77297958_ProductionProject_FinalReport

by Sandesh Paudel

Submission date: 26-May-2024 04:01PM (UTC+0545)
Submission ID: 2387983777
File name: 77297958_FinalReport.docx (18.45M)
Word count: 10483
Character count: 58265

LEEDS BECKETT UNIVERSITY

The British College

KATHMANDU

The British College

Coursework Submission Coversheet

(individual coursework only)

Faculty of Arts, Environment and Technology

LBU Student Id: 77297958

FOR CHECKING BY THE STUDENT:

Please ensure all information is complete and correct and attach this form securely to the front of your work before posting it in a coursework collection box.

Award name: BSc (Hons) Computing

Module code: COMP607

Module name: Production Project

Module run:

Coursework title: Senior-Shield, A Next-Gen Healthcare App for Elderly

Due Date: **26 May 2024**

Module leader: (In LBU) Patrick Ingham

Module Supervisor: (In TBC) Suramya Sharma

TURNITIN Checked: (YES) NO *(please circle)*

Submission date & time: Date: 26 May 2024 Time: 8:00 PM

Total Word Count: 10774 **Total Number of Pages (including this front sheet):** 105

In submitting this form with your assignment, you make the following declaration:
I declare, that the coursework submitted is my own work and has not (either in whole or part) been submitted towards the award of any other qualification either at LBU or elsewhere. I have fully attributed/referenced all sources of information used during the completion of my assignment, and I am aware that failure to do so constitutes an assessment offence.

Signed:  Date: 2024-05-26

FOR COMPLETION BY THE FACULTY:

Teacher's Signature: _____ **Date:** _____

I. DECLARATION

I hereby declare that this report is my own work and that all the sources of information have been fully cited. I understand that plagiarism is a serious academic offense and certify that there is no plagiarized material in this report.

This report contains approximately 9000 words excluding appendices, bibliography, and other supplementary material.

Sandesh Paudel

26 May 2024

II. ACKNOWLEDGEMENT

I would like to express my sincere gratitude to the following individuals for their invaluable contributions and support throughout the process of completing this report:

- Suramya Sharma, my project supervisor for his expert guidance, insightful feedback, and unwavering support throughout this project.
- Surya Tamang for helping throughout the project mainly in app development.
- Shuvam Paudel, my brother, for providing moral support and helping me out with constant motivation during the challenging times of this endeavor.

I am deeply grateful to my friends, family, all the faculty of The British College and all of those who have directly or indirectly contributed their time, knowledge, and support toward the successful completion of this project. I extend my heartfelt appreciation to everyone who has been part of this incredible journey.

III. ABSTRACT

Senior Sheild is an IoT-driven healthcare application meticulously crafted to address the pressing needs of the aging population by offering real-time monitoring and comprehensive support. In a world where elderly individuals often face challenges related to health management and safety, Senior Shield emerges as a beacon of innovation and practicality. Through its sophisticated array of features, including fall detection, heart rate monitoring, medication reminders, and chat assistance, the application provides a proactive solution to mitigate risks and ensure timely assistance. Imagine an elderly individual living alone, susceptible to falls or sudden health problems. With Senior Shield, they can rest assured that they are being continuously monitored, with any detected abnormalities triggering immediate alerts to designated caregivers. Moreover, the incorporation of machine learning platforms to predict health status offers an extensive healthcare solution. The application also facilitates seamless communication with doctors or healthcare professionals through a dedicated chat platform, enabling timely consultations and interventions. Senior Sheild's user-centric design, characterized by intuitive navigation and adaptive interfaces, ensures accessibility for users of all users. By addressing these critical challenges in eldercare and leveraging IoT technology, Senior Sheild is a pioneering solution, fostering a safer and more connected environment for aging individuals and their caregivers.

Table of Contents

IV. LIST OF FIGURES

21

V. LIST OF TABLES

V. LIST OF ABBREVIATIONS

Abbreviations	Definitions
API	Application Programming Interface
BMI	Body Mass Index
CPU	Central Processing Unit
CRUD	Create, Read, Update and Delete
DRY	Don't Repeat Yourself
EERD	Extended Entity Relationship Diagram
ERD	Entity Relationship Diagram
ESP8266	Espressif System 8266
GND	Ground
GPIO	General Purpose Input/Output
HTTP	Hypertext Transfer Protocol
IDE	Integrated Development Environment
IoT	Internet of Things
IR	Infra-Red
LED	Light Emitting Display
MVC	Model View Controller
Node MCU	Node Micro-Controller Unit
RAM	Random Processing Unit
SCL	Serial Clock
SDA	Serial Data
SMS	Short Message Service
USB	Universal Serial Bus
Vin	Voltage Input
Wi-Fi	Wireless Fidelity

1.INTRODUCTION

The Senior Shield project is an innovative project in senior healthcare using modern technology to deal with problems unique to old age. Senior Shield, which is designed using Flutter framework with the integration of IoT (Internet of Things) devices provides an experience across android platform that is both seamless and easy to use hence facilitating access as well as its adoption widely. The application is primarily based on advanced health surveillance aspects, like live monitoring of heartbeat and oxygen level via pulse oximeter sensor as well as piezoelectric sensor that helps in fall detection. The primary function of these sensors involves working closely with each other to monitor continuously the body's vital changes and alert the caretakers through notifications and SMS. In addition, a Random Forest based machine learning model has been fed into the system which can continuously predict the health status whether the health is normal or not.

Senior Shield offers an advanced set of functionalities that have been designed specifically for enhancing the overall well-being and security of the aged with the additional advanced monitoring feature. Besides, it permits direct chat communication with healthcare providers and nearest ones enabling instant consultation and medical help. Instant notifications make sure that caretakers receive early notifications of any serious situations, allowing them to act promptly, ensuring the safety of the individual in question. Medication reminders contained in Senior Shield assist users in following their prescribed treatment schedules hence promoting improved health results and compliance with medication.

The development of Senior Shield employed an agile driven approach in project methodology. This sought to stress adaptability, collaborative effort as well as iterative development. By use of adaptive methodology, the tasks are broken down into smaller units that are manageable to rapid development, continuous feedback loops which ultimately helps in meeting project requirements timely. This iterative

approach aids greater flexibility and responsiveness, ultimately resulting in a more robust and user-centric application.

In the subsequent sections of this report, we will continue analyzing the various components that render Senior-Shield an iconic project in senior healthcare technology. Initially, we'll look at the technological basics like Flutter, integrated IoT devices and specific sensors used with it. Following this, we will be visualizing the design and development phase of the project focusing on the agile methodology employed. Furthermore, detailed study of application features such as health monitoring, chat functions, pill remainders as well as other ways in which the app assists older adults will be conducted in the report. Evaluation of the effectiveness of these features through feedback will be done. Lastly, the report will conclude with future projections for the project with some additional features and refining to enhance its impact on senior healthcare.

2. LITERATURE REVIEW

The Senior Shield project aims to attend to the urgent healthcare demands of the aged persons by application of advanced technology using the Internet of Things (IoT) in integration with a mobile application and Machine Learning under an agile development framework. This literature review will review what is already known about the health problems among old ones, the technological solutions available, and the appropriate methodology.

i. Healthcare Technology for Seniors

The health of old people is important due to the aging of the population around the world. There are multiple chronic conditions, a decrease in mobility associated with old age, and vulnerability to complications. This is why advanced healthcare solutions need to be designed for them. For example, falls are the primary cause of death by injury in older adults all over the world. (Roy, et al., June 2022) report that falls represent the most significant risk for injury among the old ones, highlighting the urgent need for effective fall detection and prevention systems.

Essential tools for fighting these problems are considered technologies of remote health monitoring. (Irfan, et al., 2023) emphasizes that these technologies enable continuous monitoring of vital signs, allowing the caretakers to detect and respond to health issues promptly. This comes in handy especially because old people who might suddenly fall sick and need immediate treatment. The overall quality of life for seniors has been significantly improved through the employment of technological solutions reducing the anxiety about potential health emergencies and increased autonomy.

Medication adherence is also an important part of elderly care. (Chaudhary, et al., 2017) reported that medicine remainder also has shown significant improvement on medical adherence. This research supports the inclusion of medication remainder feature in the Senior Shield project, ensuring that user follows their prescribed treatment plans thereby improving health outcomes.

The integration of a chat feature into a healthcare application would facilitate real time communication between doctors and patients fostering a general way of looking at healthcare which improves patient engagement's satisfaction of care. By doing such, they can get consultation with doctors sharing their health information and receive necessary feedback and directions without the constraints of physical appointments. For the healthcare providers, the chat functionality helps in communication procedures allowing fast inquiry and care team collaboration. Overall, this feature improves accessibility, communication and cooperation resulting in higher quality and efficient healthcare delivery.

ii. Internet of Things (IoT) in healthcare

In making healthcare smarter, the Internet of Things (IoT) has been considerable transformation particularly through the development of interconnected intelligent tools for real-time monitoring as well as collection of health information. The wearable sensors and smart home system among IoT devices make it possible for them to holistically take care of the elderly people's medical needs since they constantly monitor such critical signs as vital signs and health alerts. This real time

monitoring is crucial for early detection and intervention, reducing the risk of severe health incidents.

In their paper, (Madhu, et al., 2023) point out that health care for the elderly becomes much simpler if the Internet of Things is involved, since it ensures constant monitoring of their health and timely alarms to carers. This means that there will always be an immediate response in case of a health crisis, thereby minimizing further complications and enhancing these patient's chances of successful treatment. Wearable devices with biosensors may monitor a variety of health factors, such as heart rate, oxygen levels and mobility, offering a comprehensive picture of an individual's heath condition.

To sum up, in health care, the Internet of Things enables the collection of large volumes of health information for the purpose of trend identification and care strategy improvement. When used in the health sector, IoT led to a noticeable enhancement in patient results through individual care plans and preventive health (Hassan, et al., 2021). IoT has also been attributed a great economic importance in healthcare. IoT devices can reduce healthcare expenses by reducing frequent hospital visits and enabling early detection.

iii. Machine Learning for Health Monitoring

In todays' health care (ML) machine learning is an essential or critical aspect providing predictive measurable tools used to enhance patient care and management. In caring for the elderly, pattern recognition and warning of deviations from the norm occur before they can become fatal thanks to algorithms based on ML that operate with vast amounts of data. Thus, it helps in monitoring old people's health status timely preventing them from any serious health complications.

(Yu, et al., 2020) discusses how machine learning models can track early indicators of waning health by evaluating nonstop streams of information from wearable gadgets. This thing allows treatment providers access to practical solutions through which they can act more proactively if necessary. The Senior Shield project uses machine learning algorithms of Random Forest to continually

examine health data, predicting if the user's health state is okay or requires care. Random Forest being a supervised learning method, predicts the health status after analyzing past health records and dataset trained on the model.

Machine learning can be used to give personalized healthcare solutions by changing treatments according to the patient's unique health information, besides predictive analysis. According to (Furizal, et al., 2023), personalized healthcare programs that have utilized ML methods have resulted in better patient outcomes and greater satisfaction ratings. Such personalization becomes even more critical in elder healthcare since there exist wide differences among individuals regarding their health requirements.

For healthcare providers to allocate their resources effectively, it is necessary to identify patients who are at higher risk of health complications and prioritize their care. With this targeted approach, AI helps in ensuring that the efficiency as well as quality of care improves since care givers have a better way of directing their resources.

iv. Agile Methodology in Software Development

Agile methodology is project management approach that involves breaking down the project into phases and emphasizes continuous collaboration and improvement (Atlassian Agile, n.d.). This methodology allows development teams to adapt to these changes quickly and efficiently, ensuring that the final product meets the user requirements and industry standards.

According to the (Beck, et al., 2001), agile practices emphasize on software delivery through continuous changes which result in consistent feedback and improvement. So, because it is iterative, this process helps identify and address problems from an early stage during development thus leading to better quality applications which are easy for users. This project also takes an agile approach breaking down the works into manageable units so that helps in overall functionality and overall usability of application.

In the development of the Senior Shield project, agile was chosen over other project management and software development methodologies due to its inherent flexibility unlike other traditional methodologies that follow linear and rigid approach. Other methodologies like Waterfall, V- Model and Spiral have rigid structure and lack iterative capabilities which doesn't allow changes once a phase is completed which is problematic in the dynamic field of healthcare technology made not to choose them in this project.

3. REVIEW OF THE TECHNOLOGIES

The technologies that have been used in this project and their brief introduction are as follows:

i. Hardware

The physical devices consist of:

Node MCU

Node MCU is an open-source LUA based firmware developed for ESP8266 System which contains the crucial elements of computer like CPU, RAM, Wi-Fi that makes an excellent choice for IoT projects of all kinds (Make It Ca, 2020). It features a USB interface for programming and power, GPIO pins for connection of sensors and onboard flash memory to store data. It can be programmed using Arduino IDE. Due to its compact size, affordability, and community support, it has been popular in the development of various projects of IoT.

Figure 1 Node MCU v2.

This has been the main component to read data from sensors, processing it and sending them to firebase in the system of Senior Shield. Code is uploaded in it via Arduino IDE and according to it reads and sends data to firebase via wireless network.

Pulse Oximeter (MAX30100)

MAX30100 is an integrated pulse oximetry i.e. oxygen level and heart-rate monitoring sensor system. It uses two LEDs (IR and Red), a photodetector (Red), improved optics and low-noise analog signal processing to detect pulse oximetry and heart-rate data. It communicates with microcontrollers using I2C serial interface, allowing integration with various embedded systems.

Its pins like SCL, SDA, GND and VCC are used to connect with Node MCU for I2C communication where SCL is serial clock pin, SDA is serial data, GND is ground and VCC is power supply pin.

Figure 2 MAX30100 Pulse Oximeter Sensor

This sensor has been used to extract data like heart rate and blood oxygen levels which are essential components in health monitoring and health status prediction for project of Senior Shield.

Piezo Electric Sensor

A device that uses the piezoelectric effect to measure changes in pressure, acceleration, temperature, strain, or force by converting these into electrical charge (Anon., 2019). The capability of changing the mechanical stress into an electrical charge is known as a piezo-electric effect. When integrated with Node MCU, the

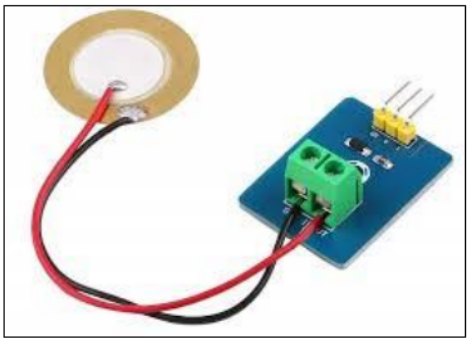


Figure 3 Piezo Electric Sensor

sensor's input can be read using analog input pins. With this connection, the voltage generated by the sensor helps in detecting the impacts on the plate made up of ceramics, quartz, and certain crystals. This sensor is used to detect the fall of elderly citizens for my system.

Jumper Wires

Jumper Wires are flexible electrical wires with connectors at each end which allow to connect two points with each other without soldering. They come with various types of connectors such as male headers, female headers, or pins. Also due to their color coding, it makes it easier to troubleshoot and maintain the wire. In the

project they have been used to establish connections between Node MCU's pins with sensors.

Figure 4 Jumper Wires

Breadboard

A breadboard is a reusable prototyping tool used in electronics to quickly build and test circuits without soldering. It consists of plastic board with interconnected holes that are arranged in grid pattern that allows devices and sensors interconnected with the help of jumper wires. They are used for temporary installation so that can be easily modified and dismantled.

Figure 5 Breadboard.

ii. Software

Software devices that have been used in the development of this project are:

Android Studio

It is an official integrated development environment (IDE) for Android application development (Tech Target, 2024). This IDE is developed by Google and based on IntelliJ IDEA which offers a comprehensive suite of tools and features tailored specifically for building Android Apps efficiently. UI Design, Code Editing, Emulator,

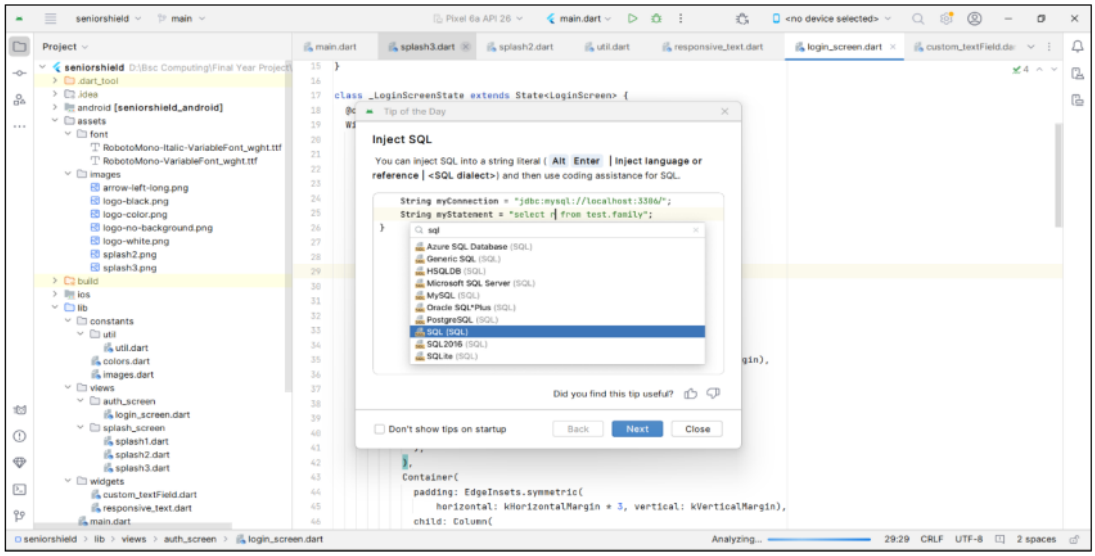


Figure 6 Android Studio IDE

Performance Profiling, Version Control Integration, Gradle Build System, and support for various libraries and APIs make the IDE more suitable and effective to use. This is the main IDE used to develop mobile applications for my system.

Flutter and Dart

Flutter is an open-source UI software development kit (SDK) created by Google for creating applications for mobile, web, and desktop from a single codebase. It is based on the Dart programming language. Fast Development, a Rich Set of Widgets, Native Performance, Open Source, and Community Driven, and most importantly single codebases, and multiple platforms are some of the features that make the Flutter framework perfect for mobile application development.

Whereas Dart is an object-oriented programming language (OOP) whose syntax is like Java and JavaScript. It offers classes, interfaces, mixing, and optional typing.

Together, Flutter and Dart offer a powerful combination for building cross-platform applications with a focus on performance, productivity, and a modern user experience.

For building mobile applications for my system, I have used the flutter framework which is easier than most android development languages because of its prebuilt libraries or widgets which helps in creating user interfaces efficiently and easily.

32
Figma

Figma is a cloud-based design tool that is used for creating user interfaces, web designs, and app prototypes. In this project, Figma has been used for creating the application design which makes the application development more efficient and productive. Various features of Figma like Cross-platform compatibility (for both Mac and Windows), vector editing tools, component-based design, prototyping and animation, inbuilt version control and comments and plugins and integrations make this software a more useful and versatile platform.

Elderly friendly as well as aesthetic appealing user interface designs for my system have been done using Figma software which made easier later in development phase.

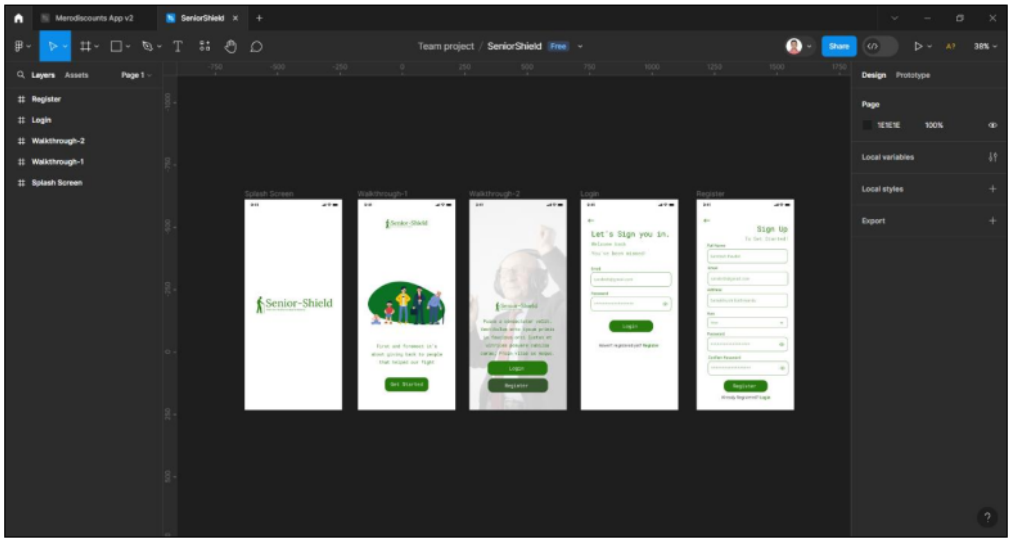


Figure 7 Figma Interface

22

Arduino IDE

It is an open-source Arduino software (IDE) that makes it easy to write code and upload on the boards. With availability of multiple libraries inside the IDE, it makes it a lot simpler to write code for various sensors to extract data. Mostly the codes are written in C++. Code for Node MCU has been written using this IDE for

Figure 8 Arduino IDE

my system to receive the data from sensors like pulse oximeter and piezo electric and send to firebase with the help of wireless network i.e. Wi-Fi.

Python / DJANGO

Python is a versatile, high level interpreted, and object-oriented programming language which is known for its easy syntax and easy to learn nature. It is widely used in web development, data analysis and AI. Django is a high-level python

Figure 9 Python and Django

framework, built with Python which encourages rapid development with its libraries and DRY principle. It also provides built in features for handling tasks like URL routing which have been used in this project for API development.

Firebase

Firebase is a product of Google which is used to build, manage, and store the data allowing developers for efficient app development (Geeks For Geeks, 2021). In this system, no programming is required as it uses NoSQL for the database for the storage of data. Main services provided by this system consists of hosting, cloud messaging, crash reporting and authentication which allows efficient integration of all the features in mobile applications. In my system, cloud messaging and authentication have played significant roles in notification handling and user registration as well as login respectively.

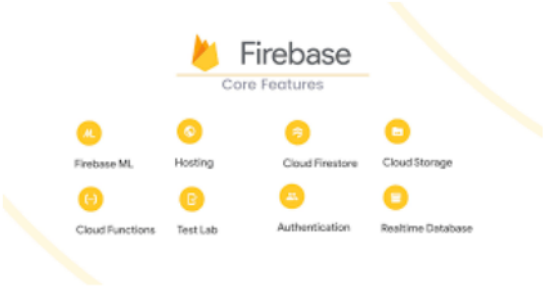


Figure 10 Firebase.

Visual Studio Code

Visual Studio Code known as VS Code, is an open-source text editor developed by Microsoft. Due to its capability to support a wide range of programming languages from Java, C++ and Python to CSS, Go and Docker file this software has been a primary choice for every developer (Educative, 2024). In context of my project, VS code has been used to develop machine learning model for health status prediction using python and creating Django application for API creation.

4.METHODOLOGY

After some research among various methodologies, agile project management method was taken into consideration. This methodology absolutely suited my project as the requirement might need some changes as it evolves on future. Agile works on breaking down multiple tasks into various smaller units so that it can be completed on time. This process features various steps for product development like planning, designing, development, testing, demonstration with client and deployment too. For this healthcare app project, we need to identify and adhere to specific requirements especially considering regulatory standards. Unlike other approaches like Waterfall, where requirements are typically set at the beginning of the project and follow a linear process but agile is much more flexible in addressing evolving needs (Kamani, 2021).

During the development of the project, the project was divided into various phases to ensure a structured and efficient approach. Started with the planning stage of the project where I identified the objectives and goals of the project very well. The thinking revolved around what this project was aimed at accomplishing and how this could be done successfully. I came up with a road map after collaborating planning with supervisor which laid the foundation for subsequent stages, setting a clear direction and vision for project's development. Following the planning phase, I delved into product design which consists of IoT architecture and its integration with mobile device. For the IoT devices, hardware specifications, communication protocols, and their circuit designing were done. Database designs, data flow diagrams, use case, product designs which consists of interfaces and navigation flows to ensure seamless user experiences were also developed for mobile app and feedback from the users were also taken which laid groundwork for the subsequent development and implementation stages.

Moving on the development phase, I started implementing the created design into functional prototypes and software solutions. In this phase, hardware configuration, integration of various components and basically code were done to create a cohesive project. Proper agile principles were followed in this process too. After each development, reviews were taken from supervisor and other users so that it can be improvised. After successful completion of the development phase, I started working on testing the application to ensure its quality. Successful deployment was done after proper quality assurance.

Agile methodology was pivotal while developing this project. Various changes were made during the development phase which could have been possible through this method only. Breaking down tasks into smaller parts, taking regular feedback and making iterative changes made the overall project easier and the project was successfully completed.

5. PRODUCT DESIGN

The Senior Shield project design process includes several important aspects which guarantee that different components are seamlessly integrated resulting in a user-friendly, efficient healthcare solution. In this chapter of report, the following aspects thematically cover the database design, use case diagram, application logo, application UI design, IoT Circuit design and the data flow diagram.

i. Database Design

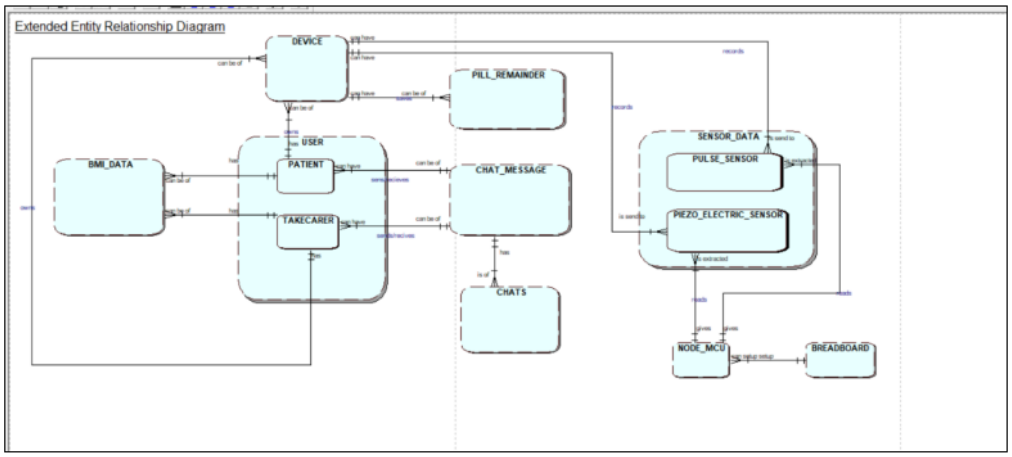


Figure 11 EERD.

This extended entity relationship diagram is an extended version of ERD which has been designed for this system for monitoring and recording data related to patients and their caretakers. The central entity is User which is separated from caretaker and doctor with the role. The user table stores all the necessary data of the application user including caretaker's number. The device entity is associated with pill reminder which records the information about the medication reminder. Chat Message and Chats are entities which are created to store the messages between multiple users inside the Chat Table.

ii. Use Case Diagram

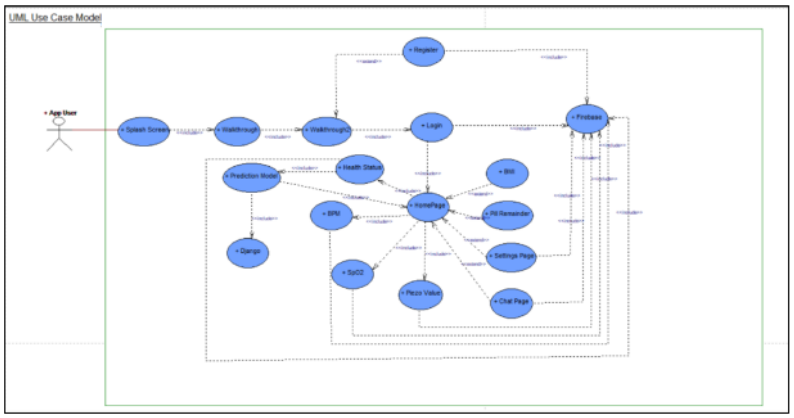


Figure 12 Use Case Diagram

In this project, app user represents the primary actor of the Senior-Shield application where user can be differentiated with their roles but have similar functionality. The user interacts and initiates with various cases in the project. Users must be registered before login, and before login each user should pass through splash screen and walkthrough pages. After login, the user navigates to the homepage and other screens accordingly in response passed by the user. Various use cases have been made like monitor health, receive notifications, view health reports, manage medications, communicate with caregivers and doctors. This diagram provides a comprehensive overview of the application's capabilities from the perspective of the end-user.

iii. Application Logo

Figure 13 Senior-Shield App Logo

The logo design in project development might be simple yet the logo can create an impact to whole project. Logo must be suitable and reflect the vision of the project being built. Here, Senior Shield logo features an old man with a cane that symbolizes elderly care, and the tag line “Next-Gen Healthcare App for Elderly” is reflecting what the app is for. The green color in the app conveys health, safety and vitality reflecting the app’s objective to enhance the well-being of old ones.

iv. Application UI Design

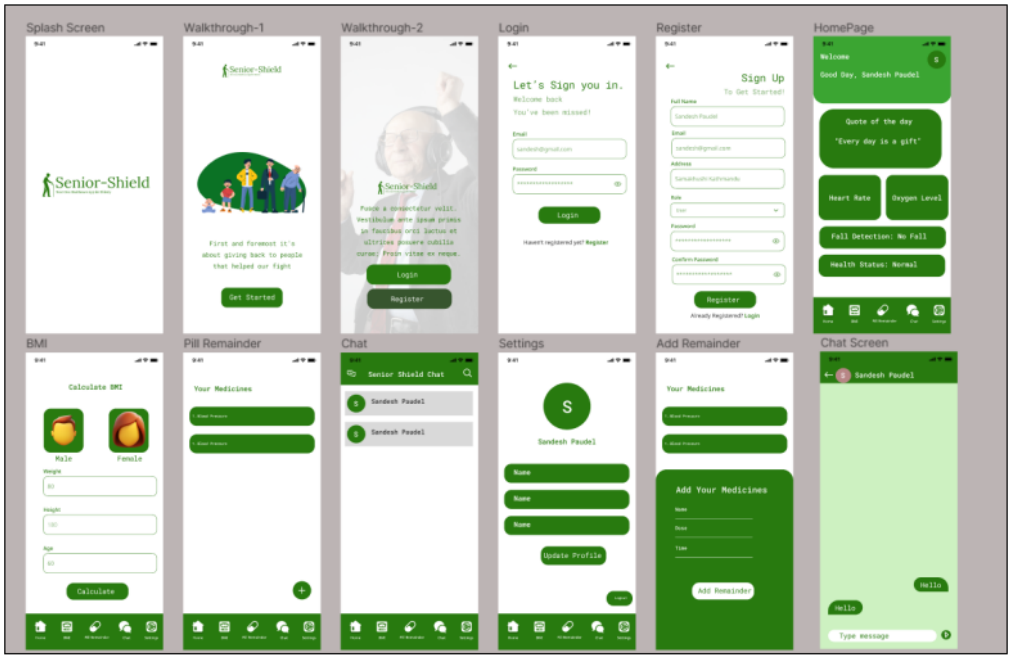


Figure 14 App UI Design Using Figma

User Interface design is also one of the most important parts before the development of any product. It is crucial for user friendly experience allowing the

app to understand how to navigate through each screen. Focusing on creating user friendly, intuitive, and accessible interface makes the application to serve better to its users.

