation bar with tabs: Identity, Device Information, Recent Events (which is selected), State, and Logs. A close button (X) is on the right. A message below the tabs states: "The recent events listed show the live stream of data that is coming and going from this device." Below this is a table with columns: Event, Value, Format, and Last Received. The table lists five data entries, all in json format and received "a few seconds ago".

Device ID	Status	Device Type	Class ID	Date Added	Descriptive Location
123	Connected	nodeajv	Device	12 Nov 2022 21:53	...

Event	Value	Format	Last Received
Data	{"Distance":1.99,"ALERT!!":"Distance less than 1...}	json	a few seconds ago
Data	{"Distance":84.95,"ALERT!!":"Distance less than ...}	json	a few seconds ago
Data	{"Distance":1.99,"ALERT!!":"Distance less than 1...}	json	a few seconds ago
Data	{"Distance":1.99,"ALERT!!":"Distance less than 1...}	json	a few seconds ago
Data	{"Distance":47.97,"ALERT!!":"Distance less than ...}	json	a few seconds ago

TESTING

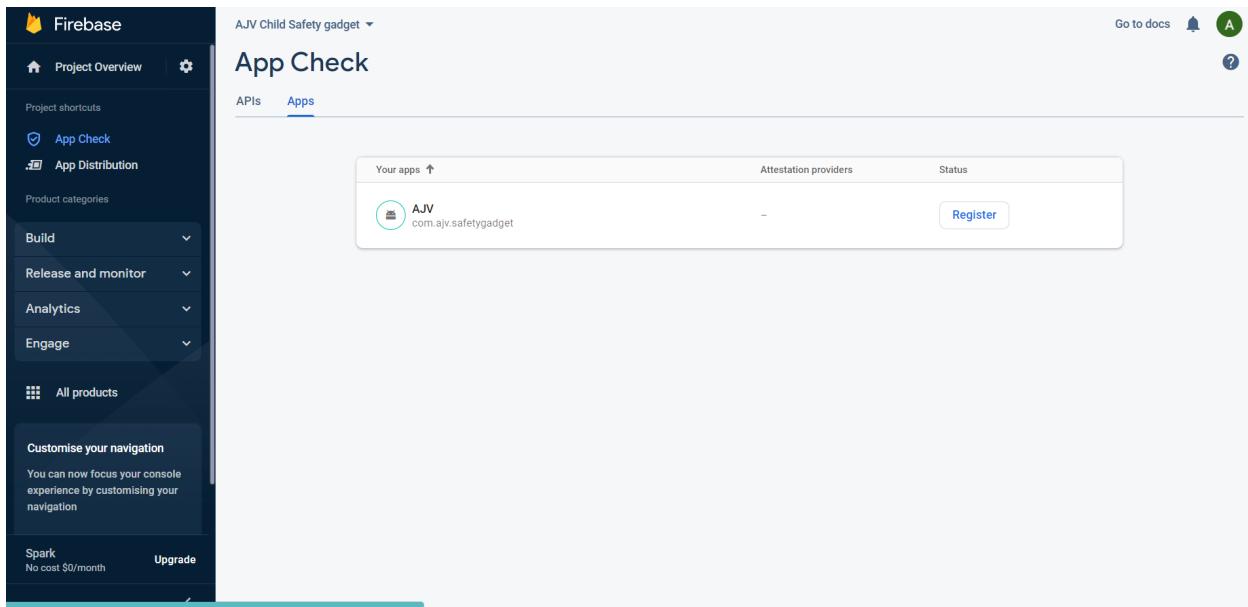
8.1. Test Cases

The screenshot shows the Firebase console interface. On the left is a dark sidebar with navigation links: Project Overview, App Check, App Distribution, Build, Release and monitor, Analytics, Engage, All products, and a section for customizing navigation. The main area is titled "AJV Child Safety gadget" and includes a "Spark plan" button, a "AJV" button, and a "+ Add app" button. It features a cartoon illustration of a woman holding a smartphone. Below the illustration, a progress bar indicates "Waiting for Analytics data...". At the bottom, there is a banner stating "Store and sync app data in milliseconds" with a progress bar showing a purple segment followed by an orange segment.

