ST. JOSEPH'S
COLLEGE OF ENGINEERING
AND TECHNOLOGY,
- PALAI -

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CSD 415 PROJECT PHASE II

Final Review

02-05-2024

CAREWAVE

HEALTH MONITORING SYSTEM

TEAM GUIDE:
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TEAM MEMBERS:

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SWATHILEKSHMI S

COURSE OUTCOMES

Course Outcomes [COs]: After successful completion of the course, the students will be able to:

CO1	Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: **Apply**).
CO2	Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: **Apply**).
CO3	Function effectively as an individual and as a leader in diverse teams and to comprehend and execute designated tasks (Cognitive knowledge level: **Apply**).
CO4	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: **Apply**).
CO5	Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: **Analyze**).
CO6	Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: **Apply**).

CONTENT

ABSTRACT

- The system utilizes sensors to capture realtime vital signs, including heartbeat and blood oxygen saturation (SpO2). An AI model continuously analyses this data, identifying anomalies that deviate from the user's established baseline.

- When the AI detects fluctuations outside the user's normal parameters, a multitiered alert system is activated. Initially, the user receives a notification on their health status.

- The system offers medication reminders, promoting adherence to prescribed medication schedules. A companion mobile application acts as a user interface, displaying vital sign data, medication schedules, and any triggered alerts.

INTRODUCTION

- The existing healthcare systems, though robust in many aspects, are confronted with limitations when it comes to delivering personalized health management and prompt emergency response.

- Carewave revolutionizes health management by seamlessly integrating hardware and software to provide real-time vital sign monitoring and medication alerts

- With its proactive alert system and customizable interface, users can stay ahead of their health, receiving timely notifications and taking proactive measures to maintain their well-being

PROBLEM STATEMENT

- The aging population and individuals with health conditions lack a comprehensive healthcare solution tailored to their needs.
- Existing systems fall short in providing personalized health management and swift emergency response.
- This gap results in challenges such as delayed interventions and insufficient remote monitoring.
- The problem statement calls for the development of an innovative AI-powered software to bridge these gaps and improve the well-being of this vulnerable population.

LITERATURE SURVEY

RESEARCH PAPER

- Title: Real-time artificial intelligence based health monitoring, diagnosing and environmental control system for COVID-19 patients.
  Author: Muhammad Zia Ur Rahman
  Summary: This paper presents a real-time artificial intelligence-based health monitoring, diagnosing, and environmental control system for COVID-19 patients.

- Title: Smart Health Monitoring Using Deep Learning and Artificial Intelligence
  Author: Suma K G Journal: Revue d'Intelligence Artificielle Date: May 2023
  Summary: The paper discusses the use of deep learning and artificial intelligence in smart health monitoring systems.

EXISTING SOLUTIONS

- Vivify Health : Vivify Health is a cloud-based remote care solution that helps businesses in the healthcare industry design personalized care plans and monitor patient status.

- Keva Health : Keva Health's SaaS Respiratory Care Platform for physicians captures the complete patient journey with consistent and accurate capture of remote care data outside the physician's office or hospital.

- Hale : Hale is a remote patient monitoring platform, enabling clinical teams and health care practices to gain real-time health data without the need for on-site consultations.

PROPOSED SYSTEM

- Introducing CareWave, leveraging ESP32 and MAX30102 sensors for real-time heart rate and oxygen saturation monitoring.
- Caregivers manage user profiles and schedule medication reminders, ensuring timely dosage and refill alerts.
- The Emergency SOS feature enables users to alert caregivers in emergencies.
- AI algorithms analyze user data for valuable insights, with caregivers receiving emergency alerts for critical situations.

SOFTWARE REQUIREMENT SPECIFICATION

FUNCTIONAL REQUIREMENTS

- **Vital sign monitoring**

Vital signs like heart rate and spo2 of the user is monitored to know about the health status.

- **Medication reminders**

Medication adherence, the act of taking medications as prescribed, is crucial for managing chronic conditions and preventing adverse health outcomes.

- **Alert notifications**

Timely alert messages to caregivers are crucial for ensuring the well-being of individuals who require assistance, particularly those with chronic conditions, disabilities, or age-related limitations.

NON-FUNCTIONAL REQUIREMENTS

- **Compatibility** : It refers to the ability of two or more things to work together harmoniously.
- **Performance** : Application performance refers to how effectively an application functions and meets the needs of its users.
- **Security** : Data security of an application is crucial for protecting sensitive information from unauthorized access, modification, or destruction.
- **Usability** : Usability is a crucial aspect of any application, determining how effectively and easily users can achieve their desired goals.
- **Reliability** : The reliability of an application refers to its ability to perform consistently and accurately according to its specifications.

TECHNOLOGY STACK

The following are the technical tools we've used for this project:

- Android Studio: An integrated development environment (IDE) for building Android applications.
- Firebase: A platform offering various tools and services for mobile and web app development, including authentication, real-time databases, and cloud messaging.
- Arduino IDE: A software environment used to develop code for Arduino microcontroller boards.

TECHNOLOGY STACK

- Internet of Things (IoT): A network of interconnected devices that communicate and exchange data, enabling smart functionalities and automation.
- Python: A versatile programming language known for its simplicity and readability, widely used in web development, data analysis, and artificial intelligence.
- Kotlin: A modern programming language for developing Android applications, officially supported by Google as an alternative to Java.
- TensorFlow: An open-source machine learning framework developed by Google for building and training neural network models.

