PERSONAL ASSISTANCE FOR SENIOR WHO ARE

SELF-RELIANT

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Project Report

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1.Introduction

1.1 project overview:

Sometimes elderly people forget to take their medicine at the correct time. They also forget which medicine He / She should take at that particular time. And it is difficult for doctors/caretakers to monitor the patients around the clock. To avoid this problem, this medicine reminder system is developed. 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 Data Base. If the medicine time arrives the web application will send the medicine name to the Internet of Things Device through the IBM Internet of Things platform. The device will receive the medicine name and notify the user with voice commands.

1.2 Purpose:

This is an Android-based application in which an automatic voice command system is implemented. Patients need not remember their medicine dosage timings as they can set an alarm on their dosage timings. The alarm can be set for multiple medicines and timings including date, time and medicine description. A notification will be sent to them through message inside the system preferably chosen by the patients.

➢ Easy-to-use and time-saving. ...
➢ Extra safety measure around children and pets. ...
➢ Reminds the patient to take the right dose, of the right medication, at the right time. ...
➢ Independence

2. LITERATURE SURVEY:

2.1 EXISTING SYSTEM

Fernandes A [1] Considered as elderly people suffer from an increasing number of problems, mainly due to social isolation and loneliness, requiring support from social agents. These problems, related to loneliness, social isolation, and reduced social activity are linked to the person's mental health, depression, and social bonds. Promoting the social engagement motivates persons to have more complex interactions, mobilizing the cognitive faculties and helping to maintain a good mental health.**] (2001**

Reis A, Reis C, Morgado [2] (2016) Proposed a model for the design of an autonomous system, based on the paradigm of the intelligent personal assistant, in order to support the elderly people in maintain their social bonds with the family, friends and colleagues' groups. This proposal is focused on tailoring the digital assistant for the specific group of elderlies and for their specific life contexts, which has good perspectives, as the intelligent personal assistants are equipment's that are becoming more interactive and with a more natural language.

Palmer D [3] (2016) Assess the possibility of using the intelligent personal assistants, currently available to the consumer public, accordingly to the previously proposed model. The intelligent personal assistants chosen were: Google Assistant, Amazon Alexa, Apple Siri and Microsoft Cortana. These are the most popular and readily available from the large, world class, technology companies.

Stefan Kopp & Karola Pitsch [5] Analyze the people with cognitive impairments have problems organizing their daily life autonomously. A virtual agent as daily calendar assistant could provide valuable support, but this requires that these special user groups accept such a system and can interact with it successfully. In this paper we present studies to elucidate these questions for elderly users as well as cognitively impaired users

Barroso J [12] Presented a comparison of several intelligent personal assistants, with the objective to evaluate how well these services would fulfil the proposed model, based on previous work. These services have many features in common, such as, playing music, search online, or playing games. Although it is important to know what are the features that each service provides,

it is also important to understand the extent of how much an third party developer can use and customize these services to accomplish the proposed objectives.

2.2 REFERENCES:

https://developer.amazon.com/public/solutions/alexa/alexa- c

https://developer.microsoft.com/en-us/cortana

https://assistant.google.com

http://www.apple.com/ios/siri/

2.3 PROBLEM STATEMENT DEFINITION:

Good health has been a major concern since the inception of mankind whilst for some people attaining good health requires taking prescribed medicines or pills routinely. However, many patients find it very difficult to keep track of taking their medication in the right time and proportion. This happens especially if it involves taking pills or medication on daily basis due to several reasons such as heavy work load, forgetfulness, old age and alterations in day-today behavior can have a significant result on whether patients recall to take their prescribed medications which can be termed as medicine adherence, which is a serious problem because it may affect the total well-being of the patient ,medical cost of the patient and can be a matter of life and death .The medicine reminder application could impact positively on the life of the patient as it will help the patient by remembering the intake of these prescribed medications could be a matter of life and death.

PROBLEM STATEMENT	I AM (Customer)	I AM TRYING TO	BUT	BECAUSE	WHICH MAKES ME FEEL
Problem for the user	Senior citizen who are self reliant	Eat medicines at correct time.	Fails to eat	There is no one to remind about medicne.	Anxious and feeling of being alone.

3. IDEATION AND PROPOSED SOLUTION:

3.1 EMPATHY MAP CANVAS:
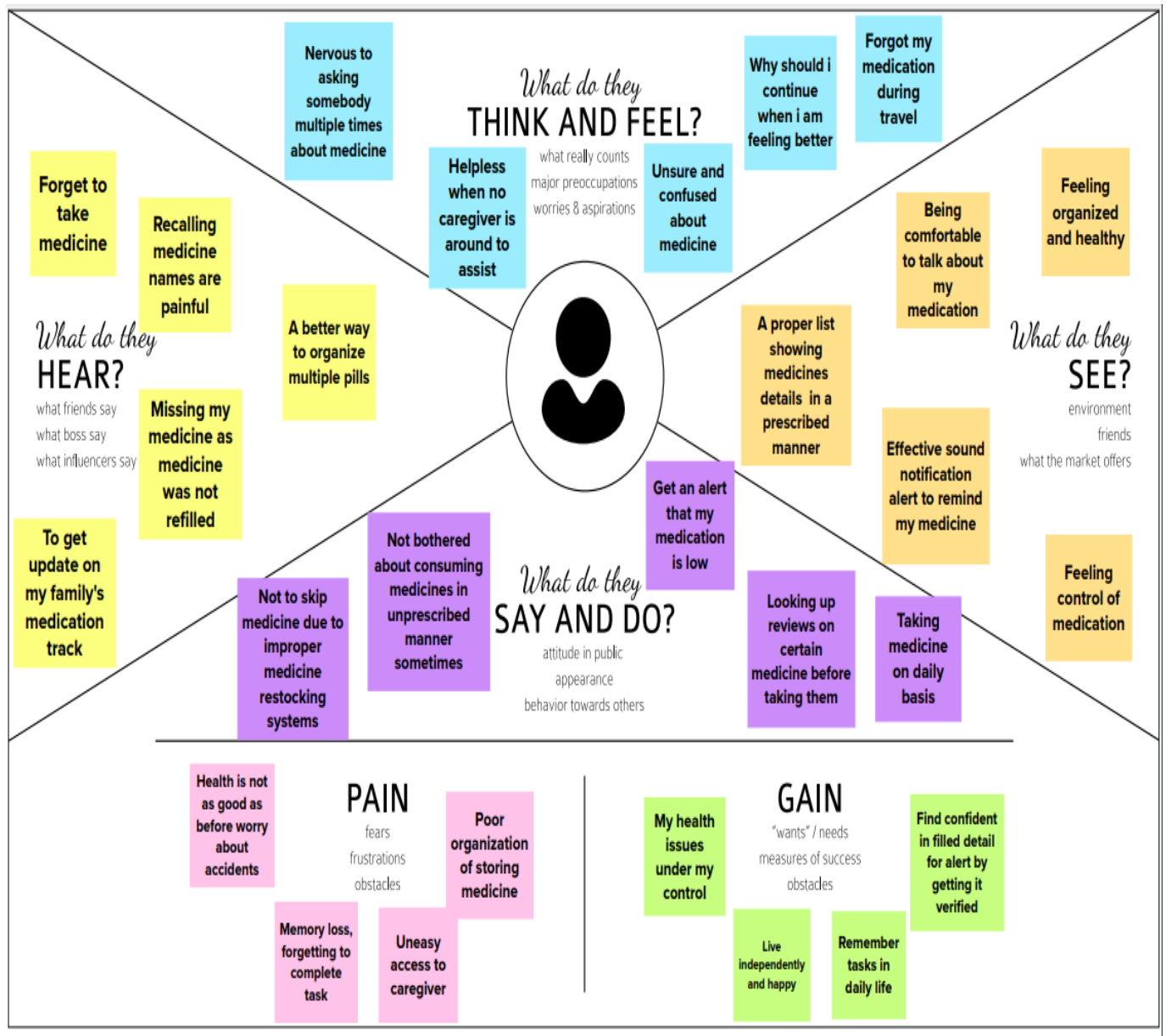
3.2 IDEATION AND BRAINSTORMING:

Step-1: Team Gathering, Collaboration and Select the Problem Statement:

Brainstorm and Idea Presentation

Personal Assistance for Seniors Who Are Self-Reliant

⏱ 30-60 minutes to collaborate
👤 3-8 people recommended

Created in partnership with 𝕄 Meta 𝕄 Meta

Share template feedback

Before you collaborate

A little bit of preparation goes a long way with this session. Here's what you need to do to get going.

⏱ 15 minutes

A Choose your best "How Might We" Questions
Create 5 HMW statements before the activity to propose them to the team.

B Set the stage for creativity and inclusivity
Go over the brainstorming rules and keep them in front of your team while brainstorming to encourage collaboration, optimism, and creativity.

