

Personal Assistance For Seniors Who Are Self-Reliant
PROJECT REPORT

| | |
|---------------------|---|
| Team ID | PNT2022TMID31307 |
| Project Name | Personal Assistance for Seniors who are self reliant |

1.INTRODUCTION:

1.1.Project Overview

Elderly people tend to forget which pill should be taken at what time. And also there is much burden placed on the caregivers. This makes the caregivers and also the patients frustrated.

We developed a Web application integrated with IoT device to provide scheduled voice output and display the medicine name on a microcontroller during intake time.

1.2.Purpose

- To cater to the needs of the elderly lacking physical assistance during their course of medication.
- To provide better quality of life for individuals with chronic disabilities and their caregivers.

2.LITERATURE SURVEY

2.1.Existing Problem

The existing methodologies include various gadgets available to assist patients in taking their medication either by simplifying administration or by assisting them in remembering to do so.

Pill reminder charts, drug diaries, calendar clocks, telephone prompting service, multi compartment compliance aids (MCAs), talking labels, voice reminders, watch reminders, daily pill boxes, and automated pill dispensers are just a few examples.

2.2.References

- B. B. Singh, GSM Based Automatic Pill Dispenser, vol. 7, no. 4, pp. 10694-10695, 2017.
- S. Shinde, N. Bange, M. Kumbhar and S. Patil, Smart Medication Dispenser, vol. 6, no. 4, pp. 200-204, 2017.
- S. Shinde, T. Kadaskar, P. Patil and R. Barathe, A Smart Pill Box With Remind And Consumption Using IoT, pp. 152-154, 2017.

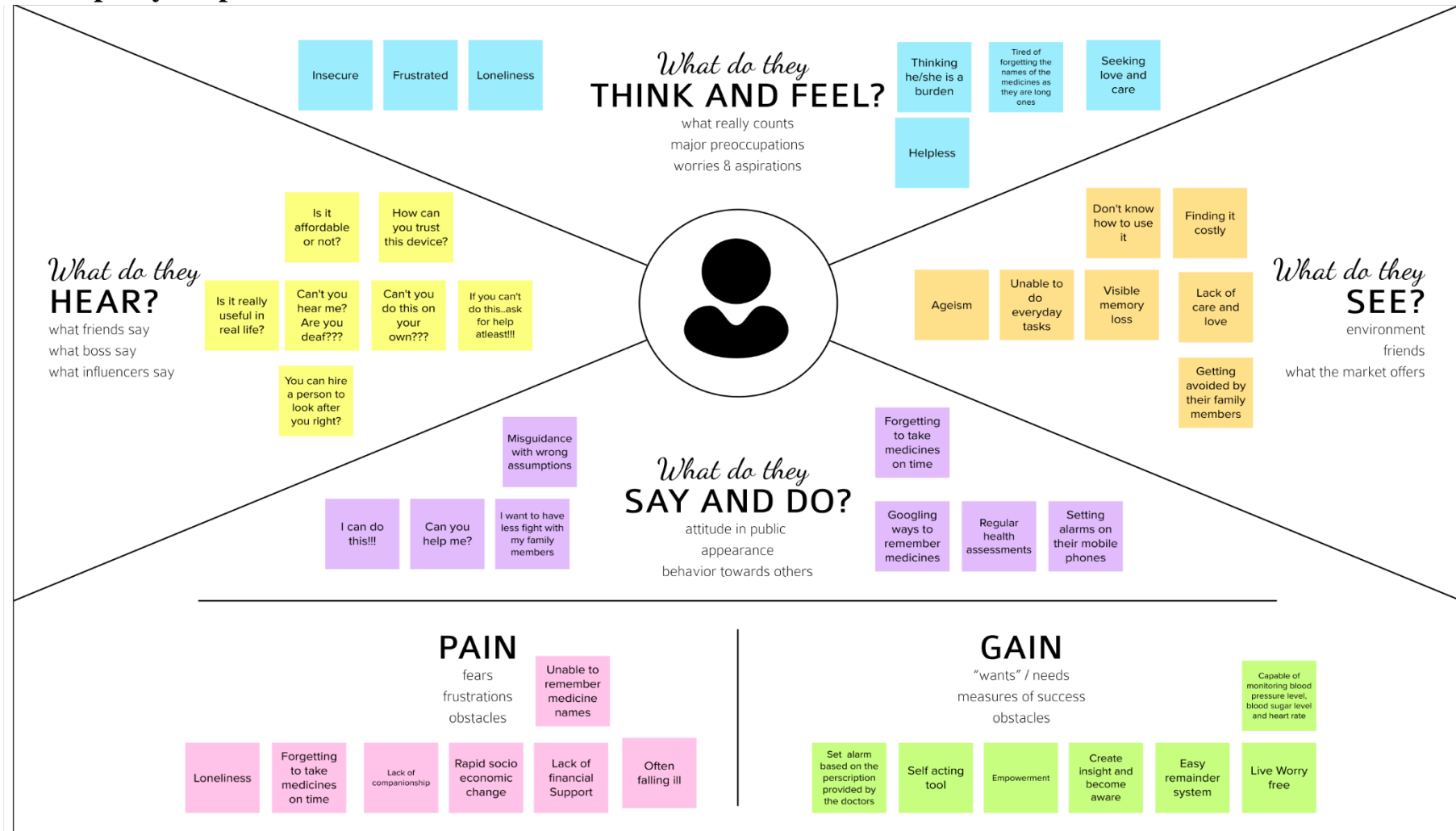
- H. K. Wu, C. M. Wong, P. H. Liu, S. P. Peng, X. C. Wang, C. H. Lin, et al., "A Smart Pill Box with Remind and Consumption Confirmation Functions", Conf. Proc. IEEE Consumer Electronics, pp. 658-659, 2015.
- T. L. Hayes, J. M. Hunt, A. Adami and J. A. Kaye, "An Electronic Pillbox for Continuous Monitoring of Medication Adherence", Conf. Proc. IEEE Eng. Med. Biol. Soc, pp. 6400-6403, 2006.
- S. C. Huang, H. Y. Chang, Y. C. Jhu and G. Y. Chen, "The intelligent pillbox - Design and implementation", Conf. Proc. IEEE Consumer Electronics, pp. 235-236, 2014. 7.P. H. Tsai, T. Y. Chen, C. R. Yu, C. S. Shih and J. W. S. Liu, "Smart Medication Dispenser: Design Architecture and Implementation", IEEE Systems Journal, pp. 99-110, 2010.

