

PERSONAL ASSISTANCE FOR SENIORS WHO ARE SELF-RELIANT

Project Report

Project Name	Personal Assistance For Seniors Who Are Self-reliant
Team ID	PNT2022TMID27573
Team Members	Jane Ruffina Mary (Team Lead) Vincy Veronica A Maria Anisha G Preethi R

1. INTRODUCTION

1.1 Project Overview:

Elderly people (Seniors) often forget to take medicines on time. Even though they remember to take medicine, sometimes they may forget which medicine to take. To avoid these problems, we developed a web application integrated with IOT device which will provide a scheduled voice output and display medicine name on a microcontroller during intake time.

1.2 Purpose:

- This helps elderly people to take medicine on time
- Taking medicine on time can improve their health conditions
- Caretakers can feel at ease and are reminded too

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:

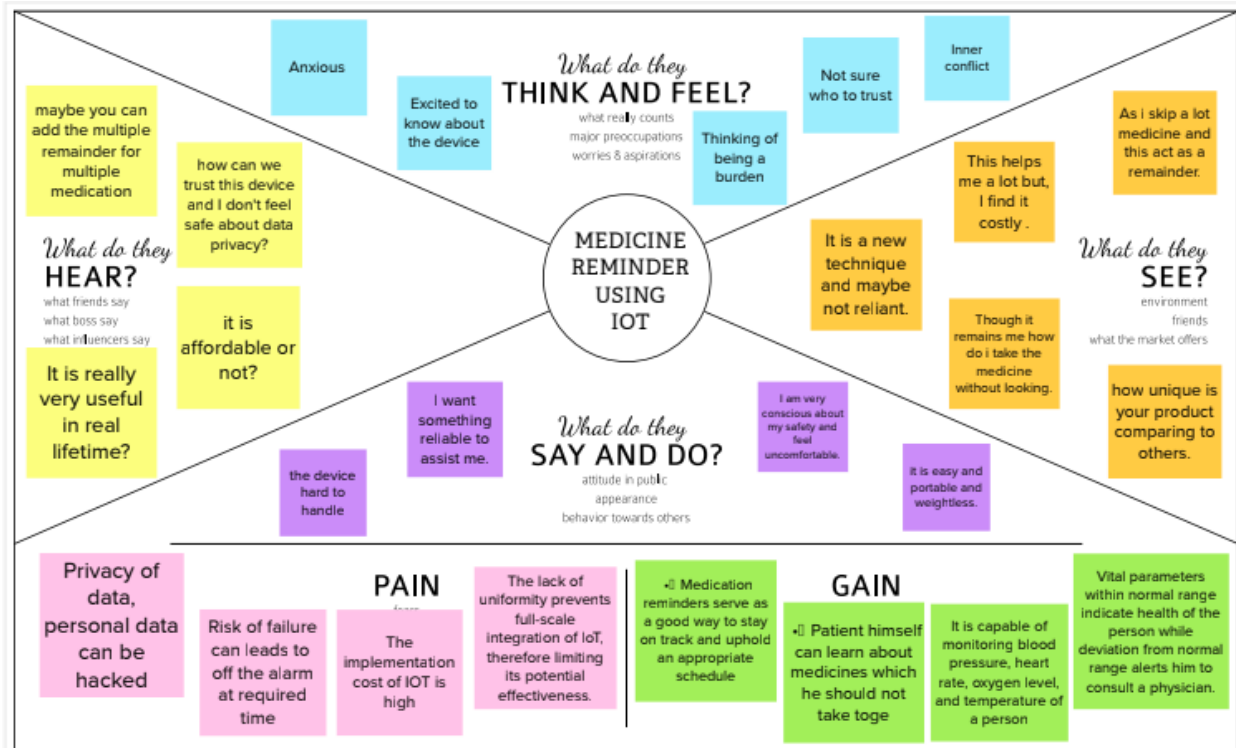
- T. L. Hayes, J. M. Hunt, A. Adami and J. A. Kaye, "An Electronic Pillbox for Continuous Monitoring of Medication Adherence", Conf. Proc. IEEE Eng. Med. Biol. Soc, pp. 6400-6403, 2006.
- S. Shinde, T. Kadaskar, P. Patil and R. Barathe, A Smart Pill Box With Remind And Consumption Using IoT, pp. 152-154, 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.
- B. B. Singh, GSM Based Automatic Pill Dispenser, vol. 7, no. 4, pp. 10694-10695, 2017.
- 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:

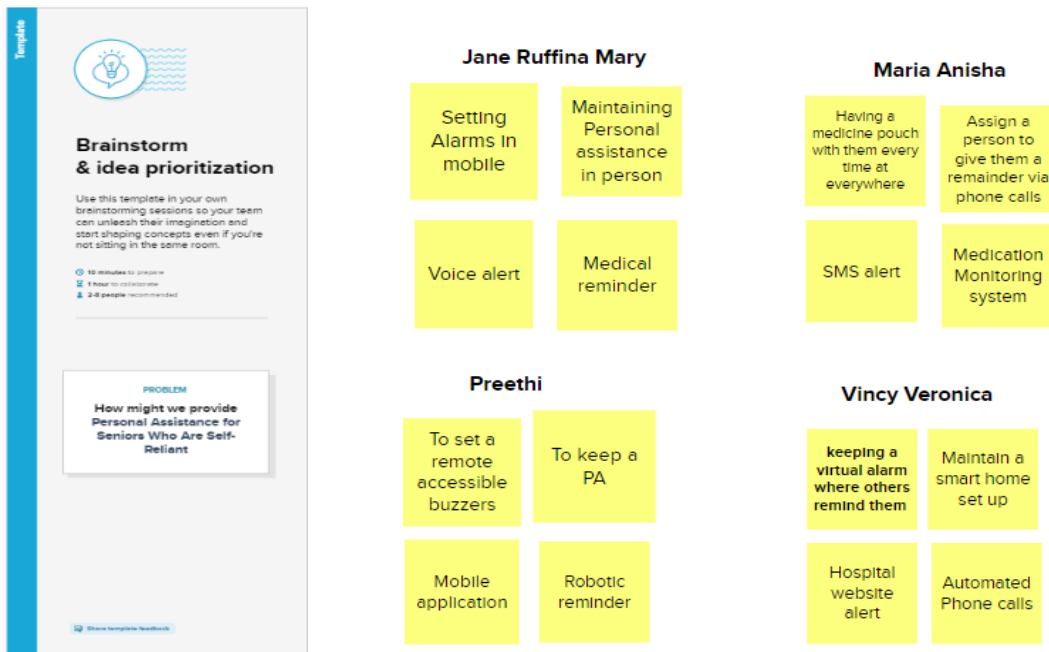
Elderly people (Senior) who wants to take medicines on time, but unable to take medicines on time due to their forgetfulness, are worried about their health.

