



Design and Implementation of Obesity Healthcare System (OHS) Using Flutter Platform

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Abstract. The aim of this paper is to educate people about technology advancement and allow them to use this technology for a healthy lifestyle along with balancing environmental sustainability, and social and economic needs, letting prosperity for now and future generations. The proposed system “Obesity Healthcare System (OHS)” ensures healthy lives and promotes well-being for all ages. This aim is essential to sustainable development, it is the third goal of the Sustainable Development Goals (SDGs). OHS will include all the knowledge-based information that will guide the user regarding his/her health, and medications and advise them accordingly. The proposed mobile application Obesity Healthcare System (OHS) is designed in Android Studio using the Dart programming language to provide the users with the necessary tools to monitor their current health by checking and updating their health trackers such as weight and BMI, and if any of these trackers reaches abnormal levels, the user will be alerted and given recommendations on how to improve the condition of their trackers. In addition, it’s the ability to set hospital appointments manually, where the user is notified of their appointments. This system is integrated into several hospitals and provides users with access to their medical records. OHS allows the user to enter symptoms they are suffering from and check the stored list of diseases and provide advice accordingly. This system is built using the Flutter framework, tested, and run on an emulator Android SDK build for x86 (mobile). OHS is a novel system as a digital health approach to healthcare. It aims to BMI calculator, health tracker, symptoms checker, reminders, and access to medical records that would be a full-pack package to help obese people with their weight and health. With the digital health OHS platform, people have quicker access to health services, improving the quality of care provided to them. Simultaneously, this system reduces burdens on healthcare facilities by pioneering the idea of self-care.

Keywords: Mobile Application · Healthcare System · Flutter · Obesity · Dart Programming Language · Environmental Sustainability

1 Introduction

With the increasing number of people living with different types of diseases and the rising costs of healthcare, there is ever-growing pressure on healthcare systems around the world to conserve natural resources to support health and well-being in environmental sustainability. Keeping ourselves healthy can sound easy but is quite difficult. People require a hand-held system that could make them easily follow their diet and be notified about their health and medications. The proposed Obesity Healthcare System (OHS) is an obesity healthcare application that works as an advisor for obese people who have limited knowledge about their health. OHS is a guide to a healthy lifestyle for obese people including advice regarding a complete diet plan, feedback from doctors for some health issues, and working as an alarm for taking the medicine. One of the most effective features of this application is that even if the user is suffering from mild health issues, he/she can know what caused this issue and will be advised and directed to the hospital accordingly. OHS enables you to track your weight and alerts you if the weight is going beyond the excess level. OHS provides perceptive guidelines to put your mind at ease so you don't stress out about your weight. Furthermore, the user can manage his/her schedule by entering the details such as hospital appointments, medications, and diet so they don't miss any important guide. In addition, the user can access his/her hospital medical records easily without the need to go to the hospital and ask for printed records. This system will have a significant positive impact on people's health care and is considered one of the innovations that develop life-enhancing treatments and offers a set of choices for consumers of health care.

2 Related Work

Environmental factors are largely responsible for Obesity, and better-designed systems on the true importance of environmental factors for obesogenic behavioral change are needed to achieve the success of large-scale environmental change interventions [1, 2]. Recently many systems have been growing to provide enthralling suitable solutions to encourage a healthier lifestyle and support the optimal weight. These studies and work employ numerous approaches and techniques to facilitate the target behavior, each having different services. The following are some of these applications such as myPace is a mobile application that is designed to prevent obesity in adult patients. This is a management system for behavior change of complete patient's weight loss arranged on smartphone devices. It allows the patients to communicate with the dietitians to have a face-to-face consultation and extends the relationship through the patient's regular progress and allows timely advice given for sustained behavior change. MySugr–Diabetes Tracker Log is an application that has come into existence in 2021, it enables diabetes patients to track their sugar level, bolus, and carbs HbA1c all at one time. This diabetes management application is specially designed for people suffering from diabetes, to control their sugar levels and be able to live a better life, this application is compatible both with IOS and Android operating systems [3].