MODULE DESCRIPTION

- **USER**
- Sign in using google
- Basic details
- Medication details

- **DATA**
- Vitals collection
- Monitoring
- Save data
- Values to verify(max and min limits)

- **ALERT**
- Medication alerts with medicine name and dose.
- Timely alerts for fluctuation of vital signs

- **HARDWARE**
- For collecting the vital signs
- Sending data to database and application

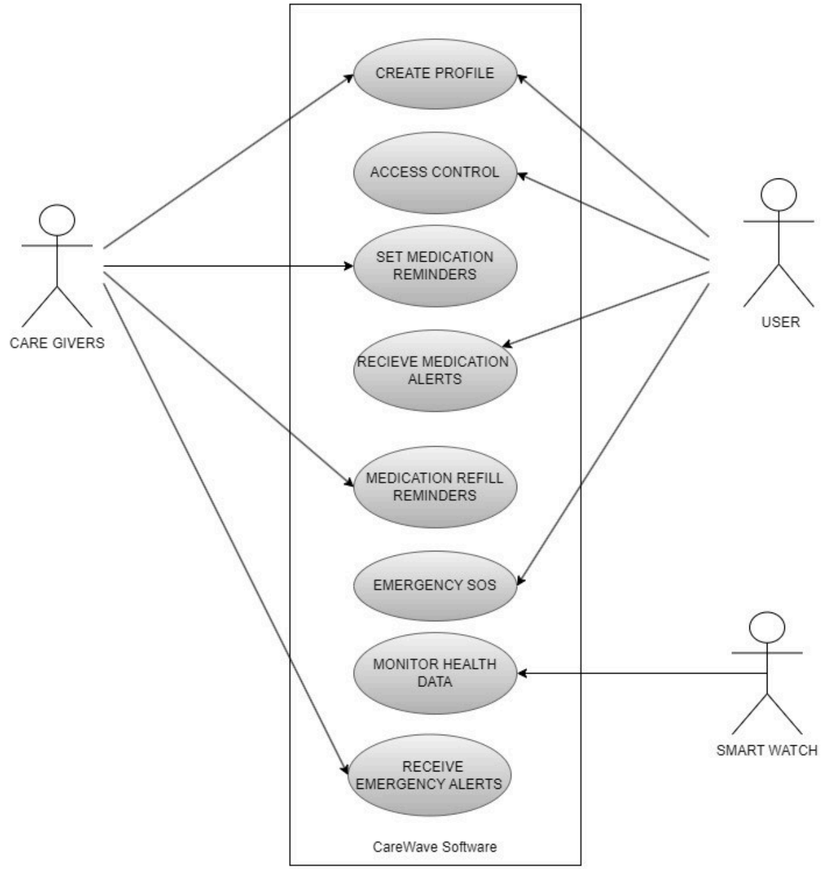
UML DIAGRAMS

1.Use case diagram

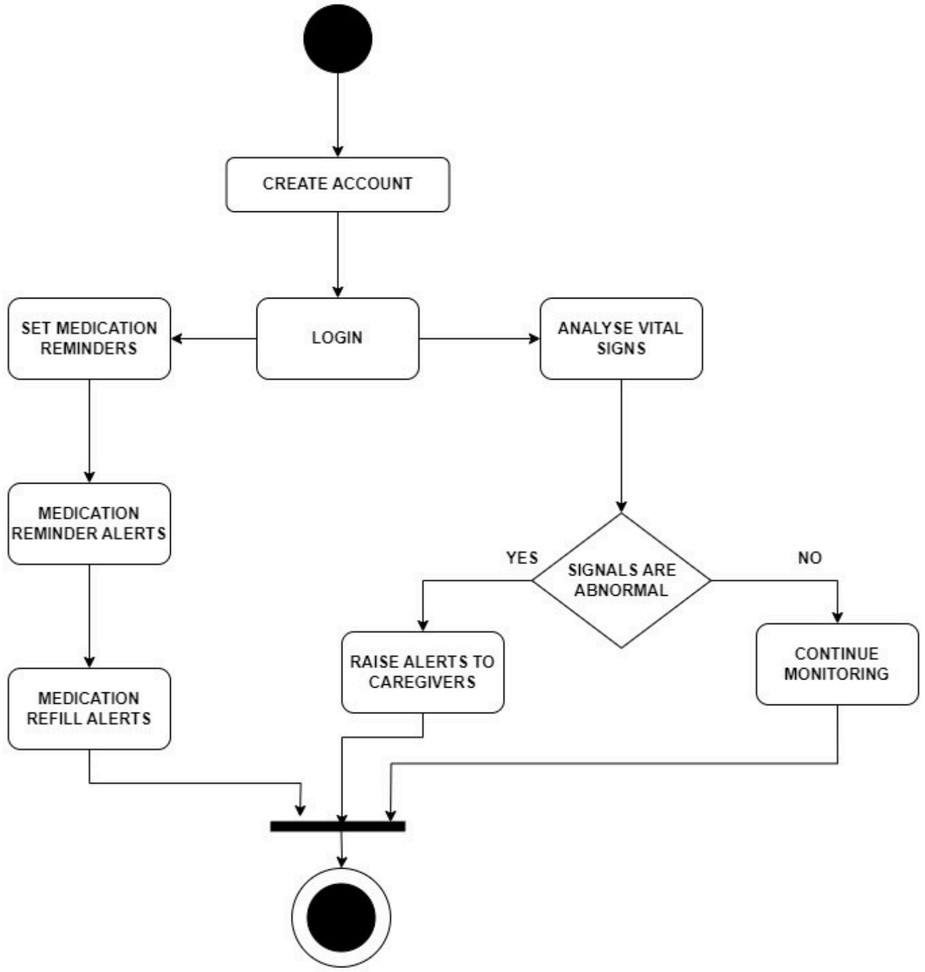
2.Activity diagram

3.Schema Diagram

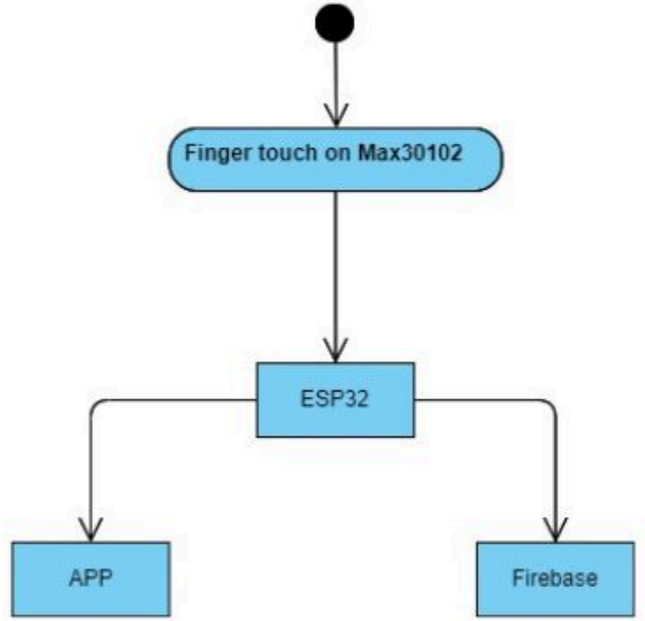
1.Use case diagram



2.Activity diagram

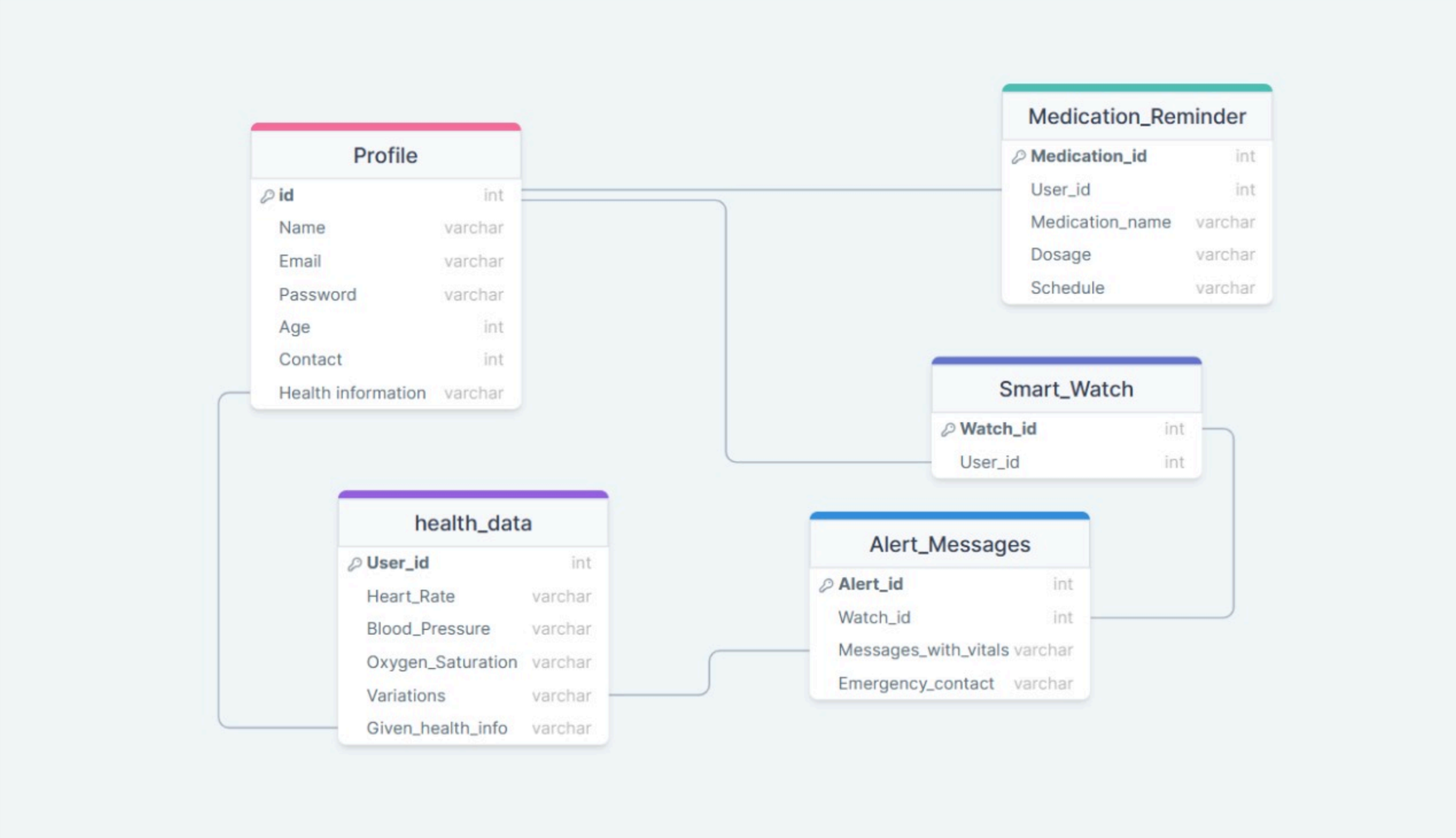