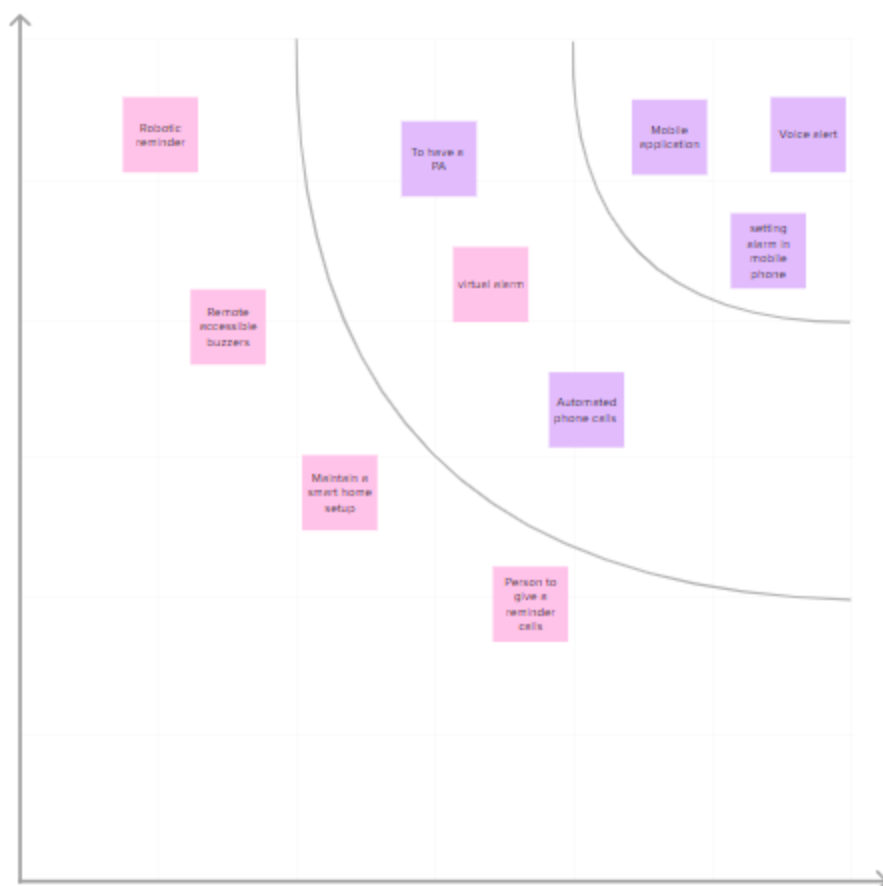
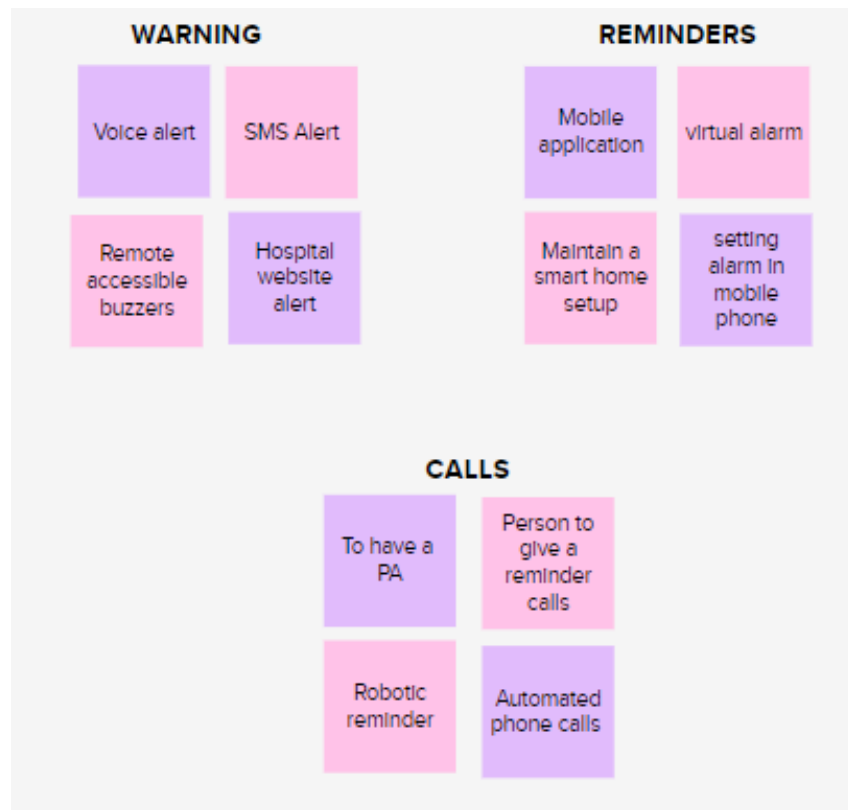
3.IDEATION AND PROPOSED SOLUTION

3.1 Empathy Map Canvas:



3.2 Ideation and Brainstorming:





3.3 Proposed Solution:

A website is built for the user 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)	Elderly patients(above age of 55) who are in need of pill reminders For taking medicines on time.
2.	Idea / Solution description	Web application integrated with a microcontroller to provide scheduled voice output of the medicine name during intake time
3.	Novelty / Uniqueness	It avoids over dosage of medication by the patients.
4.	Social Impact / Customer Satisfaction	Improved ability to stay self-sufficient at home.
5.	Business Model (Revenue Model)	Revenue can be generated by selling the web app at a cost for the users in playstore/App store and also by using the app to advertise pharmaceutical products.
6.	Scalability of the Solution	The web app can be further improved to record and analyze daily activities (such as sleep tracking,step counting)to help maintain a successful diet and lead a healthy lifestyle.

