SMART PATIENT MONITORING SYSTEM

18IT660 MOBILE APPLICATION DEVELOPMENT
&
18IT630 PROGRAMMING FOR IOT

Submitted by

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BONAFIDE CERTIFICATE

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Date : 02.05.2021

Station : Madurai

ABSTRACT

With an improvement in technology and miniaturization of sensors, there have been attempts to utilize the new technology in various areas to improve the quality of human life. One main area of research that has seen an adoption of the technology is the healthcare sector. The people in need of healthcare services find it very expensive; this is particularly true in developing countries. As a result, this project is an attempt to solve a healthcare problem currently society is facing. The main objective of the project was to design a smart patient monitoring system. It comprises three main parts. The first part being, detection of patient's vitals using sensors, second for sending data to cloud storage and the last part was providing the detected data for remote viewing. Remote viewing of the data enables a doctor or guardian to monitor a patient's health progress away from hospital premises. The Internet of Things (IoT) concepts have been widely used to interconnect the available medical resources and offer smart, reliable, and effective healthcare service to the patients.In this project, we have presented an IoT architecture customized for healthcare applications. The aim of the project was to come up with a Smart Patient Monitoring System that can be made with locally available sensors with a view to making it affordable if it were to be mass produced. Hence the proposed architecture collects the sensor data through Arduino microcontroller and relays it to the cloud where it is processed and analyzed for remote viewing.Patients actions based on the analyzed health data can be sent back to the doctor or guardian through Email and/or SMS alerts in case of any emergencies.

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CHAPTER 1
INTRODUCTION

1.1 Basic Concept

Smart Patients Monitoring System is an extension of a hospital medical system where a patient's vital body state can be monitored remotely. This system monitors patient health by using a temperature sensor, IR sensor and other sensors. By this we can easily provide alerts from users or patients critical conditions sent to the doctor at real time over the internet. This patient monitoring system using IOT, the real time data of patient's health are sent to a remote Internet location so that users can view these details from anywhere in the world. This is a major advantage of IOT based patient monitoring systems. Things speaks is a service provider which can be used to view this data over the internet. Using this system, data can be sent wirelessly to the Patient Monitoring System, allowing continuous monitoring of the patient. Doctor or Nurse can monitor patient health parameters just by visiting an app. The proposed system is efficient in alerting the concerned medical authorities if the parameters like temperature, heartbeat, blood pressure bounce above its predefined critical values

1.2 Scope and Importance

Giving care and health assistance to the bedridden patients at critical stages with advanced medical facilities have become one of the major problems in the modern world. In hospitals where many patients whose physical conditions must be monitored frequently as a part of a diagnostic procedure, the need for a cost-effective and fast responding alert mechanism is inevitable. Thus the implementation of such systems can provide timely warnings to the medical staff and doctors and their service can be activated in case of medical emergencies. This system won't work without a WiFi network. Node MCU is used which continuously reads the input. The scope of this project was limited to ECG, temperature, pressure detection and remote viewing of the collected data for all the patients. Here the most important specification considered was that they should be safe to use and accurate. This is because the physiological information being detected determines the severity of a critical life threatening situation.

CHAPTER 2

SOFTWARE REQUIREMENTS

2.1 WINDOWS REQUIREMENTS

- **OS** : Microsoft Windows 7 or higher
- **Memory** : 3 GB RAM minimum, 8 GB RAM recommended (plus 1 GB for the Android Emulator)
- **Disk space** : 2 GB of available disk space minimum, 4 GB recommended (500 MB for IDE plus 1.5 GB for Android SDK and emulator system image)
- **Platform** : Thingspeak
- **IDE** : Arduino 1.8.4
- **Database** : Firestore database(Google firebase).
- Java JDK5 or later version and Java Runtime Environment (JRE)

2.2 ANDROID STUDIO

Android Studio is the official integrated development environment for Google's Android operating system. Android is a powerful, open source, Linux-based operating system. It provides a rich development environment for building the applications. Android supports audio, video formats like JPEG, PNG, GIFBP, MP3, MP4, MIDI, AMR, AMR-WB, MPEG-4 etc.

2.3 IOT REQUIREMENTS:

Proposed system consists of following sensors and modules

1. Arduino MicroController

2. Node mcu

3. Temperature sensor

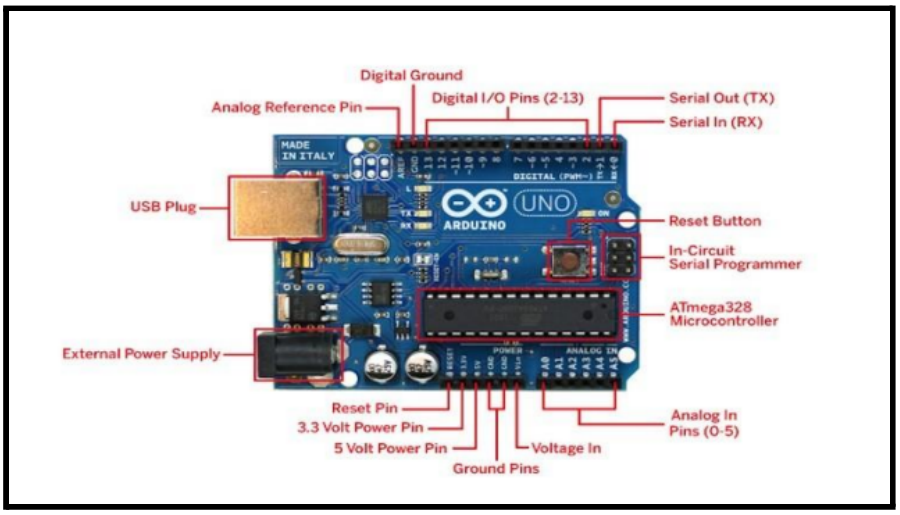
4. Pressure sensor

5. Body Movement Sensor

6. Oxygen Metre Sensor

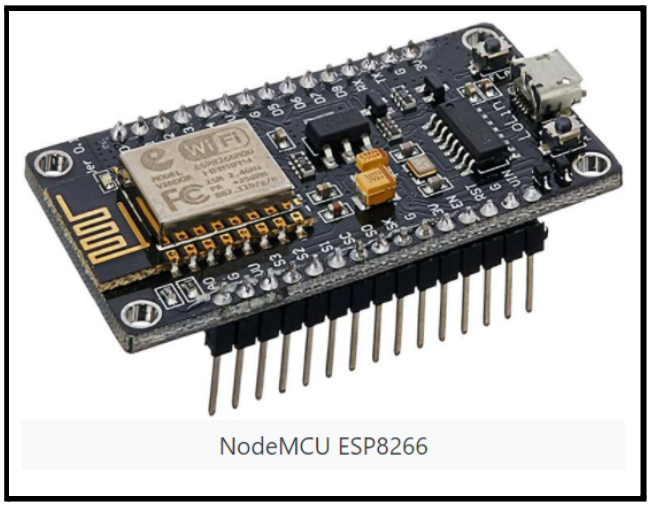
2.3.1 ARDUINO MICROCONTROLLER:

Arduino Microcontroller Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started**.**



2.3.2 NODE MCU:

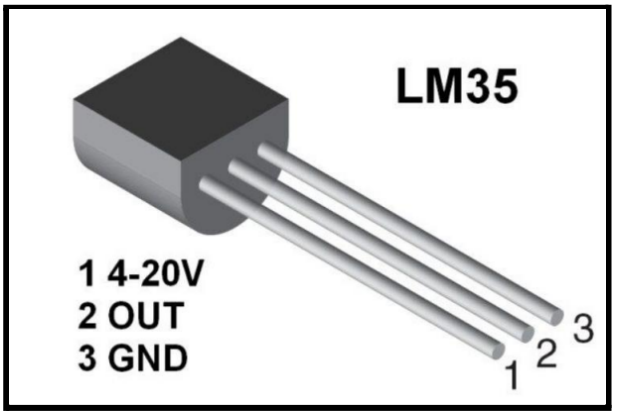
NodeMCU is an open-source based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.