1. **Encourage wild ideas** (If none of the ideas sound a bit ridiculous, then you are filtering yourself too much.)
2. **Defer judgement** (This can be as direct as harsh words or as subtle as a condescending tone or talking over one another.)
3. **Build on the ideas of others** ("I want to build on that idea" or the use of "yes, and...")
4. **Stay focused on the topic at hand**
5. **Have one conversation at a time**
6. **Be visual** (Draw and/or upload to show ideas, whenever possible.)
7. **Go for quantity**

C Interested in learning more?
Check out the Meta Think Kit website for additional tools and resources to help your team collaborate, innovate, and move ideas forward with confidence.

Open the website →

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1 Define your problem statement

What problem are you trying to solve? Frame your problem as a How Might We statement. This will be the focus of your brainstorm.

⏱ 10 minutes

QUESTION
How might we help the user with personal assisstance

QUESTION
How might we keep track of all the medication needs of the user

QUESTION
How can we alert the user, when it is time to take up the medication

QUESTION
How can we get the user input manually

Step-2: Brainstorm, Idea Listing and Grouping

2

Brainstorm solo

Have each participant begin in the "solo brainstorm space" by silently brainstorming ideas and placing them into the template. This "silent-storming" avoids group-think and creates an inclusive environment for introverts and extroverts alike. Set a time limit. Encourage people to go for quantity.

⏱ 10 minutes

DIVYA

Secure database (IBM cloud)

Simple yet better UI for elderly people

In case of severe emergency, send notification to emergency contacts

KANNAPPAN

Allow Users to update medical info manually

Easily accessible to everyone

Access to healthcare services

GUNA

Easily customisable according to user needs

Send notifications to user

Various Themes in the App

BANU MITHRA

Remind the users to take medicine in an effective way

Offer medical tips to stay healthy

3

Brainstorm as a group

Have everyone move their ideas into the "group sharing space" within the template and have the team silently read through them. As a team, sort and group them by thematic topics or similarities. Discuss and answer any questions that arise. Encourage "Yes, and…" and build on the ideas of other people along the way.

⏱ 15 minutes

TIP
You can use the Voting session tool above to focus on the strongest ideas.

Integration:

Integrates with internet for categorizing risks

Integrates with IBM cloud

Experience:

Simple yet better UI

Easily customisable.

Alert:

remind user to take medicine at the correct time

Alert Notifications

Categorization:

Categorzes. the time in which the tablets are to be consumed.

Categorise.the emergency risks in case of higher emergency. alert is given

Other:

Security

User Friendly

various Themes in the App

Offer Medical Tips

Step-3: Idea Prioritization:

④

Prioritise

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.
⊙ 5 Minutes

Priorities:

remind user to take medicine at the correct time	Integrates with IBM cloud
Security	Categorzes the time in which the tablets are to be consumed.
Integrates with internet for categorizing risks	

3.3 proposed solution:

Proposed Solution Template:

Project team shall fill the following information in proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	In the modern era people may difficult to spend time with the older people in their house and also they don't find the time to take care and monitor the elderly people in the house. the aged people are mostly suffer from memory impairment issue, they are forget to remember to take their medicine. to overcome this problem and came up with a solution of developing the web applications for automated medicine remainder which assists the elderly people by remaining them to take their medicine at right time.
2.	Idea / Solution description	To avoid this problem, the medicine remainder system is developed the app build for the user which enables to set desire time and medicine and also the how much amount of medicine they should taken in that time. if the medicine arrives the web application it will send the medicine name and amount of the medicine to the IOT through IBM IOT platform.
3.	Novelty / Uniqueness	Our proposed system we will provide voice remainder to remain the patient to take the medicine and amount of the medicine at right time.

4.	Social Impact / Customer Satisfaction	With the help if IOT based voice Assistance Suppose one patient is suffered from any of the disease or they met an accident they can't able to remain to take their medicine in correct time. with the help of this web application they can easily remember their daily routine with just a simple device.it has the capacity to store data's in the memory .it also affordable and can be used for a long term by making their life easily without depending other they can lead a independent life.
5.	Business Model (Revenue Model)	With improvement in technology, there have been attempts to utilize the new technology in various areas to improve the quality of human life. In the fast-changing environment and of its increasing need for healthcare and assistance, ubiquitous usage of Internet of Things(IOT) based smart applications can mitigate the consequential social burden.so this is a much needed device that can be helpful to the People whose memory fades in their old age..
6.	Salability of the Solution	It's a simple device and compactable. It reduces the complexity and it can also be self-repaired. It provides voice remainder, data privacy and security. And the one important thing is no one user can be handle this. Further updates can be done very easily in our project.

3.4 problem solution fit:

1.CUSTOMER SEGMENT(S)

The customer is old man or women or patient so they are suffering from health issues they don't have the personal care taker to give prescribed medicine on time.

6. CUSTOMER CONSTRAINTS

The patient is not aware of the medicine because they don't have the knowledge about reading .they forgot to take their medicine on correct time what is the medicine to take how much the amount of medicine to take before food or after food they have lot of problem on that because they don't have the care taker to remain that.

5. AVAILABLE SOLUTIONS

The medicine time arrives through web application will send the medicine name and amount of the medicine to the IOT device that device will receive that and notify to the user with message alerts suppose the message alerts are not working they will notify through message or emergency calls.

2. JOBS-TO-BE-DONE / PROBLEMS

Elderly people are forgetful to take their medicine in the correct time so we proposed the solution for this problem. The person will notify to take their medicine in the right time using message alerts.

9. PROBLEM ROOT CAUSE — RC

Most of the old age people they have multiple medicine to overcome some of the illness . due to take wrong medicine on wrong timing or they don't take medicine at all they can lead to death occur.

7. BEHAVIOUR — BE

They patient would help from the help option in the web application they can use that if they can face any problem on that.

3. TRIGGERS — TR

Friends and family who wish to took after those medically disabled will be encouraged to try this model and to promote this app through advertisement seniors with learning disabilities are may also trigger to use this app.

10. YOUR SOLUTION — SL

An web application is build for the user which enables him/her to set the desire time and medicine name to the IOT device. the device will receive the medicine name and notify the user with voice commands.

8. CHANNELS of BEHAVIOUR — CH

8.1 ONLINE
Upload detils about medicine and get alert message on correct time.

8.2 OFFLINE
Patient can directly send a feedback mail or message to the receiver.

4. EMOTIONS: BEFORE / AFTER — EM

They can feel they can take their medicine in correct time and to fell confidentiality and secured.so they, can feel much better than using this app.

4.Requriment Analysis:

4.1 Functional Requirements:

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 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.

Non-Functional Requirements:

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

FR No.	Non-Functional Requirement	Description
NFR-1	Usability	Smart medicine box usability is the characteristics of the user that facilitate .Use, to make it easier for the user to perceive the information presented by the user interface, to understand and decide based on that information.
NFR-2	Security	Smart medicine box, like other computer systems, can be vulnerable to security breaches, potentially, impacting the safety and effectiveness of the device.
NFR-3	Reliability	The probability of medicine box will perform a required function without failure under stated conditions for a specific period.
NFR-4	Performance	Medical device testing is the process of demonstrating that the device will reliably and safely perform in use.
NFR-5	Availability	Medicine box is availability over all the conditions of weather and atmosphere pressure and be carried out with us.
NFR-6	Scalability	In feature we can upgrade the smart medicine box to the health care assistant to monitor our health care and book appointments to doctor.

5.Project Design:

5.1 Data Flow Diagram:
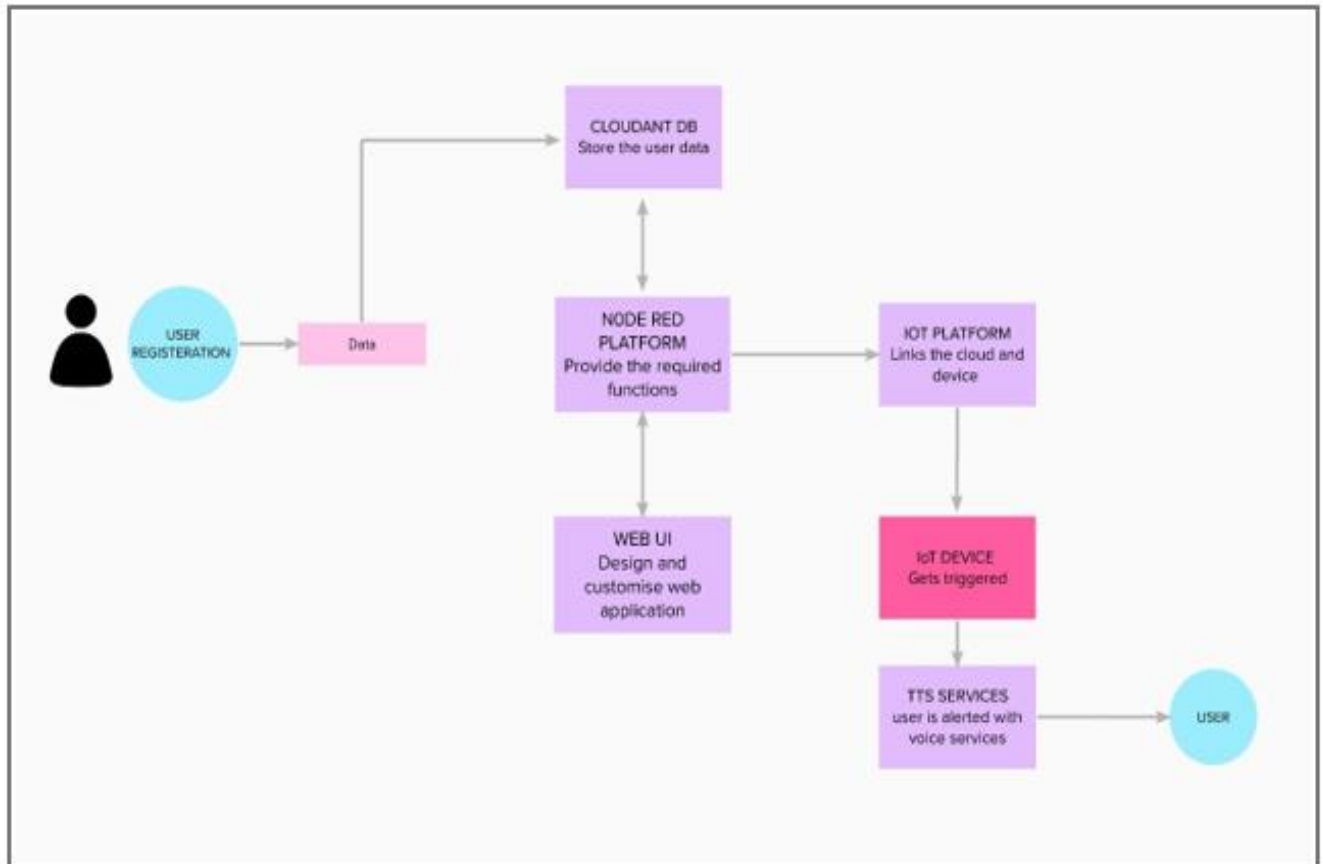
5.2 Solution and Technical Architecture:

Medicine / Supplements

Cloud Services

IoT Device

IBM Watson IoT Platform

Node-RED

Web UI

Cloudant db

TTS Service

User

Elders
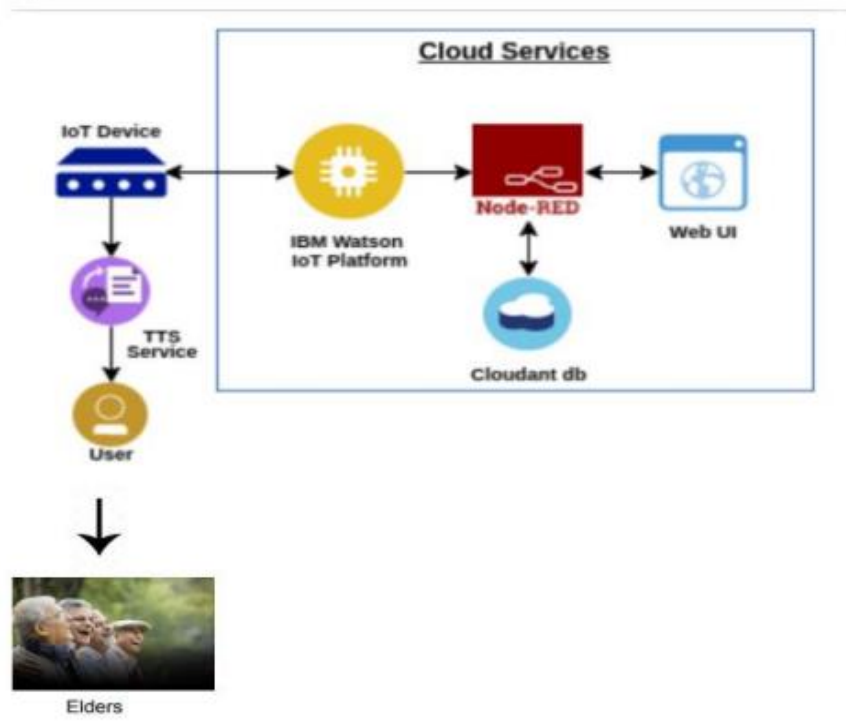
5.3 User Stories:

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

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Senior user)	caretaker	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 (Diabetes 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 (Thyroid Patient)	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	Medium	Sprint-2
Customer (Coma Patient)	Caretaker	USN-4	As a user, my patient needs medication time and prescription should load indatabase for upcoming week	My patient medication time and prescription should be in database list	low	Sprint-4
Customer (Disabled People's)	Smart medicinebox	USN-5	As a user ,i need to take my medicine in nearby places with light notification	I need to take my medicine in nearby places with light notification	Medium	Sprint-3

6.Project Planning &Scheduling:

6.1 Sprint Planning &Estimation:

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration. Creation of IBM services like NodeRED, Cloudant DB, TTS Service and design of IoT system	USN-1	As a user, I must be able to login to the IBM platform	2	High	Kannappan Banumithra Guna Divya
Sprint-2	Web UI. Creation of Web UI using NodeRED service	USN-2	As a user, I must be able to update the medicine details in the web UI	2	High	Kannappan Banumithra Guna Divya
Sprint-3	Software implementation. Developing Python code to retrieve data from cloudant db to send that data to IoT device	USN-3	As a user, I must be push the details to the IoT device	2	High	Kannappan Banumithra Guna Divya
Sprint-4	Final demonstration and user testing. Generating voice commands using IBM Text to Speech service	USN-4	As a user, I must be able hear the medicine name which is to be taken at the appropriate time and check its accuracy	2	High	Kannappan Banumithra Guna Divya

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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

6.2 Sprint Delivery Schedule:

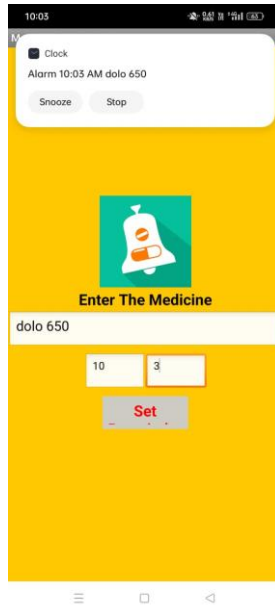| Sprint	Sprint Topic	Start Date	Expected Delivery
Sprint 1	Set alarm	29-10-2022	5-11-2022
Sprint 2	Notification	7-11-2022	14-11-2022
Sprint 3	Medication details	16-11-2022	23-11-2022
Sprint 4	Over all coding	23-11-2022	30-11-2022