In my application design firstly, there is a splash screen which displays logo, creating a welcoming introduction to the app. Two walkthrough screens are there which contain the apps' mission and provide additional information about the apps' features encouraging users to get started. Login and Registration Page has been designed that allows users to create their account and login if already registered. If a user forgets their password, then forget password page also has been designed to make user to reset their password and create new one. Home Page is the central dashboard to display the key health metrices like heartrate, oxygen level, fall detection and health status along with motivational quote and welcoming message. BMI Screen design has been created to make sure users can calculate their body mass index. Pill Remainder page is designed to allow users to set remainders for taking their medicines on time. Chat Screen is also available where can communicate with other persons including doctors, caretakers, and their friends. A personalized user settings page is there that allows the users to update their personal information and user can also sign out from the application through the settings page.

v. IoT Circuit Design

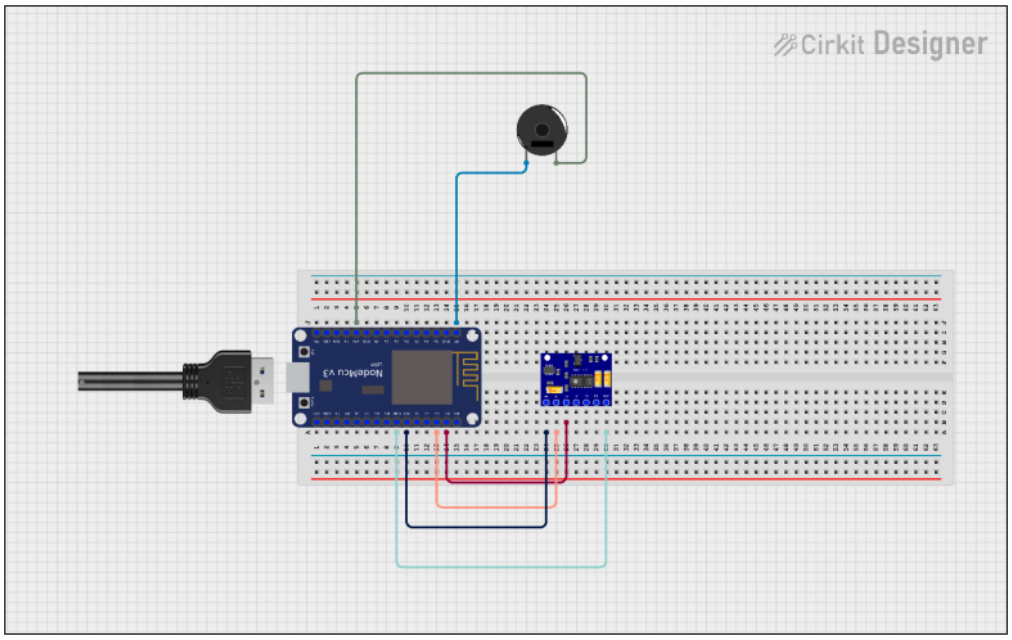


Figure 15 IoT Circuit Design

The circuit design has been made to connect the IoT Devices with each other. This allows the sensors to monitor the health parameters like heart rate, oxygen levels and fall detection. The Node MCU is the center point which collects the data from the sensors, processes it and transmits to the firebase to store the data via Wi-Fi. In the design part following consists of the connection of sensors with Node MCU via GPIO pins.

NODE MCU	PULSE OXIMETER	NODE MCU	PIEZO-ELECTRIC
GND	GND	GND	NEGATIVE
V3	VCC	A0	S
D1	SCL	V3	POSITIVE
D2	SDA		

Table 1 Pin Connection

These pins can be connected using the breadboard as shown in the design which is made using Cirkit Designer software.

vi. Data Flow Diagram

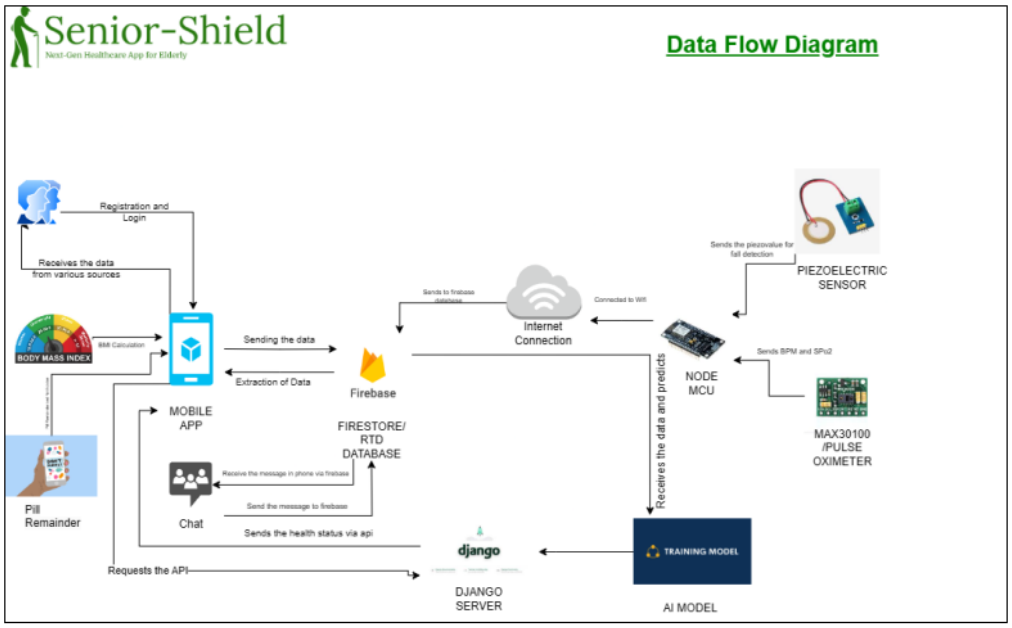


Figure 16 Data Flow Diagram

The dataflow diagram of Senior Shied projects illustrates how the data flows within the system, detailing how data is collected, processed, stored, and utilized to provide real time monitoring and alerts for old ones. Initially user registers and login with their details through mobile app which collects the data vitals through pulse oximeter max30100 and piezo electric sensor to determine heart rate, oxygen level and fall detection respectively. The data received from sensors is sent to firebase through Node MCU via Wi-Fi. Django server receives and handles the request sent from the mobile device to predict the health status of individual. A random forest model analyzes the data from the mobile app and send via API to the mobile app. Moreover, the app calculates the BMI, Pill Reminder to save the reminder of medicine and notify on schedule time. Notifications and Alerts are sent to the mobile app and via SMS on the status of the body. Continuous synchronization between mobile app, Firebase and the AI model ensures up to date information and effective healthcare of elderly people.

6. SOFTWARE REQUIREMENT ANALYSIS

Software requirement analysis is one of the important parts of successful software development projects. According to (Geeks, 2024) this part of project describes what features of the software will be and what its behavior will be i.e. how it will perform. Under this section a requirement catalogue has been made which consists of functional and non-functional requirements that need to be developed under the project Senior Shield. MoSCoW rule is being used to differentiate the requirements of the project where the features are necessary or not and how necessary they are.

Requirement Catalogue

i. Functional Requirements

Functional Requirements	MoSCoW
Continuous monitor of vital signs like heartrate, blood pressure using IoT devices	M
Fall Detection and Emergency Response	M
User Authentication and Authorization	M
Health Prediction Using Machine Learning	M
Real Time Alerts and Notifications	M
Customization of User Information	M
Medication Management / Pill Remainder	M
Automatic Device Synchronization	S
Responsive UI	S
SMS Alert on Fall detection and Health Status Abnormal	S
Chat Service Integration with Doctor	S
Integration of Brain Games	C
Chat with Friends	C
Offline Capability	C
Activity and Sleep Pattern Monitoring	C

Table 2 Functional Requirements

The Senior Shield project being designed to enhance the quality and safety of senior citizens, it has some required features need to be there for its proper implementation. Continuous monitoring of vital signs like heart rate and blood oxygen levels with the IoT devices is its core feature. In addition to continuous

monitoring, the system must be able to detect the fall of elderly people and sending the notification alert to the caregivers. User authentication and authorization are also fundamental to the system, ensuring the data to be accessed by the authorized individuals only. Prediction of health status by leveraging machine learning must be there for proactive health management. Real time alerts and notifications are also integral requirements of the project keeping both users and caregivers informed about the health issues. Other must be features are pill reminders or medication management and user information customization.

To enhance the user experience, the system should support automatic device synchronization where the user's information and data are synchronized according to their credentials. The UI should be responsive across multiple devices. SMS Alert also should be there for fall detection and abnormal health status which is predicted using the machine learning algorithm. Chat Service is also one of the essential features of the project which helps in telemedicine communication with doctors, caregivers as well can chat with peer group too.

Additionally, Senior Shield could have optional features like offline capabilities, integration of mind games, activity and sleep pattern monitoring which might be boon for the end users for improvised healthcare solutions and enhancing the overall quality of life for senior citizens.

ii. Non-Functional Requirements

Non-Functional Requirements	MoSCoW
Security Measures with Data Encryption	**M**
Easy To Use for Seniors and Understandable	**M**
Smooth Working with Traffic Handling	**M**
Compatibility With Multiple Devices	**S**
Continuous Improvement with Feedback and new technology	**S**
Awareness Messages	**S**
Aesthetic Appealing	**C**

Table 3 Non-Functional Requirements

The Senior Shield project's non-functional requirement ensures system performance, usability, and security, among others. Among these key requirements are robust security measures and data encryption for storing the user's personal data. The system must be easy to use for elderly people and functionality must be easily understandable. The system being built using Agile Methodology, continuous improvement on the app should be done on feedback from the user's experience. These requirements collectively ensure the Senior Shield app to be secured, efficient, user-friendly, and adaptable to evolving needs and technologies.

7. IMPLEMENTATION AND TESTING

This section of a project development typically covers the process of transforming the project requirements and design into a working product as well as the activities that are used in testing its quality.

PRODUCT DEVELOPMENT

IoT Device

During this implementation, pulse oximeter and piezo electric sensor were connected to Node MCU microcontroller board via jumper wires to collect and transmit vital health data. The pulse oximeter, a medical sensor, was used to measure the oxygen saturation level (SpO2) and the heart rate in beats per minute. On the other hand, the piezoelectric sensor was integrated for fall detection or motion sensing. This sensor detects the vibration and converts them into electrical signals which enables the identification of unusual movements or falls.

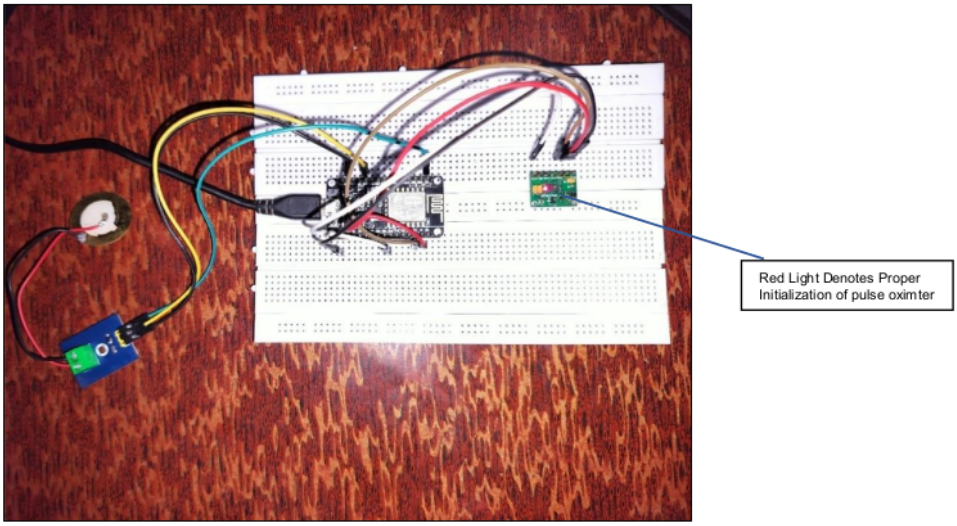


Figure 17 IoT Device Setup

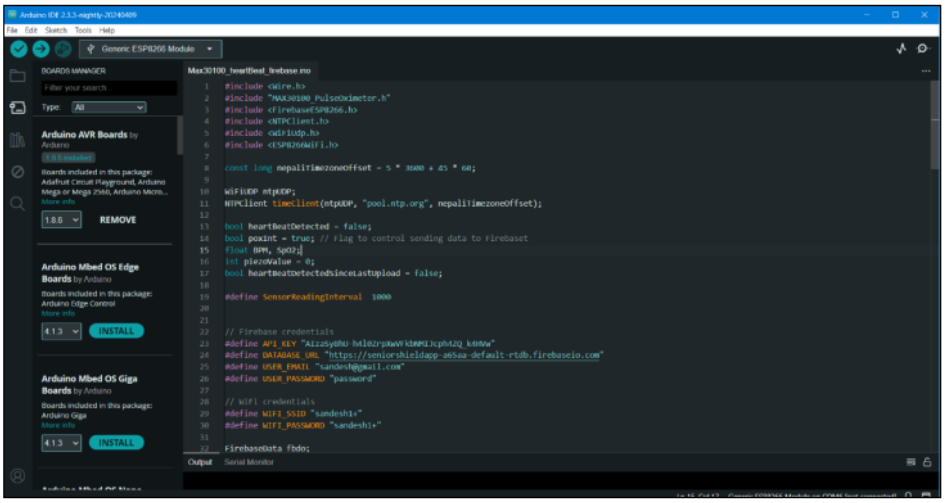


Figure 18 Arduino Code

The pins of Pulse Sensor GND, SDA, SCL and VCC were connected to GPIO pins of Node MCU GND, D2, D1 and V3 respectively. For piezo electric sensor pins positive (+), negative (-) and signal(s) were connected to V3, GND and A0 pins in Node MCU respectively. The complete setup of the project has been displayed in Figure 16.

Now, after the connection of Node MCU, pulse sensor and piezo electric, code was written in C++ inside the Arduino IDE which is also visible in Figure 17. With the help of this code, the pulse oximeter is initiated and starts to read the beat detection and similar for piezo where micro controller receives its signal via analog pin A0. For pulse oximeter, data is extracted to node via digital pin D1 and D2. The code written in Arduino IDE is uploaded to Node MCU via USB port. After reading the proper data from the sensors, the data of sensors are sent to firebase from Node MCU via Wi-Fi network to store for future usages and health monitoring. The Wi-Fi network adapted by Node MCU is 2.4 GHz.

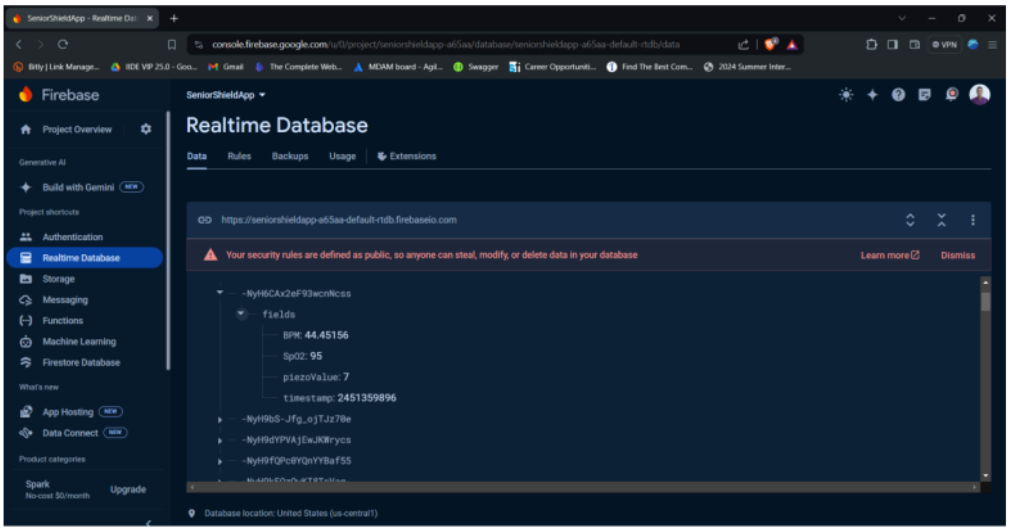


Figure 19 Real-time Firebase Database for Sensor Data Storage

Application Development

During this implementation, android studio was used as IDE to develop an android application. Senior Shield app is developed using Dart Language and its

framework Flutter. Flutter, being a cross platform-based application building framework single code can develop applications for iOS, android, web, and desktop. For this project app development started with development of splash screen and completion with setting screen. I followed MVC architecture during this app development where models, views and controllers are the primary components. Model represents the database manipulation methods to interact with data in database. Views are basically the user interface of the application. Inside this data extracted from model are displayed and interacts with input given by user. Controller in the intermediate between model and view. It helps in handling user input, manipulating the models and updating the view accordingly. The basic file structure for the development of application i.e. Senior Shield is visible below in Figure 20.

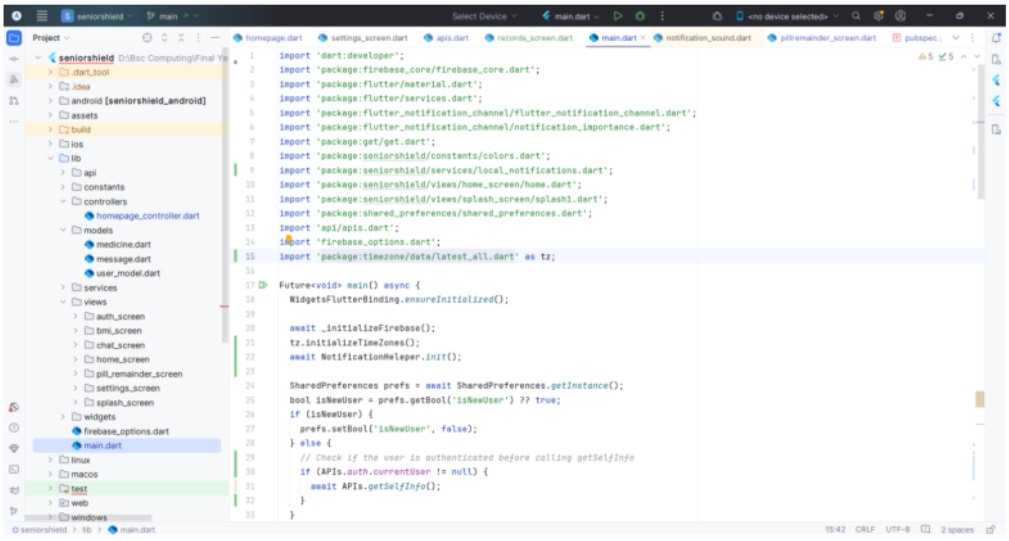


Figure 20 MVC Pattern in App Development

Login Screen

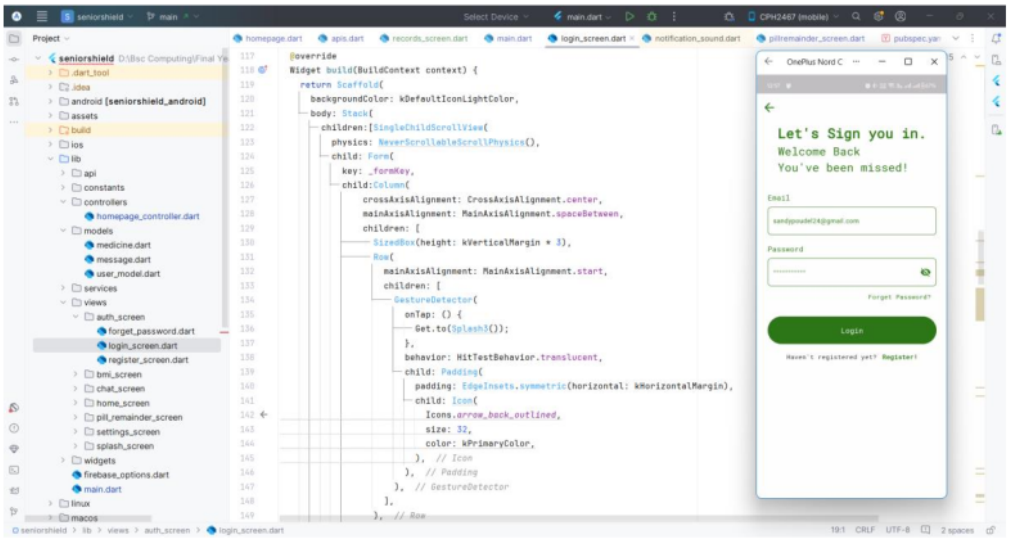
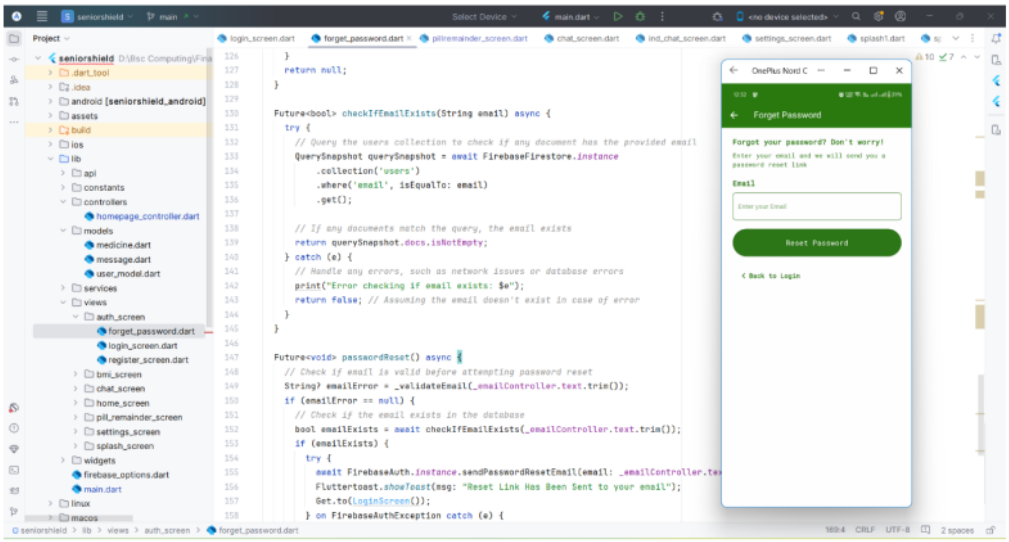


Figure 21 Login Screen

User authentication is an essential part of any mobile application. So, there is great importance of login screen from where user gets access to their personal data and records. A dart file “login_screen.dart” was created for creation of login page where text fields for email and password along with submit button also included in it. Authentication logic has also been implemented to verify the user credentials from Firebase Database. Form validation has also been added for the client side. State management like set-State and get-X has also been added for handling changes.

Forget Password Screen



In any circumstances, if user forgets his/her password, then simply password can be reset using the email address. On entry of valid email on email field in password forget screen, an email will be sent to the email address with a password reset link. Opening the link redirects to webpage to enter new password and user can login again with the new password created.

Register Screen

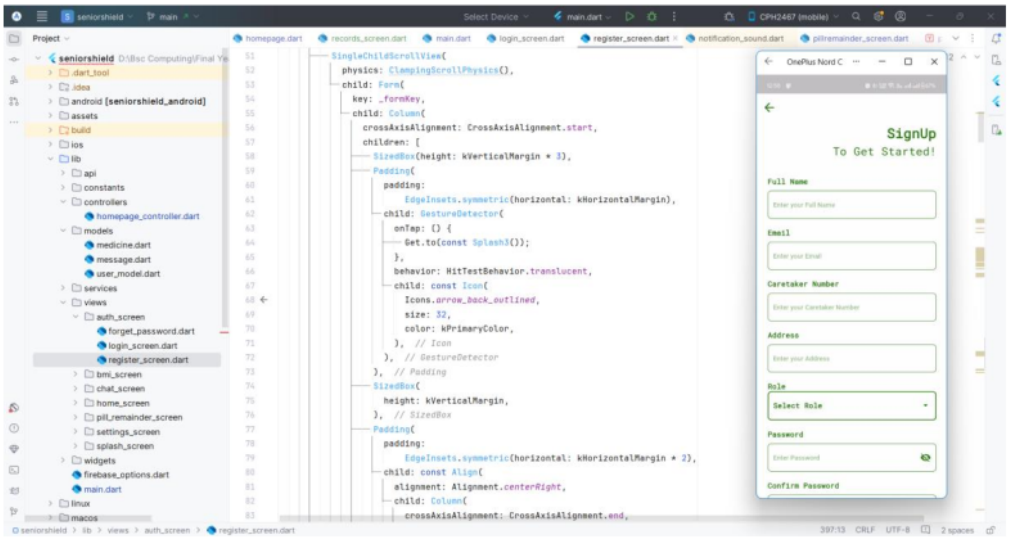


Figure 22 Register Screen

Those who are not registered in the system are required to register before using the application. Therefore, registration screens have equal importance in any sort of app development. “register_screen.dart” was created which includes the field of Full Name, Email, Address, Role, Caretaker Number, password fields. These fields are properly validated from both client side and server side. After successful validation user details are saved in the firebase fire store database to create a new account. After successful registration, it redirects to login page.

Home Screen

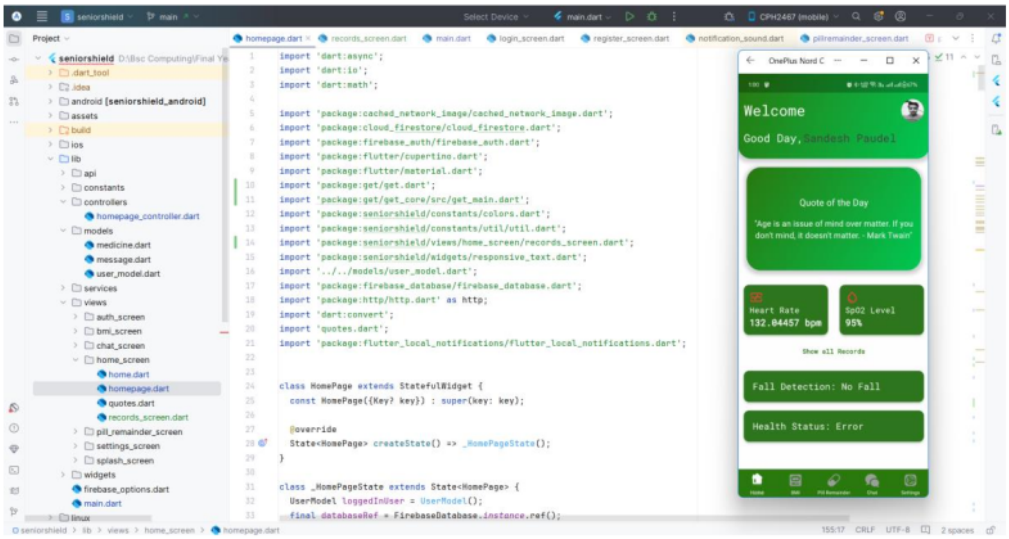


Figure 23 Home Screen

The main landing screen after successful login is the home page. Home Screen is developed with the combination of welcome message, user profile and name, motivational quote, and health monitoring details like heart rate and blood oxygen level. Other features of the app like fall detection status along with prediction of health status have also been integrated into home screen. Through this page user can navigate to health records page to view all the health information and data from the sensors. Flutter's stream builder widget is being used hereby in the homepage for real-time monitoring of health data of elder people. Bottom Navigation Bar has also been added for smoother navigation to various screens as seen in Figure 23. All the contents of home screen are saved in "home_screen.dart" file and other reusable widgets are being imported from widgets directory. On change on data of sensors and health prediction, notification and SMS alert will be sent to caretaker device and number alerting them for abnormal health status, falls and other health impacts. API handling for health status and sending SMS has also been done in home screen itself.

BMI Calculator Screen

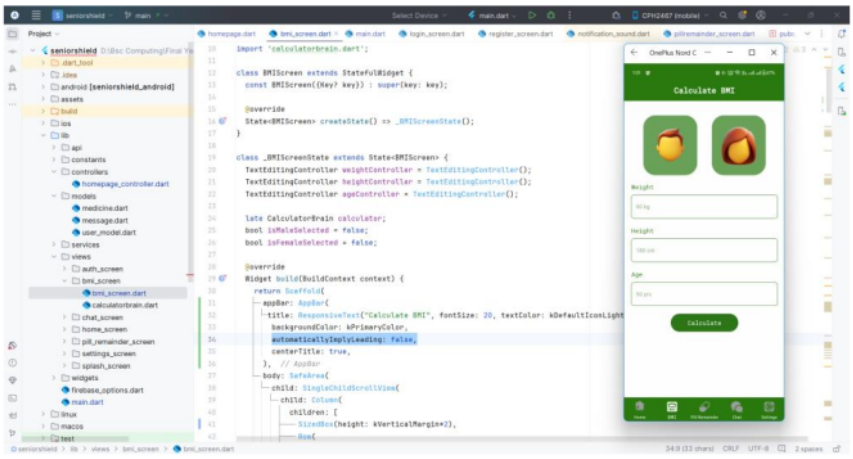


Figure 24 BMI Calculator Screen

File named as “bmi_screen.dart” contents all the code for the BMI calculator. This screen was developed with the purpose of calculating the body mass index and letting user know how well his/her body is. A BMI calculation logic has been implemented in “calculatorbrain.dart” file which in response to user input for gender, weight, height, and age gives a result showing the actual body condition.

