SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

A PROJECT REPORT

Submitted by

KESAVAN. L

MOGAMATH JALEELL. A

KRISHNAKUMAR. S

KARTHICK. M

in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

ELECTRONICS AND COMMUNICATION ENGINEERING

ER.PERUMAL MANIMEKALAI COLLEGE OF ENGINEERING, HOSUR

ANNA UNIVERSITY::CHENNAI 600 025

NOVEMBER 2022

ABSTRACT

Automatic car monitoring has turned out to be a very crucial scenario in the current years. It may develop into possibility by executing the following technologies. This project targets to propose a system, which detects safe zone cars over a specific speed limit and immediately report to concerned authorities at specific areas like school, hospital, sigh limit which will give detection alert through the android application of IBM cloud computing. At present, road accidents rates have raised due to weather condition and so on, so, there is a necessity for developing a system that detects a safe zone car. The implementation of Car Safe Zone Detector using Internet of Things determines all the humidity and temperature information automatically with intelligence using IBM IoT cloud based. The cars are suitable with safe zone detector that has capability for recording, storing and information sharing about the particular location and humidity with temperature especially about safe zones. The system contains Node MCU, temperature sensor, power supply and IBM cloud based IoT. A car safe zone sensor is employed and is combined with IoT in order to ensure which place they should drive carefully at particular places like schools, hospitals, etc., prone zones. If this cloud-based technology is for safety for advance development, then avoidance of accidents may be attained and also can give as a healthy environment. The system sends the data wirelessly through the cloud computing. The purpose of the proposed which will also show the temperature and humidity of the mobile app, it also decreases high death rates because of accidents.

1. INTRODUCTION

1.1 Project Overview:

The major concern of car safety is the part of necessary one because continual disaster lists, which happens anywhere due to weather condition and specially in sensitive areas like school places, hospitals areas where cars should travel in low speed. In accordance with Association for Safe International Road Travel Report, around 1.24 million people die and 50 million people are getting wounded on the roads each year in the World. Statistically, they are assumed as the second important reasons for death. In order to overcome these problems, many automobile device industries and car manufacturers have tried to propose safe control techniques in order to keep up a car safe distance from specific location. In this direction, the effort is going on devising a security driving application for cars by new rising IoT-oriented technology with cloud computing, which is employed for devising a more effective solution. The IoT (Internet of Things) is the interrelation of distinctly identifiable cloud computing appliances inside the existing infrastructure. The cloud computing which provides the data from cloud stored where we can see from anywhere and how every. This interrelation of cloud computing appliances like smart method is implemented in all types of cars enabling modern applications such as Node MCU. The target of this project is to propose and develop cars Safe zone Detector by indicating that car is using IoT technology and cloud computing for alerting information about safe zone areas and weather condition. The car safe zone detector is very essential for the human life as there are so many accidents in school side, hospitals, etc., every day.

1.2 Purpose:

- In this direction, the effort is going on devising a security driving application for cars by new rising IoT-oriented technology and cloud computing technology, which is employed for devising a more effective solution.

- The target of this project is to propose and develop a new Smart Cars safe zones Detector using IoT technology for alerting information about safe zones area where cars should travel at low speed.

- Cars travelling safe zones which are necessary one to detector is very essential for the human life as there are so many accidents in schools' side and due to weather condition. This can be avoided by using IoT of cloud computing technology.

2. LITERATURE SURVEY

2.1 Existing problem:

An IoT system depends on the psychological state of focus through monitoring head movements and helpful in alerting drivers at the sleep cycle stage of drowsiness. An ordinary eye blink moment has no effect on the system results. The projects, have designed and developed a novel system, which may be not efficiently identify safer areas and humidity with temperature violations on roads and which do not help driver to respect that should maintain speed limits in schools' side and in hospital areas to know that patients and children are important by maintaining speed along with the prescribed speed limit in those particular area. Many approaches need human focus and engage many attempts that is complex to execute those system specially. The projects have not aimed to propose a device for the early detection and provided alert of risky travel during patterns linked to danger zones like weather detection.

2.2 References:

- K. Ramamritham and J. A. Stankovic, “Scheduling algorithms and operating systems support for real- time systems”, Proceedings of the IEEE, vol. 82, no. 1, (1994) January, pp. 55-67.
- F. Sensini, G. Buttazzo and P. Ancilotti, “Ghost: A tool for simulation and analysis of real-time scheduling algorithms”, In Proceedings of the IEEE Real-Time Educational Workshop, (1997), pp. 42- 49.
- Y. Chandarli, F. Fauberteau, D. Masson, S. Midonnet and M. Qamhieh, “Yartiss: A tool to visualize, test, compare and evaluate real-time scheduling algorithms”, In WATERS 2012, UPE LIGM ESIEE, (2012), pp. 21-26.
- A. P. Castellani, M. Gheda, N. Bui, M. Rossi, and M. Zorzi, “Web services for the Internet of Things through CoAP and EXI,” in Proc. IEEE Int. Conf. Commun. (ICC 2001), Kyoto, Japan, 2011.
- B. Nikolic, M. Ali Awan and S. M. Petters, “SPARTS: Simulator for power aware and real-time systems”, In Trust, Security and Privacy in Computing and Communications (TrustCom), 2011 IEEE 10th International Conference on IEEE, (2011), pp. 999-1004.
- R. Bonetto, N. Bui, V. Lakkundi, A. Olivereau, A. Serbanati, and M. Rossi, “Secure communication for smart IoT Objects: Protocol stacks, use cases and practical examples,” in Proc. IEEE IoT-SoS, San Francisco, CA, USA, 2012, pp. 1–7.
- M. Dohler, I. Vilajosana, X. Vilajosana, and J. Llosa, “Smart Cities: An action plan,” in Proc. Barcelona Smart Cities Congress, Barcelona, Spain, Dec. 2011, pp. 1–6.
- IEEE Standard for Local and Metropolitan Area Networks—Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs), IEEE Standard 802.15.4-

2011.

- ISO/IEC14443-1:2008, Identification Cards—Contactless Integrated Circuit Cards—Proximity Cards—Part 1: PhysicalCharacteristics. [Online]. Available: http://www.wg8.de/wg8n1716_17n3994_Notification_ for_Ballot_FDIS_14443- 1_2008_FDAM1.pdf.
- S. Lee, D. Yoon, and A. Ghosh, “Intelligent parking lot application using wireless sensor networks,” in Proc. Int. Symp. Collab. Technol. Syst., Chicago, May 19–23, 2008, pp. 48–57.
- A. Gamatié and T. Gautier, “Synchronous modeling of avionics applications using the Signal language”, In Real-Time and Embedded Technology and Applications Symposium, 2003, Proceedings of the 9th IEEE, (2003), pp. 144-151.
- R. Urunuela, A.-M. Déplanche and Y. Trinquet, “Storm a simulation tool for real-time multiprocessor scheduling evaluation”, In Emerging Technologies and Factory Automation (ETFA), 2010 IEEE Conference on IEEE, (2010), pp. 1-8.
- D. Decotigny and I. Puaut, “ARTISST: an extensible and modular simulation tool for real-time systems”, In Object-Oriented Real-Time Distributed Computing, 2002.(ISORC 2002), Proceedings. Fifth IEEE International Symposium on IEEE, (2002), pp. 365-372.
- Z. Shelby, K. Hartke, C. Bormann, and B. Frank, Constrained applica- tion protocol (CoAP), draft-ietf-core-coap-18 (work in progress), s.l.: IETF 2013. [Online]. Available: http://tools.ietf.org/html/draft-ietf-core- coap-18.