NodeMCU ESP8266

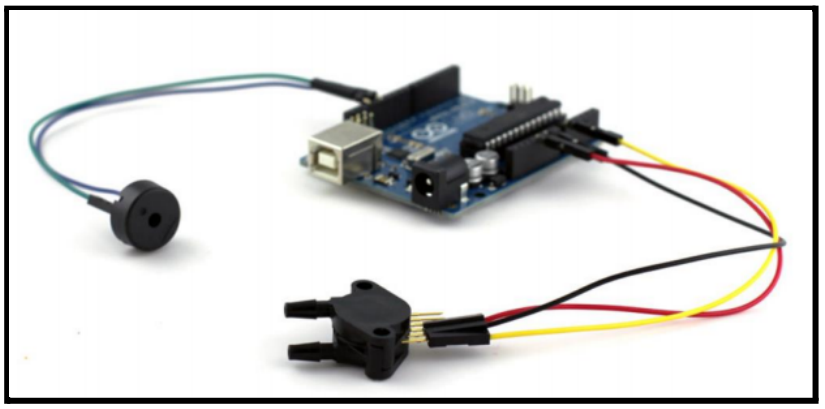
2.3.3 TEMPERATURE SENSOR:

Temperature sensor is a device which is designed specifically to measure the hotness or coldness of an object. LM35 is a precision IC temperature sensor with its output proportional to the temperature (in °C). With LM35, the temperature can be measured more accurately than with a thermistor. It also possesses low self-heating and does not cause more than 0.1 °C temperature rise in still air. The operating temperature range is from -55°C to 150°C.The LM35's low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy.



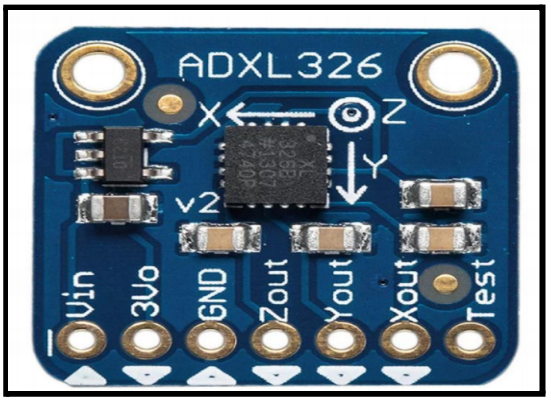
2.3.4 PRESSURE SENSOR:

A pressure sensor, as the name suggests, is a device that senses and measures pressure (usually of gases or liquids). The pressure sensor in electronic circuits is in the form of an integrated circuit that acts as a transducer, that is, it replicates (in the form of an electrical signal) the signal it receives as a function of imposed pressure. A pressure sensor is also known as a pressure transducer, pressure transmitter, pressure sender, pressure indicator, piezometer and manometer.



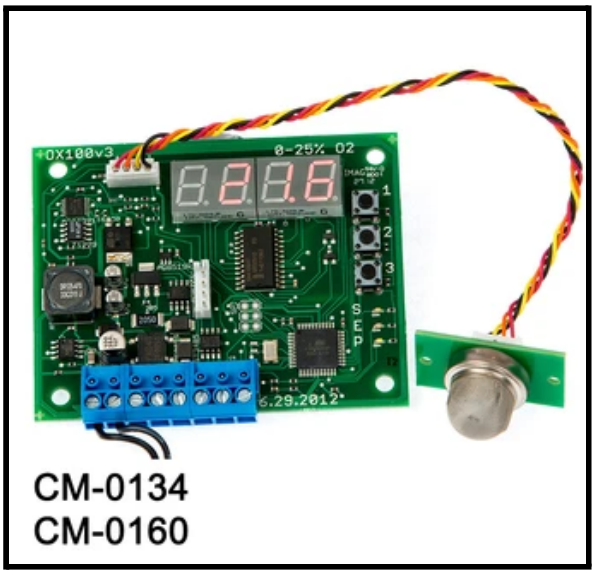
2.3.5 BODY MOVEMENT SENSOR :

Unintentional falls are a common cause of severe injury in the elderly population. By introducing small, non-invasive sensor in conjunction with a wireless network, this project aims to provide a path towards more independent living for the elderly or bed ridden patients. Using a small device worn on the waist and a network of fixed in the home environment, we can detect the occurrence of a fall and the location of the victim. Low-cost and low-power MEMS accelerometers are used to detect the fall while RF signal strength is used to locate the person.



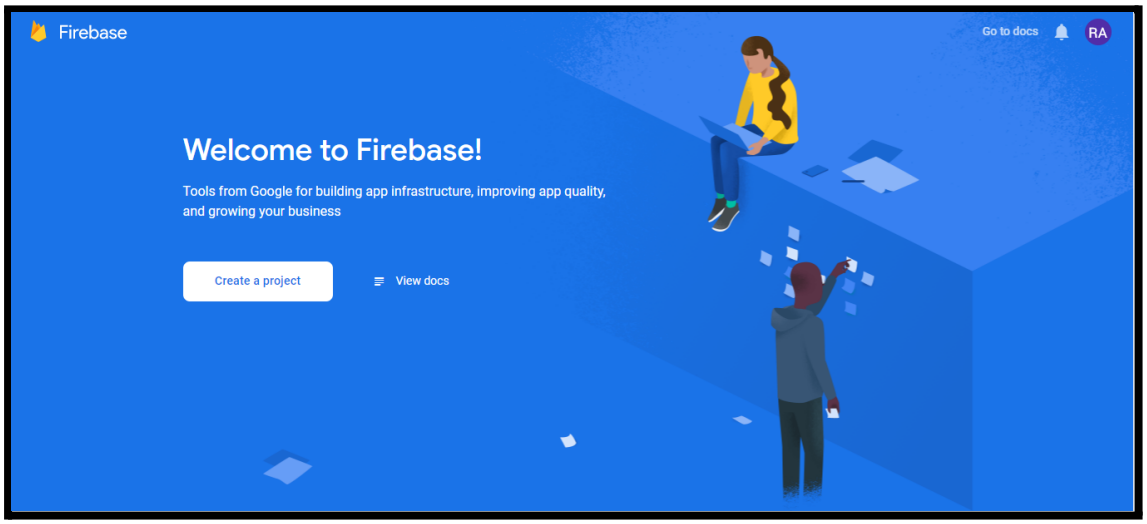
2.3.6 OXYGEN METRE SENSOR:

Oxygen sensors and oxygen monitors are designed to measure the quantity of oxygen in the air or in a closed environment. Fresh air at standard temperature and pressure has 20.95% oxygen (209,5000 ppm). OSHA defines air that contains less than 19.5 percent oxygen as oxygen deficient, and air that contains more than 22 percent as oxygen enriched.0-25% oxygen sensors can also be used to measure oxygen enriched air.



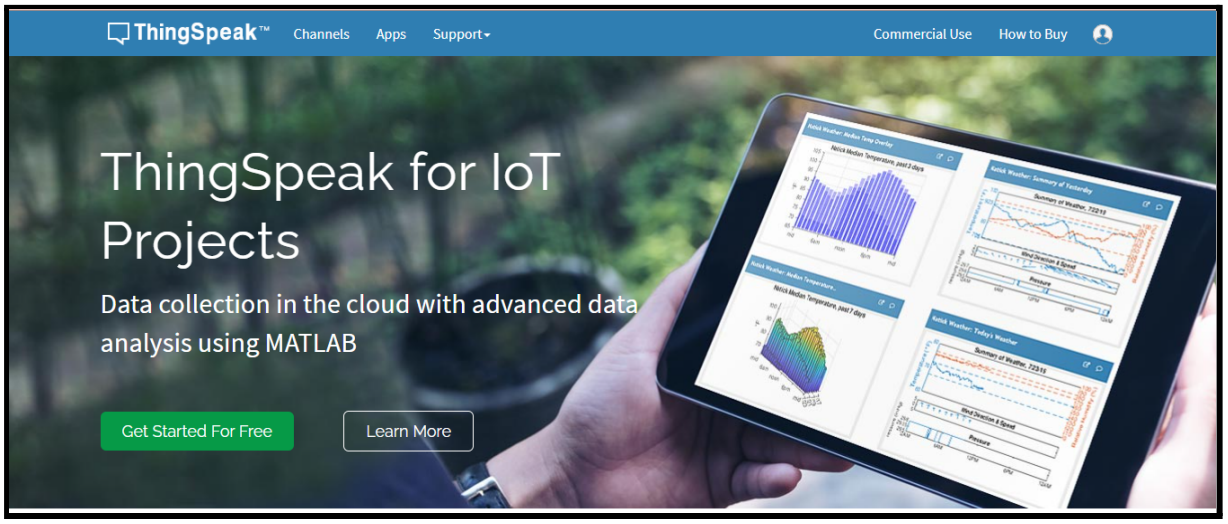
2.4 FIRESTORE DATABASE:

Cloud Firestore is a flexible, scalable database for mobile, web, and server development from Firebase and Google Cloud. Like Firebase Realtime Database, it keeps your data in sync across client apps through real time listeners and offers offline support for mobile and web so you can build responsive apps that work regardless of network latency or Internet connectivity.