Pill Reminder Screen

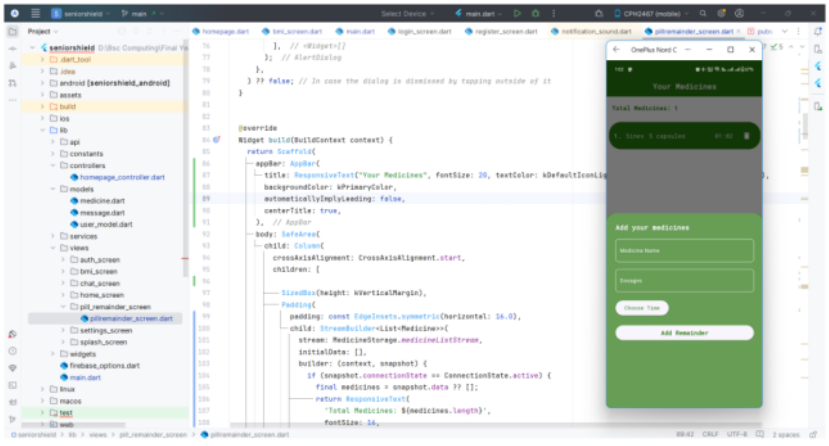


Figure 25 Pill Reminder Screen

One of the core features of Senior Shield is pill remainder which is built for user to get reminder of their medicine prescribed by the doctors and physicians. The data of pill are saved in local storage of device using shared preference packages of flutter. Local notification has been enabled for schedule notification for proper remainder of medicine in specific time specified by the users. A notification service is also created to send the schedule notification at a specified time by the user. Flutter's "flutter_local_notifications" package has been used to make the schedule notification working in pill reminder feature. All the saved medicine information can also be viewed and deleted from the device. All these are done in "pill_remainder_screen.dart" file inside the project directory.

Chat Screen

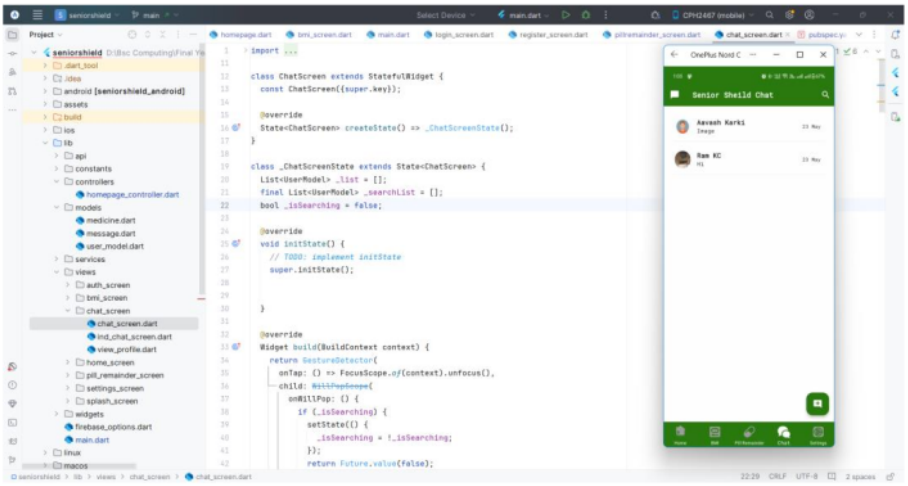


Figure 26 Chat Screen

This page is developed to get telemedicine consultation with doctor. Not only doctors, but the user of mobile devices can also get to chat with caregivers and their peer groups too. "chat_screen.dart" is the main file for this page where Stream Builder is used to view real-time change in chat information. A new user can be added to the chat screen for new chat, but the user must be registered in the application. Search functionality has also been added to the top bar of the screen which helps users in searching for their people for chat. Clicking on user card navigates to individual user's chat screen where user have their personal chats. Here firebase cloud messaging platform is being used to send notification on

message sent to other persons device with the package “cloud_messaging” through push token.

Individual Chat Screen

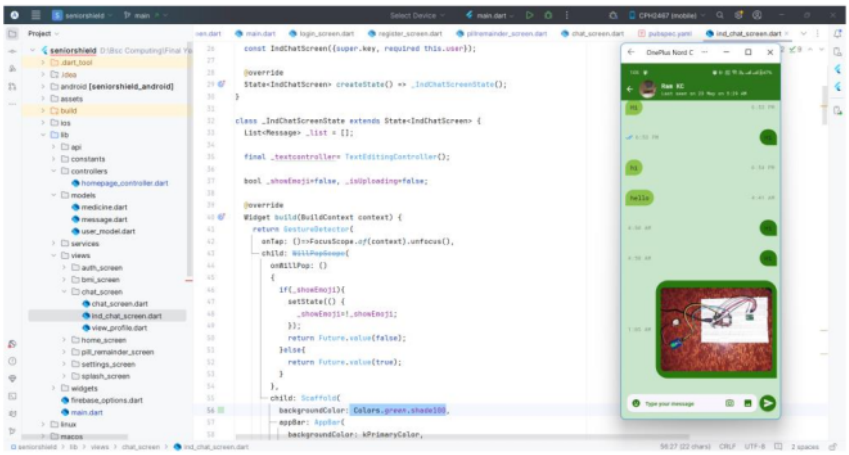


Figure 27 Individual Chat Screen

This page is developed for chatting with individual users. This screen consists of a message card for sending and receiving messages. Users can send text, emoji, and images message though camera and gallery for multiple images too. This helps people to send health information and reports to doctors and caretakers.

Settings Screen

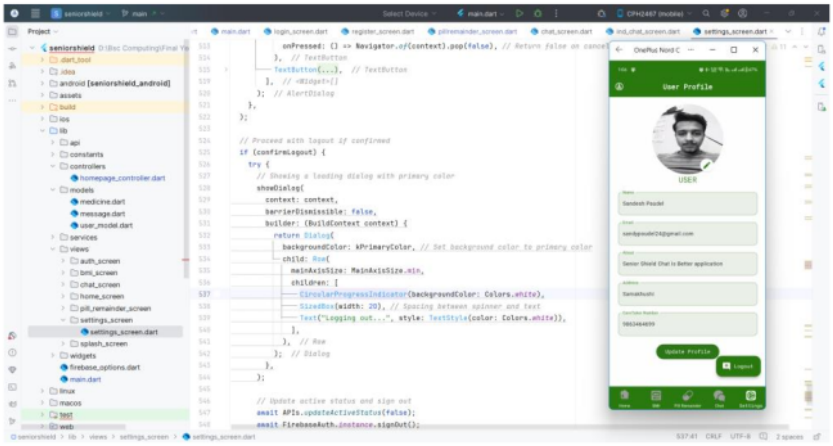


Figure 28 Settings Screen

This screen of app is responsible for customization of user details. Users can change their profile picture and sign out from the application through this screen. “settings_screen.dart” file is created for handling all the features of this screen. Proper validation for updating the user information has been handled on this screen. Validation consists of both client and server side.

Model and API Implementation

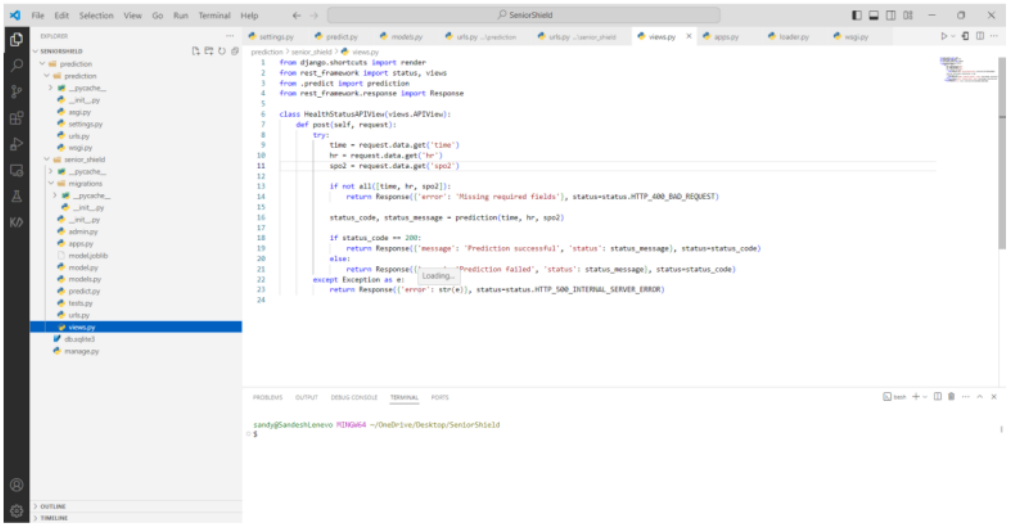


Figure 29 Model and Django API Implementation

A Random Forest model has been developed using python code to predict the health status of elderly people. The model has been fed with around 10000 datasets available on the internet. An API has also been developed using DJANGO, a python framework for sending the status to mobile device. Home Page sends HTTP POST requests to API and extracts the health status from heart rate and SpO2 level. All these features are synchronized in real-time for proper alert and real-time health monitoring. Django application has been developed and implemented on visual studio code IDE.

Firebase Fire store Database

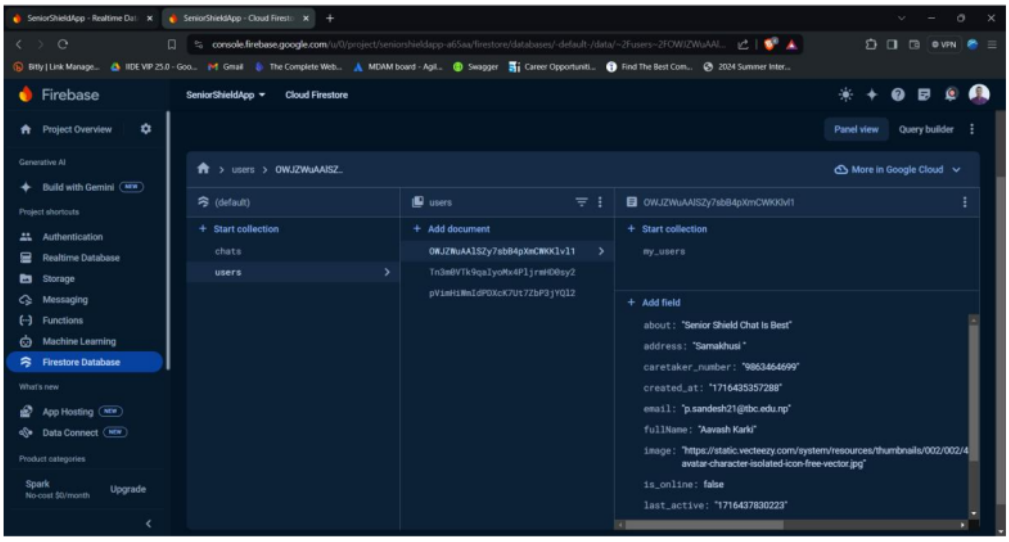


Figure 30 Fire store Database.

A firebase application has been created named “SeniorShieldApp” in firebase database and has also been configured to the application. Cloud-fire store package of flutter helps in connecting the mobile app with application created in firebase. This database is capable of CRUD operations, storing the images, authentication, and other features too. Using this database, user information along with their other data like chats and sensors data have also been stored in the fire store database.

TESTING

Various test cases were built for testing purposes of the application. Test cases are built with some parameters like test id, fields, condition, input, expected output and result whether they are passed or not. Some of essential test cases that were used while testing the application are:

	Test Case ID	Field	Condition	Input	Expected Output	Result
Register	1	Full Name	Empty Field	""	Plesase enter your full name	PASS
	2	Full Name	Numeric Validation	13656	Enter the valid name	FAILED
	3	Full Name	Valid FullName	Sandesh Paudel	No error	PASS
	4	Email	Empty Field	""	Plesase enter your email	PASS
	5	Email	Invalid Email	sandeshpaudel	Enter a valid email	PASS
	6	Email	Already Registered Email	sandesh@gmail.com	The email is already in use	PASS
	7	Email	Valid Email	sandesh123@gmail.com	No error	PASS
	8	Address	Empty Field	""	Plesase enter your addres	PASS
	9	Address	Valid Address	Samakhushi Kathmandu	No error	PASS
	10	CareTaker Number	Empty Field	""	Plesase enter your caretaker number	PASS
	11	CareTaker Number	Invalid Number	9856566sdaf	Invalid number format	PASS
	12	CareTaker Number	Length Limit	6565656	Caretaker number must be 10 digits long	PASS
	13	CareTaker Number	Valid Number	9815572896	No error	PASS
	14	Role	Valid Role	user	No error	PASS
	15	Role	Empty Field	""	Please select a role	PASS
	16	Password	Length Limit	kdsjlkk	Password at least 8 characters long	PASS
	17	Password	Empty Field	""	Please enter your password	PASS
	18	Password	Valid Password	sandesh12345	No error	PASS
	19	Confirm Password	Empty Field	""	Please confirm your password	PASS
	20	Confirm Password	Valid Password	sandesh12345	No error	PASS
Login	1	Email	Empty Field	""	Please enter your email	PASS
	2	Email	Invalid Email Format	sandesh.com	Enter a valid input	PASS
	3	Email	Email Not Found	sandesh1234@gmail.com	Error Loggin In. Invalid Credentials	PASS
	4	Email	Valid Email	sandesh@gmail.com	Login Successful :)	PASS
	5	Password	Empty Field	""	Please enter your password	PASS
	6	Password	Password Length	3565	Password at least 8 characters long	PASS
	7	Password	User not Found	ksajfkalsfjkl	Error Loggin In. Invalid Credentials	PASS
	8	Password	Valid Password	password	Login Successful :)	PASS
Forget Password	1	Email	Empty Field	""	Please enter your email	PASS
	2	Email	Invalid Email	sandesh.com	Enter a valid email	PASS
	3	Email	Unregistered Email	sandes@gmail.com	The email is not registered	PASS
	4	Email	Valid Email	sandesh123@gmail.com	Reset Link has been sent to your email	PASS

Figure 31 TestCases1.

HomePage	1	User Name	LoggedInUser	fullName	Sandesh Paudel	PASS
	2	BPM	Sensor Data / Pulse Oximeter	BPM	78.6565	PASS
	3	SpO2	Sensor Data / Pulse Oximeter	SpO2	95	PASS
	4	Fall Detection	Piezo Value	Fall Detection/ No Fall	No Fall	PASS
	5	Health Status	API	Normal /Abnormal	Normal	PASS
	6	Quote	Daily Quote	Daily Quote	"Tit for Tat"	PASS
BMI Calculator	1	Height	Empty Fields	""	Please fill all the fields	PASS
	2	Height	Valid Input	150	No error	PASS
	3	Weight	Empty Fields	""	Please fill all the fields	PASS
	4	Weight	Valid Input	60	No error	PASS
	5	Age	Empty Fields	""	Please fill all the fields	PASS
	6	Age	Valid Input	40	No error	PASS
Pill Remainder	1	Medicine Name	Empty Field	""	Please enter a medicine name	PASS
	2	Dosages	Empty Field	""	Please enter the dosage	PASS
	3	Time	Empty Field	""	Please enter the time	PASS
	4	Medicine Name	Valid Input	Sinex	No error	PASS
	5	Dosages	Valid Input	3 capsule	No error	PASS
	6	Time	Valid Input	16:54	No error	PASS
Settings Screen	1	Profile Picture	Valid Image Path	Choose from device	Profile Picture Updated Successfully	PASS
	2	Name	Empty Field or Invalid Input	"" or 55265	Please enter your name	PASS
	3	About	Empty Field or Invalid Input	""	Please enter something about yourself	PASS
	4	Address	Empty Field or Invalid Input	""	Please enter your name	PASS
	5	CateTaker Number	Empty Field or Invalid Input	""	Please enter your address	PASS
	6	Profile Picture	Invalid Path	""	No image path found	PASS
	7	Name	Valid Full Name	Sandesh Paudel	No error	PASS
	8	About	Valid About	I am the Best	No error	PASS
	9	Address	Valid Address	Samakhushi Kathmandu	No error	PASS
	10	CateTaker Number	Valid Contact Number	9815595596	No error	PASS
	11	Logout	Cancel	Cancel Button	No error	PASS
	12	Logout	LogOut	LogOut Button	Logout Successful	PASS
Chat Screen	1	Add User	Unregistered or Invalid Email Entered	sandesh@gmail.com	User cannot be added	PASS
	2	Add User	Valid Email Entered	sandesh123@gmail.com	User has been added successfully	PASS
	3	Search User	Enter the user name or email	sandesh123@gmail.com	User is visible on screen	PASS
	4	User Card	All the added User	View User Card	Visible on the screen	PASS
	5	Send Message	nd the Message from Individual Message Scre	Clik on Send Button	Message is send and visible	PASS
	6	Message Notification	Receive the message notification	View the Notification Bar	A message notification is seen	PASS
	7	Image Message	end the Image Message with Camera and Galle	Clik on Camera or Gallery	Image message has been sent and received	PASS

Figure 32 TestCases2.

Various Tests Done for these test cases are:

Login Testing

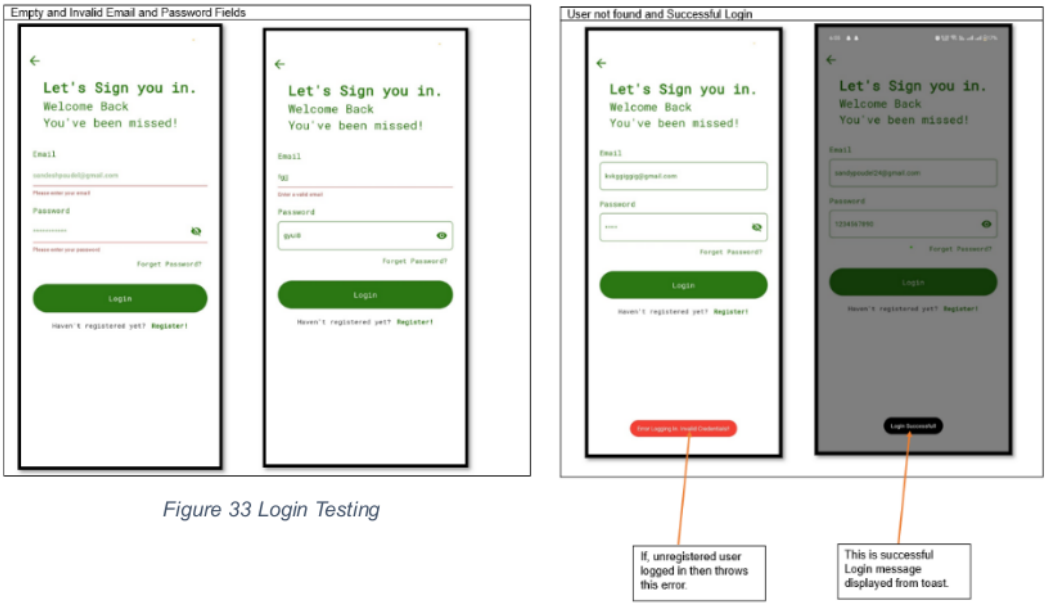


Figure 33 Login Testing

For login testing, empty fields were submitted, and error message is visible on the screen. Invalid email was used and tested, and invalid email message is also visible. In the second image, unregistered email and password have been used and for that error toast message is seen and finally valid email and password passed and successfully logged in message is visible in second image.

Registration Testing

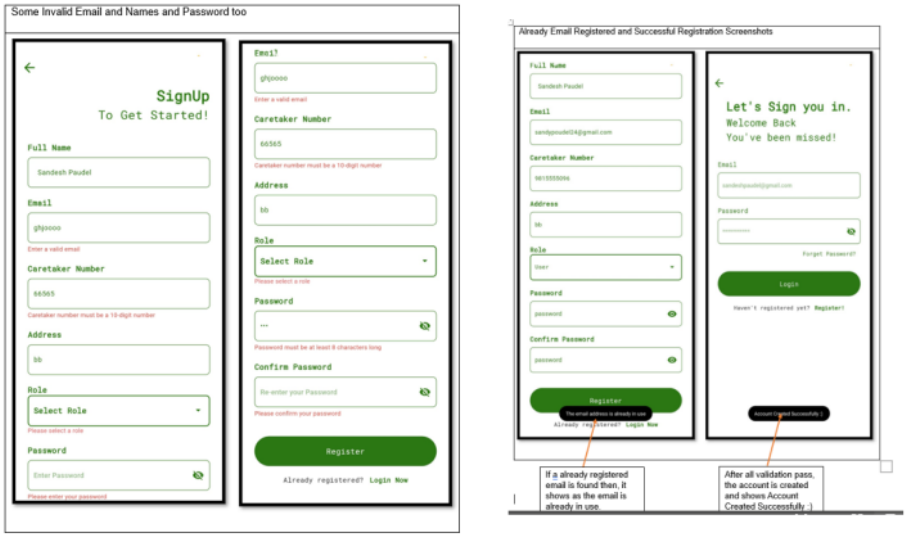


Figure 34 Registration Testing

In the above image, test cases for registration screen were tested which consists of empty fields, invalid email format, already registered email, and other field too and response error and success message is also visible in the screen.

Forget Password Testing

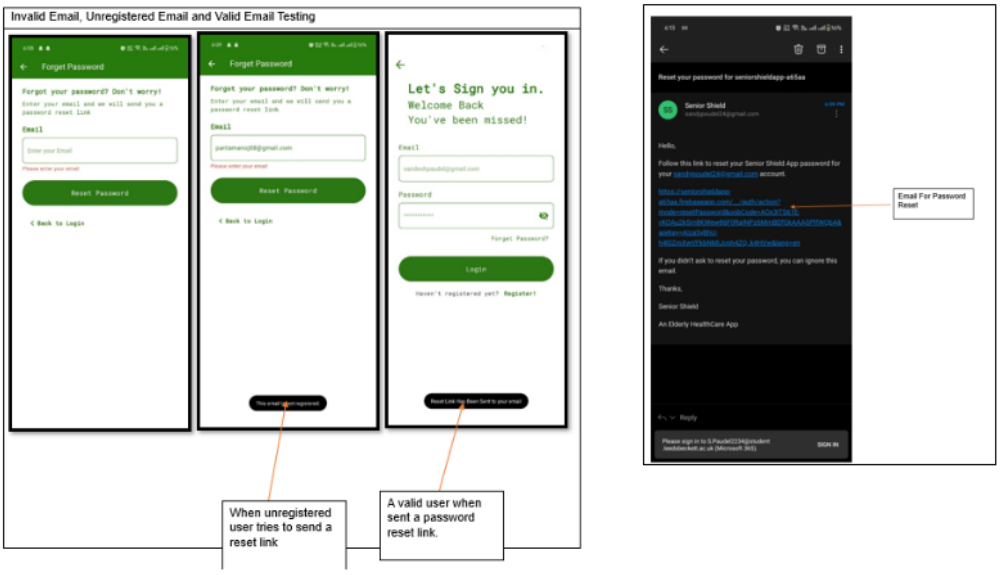


Figure 35 Forget Password Testing

For forget password testing, empty email, invalid email and unregistered email and lastly registered email were used for testing and successive response message are seen in the mobile screen in forget password page.

Home Screen Testing

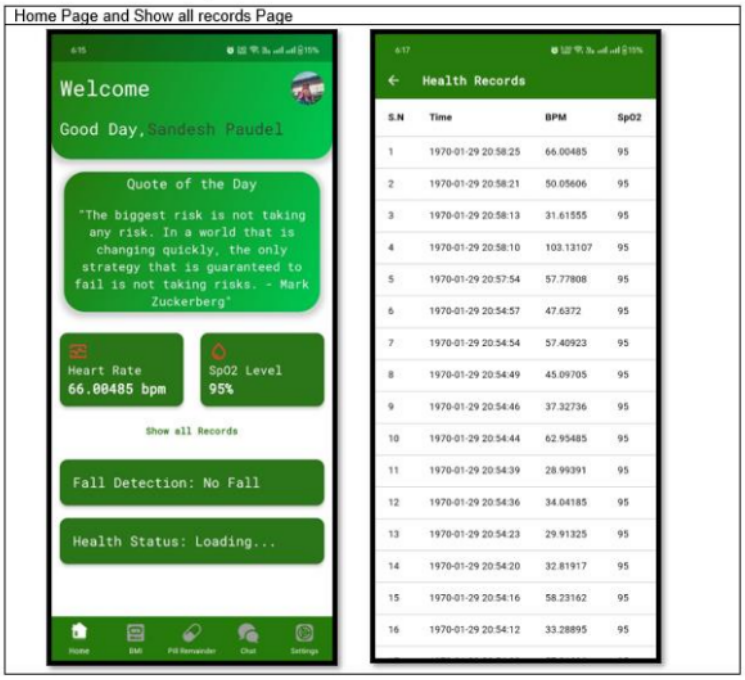


Figure 36 Home Page Testing

In the home screen testing, various data extraction from firebase database were tested. Logged IN username and profile picture were attached as shown in figure 36. Proper quotes are visible along with health data like heart rate and SpO2 level were also extracted with real time change in corresponding to value sent by sensor to firebase. Fall detection and health status is also visible and past records screen is also navigated from home screen.

Notification and Alert Testing

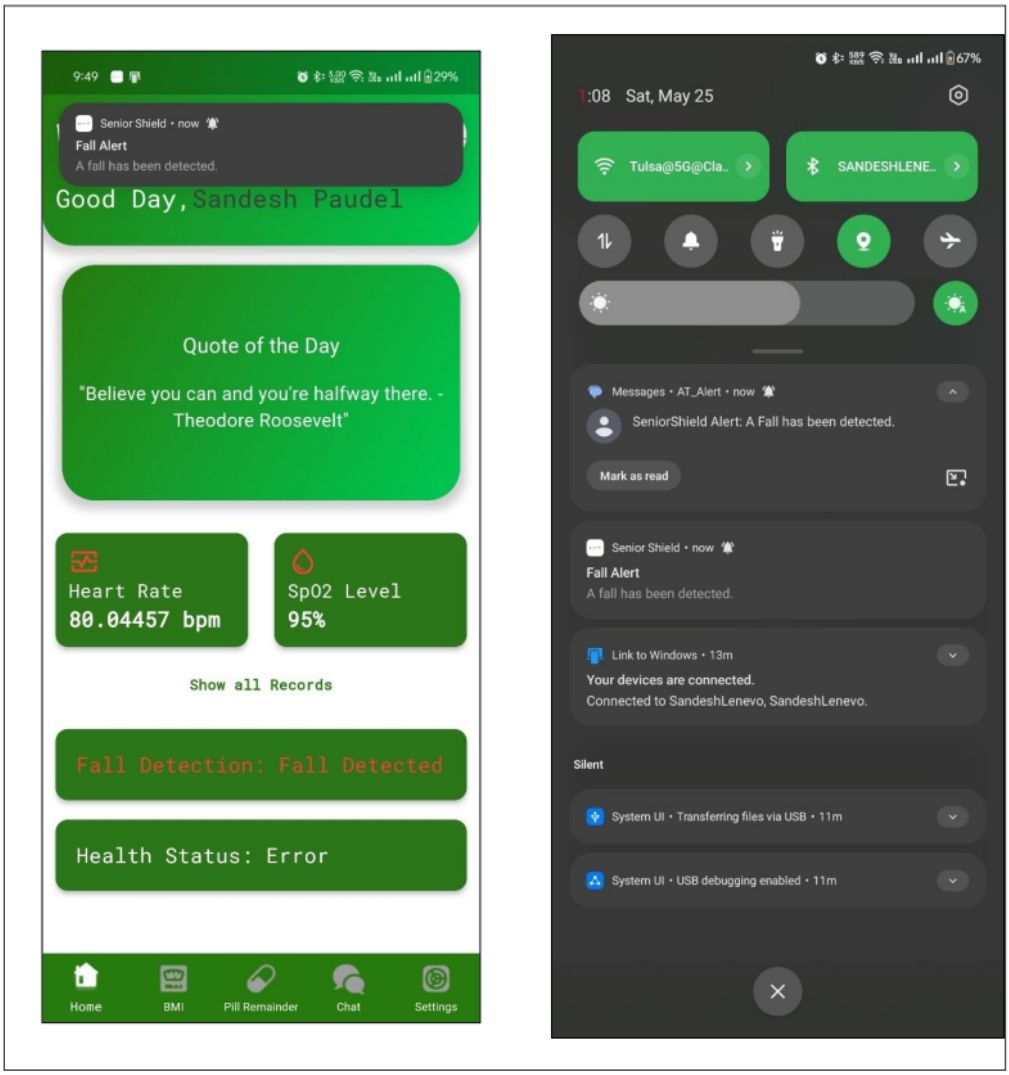


Figure 37 Alert Notification and SMS Testing

On change in fall data of fall detection to Fall Detected, a notification along with SMS alert has been sent to caretaker device and number. Similar functionality is for health status too. In the figure error message is visible because of invalid response from API due to server down.