2.3 Problem Statement Definition

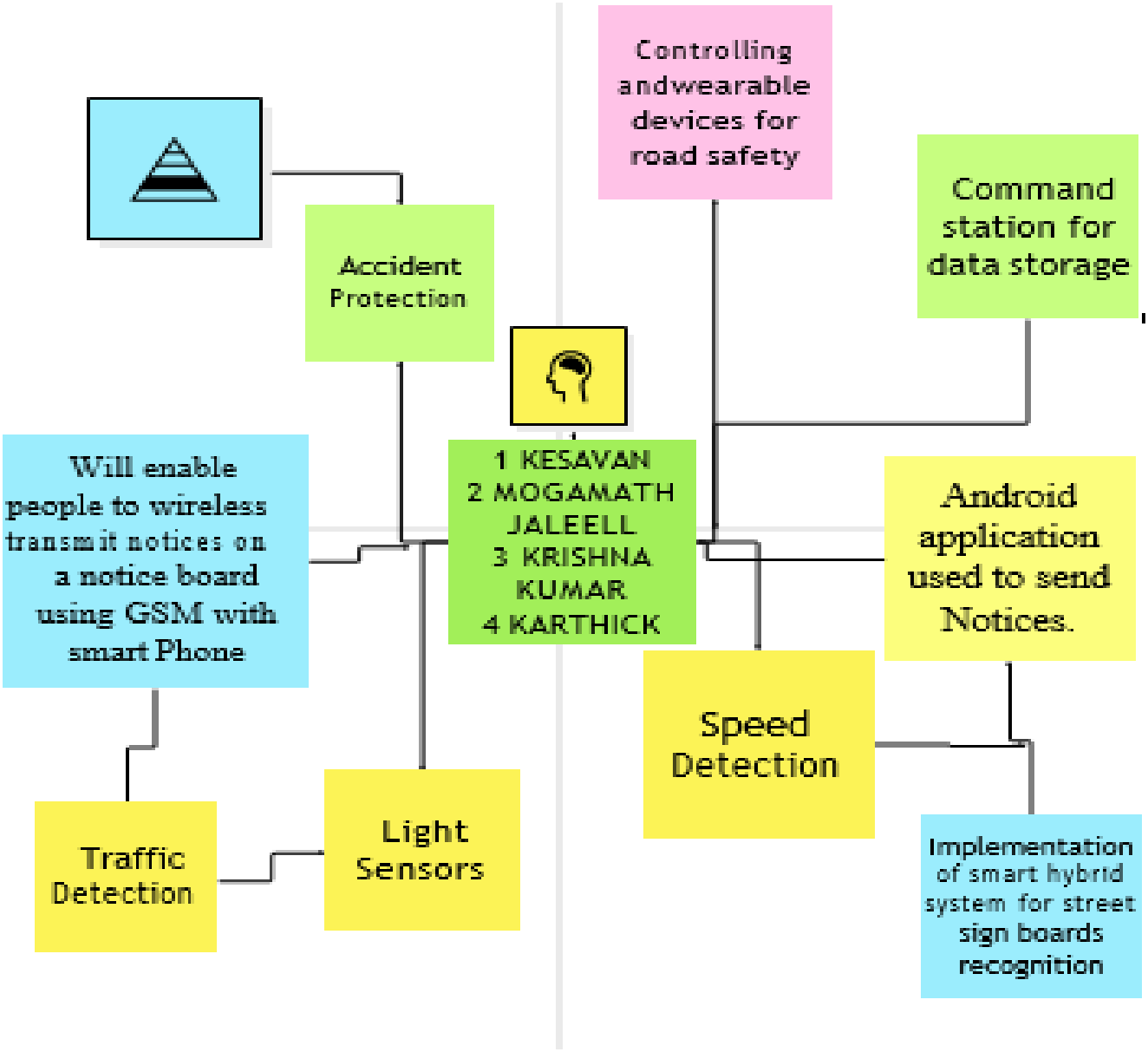
In highways, in city roads most of the traffic sign boards are static which means it will not change, it remains same, due to this issue, some of the problems like accidents, traffic collisions, lack of information about that place can be happen. It will not change based on the weather conditions and fatal traffic situations. In this case, smart connected sign boards takes place. This boards can change dynamically based on the weather conditions using open weather API & different modes like nearby hospitals, schools, diversion signs can also be displayed.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

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

3.2 Ideation & Brainstorming



3.3 Proposed Solution

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Avoid the over speed and to decrease the accidents
2.	Idea / Solution description	• To replace the static signboards, smart connected sign boards are used. • These smart connected sign boards get the speed limitations from a web app using weather api and update automatically. • Based on the weather changes the speed may increase or decrease. • Based on the traffic and fatal situations the diversion signs are displayed. • Guide(schools), warning and service(hospitals, restaurant) signs are also displayed accordingly. • Different modes of operations • Can be selected with the help of buttons.
3.	Novelty / Uniqueness	Sign boards are converted to digitals
4.	Social Impact / Customer Satisfaction	Reduce the accidents , Control the vehicles in speed
5.	Business Model (Revenue Model)	In this we can get good no of users,so that the business can get profit
6.	Scalability of the Solution	We can scalable the project by schools and colleges as our customer

3.4 Problem Solution fit

Problem-Solution Fit — **Signs With Smart Connectivity For Better Road Safety**

Define CS, fit into CC

1. CUSTOMER SEGMENT(S) CS

Who is your customer?

- **Highway Department**
- **Traveller**

6. CUSTOMER CONSTRAINTS CC

An important and unexpected factor in the experiments was the impact of the network.
This IoT based system was successful in replicating a large scale smart farm environment considering the number of sensors.

5. AVAILABLE SOLUTIONS AS

The available solutions are static boards with the predetermined instructions are placed in highway roads.

Explore AS, differentiate

Focus on J&P, tap into

2. JOBS-TO-BE-DONE / PROBLEMS J&P

The Smartboard Connectivity requires quite number of jobs like, it should maintain the Temperature Sensor readings exactly and it should notify in the board to determine the customer car's speed.