2.3.Problem Statement Definition

Elderly patients will try to intake medicine on prescribed time but fail to intake medicine on prescribed time because there is no caregiver to remind, Which makes them feel insecure about their health.

3.IDEATION & PROPOSED SOLUTION

3.1.Empathy Map Canvas



3.2.Ideation & Brainstorming

2

Brainstorm

Write down any ideas that come to mind that address your problem statement.

🕒 10 minutes

TIP
You can sketch

BRINTHA D

| | | |
|-------------------------------|-----------------------------------|---|
| Voice Notification | An easy to use alarm when patient | No need to connect on phone |
| Prevent drug interactions | Prevents Prescription | It is app to be installed with the smartphone |
| Provides medication reminders | No need to appoint doctor's visit | Can also connect with the doctor |

CINEHAA M

| | | |
|------------------------------|---|--|
| User friendly | Reminders for medicine | A report on medicines in order of medicines |
| Provides online consultation | Reminds app to take medicine on or anywhere | Reminds the patient to take medicine on time |
| A good Companion | Notifies doctor with the medicines | This app is effective and easy to use |

KEERTHANA T

| | | |
|--|--|--------------------------------------|
| Secure and safe device to use for medicine | It is a 4 MB device with a camera and a microphone | App is available for all smartphones |
| 24/7 monitoring system | Can use doctor's advice | Provides quick advice |
| Provides time to take every dose of a drug | Ends the doctor's visit | Cloud is used for storage |

MAHESWARI J

| | | |
|---|-------------------------------|---------------------------------------|
| Voice reminder | Audio calls medicine reminder | Reminder |
| Reminds doctor about the patient's medicine | Provides a Reminder service | Emergency app |
| Provides an emergency and location | Provides medicine details | Can connect with the health authority |

3

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you can break it up into smaller sub-groups.

🕒 20 minutes

TIP
Add customizable tags to sticky notes to make it easier to find, browse, organize, and categorize important ideas as themes within your mural.

An easy to use medicine reminder system for the elderly people that helps their doctors and family members to monitor their activities more effectively, thus helps to prevent errors in medications and other possibilities.

It can be implemented in smart watches and home IOT devices. It should have the ability to send notifications and provide voice assistance in offline mode also.

It shows medicine availability. If not it will send notifications to buy next batch of medicines.

To generate a report on the medicine intake that makes it easier for the doctors to monitor the patient conditions.

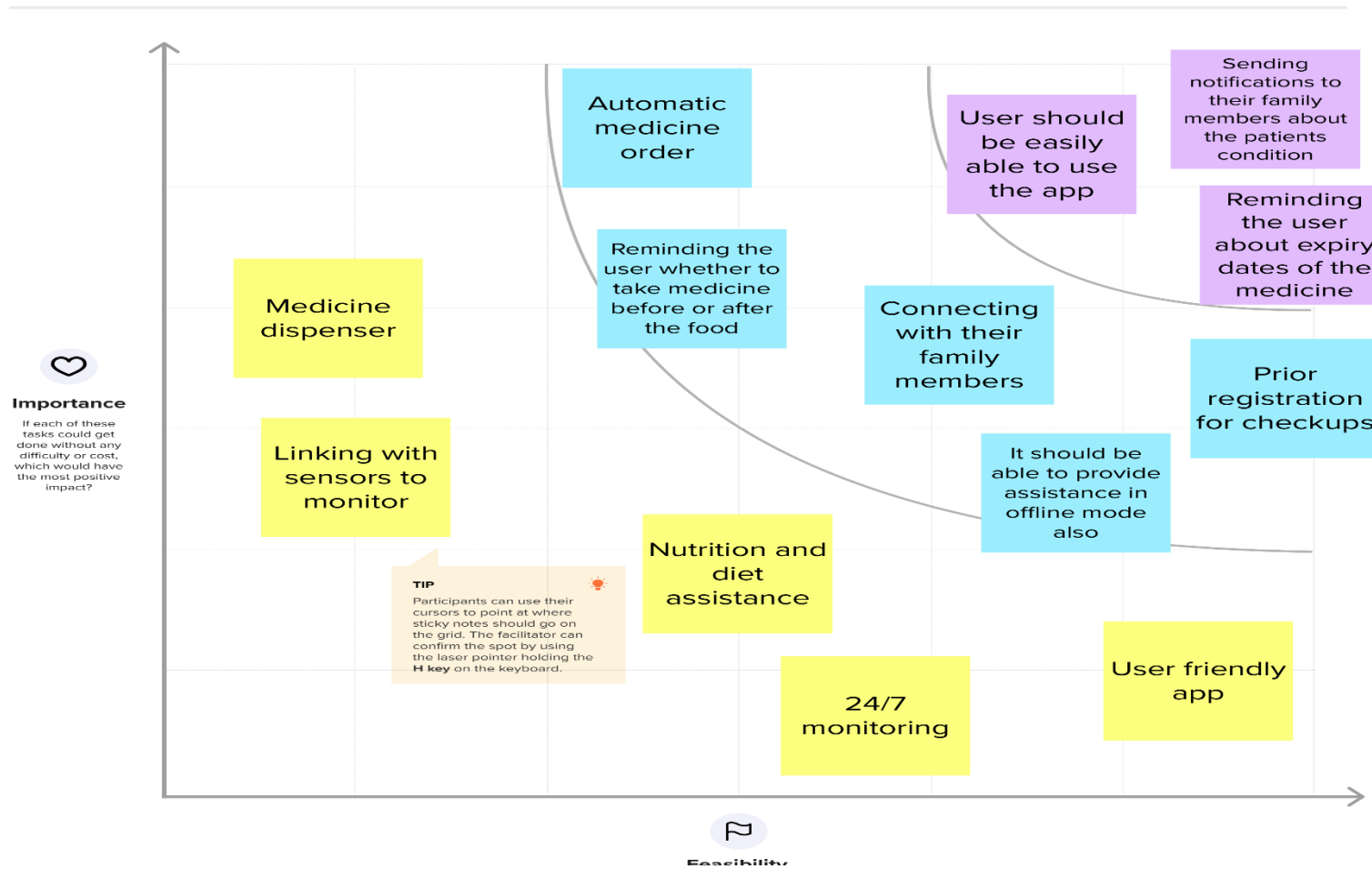
To send reminders via voice. Notification when the patient forgets to take medicine on the scheduled time. Also alerts them if the medicine stock is about to finish.

