IoT Based Safety Gadget for Child Safety Monitoring & Notification

TEAM ID:	PNT2022TMID51449
PROJECT NAME:	IoT Based Safety Gadget for Child Safety Monitoring & Notification
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1. INTRODUCTION

1.1 PROJECT OVERVIEW

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 via 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. Heart-beats, temperature is monitored and the values are updated to cloud continuously for parent app monitoring. Boundary monitoring system is implemented on safety gadget with the help of BEACON technology, as soon as the safety gadget moves far away from the binding gadget an alert is provided to parent on binding gadget. the system is used to monitor the health parameters and also used for location tracking during necessary situations in safety concern.

1.2 PURPOSE

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**. 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 the cloud.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM

This paper presents a system to monitor pick-up/drop-off of school children to enhance the safety of children during daily transportation from and to school. The system consists of two main units, a bus unit, and a school unit. The bus unit the system is used to detect when a child boards or leaves the bus. This information is communicated to the school unit that identifies which of the children did not board or leave the bus and issues an alert message accordingly. The system has a developed web-based database-driven application that facilities its management and provides useful information about the children to authorized personnel. A complete prototype of the proposed system was implemented and tested to validate the system functionality. The results show that the system is promising for daily transportation safety

2.2 REFERENCES

1. Starner, T Schiele, B and Pentland, A. (1998) 'Visual contextual awareness in wearable computing', Second International Symposium on Wearable Computers, Pittsburgh, PA, IEEE Computer Society, pp. 50-57.

2. AkashMoodbidri, Hamid Shahnasser (Jan 2017) 'Child safety wearable device', International Journal for Research in Applied Science & Engineering Technology, Vol. 6 Issue II, IEEE, pp. 438- 444.

3. AsmitaPawar, PratikshaSagare, TejalSasane, KiranShinde (March– 2017) 'Smart security solution for women and children safety based on GPS using IOT', International Journal of Recent Innovation in Engineering and Research, vol. 02, Issue. 03, pp.85-94.

4. Nitishree, (May-June, 2016) 'A Review on IOT Based Smart GPS Device for Child and Women Safety', International Journal of Engineering Research and

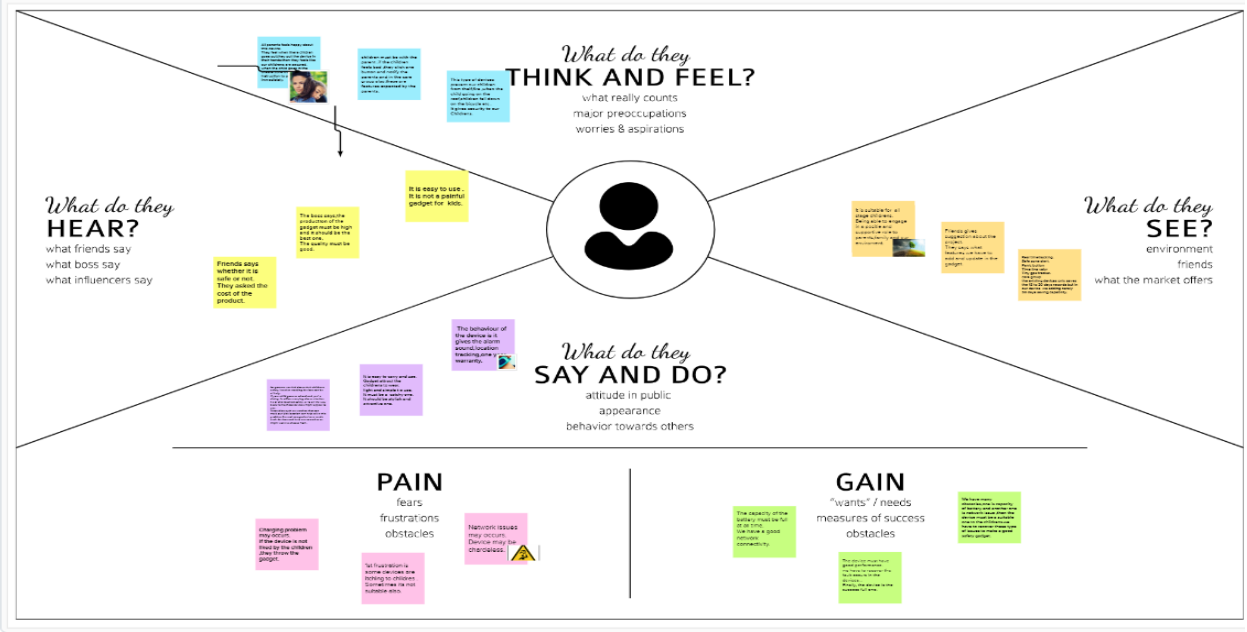
General Science, Vol.4, Issue. 3, pp. 159- 164. 5. Kok Sun Wong, Wei Lun Ng, Jin Hui Chong, CheeKyun Ng, AduwatiSali, Nor KamariahNoordin, (15 -17)December 2009) 'GPS Based Child Care System using RSSI Technique', Proceedings of the Malaysia International Conference on Communications. pp. 899-904.