3.4 Proposed Solution Fit:

<p>1. CUSTOMER SEGMENT(S) CS</p> <ul style="list-style-type: none"> • Senior citizens aged from 60-80 and caregivers aged from 30-60, who are familiar with the use of smart phone, minimum use of internet at least 2hrs a day and mobile apps. • Individuals with chronic disabilities. • Physically challenged who are self-reliant. 	<p>6. CUSTOMER CONSTRAINTS CC</p> <ul style="list-style-type: none"> • Network connectivity is mandatory. • Device should be near the user's vicinity. • Prior knowledge of using web apps. • Only registered users can access the app. • Pill name and time needs to be entered manually for each medicine to the app. 	<p>5. AVAILABLE SOLUTIONS AS</p> <ul style="list-style-type: none"> • 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.
<p>2. JOBS-TO-BE-DONE / PROBLEMS J&P</p> <ul style="list-style-type: none"> • Less dependant on caregivers. • Accurate medicine intake and notifying system. • Better lifestyle for patients avoiding overdosage. • Wrong intake of pill is not possible. 	<p>9. PROBLEM ROOT CAUSE RC</p> <ul style="list-style-type: none"> • Lack of caregivers. • Population aging causes chronic illness and require medication on a day-to-day basis. • Forgetfulness developed in elderly due to age constraints 	<p>7. BEHAVIOUR BE</p> <ul style="list-style-type: none"> • Customers can use the user-guide available in the 'help' section. • Demo video links will be provided for better understanding about the working.
<p>3. TRIGGERS TR</p> <ul style="list-style-type: none"> • Doctor's recommendation. • Creating website for advertising with features such as online ordering of the product. <p>4. EMOTIONS: EM</p> <p>BEFORE:</p> <ul style="list-style-type: none"> • Elderly felt insecure about not taking medicine on time <p>AFTER:</p> <ul style="list-style-type: none"> • Elderly users feel confident in taking medication at the right time. 	<p>10. YOUR SOLUTION SL</p> <ul style="list-style-type: none"> • Notifying the medicine name at the appropriate time using voice commands with the help of data fed into the web application which sends the medicine name when the deadline is met. • The user details which are fed into the app are stored in IBM Cloudant DB. • The voice commands are triggered using the Node-Red platform. 	<p>8. CHANNELS of BEHAVIOUR ONLINE: CH</p> <ul style="list-style-type: none"> • The medicine name and intake time is scheduled. <p>OFFLINE:</p> <ul style="list-style-type: none"> • Users get the notification to take the medicine on time

4.REQUIREMENT ANALYSIS

4.1 Functional Requirements:

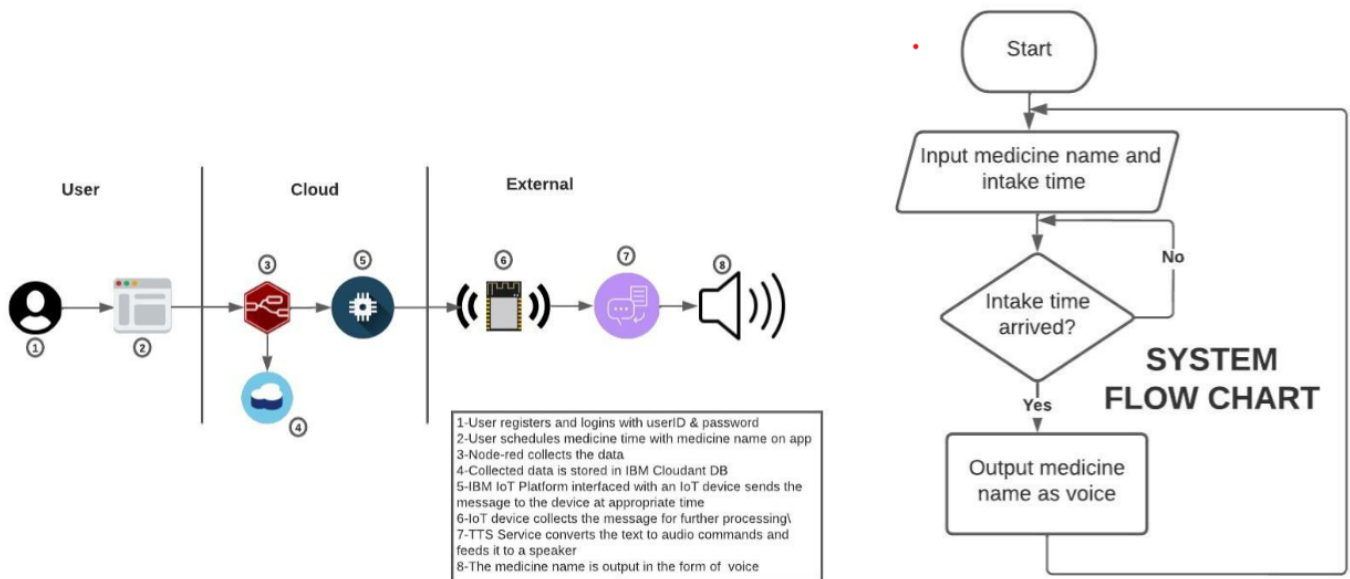
FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIn
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Login	Login via username and password
FR-4	Network connectivity	Mobile data/Wi-Fi
FR-5	Node-Red	Sends the message from Web App to Iot device at the scheduled time using MQTT protocol.
FR-6	IBM Cloudant DB	For storing user details and medicine details on cloud.