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

🕒 20 minutes



3.3.Proposed Solution

An app is built for the user (caretaker) which enables him to set the desired time and medicine. These details will be stored in the IBM Cloudant DB. If the medicine time arrives the web application will send the medicine name to the IoT Device through the IBM IoT platform. The device will receive the medicine name and notify the user with voice commands.

| S.No. | Parameter | Description |
|-------|--|--|
| 1. | Problem Statement (Problem to be solved) | Sometimes elderly people forget to take their medication at the scheduled time which has been prescribed by their doctors. They also forget which medication to take at that time.It is also difficult for doctors and caregivers to monitor patients around the clock. This medicine reminder system was created to address this issue. A user (caretaker) app is created that allows him to set the appropriate time and medicine |
| 2. | Idea / Solution description | We present a smart Internet of Things-based medication reminder system. The suggested plan was specifically designed for the Android operating system. We use a reminder system for our system, which sounds an alarm when it's time to take your medication. Additionally, the user can set their medication time using an android application. There will be some features in the application that allow the user to learn more specifics about their medication. It keeps track of the medications, allowing the user to adjust how much medication to take within the application. |

| | | |
|----|---------------------------------------|--|
| 3. | Novelty / Uniqueness | It is an easy-to-use app that reminds users to take their medications and get them refilled, warns about drug interactions, and assists caregivers in managing Prescriptions for loved ones. |
| 4. | Social Impact / Customer Satisfaction | We constructed these proto-personas, or names, based on the research findings from the user interview. They would be crucial to the rest of the design process. All design decisions may be assessed and re- evaluated using these personas, keeping the user and their perspective in mind. |
| 5. | Business Model (Revenue Model) | There is no one-size-fits-all answer when it comes to business. The model you selected depends on your target market, business |

| | | |
|----|-----------------------------|---|
| | | objectives, and the resources you already have available. |
| 6. | Scalability of the Solution | The user can set the time for their medication. There will be some features in the application that allow the user to learn more specifics about their medication. It keeps track of the medications; it also allows the user to adjust how much medication to take within the application. |

3.4 Problem Solution fit:

| | | | | |
|---|---|---|---|---|
| Define CS, fit into CL | 1. CUSTOMER SEGMENT(S) Seniors who are forgot to take their medicines/drugs at the time. | 6. CUSTOMER LIMITATIONS EG. BUDGET, DEVICES Efficient/valuable cost for their intake in medicines by reminding their medicines. | 5. AVAILABLE SOLUTIONS PLUSSES & MINUSES By this applications they can be relaxed by taking their medicines/drugs at correct time and correct medicine. | EXPLORE AS, DIFFERENTIATE |
| Focus on PR, tap into BE, understand RC | 2. PROBLEMS / PAINS + ITS FREQUENCY <ul style="list-style-type: none">Elders who are suffering to identify their daily medicines, due to their carelessness.Patients who are risk to remember their medicines/drugs. | 9. PROBLEM ROOT / CAUSE When the Elders/Patients forgot to take their medicine/drugs at the time that causes severe damage in their internal organs and their body. | 7. BEHAVIOR + ITS INTENSITY <ul style="list-style-type: none">Before ages there are peoples who are appointed to remind them by taking medicines at the time.By forgetting their medicines they risk their life in danger. | FOCUS ON PR, tap into BE, UNDERSTAND RC |
| Identify strong fit & EA | 3. TRIGGERS TO ACT This may leads to a wrong/other intake medicine/drugs that may cause several diseases. | 10. YOUR SOLUTION To develop an application that reminds their medicine at the time. | 8. CHANNELS of BEHAVIOR Promoting through social media. With the help of social media entrepreneurs/influencer. | EXTRACT ONLINE & OFFLINE CH of BE |
| | 4. EMOTIONS BEFORE / AFTER Before: They risk their life by taking different medicines/drugs. After: increase their confidence by reminding their medicines. | | OFFLINE Through newspaper advertisements. | |