Patient-centered Assessment and Counseling Mobile Energy balance (PmEB) is a mobile application that enables the users to self-monitor caloric balance in real-time, it's

a tracking mobile application that allows the user to control and monitor their calories, plan their meals, get healthy recipes, get social support, and even obtain support and advice from experienced and trained professionals. This application was developed and applied with the 4-phase iterative research and development methodology to put the pilots to test the PmEB mobile application. Thematic analysis was carried out that showed that the mobile users scored PmEB the same as or higher on satisfaction, usability, and compliance showing that PmEB is feasible [4]. Epocrates is a mobile application that allows patients to get clinical decision support and provides the right medical information when needed. This application consists of a provider directory that finds providers for referrals and consults. It even helps review information such as drug prescriptions, provides access to timely medicine news and research information, information on any disease, lab guides, alternative medications, and more clinical tools [5]. Doctor at work PLUS is a standalone electronic medical record application that is built to manage patients' health and medical records, bills, and appointments. This application routes phone calls and texts and even maintains documentation of each encounter for continuity of patient care [5].

Some works reported in [9, 12] showed that mostly these proposed applications are intended for a targeted set of people such as adults and the elderly. Hand-held computer technologies were created to improve the dietary intake in [12] and research was carried out to evaluate the efficacy of a hand-held computer, the findings provided primary evidence that using the PDAs to offer everyday modified responses to dietary behavior in the real world can upsurge the consumption of healthy food groups. Research where Environment-Aware System for Alzheimer's patient was developed at Fraunhofer Portugal, this project aimed to create a remote monitoring system for the patients who are suffering from Alzheimer's disease. This system consists of a device that can monitor the surrounding temperature and humidity and track the patient's movement and location using GPS. This device will then send this information to the patient's caretaker through SMS and even to the server where all his/her medical records are stored. This medical record can be accessed by the caretaker using the application that is built into the project [6].

mCHOIS is an Application of Mobile Technology for Childhood Obesity Surveillance, this application was an improved version of the CHOIS (Childhood Obesity Informatics System) which was a web-based application and was limited by the internet access at the site. It enabled the field worker to enter or modify the medical data and be able to store it locally on the phone, and once the phone is connected to the internet the data will be sent to the remote database of CHOIS. This application was successfully tested and is now under deployment for use by the IDHS (Illinois Department of human resources) for its school health program [10]. ALHOSN UAE app is an integrated digital platform that was designed to enable the users to receive their PCR tests for Covid-19 directly on their mobile phones and it can even detect if the user has come in close contact with the people infected with covid-19 but only if the application is downloaded on both the ends. This application will activate when the user's open the Bluetooth function [11].

HealthTap is one of the mhealth application that enables the user to get answers to health-related questions from real doctors. This application simply works by posting a question in a platform and the doctors will respond within 24 hours, this application even

enables the user to meet and consult the doctor, psychologist, or dentist online regarding user's lab reports and or prescriptions on scheduled dates [7].

All the above applications listed are more commercial and money-making applications each with its functionalities, but the proposed Obesity Healthcare System (OHS) is more focused on a particular group of people that are suffering from obesity and provides the functionalities that can keep the obese people motivated, informed and aware of their health. The OHS system has the following features that makes it different from other applications,

- Health tracking: This feature will help manage the user's weight, body mass index (BMI), and diet, be able to get advice regarding their diet. Be able to set reminders and notify the user to ensure that their sleep, medication, and daily consumption schedule is going correct.
- Reminders and notifications: This function will allow the users to get reminded regarding their medicine time, appointments, and schedule follow-up.
- Symptom's checker: This functionality will allow the obese people to take necessary precautions and get educated about their minor health issues and further advise accordingly.
- BMI checker: Helping understand the user more about his/her health
- Keep medical records: The user can keep his/her medical records in one place so it's easy to access the records without going to the hospital and waiting for the details
- Security and user friendly: To maintain the confidentiality and the security of the user this application will include a log- in security feature so that the application is reliable, and the user can use it safely.