4.2 Non-Functional Requirements:

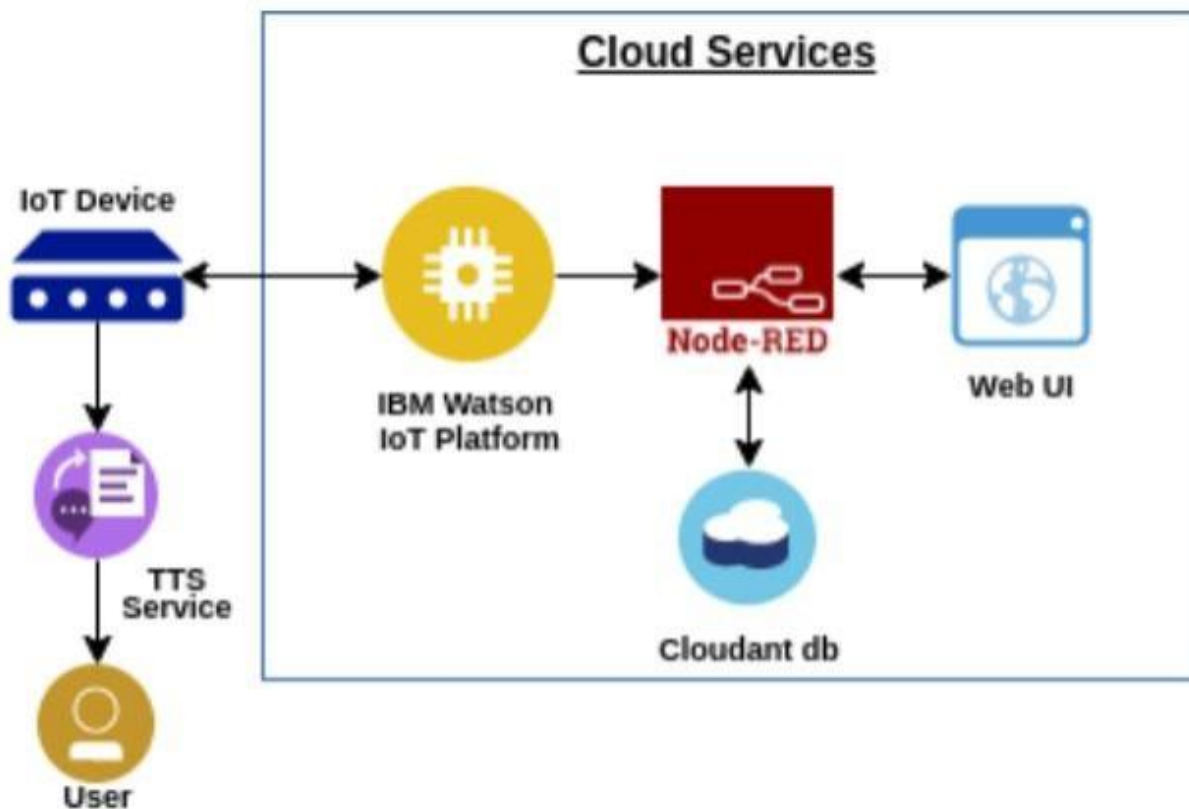
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	It tracks the medication time and signals the user when it's time to take the medicine
NFR-2	Security	IBM Cloudant DB is highly secure from various attacks
NFR-3	Reliability	The app sends scheduled messages to take the medicine on time without any latency.
NFR-4	Performance	The system manages the overall user interaction and increases the efficiency of taking the medicine at the right time.
NFR-5	Availability	The system functions round the clock when connected to the internet.
NFR-6	Scalability	The users can schedule a large number of medicines to be taken in a day using the app