4.REQUIREMENT ANALYSIS

4.1.Functional requirement

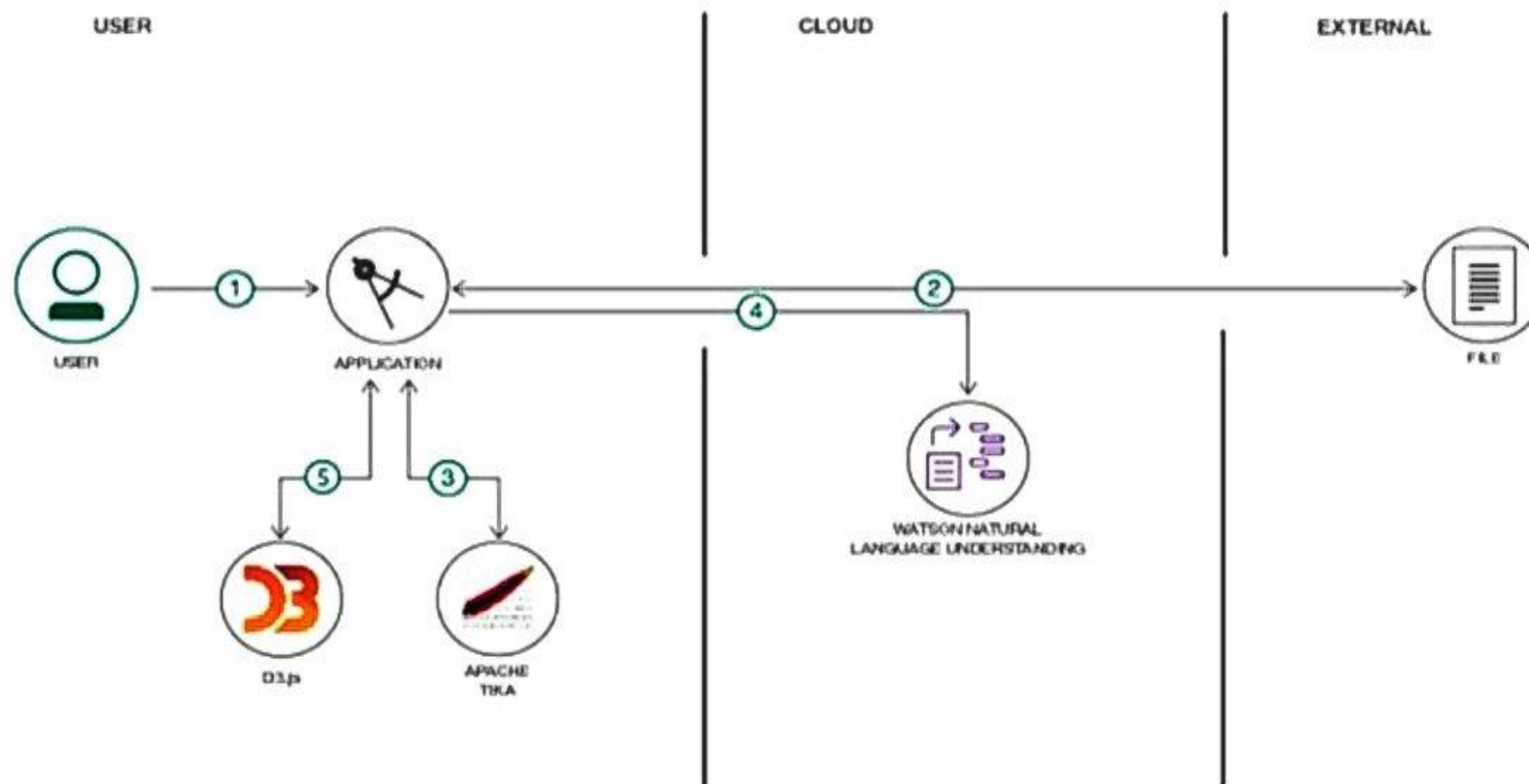
| FR No. | Functional Requirement (Epic) | Sub Requirement (Story / Sub-Task) |
|--------|-------------------------------|--|
| FR-1 | User Registration | Registration has been done through the form in our Application |
| FR-2 | User Confirmation | Confirmation has been done within our Application. |
| FR-3 | Data management | All the data's are stored in the cloud and retrived when it is needed. |
| FR-4 | Internet Connectivity | Users should have a stable internet connection to access the Application. |
| FR-5 | User Input management | All the user's data are gotten with the help of a text field in the dashboard in the app. |
| FR-6 | Acknowledgement | All the data are stored in the cloud via the app and acknowledgment will be given to the user. |

4.2.Non-Functional requirement

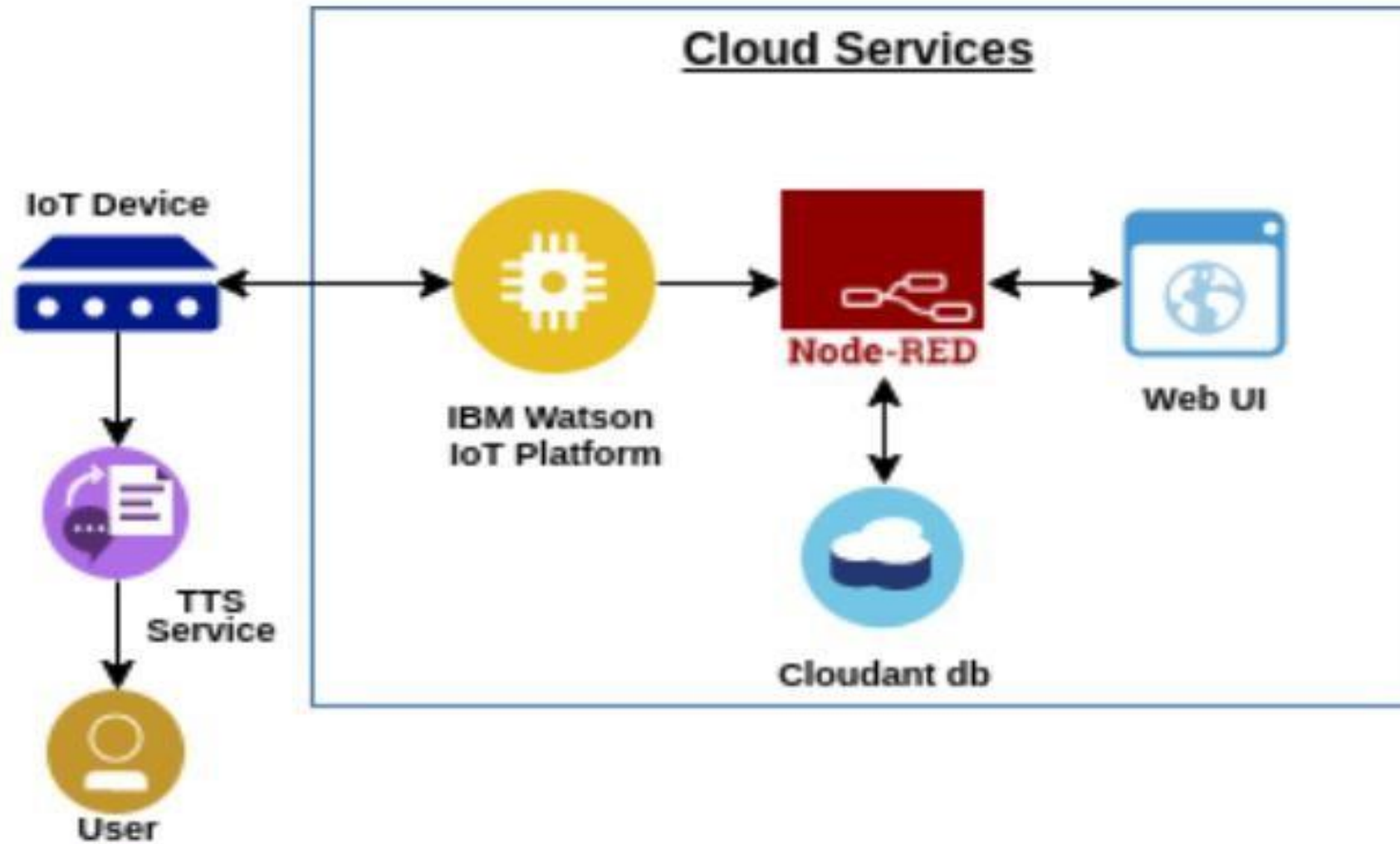
| FR No. | Non-Functional Requirement | Description |
|--------|----------------------------|--|
| NFR-1 | Usability | The Application is created user friendly for the elder peoples to handle it in easy manner |
| NFR-2 | Security | Datas that are stored in the cloud is completely secure |
| NFR-3 | Reliability | All the datas that are stored in the Cloud is reliable |
| NFR-4 | Performance | The Application achieves the IOT concept so the performance is high |
| NFR-5 | Availability | The data stored in the cloud is available for all the time, So the users can avail the app all the time. |
| NFR-6 | Scalability | The Application is highly scalable even if the users rate will increase |