The screenshot shows the 'Project settings' page for the 'AJV Child Safety gadget' project. The left sidebar includes links for Project Overview, App Check (selected), App Distribution, Product categories, Build, Release and monitor, Analytics, Engage, All products, and a section to Customize your navigation. The main content area has tabs for General, Cloud Messaging, Integration, Service accounts, Data privacy, Users and permissions, and App Check. The General tab is selected, displaying the 'Your project' section with fields for Project name (AJV Child Safety gadget), Project ID (ajv-child-safety-gadget), Project number (609557109383), Default GCP resource location (asia-south1), and Web API key (No web API key for this project). Below this is the 'Environment' section, which allows customizing the project for different stages of the app lifecycle. The 'Public settings' section controls instances shown to the public, with a Public-facing name field set to project-609557109383.

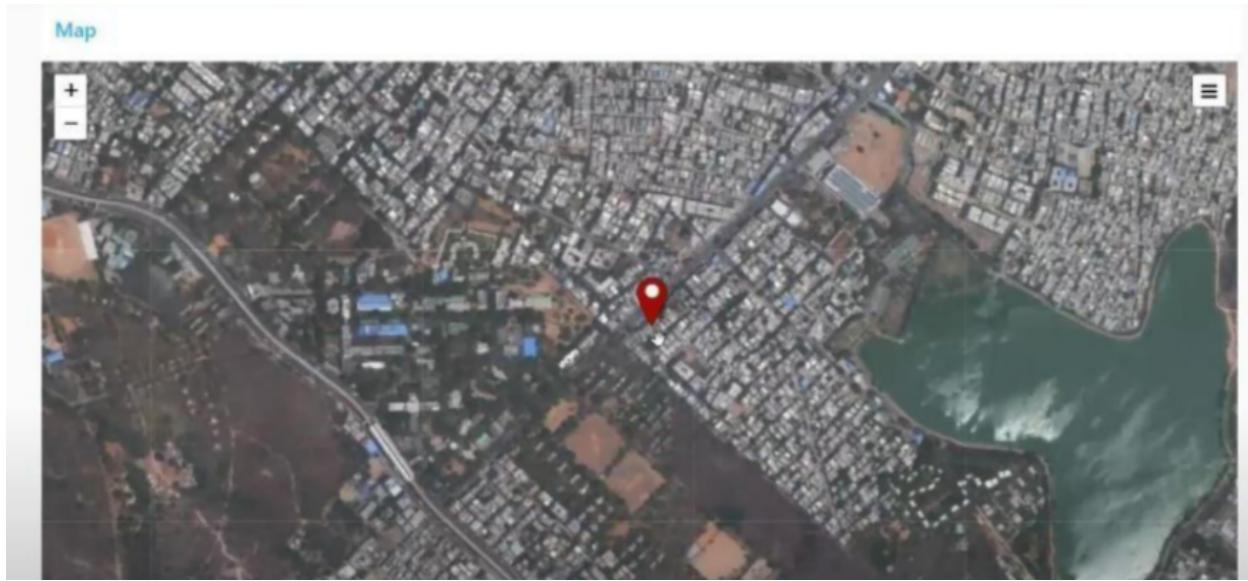
The screenshot shows the 'App Check' page for the 'AJV Child Safety gadget' project. The left sidebar is identical to the previous screenshot. The main content area has tabs for APIs (selected) and Apps. The Apps tab displays a table with columns for Your apps, Attestation providers, and Status. A single entry is listed: 'AJV com.ajv.safetygadget' with a status of '-' and a 'Register' button. The table header is 'Your apps ↑'.