The following sections clarify the design and implementation of the proposed OHS with the approach results and recommendations.

3 Design of the Proposed System

The Obesity Healthcare System (OHS) is designed using the Flutter mobile application development environment and Dart programming language. The purpose of choosing this language is that it can produce cross-compatible code that runs on both Android and IOS. The user interface design of OHS is varied accordingly to match the user requirements and preferences. The methodology of the OHS-designed system is an iterative and rapid approach that focuses on the customer and client response. Any change or modification of requirements from the user is acceptable thus encouraging persistent responses from the customer or client. Regular and constant monitoring of approaches, requirements, and results provides the OHS project management team with a usual outline for adapting to evolution.

Figure 1 shows OHS main screens that navigate the user to the sign-up page so he/she can create a new account and log in to the system. The prototype is designed using Figma tool [8].

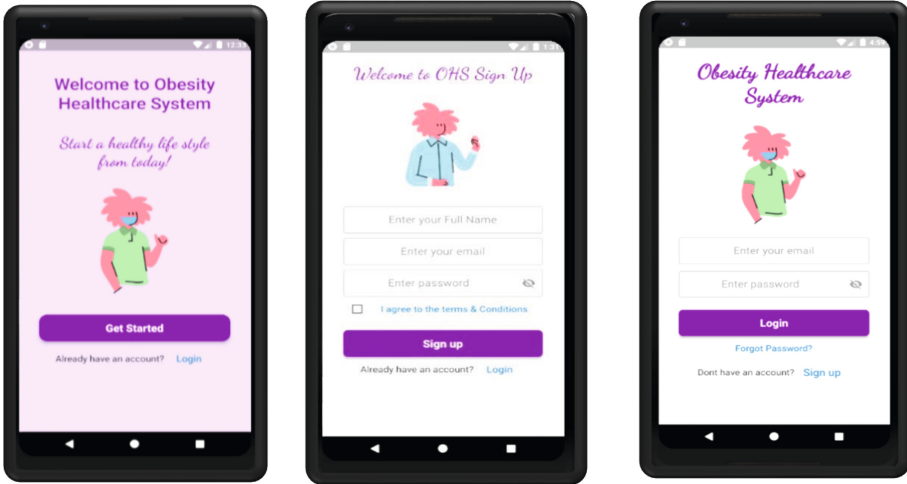


Fig. 1. Obesity Healthcare System Main Screens

Figure 2 shows the Context Analysis diagram DFD Level 0 for the OHS, The Fig. 2 shows the Context Analysis diagram for the OHS, this is Level 0 Data Flow Diagram (DFD), that shows an overall view of the OHS, where the process is being analyzed. The system is showed as a single process Obesity Healthcare System, with its relationship to external entities, User, Symptom’s checker, Tracker, Hospital Appointment and Medical Records. It represents the whole Obesity Healthcare System bubble with input and output data that is indicated by incoming and outgoing arrows.