5. Project Design

5.1. Data Flow Diagrams



5.2.Solution & Technical Architecture

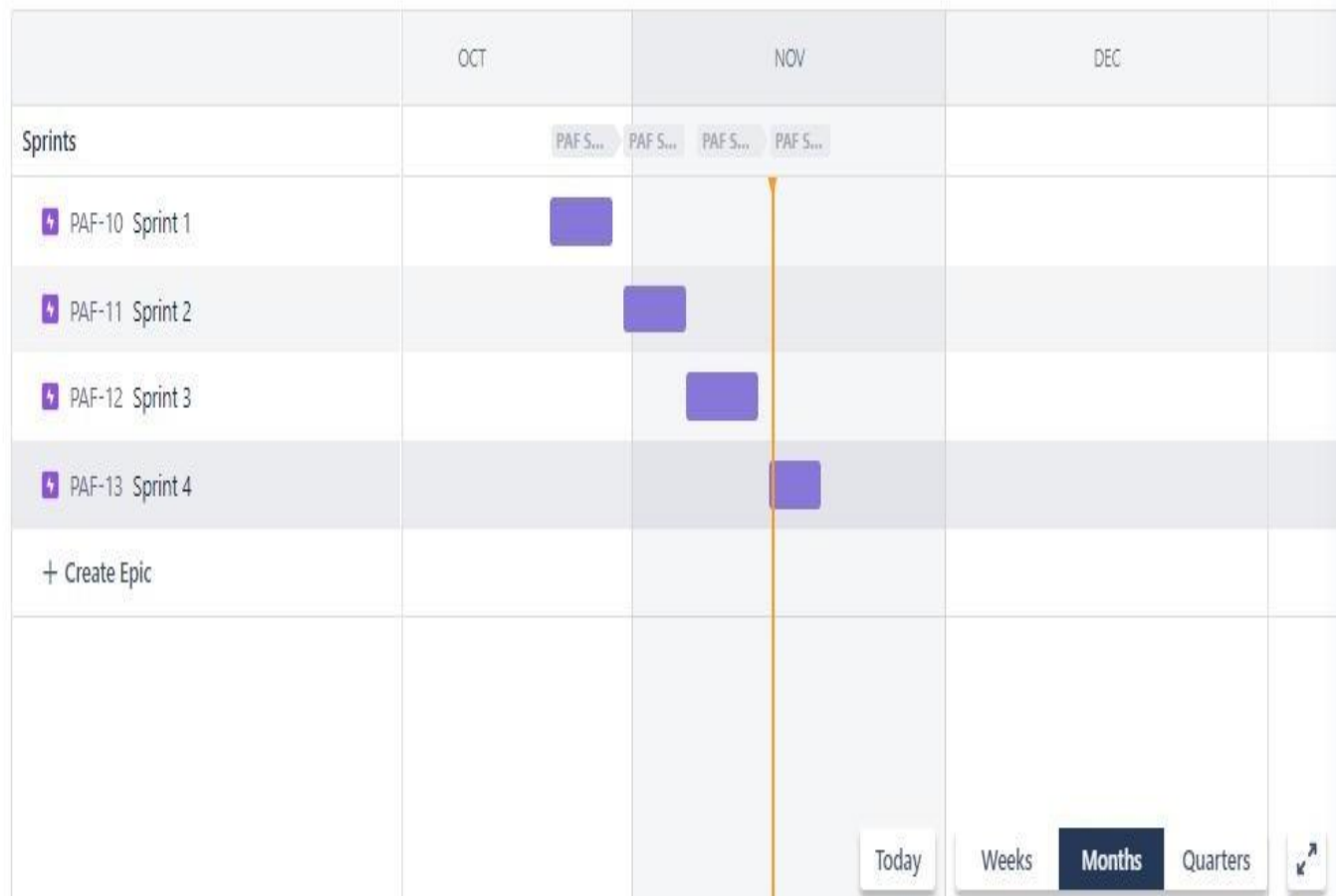


5.3.User Stories

| User Type | Functional Requirement (Epic) | User Story Number | User Story / Task | Acceptance criteria | Priority | Release |
|-----------------------------------|-------------------------------|-------------------|--|--|----------|----------|
| Customer (Senior citizen) | Caretaker | USN-1 | As a user, I want to take medicines on time so that I can my health. | I want to take medicine on time. | High | Sprint-1 |
| Customer (Mentally idled patient) | Janitor | USN-2 | As a user, my patient should maintain good health by consuming medicines on time. | My patient needs to take medicines at proper time. | High | Sprint-2 |
| Customer (Disabled person) | Smart medicine box | USN-3 | As a user, I need to take my medicinesat correct time through nearby person via SMS. | I need to take medicines at accuratetime by notification. | Medium | Sprint-4 |
| Customer (Coma patient) | Virtual med kit | USN-4 | As a user, my patient medication timeand name should be loaded in database. | My patient's medicine name and time shouldbe in database list. | High | Sprint-2 |
| Customer (Alzheimer patient) | Digital Medicare | USN-5 | As a user, I want to take medicines on time by voice commands. | I want to take medicines on time by voice assist. . | Medium | Sprint-3 |

6.PROJECT PLANNING & SCHEDULING

Sprint Planning & Estimation



- ☒ Map out your project goals ▼
- ☒ Identify small chunks of work ▼
- ☒ Monitor and manage risk ▼
- ☒ Create an issue ▲











Issues are individual pieces of work that you assign to teammates.