2.5 THINGSPEAK:

ThingSpeak is an IoT analytics open source platform service that allows you to aggregate, visualize, and analyze live data streams in the cloud. You can send data to ThingSpeak from your devices, create instant visualizations of live data, and send alerts using web services like Twitter and Twilio. With MATLAB analytics inside ThingSpeak, you can write and execute MATLAB code to perform preprocessing, visualizations, and analyses. ThingSpeak enables engineers and scientists to prototype and build IoT systems without setting up servers or developing web software.



CHAPTER 3

PROBLEM DESCRIPTION

3.1 Problem Environment

The environment contains login ,sign up, front page, user / nurse account type chosen, emergency numbers ,hospital reference links, updation of attender/doctor or guardian details, ICU details. The user login/signup to their page and incase of emergency they can call or message to respective numbers,visit the website of the hospital in which they have been taking treatment and update the schedule and they can see their health details next the nurse login/signup to their page and incase of patient's emergency they can call or message to respective peer numbers,visit the website of the hospital in which they have been working and fix the schedule for patients and they can see their assigned ward's patient health details. This application will help us to reduce time consumption. Smart Patient Monitoring System developed by TechCroods is a wireless health monitoring system (WHMS) mainly for facilitating better communication between patient and the doctor and intended for the usage in intensive care units (ICUs). We believe that this system will transform health care delivery and management.

3.2 Problem Objective

The main objective of this application is,

- To diagnose the health condition of the patients regularly,
- To send patient's data wirelessly to the Patient Monitoring System, allowing continuous monitoring of the patient,
- To contribute accuracy in measurements and provide security in proper alert mechanisms give this system a higher level of customer satisfaction and low-cost implementation in hospitals.
- To reduce the time consumption.
- To facilitate better communication between patient and the doctor and intended for the usage in intensive care units (ICUs)

3.3 Modules Description

Account selection

The account selection page consisted of two accounts : 1) Patient and 2) Nurse. Either one can be selected and redirected to login/signup page.

Login

The login page should provide two text fields - one for entering a login name and one for entering a password. If either of the text fields is left blank it is an error that must be reported to the user. If both fields are filled in but there is no record of the user name or the password is incorrect that must also be reported to the user.It will be stored in the database in firebase.

SignUp

This page should be displayed when a user clicks on the signup button in the login page. If any of the text fields is left blank it is an error that must be reported to the user. It gets basic info about the user/nurse based on the account.If all fields are filled in but there is already a record for the user name then that must be reported as an error. If the two passwords are different that must also be reported as an error.

Call/Messaging Service

This use case denotes a set of actions required by the patient/nurse to send a message to the subject's guardian or doctors in case of emergencies.

Update Schedule

The extra details like guardian number , peer nurse details can be collected here in form and stored in a database.

ICU details:

In a patient's login , the details of the respective patient will be displayed whereas in nurse login all the patients under allotted ward will be displayed.

Ward Selection:

Nurse has this option to select the patient under his ward to view their health status.

Appointment Scheduling:

Here nurses can fix appointments and schedule events on a regular basis.

3.4 Benefits

- IOT Monitoring proves really helpful when we need to monitor & record and keep track of changes in the health parameters of the patient over the period of time. So with the IOT health monitoring, we can have the database of these changes in the health parameters.
- Doctors can take the reference of these changes or the history of the patient while suggesting the treatment or the medicines to the patient.
- Hospital stays are minimized due to Smart Patient Monitoring. Hospital visits for normal routine checkups are minimized.
- Patient health parameter data is stored over the cloud. So it is more beneficial than maintaining the records on printed papers kept in the files. Or even the digital records which are kept in a particular computer or laptop or memory device like pen- drive. Because there are chances that these devices can get corrupt and data might be lost. Whereas, in case of IOT, the cloud storage is more reliable and does have minimal chances of data loss.

CHAPTER 4

SOLUTION METHODOLOGY

4.1 Features Used in Application

Layout

Linear layout is used to place all the required texts and button in our application.

Intent

Implicit intent-It is used to get all the necessary information about a hospital and hence the corresponding hospital's website link is provided and it will redirect to that website.

Explicit intent-For Login/signup explicit intent is used to switch over pages inside our application.

Menu

Menus are a common user interface component in many types of applications.

Option menu - This menu is used in our application to show extra features like settings, about, report, etc..

Context menu - This menu is used to display the features when we click a button. For eg. When the emergency button is clicked it displays the features like call the nurse or doctor, message the nurse or doctor, etc.. When the call option is clicked the call is automatically made to the respective number.

Popup menu - This is used in case when we fix an appointment. It displays the available wards and we can select the desired ward. Then the toast message is displayed as "Appoint is fixed".