BMI Testing

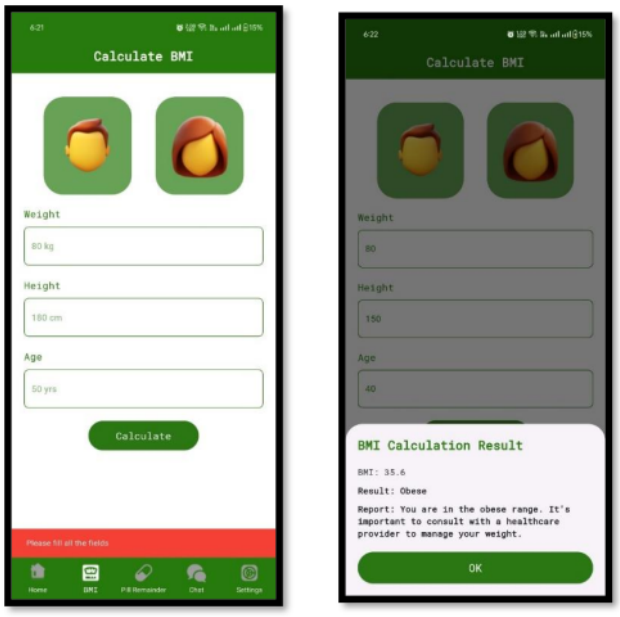
Valid and Invalid input Fields for BMI Calculation


Figure 38 BMI Calculation Testing

In this testing, empty fields were submitted while calculating the BMI. In response to the entry, a snack bar showing error message about empty fields is visible. As soon as the field is filled and submitted the proper calculation of BMI with result is seen as shown in Figure 38.

Pill Reminder Testing

Valid and Invalid Input Screenshots

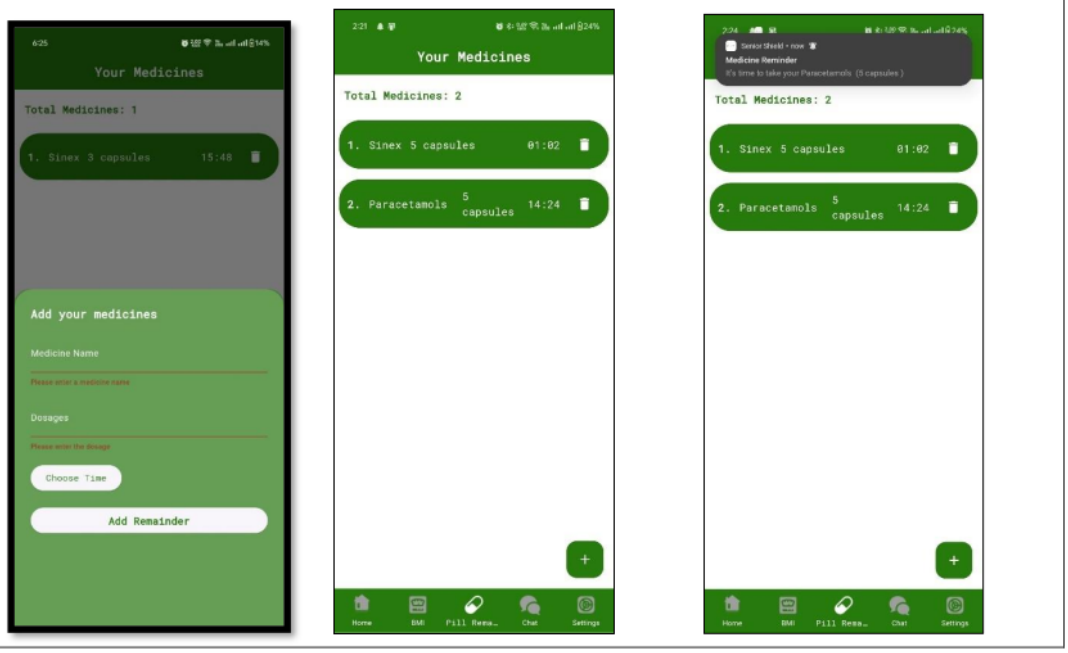
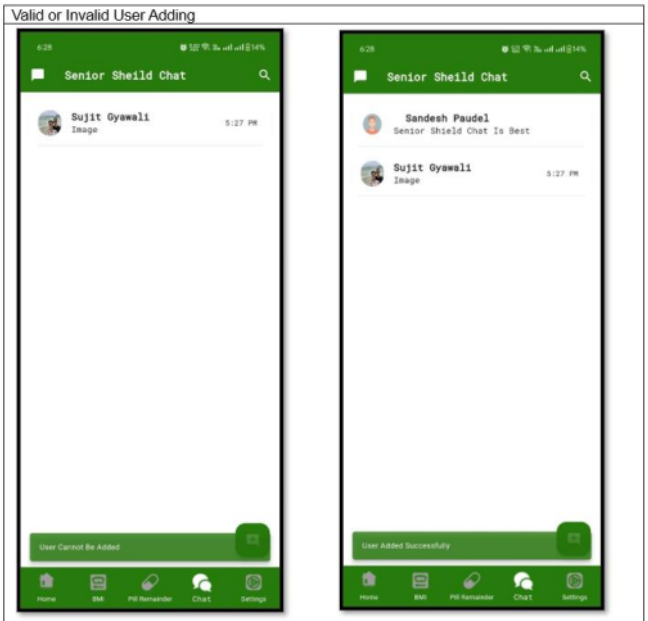


Figure 39 Pill Reminder Testing

While assuring the quality of the feature pill reminder screen, various test cases were taken into implementation. Invalid entry form was submitted to check the empty fields and medicine info will not be saved as well as error message is thrown in its response. After input of valid information for medicine, medicine's data will be stored in local storage using shared preference and are visible in the screen and an alarm notification will be set on the scheduled time and notification is also tested as shown in above figure. This completes the proper testing of pill reminder feature of this app.

Chat Screen Testing

Valid or Invalid User Adding



Message Receiving Notification

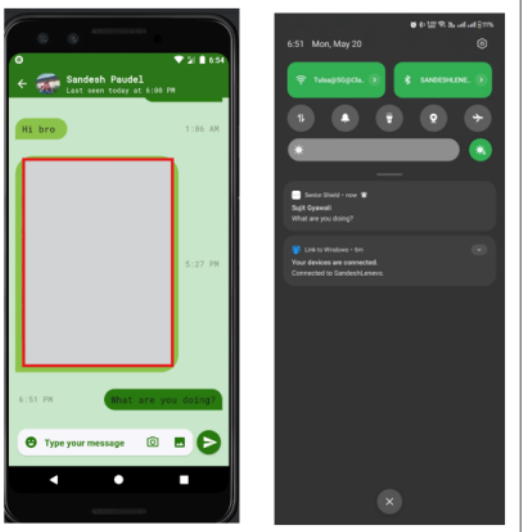


Figure 40 Message Notification Testing

For testing of chat screen and message notification for chat feature, firstly invalid user was tried to be added but can't be added message is thrown via toast. After

adding a valid user, the user card is visible in the screen. Clicking on card redirects to individual chat screen and chat sending and receiving were tested. Push notification on sending and receiving of messages were also tested and successfully passed on the chat feature.

Setting Screen Testing

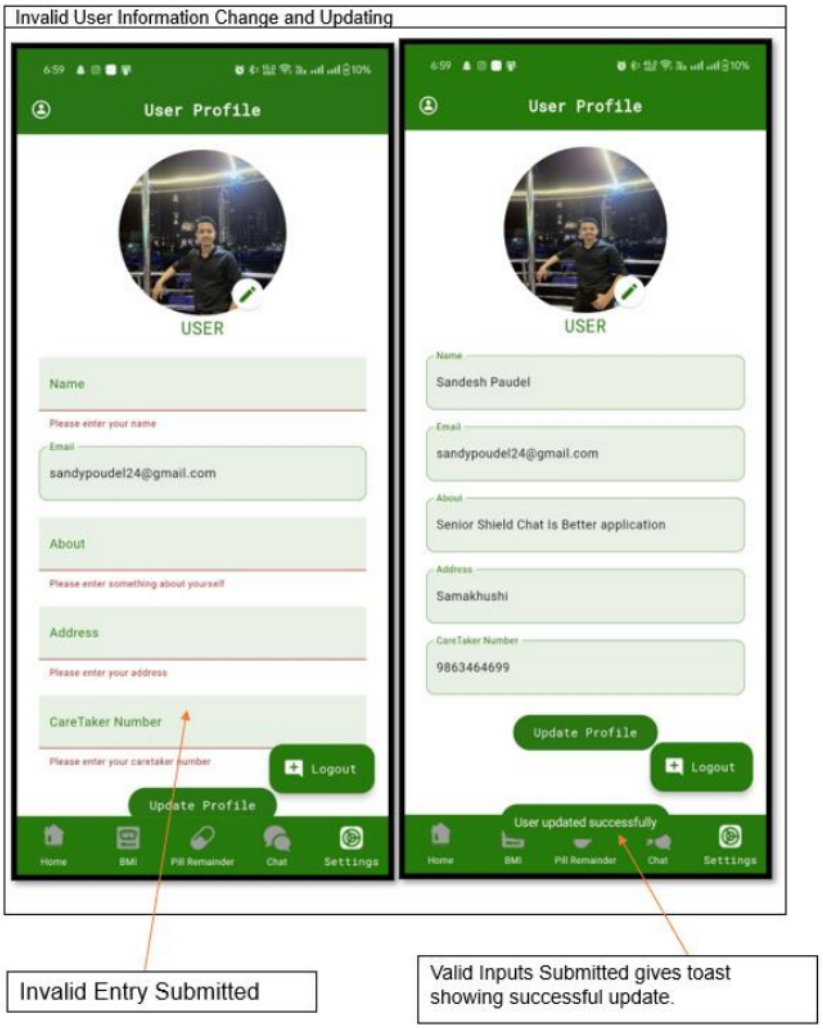


Figure 41 Settings Screen Testing

The testing of setting screen of Senior Shield application consists of form submission for updating profile, logout functionality changes in profile picture. Some testing done for this page can be seen in the Figure above.

8. PRODUCT EVALUATION

The product developed in the project Senior Shield consists of mobile application and IoT Device Integration. In this chapter of report will evaluate how Senior Shield has performed by appraising its incorporation of mobile app and IoT devices according to what was initially intended when planned. The following table represents the core requirements, expectations, outcomes, and their evaluation of success:

S.N.	REQUIREMENT	EXPECTATION	OUTCOMES	EVALUATION
1.	User Authentication and Authorization	Everyone has their own credentials, data, and information regarding health details.	User registers and their new account is created where their personal data are stored and have individual login credentials	SUCCESS
2.	Health Monitoring	Data send via sensors to be stored in database and display in mobile app	The Node MCU sends data to firebase and extracted to homepage in app for real-time monitoring	SUCCESS

3.	Alert and Notifications	Alert the caretaker with notification on fall detection and abnormal health condition	Notifications along with SMS has been added to app to alert on abnormal health condition and fall detection	SUCCESS
4.	Health Prediction Using ML	Machine Learning model to predict health status with data from sensors	With heart rate and SpO2, health status prediction mechanism has been developed using Random Forest algorithm.	SUCCESS
5.	Pill Reminder	Medication reminder to remind the patient to take medicine on time with medicine dosages	Schedule Notification with alarm for specific time to remind for medicine information has been created	SUCCESS
6.	Chat Feature	Feature to take consultation with doctors and caretakers	User can add their doctors via email and start chatting for telemedicine consultation and can chat with other individuals too.	SUCCESS

7.	BMI Calculation	User must be able to calculate the body mass index	Individual can calculate their BMI any time with the BMI calculator feature	SUCCESS

Table 4 Product Evaluation

Overall, when we observe the product evaluation, the Senior Shield project has accomplished all its primary objectives with details and clearness hence providing old ones with healthcare services that are so friendly to use as well as being complete. Each feature from user authentication to health monitoring, alerts and machine learning-based health predictions has been effectively implemented. The system's ability to handle the data securely, smooth operation and remain user-friendly ensures it meets the initial project specification. With respect to initial planning, almost every feature has been implemented ensuring that the system delivers the intended benefits and functionalities.

9. PROJECT EVALUATION

Overall success, project management principles used, how objectives were fulfilled, problems faced, and the outcomes of the Senior Shield will be discussed in this chapter of the report. The complete evaluation of the project will be done with evaluating the following topics:

i. Project Management

Throughout the development of Senior Shield Project, Agile methodology was utilized which allowed iterative development, regular feedback, and flexibility in addressing changes according to the feedback. For defining the overall tasks into smaller units, MS Project software was used in creation task and their duration

with starting and ending time. Here, each of the MS project's components will be used in project evaluation.

i. Task Sheet

	Task	Task Name	Duration	Start	Finish	Predecessors
0		**SeniorSheild_ProjectManagement**	**121 days**	**Fri 12/1/23**	**Sun 5/26/24**	
1		**Initiation Phase**	**26 days**	**Fri 12/1/23**	**Sun 1/7/24**	
2		Module Research	11 days	Fri 12/1/23	Fri 12/15/23	
3		Research on Project Title	4 days	Mon 12/18/23	Thu 12/21/23	2
4		Title Finalization	3 days	Fri 12/22/23	Tue 12/26/23	3
5		**Initial Project Planning Report**	**8 days**	**Wed 12/27/23**	**Sat 1/6/24**	
6		Research on Past Articles,Reports	3 days	Wed 12/27/23	Fri 12/29/23	4
7		Project Specification	3 days	Mon 1/1/24	Wed 1/3/24	6
8		Project Management(MS Project)	2 days	Thu 1/4/24	Fri 1/5/24	7
9		Report Completion	2 days	Fri 1/5/24	Sat 1/6/24	
10		Initial Project Plan Submission	1 day	Sun 1/7/24	Sun 1/7/24	
11		**Planning Phase**	**10 days**	**Mon 1/8/24**	**Fri 1/19/24**	
12		Skill Assessment	3 days	Mon 1/8/24	Wed 1/10/24	10
13		Resource Identification	2 days	Thu 1/11/24	Fri 1/12/24	12
14		Budgeting and Cost Refinement	2 days	Mon 1/15/24	Tue 1/16/24	13
15		Project Schedule Refinement	3 days	Wed 1/17/24	Fri 1/19/24	14
16		**Research and Training**	**23 days**	**Sat 1/20/24**	**Wed 2/21/24**	
17		Literature Review Research from past reports,article	15 days	Mon 1/22/24	Fri 2/9/24	15
18		Research Methodology	12 days	Sat 1/20/24	Mon 2/5/24	
19		Research on IoT Gadgets	13 days	Sun 1/21/24	Tue 2/6/24	
20		Research and Training on Firebase	4 days	Wed 2/7/24	Sat 2/10/24	19
21		Training on IoT devices	4 days	Mon 2/12/24	Thu 2/15/24	20
22		Flutter, Dart and Figma Training	4 days	Fri 2/16/24	Wed 2/21/24	21
23		**Development Phase**	**37 days**	**Thu 2/22/24**	**Fri 4/19/24**	
24		Logo Design	3 days	Thu 2/22/24	Mon 2/26/24	22
25		Prototype and Iterative Development	16 days	Sat 2/24/24	Fri 3/15/24	
26		IoT Device Integration	6 days	Sat 3/16/24	Fri 3/22/24	
27		Database Management i.e. FireBase	7 days	Tue 3/26/24	Wed 4/10/24	26
28		Backend Development	11 days	Thu 4/4/24	Fri 4/19/24	
29		**Testing and Evaluation Phase**	**15 days**	**Fri 4/19/24**	**Thu 5/9/24**	
30		Cross Platform Testing on Personal system	2 days	Fri 4/19/24	Mon 4/22/24	28
31		UI Optimization	3 days	Tue 4/23/24	Thu 4/25/24	30
32		Performance Testing	2 days	Fri 4/26/24	Sat 4/27/24	31
33		Supervisor Feedback Analysis	7 days	Mon 4/29/24	Tue 5/7/24	32
34		User Satisfaction Survery	2 days	Wed 5/8/24	Thu 5/9/24	33
35		**Closing Phase**	**11 days**	**Fri 5/10/24**	**Sun 5/26/24**	
36		Documentation and File Management	6 days	Fri 5/10/24	Fri 5/17/24	34
37		Submission of Final Product	3 days	Mon 5/20/24	Wed 5/22/24	36
38		Final Demo/Presentation	3 days	Thu 5/23/24	Sun 5/26/24	37

TASK SHEET

TASK SHEET

Figure 42 Task Sheet

The Task Sheet above outlines the Senior Shield project's phases initiation, planning, research and training, development, testing and evaluation with closing phase. Each phase was organized properly so that the project would be completed on time. The starting and ending time of each phase were declared so that task completion would be punctual.

ii. Gantt Chart

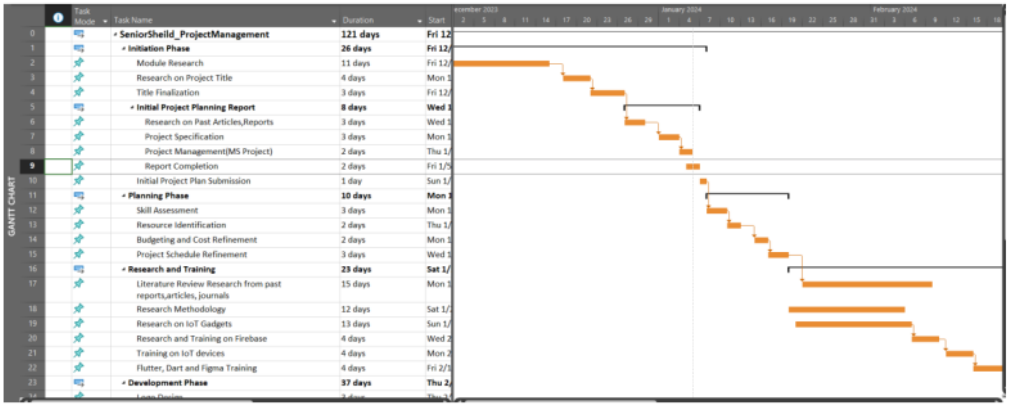


Figure 43 Gantt Chart

This represents the visual representation of tasks showing the starting and ending date of project. It helps in tracking the project progress and identifying potential scheduling conflicts and delays.

iii. Timeline

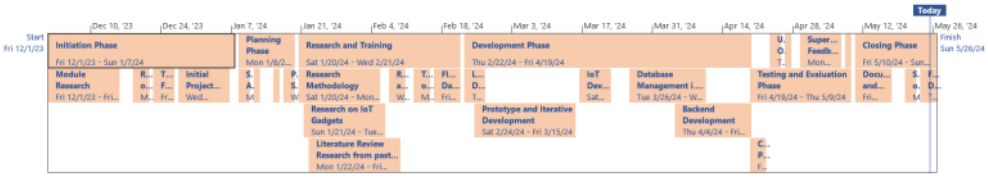


Figure 44 Timeline.

The timeline shows the overall progress of the project. The project was started on December 1, 2023, and would be completed on 26 May 2024. The chart highlights task dependencies and overlaps that facilitate effective management of project and timely completion of project.

ii. Achievement of Aims and Objectives

The primary aim of Senior Shield project was to establish an integrated comprehensive health management system for elder people combining mobile application with IoT. The system now provides continuous monitoring of health data through IoT sensors that sends the real-time data to firebase database and can be accessible to mobile app. Proper user authentication and authorization added in

the system ensures the protection of health related as well as other information too. The alert via notification and SMS has enhanced the safety mechanism with informing the caretakers on falls and abnormal health conditions on fault on real time health data. The implementation of Random Forest algorithm to predict the health status of elderly people based on collected data provides valuable insights to the application. Medication management or Pill Reminder is also acting as adherence to treatment plan with reminder of taking medicine timely. Communication feature i.e. Chat Integration in the system has ensured the health care better with telemedicine chat with doctors and caretakers. Additional features like BMI calculations and daily motivational messages also provide support for elderly overall wellbeing. Almost all the aims were successfully implemented, fulfilling the project's primary objectives comprehensively.

iii. Problems and Issues Encountered

On the process of completing the project various problems and issues were encountered. Initially, I had issues with integration of IoT Devices. Using the IoT gadgets for the first time made me feel like I would not be able to complete the project. After some research on the devices and their connection I was able to connect the IoT with mobile applications. While sending the data to firebase via Node MCU, further issues were arisen in pulse oximeter. The device was not reading the bpm and SpO2 while adding the code that sends their data to firebase. The issue really made me frustrated, and it was hard to solve. Somehow, the issue was solved.

Additionally, there were many issues while developing mobile applications too. While adding features like medication reminder the problem was with schedule notifications. It was much harder than I thought I would be. I got some issues with implementing chat features in the app. The chat should be differentiated according to the users, so it was little confusing to build.

I would rather say confusion than issue I got while designing the user interfaces. Elder friendly as well as aesthetic appealing was the concept of design and various feedback were taken while designing the UI. Additionally, development of an accurate health prediction model using machine learning was complicated too. From finding the training dataset and data processing as well as development of API via Django was giving some sort of problems.

Overall, solving these problems was some sort of fun. It is the beauty of project development to tackle problems and progress the project onward solving these issues and obstacles.

iv. Overall, Success on Project and Project Management Methods

Despite encountering several problems, the project still achieved significant success both in terms of project outcomes and project management methods used in the project. The comprehensive functionality of the system stands out as a major achievement. Successful integration of all planned features like continuous health monitoring, alert, and notifications system on abnormal and fall detection, prediction of health status, medication management, chat functionalities, BMI calculation resulted in versatile healthcare solution.

The efficient application of the project management method i.e. Agile methodology played a crucial role in successful project completion. It ensured the task prioritization with regular iterative development and due to its flexibility to adapt to change feature made the project completed on time addressing all the issue swiftly.

10. SUMMARY/ CONCLUSION

Senior Shield is a healthcare project aiming to provide comprehensive healthcare monitoring system designed for senior citizens by incorporating IoT Devices and machine learning algorithm through a user-friendly mobile application. Careful steps have been taken from the initiation of research, planning of project, and development until evaluating this project to provide or ensure that every aim is effectively implemented. Agile Methodology was used to accomplish those steps. Features have been successfully developed to provide users with a system that allows them to receive real-time insights of their body. Continuous health monitoring, health status prediction, medication reminder, machine learning based health status prediction, chat functionalities and other features like BMI calculation and health awareness message as well as motivational quote made the system efficient and robust in the field of health sector. Each of the features integrated in the system has their own importance in the project. The sensors like pulse oximeter which gives blood oxygen level as well as heart beats and piezo electric sensor which changes mechanical signal or shock into electrical were integrated with the help of micro controller i.e. Node MCU and reading from those sensors were sent to database via Wi-Fi. Those data were received on mobile devices through the connection of firebase and mobile application. For medication management, medicine information is saved in local storage and alerting the user in specified time with reminder to take medicine. Similar for chat feature too. A chat section is created where user can add another person to whom he/she wants to chat and get consultation related to their health or personal talks with peer. A random forest algorithm has also been integrated to provide health status prediction in response to their health data. Although, the project had plenty of problems in the development phase, integration phase and designing phase but still project got hand on successful result passing all the requirements that were aimed during the planning.

Talking about findings, the project results are mostly success cases and possible improvements. It was a great achievement, whereby the IoT gadgets has been

integrated into the mobile application in such manner to allow real time health monitoring for which data transfer has been smoother and efficient. The overall applied usability and reliability were general satisfactions based on UI designs and the total user experience that confirmed the success. Proper user authentication and authorization including data encryption were successfully implemented resulting in protection of user sensitive health information. The machine learning approach utilizing Random Forest, provided effective health status prediction which also enabled proactive health management.

There are so many potential ideas and improvements that can be instilled in the Senior Shield system. User's sleep pattern monitoring, activity monitoring, diet management can add some extra help in uplifting the system. Some other health metrics can be included in the system like glucose or sugar level and ECG monitoring for better health status prediction. Deeper exploration and development of advanced AI models also make improvision in accuracy and predictive potential health monitoring. Communication channels could be made better with the inclusion of video consultations with health professionals and caregivers. Alert mechanisms can be made more accurate by handling the trigger to send alert messages and notification on time using cloud functions like Firebase Functions which can send notification on change on data in its database. All the above-mentioned future enhancements will only make the system better and ensure that it gets kept up to date with developing needs of elderly healthcare in both functional and user experience. Above all, the Senior Shield project has been successfully executed to deliver an advanced health care system. This system is flexible enough to meet the needs of elderly people, therefore making it possible to improve quality and wellbeing of life along with safety. Due to this fact, the project paves way for more innovations in this very important area.

Bibliography

Anon., 2019. *Electronics For You*. [Online]
Available at: https://www.electronicsforu.com/technology-trends/learn-electronics/piezoelectric-sensor-basics
[Accessed 09 03 2024].

Atlassian Agile, n.d. *What is the Agile methodology?*. [Online]
Available at: https://www.atlassian.com/agile
[Accessed 18 05 2024].

Basanta, H., P. Huang, Y. & Lee, T. T., 2016. *Intuitive IoT-based H2U healthcare system for elderly people*. Mexico City, Mexico, IEEE, pp. 1-6.

Beck, K. et al., 2001. *The Agile Manifesto*. [Online]
Available at: https://www.agilealliance.org/agile101/the-agile-manifesto/
[Accessed 18 05 2024].

Chaudhary, N. K., Krumme, A. A. & Ercole, P. M., 2017. Effect of Reminder Devices on Medication Adherence. *The REMIND Randomized Clinical Trial*, 177(5), pp. 624-631.

Educative, 2024. *What is Visual Studio Code?*. [Online]
Available at: https://www.educative.io/answers/what-is-visual-studio-code
[Accessed 25 05 2024].

Furizal, F., Ma'arif, A. & Rifaldi, D., 2023. Application of Machine Learning in Healthcare and Medicine: A Review. *Journal of Robotics and Control*, Volume 4, p. 2023.

Geeks For Geeks, 2021. *Firebase – Introduction*. [Online]
Available at: https://www.geeksforgeeks.org/firebase-introduction/
[Accessed 25 05 2024].

Geeks, G. F., 2024. *Importance of Software Requirements Specification (SRS)*. [Online]
Available at: https://www.geeksforgeeks.org/importance-of-software-requirements-specification-srs/
[Accessed 20 05 2024].

Hassan, A. et al., 2021. *Data Science and Innovations for Intelligent Systems*. 1 ed. s.l.:CRC Press.

Irfan, et al., 2023. Remote Health Monitoring Systems for Elderly People: A Survey.. *Sensors (Basel)*, 232(16 7095).

Ismailov, A. S., Jo'rayev, Z. B. & Institure, A. M. B., 2022. Study of arduino microcontroller board. *Science and Education" Scientific Journal*, 3(3).

Kamani, D. V., 2021. *Agile Software Development In Healthcare: Benefits and Crucial Considerations.* [Online]
Available at: https://arkenea.com/blog/agile-software-development-in-healthcare/
[Accessed 18 05 2024].

Madhu, S., Jyothi, K., Pravallika, S. & Sridurga, N., 2023. *IoT-Enabled Applications for Elderly Support and Care: A Systematic Review.* Singapore, Springer.

Mahgoub, et al., 2015. Health monitoring system using Pulse Oximeter with remote alert. In: *2015 International Conference on Computing, Control, Networking, Electronics and Embedded Systems Engineering (ICCNEEE).* s.l.:IEEE, pp. 357-361.

Make It Ca, 2020. *NodeMCU ESP8266 Detailed Review.* [Online]
Available at: https://www.make-it.ca/nodemcu-details-specifications/
[Accessed 14 05 2024].

Marathe, S., Zeeshan, D., Thomas, T. & Vidhya, S., 2019. *A Wireless Patient Monitoring System using Integrated ECG module, Pulse Oximeter, Blood Pressure and Temperature Sensor.* Vellore,India, IEEE, pp. 1-4.

Pinto, S., Cabral, J. & Gomes, T., 2017. *We-Care: An IoT-based Health Care system for Elderly People.* s.l., s.n.

Roy, H. S., Khondakar, M. F. K. & Sarowar, M., June 2022. Internet of things based fall detection and heart rate monitoring system for senior citizens. *International Journal of Electrical and Computer Engineering (IJECE).*

Tech Target, 2024. *Android Studio.* [Online]
Available at:
https://www.techtarget.com/searchmobilecomputing/definition/Android-Studio
[Accessed 25 05 2024].

Yu, J., Park, S. J., Lee, H. & Pyo, C.-S., 2020. An Elderly Health Monitoring System Using Machine Learning and In-Depth Analysis Techniques on the NIH Stroke Scale. *Mathematics,* 06 07, Volume 8, p. 1115.

Appendices

i. Ethical Approval Form

STAGE 1 - RESEARCH ETHICS APPROVAL FORM

Research by students and staff at the University must receive ethical approval before any data collection commences. Applications may be made on the Research Ethics Online system or via approval forms.

If using the approval forms, applicants complete this Stage 1 - Research Ethics Approval Form which includes the Risk Checklist.

For student projects classified as Risk Category 1 (e.g., many literature reviews), these can be approved on this Stage 1 – Research Ethics Approval Form by the Research Supervisor.

Applicants whose research studies are classified as Risk Category 2 or 3 must also complete and submit the separate Stage 2 - Research Ethics Approval Form.

Guidance for completion of this form and the application process is provided on pages 3 and 4.

APPLICANT DETAILS	
Your name (if a group project, include all names)	Sandesh Paudel
School	The British College Kathmandu
STATUS	
• Undergraduate student	☒
• Taught Postgraduate student	☐
• Research Postgraduate student	☐
• Staff member	☐
• Other (give details)	
IF THIS IS A STUDENT PROJECT	
• Student ID	77297958
• Course title (eg, BA (Hons) History)	BSc(Hons) Computing
• Student email	S.Paudel2234@student.leedsbeckett.ac.uk / p.sandesh21@tbc.edu.np
• Research Supervisor's name Or Director of Studies' name	Rohit Raj Pandey
THE PROJECT/STUDY	
Project /study title	Senior Shield- Next-Gen HealthCare App for Elderly
Start date of project	1st Dec 2023
Expected completion date of project	27th May 2024
Project summary – please give a brief summary of your study (maximum 100 words)	
My project is about the IoT-base Healthcare solution for the elderly, featuring continuous vital sign monitoring, fall detection, medication management, and real time alerts.With the user-friendly interface, the project aims to enchance elderly care, offering a cost-effective solution for health and safety at home. The system also ensures the user authentication, location tracking, and integrates with brain games too for well being of the old ones.	