Issues can be tasks or stories.

Show me [View issue tutorial](#)

Go to Settings to activate Windows.
Dismiss Quickstart

| | | T | NOV | | | | DEC | | | | |
|--|------|---|---|---|---|---|-----|--|--|--|--|
| Sprints | | | PAF Sp... | PAF... | PAF Sp... | PAF... | | | | | |
|  PAF-10 Sprint 1 | DONE | |  | | | | | | | | |
|  PAF-11 Sprint 2 | DONE | | |  | | | | | | | |
|  PAF-12 Sprint 3 | DONE | | | |  | | | | | | |
|  PAF-13 Sprint 4 | DONE | | | | |  | | | | | |

7.CODING & SOLUTIONING

Features

#1 Web UI to schedule medicine name and intake time:

Medicine Reminder

Medicine Name *

DOLO650

Time *

23:00



Date *

13-11-2022



SUBMIT

CANCEL

MEDICATION REMAINDER

Medicine name:

Hint for TextBox1

Date:

YYYY:MM:DD

Time:

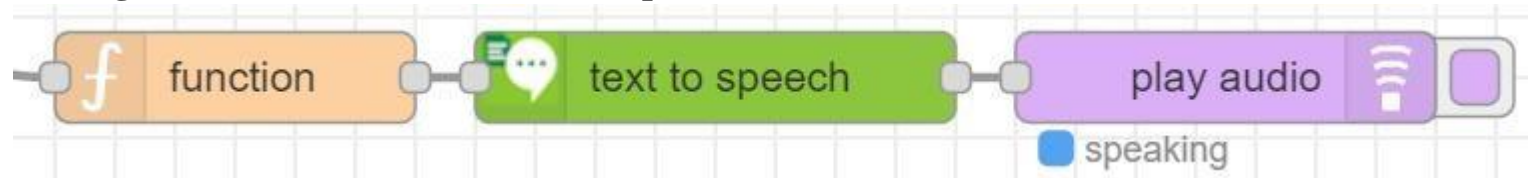
HH:MM

SUBMIT

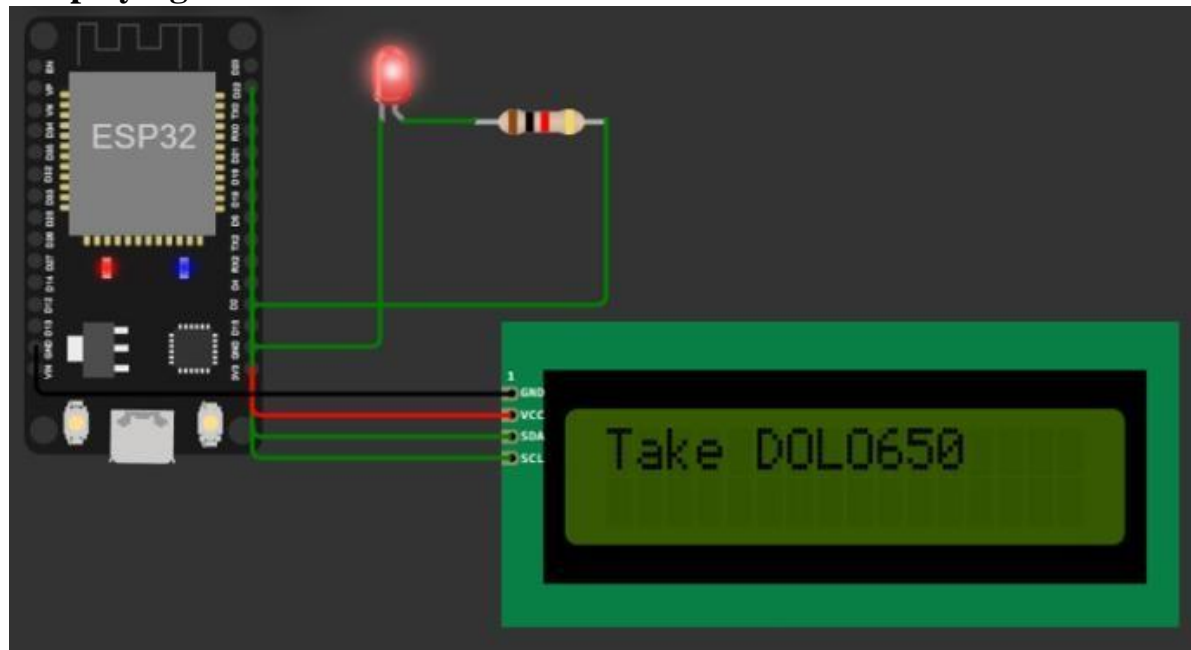
Web page UI

APP UI

#2 Sending the medicine name as Voice output at the scheduled time



#3 Displaying the medicine name on the IoT device at the scheduled time



#4 Secure data transmission and storage with IBM Cloudant database

↔

⏪

⋮

All Documents

+

Query

Permissions

Changes

Design Documents

+

Document ID

⌵

⚙️ Options

{ } JSON

📖

🔔

Table

Metadata

{ } JSON

Create Document

⌵

_id

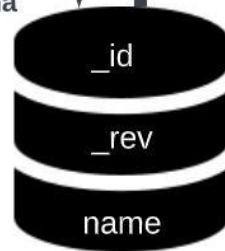
⌵

Database Schema

Logical Schema

| medicine | |
|----------|------|
| name | TEXT |
| time | TIME |
| date | DATE |

Physical Schema



id "2022-11-11 20:16"

```
{
  "id": "2022-11-11 20:16",
  "key": "2022-11-11 20:16",
  "value": {
    "rev": "1-4910298aee742c3f200a0e4191701a3a"
  },
  "doc": {
    "_id": "2022-11-11 20:16",
    "_rev": "1-4910298aee742c3f200a0e4191701a3a",
    "name": "Dolo-650"
  }
}
```