5.PROJECT DESIGN

5.1. Data Flow diagrams:



5.2 Solution and Technical Architecture:



5.3 User Stories:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Citizen)	Scheduling	USN-1	As a user, I want to take Medicines on time and monitor my health.	I want to take medicines on time	High	Sprint-1
Customer (Patient)	Smart medicine box	USN-2	As a user, I want to take my tablets on time by voice command.	I want to take my tablets on time by voice command	High	Sprint-1
Customer (Doctor)	Smart medicine box	USN-3	As a user, my patient needs to take medicines on time and monitoring the activity.	My patient needs to take medicines on time	Low	Sprint-2
Customer (CareTaker)	Data storage	USN-4	As a user, my patient needs medication time and prescription should load in the database for the upcoming week.	My patient medication time and prescription should be in database list	Medium	Sprint-3
Customer (CareTaker)	Smart medicine box	USN-5	As a user, I need to take my medicine in nearby places with light notification.	I want to access the customer health 24/7	High	Sprint-4
Customer (Patient)	User Experience	USN-6	As a user,the app should be easy and simple to use	I want an easy to handle application	Medium	Sprint-4

6.PROJECT PLANNING AND SCHEDULING

6.1 Sprint Planning and Schedule:

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	REGISTRATION: Creation of IBM services like NODE RED, Cloudant DB and design of IOT system	USN-1	As a user, I should login into my IBM Cloud account	2	High	Vincy Veronica A, Preethi R
Sprint-2	WEB UI: Creating web UI using node red and connect it to IBM Cloudant DB	USN-2	As a user, I should be able to feed the medicine name and intake time in the web UI	2	High	Maria Anisha, Jane Ruffina Mary
Sprint-3	SOFTWARE IMPLEMENTATION: Developing Python code to retrieve data from cloudant db to send that data to IOT device at appropriate time	USN-3	As a user, I should be able to send the medicine name to the IOT device at the scheduled time	2	High	Preethi R, Maria Anisha
Sprint-4	HARDWARE IMPLEMENTATION: Converting data received from cloud as voice using IBM text to speech service	USN-4	As a user, I must be able to hear the medicine name which is to be taken at the appropriate time	2	High	Vincy Veronica, Jane Ruffina Mary