9. PROBLEM ROOT CAUSE RC

If there is no internet connection there would no sensor readings from the climate will affect the speed limitation. Some persons may press the accident indicator button unnecessarily it may create some issues.

7. BEHAVIOUR BE

The IOT cloud behaves as the instructor to the smartboard about the road condition in regular intervals.

Focus on J&P, tap int C

Identify strong TR & EM

3. TRIGGERS TR

For Example : The climate is in bad condition the car should be in threshold speed. To notify the customer using the sensors the value should be displayed on the smart board.

4. EMOTIONS: BEFORE / AFTER EM

The customers would feel better after using the smartboard connectivity then they will follow the smartboard instructions.

10. YOUR SOLUTION SL

Our Solution to replace the static signboards, smart connected sign boards are used.These smart connected sign boards get the speed limitations from a web app using weather API and update automatically.Based on the weather changes the speed may increase or decrease.Based on the traffic and fatal situations the diversion signs are displayed.Guide(Schools), Warning and Service(Hospitals, Restaurant) signs are also displayed accordingly.Different modes of operations can be selected with the help of buttons.

8. CHANNELS of BEHAVIOUR CH

The traveller can use the smartboard signs to know the road condition whether the traveller from anywhere and following instructions is one of the big task for the traveller.

The customers can directly send a feedbackmail or message to the departments . (Nearby Patrol Officers)

Extract online & offline CH of BE

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

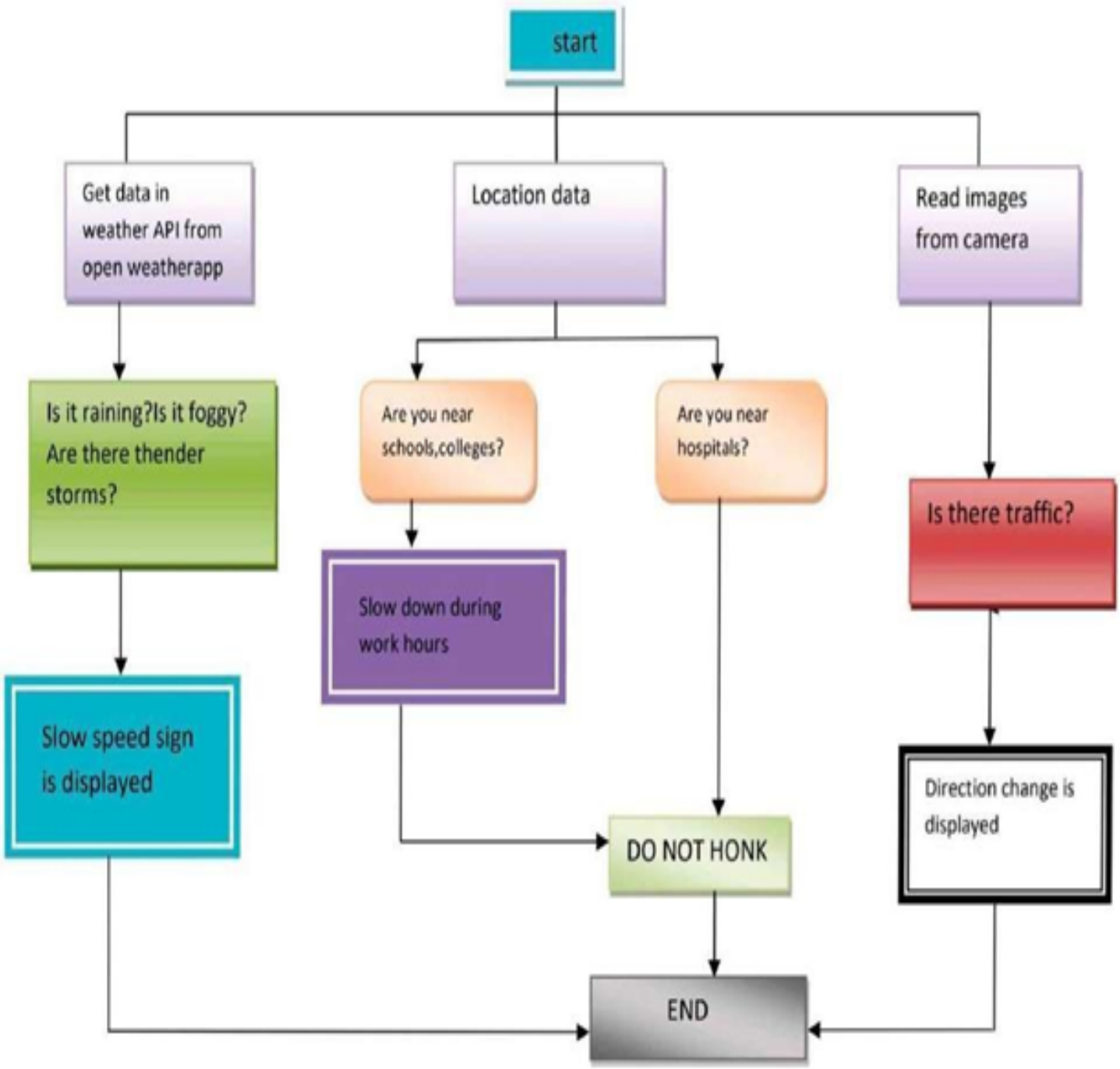
FR No.	Functional Requirement (Epic)	Sub Requirement (Story/Sub-Task)
FR-1	User Visibility	Sign Boards should be madewith LED's whichare bright colored and are capableof attracting the drivers attention but it should also not be too distracting or blinding cause it may lead to accidents.
FR-2	User Understanding	For betterunderstanding of the driver, the signs should be big, clear and legible and it can also include illustrations which willmake it easilyunderstandable to the driver.
FR-3	UserConvenience	The display shouldbe big enoughthat it shouldeven bevisible from far distance clearly.