CONFIRMATION STATEMENTS	
The results of research should benefit society directly or by generally improving knowledge and understanding. Please tick this box to confirm that your research study has a potential benefit. *If you cannot identify a benefit you must discuss your project with your Research Supervisor to help identify one or adapt your proposal so the study will have an identifiable benefit.*	☒
Please tick this box to confirm you have read the Research Ethics Policy and the relevant sections of the Research Ethics Procedures and will adhere to these in the conduct of this project.	☒

RISK CHECKLIST - Please answer ALL the questions in each of the sections below – tick YES or NO WILL YOUR RESEARCH STUDY.....?		YES	NO
1	Involve direct and/or indirect contact with human participants?	☒	☐
2	Involve analysis of pre-existing data which contains personal or sensitive information not in the public domain?	☐	☒
3	Require permission or consent to conduct?	☒	☐
4	Require permission or consent to publish?	☒	☐
5	Have a risk of compromising confidentiality?	☐	☒
6	Have a risk of compromising anonymity?	☐	☒
7	Collect / contain sensitive personal data?	☐	☒
8	Contain elements which you OR your supervisor are NOT trained to conduct?	☐	☒
9	Use any information OTHER than that which is freely available in the public domain?	☒	☐
10	Involve respondents to the internet or other visual/vocal methods where participants may be identified?	☐	☒
11	Include a financial incentive to participate in the research?	☐	☒
12	Involve your own students, colleagues or employees?	☒	☐
13	Take place outside of the country where you are enrolled as a student, or for staff, outside of the UK?	☐	☒
14	Involve participants who are particularly vulnerable or at risk?	☐	☒
15	Involve any participants who are unable to give informed consent?	☐	☒
16	Involve data collection taking place BEFORE informed consent is given?	☐	☒
17	Involve any deliberate deception or covert data collection?	☐	☒
18	Involve a risk to the researcher or participants beyond that experienced in everyday life?	☐	☒
19	Cause (or could cause) physical or psychological harm or negative consequences?	☐	☒
20	Use intrusive or invasive procedures?	☐	☒
21	Involve a clinical trial?	☐	☒
22	Involve the possibility of incidental findings related to health status?	☐	☒
23	Fit into any of the following security-sensitive categories: concerns terrorist or extreme groups; commissioned by the military; commissioned under an EU security call; involves the acquisition of security clearances? If yes, see the guidance.	☐	☒

CLASSIFICATION The following guidance will help classify the risk level of your study	Tick the box which applies to your project
If you answered **NO** to all the above questions, your study is provisionally classified as **Risk Category 1** (literature reviews will be Risk Category 1).	☐
If you answered **YES** to any question from 1-13 and **NO** to all questions 14-22, your study is provisionally classified as **Risk Category 2**.	☒
If you answered **YES** to any question from 14-22, your study is provisionally classified as **Risk Category 3**.	☐
If question 23 has been answered **YES**, your application will be reviewed by the Chair of the University Research Ethics Sub-committee	☐

DECLARATION AND SIGNATURE/S			
I confirm that I will undertake this project as detailed above. I understand that I must abide by the terms of the approval and that I may not make any substantial amendments to the project without further approval.			
Signed		*Date*	30th Jan 2024

FOR RISK CATEGORY 1 STUDENT PROJECTS						
Approval from the Research Supervisor or Director of Studies for a student project: *I have discussed the ethical issues arising from the project with the student. I approve this project.*						
Name	Rohit Raj Pandey	*Signed*			*Date*	30th Jan 2024

NEXT STEP
RISK CATEGORY 1 PROJECTS: IF YOUR PROJECT HAS BEEN CLASSIFIED AS RISK CATEGORY 1: • Students: The Research Supervisor should return the signed form to the student and send a copy to the Local Research Ethics Co-ordinator and where relevant, the Research Module Leader, for information. • Staff: Submit this form to your Local Research Ethics Co-ordinator. **RISK CATEGORY 2 OR 3 PROJECTS:** IF YOUR PROJECT HAS BEEN CLASSIFIED AS RISK CATEGORY 2 OR 3 please complete the Stage 2 - Research Ethics Approval form and submit both forms together with supporting documentation. **QUESTION 23:** If this question has been answered **YES**, your application will be reviewed by the Chair of the University Research Ethics Sub-committee, and the forms should be submitted directly to Professor Karl Spracklen, k.spracklen@leedsbeckett.ac.uk. You will need to submit the Security-sensitive research form available from the Research Ethics web page. *Research ethics application forms will be retained in the School for the purposes of quality assurance of compliance and audit for THREE years*

NOTES FOR COMPLETION

University Research Ethics Policy and Procedures: The University Research Ethics Policy and Research Ethics Procedures should be read prior to commencing this application. Consideration of the application by the reviewer/s will be undertaken in accordance with the Policy and Procedures.

External requirements for the project: Applicants should consider if there are requirements by any relevant professional, statutory or regulatory body, or learned society, which may be relevant to the project or if the project also requires external approval.

Submission

- Student applicants: email the typed form/s to your Research Supervisor or Director of Studies.
- Staff applicants: email the typed form/s to your Local Research Ethics Co-ordinator.

How to complete the form

You can navigate through the form by using the tab keys. If you prefer to complete a normal Word document, you can unlock the form by selecting the 'Restrict Editing' button on the Developer tab, then click on 'Stop Protection'. The boxes should expand to allow space for your text.

Signatures
Electronic/typed signatures are acceptable for emailed forms, as the emails provide the audit trail for all parties' agreement and approval of the forms (e.g., student applicant →Research Supervisor →Local Research Ethics Co-ordinator).

Outcome
Applicants will be advised of the outcome of the application by receipt of the signed form fromm:

- The Research Supervisor or Director of Studies for Risk Category 1 student projects;
- The Local Research Ethics Co-ordinator or the School level group for Risk Category 2 and 3 projects.

YOU MAY ONLY BEGIN ANY DATA COLLECTION ONCE YOU RECEIVE NOTIFICATION THAT THE PROJECT HAS ETHICAL APPROVAL. If the circumstances of your research study change after approval it is your responsibility to revisit the Risk Checklist and complete a further application.

Advice
When completing the Stage 1 - Research Ethics Approval Form,. if you are uncertain about the answer to any question, read the relevant section of the Research Ethics Procedures document, and if you are still unsure:

- if you are student, seek guidance from your Research Supervisor or Director of Studies;
- if you are a staff member, contact your Local Research Ethics Co-ordinator.

LEEDS BECKETT UNIVERSITY

STAGE 2 - RESEARCH ETHICS APPROVAL FORM

All research carried out by students and staff at the University must receive ethical approval before any data collection commences.

Notes

- Applicants complete the Risk Checklist and Stage 1 - Research Ethics Approval Form prior to completing this Stage 2 - Research Ethics Approval Form. Following completion of the Risk Checklist and Stage 1 - Research Ethics Approval Form, if your research study was provisionally classified as Risk Category 2 or 3, you need to complete this form.
- Full details of the project are to be provided in this Stage 2. Where a question in the Risk Checklist was answered YES, please ensure that specific details are included in the appropriate box below.
- If a question does not apply to your project, insert 'Not applicable' or N/A.
- Help is provided for each question. Further help can be found in the Research Ethics Procedures document.
- You navigate through the form by using the tab keys. If you prefer to complete a normal Word document, you can unlock the form by selecting the 'Restrict Editing' button on the Developer tab, then click on 'Stop Protection'. The boxes should expand to allow space for your text.
- Spellchecking is not available in Word forms, so you may find it helpful to prepare your responses in a Word document and then copy these to this form.
- Ensure the form is completed in sufficient detail to allow the reviewer to judge the ethical issues raised by the study. Remember that the reviewer will be considering the following questions when reviewing your application in order to be able to give ethical approval:
  - is it ethical to conduct the research project and is the proposed method of investigation appropriate, thorough and ethical?
  - does the research project meet the requirements of the relevant Research Ethics Principles (Research Ethics Policy A2.4)?

TO BE COMPLETED FOR PROJECTS IN RISK CATEGORY 2 AND 3	
Your name	Sandesh Paudel
Project title	Senior Shield- Next-Gen HealthCare App for Elderly

1	**Project Overview**
Please give a brief overview of your study, including a summary of your aims and objectives. Help: Describe the purpose of the research and what question(s) the project should answer.	
This project will recognize continuou vital sign, fall detection and medication management along with real time alerts to provide IoT-base Healthcare solution for the elderly.With the user-friendly interface, the project aims to enchance elderly care, offering a cost-effective solution for health and safety at home. Ensuration of the user authentication, location tracking, and integrates with brain games too for well being of the old ones are some of the features of the project.	

2	Methodology
Please give a description of your methodology, including any data collection and analysis methods. Help: Give an outline of your study here. If the project is complex, you can also submit your research proposal/protocol (no more than 2-3 A4 sides) if this would help the reviewer's understanding of the project. Include details of your (or your Research Supervisor's) appropriate skills and qualifications to carry out this research.	
The methodology consists of a literature review, followed by an examination of the IoT healthcare application, incorporating both qualitative and quantitative measures. Human testing will be central to real-world research.	

3	Main Ethical Considerations
Please give a brief description of the main ethical considerations involved in the study. Help: All research projects will have ethical issues, and you will be asked later in the process on recruitment, voluntary participation and the right to withdraw, but highlight here the main ethical considerations for your study (which may concern, e.g., the type of participants, the sensitive nature of the study, the data collection process, a lone researcher carrying out research off-campus, security-sensitive research) and advise how you will address the main issues. If the project is funded, give details here, and whether there are any potential conflicts of interest involved in the study.	
Ethical considerations focus on ensuring human trials, voluntary participation, informed consent, and the right to withdraw from the health app. Priority was given to maintaining confidentiality, anonymity, and adherence to ethical guidelines.	

4	Human Participants
If your study includes Human Participants (or their data), please give a description of who will be included. Help: • Please note this should include sample size/number of participants, whether the project will focus on any particular groups/individuals, if it will include any at risk or vulnerable participants, participants aged 16 years or under, etc. Please also specify your rationale for including / excluding groups of participants. • If the research involves secondary data not in the public domain, give details in this section.	
As this is mainly focused on the Elder One, but the data collection of such age groups might be difficult.	

So people above 30 yrs might be taken into considerations.

5	Recruitment, Voluntary Participation, Consent and Right to Withdraw

If your study includes Human Participants, please give a brief description of the recruitment process, how you will ensure voluntary participation, if (and how) informed consent will be obtained prior to participants taking part in the study, and the right of withdrawal from the research process.

Help:

- This should include clear information on how participants will be identified, approached and recruited; whether the study will include any covert research or deliberate deception; whether help is required from a third party/ gatekeeper to access participants; what information you will give participants, etc.
- If expenses or any incentives are to be offered to participants, give full details.
- If your research involves students, colleagues and/or other employees then you must specify the rationale for this and how you will address issues of coercion or feelings of obligation.
- Regarding withdrawal from the study, discuss the different stages/dates a participant could withdraw or withdraw their data, and how they could do this.

Participants will be recruited locally, within my immediate surroundings.The process ensures voluntary participation, and potential participants will be approached directly, provided with comprehensive information about the study's purpose, and informed about their right to withdraw at any stage without consequences.Withdrawal can occur at any stage before data analysis, and participant data will be promptly deleted upon withdrawal

6	Risks and Benefits

Please give a brief description of how, when and where the research will take place and whether there are any risks and/or benefits involved.

Help:

- This should include information on what participants will be required to do, the rationale for this and the level of risk involved.
- When considering risks, please refer to risks to the participants (e.g., for research in sensitive areas), the researcher, any other parties to the research; and also any health and safety issues for anyone involved (e.g., for lone researchers carrying out fieldwork).
- If participants will be exposed to ionising radiation, separate approval documentation must be submitted with this application.

N/A

7	Personal Data, Anonymity and Confidentiality
Please specify what type of information/data will be collected/analysed and the source(s). In addition, specify if and how you will ensure the anonymity of participants and keep information confidential. Help: This should include information on whether you are collecting new information/data or using that that is already in the public domain; whether the data you are using includes personal details; how the data will be processed and stored; who will have access to it; how and when it will be destroyed; the Data Protection requirements for any sensitive personal data, etc. In addition, include whether there may be any requirements for disclosure of information to other parties due to professional practice or legal reasons. If there are limits to confidentiality, explain clearly how the participants would be advised about these limits and possible outcomes.	
The study collects additional data from human testing of an IoT healthcare app. Personal descriptions will include user interactions and comments. The anonymity of the participants will be protected through anonymity, and confidentiality will be maintained by restricting only authorized personnel. After analysis, the data will be securely stored and destroyed. Disclosure to other parties is not required, and participants will be informed of confidentiality restrictions. The survey complies with data security requirements for sensitive personal data	

8	Reporting and Dissemination
Please give details of the planned dissemination and specify if the findings from the research will be published and whether any permission is required for this. Help: This should include information on the methods of dissemination (e.g., dissertation/thesis) and/or what will be published and where (research papers, conference presentations). Specify if any permission is needed (e.g., from participants, clients, gatekeepers, etc.) prior to publication, and whether there are any potential issues relating to Intellectual Property Rights when creating or using materials.	
N/A	

9	Location of research
Will the research take place outside of the country where you are enrolled as a student, or for staff, outside of the UK?	
YES ☐ **NO** ☒ **If yes, give details below.**	
Help: If yes, please specify where the research will take place and what will be involved. Research must comply with the laws of the country where it is taking place and also comply with local Data Protection and Intellectual Property legislation: you must confirm that your research is compliant with local requirements and how you have ascertained this. Advise if the project requires ethical approval in-country and how this has been ascertained. If approval is required, a copy of this should be included in the application or details of the process of how it will be obtained. Please make reference to insurance and indemnity cover for the project where relevant.	

10	Collaborative Projects
Is the research is a collaborative project (i.e., it involves more than one institution)?	
YES ☐ **NO** ☒ **If yes, give details below.**	
Help: If yes, please specify the other institutions involved and if ethical approval needs to be / has been given by them. Please also specify what procedures have been put in place to ensure ethical compliance from all partners.	

11	Any other permission or external ethical approval required to undertake the project
Please specify if the project requires any other ethical approval or permissions not mentioned previously in this application and how and when these will be obtained. Help: • Other permissions: ethical approval does not give the right of access to the University's students, staff or the use of University premises to carry out research, and you may need to contact an appropriate University gatekeeper for agreement to approach potential participants or for the use of premises, so please give details. • Gatekeepers: permission of a gatekeeper for initial access to participants may be required or to carry out data collection on their premises. • If your project requires approval from an external ethics committee, this should normally be obtained prior to submitting this application. • If a Disclosure and Barring Service check is required due to the specific participant group, give details. • Regarding insurance and indemnity cover, some projects will require individual confirmation of cover. See the Research Ethics Procedures document for more details.	

ii. Risk Register

ID	Risk Description	Likelihood	Impact	Severity	Owner	Mitigation	Status
R01	Integration Challenges (IoT Devices with Mobile App)	Medium	High	High	Sandesh Paudel	Through Testing, Collaboration with Supervisor, Flexible Architecture	Open
R02	Device Failures (Failure of connection)	Medium	High	High	Sandesh Paudel	Testing, Maintenance Checks, Establishment of different Protocols	Open
R03	Connectivity Challenges (Network Connectivity Challenges)	High	Medium	High	Sandesh Paudel	Through Network Testing, Strong connectivity protocols	Open
R04	Device Compatibility (Responsiveness of the App)	Medium	Medium	High	Sandesh Paudel	Prioritize the compatibility devices and multiple compatibility testing	Open
R05	Inefficiency Emergency Response (Alert Notification on Time)	Medium	High	High	Sandesh Paudel	Regular practice of emergency protocols, establishment of clear communication channels	Open
R06	Insufficient User Training (How to Use the System)	Low	Medium	Low	Sandesh Paudel	Training to User, Tutorials Support	Open

Notes:

ID values may be useful to refer to in your final documentation. Number these in order. This register should be included in the appendix.

Risk description provides an outline of the issue.

Please use Low, Medium and High to identify the risk level and colour code.

Typically, the owner will be you, but it may be the case in teamwork or other projects that have external clients, other activities may impact on the project

Mitigation implies on how you will manage the risk and to reduce the likelihood of it occurring.

Status – has the risk event now passed. It should indicate an Open and Closed status.

iii. Dataset For Machine Learning

Human_vital_signs_R.csv

	time	hr	spo2	status
1				
2	0	94	97	Normal
3	1	94	97	Normal
4	2	101	93	Abnormal
5	3	55	100	Abnormal
6	4	93	95	Normal
7	5	93	97	Normal
8	6	94	97	Normal
9	7	94	97	Normal
10	8	94	97	Normal
11	9	94	97	Normal
12	10	94	97	Abnormal
13	11	94	97	Abnormal
14	12	94	97	Normal
15	13	94	97	Normal
16	14	94	97	Normal
17	15	95	97	Normal
18	16	94	97	Abnormal
19	17	94	97	Abnormal
20	18	94	97	Normal
21	19	94	97	Normal
22	20	94	97	Abnormal
23	21	94	97	Abnormal
24	22	94	97	Normal
25	23	94	97	Normal
26	24	94	97	Abnormal
27	25	94	97	Abnormal
28	26	94	98	Normal
29	27	94	98	Normal
30	28	94	98	Normal
31	29	94	98	Normal
32	30	94	98	Normal
33	31	94	98	Normal
34	32	94	98	Abnormal
35	33	93	98	Abnormal
36	34	93	98	Normal
37	35	93	97	Normal
38	36	93	97	Abnormal
39	37	93	97	Abnormal
40	38	92	97	Normal
41	39	92	97	Abnormal

iv. Meeting Logs

School of Computing, Creative Technologies, and Engineering 2022/23 **Level 6 Production Project**	
MEETING RECORD SHEET:	**Meeting Number:01**
Student: Sandesh Paudel	**Student I.D.: 77297958**
Date of Meeting: 2024-02-15	**Supervisor: Suramya Sharma**
Actions agreed at previous meeting (completed or comment):	
1	First Meeting ☐
2	Individual Introduction ☐
3	☐
4	☐
5	☐
6	☐
Comments of student (if any):	
***ABOVE here** – student to complete before Meeting with supervisor. **BELOW here** – complete at the Meeting.*	
Next meeting (date/time)**: 2024-02-18**	
Agreed Actions to complete before next meeting:	
1	Topic Finalization
2	Initiation of Project
3	
4	
5	
6	
Comments of supervisor (if any):	

School of Computing, Creative Technologies, and Engineering 2022/23

Level 6 Production Project

MEETING RECORD SHEET:	**Meeting Number:02**
Student: Sandesh Paudel	**Student I.D.: 77297958**
Date of Meeting: 2024-02-18	**Supervisor: Suramya Sharma**

Actions agreed at previous meeting (completed or comment):

1	Finalization of topic	☐
2	Project Initiation and Explanation of objectives	☐
3		☐
4		☐
5		☐
6		☐

Comments of student (if any):

Product and report need to be started as soon as possible.

ABOVE here *– student to complete before Meeting with supervisor.* ***BELOW here*** *– complete at the Meeting.*

Next meeting (date/time)**:2024-03-02**

Agreed Actions to complete before next meeting:

1	Draft Report Submission
2	Discussion on report
3	General Update on Project
4	Figma Design
5	
6	

Comments of supervisor (if any):

School of Computing, Creative Technologies, and Engineering 2022/23

Level 6 Production Project

MEETING RECORD SHEET:	**Meeting Number:03**
Student: Sandesh Paudel	**Student I.D.: 77297958**
Date of Meeting: 2024-03-02	**Supervisor: Suramya Sharma**

Actions agreed at previous meeting (completed or comment):

1	Report Draft Submission	☐
2	Product Design on Figma	☐
3		☐
4		☐
5		☐
6		☐

Comments of student (if any):

ABOVE here *– student to complete before Meeting with supervisor.* ***BELOW here*** *– complete at the Meeting.*

Next meeting (date/time)**:2024-03-10**

Agreed Actions to complete before next meeting:

1	Continuation of Report
2	Login and Signup Page UI Completion
3	Purchase of IoT Devices
4	Database designs
5	
6	

Comments of supervisor (if any):

School of Computing, Creative Technologies, and Engineering 2022/23

Level 6 Production Project

MEETING RECORD SHEET:	**Meeting Number:04**
Student: Sandesh Paudel	**Student I.D.: 77297958**
Date of Meeting: 2024-03-10	**Supervisor: Suramya Sharma**

Actions agreed at previous meeting (completed or comment):

1	Report Continuation	☐
2	Login and Signup Page UI completion	☐
3	Database Designs	☐
4		☐
5		☐
6		☐

Comments of student (if any):

Need to increase the pace of product development.

***ABOVE here** – student to complete before Meeting with supervisor. **BELOW here** – complete at the Meeting.*

Next meeting (date/time)**:2024-03-29**

Agreed Actions to complete before next meeting:

1	Home Screen along with other pages UI too
2	Report Continuation
3	Last Meeting before IMP of college so need proper update on project.
4	Firebase Connection
5	
6	

Comments of supervisor (if any):

School of Computing, Creative Technologies, and Engineering 2022/23

Level 6 Production Project

MEETING RECORD SHEET:	**Meeting Number:05**
Student: Sandesh Paudel	**Student I.D.: 77297958**
Date of Meeting: 2024-03-29	**Supervisor: Suramya Sharma**

Actions agreed at previous meeting (completed or comment):

1	Completion of Home Page UI and BMI Calculator	☐
2	Database connection in firebase	☐
3	Database Designs	☐
4		☐
5		☐
6		☐

Comments of student (if any):

ABOVE here *– student to complete before Meeting with supervisor.* ***BELOW here*** *– complete at the Meeting.*

Next meeting (date/time)**:2024-04-09**

Agreed Actions to complete before next meeting:

1	IoT Device connection
2	Chat App, and remaining UI
3	File Management
4	
5	
6	

Comments of supervisor (if any):

School of Computing, Creative Technologies, and Engineering 2022/23

Level 6 Production Project

MEETING RECORD SHEET:	**Meeting Number:06**
Student: Sandesh Paudel	**Student I.D.: 77297958**
Date of Meeting: 2024-04-09	**Supervisor: Suramya Sharma**

Actions agreed at previous meeting (completed or comment):

1	Remaining UI Completion	☐
2	IoT Device Connection	☐
3	User registration and login completion	☐
4		☐
5		☐
6		☐

Comments of student (if any):

Submisstion deadline is nearyby so project need to be completed as soon as possible

***ABOVE here** – student to complete before Meeting with supervisor. **BELOW here** – complete at the Meeting.*

Next meeting (date/time)**:2024-04-14**

Agreed Actions to complete before next meeting:

1	Report Continuation
2	Solving the issue of pulse sensor
3	Continuation with app too
4	
5	
6	

Comments of supervisor (if any):

School of Computing, Creative Technologies, and Engineering 2022/23

Level 6 Production Project

MEETING RECORD SHEET:	**Meeting Number:07**
Student: Sandesh Paudel	**Student I.D.: 77297958**
Date of Meeting: 2024-04-14	**Supervisor: Suramya Sharma**

Actions agreed at previous meeting (completed or comment):

1	Solving the issue with pulse oximter	☐
2	Completed the pill remainder Ui and add medicine	☐
3	Fixing some bugs in the app	☐
4		☐
5		☐
6		☐

Comments of student (if any):

ABOVE here *– student to complete before Meeting with supervisor.* ***BELOW here*** *– complete at the Meeting.*

Next meeting (date/time)**:2024-04-28**

Agreed Actions to complete before next meeting:

1	Data Extraction from IoT Device
2	Sending the data to firebase
3	Optimization in Flutter code
4	
5	
6	

Comments of supervisor (if any):

School of Computing, Creative Technologies, and Engineering 2022/23

Level 6 Production Project

MEETING RECORD SHEET:	**Meeting Number:08**
Student: Sandesh Paudel	**Student I.D.: 77297958**
Date of Meeting: 2024-04-28	**Supervisor: Suramya Sharma**

Actions agreed at previous meeting (completed or comment):

1		☐
2		☐
3		☐
4		☐
5		☐
6		☐

Comments of student (if any):

Absent Due to some personal work

***ABOVE here** – student to complete before Meeting with supervisor. **BELOW here** – complete at the Meeting.*

Next meeting (date/time)**:2024-05-01**

Agreed Actions to complete before next meeting:

1	
2	
3	
4	
5	
6	

Comments of supervisor (if any):

School of Computing, Creative Technologies, and Engineering 2022/23

Level 6 Production Project

MEETING RECORD SHEET:	**Meeting Number:09**
Student: Sandesh Paudel	**Student I.D.: 77297958**
Date of Meeting: 2024-05-01	**Supervisor: Suramya Sharma**

Actions agreed at previous meeting (completed or comment):

1	Data Extraction and Data Sending to Firebase	☐
2	Optimized the Code	☐
3	Notification alerts for pill remainder	☐
4		☐
5		☐
6		☐

Comments of student (if any):

Project need to be completed as soon as possible due to the submission deadline

***ABOVE here** – student to complete before Meeting with supervisor. **BELOW here** – complete at the Meeting.*

Next meeting (date/time)**:2024-05-15**

Agreed Actions to complete before next meeting:

1	Project Completion
2	Solving the Issue of Pulse oximeter while sending data to firebase
3	File Management
4	Report Completion
5	Presentation too
6	

Comments of supervisor (if any):

School of Computing, Creative Technologies, and Engineering 2022/23

Level 6 Production Project

MEETING RECORD SHEET:	**Meeting Number:10**
Student: Sandesh Paudel	**Student I.D.: 77297958**
Date of Meeting: 2024-05-15	**Supervisor: Suramya Sharma**

Actions agreed at previous meeting (completed or comment):

1	Solved the pulse code while sending data to firebase	
2	Chat App and Overall App Completed	☐
3	Adding the machine learning model in the app	☐
4	Final Touch to the overall project and slide and other folders to be completed	☐
5		☐
6		☐

Comments of student (if any):

Product submission on 22nd so that everything needs to be prepared and ready

***ABOVE here** – student to complete before Meeting with supervisor. **BELOW here** – complete at the Meeting.*

Next meeting (date/time)**:2024-05-20**

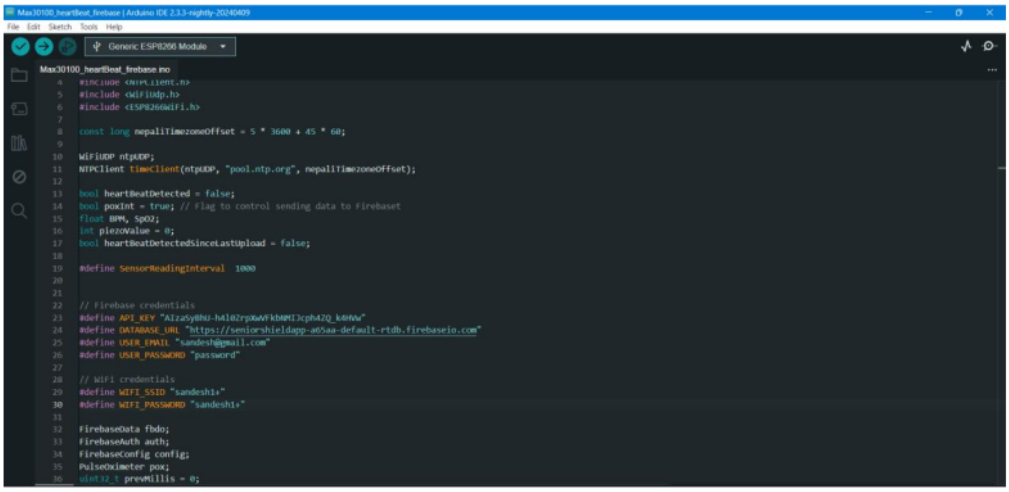
Agreed Actions to complete before next meeting:

1	Overall Project Demonstration
2	Preparation for presentation
3	Product Submission File Management
4	Report Continuation
5	
6	