2.3 PROBLEM STATEMENT DEFINITION

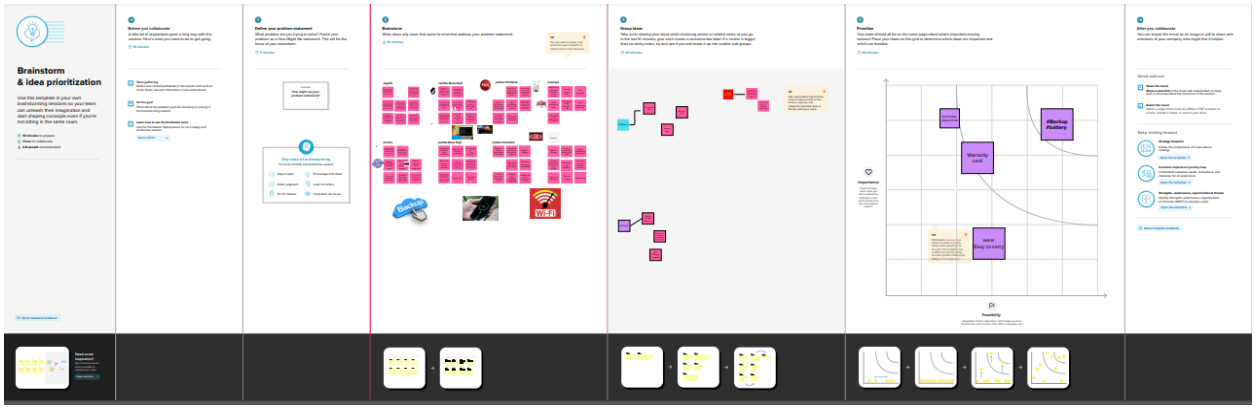
The child safety wearable system **acts as a smart device**. Child's surroundings can be located with the help of accurate and precise real-time location. Surrounding environment temperature, SOS light along with Distress buzzers are provided in this system . This helps in locating their child .