Activity diagram for software



Activity diagram for hardware

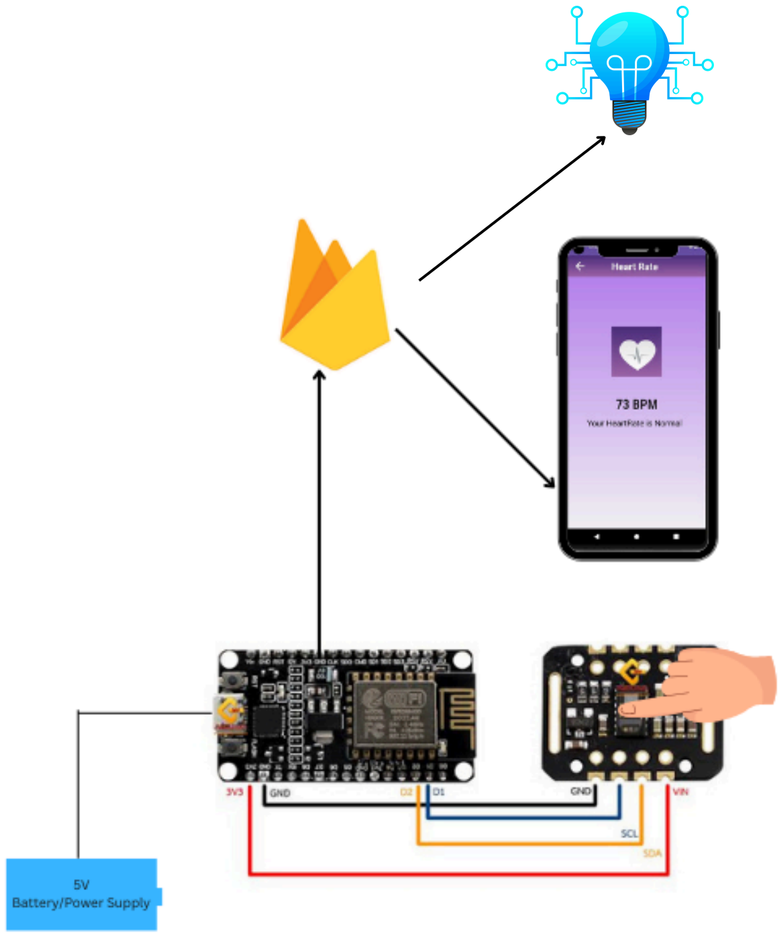
3.Schema Diagram



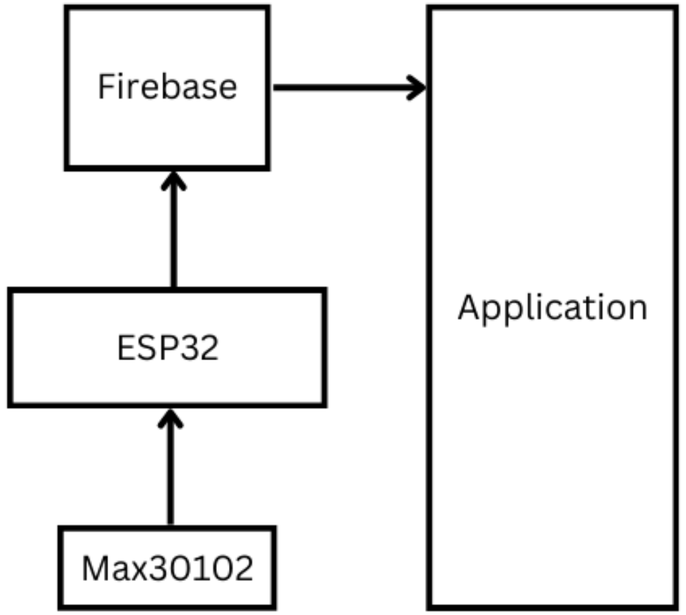
SYSTEM IMPLEMENTATION

- A user comes in contact with the Max30102 sensor so that, his/her ‘s Heart Rate and Blood Oxygen Saturation Levels are calculated and is taken to the database.
- This data is transferred to the application and the incorporated AI model so that the model verifies the values.
- After the verification, alert messages are sent if necessary.
- The option to add medications will help improvise the timely intake of medicines by the user.