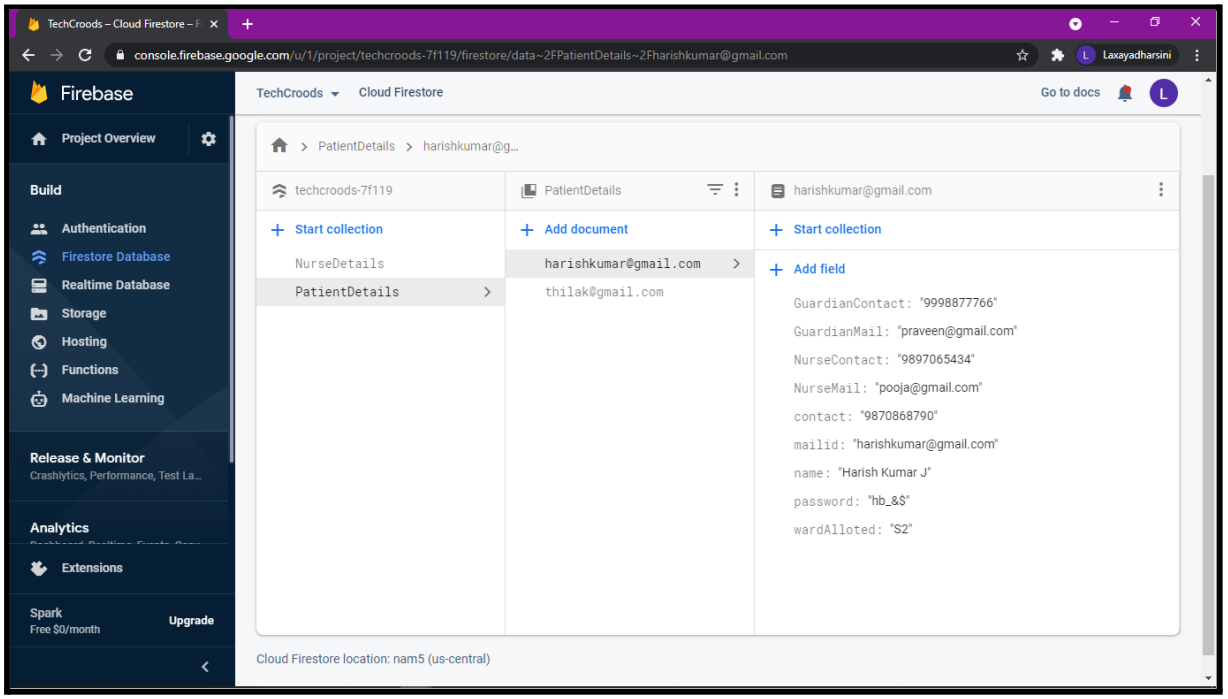
Notification

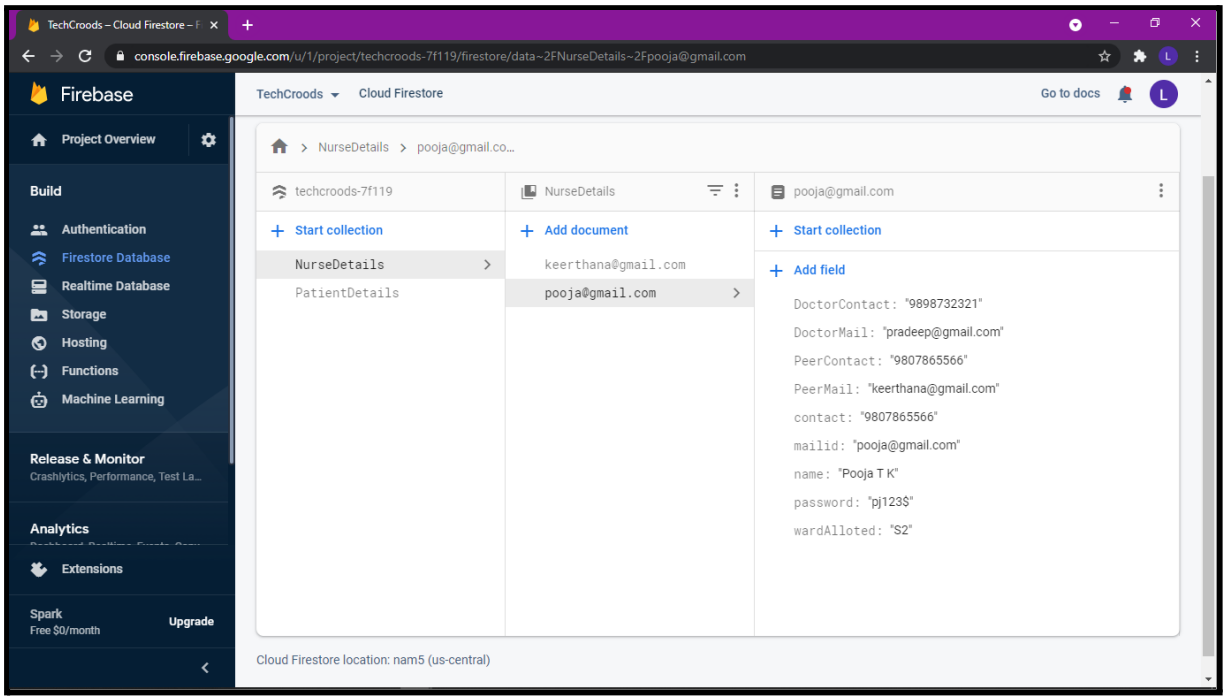
A notification is a message you can display to the user outside of your application's normal UI. Android Toast class provides a handy way to show users alerts, here in report and emergency we used.

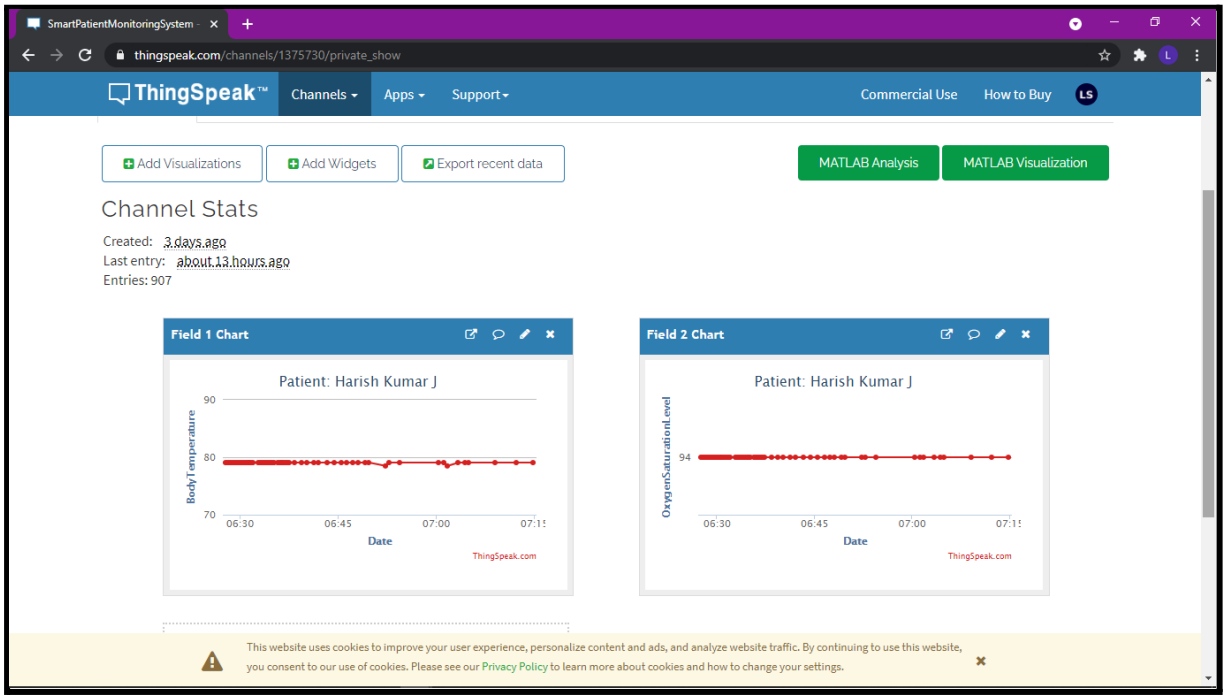
Database

Firestore is a cloud-hosted, NoSQL **database** that your iOS, **Android**, and web apps can access directly via native SDKs.

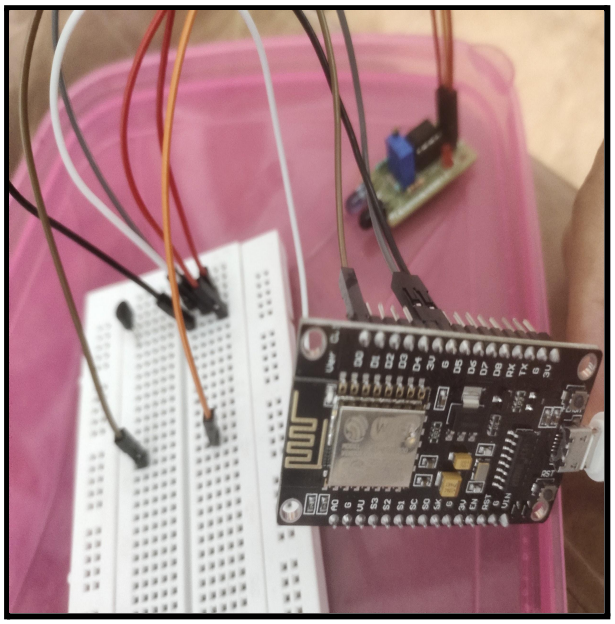
Screenshots:

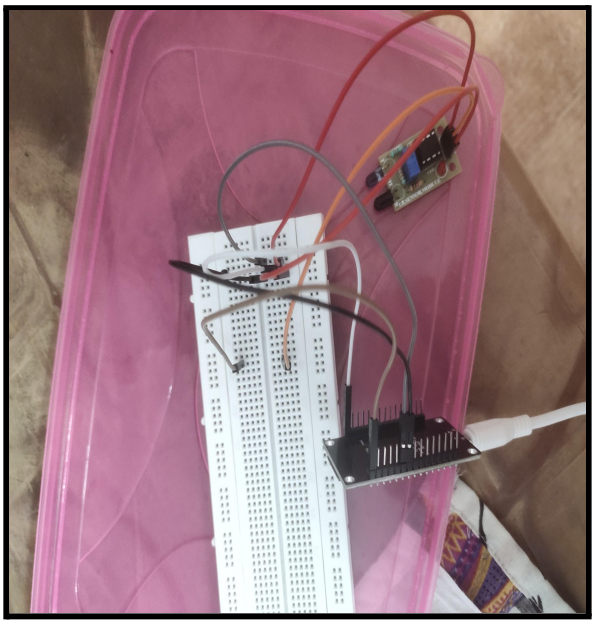


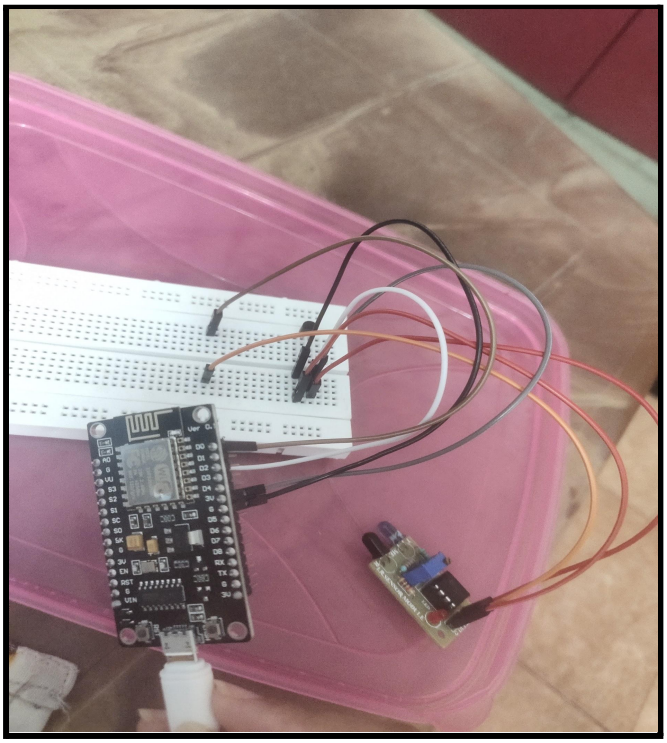


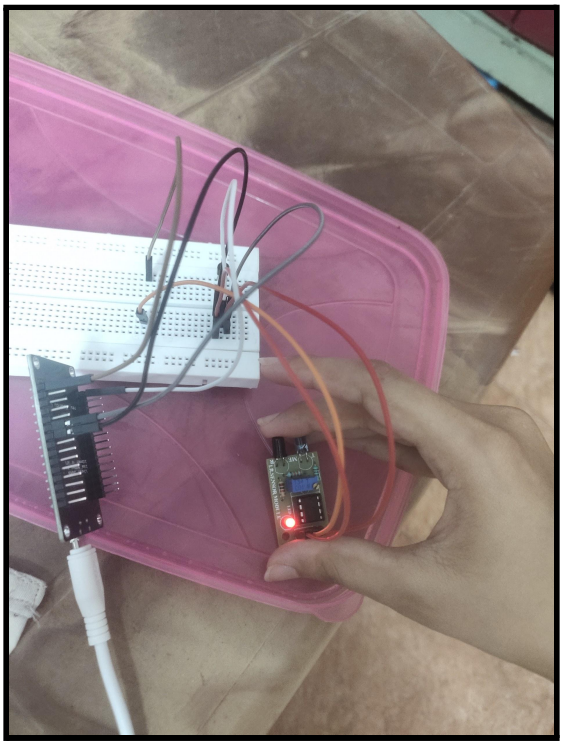

SmartPatientMonitoringSystem
thingspeak.com/channels/1375730/private_show
ThingSpeak™
Channels
Apps
Support
Commercial Use
How to Buy
Add Visualizations
Add Widgets
Export recent data
MATLAB Analysis
MATLAB Visualization
Channel Stats
Created: 3 days ago
Last entry: about 13 hours ago
Entries: 907
Field 1 Chart
Patient: Harish Kumar J
Body Temperature
90
80
70
06:30
06:45
07:00
Date
ThingSpeak.com
Field 2 Chart
Patient: Harish Kumar J
OxygenSaturationLevel
94
06:30
06:45
07:00
Date
ThingSpeak.com
This website uses cookies to improve your user experience, personalize content and ads, and analyze website traffic. By continuing to use this website, you consent to our use of cookies. Please see our Privacy Policy to learn more about cookies and how to change your settings.

Circuits:

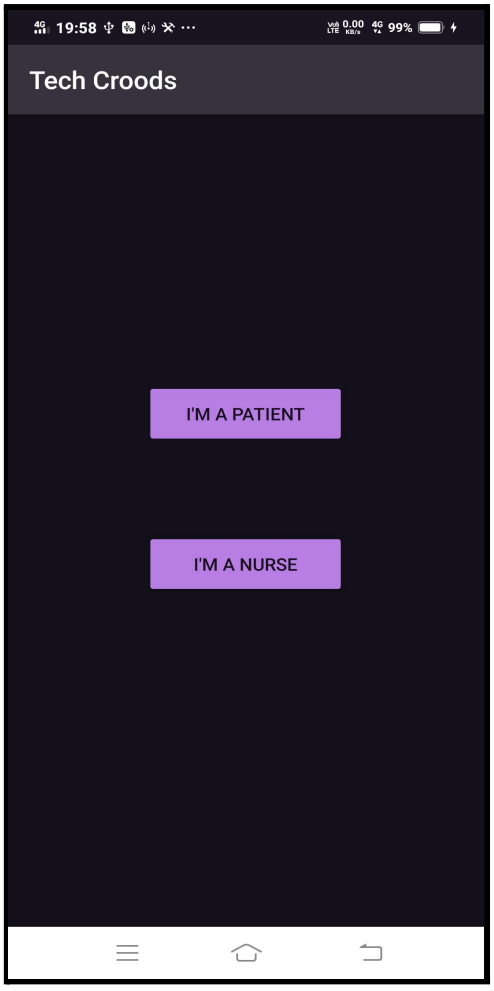


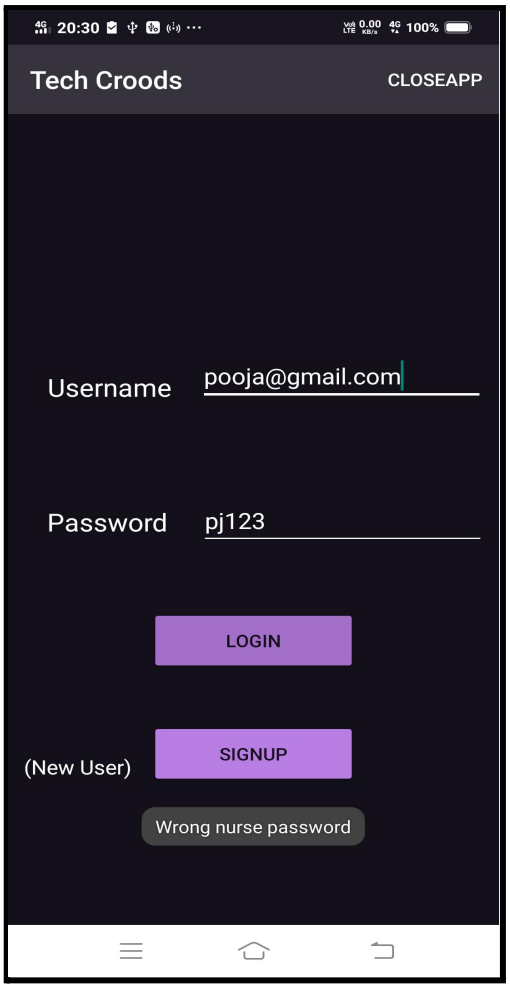


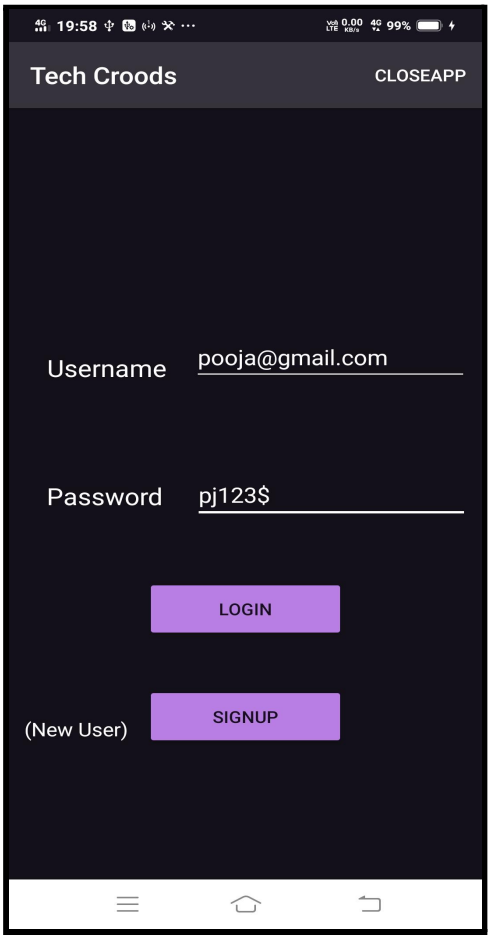


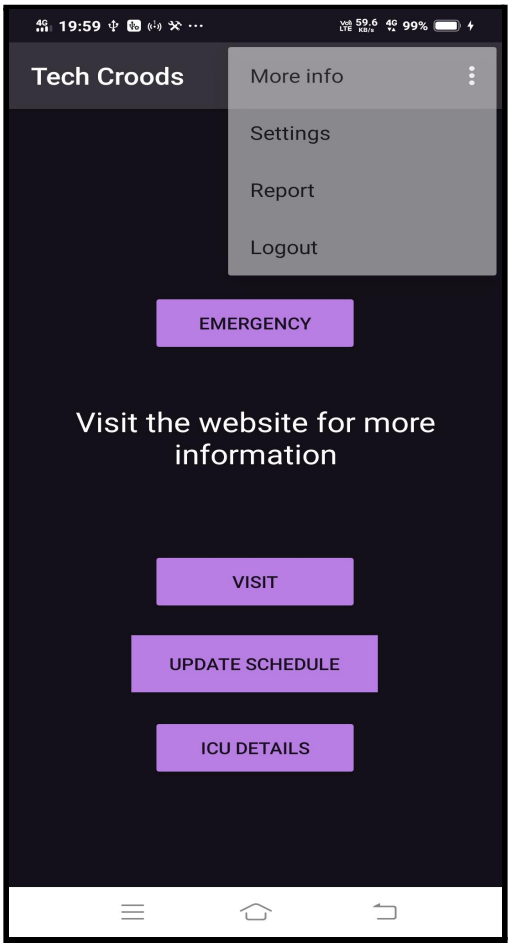


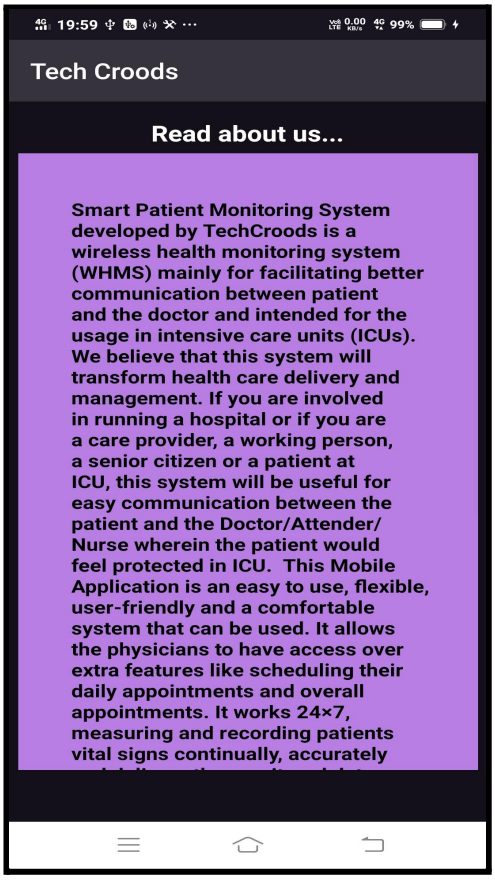
Application Screenshots:

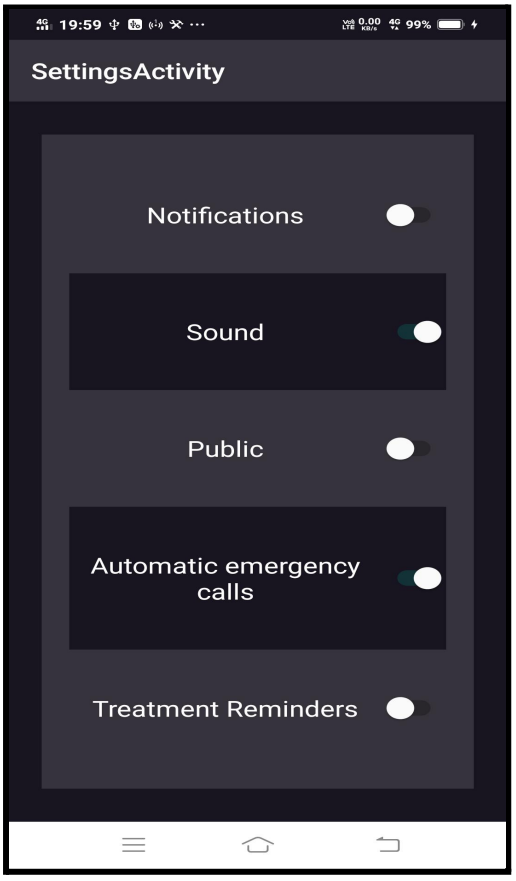





19:58
Tech Croods
CLOSEAPP
Username
pooja@gmail.com
Password
pj123$
LOGIN
(New User)
SIGNUP


19:59
Tech Croods
More info
Settings
Report
Logout
EMERGENCY
Visit the website for more information
VISIT
UPDATE SCHEDULE
ICU DETAILS


19:59
Tech Croods
Read about us...
Smart Patient Monitoring System developed by TechCroods is a wireless health monitoring system (WHMS) mainly for facilitating better communication between patient and the doctor and intended for the usage in intensive care units (ICUs). We believe that this system will transform health care delivery and management. If you are involved in running a hospital or if you are a care provider, a working person, a senior citizen or a patient at ICU, this system will be useful for easy communication between the patient and the Doctor/Attender/ Nurse wherein the patient would feel protected in ICU. This Mobile Application is an easy to use, flexible, user-friendly and a comfortable system that can be used. It allows the physicians to have access over extra features like scheduling their daily appointments and overall appointments. It works 24×7, measuring and recording patients vital signs continually, accurately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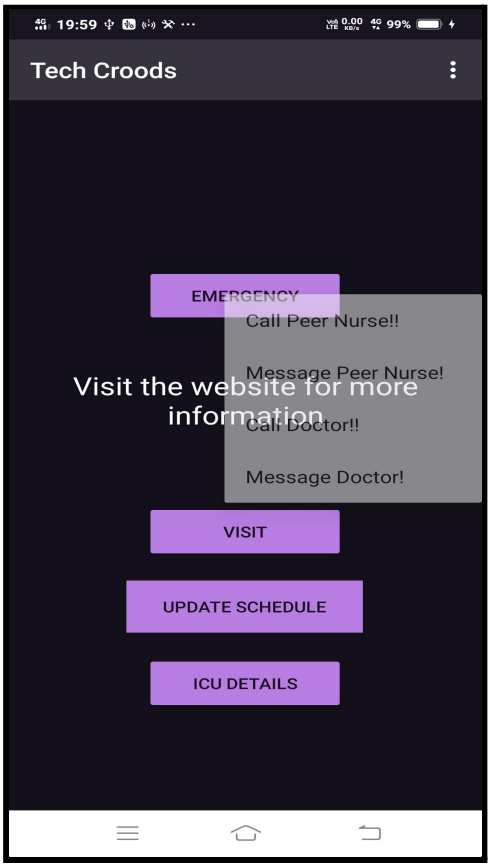
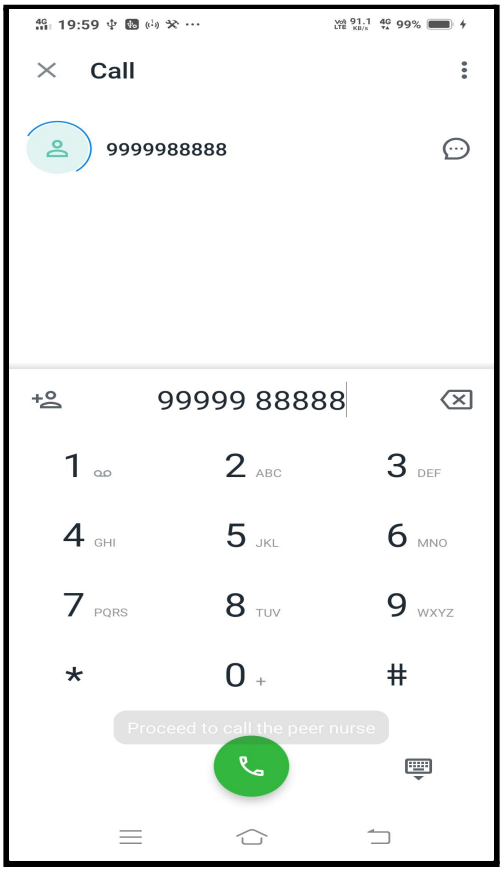
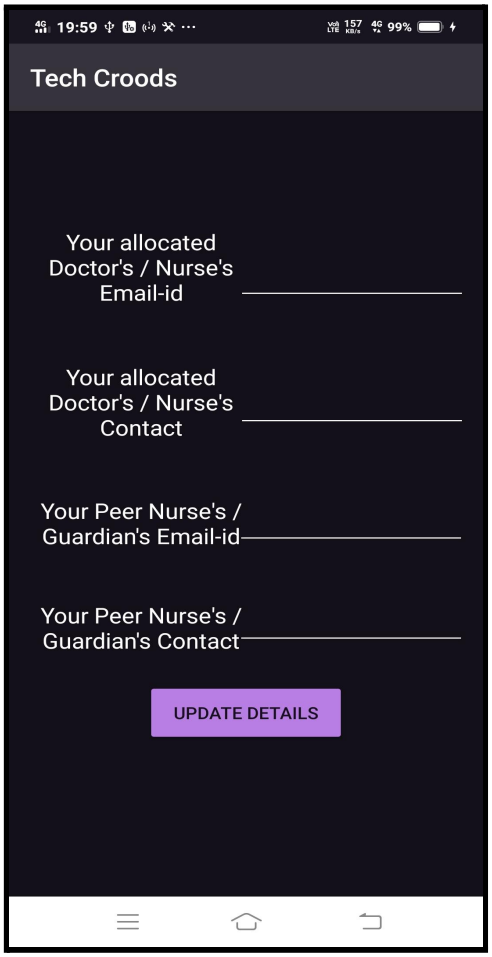
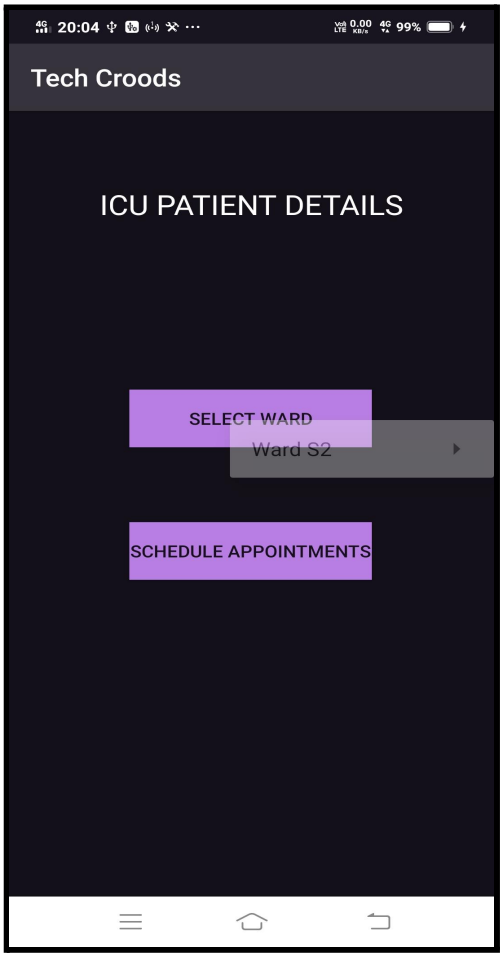
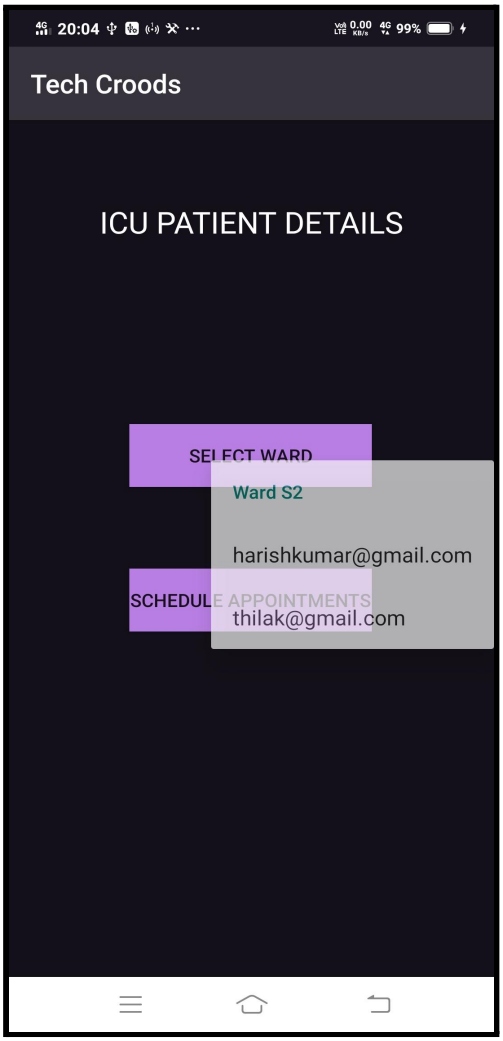
SettingsActivity
Notifications
Sound
Public
Automatic emergency calls
Treatment Reminders