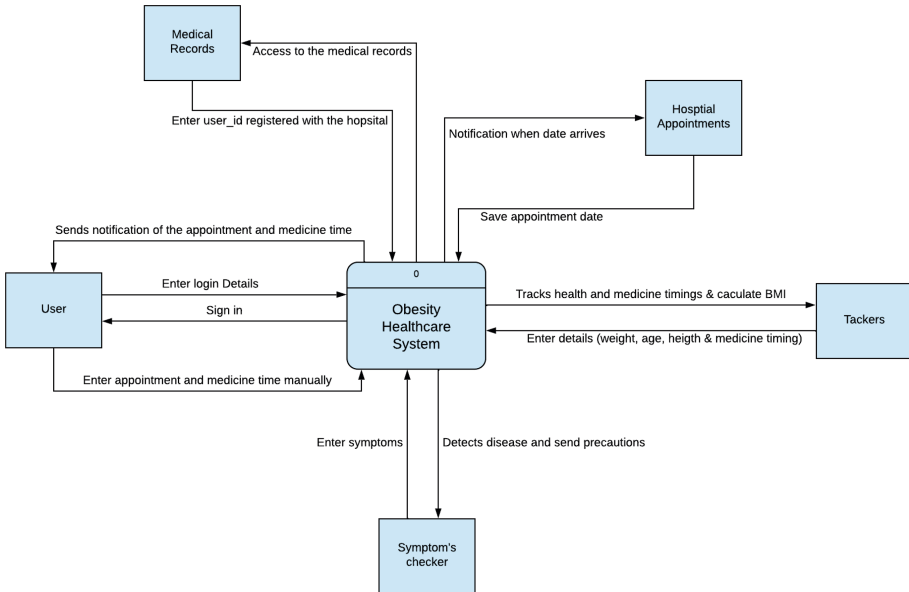


Fig. 2. Context Analysis Diagram DFD Level 0 for OHS

The main technical steps of OHS are as follows:

- Register your account by providing credentials such as name, email address and the password of 8 characters, if the email address is authenticated and correct and the password matches the criteria then the account is created successfully else if the email and or password is not correct the account will not be created.
- Login to the OHS account using the email address and the password that was used to register/sign up the OHS account.

The following shows the login criteria:

```
if(emailController.text.isEmpty && passController.text.isEmpty){
    showMessage('Please enter your email and password to login',
    context);}
else if (emailController.text.isNotEmpty && passController.text.isEmpty){
    showMessage('Please enter password', context);}
else if(emailController.text.isEmpty && passController.text.isNotEmpty){
    showMessage('Email is required', context);}
else{
    setState() {
    showSpinner = true;});
    .....
```

- Once the user has logged in successfully, he needs to go to the enter his age, weight, and height this will generate the BMI of the user
- The user is supposed to even enter his medicine timings to get notified
- The user is supposed to enter the hospital name to connect to the hospital and be able to get notified about the appointments and medical records
- The user needs to enter his/her symptoms so to generate the medical advice accordingly.

OHS has two types of databases, the cloud database “Firebase”, and a local database “Drift”. Firebase is used to register the users with the OHS, allowing the registration/sign-up data of the user to be stored securely and thus authenticating the user while logging in to the OHS homepage. The reason to choose firebase is that it is secure to use and authenticates the user’s validity and authenticity. The Drift/moor database is locally generated using Android Studio, and it stores the data of the user such as the medicine name, amount, and time to be taken. Moreover, it will store the details of the appointment. The implementation and results of the Obesity Healthcare System (OHS) are presented in the following section.