3. IDEATION AND PRPOSED SOLUTION

3.1 EMPATHY MAP CANVAS



3.2 IDEATION & BRAINSTORMING



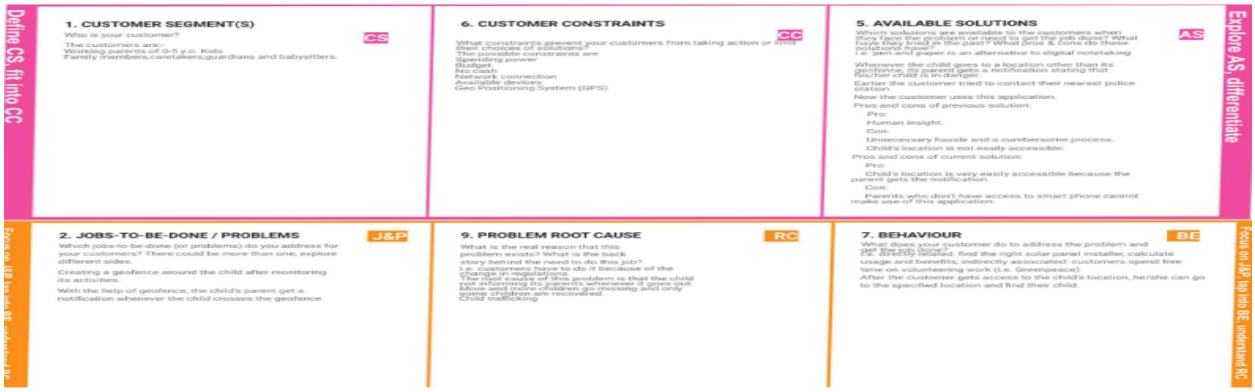
3.3 PROPOSED SOLUTION

Proposed Solution :-

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Parents who are engaged with with busy lifestyle who have no time to monitor their children and nowadays the misbehaviours against children are increasing at an exponential rate.They are under the threat of easily being kidnapped.So the parents needs a way to monitor their children continuously and detect early if there is any abnormal behaviour in their children surroundings so that they can do their duties efficiently rather than worrying about their children, This will indeed reduce the worries of the parents and create a safe environment.
2.	Idea / Solution description	Parents need a way to monitor their children continuously and detect early if there is any abnormal behaviour in their children's surroundings so that they can do their duties efficiently rather than worrying about their children. This will indeed reduce the worries of the parents and create a safe environment.

3.	Novelty / Uniqueness	Even though there are many existing solutions for this problem they failed to satisfy the needs of customer.Some of the solutions are only detecting some particular issues where some other failed to alert the parents and other solution with some delays.Our solution not only notify the parents but also notify the persons who are nearer to the childlike teachers so that they can take control over the situation and our solution will alert the persons who are closer to the child's parents.
4.	Social Impact / Customer Satisfaction	Our solution will be very helpful for the society and the people who are worrying about their child's safety.Our solution will prevent many problems which are faced by childrens and we can able to stop crime.Through this project the parents mental pressure will be reduced and it is very helpful to provide a safer environment for the children.
5.	Business Model (Revenue Model)	The main target of our solution is Parents who are worrying about their children so we planned to visit workplaces and explain about the positives of our product.So that they can be aware of the importance of this solution and use it.
6.	Scalability of the Solution	Our solution can be integrated for further future use because the solution we have provided will be lay on the basics or initial stage of any upgraded version

3.4 PROBLEM SOLUTION FIT



4. REQUIREMENT ANALYSIS

4.I FUNCTIONAL REQUIREMENT

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	Authentication	Only the authorized person for that product will know Ensures security
FR-4	User Interface	The Inventor Able to see the location of children when they are out of geofence will also track the exact information about the children
FR-5	Notification	Notified through mobile and mail

4.2 NON FUNCTIONAL REQUIREMENTS

Non-functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Accessed through Mobile App Showing location (latitude and longitude) of child and also other measures to ensure safety like notification. Portable and comfortable to use.
NFR-2	**Security**	Database security and ensuring the safety of the product while in use.
NFR-3	**Reliability**	Once logged in, the webpage is available until logging out of the app, and a comfortable platform or creates a good environment for users to use.
NFR-4	**Performance**	Each page must load within 4 seconds and database needs to be updated every few seconds and a notification must be sent immediately if seen a change in the child's location.
NFR-5	**Availability**	The data must be available whenever needed and the product should be able to use at any time.
NFR-6	**Scalability**	The process must be flexible to use at anytime and versatile.