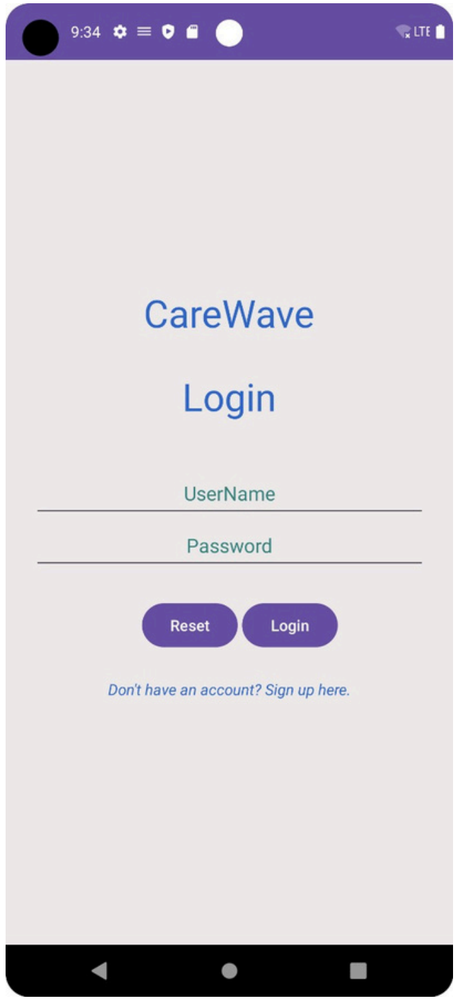
WORKFLOW

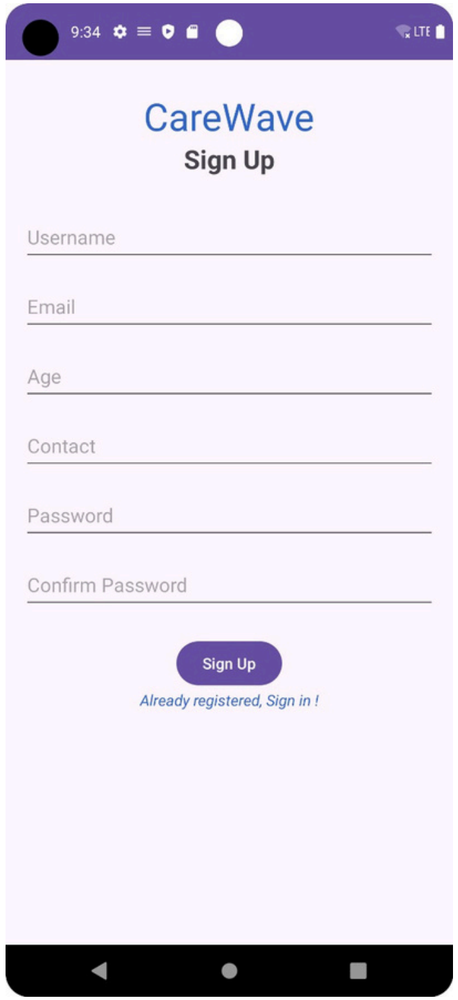


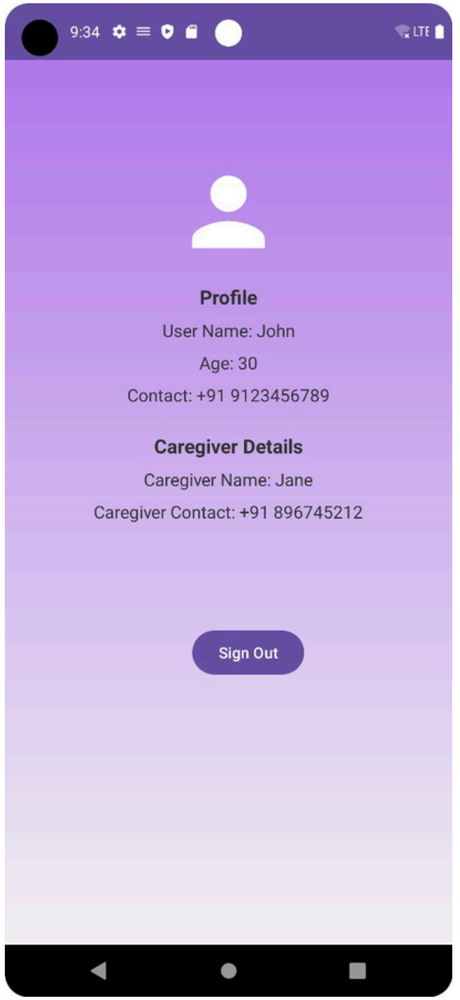
BLOCK DIAGRAM

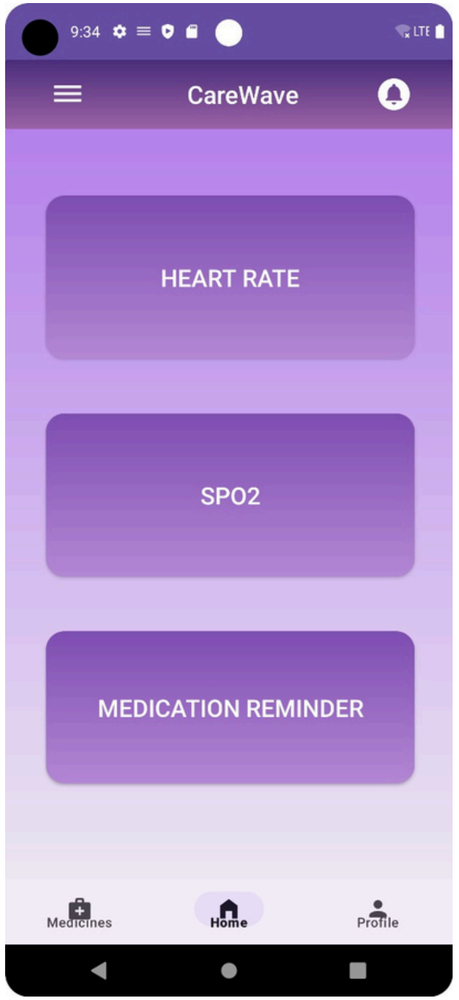


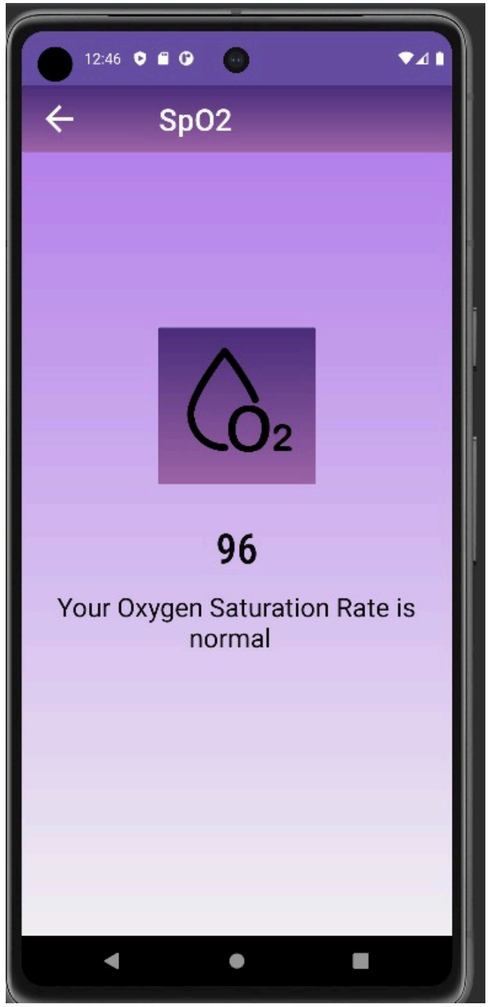
EXPERIMENTAL RESULTS

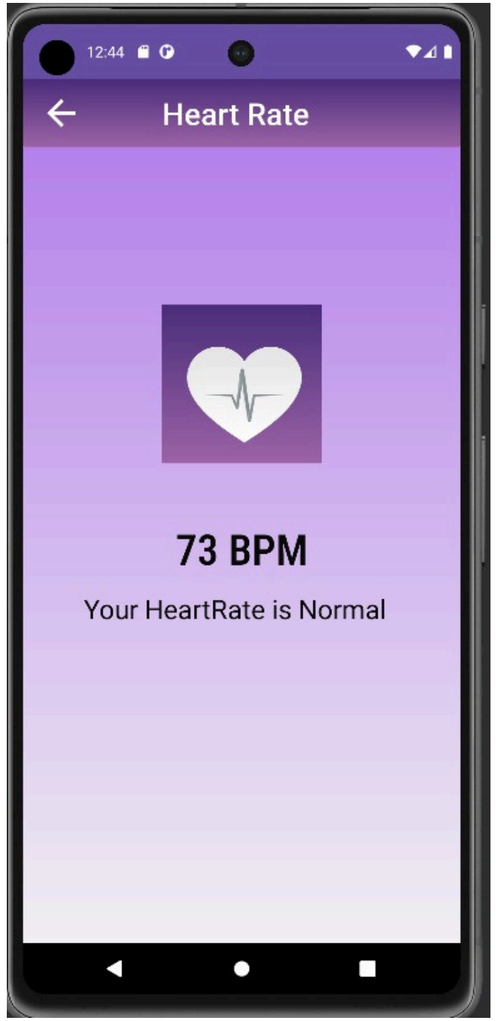




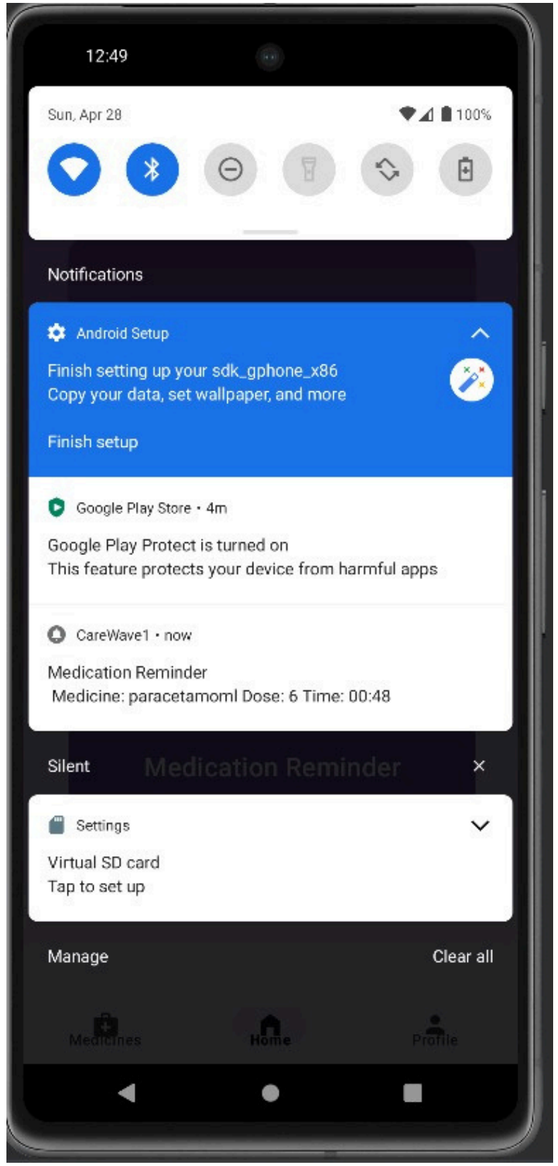


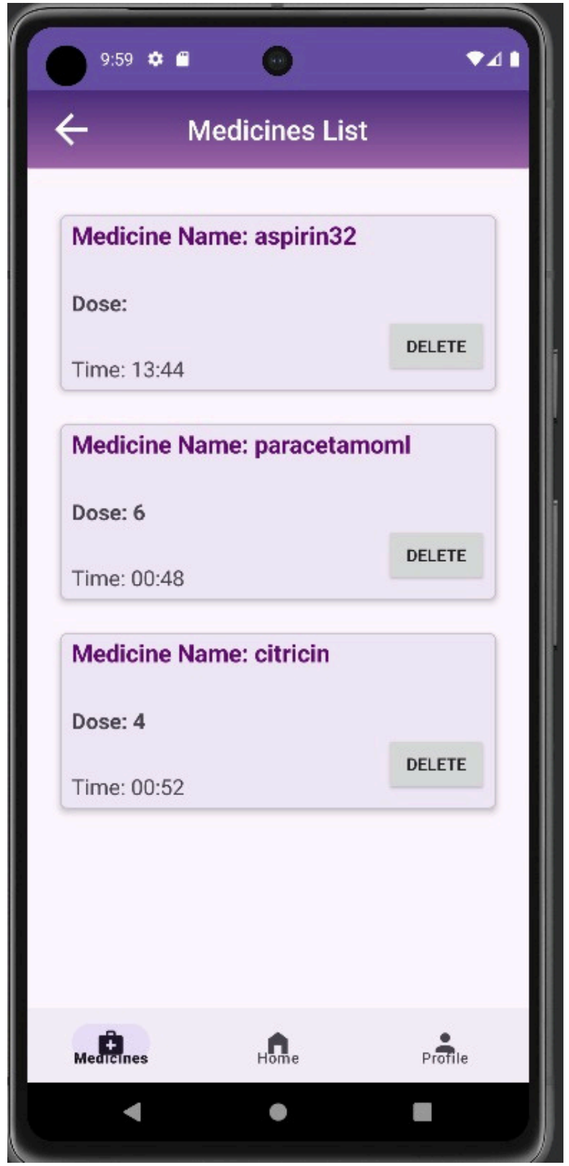

9:34
CareWave
HEART RATE
SPO2
MEDICATION REMINDER
Medicines
Home
Profile

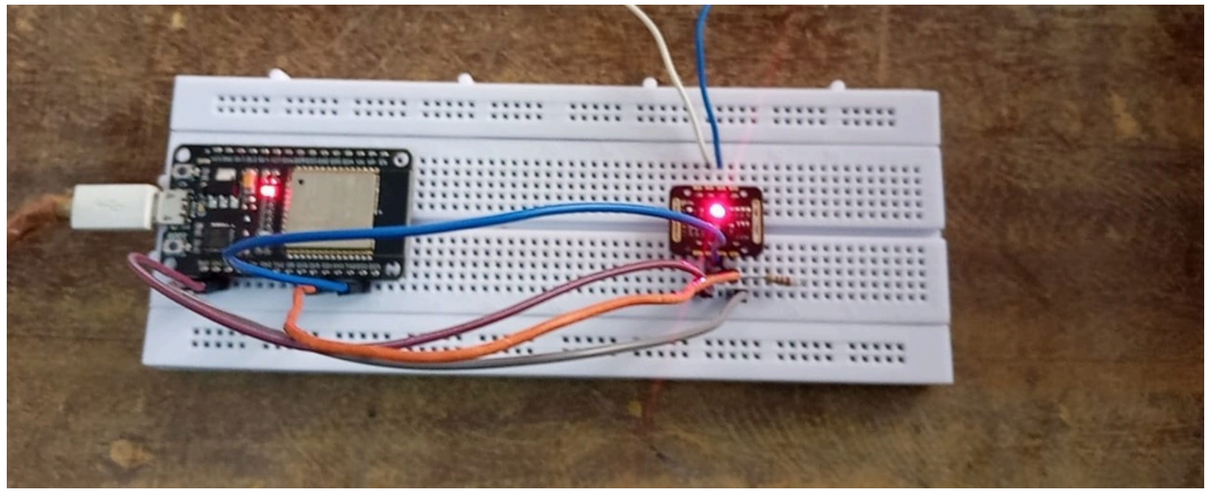

12:46
SpO2
96
Your Oxygen Saturation Rate is normal

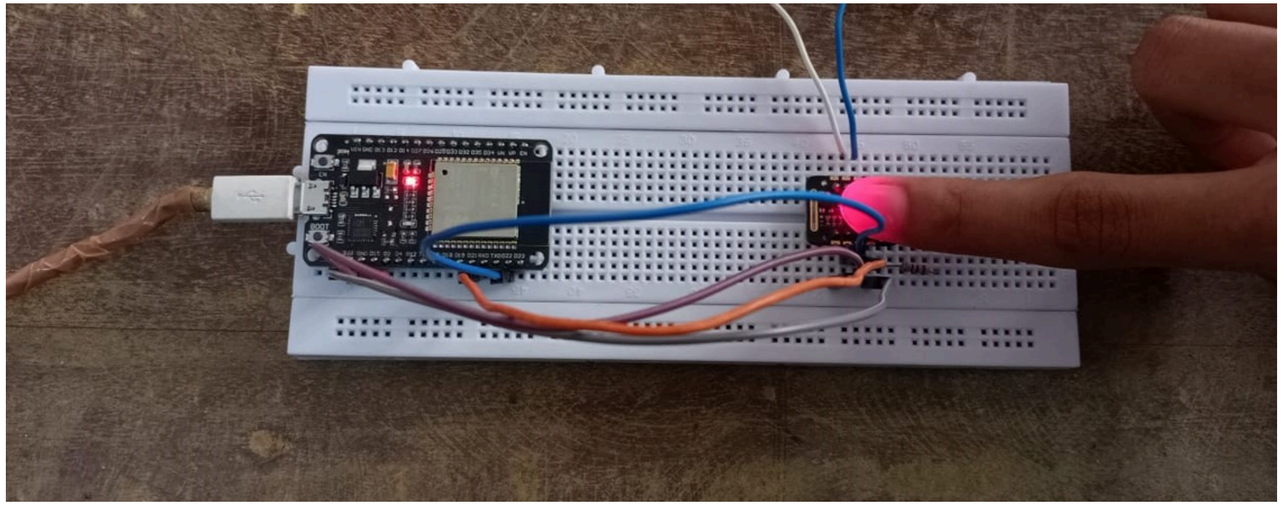

12:44
Heart Rate
73 BPM
Your HeartRate is Normal


10:10
Medication Name
telmisartan
Time to take
10:10
AM
PM
00
05