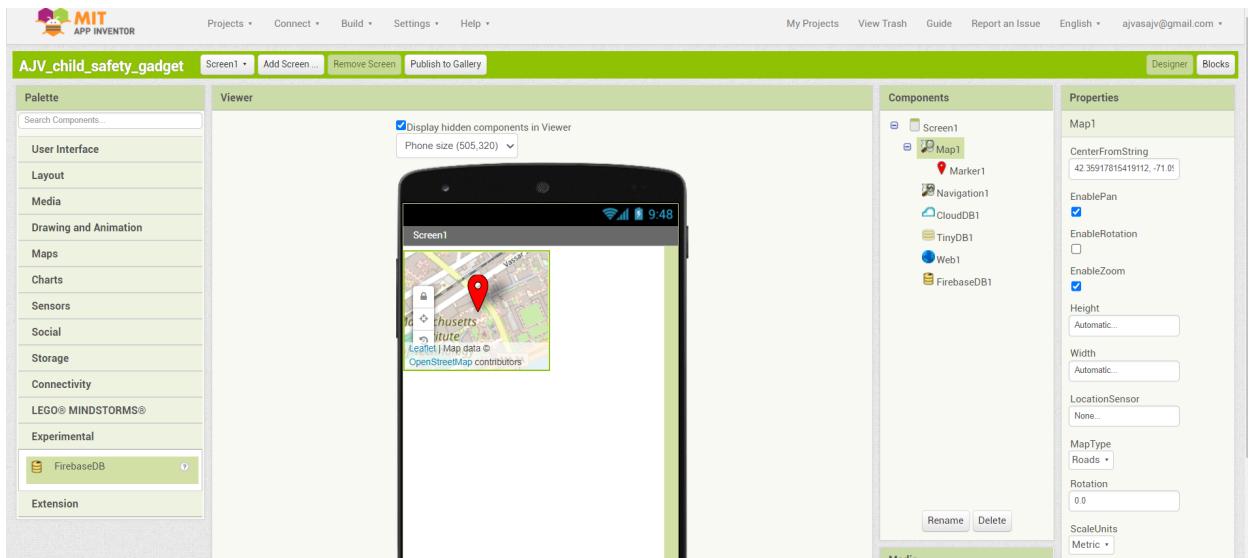
8.2. User Acceptance Testing



The screenshot shows the Firebase App Check dashboard for the project 'AJV Child Safety gadget'. The left sidebar contains navigation links for Project Overview, App Check (which is selected), App Distribution, Product categories, Build, Release and monitor, Analytics, Engage, and All products. A 'Customise your navigation' section allows users to focus on specific console experience by customising their navigation. The main area is titled 'App Check' and shows two tabs: APIs and Apps. Under the Apps tab, there is a table with columns for 'Your apps', 'Attestation providers', and 'Status'. One row is listed: 'AJV com.ajv.safetygadget' with a status of '-' and a 'Register' button.

RESULT





The result was obtained to be child safety locator to detect if the child was missing and we can track the child using our safety monitoring and notification at the right time.

Also the connected device of child's guardian, parents and caretakers will be able to receive the notification since their device was connected to the Watson platform.

Device ID	Status	Device Type	Class ID	Date Added	Descriptive Location
123	Disconnected	nodeajv	Device	12 Nov 2022 21:53	
455	Disconnected	nodeajvas	Device	12 Nov 2022 21:54	
786	Disconnected	nodeajv	Device	12 Nov 2022 21:54	
ddd	Disconnected	nodesss	Device	12 Nov 2022 21:52	

Gps is installed on gadget to track its current location to be tracked on android app and via SMS request send from parent phone to safety gadget.

9.1. Performance metrics

Performance measurement is the process of collecting, analyzing and/or reporting information regarding the performance of an individual, group, organization, system or component . Definitions of performance measurement tend to be predicated upon an assumption about why the performance is being measured.

Performance metrics are defined as figures and data representative of an organization's actions, abilities, and overall quality.



ADVANTAGES AND DISADVANTAGES

10.1. Advantages

- Easy Availability &Affordability.
- Tracking Made Easy.
- Smart watch is Technology in Disguise.
- Watch over your kids.
- Track kids when they are away from home and out of your sight.

10.2. Disadvantages

- Data security concerns.
- Technical concerns.
- Capabilities are limited.
- Wearable technology is expensive.

CONCLUSION

Camera Module can be used for surveillance of the child surroundings. This gets a clearer picture of the location or place this wearable can also be incorporated on a camera module . The hardware that can be used would be a adafruit TTL serial camera or any other camera module. Since the major focus of this wearable is the GSM module which is a better alternative than Bluetooth, Wi -Fi or ZigBee due to the short range and connectivity issues. Some camera module supports video streaming. Due to the constraint of trying to use only SMS, only four wire connections are used. The red and black wires will be connected directly to +5V and GND respectively to the Arduino Uno board. The RX pin is used for sending data via arduino Uno and GSM board .The TX pin is utilized for receiving incoming data from the modules. The 10 K resistor divider is used. The camera's serial data pins utilizes a 3.3V logic, and it would be a good idea to divide the 5V down so that it reaches 2.5V.