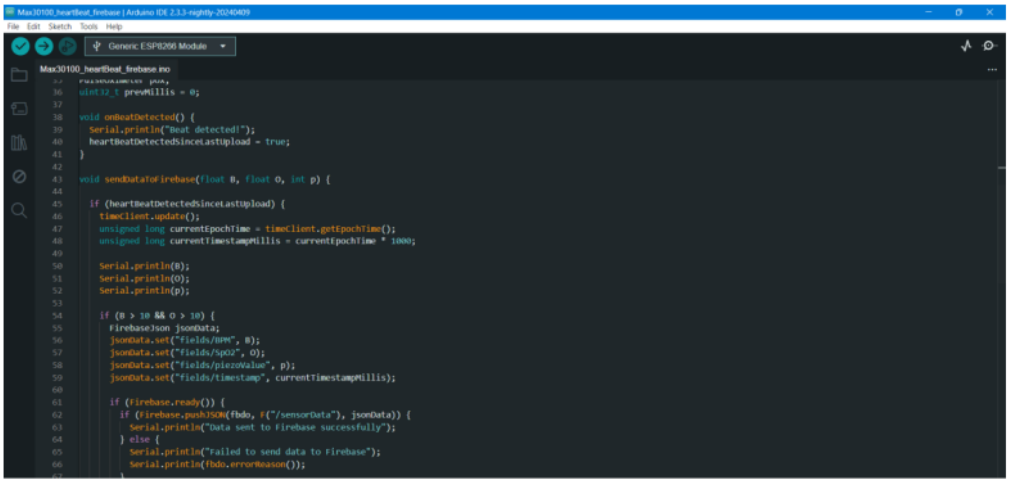
Comments of supervisor (if any):

v. Development Code

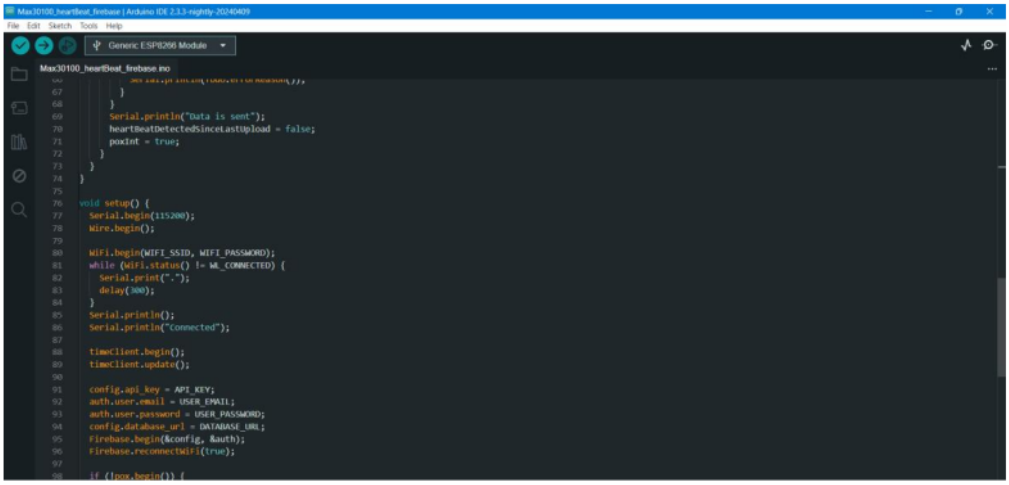
i. Arduino Code

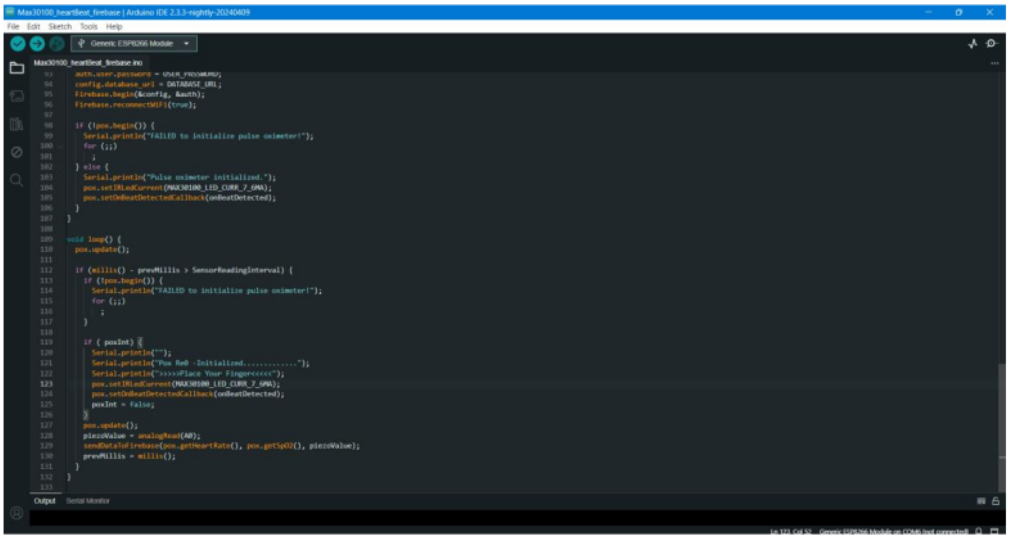


```
#include <NTPClient.h>
#include <WiFiUdp.h>
#include <ESP8266WiFi.h>

const long nepaliTimezoneOffset = 5 * 3600 + 45 * 60;

WiFiUDP ntpUDP;
NTPClient timeClient(ntpUDP, "pool.ntp.org", nepaliTimezoneOffset);

bool heartBeatDetected = false;
bool poxInt = true; // Flag to control sending data to Firebaset
float BPM, SpO2;
int piezoValue = 0;
bool heartBeatDetectedSinceLastUpload = false;

#define SensorReadingInterval  1000


// Firebase credentials
#define API_KEY "AIzaSyBNU-h4l0ZrpXwVFkhMMI3cphA2Q_k4HAw"
#define DATABASE_URL "https://seniorshieldapp-a65aa-default-rtdb.firebaseio.com"
#define USER_EMAIL "sandesh@gmail.com"
#define USER_PASSWORD "password"

// WiFi credentials
#define WIFI_SSID "sandesh1+"
#define WIFI_PASSWORD "sandesh1+"

FirebaseData fbdo;
FirebaseAuth auth;
FirebaseConfig config;
PulseOximeter pox;
uint32_t prevMillis = 0;
```

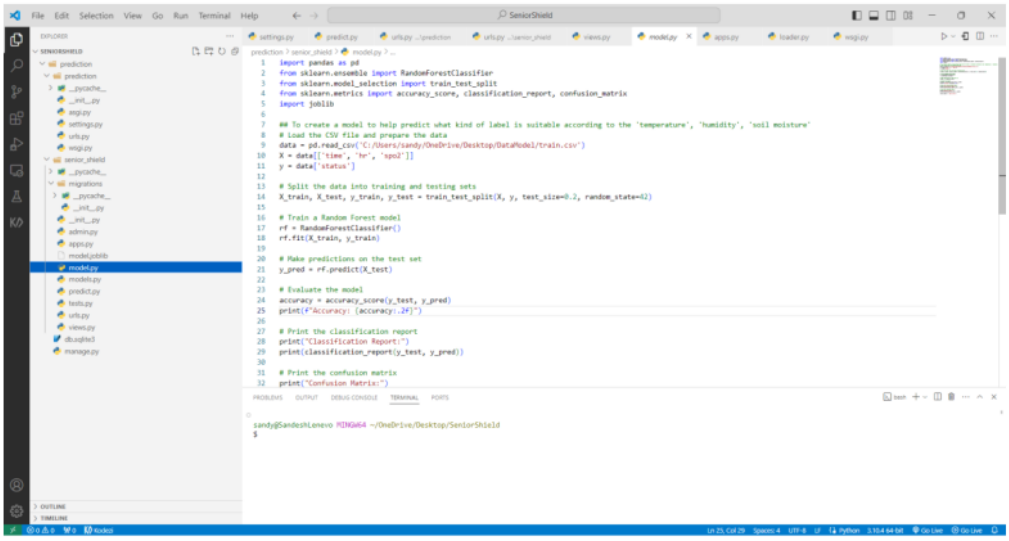


```
uint32_t prevMillis = 0;

void onBeatDetected() {
  Serial.println("Beat detected!");
  heartBeatDetectedSinceLastUpload = true;
}

void sendDataToFirebase(float B, float O, int p) {

  if (heartBeatDetectedSinceLastUpload) {
    timeClient.update();
    unsigned long currentEpochTime = timeClient.getEpochTime();
    unsigned long currentTimestampMillis = currentEpochTime * 1000;

    Serial.println(B);
    Serial.println(O);
    Serial.println(p);

    if (B > 10 && O > 10) {
      FirebaseJson jsonData;
      jsonData.set("fields/BPM", B);
      jsonData.set("fields/SpO2", O);
      jsonData.set("fields/piezoValue", p);
      jsonData.set("fields/timestamp", currentTimestampMillis);

      if (Firebase.ready()) {
        if (Firebase.pushJSON(fbdo, F("/sensorData"), jsonData)) {
          Serial.println("Data sent to Firebase successfully");
        } else {
          Serial.println("Failed to send data to Firebase");
          Serial.println(fbdo.errorReason());
```

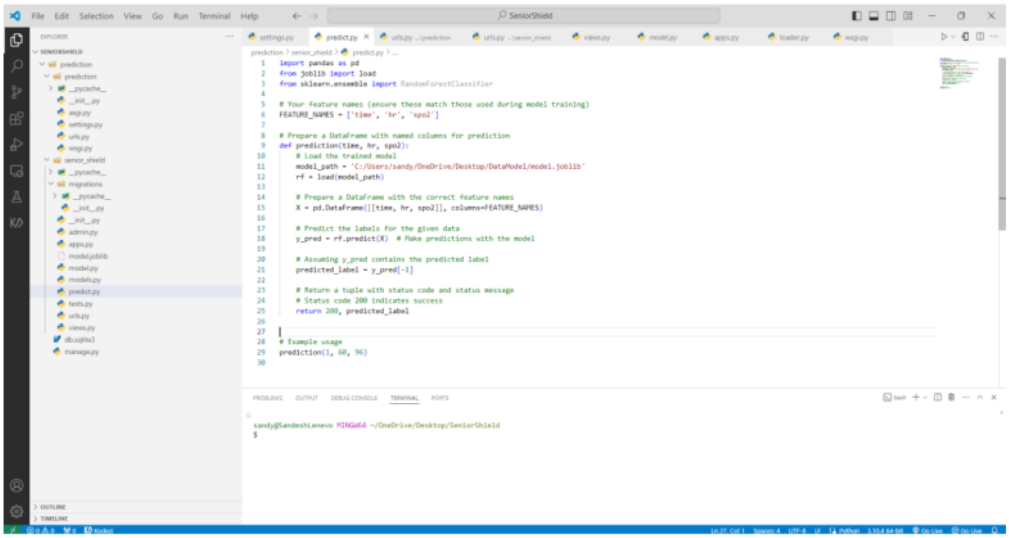

Max30100_heartBeat_firebase | Arduino IDE 2.3.3-nightly-20240409
File Edit Sketch Tools Help
Generic ESP8266 Module
Max30100_heartBeat_firebase.ino
Data is sent
heartBeatDetectedSinceLastUpload = false;
poxInt = true;
void setup() {
Serial.begin(115200);
Wire.begin();
WiFi.begin(WIFI_SSID, WIFI_PASSWORD);
while (WiFi.status() != WL_CONNECTED) {
Serial.print(".");
delay(300);
Serial.println();
Serial.println("Connected");
timeClient.begin();
timeClient.update();
config.api_key = API_KEY;
auth.user.email = USER_EMAIL;
auth.user.password = USER_PASSWORD;
config.database_url = DATABASE_URL;
Firebase.begin(&config, &auth);
Firebase.reconnectWiFi(true);
if (!pox.begin()) {


Max30100_heartBeat_firebase | Arduino IDE 2.3.3-nightly-20240409
File Edit Sketch Tools Help
Generic ESP8266 Module
Max30100_heartBeat_firebase.ino
auth.user.password = USER_PASSWORD;
config.database_url = DATABASE_URL;
Firebase.begin(&config, &auth);
Firebase.reconnectWiFi(true);
if (!pox.begin()) {
Serial.println("FAILED to initialize pulse oximeter!");
for (;;)
;
} else {
Serial.println("Pulse oximeter initialized.");
pox.setIRLedCurrent(MAX30100_LED_CURR_7_6MA);
pox.setOnBeatDetectedCallback(onBeatDetected);
}
}
void loop() {
pox.update();
if (millis() - prevMillis > SensorReadingInterval) {
if (!pox.begin()) {
Serial.println("FAILED to initialize pulse oximeter!");
for (;;)
;
}
if (poxInt) {
Serial.println("");
Serial.println("Pox ReD -Initialized.....");
Serial.println(">>>>>Place Your Finger<<<<<");
pox.setIRLedCurrent(MAX30100_LED_CURR_7_6MA);
pox.setOnBeatDetectedCallback(onBeatDetected);
poxInt = false;
}
pox.update();
piezoValue = analogRead(A0);
sendDataToFirebase(pox.getHeartRate(), pox.getSpO2(), piezoValue);
prevMillis = millis();
}
}
Output Serial Monitor

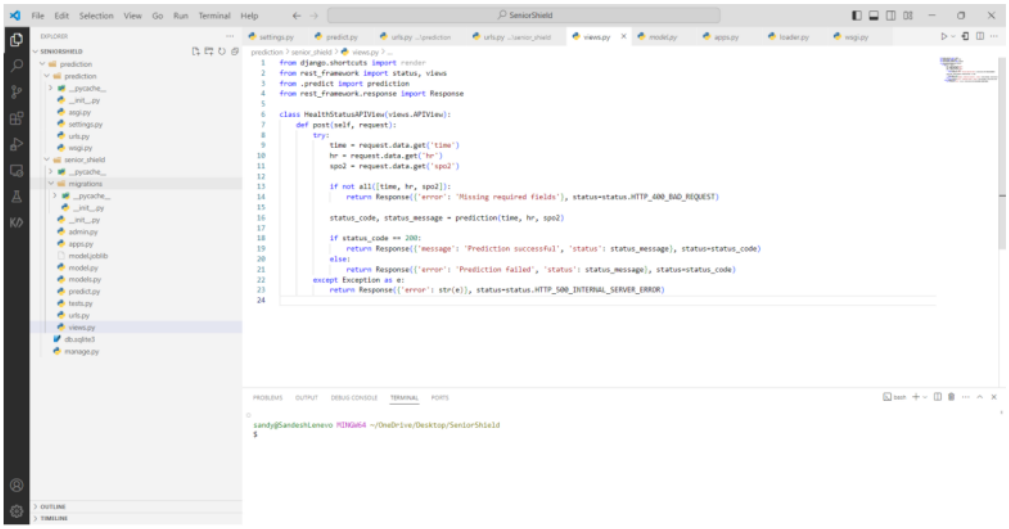
ii. Modeling and Python Django Code

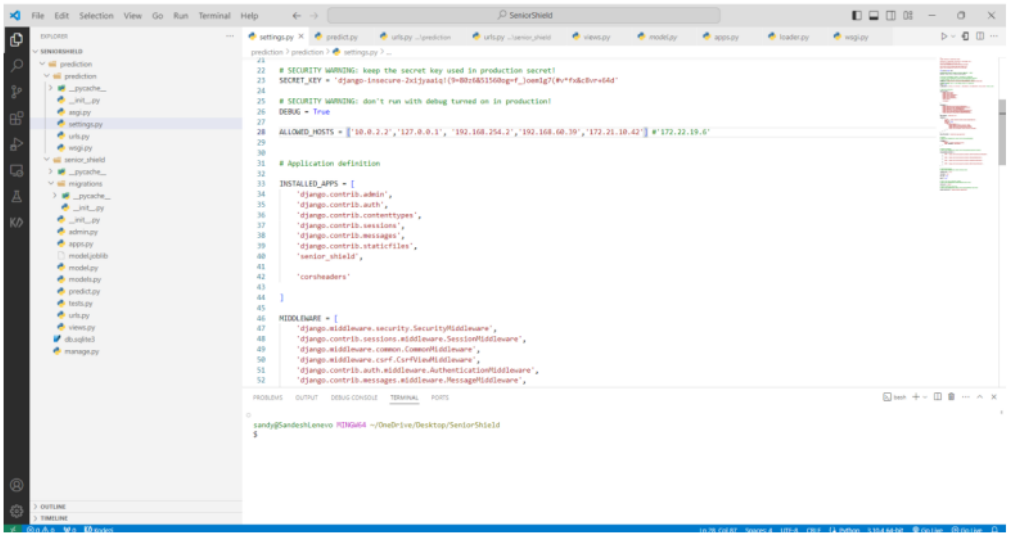


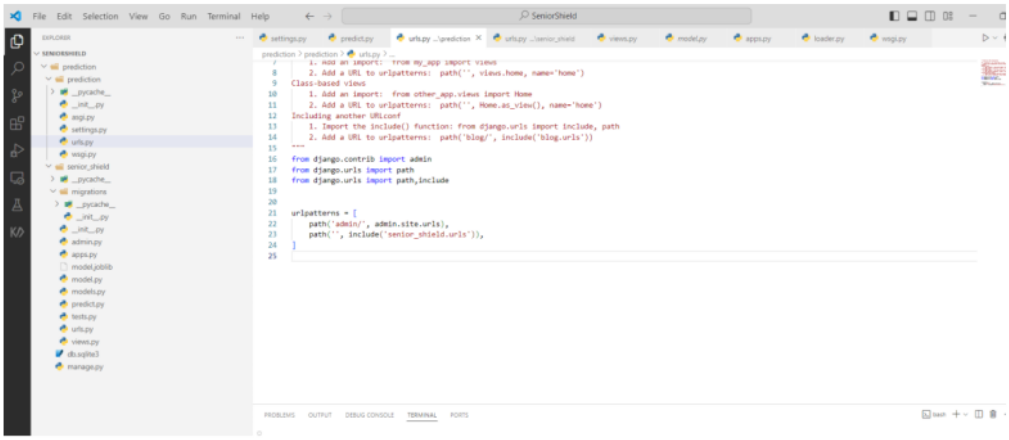
```
import pandas as pd
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix
import joblib

## To create a model to help predict what kind of label is suitable according to the 'temperature', 'humidity', 'soil moisture'
# Load the CSV file and prepare the data
data = pd.read_csv('C:/Users/sandy/OneDrive/Desktop/DataModel/train.csv')
X = data[['time', 'hr', 'spo2']]
y = data['status']

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Train a Random Forest model
rf = RandomForestClassifier()
rf.fit(X_train, y_train)

# Make predictions on the test set
y_pred = rf.predict(X_test)

# Evaluate the model
accuracy = accuracy_score(y_test, y_pred)
print(f"Accuracy: {accuracy:.2f}")

# Print the classification report
print("Classification Report:")
print(classification_report(y_test, y_pred))

# Print the confusion matrix
print("Confusion Matrix:")
```

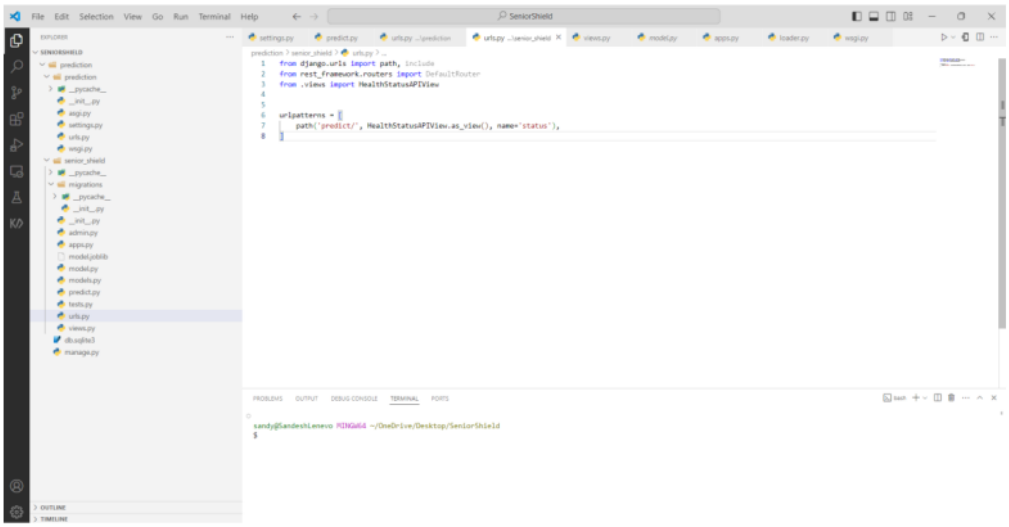


```
import pandas as pd
from joblib import load
from sklearn.ensemble import RandomForestClassifier

# Your feature names (ensure these match those used during model training)
FEATURE_NAMES = ['time', 'hr', 'spo2']

# Prepare a DataFrame with named columns for prediction
def prediction(time, hr, spo2):
    # Load the trained model
    model_path = 'C:/Users/sandy/OneDrive/Desktop/DataModel/model.joblib'
    rf = load(model_path)

    # Prepare a DataFrame with the correct feature names
    X = pd.DataFrame([[time, hr, spo2]], columns=FEATURE_NAMES)

    # Predict the labels for the given data
    y_pred = rf.predict(X)  # Make predictions with the model

    # Assuming y_pred contains the predicted label
    predicted_label = y_pred[-1]

    # Return a tuple with status code and status message
    # Status code 200 indicates success
    return 200, predicted_label

# Example usage
prediction(1, 60, 96)
```

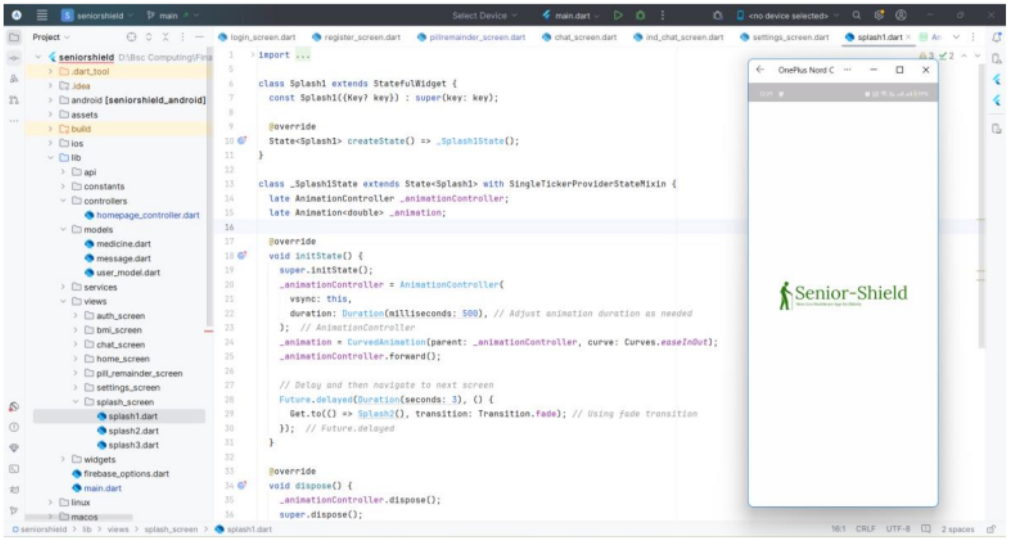

from django.shortcuts import render
from rest_framework import status, views
from .predict import prediction
from rest_framework.response import Response
class HealthStatusAPIView(views.APIView):
def post(self, request):
try:
time = request.data.get('time')
hr = request.data.get('hr')
spo2 = request.data.get('spo2')
if not all([time, hr, spo2]):
return Response({'error': 'Missing required fields'}, status=status.HTTP_400_BAD_REQUEST)
status_code, status_message = prediction(time, hr, spo2)
if status_code == 200:
return Response({'message': 'Prediction successful', 'status': status_message}, status=status_code)
else:
return Response({'error': 'Prediction failed', 'status': status_message}, status=status_code)
except Exception as e:
return Response({'error': str(e)}, status=status.HTTP_500_INTERNAL_SERVER_ERROR)
sandy@SandeshLenevo MINGW64 ~/OneDrive/Desktop/SeniorShield
$


SECRET_KEY = 'django-insecure-2x1jyaaiq!(9=80zf&51560qg=f_loem1g7(#v*fx&cBvr=64d'
DEBUG = True
ALLOWED_HOSTS = ['10.0.2.2','127.0.0.1', '192.168.254.2','192.168.60.39','172.21.10.42'] #'172.22.19.6'
INSTALLED_APPS = [
'django.contrib.admin',
'django.contrib.auth',
'django.contrib.contenttypes',
'django.contrib.sessions',
'django.contrib.messages',
'django.contrib.staticfiles',
'senior_shield',
'corsheaders'
]
MIDDLEWARE = [
'django.middleware.security.SecurityMiddleware',
'django.contrib.sessions.middleware.SessionMiddleware',
'django.middleware.common.CommonMiddleware',
'django.middleware.csrf.CsrfViewMiddleware',
'django.contrib.auth.middleware.AuthenticationMiddleware',
'django.contrib.messages.middleware.MessageMiddleware',
sandy@SandeshLenevo MINGW64 ~/OneDrive/Desktop/SeniorShield
$

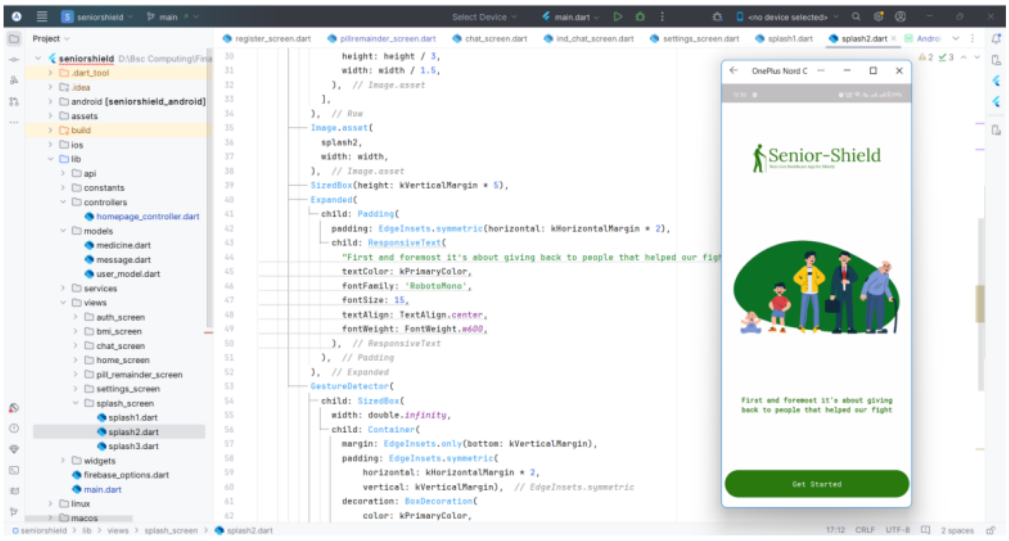

File Edit Selection View Go Run Terminal Help
SeniorShield
urls.py
from django.contrib import admin
from django.urls import path
from django.urls import path,include
urlpatterns = [
path('admin/', admin.site.urls),
path('', include('senior_shield.urls')),
]


File Edit Selection View Go Run Terminal Help
SeniorShield
from django.urls import path, include
from rest_framework.routers import DefaultRouter
from .views import HealthStatusAPIView
urlpatterns = [
path('predict/', HealthStatusAPIView.as_view(), name='status'),
]
sandy@SandeshLenevo MINGW64 ~/OneDrive/Desktop/SeniorShield
$

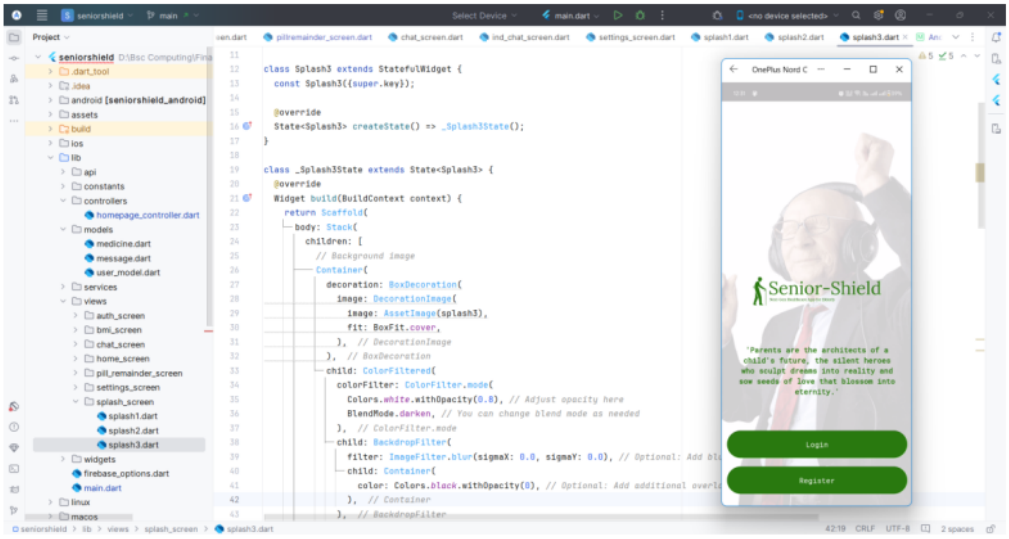
iii. Flutter Code

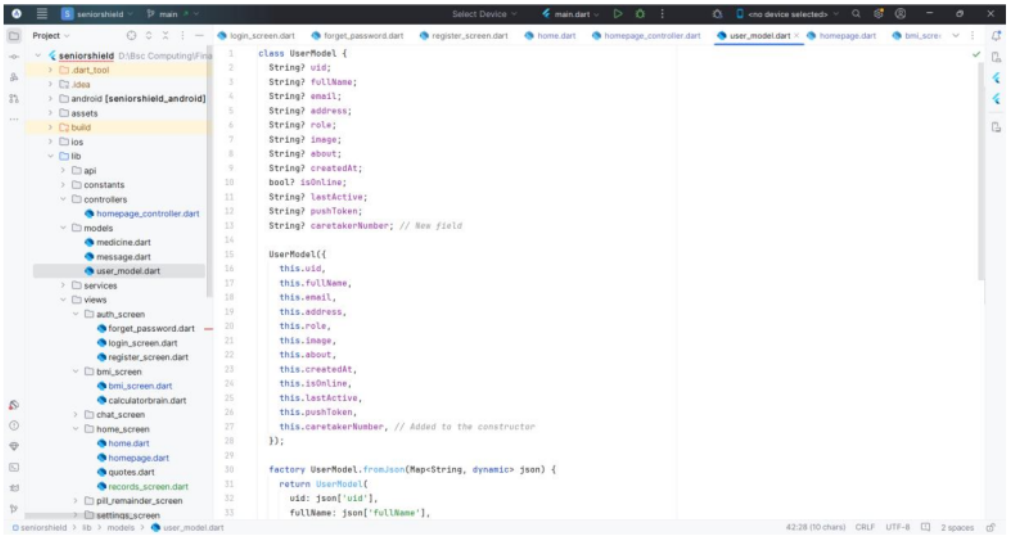


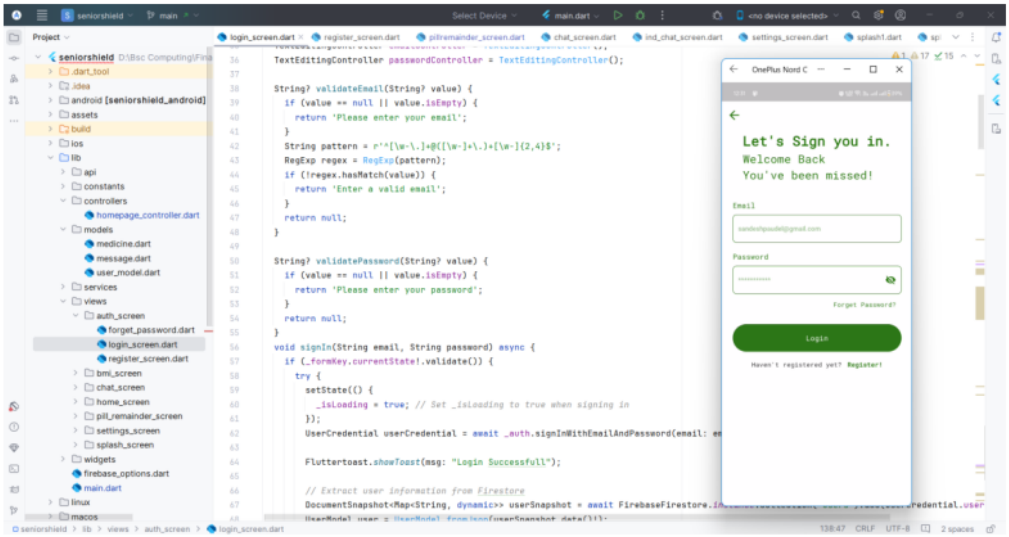
```dart
import ...

class Splash1 extends StatefulWidget {
  const Splash1({Key? key}) : super(key: key);

  @override
  State<Splash1> createState() => _Splash1State();
}

class _Splash1State extends State<Splash1> with SingleTickerProviderStateMixin {
  late AnimationController _animationController;
  late Animation<double> _animation;

  @override
  void initState() {
    super.initState();
    _animationController = AnimationController(
      vsync: this,
      duration: Duration(milliseconds: 500), // Adjust animation duration as needed
    );  // AnimationController
    _animation = CurvedAnimation(parent: _animationController, curve: Curves.easeInOut);
    _animationController.forward();

    // Delay and then navigate to next screen
    Future.delayed(Duration(seconds: 3), () {
      Get.to(() => Splash2(), transition: Transition.fade); // Using fade transition
    });  // Future.delayed
  }

  @override
  void dispose() {
    _animationController.dispose();
    super.dispose();
```