8. Testing:

8.1. Test cases Reports:

| Test case ID | Feature Type | Component | Test Scenario | Pre-Requisite | Steps To Execute | Test Data | Expected Result | Actual Result | Status | Comments | TC for Automation(Y/N) | BUG ID | Executed By |
|----------------------|--------------|-----------|---|---------------|---|--|---|---------------------------------|--------|-----------------------------------|------------------------|--------|-------------|
| LoginPage_TC_OO1 | UI | Home Page | Verify whether user is able to access the URL | APP URL | https://node-red-psifx-2022-11-13.au-syd.mybluemix.net/ui/#/0?socketid=0mz8-FVr6Ap8pjFsAAAf | URL | Able to access the URL | failed to access in mobile | Fail | Wrong Browser selected | NO | 101 | BRINTHA D |
| LoginPage_TC_OO2 | UI | Home Page | Verify whether user is able to access the URL | APP URL | https://node-red-psifx-2022-11-13.au-syd.mybluemix.net/ui/#/0?socketid=0mz8-FVr6Ap8pjFsAAAf | URL | Now User able to access the URL | Able to access in mobile | Pass | Able to access in Chrome and Edge | YES | | CINEHAA M |
| LoginPage_TC_OO3 | Functional | Home page | User can enter the data in specified format | APP URL | To have browsers to have enhanced capabilities | URL | enter a data in specified format only | specified input is not received | Fail | Specify the User formats | NO | 110 | KEERTHANA T |
| LoginPage_TC_OO4 | Functional | Home page | User can enter the data in any format | APP URL | User can enter the data in required format | Time(HH:MM): DATE(YYYY-MM-DD): | User can enter the data in specified format now | Input received properly | Pass | Format specified | YES | | MAHESWARI J |
| CLOUD_STORAGE_TC_005 | Functional | Cloud | Verify if User input is stored in the cloud | CLOUD | User is able to access the URL with the given link. User has to enter the data(name,time and date) and click the SUBMIT button.Data to be stored in IBM cloud | MEDICINE NAME: Time(HH:MM) : DATE(YYYY-MM-DD): | User inputs has to be stored in cloud | Failed to storing the inputs | Fail | Cloud not connected properly | YES | 111 | BRINTHA D |
| CLOUD_STORAGE_TC_006 | Functional | Cloud | Verify if User input is | CLOUD | User is able to access the URL with the given link. User has to enter the data(name,time and date) and click the SUBMIT button.Data to be stored in | MEDICINE NAME: Time(HH:MM) : DATE(YYYY-MM-DD): | User inputs has to be stored in cloud | Inputs are stored in the cloud | Pass | Cloud connected properly | YES | | CINEHAA M |

| | | | | | | | | | | | | | |
|--------------|------------|------------|--|--------------------|---|------------------------------------|---|--|-------|--|-----|-----|-------------|
| OUPUT_TC_007 | Functional | lot device | Verify if it reminds the medicine intake to the user | IOT device | Comparing the UTC time and medicine intake time | Real time and medicine intake time | Gives True when both times match | Null | Fail | Check the input | YES | 113 | KEERTHANA T |
| OUPUT_TC_007 | Functional | lot device | Verify if it reminds the medicine intake to the user | IOT device | Comparing the UTC time and medicine intake time | Real time and medicine intake time | Gives True when both times match | TRUE | Fail | verified | Yes | | MAHESWARI J |
| TTS_TC_008 | Functional | lot device | Verify if it gives voice notifications | IOT device and TTS | When True it gives a voice notifications | Voice notifications | Voice notifications | Voice notifications service didn't | Fail | In program, commands are as object instead of | NO | 121 | BRINTHA D |
| TTS_TC_009 | Functional | lot device | Verify if it gives voice notifications | IOT device and TTS | When True it gives a voice format notifications | Voice notifications | Voice notifications | Voice notifications arrived | Pas s | New string functions were added | YES | | CINEHAA M |
| ACK_TC_010 | Functional | URL | Verify whether the patient has taken the medicine or not | IOT device | The TAKEN button has been included | The status of the medicine intake | The User clicks the TAKEN button to show that medicine has been taken | Button is unfunctional | Fail | Error occurs due to failure of call and connect function of the "taken " button' | NO | 132 | KEERTHANA T |
| ACK_TC_011 | Functional | URL | Verify whether the patient has taken the medicine or not | lot device | The TAKEN button has been included | The status of the medicine intake | The User clicks the TAKEN button to show that medicine has been taken | The Taken status is updated in the cloud | Pas s | The status of the medicine intake is updated in the cloud | Yes | | MAHESWARI J |

8.2.User Acceptance Testing(UAT):

Purpose of Document:

The purpose of this document is to briefly explain the test coverage and open issues of the Personal assistance for seniors who are Self-Reliant project at the time of the release to User Acceptance Testing (UAT).

Defect Analysis:

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved

| Resolution | Severity 1 | Severity 2 | Severity 3 | Severity 4 | Subtotal |
|----------------|------------|------------|------------|------------|----------|
| By Design | 5 | 3 | 1 | 2 | 11 |
| Duplicate | 2 | 1 | 0 | 0 | 3 |
| External | 2 | 2 | 0 | 0 | 4 |
| Fixed | 10 | 2 | 3 | 15 | 30 |
| Not Reproduced | 0 | 1 | 0 | 0 | 1 |
| Skipped | 0 | 0 | 2 | 0 | 2 |
| Won't Fix | 0 | 2 | 4 | 5 | 11 |
| Totals | 19 | 10 | 8 | 22 | 62 |

Test Case Analysis:

This report shows the number of test cases that have passed, failed, and untested

| | | | | |
|---------------------|---|---|---|---|
| Outsource Shipping | 0 | 0 | 0 | 0 |
| Exception Reporting | 2 | 0 | 0 | 2 |
| Final Report Output | 6 | 0 | 0 | 6 |
| Version Control | 1 | 0 | 0 | 1 |