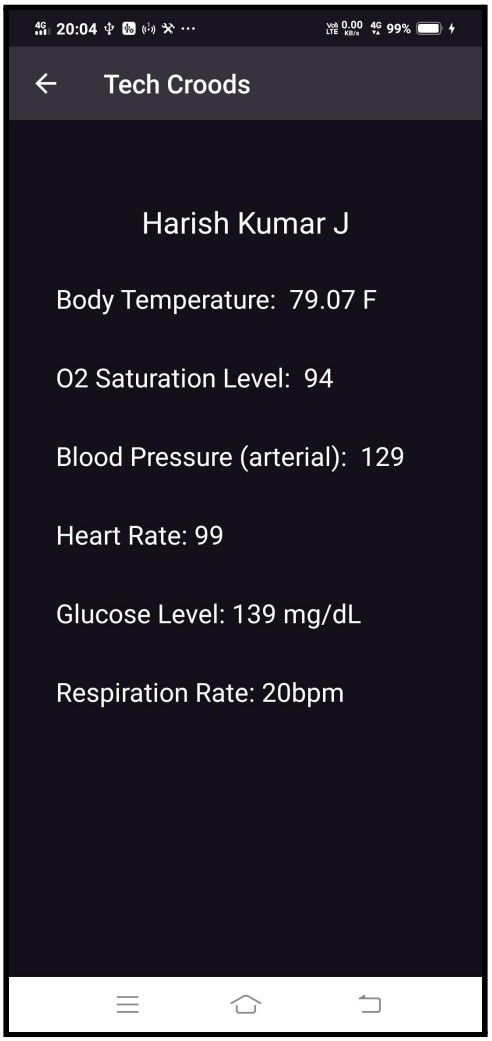

Tech Croods
EMERGENCY
Call Peer Nurse!!
Message Peer Nurse!
Call Doctor!!
Message Doctor!
Visit the website for more information
VISIT
UPDATE SCHEDULE
ICU DETAILS

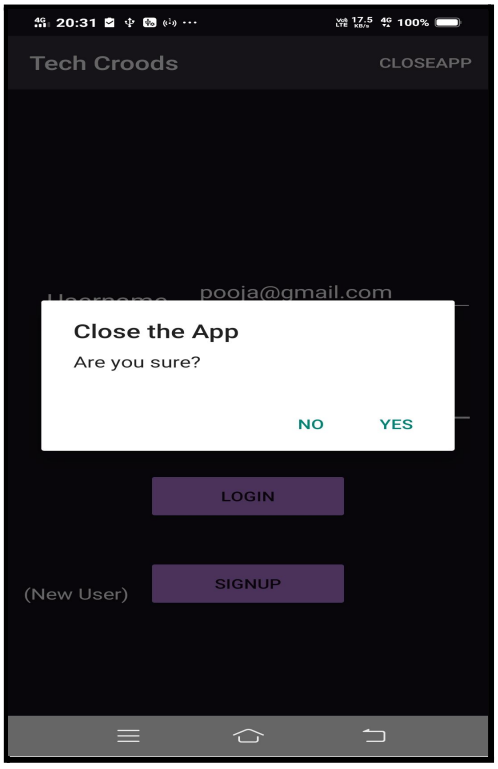

Call
9999988888
99999 88888
Proceed to call the peer nurse

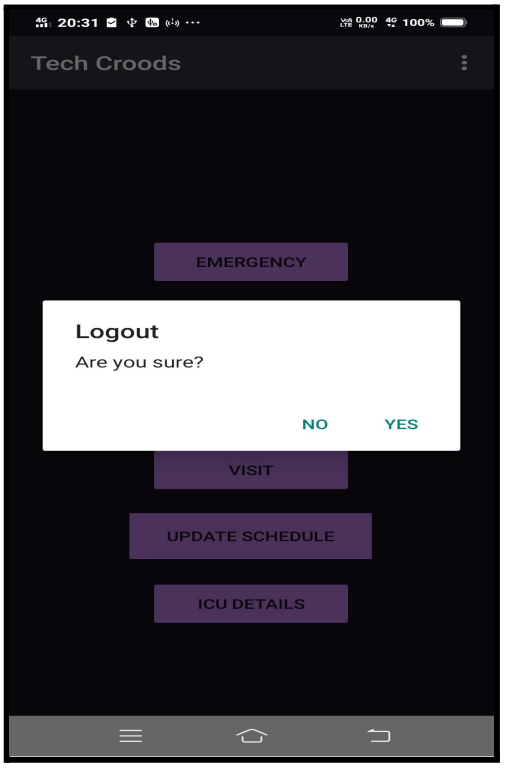

Tech Croods
Your allocated Doctor's / Nurse's Email-id
Your allocated Doctor's / Nurse's Contact
Your Peer Nurse's / Guardian's Email-id
Your Peer Nurse's / Guardian's Contact
UPDATE DETAILS