5. PROJECT DESIGN

5.1 DATA FLOW DIAGRAM

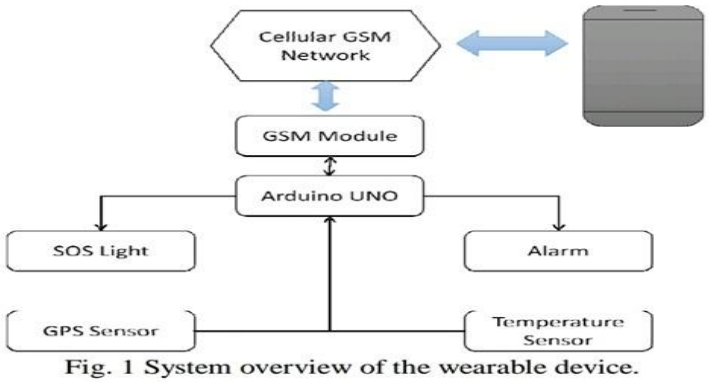


Fig. 1 System overview of the wearable device.

5.2 SOLUTION & TECHINICAL ARCHITECTURE

Solution Architecture Diagram:

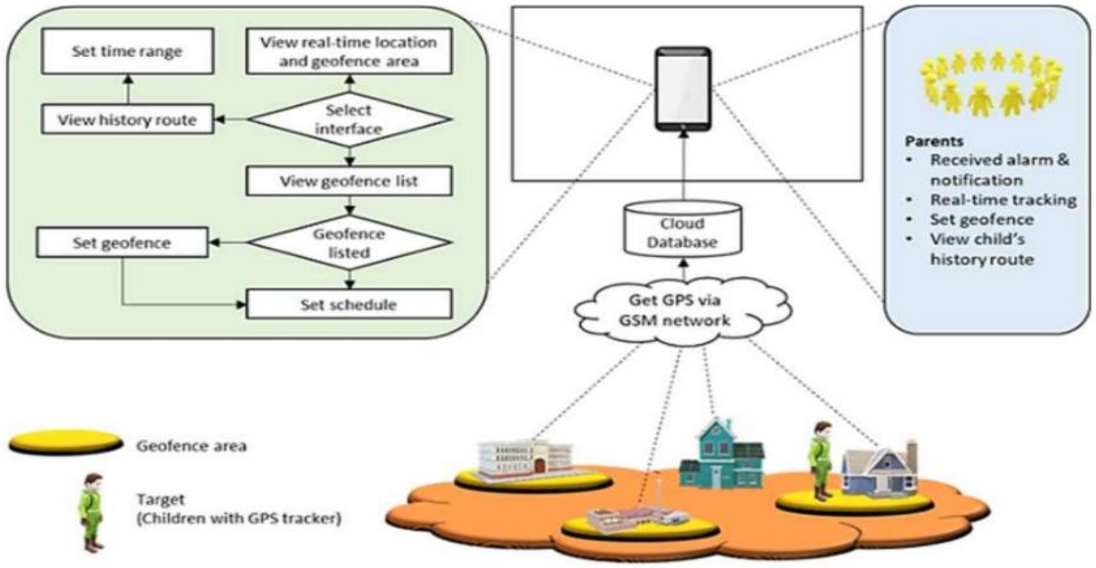


Figure 1: Architecture and data flow of the Child Safety Monitoring and Notification

5.3 USER STORIES

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
	Communication	USN-3	I should be able to communicate with my parents		Low	Sprint-3

6. PROJECT PLANNING & SCHEDULING

6.1 SPRINT PLANNING AND ESTIMATION

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.

6.2 SPRINT DELIVERY SCHEDULE

Sprint planning is an essential process that an organization needs to adapt to be successful. It indicates the roadmap for the next two to four weeks when stakeholders and team members decide as a group what they need to complete and deliver before the next sprint review meeting.

Sprint planning is the first step in an agile project and is crucial to project success. A high level view of the sprint backlog is created where the scrum team discusses, creates a plan for completing their work, establishes dependencies, and identifies risks that need to be addressed.

Sprint planning is an open forum where everyone comes together, appreciates each other's work, and gets more clarity about the sprint goals and objectives. That makes every member of the team accountable and re-enforces healthy communication

This article will explain and help you understand the concepts and provide tips for successful sprint planning meetings. Additionally, we'll show you how it's not just about the tasks themselves. It's also about helping your team to reach their full potential.

Sprint planning refers to a meeting that takes place before the start of a sprint. The team conducts this meeting to determine the sprint plan and set a sprint goal. The members decide on the number of backlog items in the sprint and sets up a sprint backlog and current sprint.