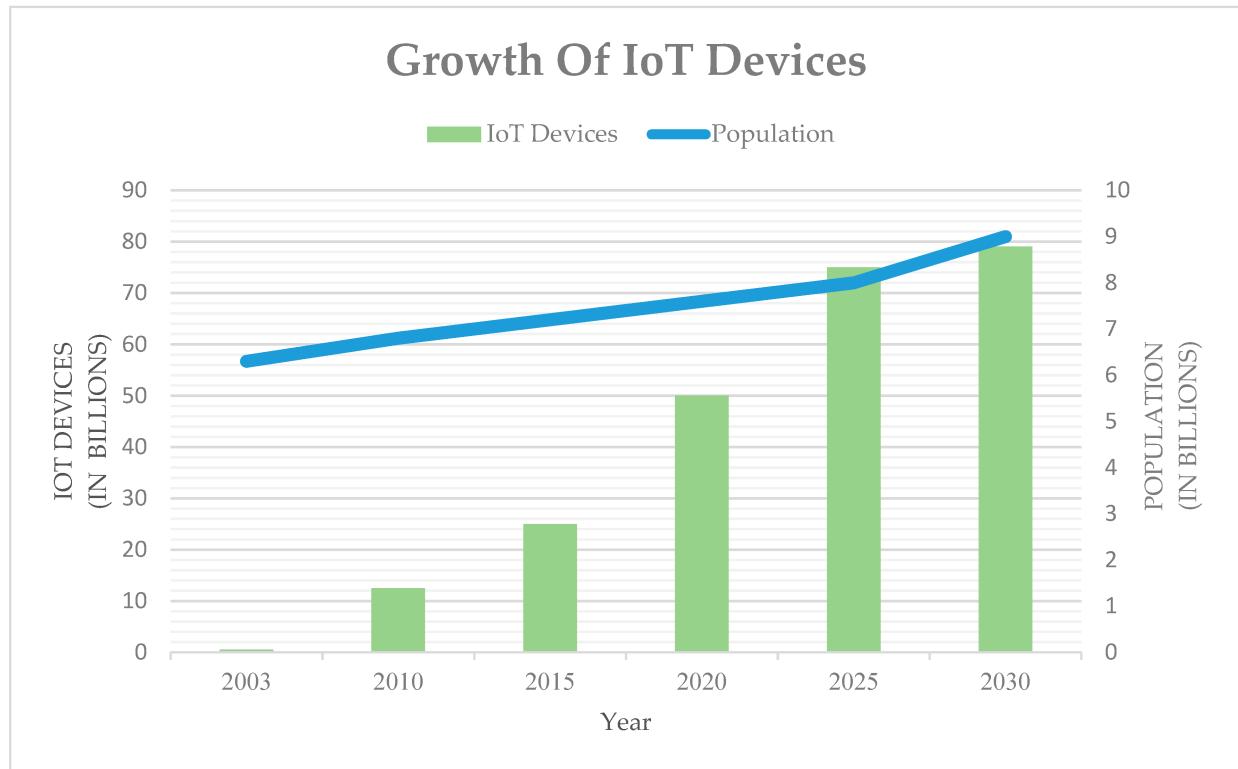
Normally the output from the digital 0 pin is 5V high. Resistors are connected such that camera input never reaches beyond 3.3V. Two digital pins and a software serial port will be used by Arduino Uno while communicating with the camera. An external storage micro board can be used to save the images provisionally as the camera or the Arduino Uno do not have sufficient onboard storage space to save snapshots. Camera operates on a typical baud rate of 38400 baud. The camera collects information in the same method as the GPS module does.

It will be on standby power saving mode and waits for the keyword 'snapshot' or any other word welldefined in the program. This keyword is sent from the user's mobile phone to the GSM kit. This in turn activates the camera by the Arduino Uno. Then a snapshot of the surroundings can be taken and the file can be saved temporarily on the external SD (Secure Digital) memory card. After this process, Arduino Uno will access the stored images from the SD storage and relocate it to the GSM module. This in turn is sent to the user through SMS text. **Android App:** An automated bot is required to respond to text message responses from the user. This is the main idea behind the use of Android App.