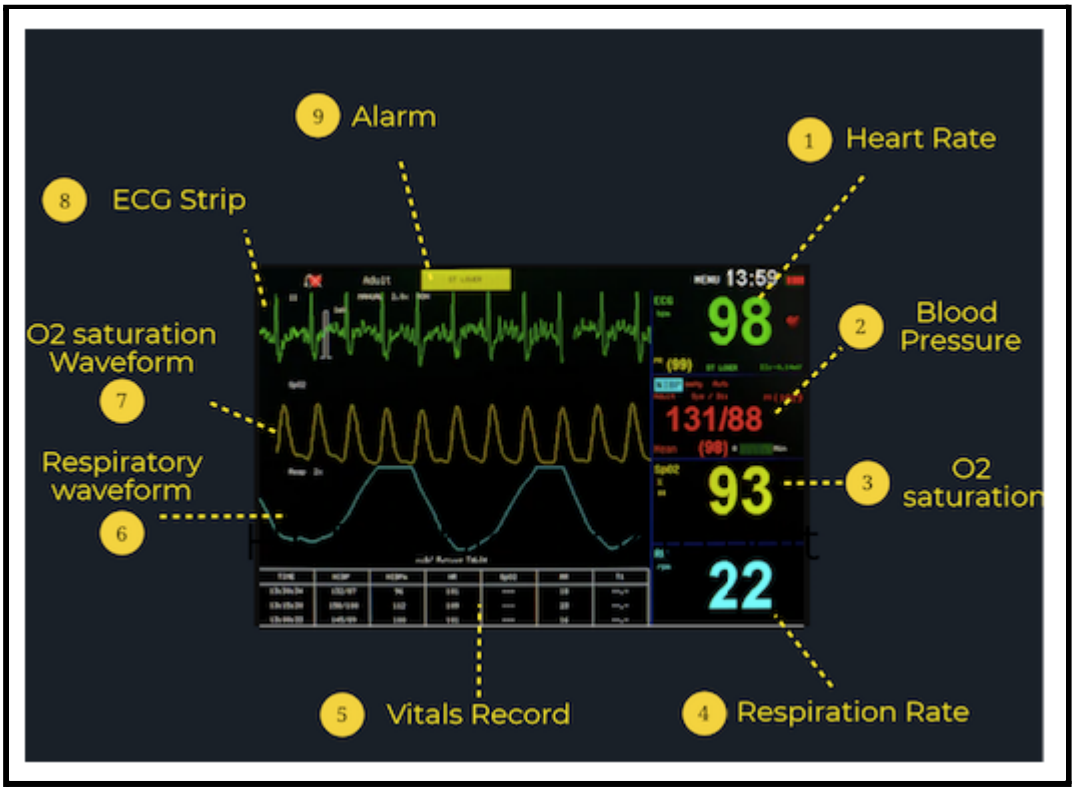

Tech Croods
ICU PATIENT DETAILS
SELECT WARD
Ward S2
SCHEDULE APPOINTMENTS

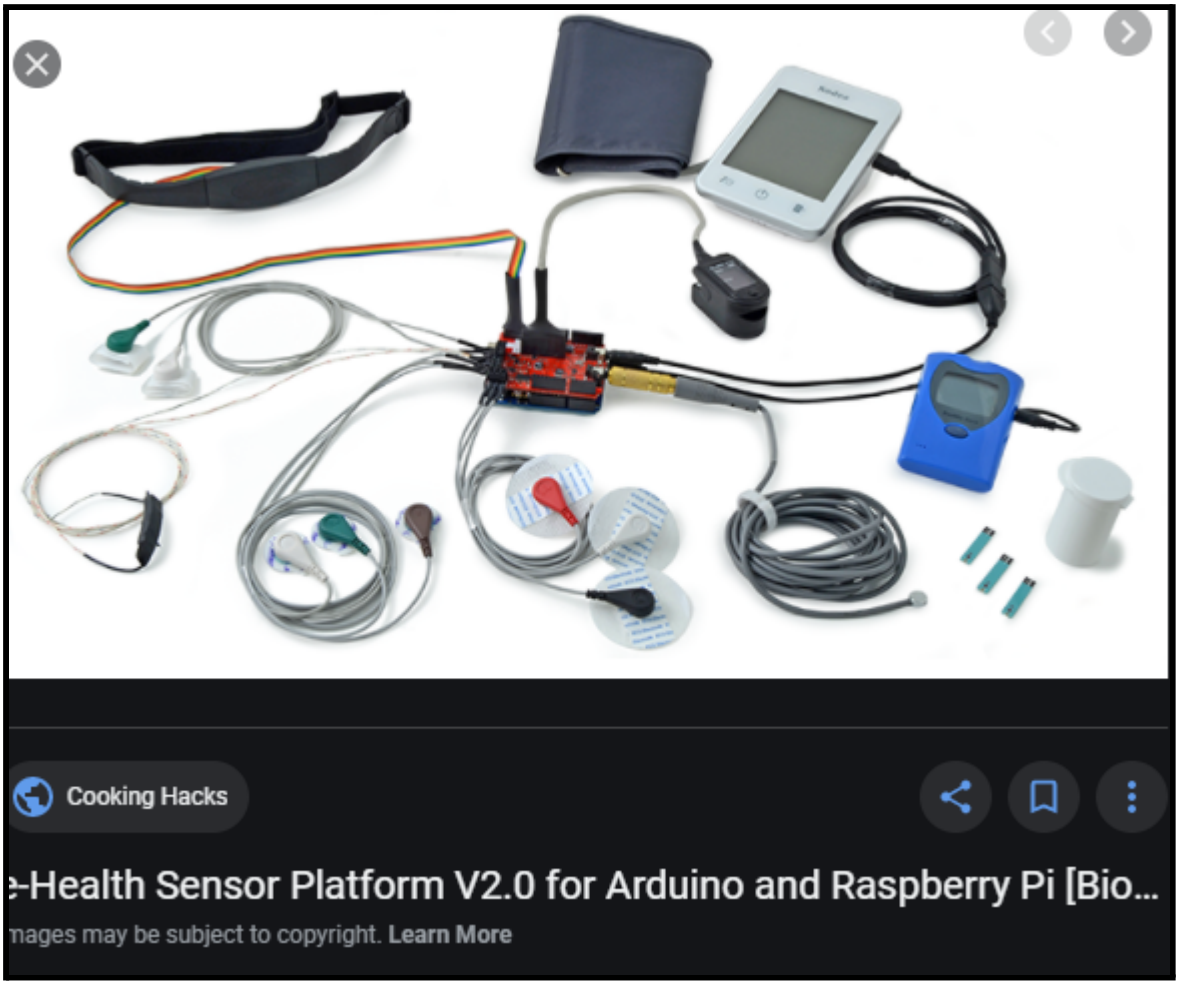

20:04
99%
Tech Croods
ICU PATIENT DETAILS
SELECT WARD
Ward S2
harishkumar@gmail.com
SCHEDULE APPOINTMENTS
thilak@gmail.com


20:04
99%
Tech Croods
Harish Kumar J
Body Temperature: 79.07 F
O2 Saturation Level: 94
Blood Pressure (arterial): 129
Heart Rate: 99
Glucose Level: 139 mg/dL
Respiration Rate: 20bpm


20:31
100%
Tech Croods
CLOSEAPP
pooja@gmail.com
Close the App
Are you sure?
NO
YES
LOGIN
(New User)
SIGNUP


20:31
100%
Tech Croods
EMERGENCY
Logout
Are you sure?
NO
YES
VISIT
UPDATE SCHEDULE
ICU DETAILS


9 Alarm
1 Heart Rate
8 ECG Strip
2 Blood Pressure
O2 saturation Waveform
7
Respiratory waveform
6
3 O2 saturation
5 Vitals Record
4 Respiration Rate
13:59
98
131/88
93
22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CHAPTER 5
CONCLUSION

The main objective of the experiment was successfully achieved. All the individual modules like Temperature detection module, oxygen saturation detection module etc. and remote viewing module gave out the intended results. The designed system modules can further be optimized and produced to a final single circuit. The readings are collected in a simple cloud database and can be viewed remotely by a doctor or Healthcare giver. The data can also be used in research on medical issues affecting the elderly or chronically ill. In future,on the security of the data, the database system is protected with Advanced Encryption Standard (AES). This generates the secret key which can be used to decrypt the patients' records ensuring that only authorized personnel access the data. This safeguards the patients' records from unauthorized users and hackers who may want to intercept.

REFERENCES

1. https://www.researchgate.net/profile/Md-Islam-191/publication/338246586_Developing_IoT_Based_Smart_Health_Monitoring_Systems_A_Review/links/5ece0a664585152945148d4c/Developing-IoT-Based-Smart-Health-Monitoring-Systems-A-Review.pdf
2. https://acadpubl.eu/hub/2018-119-16/1/8.pdf
3. https://www.mdpi.com/1424-8220/14/9/17212
4. https://www.ceeol.com/search/article-detail?id=851158
5. https://www.sciencedirect.com/science/article/abs/pii/S254266052030014