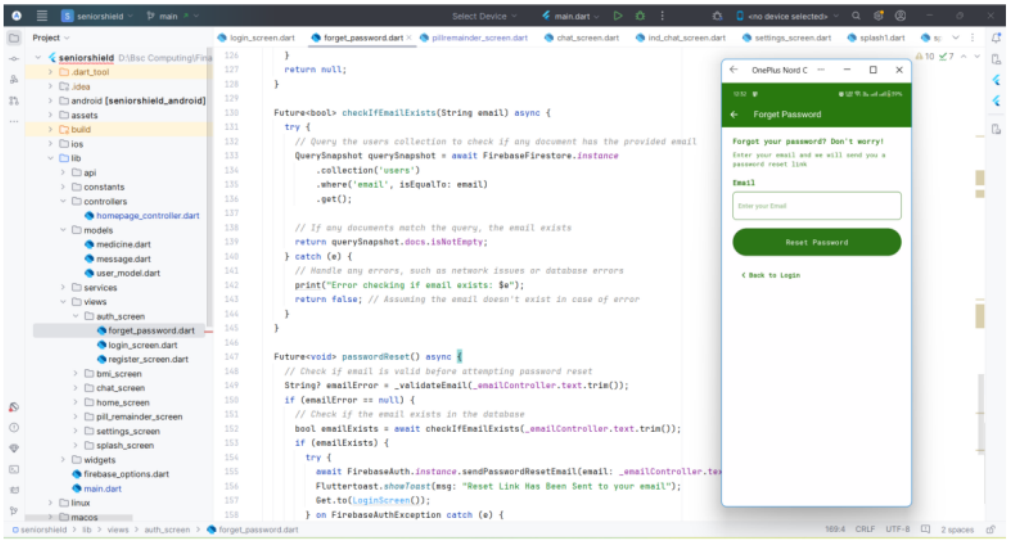


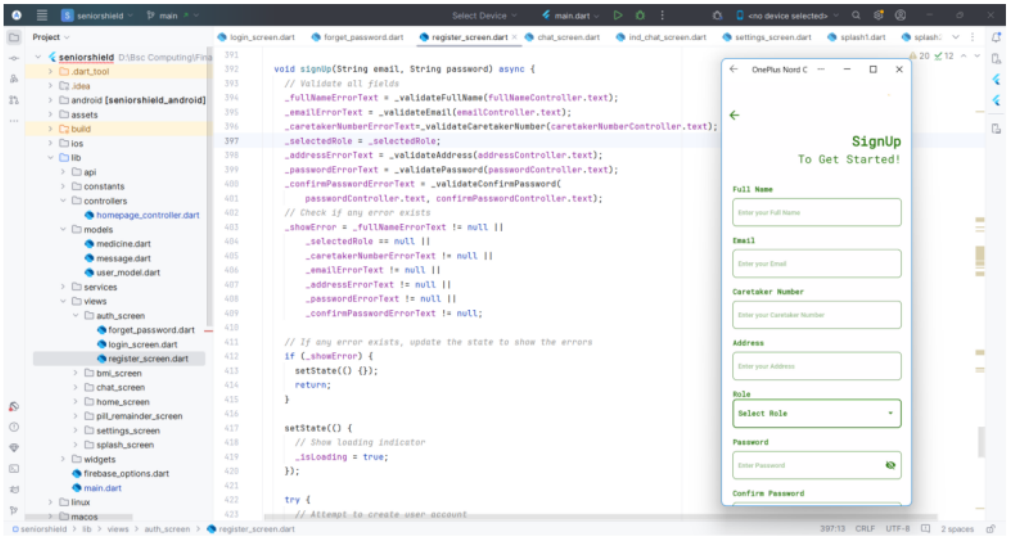
```dart
            height: height / 3,
            width: width / 1.5,
          ),  // Image.asset
        ],
      ),  // Row
      Image.asset(
        splash2,
        width: width,
      ),  // Image.asset
      SizedBox(height: kVerticalMargin * 5),
      Expanded(
        child: Padding(
          padding: EdgeInsets.symmetric(horizontal: kHorizontalMargin * 2),
          child: ResponsiveText(
            "First and foremost it's about giving back to people that helped our fig
            textColor: kPrimaryColor,
            fontFamily: 'RobotoMono',
            fontSize: 15,
            textAlign: TextAlign.center,
            fontWeight: FontWeight.w600,
          ),  // ResponsiveText
        ),  // Padding
      ),  // Expanded
      GestureDetector(
        child: SizedBox(
          width: double.infinity,
          child: Container(
            margin: EdgeInsets.only(bottom: kVerticalMargin),
            padding: EdgeInsets.symmetric(
                horizontal: kHorizontalMargin * 2,
                vertical: kVerticalMargin),  // EdgeInsets.symmetric
            decoration: BoxDecoration(
                color: kPrimaryColor,
```

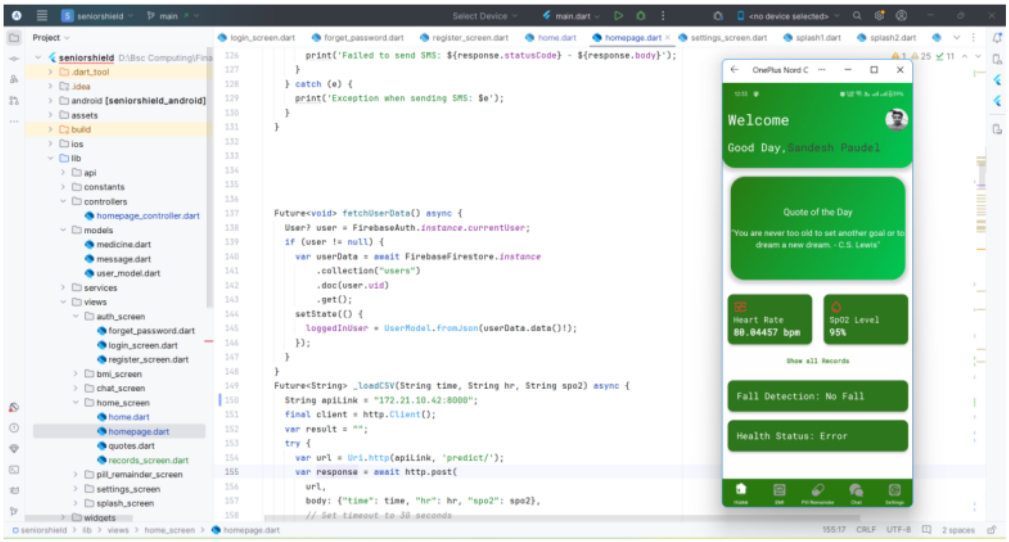

class Splash3 extends StatefulWidget {
const Splash3({super.key});
@override
State<Splash3> createState() => _Splash3State();
}
class _Splash3State extends State<Splash3> {
@override
Widget build(BuildContext context) {
return Scaffold(
body: Stack(
children: [
// Background image
Container(
decoration: BoxDecoration(
image: DecorationImage(
image: AssetImage(splash3),
fit: BoxFit.cover,
), // DecorationImage
), // BoxDecoration
child: ColorFiltered(
colorFilter: ColorFilter.mode(
Colors.white.withOpacity(0.8), // Adjust opacity here
BlendMode.darken, // You can change blend mode as needed
), // ColorFilter.mode
child: BackdropFilter(
filter: ImageFilter.blur(sigmaX: 0.0, sigmaY: 0.0), // Optional: Add bl
child: Container(
color: Colors.black.withOpacity(0), // Optional: Add additional overl
), // Container
), // BackdropFilter
OnePlus Nord C
Senior-Shield
'Parents are the architects of a child's future, the silent heroes who sculpt dreams into reality and sow seeds of love that blossom into eternity.'
Login
Register

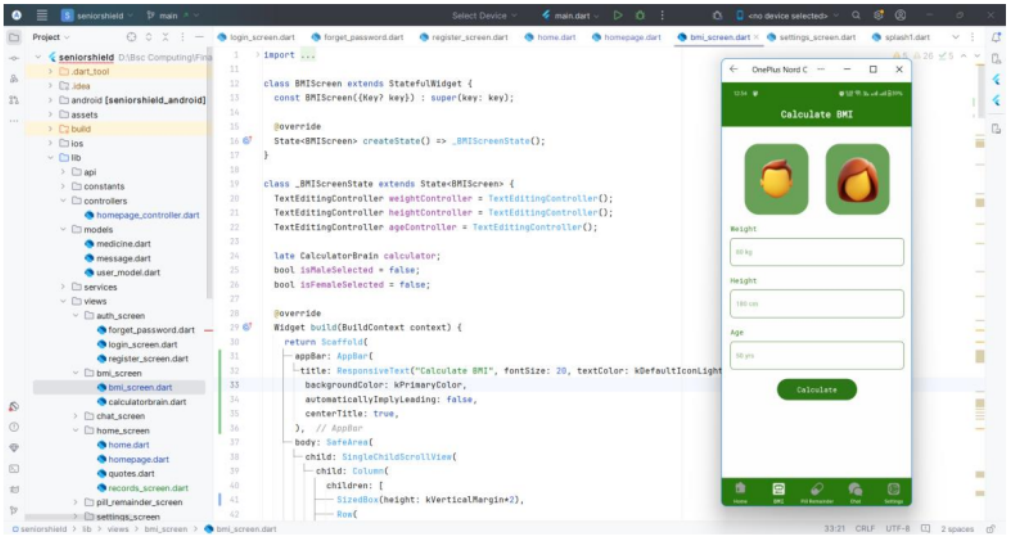

class UserModel {
String? uid;
String? fullName;
String? email;
String? address;
String? role;
String? image;
String? about;
String? createdAt;
bool? isOnline;
String? lastActive;
String? pushToken;
String? caretakerNumber; // New field
UserModel({
this.uid,
this.fullName,
this.email,
this.address,
this.role,
this.image,
this.about,
this.createdAt,
this.isOnline,
this.lastActive,
this.pushToken,
this.caretakerNumber, // Added to the constructor
});
factory UserModel.fromJson(Map<String, dynamic> json) {
return UserModel(
uid: json['uid'],
fullName: json['fullName'],

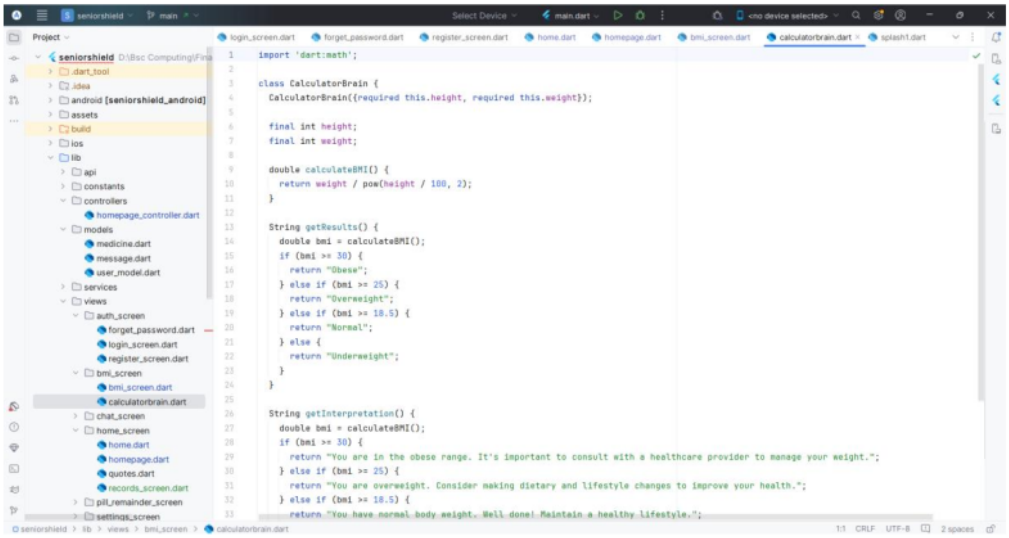

Let's Sign you in.
Welcome Back
You've been missed!
Email
Password
Forget Password?
Login
Haven't registered yet? Register!

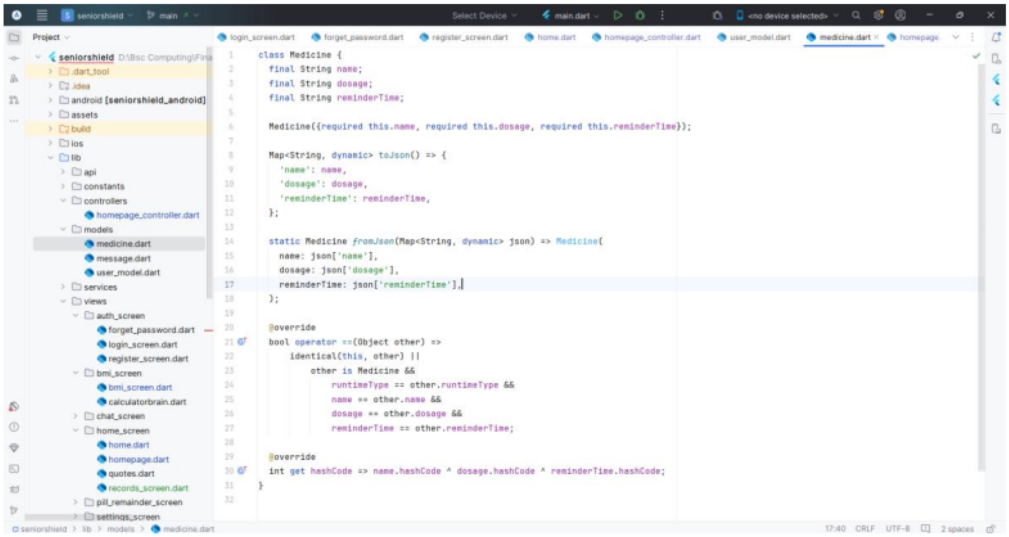

Forget Password
Forgot your password? Don't worry!
Email
Reset Password
Back to Login


SignUp
To Get Started!
Full Name
Email
Caretaker Number
Address
Role
Select Role
Password
Confirm Password

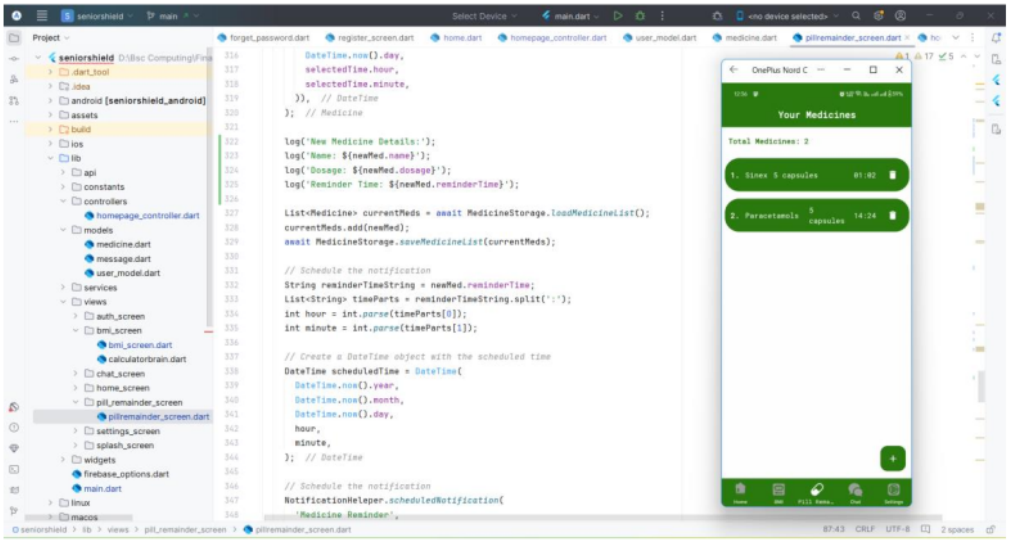

Welcome
Good Day, Sandesh Paudel
Quote of the Day
"You are never too old to set another goal or to dream a new dream. - C.S. Lewis"
Heart Rate
80.04457 bpm
SpO2 Level
95%
Show all Records
Fall Detection: No Fall
Health Status: Error


Calculate BMI
Weight
Height
Age
Calculate

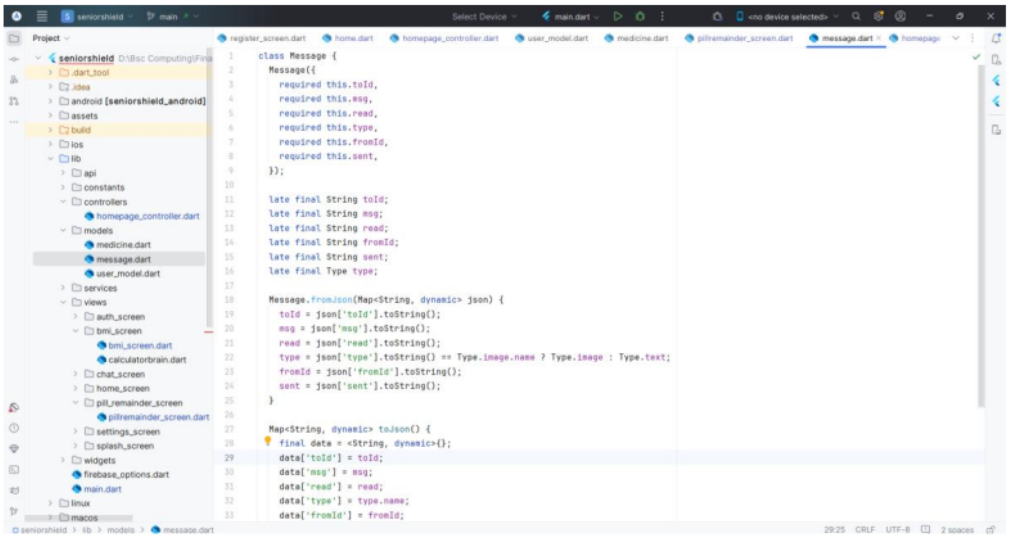




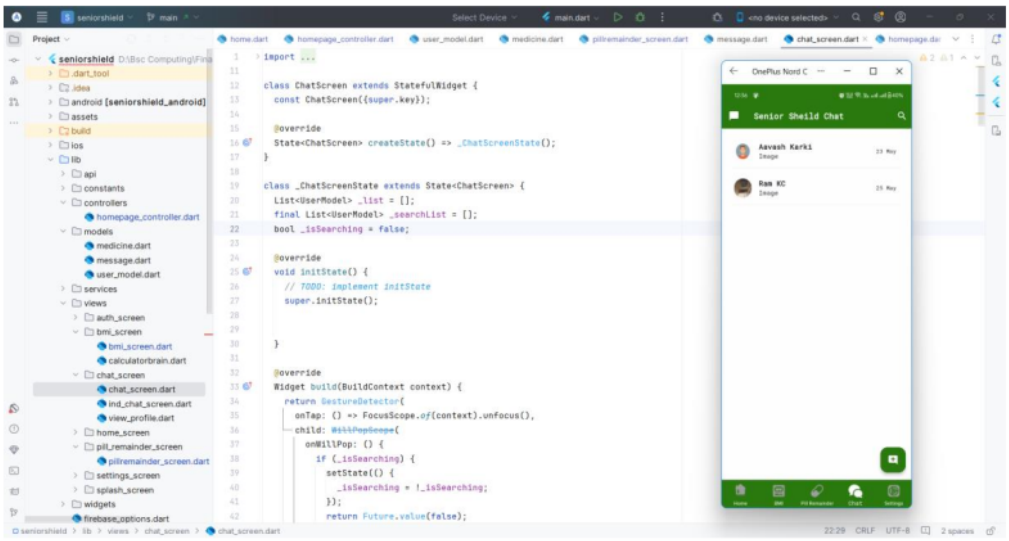
```dart
class Medicine {
  final String name;
  final String dosage;
  final String reminderTime;

  Medicine({required this.name, required this.dosage, required this.reminderTime});

  Map<String, dynamic> toJson() => {
    'name': name,
    'dosage': dosage,
    'reminderTime': reminderTime,
  };

  static Medicine fromJson(Map<String, dynamic> json) => Medicine(
    name: json['name'],
    dosage: json['dosage'],
    reminderTime: json['reminderTime'],
  );

  @override
  bool operator ==(Object other) =>
      identical(this, other) ||
          other is Medicine &&
              runtimeType == other.runtimeType &&
              name == other.name &&
              dosage == other.dosage &&
              reminderTime == other.reminderTime;

  @override
  int get hashCode => name.hashCode ^ dosage.hashCode ^ reminderTime.hashCode;
}
```



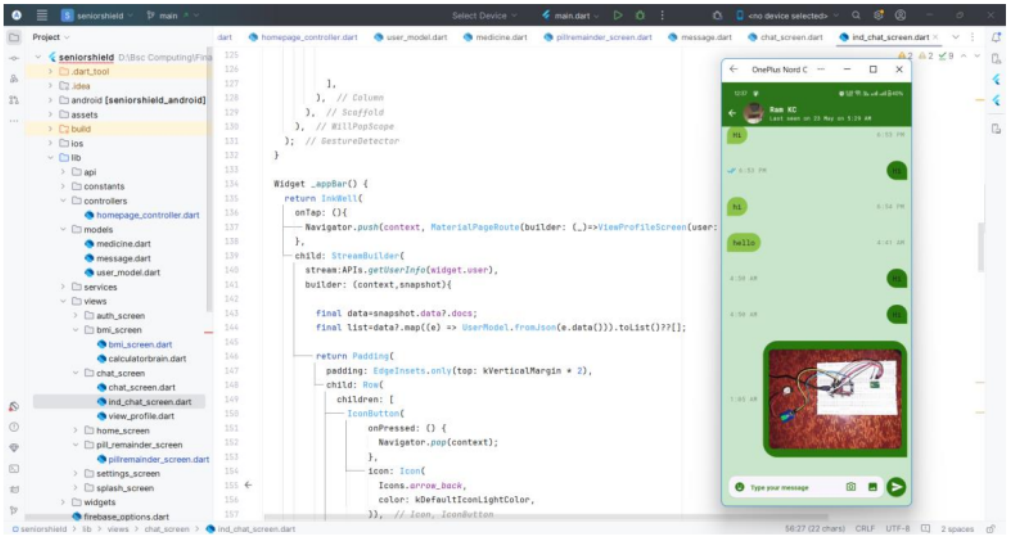
```dart
      DateTime.now().day,
      selectedTime.hour,
      selectedTime.minute,
    ),  // DateTime
  );  // Medicine

  log('New Medicine Details:');
  log('Name: ${newMed.name}');
  log('Dosage: ${newMed.dosage}');
  log('Reminder Time: ${newMed.reminderTime}');

  List<Medicine> currentMeds = await MedicineStorage.loadMedicineList();
  currentMeds.add(newMed);
  await MedicineStorage.saveMedicineList(currentMeds);

  // Schedule the notification
  String reminderTimeString = newMed.reminderTime;
  List<String> timeParts = reminderTimeString.split(':');
  int hour = int.parse(timeParts[0]);
  int minute = int.parse(timeParts[1]);

  // Create a DateTime object with the scheduled time
  DateTime scheduledTime = DateTime(
    DateTime.now().year,
    DateTime.now().month,
    DateTime.now().day,
    hour,
    minute,
  );  // DateTime

  // Schedule the notification
  NotificationHelper.scheduledNotification(
    'Medicine Reminder',
```

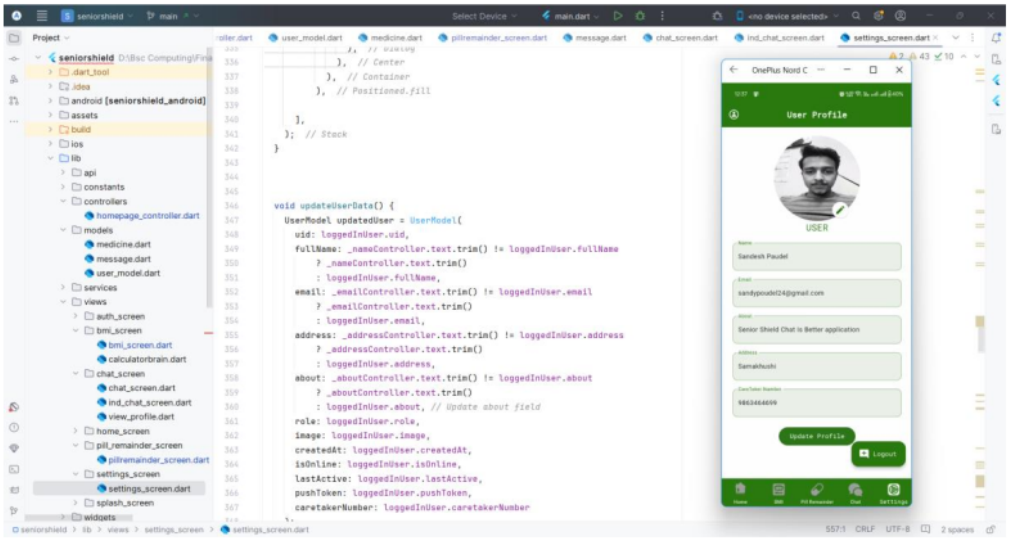


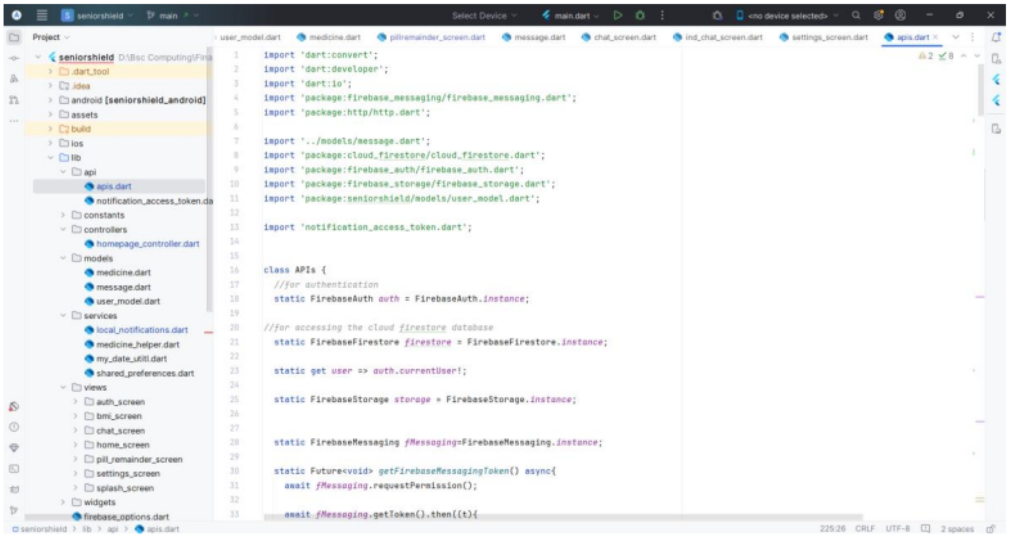
```dart
class Message {
  Message({
    required this.toId,
    required this.msg,
    required this.read,
    required this.type,
    required this.fromId,
    required this.sent,
  });

  late final String toId;
  late final String msg;
  late final String read;
  late final String fromId;
  late final String sent;
  late final Type type;

  Message.fromJson(Map<String, dynamic> json) {
    toId = json['toId'].toString();
    msg = json['msg'].toString();
    read = json['read'].toString();
    type = json['type'].toString() == Type.image.name ? Type.image : Type.text;
    fromId = json['fromId'].toString();
    sent = json['sent'].toString();
  }

  Map<String, dynamic> toJson() {
    final data = <String, dynamic>{};
    data['toId'] = toId;
    data['msg'] = msg;
    data['read'] = read;
    data['type'] = type.name;
    data['fromId'] = fromId;
```