4.2 Non-Functional requirements

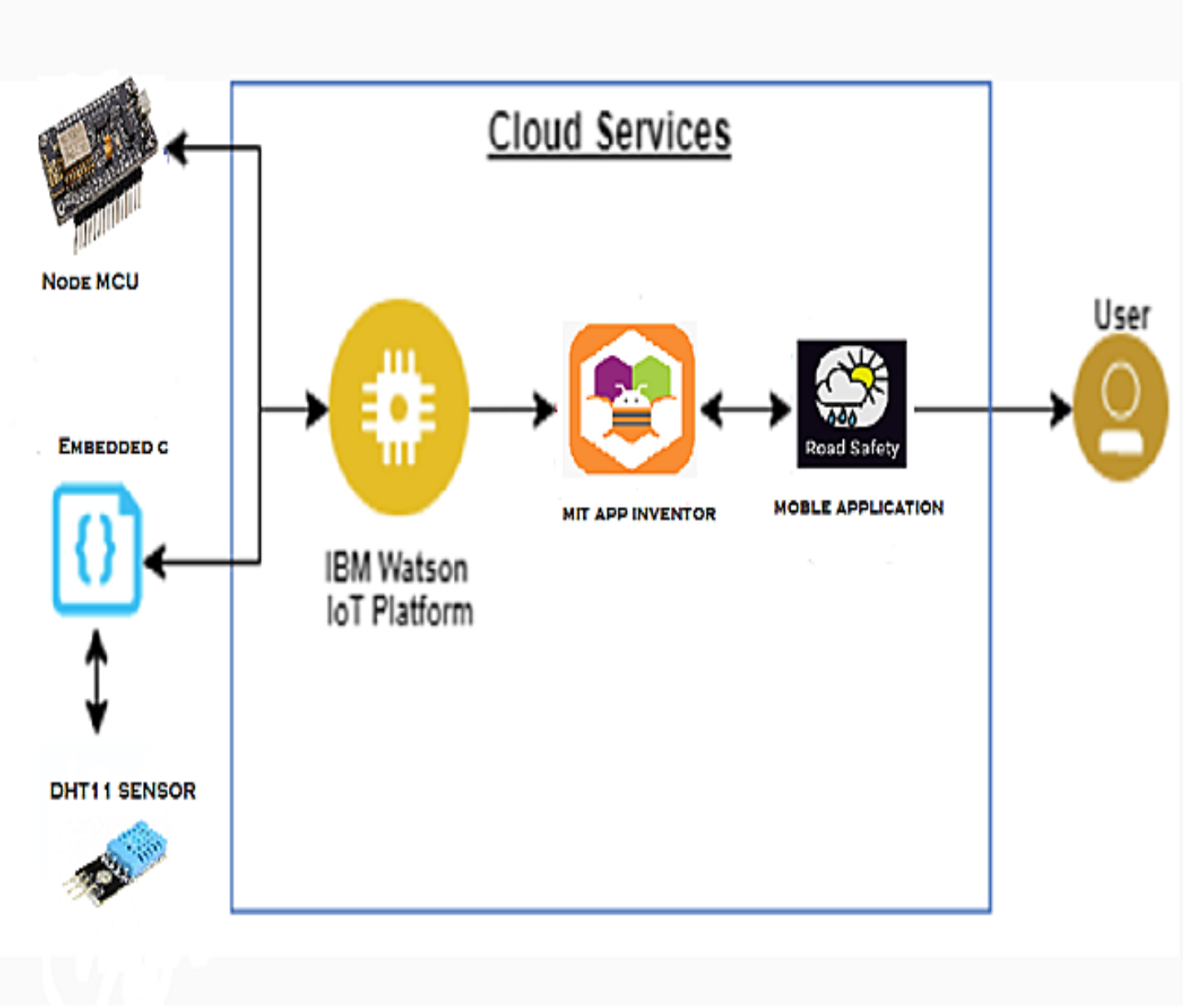
FR No.	Non-Functional Requirements	Description
NFR-1	**Usability**	It should be able to Upgrade and Update whenthere is aneed for it.
NFR-2	**Security**	It should have good security system so that no other person is able to hack and display theirown directions.
NFR-3	**Reliability**	It shouldbe able to display to information correctly anderror-free.
NFR-4	**Performance**	It should be ableto automatically updateitself whencertain weather or traffic problemoccurs.
NFR-5	**Availability**	It should be available 24/7 so thatit can be beneficial tothe customer i.e the driver.
NFR-6	**Scalability**	It should be able to easily changeand upgrade accordingto change and need in requirement.