6.2 Report From Jira:

	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

7.1 Web UI to enter medicine name and time for intake:

Medicine Reminder

Medicine Name *

DOLO650

Time *

23:00

🕒

Date *

13-11-2022

📅

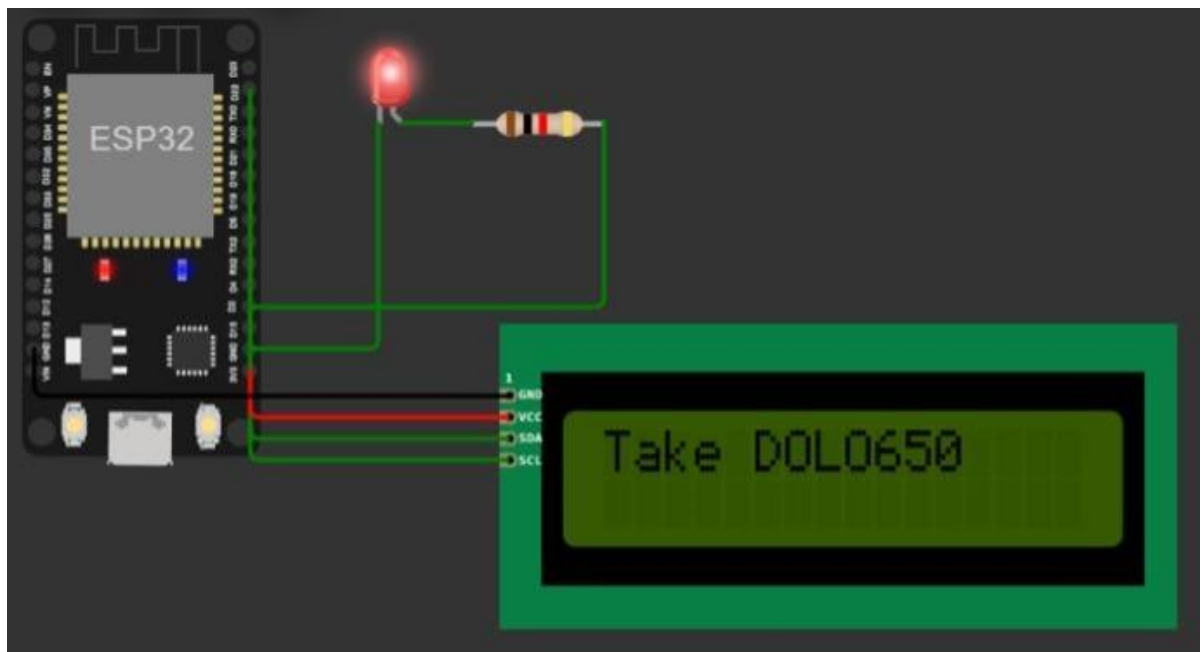
SUBMIT

CANCEL

7.2 Sending voice output at the scheduled time:



7.3 Display the name of the medicine in an IoT device at the scheduled time:

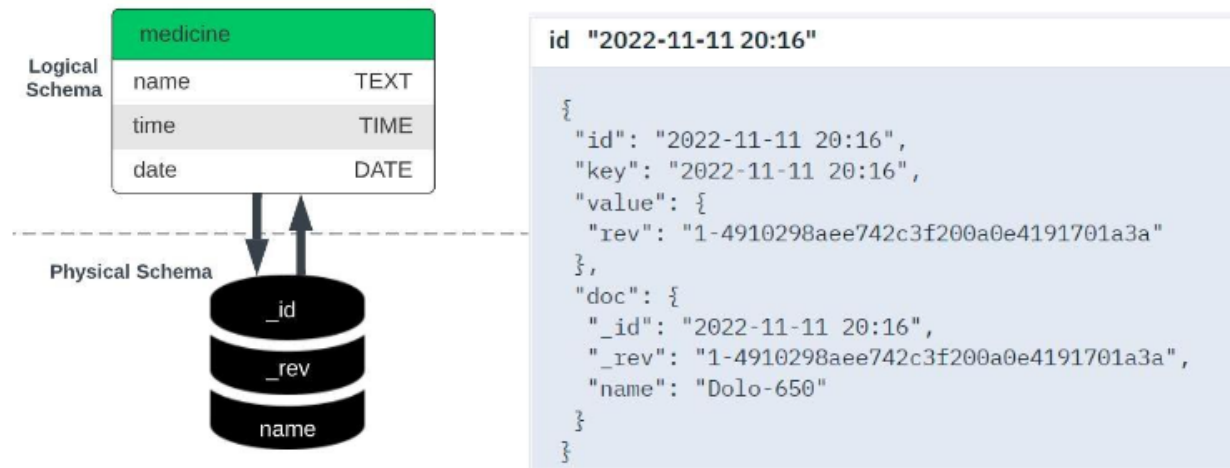


7.4 Cloudant Database to store medicine name and intake time:

The screenshot shows the Cloudant database interface. The database is named "medicine". The table view displays the following data:

	_id	name
<input type="checkbox"/>	2022-11-11 20:16	Dolo-650
<input type="checkbox"/>	2022-11-11 20:18	Cetirizine
<input type="checkbox"/>	2022-11-11 20:20	Azithromycin
<input type="checkbox"/>	2022-11-12 21:00	PAN-20
<input type="checkbox"/>	2022-11-12 8:30	Amoxicillin