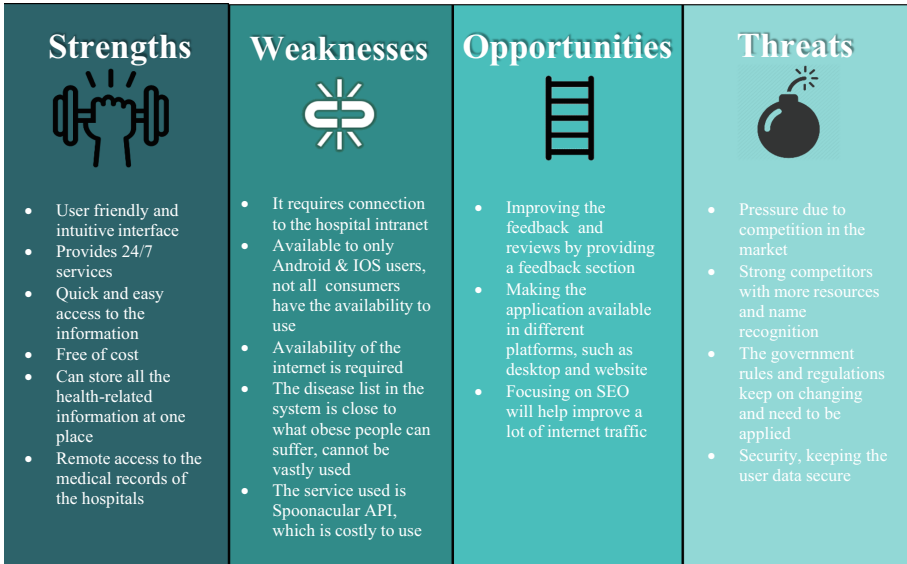


Fig. 3. OHS SWOT Analysis

4 Implementation and Results

The Obesity Healthcare System (OHS) has a user-friendly interface and ensures security. The user can use the OHS on their android mobile phones at any time anywhere if the device is connected to the internet. OHS application contributes more towards sustainable environment as it supports the idea of eating healthy and plant-based food this is one of the effective ways to reduce carbon emissions. Another main factor of OHS is that it advices the obese people to use bicycle or walk to miles in order to burn the calories they have gained hence reducing the use of cars, therefore reducing the use of fuels and saving money. OHS enables the user to have his/her medical records to be saved in their smartphones without the need for printing the records on the paper, hence using the less paper leads to conserving energy and saving more trees.

A stateful widget is used because it is a dynamic one that can change the appearance of the page with the user interaction. Custom dialogue is used so to allow the user to get better information in it and easily get through the sign-up page. FlatButton is used to create the Login button so when the user clicks on it will navigate the user to the login page. To navigate the user from one page to another each page should have a static route named so that when they navigated in that route path. SizedBox is used to create a box here the purpose for me to use it is just to create spaces between the different widgets.

OHS functionalities are Signing up, the user is asked to provide details such as their email address, enter their desired username and password to be set to log in, the password should be of 8 characters with symbols, the user is authenticated as he/she enters the username and password they have registered while signing up the application. Registered users will be able to change their password once in 30 days, this will be done when the user provides his/her contact number or email so that the verification code is sent to

them, and they can reset their password. Registered users will be asked to enter details such as weight, age and name, medication timings and hospital visits, and upcoming appointments. Trackers will include weight, diet, medication, hospital visits, and health. Registered User is suffering from a mild health issue he/she can enter the problem and they will get the advice and or precautionary measures accordingly. A weight tracker will be used to track the user's weight, the user will manually add his weight each time he/she checks so that it can be analyzed and measured later. A medicine tracker will be used to track the user's medication timings that will be entered by the user, the user will be then notified through alarm/notification when it's time to take their medicine if any. A tutorial and walk of the system of how to use the application will be provided on the dashboard of the application. A standard diet plan for obese people will already be in the diet plan section, just as the user clicks on the diet plan tab. The medical record tab in the OHS will allow the user to access the hospital medical record. Symptom's checker tab enables the registered user to check what disease they are suffering from and precautionary measures to be taken. Authentication and Validation of all entered data are implemented.

Figure 4 shows an implemented user manual to guide the user on how to use the OHS, step-by-step instructions on each OHS page, and features that have been explained using images and directions. A stateful widget was used and the pdf test String variable was declared and initialized. A single child scroll view is used to allow the user to scroll down and be able to read the screen from top to the end. Images have been imported, these images have been taken from the emulator and they are marked in a way, so the user is guided easily.