The members who take part in the sprint planning meeting include:

- **The Scrum Master**

The scrum master is in charge of facilitating the sprint planning meeting and ensures that the rooms are set, people are prepared, supplies are available, and the video conferencing and other connectivity are set accordingly. He/she time boxes the meeting according to the length of the sprint. For example, the duration of a two weeks' sprint should be 2-4 hours. He keeps time and ensures they attain their goal at the end of the sprint planning meeting.

- **Product Owner**

The product owners ensure all the items in the product backlog are set before they start the meeting. Therefore, they have to prepare adequately and know the objective of each item. Moreover, the members ask them questions concerning the case and acceptance criteria, and they have to clarify to them

6.3 REPORTS FROM JIRA

Reporting **helps you track and analyze your team's work throughout a project**. Jira Software has a range of reports that you can use to show information about your project, versions, epics, sprints, and issues.

Click Projects in the navigation bar and select the relevant project. If the project is only associated with one board, you can then click Reports. If the project is associated with multiple boards, you can select from the dropdown before clicking Reports.

7. CODING & SOLUTIONING

7.1 FEATURE 1

```
 <!DOCTYPE html>
<html> <head>
<meta name="viewport" content="width=device-width, initial-scale=1">
<title> Login Page </title>
<style> Body {
font-family: Calibri, Helvetica, sans-serif; background-color: #9FE2BF;
}
button {
background-color: #9FE2BF;
width: auto; padding: 10px 18px; margin: 10px 5px;
}
.container {
padding: 25px;
background-color: #CCCCFF;
}
</style> </head>
<body>
<center> <h1> Login Form </h1> </center>
<form>
<div class="container">
<label>Device ID/Number: </label>
<input type="password" placeholder="Enter Password" name="password" required>
<label>E-Mail : </label>
<input type="text" placeholder="Enter Username" name="username" required>
<label>Password : </label>
<input type="password" placeholder="Enter Password" name="password" required>
<button type="submit">Login</button>
<button class="loginBtn loginBtn--facebook">Login with Facebook.</button>
<button class="loginBtn loginBtn--google">Login with Google.</button>
<input type="checkbox" checked="checked"> Remember me
```

<button type="button" class="cancelbtn"> Cancel</button> Forgot password?