6.3 Reports from JIRA:

Burndown Chart
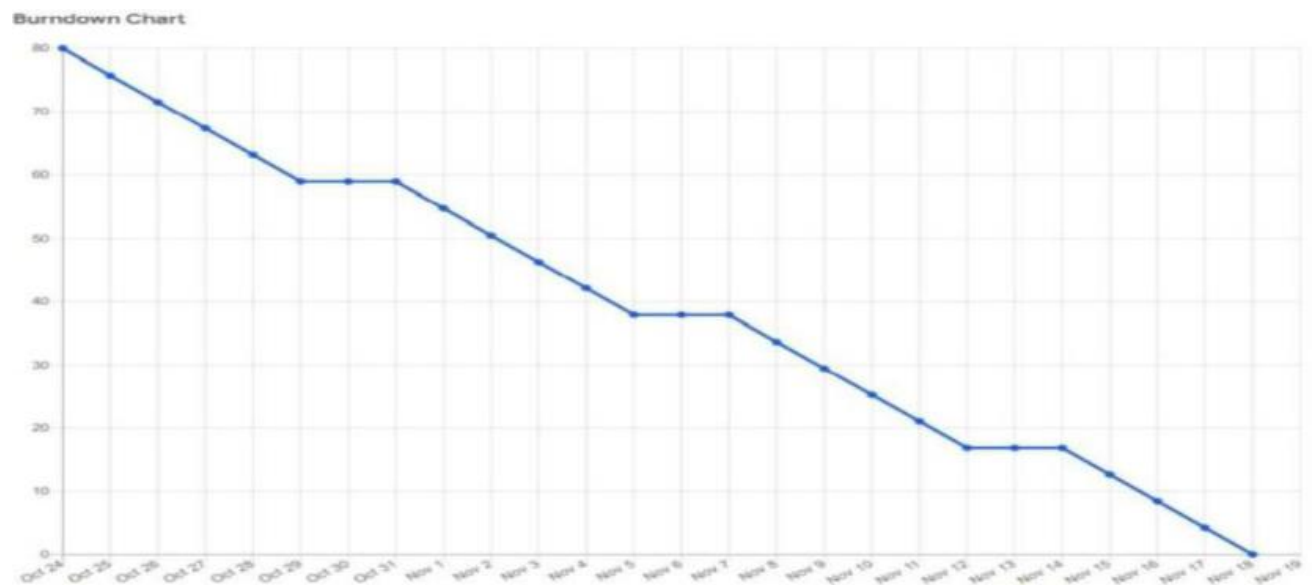
7. CODING & SOLUTIONS

7.1 Feature 1:
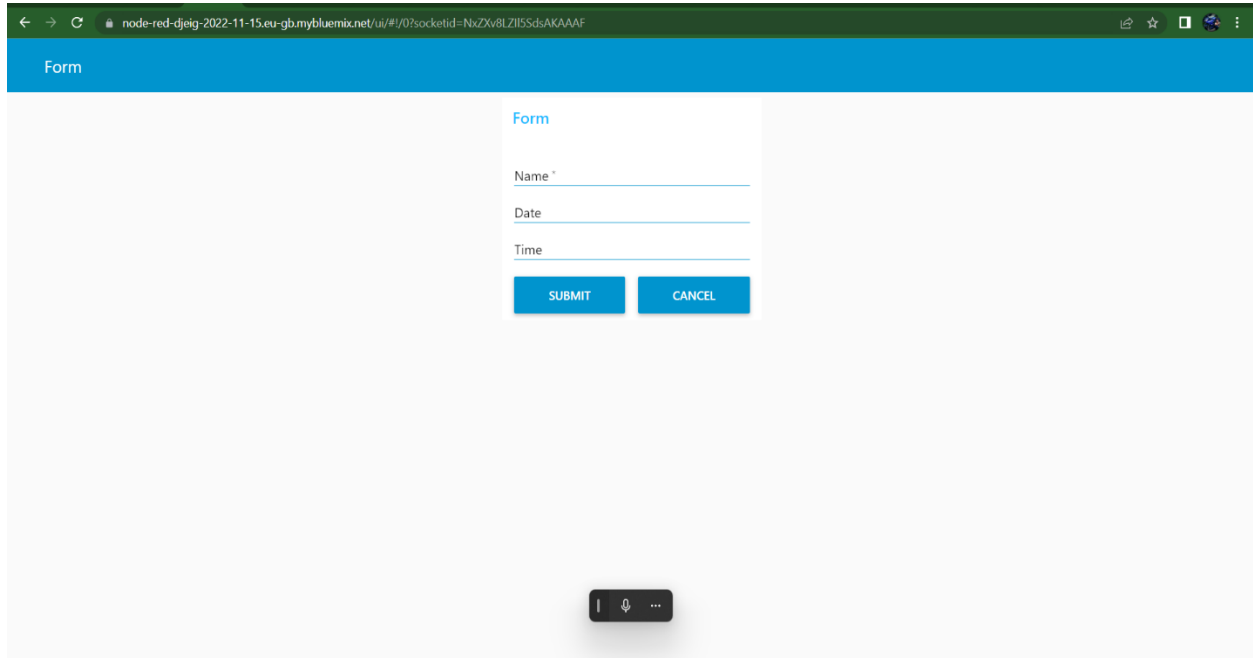
Feature 2:
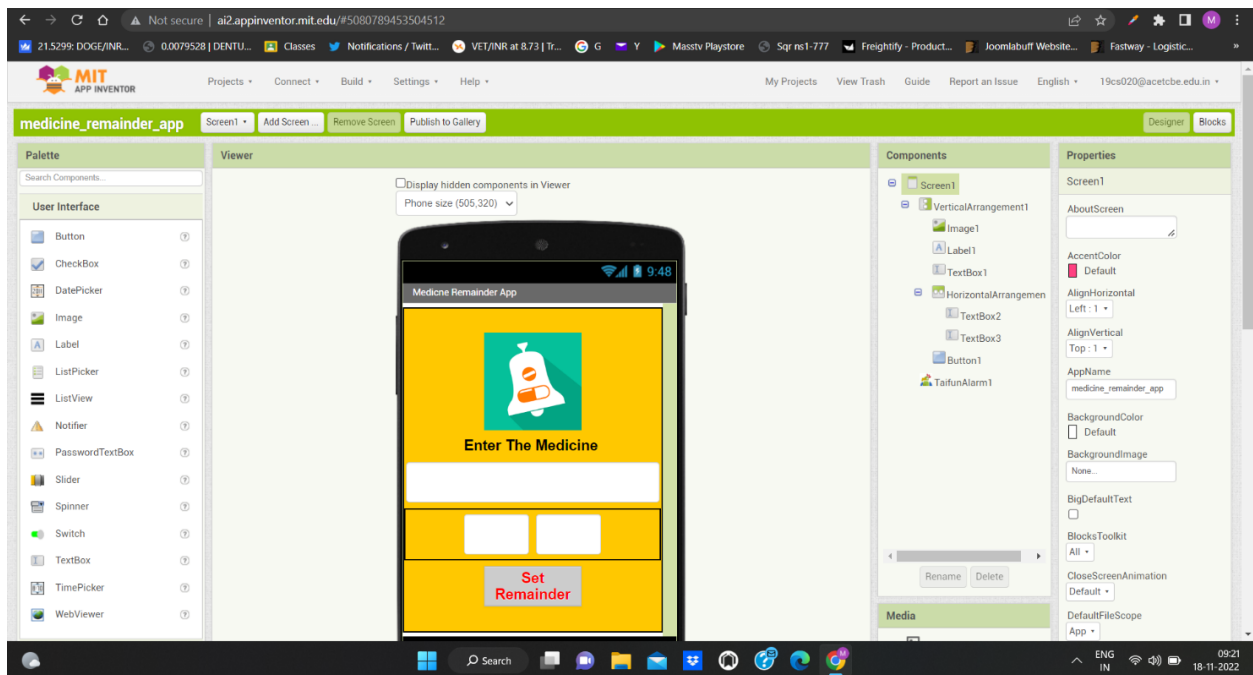
CODE:

```
{
 "_id": "2022-11-13 10:15",

"_rev":"1-09a338da0c9bfff41a1c92b85b25311",

"medicine": "acetaminophen"

}
```

8.Testing

8.1 Test Cases:

	S.No	Project Name	Scope/feature	Functional Changes	Hardware Changes	Software Changes	Impact of Downtime	Load/Voluem Changes	Risk Score	Justification
						NFT - Risk Assessment				
	1	Personal Assistance	New	Low	Moderate	Moderate	Low	>10 to 30%	GREEN	As we had made this project in
		for Seniors Who Are									MERN stack With industry Mentor Aproval
		Self-Reliant									

		S.No	Project Overview	NFT Test approach	Assumptions/Dependencies/Risks	Approvals/SignOff
				NFT - Detailed Test Plan		
		1	Medicine Reminder Web -UI	Stress	App Crash/ Developer team/ Site Down	Approved
		2	Medicine Reminder Web -UI	Load	Server Crash/ Developer team/ Server Down	Approved

S.No	Project Overview	NFT Test approach	NFR - Met	Test Outcome	GO/NO-GO decision	Recommendations	Identified Defects (Detected/Closed/Open)	Approvals/SignOff
				End Of Test Report				
1	Medicine Reminder Web -UI	Stress	Performance	CPU -O1	GO	High Performance Netlify Cloud server	Closed	Approved
2	Medicine Reminder Web -UI	Load	Scalability	DB Storage - O1	NO-GO	One MongoDB Instance for free	Closed	Approved

8.2 user Acceptance Testing:

	A	B	C	D	E	F	G	H
1					Date	18-Nov-22		
2					Team ID	PNT2022TMID4332		
3					Project Name	Personal assistant for senior who		
4					Maximum Marks	4 marks		
5	Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result
6	SplashScreen_TC_O O1	Functional	Home Page	Verify the splash screen is working good		1.Enter URL and click go 2.The splash screen will open 3.click the image in splash screen	https://drive.google.com/file/d/13vcj8LGrt4_f gnGKDyyosiMQbrMZFvS2/view?usp=share_link	Splash screen should display
7	HomePage_TC_OO 2	UI	Home Page	Verify the UI elements in Home screen		1.Enter URL and click go 2.Enter the medicine details to store data: a.Enter the medicine name b.Enter the Date c.Enter the Time 3. click next button to move to the next page	https://drive.google.com/file/d/13vcj8LGrt4_f gnGKDyyosiMQbrMZFvS2/view?usp=share_link	Application should show belo elements: a.Name of Medicine text bo b.Date text box c.Time tedt box d.Next button

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result
RemainderPage_TC _OO3	Functional	Home page	Verify user is able to get the remainder alarm with medicine name displayed		1.Enter URL and click go 2. automatically diplay the medicine data in the text box 3.The alarm should ring at the user entered time	It' Time to Take Medicine Glipizide	Get the remainder alarm
RemainderPage_TC _OO4	Functional	Login page	verify user is able the get the alarm at the correct time		1.Enter URL and click go 2.Alarm remainder should display	It' Time to Take Medicine Glipizide	Application should Remaind time
DB_TC_OO4	Functional	Login page	verify the data is stored in cloudant DB		1.Enter URL and click go 2.go to cloudant DB 3.Verify the data	{ "id": 2022-11-18 21:23, "medicine":Glipizide}	The Medicine data should st the DB
Simulation_TC_OO5	Functional	Login page	Verify the simulation is Working Good		1.Enter URL and click go 2.Run the simulation 3.The LED should Blink 4.The Alarm should ring	Glipizide	The Alarm should come thro buzzer and the LED also Blin Medicine name should displa LED

9.Result:

The results of this personal assistance for senior who are self reliant showed that there was a significant reduction in the levels of medication remaining in the system. The system after going through the IOT using node-red efficient and organized system that helps track and manage data more effectively. This also allows for easier and faster integration of data into other systems, as well as easier management of devices and data. The system was able to successfully remain operational throughout the duration of the test. There were no issues with disconnection or data loss. From the Node-RED dashboard, you can see that the system has successfully received data from the sensor and has displayed it accordingly. The result of the self-remaining system through IOT using Node-RED for documentation is a detailed and organized guide on how to operate and maintain the system. It also provides information on the various benefits that the system provides and how it can be used to improve the efficiency of operations. First, the system needs to be connected to the internet after that, the following flows need to be created:

1) A flow that reads data from a sensor and sends it to the cloud

2) A flow that reads data from the cloud and displays it on a dashboard.