9.Results

9.1.Performance Metrics:

| | | | NFT - Risk Assessment | | | | | | |
|------|---|-------------------|--------------------------|--|-------------------|--|---|-------------------|---|
| S.No | Project Name | Scope/feature | Functional Changes | Hardware Changes | Software Changes | Impact of Downtime | Load/Volume Changes | Risk Score | Justification |
| 1 | Personal Assistance For Seniors who are Self-Reliant | Existing | Low | Moderate | Moderate | Causes delay in runtime | >10 to 30% | ORANGE | As we have seen the changes, it adds the setup time |
| | | | NFT - Detailed Test Plan | | | | | | |
| | | | S.No | Project Overview | NFT Test approach | Assumptions/Dependencies/Risks | Approvals/SignOff | | |
| | | | 1 | Personal Assistance For Seniors who are Self-Reliant | LOAD | Dependencies | SignOff | | |
| | | | End Of Test Report | | | | | | |
| S.No | Project Overview | NFT Test approach | NFR - Met | Test Outcome | GO/NO-GO decision | Recommendations | Identified Defects (Detected/Closed/Open) | Approvals/SignOff | |
| 1 | Providing Assistance to Seniors by developing a Software application to remind their medicine Intake time | LOAD | MET | Able to Support in Other Platforms | GO | To have browsers to have enhanced capabilities | Closed | Approval | |

10.ADVANTAGES & DISADVANTAGES

Advantages:

- Helpful for people who have no caretakers.
- Helps people to take medicines on time by voice command.



Disadvantages:

- Elderly people should be aware of how to use the application.
- There is no way to determine what actually happened as it only gives the remainder to take the medicineInternet connection is required.

11.Conclusion

Our project's goal is to see how successful an automated pilldispenser will be in assisting individuals in better self-managing their medications. This might be demonstrated by the following:

- Better quality of life for individuals with chronic disabilities and their caregivers.

- Improved ability to stay self-sufficient at home.
- Social impact on the pharma sector .
- Less dependency on health-care and social-services.

The device is intended for those with memory impairments, and several of the medical diagnoses recorded for trial participants, including Alzheimer's and dementia, the elderly and persons with long-term medical conditions who must take many prescriptions every day, backed up this claim.

In conclusion, we used technology to have a social effect in the pharmaceutical industry.

12.Future scope:

- We will further extend the app where the prescriptions of the patients will be directly uploaded to the database. ● When your medicine runs low, we will reach out to third parties so you can get it delivered at your door.
- Touch sensors can be incorporated on each compartment to track the number of times the compartment has been opened so that refill time can be calculated.

13.APPENDIX

INTRODUCTION

| | |
|-------------------------|---|
| ➤ Project Overview..... | 1 |
| ➤ Purpose..... | 2 |

LITERATURE SURVEY

| | |
|-------------------------------------|---|
| ➤ Existing problem..... | 2 |
| ➤ References..... | 2 |
| ➤ Problem Statement Definition..... | 3 |

IDEATION & PROPOSED SOLUTION

| | |
|---------------------------------|---|
| ➤ Empathy Map Canvas..... | 4 |
| ➤ Ideation & Brainstorming..... | 5 |
| ➤ Proposed Solution..... | 7 |
| ➤ Problem Solution fit..... | 9 |

REQUIREMENT ANALYSIS

| | |
|-----------------------------------|----|
| ➤ Functional requirement..... | 10 |
| ➤ Non-Functional requirement..... | 11 |

PROJECT DESIGN

| | |
|--|----|
| ➤ Data Flow Diagrams..... | 12 |
| ➤ Solution & Technical Architecture..... | 13 |
| ➤ User Stories..... | 14 |
| ◆ PROJECT PLANNING & SCHEDULING | |
| ➤ Sprint Planning & Estimation..... | 14 |
| ➤ Sprint Delivery Schedule..... | 14 |
| ➤ Reports from JIRA..... | 14 |
| ◆ CODING & SOLUTIONING | 17 |
| ➤ Features..... | 17 |
| ➤ Database Schema | 19 |
| ◆ TESTING..... | 22 |
| ➤ Test Cases..... | 22 |
| ➤ User Acceptance Testing..... | 24 |
| ◆ RESULTS..... | 27 |
| ➤ Performance Metrics..... | 27 |
| ◆ ADVANTAGES & DISADVANTAGES..... | 28 |
| ◆ CONCLUSION..... | 28 |
| ◆ FUTURE SCOPE..... | 29 |

LINKS:

GITHUB: <https://github.com/IBM-EPBL/IBM-Project-38594-1660382928>

NODE-RED: <https://node-red-psifx-2022-11-13.au-syd.mybluemix.net/red/#flow/3f5f4d5d449854ae>

WOKWI: <https://wokwi.com/projects/348142722743272020>

SOURCE CODE:


```

#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQTT
#include <LiquidCrystal_I2C.h>
#define LED 2
void callback(char* subscribtopic, byte* payload, unsigned int payloadLength);

//-----credentials of IBM Accounts-----

#define ORG "ok5c7o"//IBM ORGANIZATION ID
#define DEVICE_TYPE "ESP"//Device type mentioned in ibm watson IOT Platform
#define DEVICE_ID "ESP32"//Device ID mentioned in ibm watson IOT Platform
#define TOKEN "LC!x?+V9etumdVMaSR"//Token
String data3="";

//----- Customise the above values -----
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server Name
char publishTopic[] = "iot-2/evt/Data/fmt/json";// topic name and type of event perform and format in which data to be send
char subscribtopic[] = "iot-2/cmd/command/fmt/String";// cmd REPRESENT command type 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
LiquidCrystal_I2C lcd(0x27,16,2);
//-----

```

```

WiFiClient wifiClient; // creating the instance for wificlient
PubSubClient client(server, 1883, callback ,wifiClient); //calling the predefined client id by passing parameter like server
id,portand wificredential
void setup()// configuring the ESP32
{
  Serial.begin(115200);
  pinMode(LED,OUTPUT);
  delay(10);
  Serial.println();
  wificonnect();
  mqttconnect();
}

void loop()// Recursive Function
{
  if (!client.loop()) {
    mqttconnect();
  }
}

/*.....retrieving to Cloud.....*/

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 definition for wificonnect
{
    Serial.println();
    Serial.print("Connecting to ");

    WiFi.begin("Wokwi-GUEST", "", 6); //passing the wifi credentials to establish the 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("Please take "+ data3);  
    if(data3 != "")  
    {  
        lcd.init();  
        lcd.print("Take"+ data3);
```

```
digitalWrite(LED,HIGH);  
delay(20000);  
digitalWrite(LED,LOW);  
  
}  
else {  
digitalWrite(LED,LOW);  
  
}  
  
data3="";  
  
}
```