</form>
</body>
</html>

7.2 FEATURE 2

#include<WiFi.h>//library for wifi #include<PubSubClient.h>//library for MQTT
void callback(char* subscribetopic, byte* payload,unsigned int payloadlength);
//----------credentials of IBM Account------
#define ORG "45z3o2"// IBM ORGANIZATION ID
#define DEVICE_TYPE "ESP32_Controller"//DEVICE TYPE MENTIONED IN IOT WATSON PLATFORM #define DEVICE_ID "bme2"//DEVICE ID MENTIONED IN IOT WATSON PLATEFORM
#define TOKEN "OKZ+q@JfPWDOd6wBTj"//Token String data3;
float dist;
//------------customize the above value-------
char server[]=ORG ".messaging.internetofthings.ibmcloud.com";//server name
char publishtopic[]="ultrasonic/evt/Data/fmt/json";/*topic name and type of event perform and format in which data to be send*/
char subscribetopic[]="ultrasonic/cmd/test/fmt/String";/*cmd REPRESENT Command tupe and COMMAND IS TEST OF FORMAT STRING*/
char authMethod[]="use-token-auth";//authentication method char token[]=TOKEN;
char clientid[]="d:" ORG ":" DEVICE_TYPE":" DEVICE_ID;//CLIENT ID
//
WiFiClient wifiClient;// creating an instance for wificlient
PubSubClient client(server, 1883 , callback , wifiClient);/*calling the predefined client id by passing parameter like server id,portand wificredential*/
int LED =4;
int trig =5; int echo=18; void setup(){
Serial.begin(115200); pinMode(trig,OUTPUT); pinMode(echo,INPUT);
pinMode(LED,OUTPUT); delay(10); **Serial**.println(); wificonnect(); mqttconnect();
}
char authMethod[]="use-token-auth";//authentication method char token[]=TOKEN;
char clientid[]="d:" ORG ":" DEVICE_TYPE":" DEVICE_ID;//CLIENT ID
//
WiFiClient wifiClient;// creating an instance for wificlient
PubSubClient client(server, 1883 , callback , wifiClient);/*calling the predefined client id by passing parameter like server id,portand wificredential*/
int LED =4;
int trig =5; int echo=18; void setup(){
Serial.begin(115200); pinMode(trig,OUTPUT); pinMode(echo,INPUT);
pinMode(LED,OUTPUT); delay(10); **Serial**.println(); wificonnect(); mqttconnect();
}

```
if(dist<100)
{
digitalWrite(LED,HIGH); Serial.println("no object is near"); object="Near";
}
Else

{
digitalWrite(LED,LOW); Serial.println("no object found"); object="No";
}
String payload="{\"distance\":"; payload +=dist;
payload +="," "\"object\":\""; payload += object;
payload += "\"}";
Serial.print("Sending payload: ");
Serial.println(payload);
if(client.publish(publishtopic, (char*) payload.c_str())){
Serial.println("Publish ok");/* if its sucessfully upload data on the cloud then it will print publish
ok in serial monitor or else it will print publish failed*/
} 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()//function defenition for wificonnect
{
Serial.println(); Serial.print("Connecting to ");
WiFi.begin("vivo 1816", "taetae95",6);//PASSING THE WIFI CREDIDENTIALS TO
ESTABLISH CONNECTION
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++){
//Serial.print((char)payload[i]); data3 +=(char)payload[i];
}
//Serial.println("dta: "+ data3);
//if(data3=="Near")
//{
//Serial.println(data3);
//digitalWrite(LED,HIGH);
//}

//else //{
//Serial.println(data3);
//digitalWrite(LED,LOW);//} data3="";
}
```

8. TESTING

8.1 TEST CASES

IoT testing involves executing QA tests to check IoT devices' functionality, security, and performance. It is crucial to ensure that your IoT devices can transmit sensitive information wirelessly before going to market because every IoT device sends and receives data over the Internet. Because of this, many IoT businesses rely on IoT automation, penetration, and performance testing tools to detect defects before reaching consumers.

IoT testing aims to ensure that IoT devices comply with specified requirements and work as expected.

8.2 USER ACCEPTANCE TESTING

User Acceptance Testing (UAT) is **a type of testing performed by the end user or the client to verify/accept the software system before moving the software application to the production environment**. UAT is done in the final phase of testing after functional, integration and system testing is done.

9. RESULTS

9.1 PERFORMANCE METRICS

One of the module in our project is temperature sensor which is used to detect the temperature of the child as well as the surrounding temperature. If there occurs any abnormal rise or fall in temperature in the body of the child or in the surrounding it will notify the user as per

the coded time delay as shown in the picture. It will show the temperature and humidity values notifies the user based on the predefined value abnormal fall or rise scenarios.

10. ADVANTAGES & DISADVANTAGES

ADVANTAGE

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.

DISADVANTAGE

The server will search the respective device ID from the database and search for respective contacts according to that device ID and helps in alerting the registered guardians. The disadvantage of this project are. **The child could not produce the exact alert command during a panic condition**.

11. CONCLUSION

This research demonstrates Smart IoT device for child safety and tracking, to help the parents to locate and monitor their children. If any abnormal readings are detected by the sensor, then an SMS and phone call is triggered to the parents mobile. Also, updated to the parental app through the cloud. The system is equipped with GSM and GPS modules for sending and receiving call, SMS between safety gadget and parental phone. 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. 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 the cloud. Boundary monitoring system is implemented on safety gadget with the help of BEACON technology, as soon as the safety gadget moves far away from the BLE listener gadget an alert is provided to itself.

12. FUTURE SCOPE

This research demonstrates Smart IoT device for child safety and tracking helping the parents to locate and monitor their children. If any abnormal values are read by the sensor then an SMS is sent to the parents mobile and an MMS indicating an image captured by the serial camera is also sent. The future scope of the work is to implement the IoT device which ensures the complete solution for child safety problems.