3) A flow that allows the user to control the system .

4) A flow that sends notifications to the user (SMS) if something goes wrong.

9.1 Performance Metrics

There are main performance metrics for the self-remaining system which are as follows:

- ➢ Overall system performance
- ➢ Individual component performance
- ➢ User satisfaction
- ➢ Maintenance and support costs
- ➢ Response time
- ➢ Throughput

➢ Resource utilization

➢ Reliability

10.Advantage:

It can help to improve patient compliance with taking their medication as prescribed. Second, it can help to reduce the risk of medication errors. It will provide the information about the medicine timing. The personal phone notifications and reminders are a strong supporting tool in improving medication adherence strategies.

1. Increased accuracy: One of the main advantages of medicine reminder system is the increased accuracy. This is due to the fact that the system can recognize the user's message and can therefore provide a more accurate reminder.

2. Increased convenience: Another advantage of medicine reminder system is the increased convenience. This is because the system can be used anywhere and at any time.

3. Reduced costs: A medicine reminder system can also help to reduce the costs associated with missed appointments and prescription refill requests This is because the system can help to remind the user of their medicine schedule and can also provide information on where to get the medicine.

4.Increased efficiency: IoT systems can automate many tasks related to medicine management, such as ordering and reordering, which can save time and improve efficiency.

5.Improved patient safety: IoT systems can help to improve patient safety by providing real-time alerts if a patient misses a dose or if their medication is running low. The New England Healthcare Institute estimates that $290 billion of healthcare expenditures could be avoided if medication adherence were improved. It supports an easy implementation as it is less expensive, reliable, scalable, accessible to anyone with smartphones, and do not require separate devices, packaging or extra hardware.

Disadvantage:

Need a reliable internet or telecommunication service provider to make the system operates optimally. Need additional skill to operate the monitoring and remaing the system. One-third of patients gave incorrect contact details when booking the appointment. A potential disadvantage of the system was that 2–3% of people failed to receive their text reminder as a result of incorrect data entry. It is possible that this value was higher but the recipients did not take any action. The system may be expensive to implement and maintain. Finally, the system may be vulnerable to hacking and other security threats and if the system is not properly maintained, it could become outdated or stop working properly.

11.Conclusion:

Self-reminding systems through IoT can be used to manage a variety of tasks and activities. these systems can detect when an activity needs to be completed and remind the user accordingly. This can be useful for remembering to take medication, complete chores, or perform other important tasks. Many Medication Reminder Systems have been developed on different platforms. Many of these systems require special hardware devices to remind the patients about the medicine in-take timings. Purchasing new hardware devices becomes costly and more time and money consuming. So in the given work an attempt has been made to implement a system which is economical, easily accessible and improves medication adherence. Medication non-adherence reduces the effectiveness of a treatment and imposes a financial burden on health care systems. The patients will get the schedule of medicine in-take time with medicine description, starting and ending date of medicine, notification through message or voice command, automatic voice commands system. The scheduled reminder will not suggest any kind of medicine which is not prescribed by the doctor that will assure the safety of the patient and also will avoid wrong dosages. The patients can also search doctors' disease wise (depending upon the specialization of the doctor), which provides easy searching facility to the users and saves the time.

12.Future scope:

   We plan to focus on improving the overall performance of the system. Also, interaction between patients and doctors through video calling and secure prescription will be focused upon. Some more ways to achieve medication adherence will be focused. And, also a facility of reminding the doctor's next appointment in the system has been focused. The patients will get the contact details of doctors as per their availability. Also the users can see different articles related to medical fields and health care tips. The system focuses on easy navigation and good user interface. Many such Medical Reminder Systems have been developed where a new hardware is required but in our work, we have made an attempt to develop a system which is economical, time-saving and supports medication adherence.

1. Automating the collection and analysis of patient data: Medicine remainder systems can be used to automatically collect and analyze data from patients. This information can then be used to improve the quality of care and make better decisions about treatment options.

 2. Enhancing patient safety: Medicine remainder systems can be used to enhance patient safety by providing alerts to providers when a patient is at risk for a medication error. This can help to prevent potential adverse events.

3. Reducing the cost of healthcare: Medicine remainder systems can be used to reduce the cost of healthcare by helping to improve the efficiency of care delivery. This can lead to savings for both patients and healthcare organizations.

13.Appendix:

```
#include <WiFi.h>//library for wifi #include
<PubSubClient.h>//library for MQtt#include
<LiquidCrystal_I2C.h>
#include "DHT.h"// Library for dht11
#define DHTPIN 15              // what pin we're connected
to #define DHTTYPE DHT11        // define type of sensor
DHT 11#define LED 2
```

```cpp
DHT dht (DHTPIN, DHTTYPE);// creating the instance by passing pin and typr ofdht
connected
void callback(char* subscribetopic, byte* payload, unsigned int
payloadLength);


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


#define ORG "64yf7x"//IBM ORGANITION ID
#define DEVICE_TYPE "b11m3edevicetype"//Device type mentioned in ibm watsonIOT
Platform
#define DEVICE_ID "b11m3edeviceid"//Device ID mentioned in ibm watson IOTPlatform
#define TOKEN "-&EMtr7l-v-Gz2G))e"                //TokenString data3="";
int buzz= 13;


//-------- Customise the above values --------
char server[] = ORG ".messaging.internetofthings.ibmcloud.com";// Server Namechar
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 REPRESENTcommand
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 thepredefined
```

client id by passing parameter like server id,portand wificredential

```cpp
void setup()// configureing the ESP32
{

        Serial.begin(115
        200);
        dht.begin();
        pinMode (buzz,
        OUTPUT);
        pinMode(LED,O
        UTPUT);delay(1
        0);
        Serial.println();
        wificonnect();
        mqttconnect();
}


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


}
```

```cpp
/*...................................retrieving to
Cloud. .................................................. */


        void PublishData(float temp, float humid) {
        mqttconnect();//function call for connecting to ibm


}
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 ");
```

```arduino
  WiFi.begin("Wokwi-GUEST", "", 6);//passing the wifi credentials to establishthe
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("Medicine Name:
    "data3);
    if(data3 != "")
    {
        lcd.init();


        lcd.print(data3);
        digitalWrite(LED,HI
        GH); tone(buzz,
        100, 1000);
        delay(2000);
        digitalWrite(LED,LO
        W); noTone(buzz);
        delay(1000);


    }
        else
    {
digitalWrite (LED, LOW);


    }
data3="";
}
```