5. PROJECT DESIGN

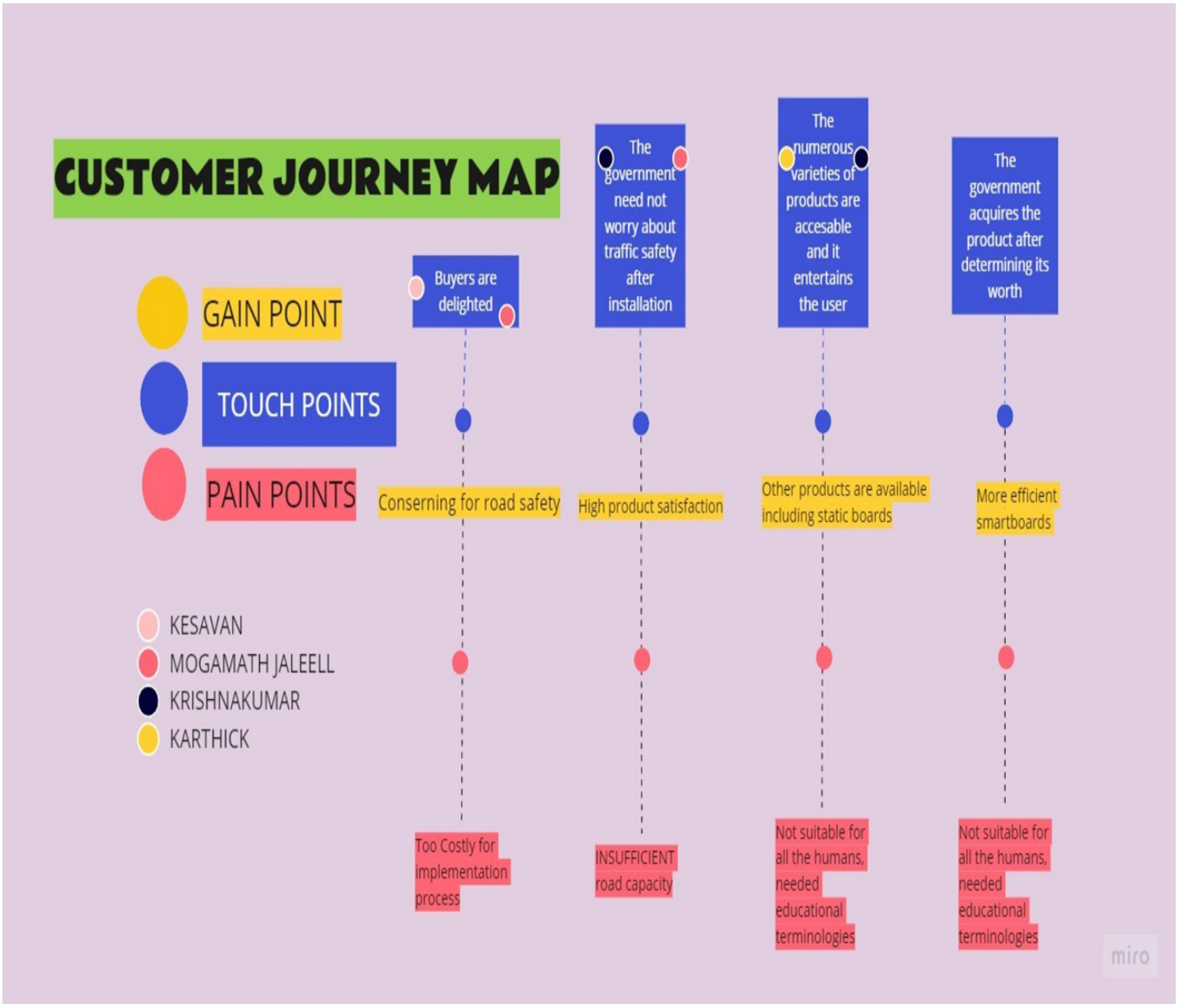
5.1 Data Flow Diagrams



5.2 Solution & Technical Architecture



5.3 User Stories



6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

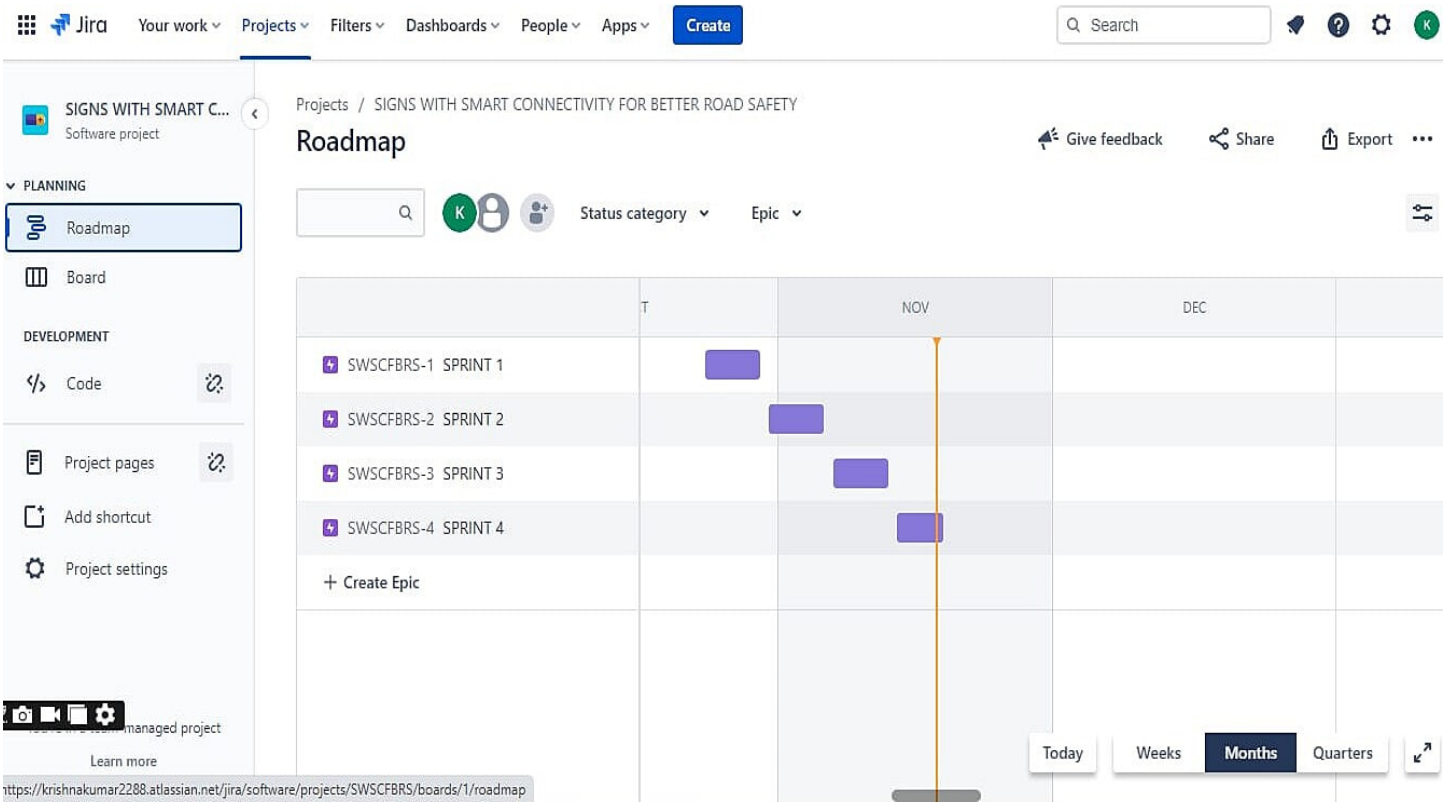
Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my mail, password, and confirming my password	2	High
Sprint-1		USN-2	As a user,I will receive confirmation email once I have registered for the application	1	High
Sprint-1		USN-3	As a user,I can register for theapplication through Gmail	1	Medium
Sprint-1	Login	USN-4	As a user, I can register for the application through Gmail	2	High
Sprint-2		USN-5	If I forgot my password or username, I can resetit again through my email	1	High
Sprint-2	Web register	USN-6	As a user, I can register by entering my email, password, and confirming my password	2	High
Sprint-2		USN-7	As a user, I will receive	1	High

			confirmation email onceI have registered for the application		
Sprint-2		USN-8	As a user, I can register for the application through Gmail	1	Medium
Sprint-2	Web login	USN-9	As a user, I can log into the application byentering email & password	2	High
Sprint-3		USN-10	If I forgot my password or username, I can resetit again through my email	1	High
Sprint-3	Help	USN-11	If I have anydoubt in usingan application orweb, I can clarify it by clicking the Help option in the dashboard	1	High
Sprint-4	Feedback	USN-12	I Can give my feedback about the application and I can post my queries.	1	Low

6.2 Sprint Delivery Schedule

Sprint	Total story points	Duration	Sprint star date	Sprint end date (planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

6.3 Reports from JIRA



7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 1 (MIT APP INVENTOR)

The smartphone is an information nexus in today's digital age, with access to a nearly infinite supply of content on the web, coupled with rich sensors and personal data. However, people have difficulty harnessing the full power of these ubiquitous devices for themselves and their communities. Most smartphone users consume technology without being able to produce it, even though local problems can often be solved with mobile devices. How then might they learn to leverage smartphone capabilities to solve real-world, everyday problems? MIT App Inventor is designed to democratize this technology and is used as a tool for learning computational thinking in a variety of educational contexts, teaching people to build apps to solve problems in their communities.