13. APPENDIX

SOURCE CODE

```
 <!DOCTYPE html>
<html> <head>
<meta name="viewport" content="width=device-width, initial-scale=1">
<title> Login Page </title>
<style> Body {
font-family: Calibri, Helvetica, sans-serif; background-color: #9FE2BF;
}
button {
background-color: #9FE2BF;
width: auto; padding: 10px 18px; margin: 10px 5px;
}
.container {
padding: 25px;
background-color: #CCCCFF;
}
</style> </head>
<body>
<center> <h1> Login Form </h1> </center>
<form>
<div class="container">
<label>Device ID/Number: </label>
<input type="password" placeholder="Enter Password" name="password" required>
<label>E-Mail : </label>
<input type="text" placeholder="Enter Username" name="username" required>
<label>Password : </label>
<input type="password" placeholder="Enter Password" name="password" required>
<button type="submit">Login</button>
<button class="loginBtn loginBtn--facebook">Login with Facebook.</button>
<button class="loginBtn loginBtn--google">Login with Google.</button>
<input type="checkbox" checked="checked"> Remember me
<button type="button" class="cancelbtn"> Cancel</button> Forgot <a href="#"> password?
</a>
</div>
</form>
</body>
</html>
```

NOTIFICATION:

This coding will make connection between IoT Device & Parent's applications. When the child cross across the geofence message will be notified on parent's application.

Coding:

```
#include<WiFi.h>//library for wifi #include<PubSubClient.h>//library for MQTT
void callback(char* subscribetopic, byte* payload,unsigned int payloadlength);
//---------------credentials of IBM Account------
#define ORG "45z3o2"// IBM ORGANIZATION ID
```

```
#define DEVICE_TYPE "ESP32_Controller"//DEVICE TYPE MENTIONED IN IOT WATSON PLATFORM #define DEVICE_ID "bme2"//DEVICE ID MENTIONED IN IOT WATSON PLATEFORM
#define TOKEN "OKZ+q@JfPWDOd6wBTj"//Token String data3;
float dist;
//------------customize the above value-------
char server[]=ORG ".messaging.internetofthings.ibmcloud.com";//server name
char publishtopic[]="ultrasonic/evt/Data/fmt/json";/*topic name and type of event perform and format in which data to be send*/
char subscribetopic[]="ultrasonic/cmd/test/fmt/String";/*cmd REPRESENT Command tupe and COMMAND IS TEST OF FORMAT STRING*/
char authMethod[]="use-token-auth";//authentication method char token[]=TOKEN;
char clientid[]="d:" ORG ":" DEVICE_TYPE":" DEVICE_ID;//CLIENT ID
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if(dist<100)
{
digitalWrite(LED,HIGH); Serial.println("no object is near"); object="Near";
}
Else
{
digitalWrite(LED,LOW); Serial.println("no object found"); object="No";
}
String payload="{\"distance\":"; payload +=dist;
payload +="," "\"object\":\""; payload += object;
payload += "\"}";
Serial.print("Sending payload: ");
Serial.println(payload);
```

```
if(client.publish(publishtopic, (char*) payload.c_str())){
Serial.println("Publish ok");/* if its sucessfully upload data on the cloud then it will print publish ok in serial monitor or else it will print publish failed*/
} else{
Serial.println("Publish failed");
}
}
void mqttconnect(){ if(!client.connected()){
Serial.print("Reconnecting client to "); Serial.println(server);
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}
Serial.println(""); Serial.println("WiFi connected"); Serial.println("IP address");
Serial.println(WiFi.localIP());
}
void initManagedDevice(){ if(client.subscribe(subscribetopic)){
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Serial.print("callback invoked for topic: ");
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//if(data3=="Near")
//{
//Serial.println(data3);
//digitalWrite(LED,HIGH);
//}

//else //{
```

```
//Serial.println(data3);
//digitalWrite(LED,LOW);//} data3="";
}
```