10
15
20
25
30
35
40
45
50
55
dose
1
am
pm
SAVE


12:49
Sun, Apr 28
100%
Notifications
Android Setup
Finish setting up your sdk_gphone_x86
Copy your data, set wallpaper, and more
Finish setup
Google Play Store • 4m
Google Play Protect is turned on
This feature protects your device from harmful apps
CareWave1 • now
Medication Reminder
Medicine: paracetamoml Dose: 6 Time: 00:48
Silent
Medication Reminder
Settings
Virtual SD card
Tap to set up
Manage
Clear all
Medicines
Home
Profile


9:59
Medicines List
Medicine Name: aspirin32
Dose:
Time: 13:44
DELETE
Medicine Name: paracetamoml
Dose: 6
Time: 00:48
DELETE
Medicine Name: citricin
Dose: 4
Time: 00:52
DELETE
Medicines
Home
Profile





```
12:40:16.725 -> IR=66314, BPM=115.16, Avg BPM=88
12:40:16.725 -> IR=66286, BPM=115.16, Avg BPM=88
12:40:16.771 -> IR=66270, BPM=115.16, Avg BPM=88
12:40:16.771 -> IR=66247, BPM=115.16, Avg BPM=88
12:40:16.807 -> IR=66235, BPM=115.16, Avg BPM=88
12:40:16.807 -> IR=66207, BPM=115.16, Avg BPM=88
12:40:16.849 -> IR=66170, BPM=115.16, Avg BPM=88
12:40:16.849 -> IR=66146, BPM=115.16, Avg BPM=88
12:40:16.891 -> IR=66142, BPM=115.16, Avg BPM=88
12:40:16.891 -> IR=66142, BPM=115.16, Avg BPM=88
12:40:16.925 -> IR=66154, BPM=115.16, Avg BPM=88
12:40:16.925 -> IR=66159, BPM=115.16, Avg BPM=88
12:40:16.965 -> IR=66175, BPM=115.16, Avg BPM=88
12:40:16.965 -> IR=66220, BPM=115.16, Avg BPM=88
12:40:17.002 -> IR=66287, BPM=115.16, Avg BPM=88
12:40:17.002 -> IR=66354, BPM=115.16, Avg BPM=88
12:40:17.033 -> IR=66455, BPM=115.16, Avg BPM=88
12:40:17.071 -> IR=66617, BPM=115.16, Avg BPM=88
12:40:17.071 -> IR=66765, BPM=115.16, Avg BPM=88
12:40:17.108 -> IR=66947, BPM=115.16, Avg BPM=88
12:40:17.108 -> IR=67165, BPM=115.16, Avg BPM=88
12:40:17.143 -> IR=67397, BPM=115.16, Avg BPM=88
12:40:17.143 -> IR=67654, BPM=115.16, Avg BPM=88
12:40:17.683 -> Data sent to Firebase Realtime Database successfully
12:40:17.683 -> IR=67945, BPM=115.16, Avg BPM=88
12:40:17.683 -> IR=67786, BPM=115.16, Avg BPM=88
12:40:17.716 -> IR=67609, BPM=115.16, Avg BPM=88
12:40:17.716 -> IR=67488, BPM=115.16, Avg BPM=88
12:40:17.753 -> IR=67401, BPM=115.16, Avg BPM=88
```