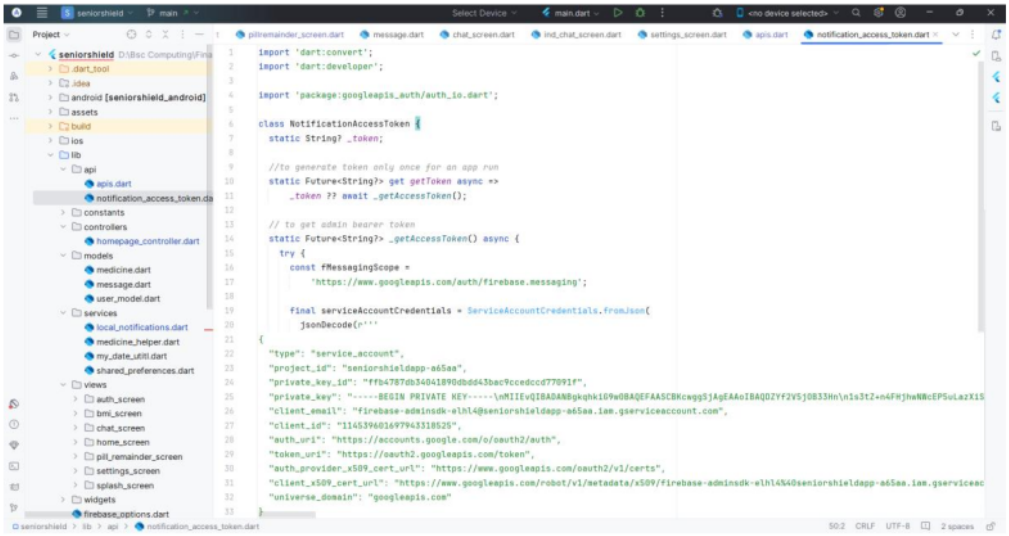
```dart
import ...

class ChatScreen extends StatefulWidget {
  const ChatScreen({super.key});

  @override
  State<ChatScreen> createState() => _ChatScreenState();
}

class _ChatScreenState extends State<ChatScreen> {
  List<UserModel> _list = [];
  final List<UserModel> _searchList = [];
  bool _isSearching = false;

  @override
  void initState() {
    // TODO: implement initState
    super.initState();


  }

  @override
  Widget build(BuildContext context) {
    return GestureDetector(
      onTap: () => FocusScope.of(context).unfocus(),
      child: WillPopScope(
        onWillPop: () {
          if (_isSearching) {
            setState(() {
              _isSearching = !_isSearching;
            });
            return Future.value(false);
```



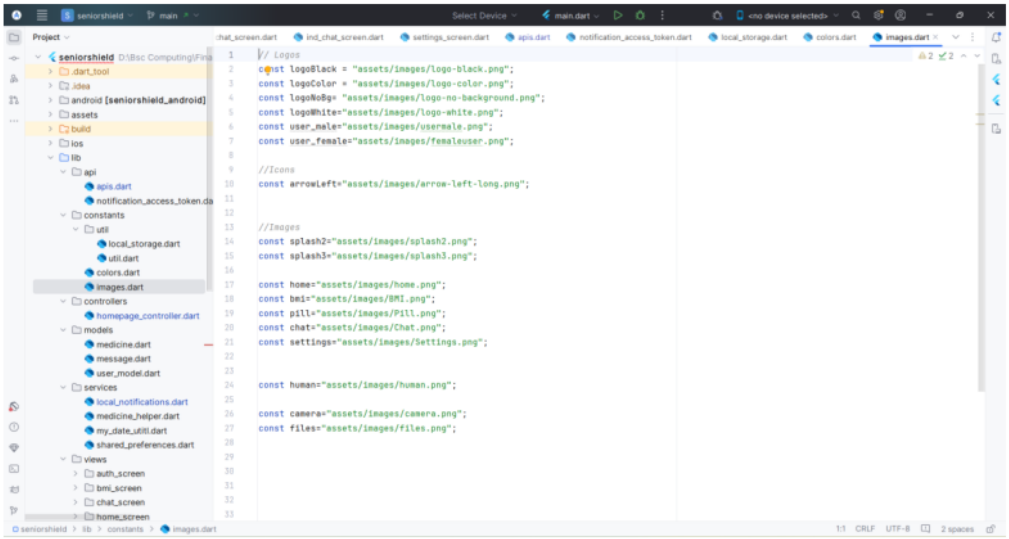




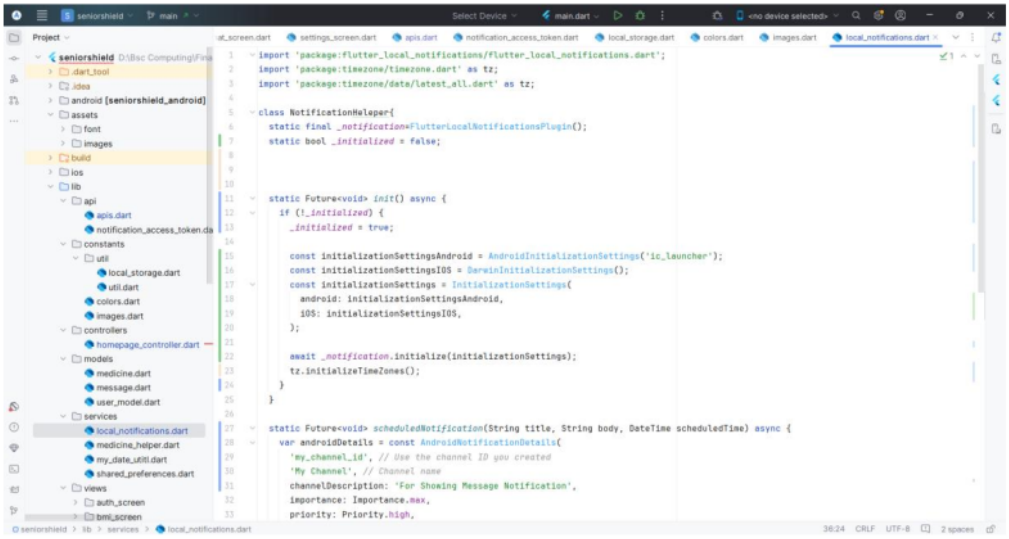
```
import 'dart:convert';
import 'dart:developer';
import 'dart:io';
import 'package:firebase_messaging/firebase_messaging.dart';
import 'package:http/http.dart';

import '../models/message.dart';
import 'package:cloud_firestore/cloud_firestore.dart';
import 'package:firebase_auth/firebase_auth.dart';
import 'package:firebase_storage/firebase_storage.dart';
import 'package:seniorshield/models/user_model.dart';

import 'notification_access_token.dart';


class APIs {
  //for authentication
  static FirebaseAuth auth = FirebaseAuth.instance;

//for accessing the cloud firestore database
  static FirebaseFirestore firestore = FirebaseFirestore.instance;

  static get user => auth.currentUser!;

  static FirebaseStorage storage = FirebaseStorage.instance;


  static FirebaseMessaging fMessaging=FirebaseMessaging.instance;

  static Future<void> getFirebaseMessagingToken() async{
    await fMessaging.requestPermission();

    await fMessaging.getToken().then((t){
```



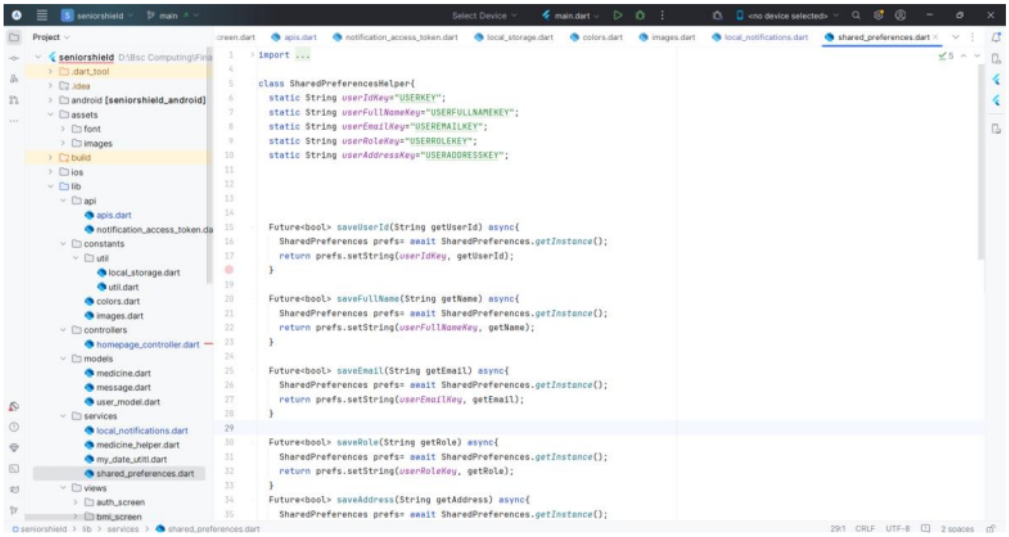
```
import 'dart:convert';
import 'dart:developer';

import 'package:googleapis_auth/auth_io.dart';

class NotificationAccessToken {
  static String? _token;

  //to generate token only once for an app run
  static Future<String?> get getToken async =>
      _token ?? await _getAccessToken();

  // to get admin bearer token
  static Future<String?> _getAccessToken() async {
    try {
      const fMessagingScope =
          'https://www.googleapis.com/auth/firebase.messaging';

      final serviceAccountCredentials = ServiceAccountCredentials.fromJson(
        jsonDecode(r'''
{
  "type": "service_account",
  "project_id": "seniorshieldapp-a65aa",
  "private_key_id": "ffb4787db34041890dbdd43bac9ccedccd77091f",
  "private_key": "-----BEGIN PRIVATE KEY-----\nMIIEvQIBADANBgkqhkiG9w0BAQEFAASCBKcwggSjAgEAAoIBAQDZYf2V5jOB33Hn\n1s3tZ+n4FHjhwNNcEPSuLazX1S
  "client_email": "firebase-adminsdk-elhl4@seniorshieldapp-a65aa.iam.gserviceaccount.com",
  "client_id": "114539601697943318525",
  "auth_uri": "https://accounts.google.com/o/oauth2/auth",
  "token_uri": "https://oauth2.googleapis.com/token",
  "auth_provider_x509_cert_url": "https://www.googleapis.com/oauth2/v1/certs",
  "client_x509_cert_url": "https://www.googleapis.com/robot/v1/metadata/x509/firebase-adminsdk-elhl4%40seniorshieldapp-a65aa.iam.gserviceac
  "universe_domain": "googleapis.com"
}
```



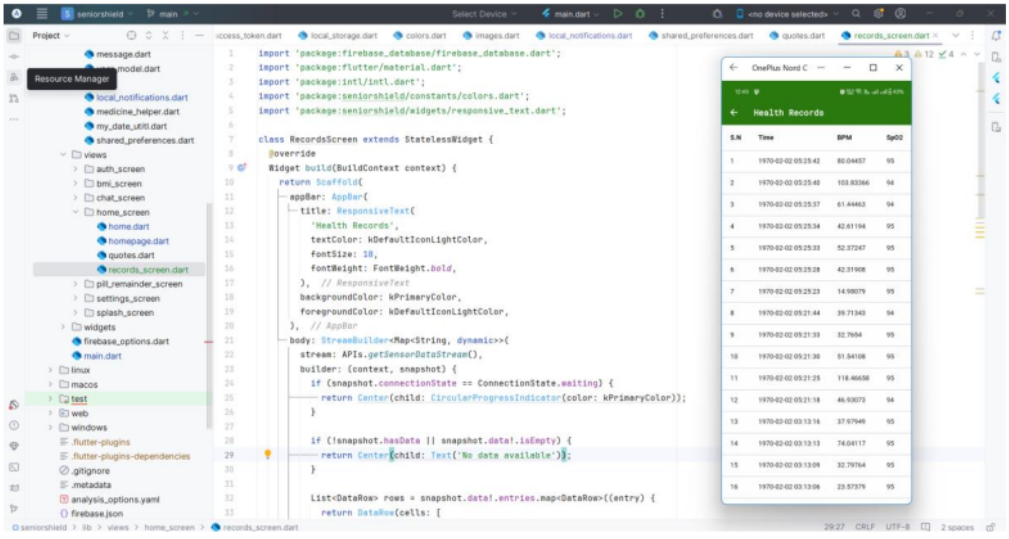
```
// Logos
const logoBlack = "assets/images/logo-black.png";
const logoColor = "assets/images/logo-color.png";
const logoNoBg= "assets/images/logo-no-background.png";
const logoWhite="assets/images/logo-white.png";
const user_male="assets/images/usermale.png";
const user_female="assets/images/femaleuser.png";

//Icons
const arrowLeft="assets/images/arrow-left-long.png";


//Images
const splash2="assets/images/splash2.png";
const splash3="assets/images/splash3.png";

const home="assets/images/home.png";
const bmi="assets/images/BMI.png";
const pill="assets/images/Pill.png";
const chat="assets/images/Chat.png";
const settings="assets/images/Settings.png";


const human="assets/images/human.png";

const camera="assets/images/camera.png";
const files="assets/images/files.png";
```



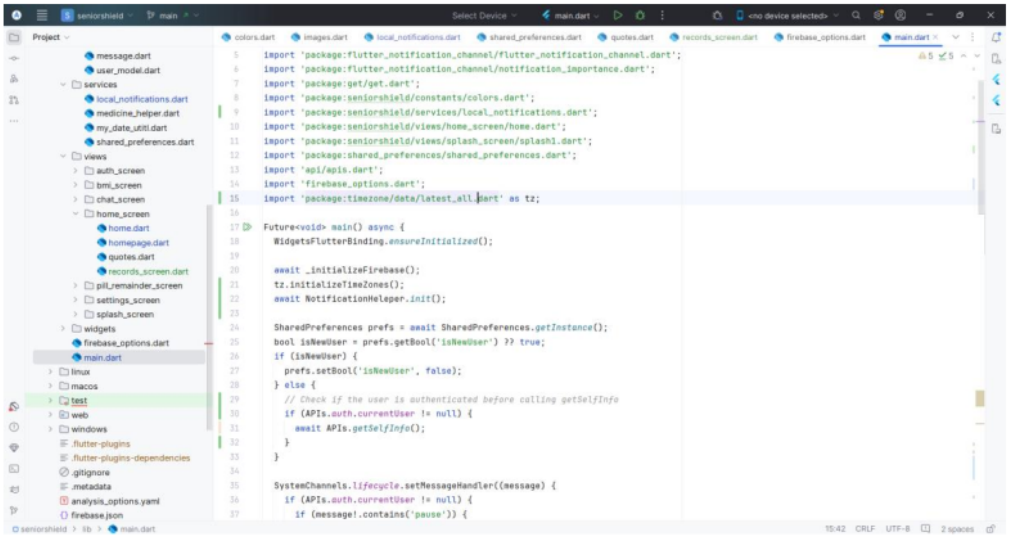
```
import 'package:flutter_local_notifications/flutter_local_notifications.dart';
import 'package:timezone/timezone.dart' as tz;
import 'package:timezone/data/latest_all.dart' as tz;

class NotificationHeleper{
  static final _notification=FlutterLocalNotificationsPlugin();
  static bool _initialized = false;



  static Future<void> init() async {
    if (!_initialized) {
      _initialized = true;

      const initializationSettingsAndroid = AndroidInitializationSettings('ic_launcher');
      const initializationSettingsIOS = DarwinInitializationSettings();
      const initializationSettings = InitializationSettings(
        android: initializationSettingsAndroid,
        iOS: initializationSettingsIOS,
      );

      await _notification.initialize(initializationSettings);
      tz.initializeTimeZones();
    }
  }

  static Future<void> scheduledNotification(String title, String body, DateTime scheduledTime) async {
    var androidDetails = const AndroidNotificationDetails(
      'my_channel_id', // Use the channel ID you created
      'My Channel', // Channel name
      channelDescription: 'For Showing Message Notification',
      importance: Importance.max,
      priority: Priority.high,
```



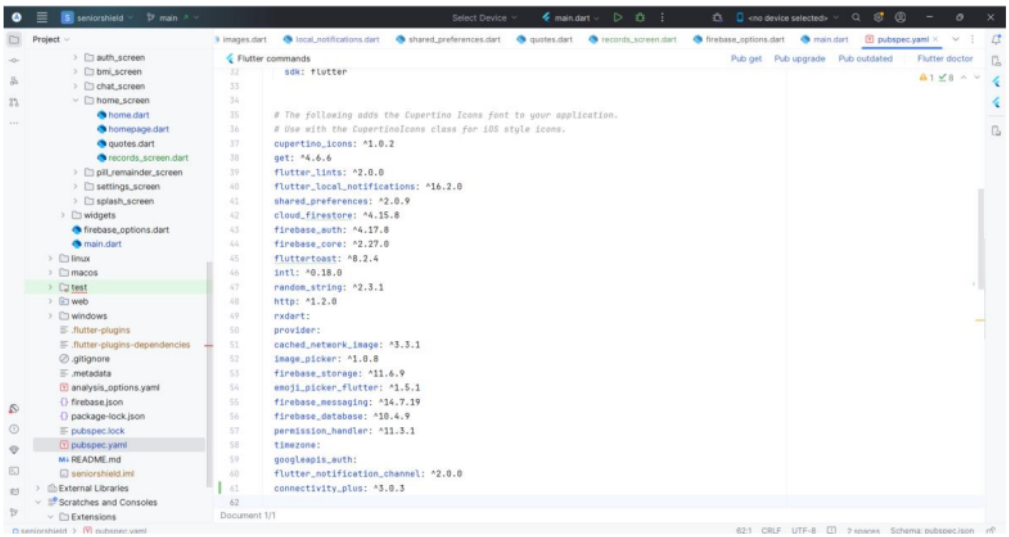
```
import ...

class SharedPreferencesHelper{
  static String userIdKey="USERKEY";
  static String userFullNameKey="USERFULLNAMEKEY";
  static String userEmailKey="USEREMAILKEY";
  static String userRoleKey="USERROLEKEY";
  static String userAddressKey="USERADDRESSKEY";



  Future<bool> saveUserId(String getUserId) async{
    SharedPreferences prefs= await SharedPreferences.getInstance();
    return prefs.setString(userIdKey, getUserId);
  }

  Future<bool> saveFullName(String getName) async{
    SharedPreferences prefs= await SharedPreferences.getInstance();
    return prefs.setString(userFullNameKey, getName);
  }

  Future<bool> saveEmail(String getEmail) async{
    SharedPreferences prefs= await SharedPreferences.getInstance();
    return prefs.setString(userEmailKey, getEmail);
  }

  Future<bool> saveRole(String getRole) async{
    SharedPreferences prefs= await SharedPreferences.getInstance();
    return prefs.setString(userRoleKey, getRole);
  }
  Future<bool> saveAddress(String getAddress) async{
    SharedPreferences prefs= await SharedPreferences.getInstance();
```



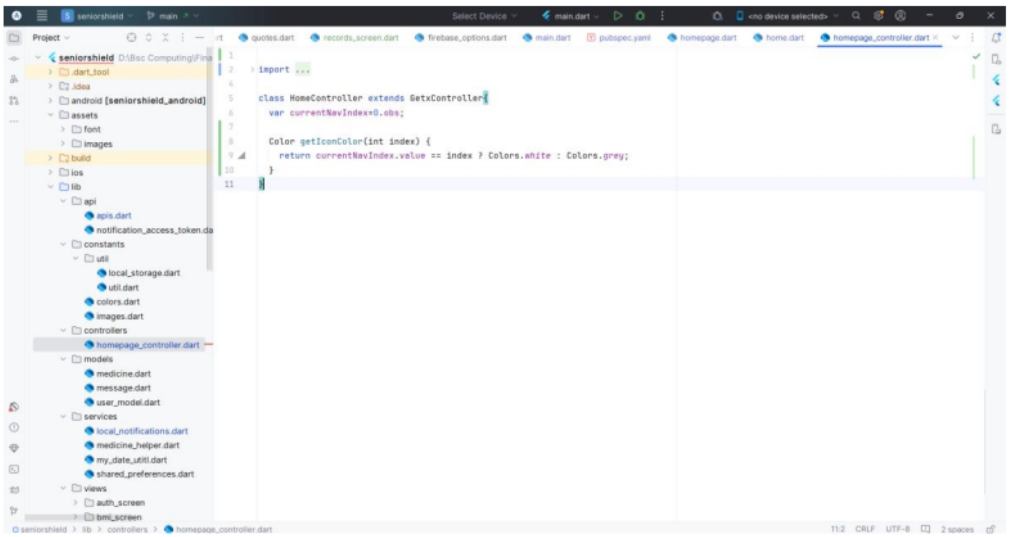
```
import 'package:firebase_database/firebase_database.dart';
import 'package:flutter/material.dart';
import 'package:intl/intl.dart';
import 'package:seniorshield/constants/colors.dart';
import 'package:seniorshield/widgets/responsive_text.dart';

class RecordsScreen extends StatelessWidget {
  @override
  Widget build(BuildContext context) {
    return Scaffold(
      appBar: AppBar(
        title: ResponsiveText(
          'Health Records',
          textColor: kDefaultIconLightColor,
          fontSize: 18,
          fontWeight: FontWeight.bold,
        ),  // ResponsiveText
        backgroundColor: kPrimaryColor,
        foregroundColor: kDefaultIconLightColor,
      ),  // AppBar
      body: StreamBuilder<Map<String, dynamic>>(
        stream: APIs.getSensorDataStream(),
        builder: (context, snapshot) {
          if (snapshot.connectionState == ConnectionState.waiting) {
            return Center(child: CircularProgressIndicator(color: kPrimaryColor));
          }

          if (!snapshot.hasData || snapshot.data!.isEmpty) {
            return Center(child: Text('No data available'));
          }

          List<DataRow> rows = snapshot.data!.entries.map<DataRow>((entry) {
            return DataRow(cells: [
```



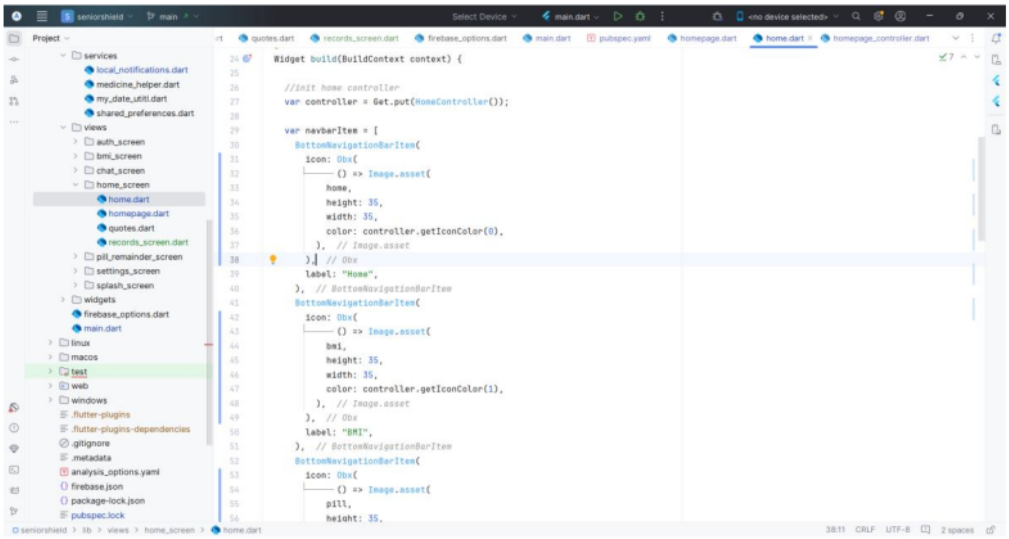
```dart
import 'package:flutter_notification_channel/flutter_notification_channel.dart';
import 'package:flutter_notification_channel/notification_importance.dart';
import 'package:get/get.dart';
import 'package:seniorshield/constants/colors.dart';
import 'package:seniorshield/services/local_notifications.dart';
import 'package:seniorshield/views/home_screen/home.dart';
import 'package:seniorshield/views/splash_screen/splash1.dart';
import 'package:shared_preferences/shared_preferences.dart';
import 'api/apis.dart';
import 'firebase_options.dart';
import 'package:timezone/data/latest_all.dart' as tz;

Future<void> main() async {
  WidgetsFlutterBinding.ensureInitialized();

  await _initializeFirebase();
  tz.initializeTimeZones();
  await NotificationHeleper.init();

  SharedPreferences prefs = await SharedPreferences.getInstance();
  bool isNewUser = prefs.getBool('isNewUser') ?? true;
  if (isNewUser) {
    prefs.setBool('isNewUser', false);
  } else {
    // Check if the user is authenticated before calling getSelfInfo
    if (APIs.auth.currentUser != null) {
      await APIs.getSelfInfo();
    }
  }

  SystemChannels.lifecycle.setMessageHandler((message) {
    if (APIs.auth.currentUser != null) {
      if (message!.contains('pause')) {
```



```yaml
sdk: flutter


# The following adds the Cupertino Icons font to your application.
# Use with the CupertinoIcons class for iOS style icons.
cupertino_icons: ^1.0.2
get: ^4.6.6
flutter_lints: ^2.0.0
flutter_local_notifications: ^16.2.0
shared_preferences: ^2.0.9
cloud_firestore: ^4.15.8
firebase_auth: ^4.17.8
firebase_core: ^2.27.0
fluttertoast: ^8.2.4
intl: ^0.18.0
random_string: ^2.3.1
http: ^1.2.0
rxdart:
provider:
cached_network_image: ^3.3.1
image_picker: ^1.0.8
firebase_storage: ^11.6.9
emoji_picker_flutter: ^1.5.1
firebase_messaging: ^14.7.19
firebase_database: ^10.4.9
permission_handler: ^11.3.1
timezone:
googleapis_auth:
flutter_notification_channel: ^2.0.0
connectivity_plus: ^3.0.3
```



```
import ...

class HomeController extends GetxController{
  var currentNavIndex=0.obs;

  Color getIconColor(int index) {
    return currentNavIndex.value == index ? Colors.white : Colors.grey;
  }
}
```



```
Widget build(BuildContext context) {

  //Init home controller
  var controller = Get.put(HomeController());

  var navbarItem = [
    BottomNavigationBarItem(
      icon: Obx(
        ------() => Image.asset(
            home,
            height: 35,
            width: 35,
            color: controller.getIconColor(0),
          ),  // Image.asset
      ),  // Obx
      label: "Home",
    ),  // BottomNavigationBarItem
    BottomNavigationBarItem(
      icon: Obx(
        ------() => Image.asset(
            bmi,
            height: 35,
            width: 35,
            color: controller.getIconColor(1),
          ),  // Image.asset
      ),  // Obx
      label: "BMI",
    ),  // BottomNavigationBarItem
    BottomNavigationBarItem(
      icon: Obx(
        ------() => Image.asset(
            pill,
            height: 35,
```

77297958_ProductionProject_FinalReport

ORIGINALITY REPORT

12%	8%	3%	10%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to The British College Student Paper	4%
2	Submitted to MCAST Student Paper	<1%
3	Submitted to University of Bedfordshire Student Paper	<1%
4	libweb.kpfu.ru Internet Source	<1%
5	www.mdpi.com Internet Source	<1%
6	Submitted to Athlone Institute of Technology Student Paper	<1%
7	Submitted to Jordan University of Science & Technology Student Paper	<1%
8	syniutajournals.com Internet Source	<1%
9	Submitted to Heriot-Watt University Student Paper	<1%

10	Submitted to Central Queensland University Student Paper	<1%
11	Submitted to University of Wollongong Student Paper	<1%
12	Submitted to University of North Texas Student Paper	<1%
13	www.coursehero.com Internet Source	<1%
14	Submitted to University of Wales Institute, Cardiff Student Paper	<1%
15	Duarte Cota, José Martins, Henrique Mamede, Frederico Branco. "BHiveSense: an integrated information system architecture for sustainable remote monitoring and management of apiaries based on IoT and microservices", Journal of Open Innovation: Technology, Market, and Complexity, 2023 Publication	<1%
16	online-journal.unja.ac.id Internet Source	<1%
17	www.123articleonline.com Internet Source	<1%
18	Submitted to Asia Pacific University College of Technology and Innovation (UCTI) Student Paper	<1%

19	trap.ncirl.ie Internet Source	<1 %
20	Submitted to City University of Hong Kong Student Paper	<1 %
21	Submitted to Nottingham Trent University Student Paper	<1 %
22	Submitted to Victoria University College Student Paper	<1 %
23	repositoriosenaiba.fieb.org.br Internet Source	<1 %
24	www.webology.org Internet Source	<1 %
25	www.theseus.fi Internet Source	<1 %
26	Submitted to Trident University International Student Paper	<1 %
27	Submitted to Universiti Teknologi Petronas Student Paper	<1 %
28	Submitted to University of Wales College, Newport Student Paper	<1 %
29	Submitted to Cheshire College South and Wes Student Paper	<1 %

30	Submitted to Jabatan Pendidikan Politeknik Dan Kolej Komuniti Student Paper	<1%
31	Submitted to University of Mauritius Student Paper	<1%
32	origin.geeksforgeeks.org Internet Source	<1%
33	Submitted to Bahrain Polytechnic Student Paper	<1%
34	Submitted to Roehampton University Student Paper	<1%
35	Submitted to University College Birmingham Student Paper	<1%
36	Submitted to University of Edinburgh Student Paper	<1%
37	Submitted to University of Greenwich Student Paper	<1%
38	Submitted to Victoria University Student Paper	<1%
39	psycnet.apa.org Internet Source	<1%
40	www.ijert.org Internet Source	<1%

41	Syed Inthiyaz, V. Rajesh, N. Nanda Prakash, G. S. V. Narendra, M. Sri Raghavendra Rao, Y. R. V. Anil. "Iot Based Smart Rider Safety System", Journal of Physics: Conference Series, 2023 Publication	<1 %
42	dspace.tul.cz Internet Source	<1 %
43	www.digitaljournal.com Internet Source	<1 %
44	dspace.cvut.cz Internet Source	<1 %
45	oa.upm.es Internet Source	<1 %
46	Submitted to Liverpool John Moores University Student Paper	<1 %
47	Safira Faizah, Dian Nugraha, Mohammed N. Abdulrazaq, Brainvendra Widi Dionova, Muhammad Irsyad Abdullah, Leni Novianti. "A rest tremor detection system based on internet of thing technology", Indonesian Journal of Electrical Engineering and Computer Science, 2024 Publication	<1 %
48	dspace.lboro.ac.uk Internet Source	

		<1%
49	www.electronicsforu.com Internet Source	<1%
50	www.go-globe.com Internet Source	<1%
51	www.igi-global.com Internet Source	<1%
52	www.readkong.com Internet Source	<1%

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		