Launch IBM Watson IoT Platform to create the virtual devices :
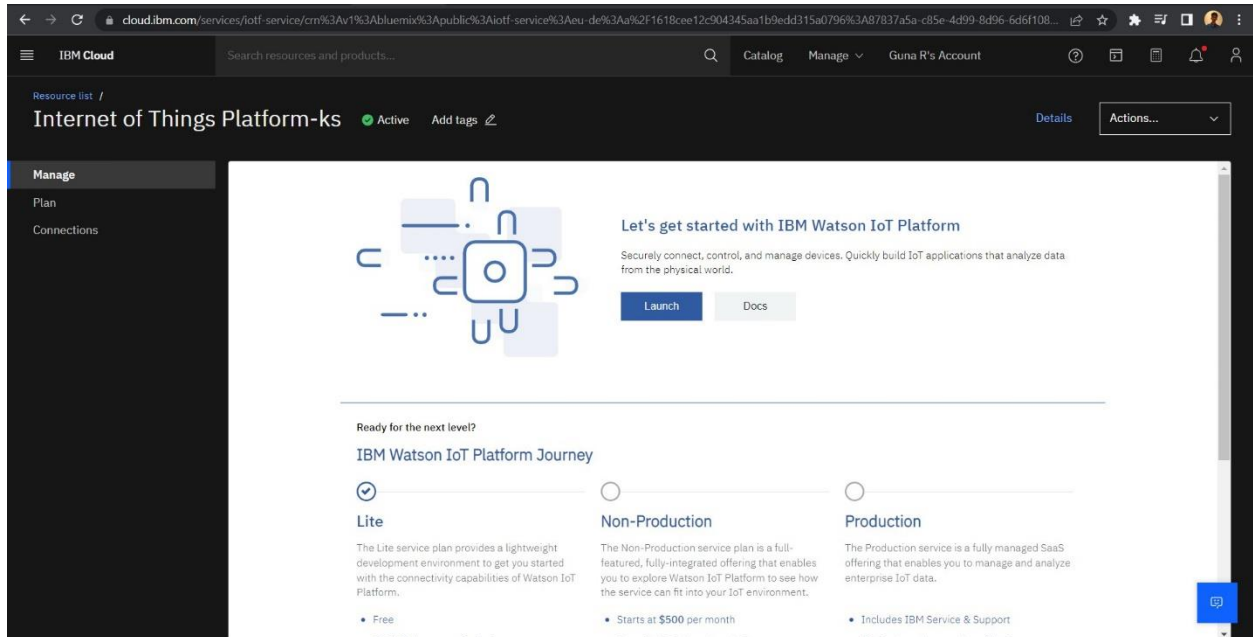
Create the Virtual Device :
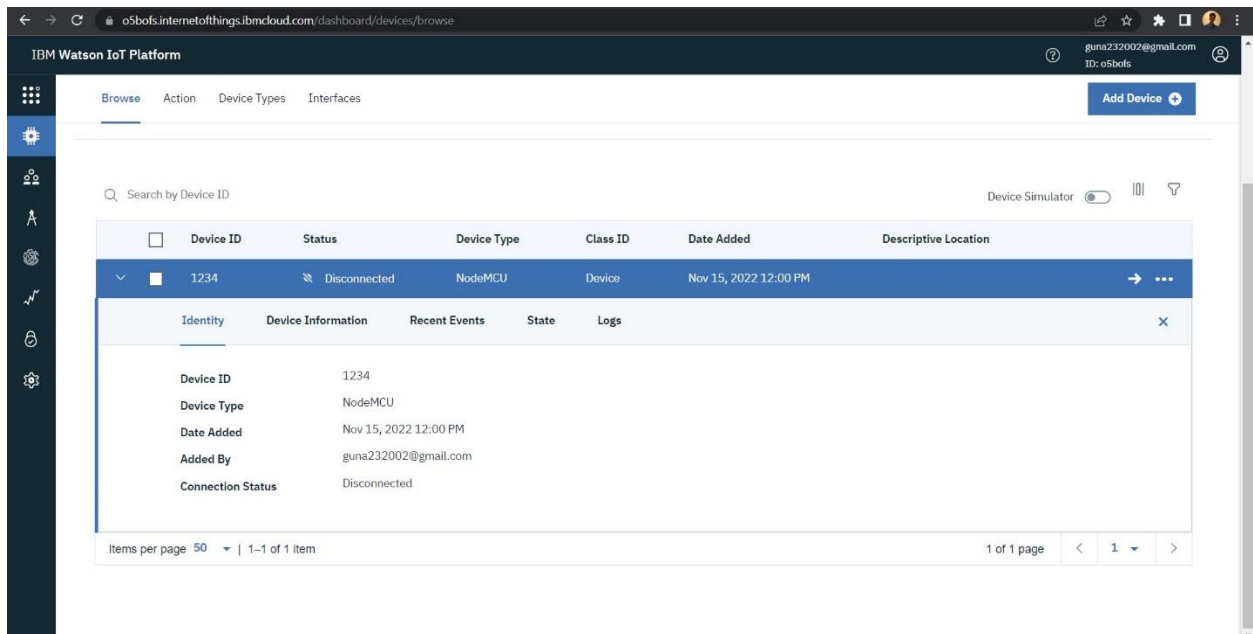
Install Node-red Services to develop a Web Application :

Install Cloudant DB to Store the Medicine Datas :