Response options are predefined and provided to the user at a single click of a button. Specific keywords that are to be sent must be memorized by the user. In addition to it, the automated bot can be pre-programmed to present the user with a set of predefined and specified keyword such as "Location," "Snapshot," "SOS," etc. As a future scope, additional specific keywords could be added. For eg, "Humidity," "Altitude," etc could be added. Android app offers extra edge to the user for understanding easily. Provision of a predefined keyword button for getting Location is the main notion in Android App. This eases the work.

FUTURE SCOPE

The child safety wearable system acts as a smart device. Child's surroundings can be located with the help of accurate and precise real-time location. Surrounding environment temperature, SOS light along with distress buzzers are provided in this system. This helps in locating their child. This also aids the bystanders to rescue the child. The smart child safety wearable can be boosted considerably in the future by using extremely squeezed Arduino modules like Lily Pad Arduino which can be embroidered into fabrics. Also as a future scope, more power efficient model can be created that holds the battery for a longer time.



APPENDIX

13.1. Source Code

code

```
#include <WiFi.h>
#include <PubSubClient.h>
void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);
#define ORG "Organization name"
#define DEVICE_TYPE "Device type"
#define DEVICE_ID "Organizagion device id"
#define TOKEN "Token authentication id"
String data3;
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";
```

```

char publishTopic[] = "iot-2/evt/Data/fmt/json";
char subscribetopic[] = "iot-2/cmd/test/fmt/String";
char authMethod[] = "use-token-auth";
char token[] = TOKEN;
char clientId[] = "d:" ORG ":" DEVICE_TYPE ":" DEVICE_ID;
WiFiClient wifiClient;
PubSubClient client(server, 1883, callback ,wifiClient);
const int trigPin = 5;
const int echoPin = 18;
#define SOUND_SPEED 0.034
long duration;
float distance;
void setup() {
Serial.begin(115200);
pinMode(trigPin, OUTPUT);
pinMode(echoPin, INPUT);
wificonnect();
mqttconnect();
}
void loop()
{
digitalWrite(trigPin, LOW);
delayMicroseconds(2);
digitalWrite(trigPin, HIGH);
delayMicroseconds(10);
digitalWrite(trigPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance = duration * SOUND_SPEED/2;
Serial.print("Distance (cm): ");
Serial.println(distance);
if(distance<100)
{

```

```

Serial.println("ALERT!!");
delay(1000);
PublishData(distance);
delay(1000);
if (!client.loop()) {
  mqttconnect();
}
}
delay(1000);
}

void PublishData(float dist) {
  mqttconnect();
  String payload = "{\"Distance\":\"";
  payload += dist;
  payload += ",\"ALERT!!\":\"\"\"Distance less than 100cms\"\"}";
  payload += "}";
  Serial.print("Child is not safe: ");
  Serial.println(payload);

  if (client.publish(publishTopic, (char*) payload.c_str())) {
    Serial.println("Publish ok");
  } else {
    Serial.println("Publish failed");
  }
}

void mqttconnect() {
  if (!client.connected()) {
    Serial.print("Reconnecting client to ");
    Serial.println(server);
    while (!!client.connect(clientId, authMethod, token)) {
      Serial.print(".");
      delay(500);
    }
  }
}

```

```

}

initManagedDevice();
Serial.println();
}

}

void wificonnect()
{
Serial.println();
Serial.print("Connecting to ");
WiFi.begin("Wokwi-GUEST", "", 6);
while (WiFi.status() != WL_CONNECTED) {
delay(500);
Serial.print(".");
}
Serial.println("");
Serial.println("WiFi connected");
Serial.println("IP address: ");
Serial.println(WiFi.localIP());
}

void initManagedDevice() {
if (client.subscribe(subscribetopic)) {
Serial.println((subscribetopic));
Serial.println("subscribe to cmd OK");
} else {
Serial.println("subscribe to cmd FAILED");
}
}

void callback(char* subscribetopic, byte* payload, unsigned int payloadLength)
{
Serial.print("callback invoked for topic: ");
Serial.println(subscribetopic);
for (int i = 0; i < payloadLength; i++) {

```

```
data3 += (char)payload[i];
}
Serial.println("data: "+ data3);
data3="";
}
```

13.2. GITHUB AND PROJECT DEMO LINK

Github link:<https://github.com/IBM-EPBL/IBM-Project-42215-1660656339>

Project Demo link:<https://photos.app.goo.gl/s2TvZuGhNrxg8fZf8>