7.2 Feature 2

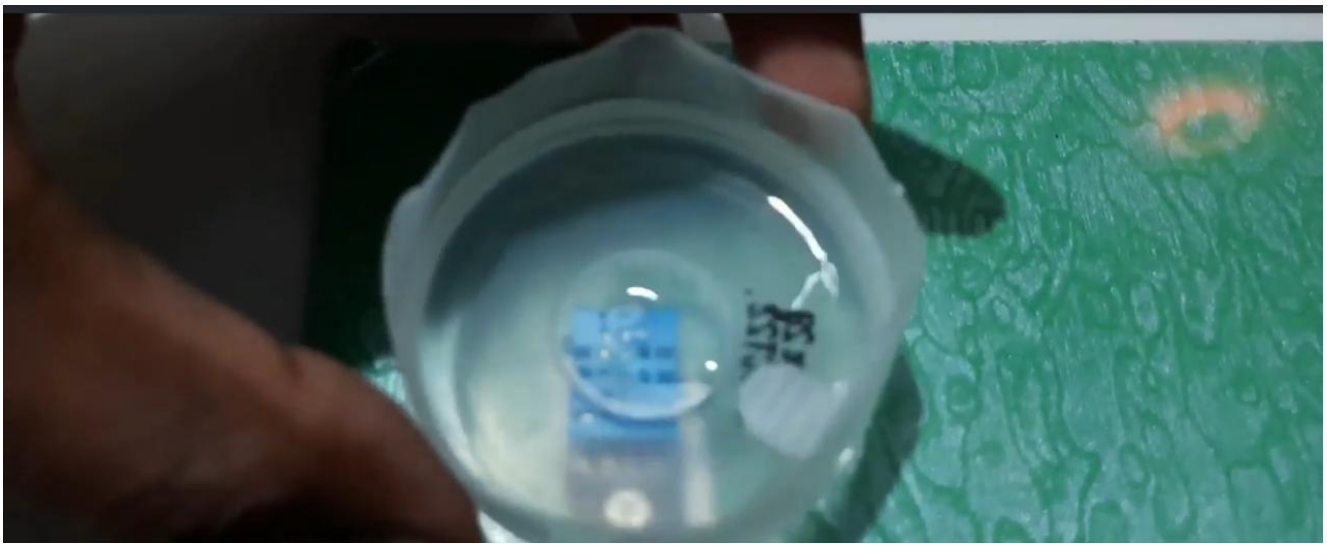
Standard assembling struct (two 3mm holes with multiple of 5cm as interval).

- User-friendly interfaces ("A" for analog and "D" for digital).
- Icons to simply illustrate sensor function.
- High quality connector.

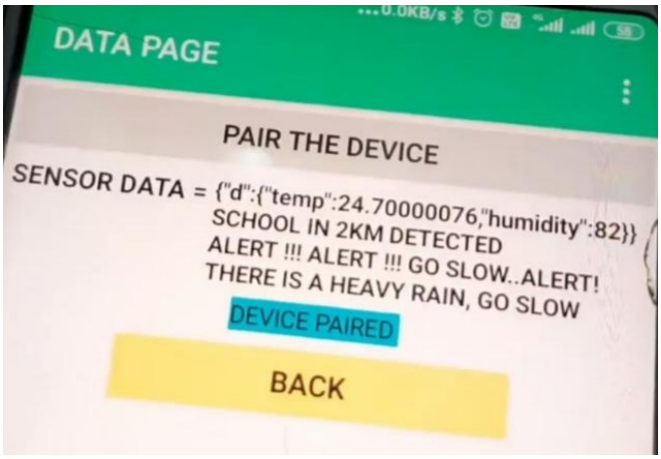
8. TESTING

8.1 Test Cases

Test case 1 : Checks the rain alert by using temperature sensor.

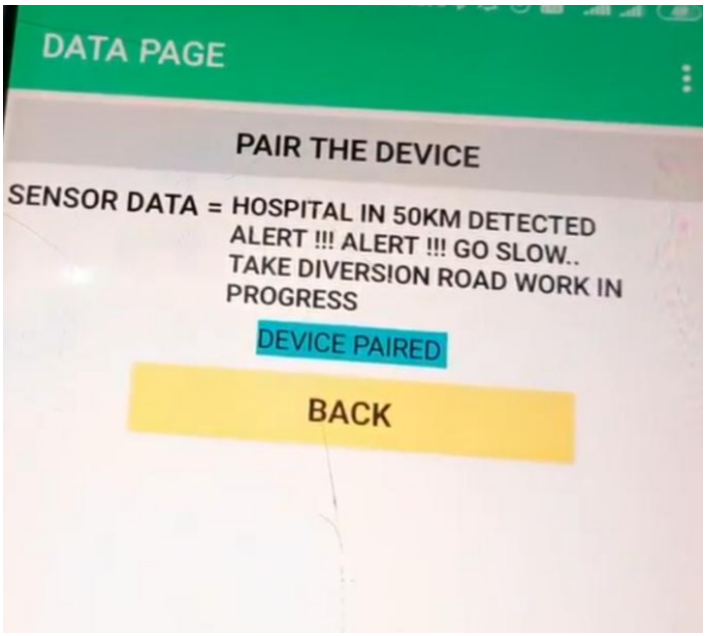


MESSAGE ALERT!

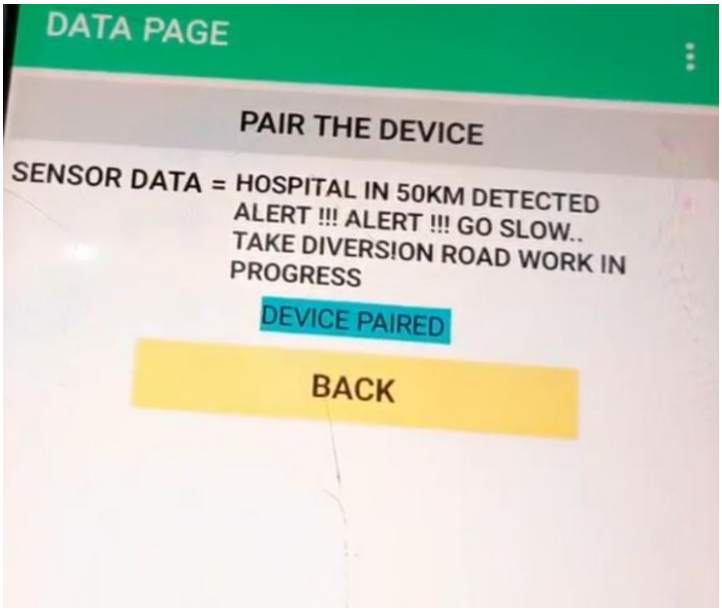


Test case 2 : Detecting the school areas, hospitals areas, etc.

MESSAGE ALERT!



Test case 3 : It gives alert to the user if there is any maintenance of the particular road.