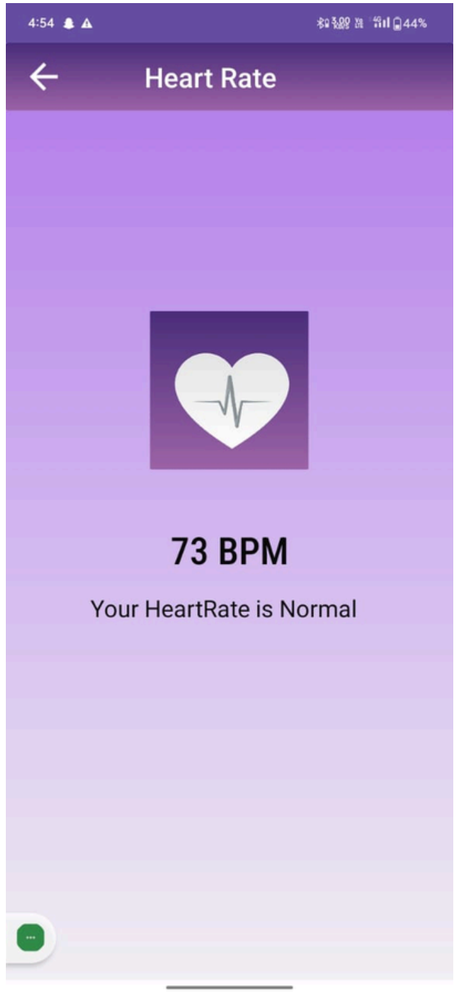
https://carewave1-2e995-default-rtdb.firebaseio.com

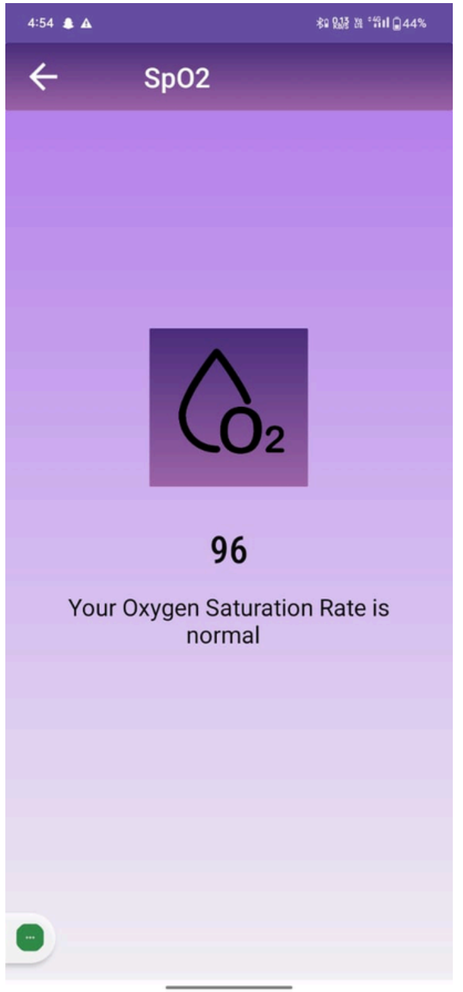
https://carewave1-2e995-default-rtdb.firebaseio.com/

- SensorDatas
- medications
- message: "Hello, World!"
- sensor_data
  - beatsPerMinute: 115
  - spo2: 99
  - timestamp: 91452

https://carewave1-2e995-default-rtdb.firebaseio.com/

- SensorDatas
- medications
- message: "Hello, World!"
- sensor_data
  - beatsPerMinute: 115
  - spo2: 92
  - timestamp: 182335





REFERENCES

- Polonelli, Tommaso, et al.~(2021) {\it H-Watch: An Open, Connected Platform for AI-Enhanced COVID19 Infection Symptoms Monitoring and Contact Tracing.} 2021 IEEE International Symposium on Circuits and Systems (ISCAS).
- Suma K G,Philip, Jeethu, et al. "Smart Health Monitoring Using Deep Learning and Artificial Intelligence." Revue d'Intelligence Artificielle 37.2 (2023).
- F. Sailer, M. Pobiruchin, and M. Wiesner~(2015) An Approach to Improve Medication Adherence by Smart Watches}, 26th Medical Informatics Europe Conference:Digital Healthcare Empowering Europeans (MIE2015)
- https://www.vivifyhealth.com/
- https://www.kevahealth.com/
- https://hale.com/
- N. Harum, Z. Z. Abidin, W. M. Shah, and A. Hassan, “Implementation of smart monitoring system with fall dectector for elderly using IoT technology,” Int. J.Comput., 2018.

- Ranveer Kumar Singh “IoT based Heart Rate Monitoring System” International Journal of Innovations and Advancement in Computer Science, Volume 6, Issue 10,October 2017.
- D. Evans, Te Internet of Tings How the Next Evolution of the Internet Is Changing Everything, Cisco IBSG.
- Z. Qin, G. Denker, C. Giannelli, P. Bellavista, and N. Venkatasubramanian, “A software defined networking architecture for the internet-of-things,” in Network Operations and Management Symposium (NOMS), 2014 IEEE, May 2014.
- Mack, David C., et al. "Development and preliminary validation of heart rate and breathing rate detection using a passive, ballistocardiography-based sleep monitoring system." IEEE Transactions on information technology in biomedicine 13.1 (2008): 111-120.
- Vicente, José, et al. "Drowsiness detection using heart rate variability." Medical \& biological engineering \& computing 54 (2016): 927-937.
- Natarasan, Sivapriya, and Pavithra Sekar. "Design and Implementation of Heartbeat rate and SpO2 Detector by using IoT for patients." 2020 International Conference on Electronics and Sustainable Communication Systems (ICESC). IEEE, 2020.
- Hess, Dean R. "Pulse oximetry: beyond SpO2." Respiratory Care 61.12 (2016): 1671-1680.

Thank You

OPEN FOR QUESTIONS