Create a Form using Node-red to get the Medicine Details :
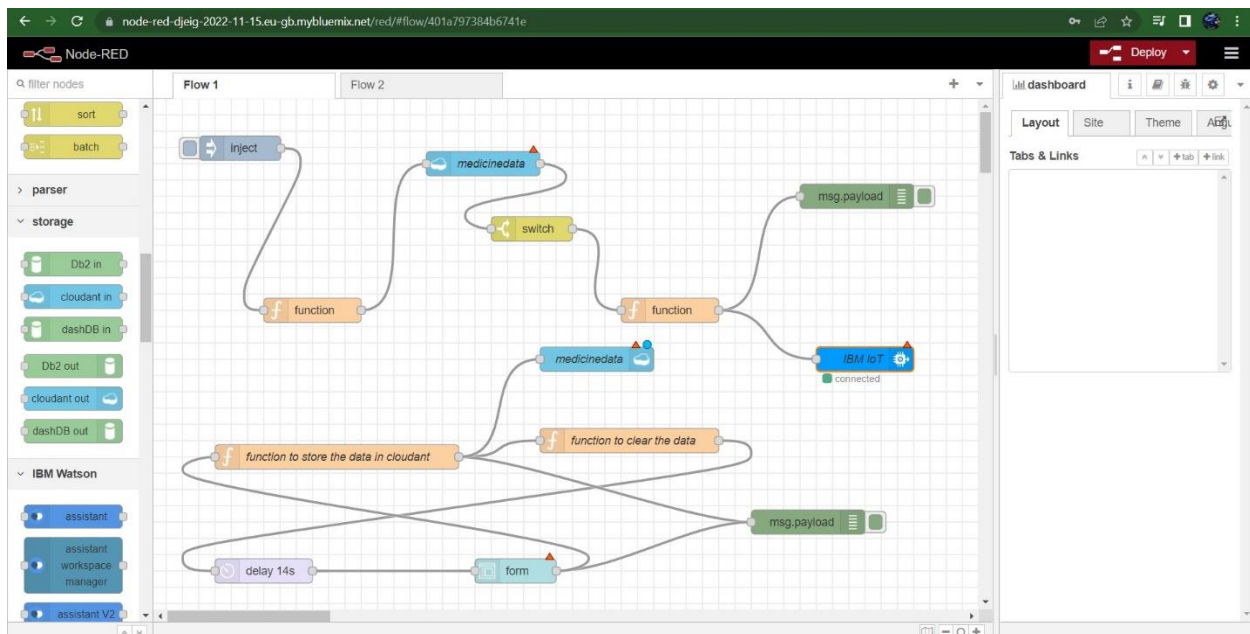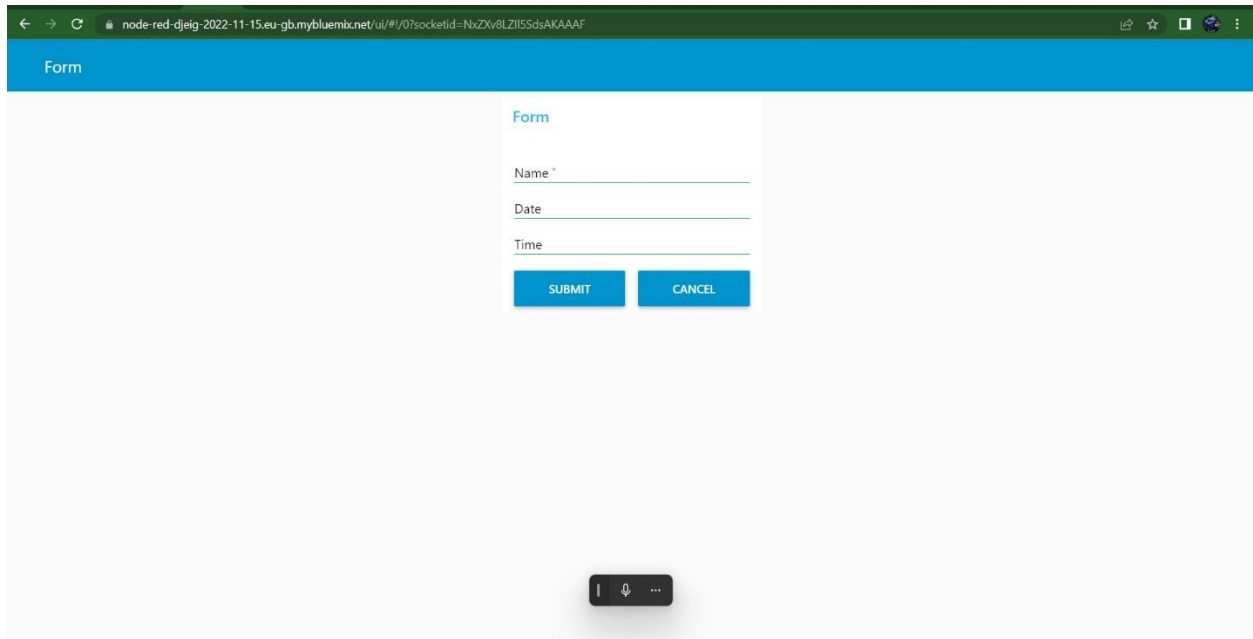
Adding IBM IoT Credentials to connect with virtual devices:
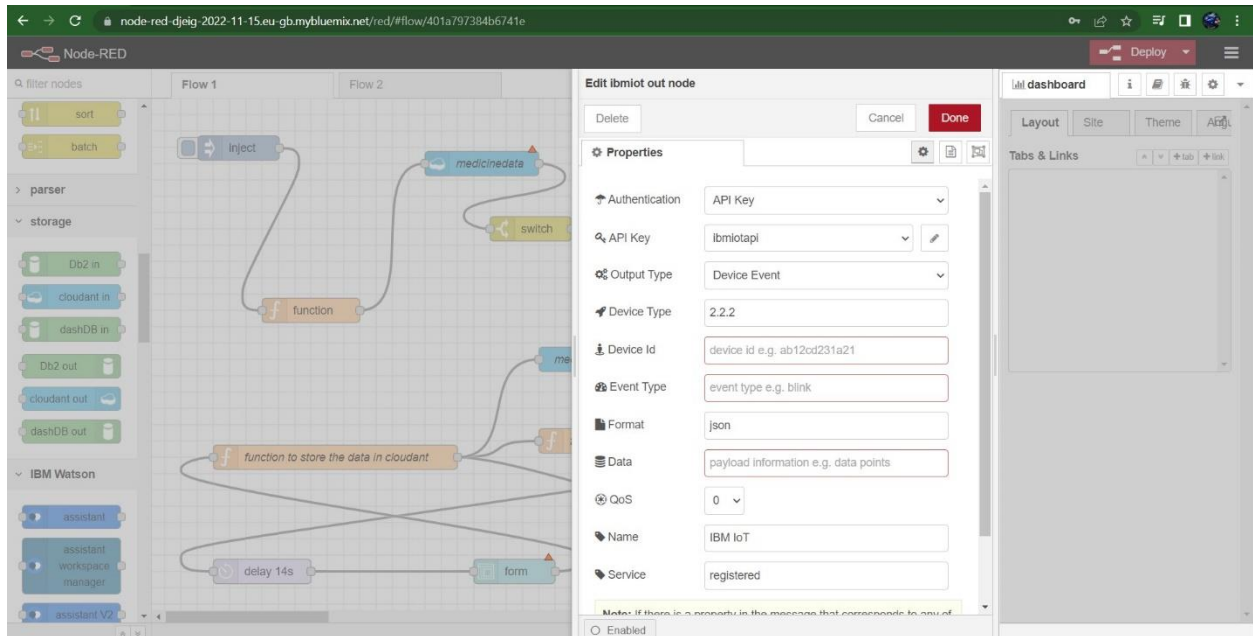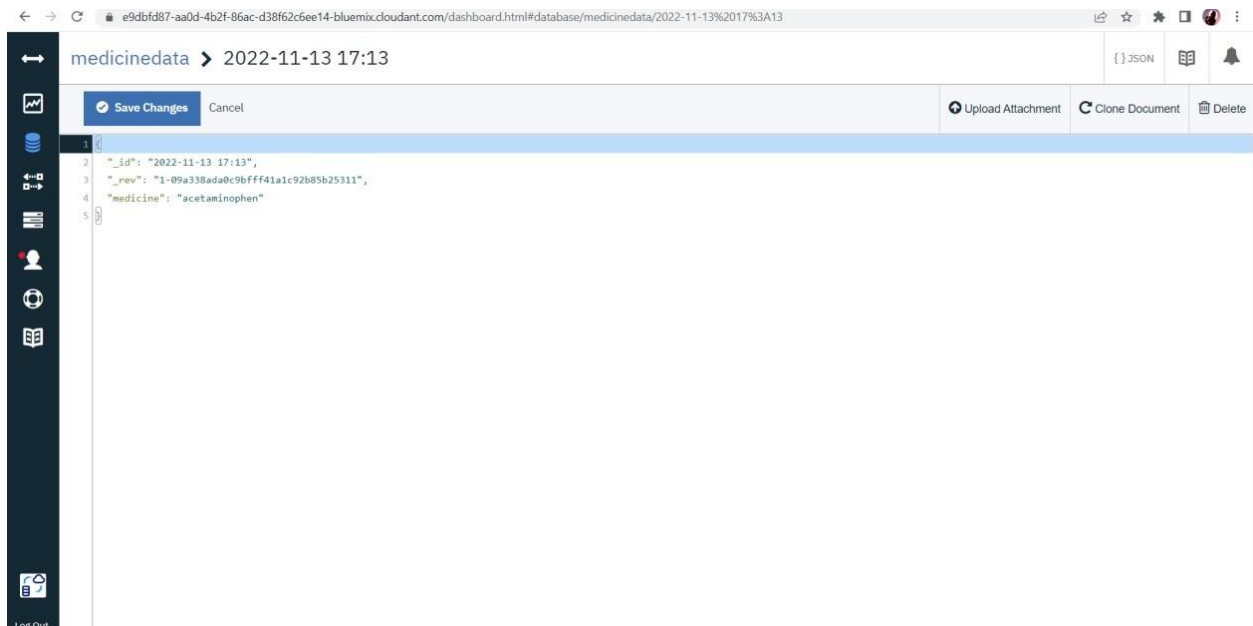
Function to Store the Medicine datas in Json format :
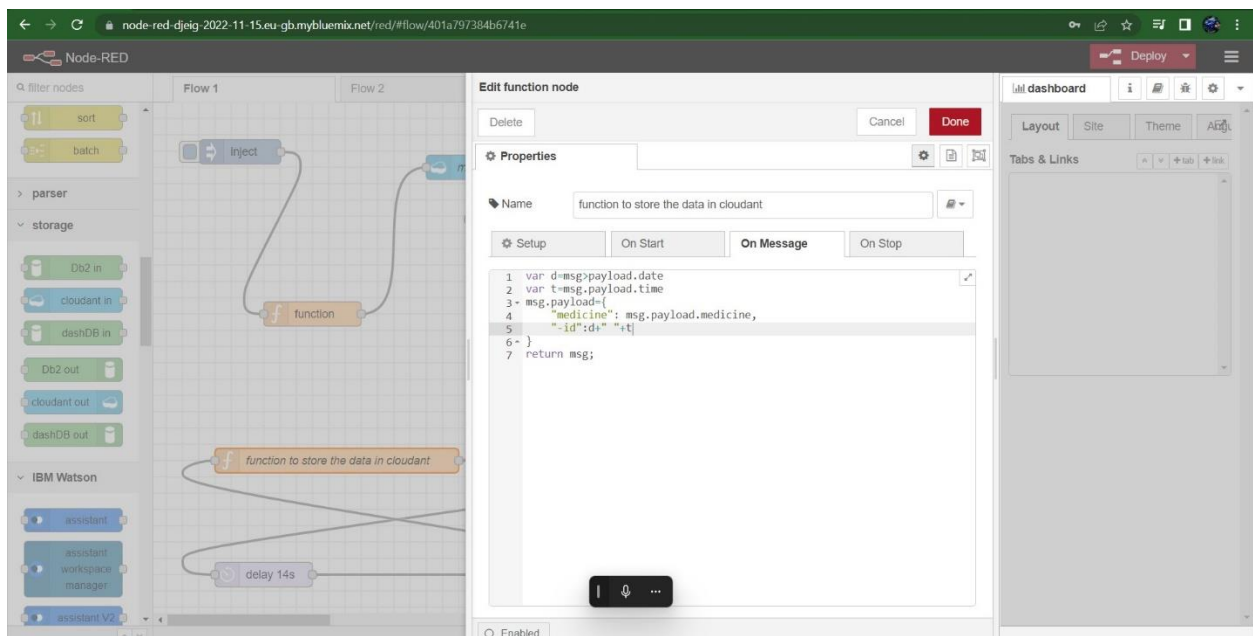
Compare the Present time with Stored time in cloudant :
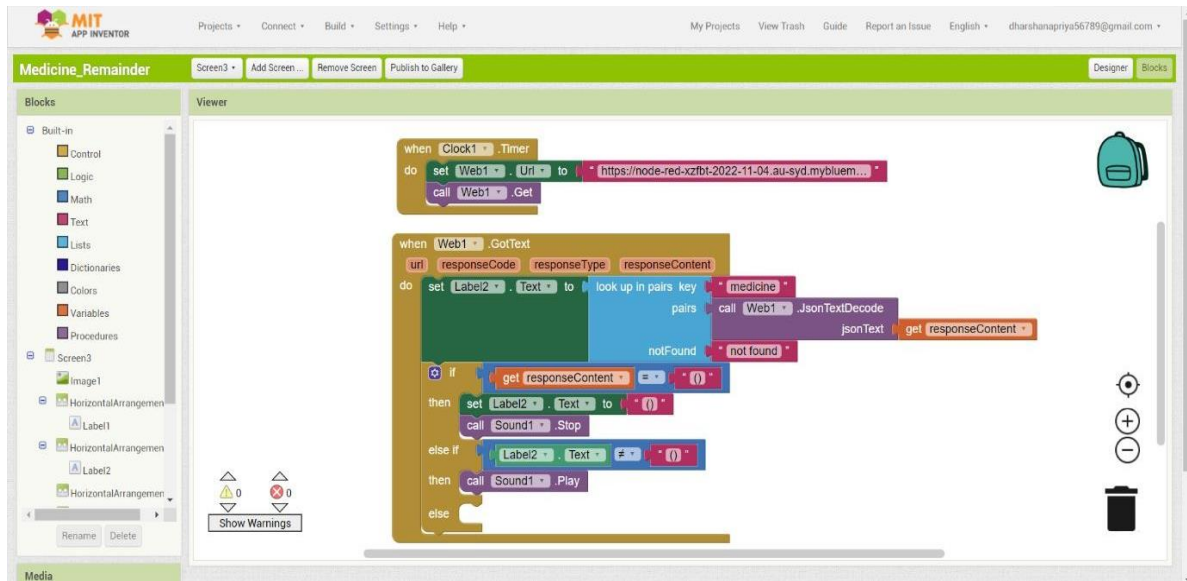
Splash Screen:

Blocks for Splash Screen:
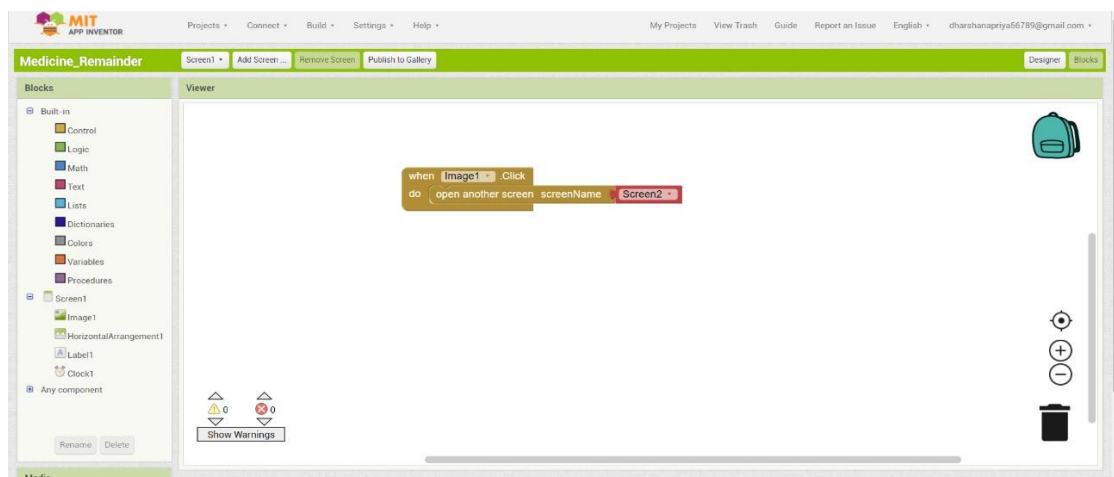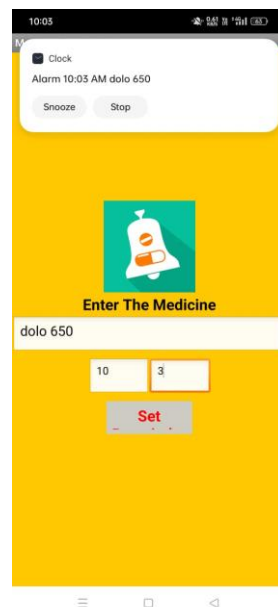
Get medicine data from user :
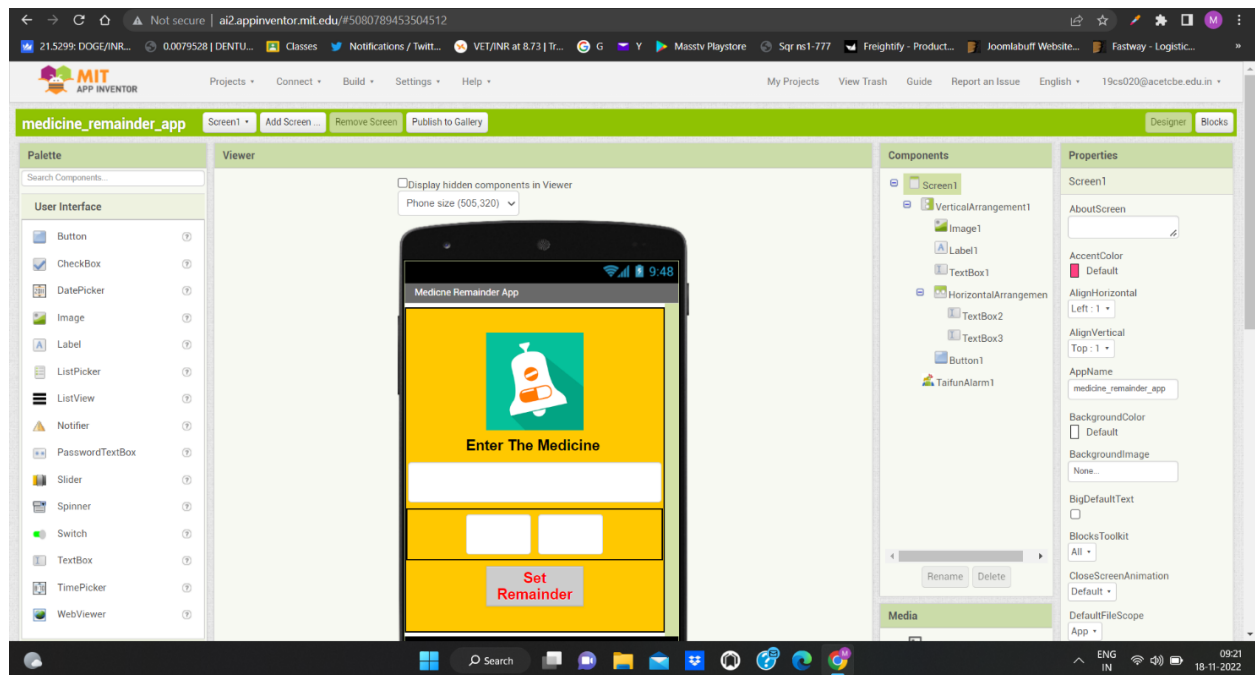
Blocks for user input:
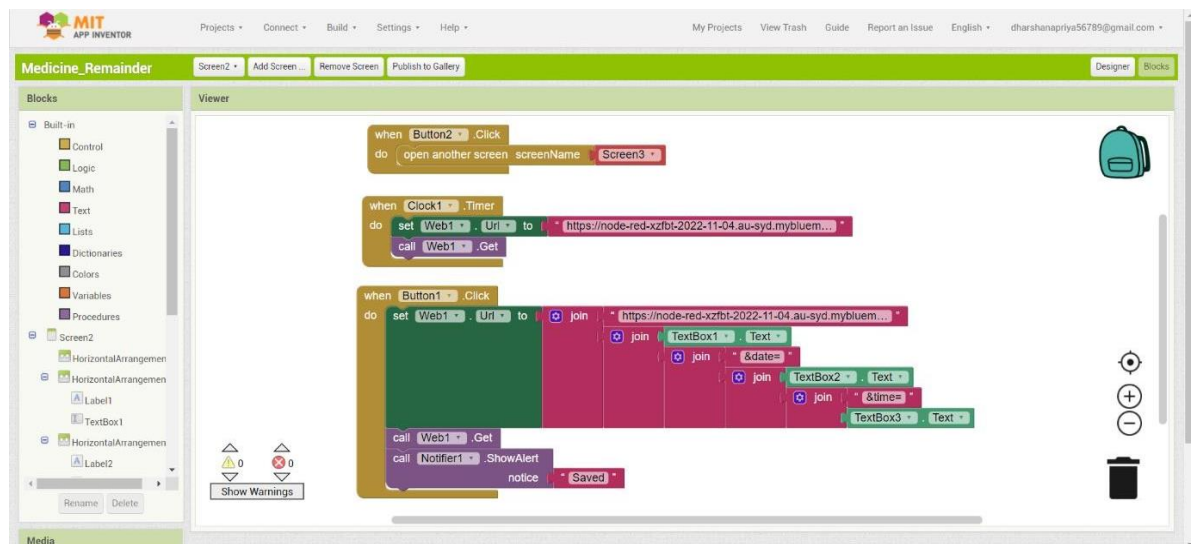
Blocks for Remainder:

Display Remainder with audio in mobile :

Demo Link:

https://drive.google.com/file/d/1FujwHIz9ITEA03FAhx5raPlO3UiQQtW/view?usp=share_link