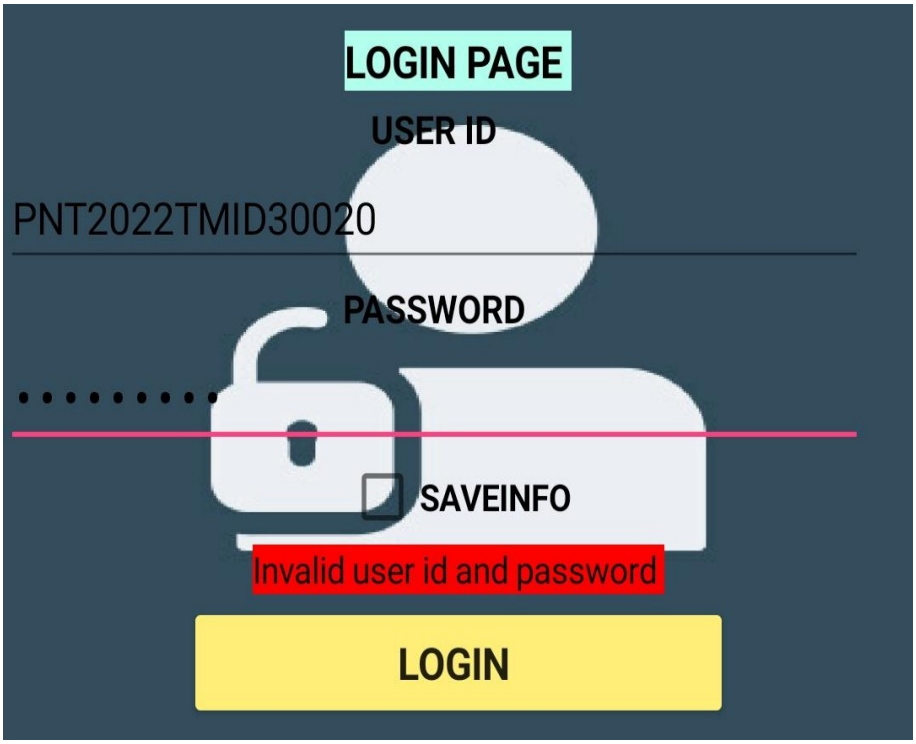
Test case 4 : Checks the road condition according to weather condition.

8.2 User Acceptance Testing

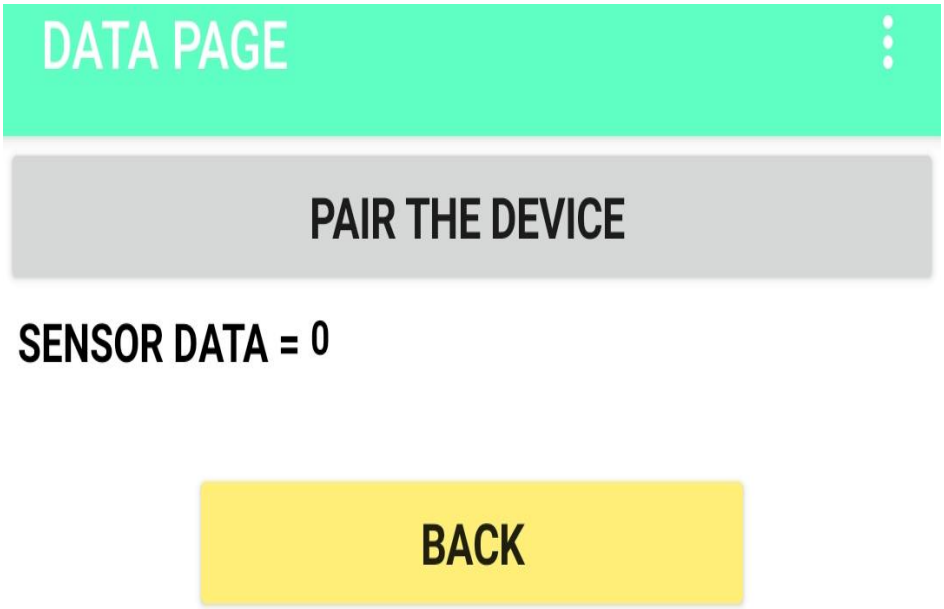
User should click this icon to access the app.

In user side they will be verified with their "USER ID" and "PASSWORD"

If the user enters wrong password it will show "Invalid user id and password"

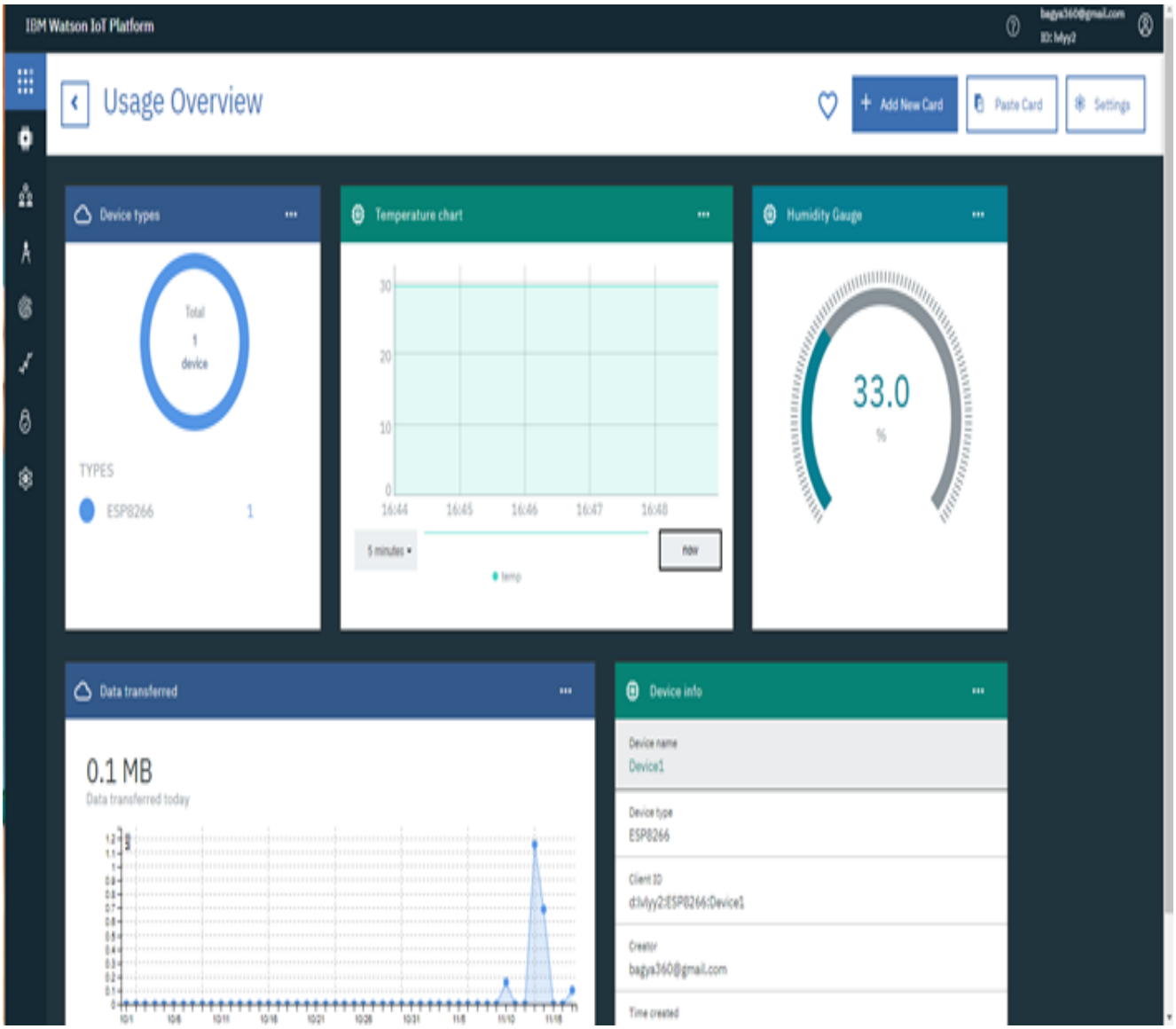


If the user enter the correct data then it will forwarded into the next page to pair the device.