7.5 Database Schema:



8. TESTING

8.1 Test Cases:

Test case ID	Feature Type	Component	Test Scenario	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
LoginPage_TC_003	Functional	Home page	User can enter the data in specified format	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	Vinoy Veronica A
LoginPage_TC_004	Functional	Home page	User can enter the data in any format	User can enter the data in required format	Time(HHMM): DATE(YYYY-MM-DD)	User can enter the data in specified format now	Input received properly	Pass	Format specified	YES		Maria Anisha
UD_STORAGE_TC_005	Functional	Cloud	Verify if User input is stored in the 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 IEM cloud	MEDICINE NAME: DATE(YYYY-MM-DD)	User inputs has to be stored in cloud	Failed to storing the inputs	Fail	Cloud not connected properly	YES	111	Jane Ruffina Mary
UD_STORAGE_TC_006	Functional	Cloud	Verify if User input is stored in the 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 IEM cloud	MEDICINE NAME: Time(HHMM): DATE(YYYY-MM-DD)	User inputs has to be stored in cloud	Inputs are stored in the cloud	Pass	Cloud connected properly	YES		Preethi R
OUPUT_TC_007	Functional	IoT device	Verify if it reminds the medicine intake to the user	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	112	Vinoy Veronica A
OUPUT_TC_007	Functional	IoT device	Verify if it reminds the medicine intake to the user	Comparing the UTC time and medicine intake time	Real time and medicine intake time	Gives True when both times match	TRUE	Fail	verified	Yes		Maria Anisha
TTS_TC_008	Functional	IoT device	Verify if it gives voice notifications	When True it gives a voice notifications	Voice notifications	Voice notifications	Voice notifications service didn't work	Fail	In program, commands are as object instead of string	NO	121	Preethi R
TTS_TC_009	Functional	IoT device	Verify if it gives voice notifications	When True it gives a voice format notifications	Voice notifications	Voice notifications	Voice notifications	Pass	New string/functions were added	YES		Jane Ruffina Mary
ACK_TC_010	Functional	URL	Verify whether the patient has taken the medicine or not	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	Maria Anisha
ACK_TC_011	Functional	URL	Verify whether the patient has taken the medicine or not	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	Pass	The status of the medicine intake is updated in the cloud	Yes		Vinoy Veronica A

8.2 User Acceptance Testing (UAT):

Purpose:

The purpose of this document is to briefly explain the test coverage and open issues of 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.

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	5	0	0	5
Client Application	42	0	0	43
Security	1	0	0	1
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						
S.No	Project Name	Scope	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						
			S.No	Project Overview	NFT Test approach	Assumptions/Dependencies/Risks	Approvals/SignOff		
			1	Personal Assistance For Seniors who are Self-	LOAD	Dependencies	SignOff		
			End Of Test						
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 pill dispenser 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:

1. Introduction	1
1.1 Project Overview	1
1.2 Purpose	1
2. Literature Survey	2
2.1 Existing Problem	2
2.2 References	2
2.3 Problem Statement Definition	2
3. Ideation & Proposed Solution	3
3.1 Empathy Map Canvas	3
3.2 Ideation & Brainstorming	3
3.3 Proposed Solution	5
3.4 Problem Solution Fit	6
4. Requirement Analysis	7
4.1 Functional Requirement	7
4.2 Non-functional Requirements	7
5. Project Design	8
5.1 Data Flow Diagrams	8

5.2 Solution & Technical Architecture	8
5.3 User Stories	9
6. Project Planning & Scheduling	9
6.1 Sprint Planning & Schedule	9
6.2 Reports From Jira	10
7. Coding & Solutioning (explain The Features Added In The Project Along With Code)	10
7.1 Web UI to enter medicine details	10
7.2 Text to Speech	10
7.3 Display name in IoT device	11
7.4 Cloudant DB	11
7.5 Database Schema	12
8. Testing	12
8.1 Test Cases	12
8.2 User Acceptance Testing	12
9. Results	14
9.1 Performance Metrics	14
10. Advantages & Disadvantages	15
11. Conclusion	15
12. Future Scope	16
13. Appendix	16

SOURCE CODE:

```
#include <WiFi.h>//library for wifi
#include <PubSubClient.h>//library for MQTT
#include <LiquidCrystal_I2C.h>
#define LED 2

void callback(char* subscribetopic, byte* payload, unsigned int payloadLength);

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

#define ORG "ok5c7o"//IBM ORGANITION 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 subscribetopic[] = "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()// configureing 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 defination 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="";
```

```
}
```

GITHUB LINK: <https://github.com/IBM-EPBL/IBM-Project-37106-1660300473>

DEMO LINK: <https://www.youtube.com/watch?v=tzZGe0kfQ8A>