9. RESULTS

Performance Metrics



10. ADVANTAGES & DISADVANTAGES

Advantages:

- Preventing Wrong-way Crashes.
- Combating Poor Visibility.
- Better Traffic Management and Safety.
- Increased Cost Efficiency.
- Strengthen the infrastructure.
- Challenging to remember.
- Conventional road signs.

Disadvantages:

- Some drivers disobey these signalstraffic signs.
- Increasing traffic congestion, air pollution, and fuel consumption.
- Increase in use of less-adequate roads to avoid traffic signs.
- Excessive delay due to time allocated by the traffic signals.

11. CONCLUSION

In this project, the problem of conducting accurate car speed limit is detection using IoT technology in safer zone side areas atmosphere to support developing of technology. Cars safe zone area travelling Detector is used to sense the weather conditions to attain great detection accuracy. Especially, the proposed system is used to detect limits of car speed in some particular places like school, hospital, etc., and this will report to concerned to android application. The following are the future enhancement that may be done into the proposed system through developing interfacing sensors and software algorithms.

12. FUTURE SCOPE

- Digital sign boards are sign boards that convey the intended message or information to the driver by alerting them through wireless devices. Besides, there are experiments taking place to develop digital sign boards to be read by the vehicles so as to act accordingly. Image processing and object recognition are all in their infancy stage but will soon dominate our roads.

- In short, the analogue sign board will give way to digital sign boards sooner or later. How it will affect our world of transport and well-being as a road user will have to find out. The one thing is sure the traffic signage will no longer be guided by stagnant, installed traffic sign boards; rather there will be camera-based, more intelligent traffic sign boards.

13. APPENDIX

13.1 Source Code

```
#include <ESP8266WiFi.h>

#include "DHT.h"

#include <ArduinoJson.h>

#include <PubSubClient.h>


// Watson IoT connection details

#define MQTT_HOST "lvlyy2.messaging.internetofthings.ibmcloud.com"
//Organization ID.messaging.internetofthings.ibmcloud.com

//change  3xr4l4

#define MQTT_PORT 1883

#define MQTT_DEVICEID "d:lvlyy2:ESP8266:Device1"  //d:Organization
ID:Device Type:Device ID

//change  3xr4l4

#define MQTT_USER "use-token-auth"

#define MQTT_TOKEN "Od?)1b3DfEl6B6ALA6" // change your auth_id :

#define MQTT_TOPIC "iot-2/evt/status/fmt/json"

#define MQTT_TOPIC_DISPLAY "iot-2/cmd/display/fmt/json"
```

```
// Add GPIO pins used to connect devices

#define DHT_PIN 2 // GPIO pin the data line of the DHT sensor is connected to

// Specify DHT11 (Blue) or DHT22 (White) sensor
#define DHTTYPE DHT11


// Add WiFi connection information
char ssid[] = "PNT2022TMID30020";     //  your network SSID (name)
char pass[] = "1234567890";  // your network password
float h = 0.0;
float t = 0.0;


void callback(char* topic, byte* payload, unsigned int length) {
```

```
  // handle message arrived
  Serial.print("Message arrived [");
  Serial.print(topic);
  Serial.print("] : ");

  payload[length] = 0; // ensure valid content is zero terminated so can treat as c-string
  Serial.println((char *)payload);
}

void setup() {
 // Start serial console
  Serial.begin(9600);
  Serial.setTimeout(2000);
  while (!Serial) { }
  Serial.println();
  Serial.println("ESP8266 IBM Cloud Application");

  // Start WiFi connection
```

```
WiFi.mode(WIFI_STA);
WiFi.begin(ssid, pass);
while (WiFi.status() != WL_CONNECTED)
{
  delay(500);
  Serial.print(".");
}
Serial.println(" ");
Serial.println("WiFi Connected");
 Serial.println(WiFi.localIP());

// Start connected devices
dht.begin();

// Connect to MQTT - IBM Watson IoT Platform
if (mqtt.connect(MQTT_DEVICEID, MQTT_USER, MQTT_TOKEN)) {
  Serial.println("MQTT Connected");
  mqtt.subscribe(MQTT_TOPIC_DISPLAY);
```

```
  }



void loop() {
  mqtt.loop();
  while (!mqtt.connected()) {
    Serial.print("Attempting MQTT connection...");
    // Attempt to connect
    if (mqtt.connect(MQTT_DEVICEID, MQTT_USER, MQTT_TOKEN)) {
      Serial.println("MQTT Connected");
      mqtt.subscribe(MQTT_TOPIC_DISPLAY);
      mqtt.loop();
    } else {
      Serial.println("MQTT Failed to connect!");
      delay(5000);
    }
```

```
  }
  h = dht.readHumidity();
  t = dht.readTemperature(); // uncomment this line for centigrade
  // t = dht.readTemperature(true); // uncomment this line for Fahrenheit


Serial.print("SCHOOL IN 2KM DETECTED");
        Serial.print("\n");
       Serial.print("ALERT !!! ALERT !!! GO SLOW..");
      if(h>80)
      {
       Serial.print("ALERT! THERE IS A HEAVY RAIN, GO SLOW");
       }
       delay(2000);
       Serial.print("SPEED LIMIT SHOULD BE LESS THAN 40KM");
       Serial.print("\n");
       Serial.print("ALERT!!! ALERT!! GO SLOW..");
       delay(2000);
       Serial.print("HOSPITAL IN 50KM DETECTED");
```

```
        Serial.print("\n");
        Serial.print("ALERT !!! ALERT !!! GO SLOW..");
        Serial.print("\n");
        Serial.print("TAKE DIVERSION ROAD WORK IN PROGRESS");
      if (!mqtt.publish(MQTT_TOPIC, msg)) {
        Serial.println("MQTT Publish failed");
      }
    }

    // Pause - but keep polling MQTT for incoming messages
    for (int i = 0; i < 10; i++) {
      mqtt.loop();
      delay(1000);
    }
}
```

13.2 GitHub & Project Demo Link

[Github link]

[Demo Video Link]