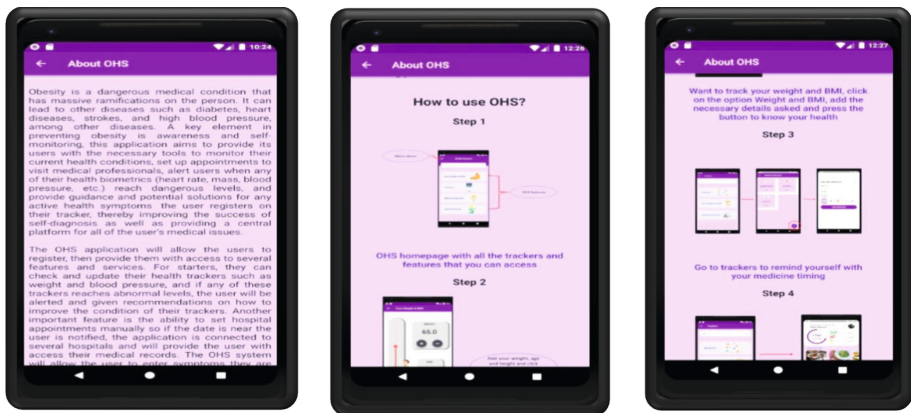
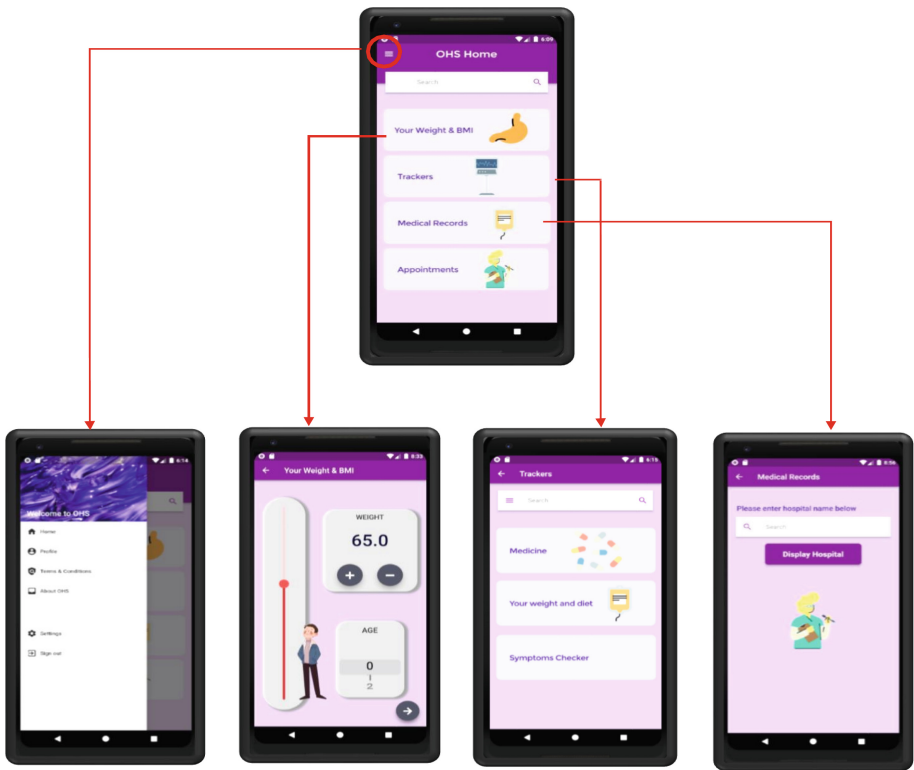


Fig. 4. User Manual of OHS

Figure 5 shows the Navigation Drawer using drawer class which is branched and has a child of list view widget, this will allow providing a linear list of the items that will be mentioned in the create Drawer Body item. The bmi_input Dart file includes the class layout builder to create a widget tree and this class warps the orientation builder class to allow the portrait and landscape orientation further this class wraps the scaffold of the

class that will consist of the round icon button, the app bar, and the data sum up the class to allow the user to add or minus his/her weight, age and a slider for height are defined.



Screen 5.1 Navigation drawer, that consists of the items shown

Screen 5.2 Your weight and BMI, where the user adds his/her weight, age and height and the system calculates their BMI

Screen 5.3 Trackers, that consists of medicine reminder, diet plans and allows the user to check his/her symptoms

Screen 5.4 Hospital name where the user enters the hospital name and click on the hospital that comes after search

Fig. 5. Screen Navigations in OHS

Figure 6 shows Trackers Screen, which contains medicine reminders, diet plan tab, and symptoms checker tab each tab has navigations as shown in the child screen

In Figure 6, the scaffold class consists of the clipRRect widget that will clip its child using a rounded rectangle such as a container or sized box. The next container is declared which consists of the column and the list tile. In the symptoms checker, the symptoms are stored in the database so when the user types in the symptom he/she will receive advice that is stored in the database.

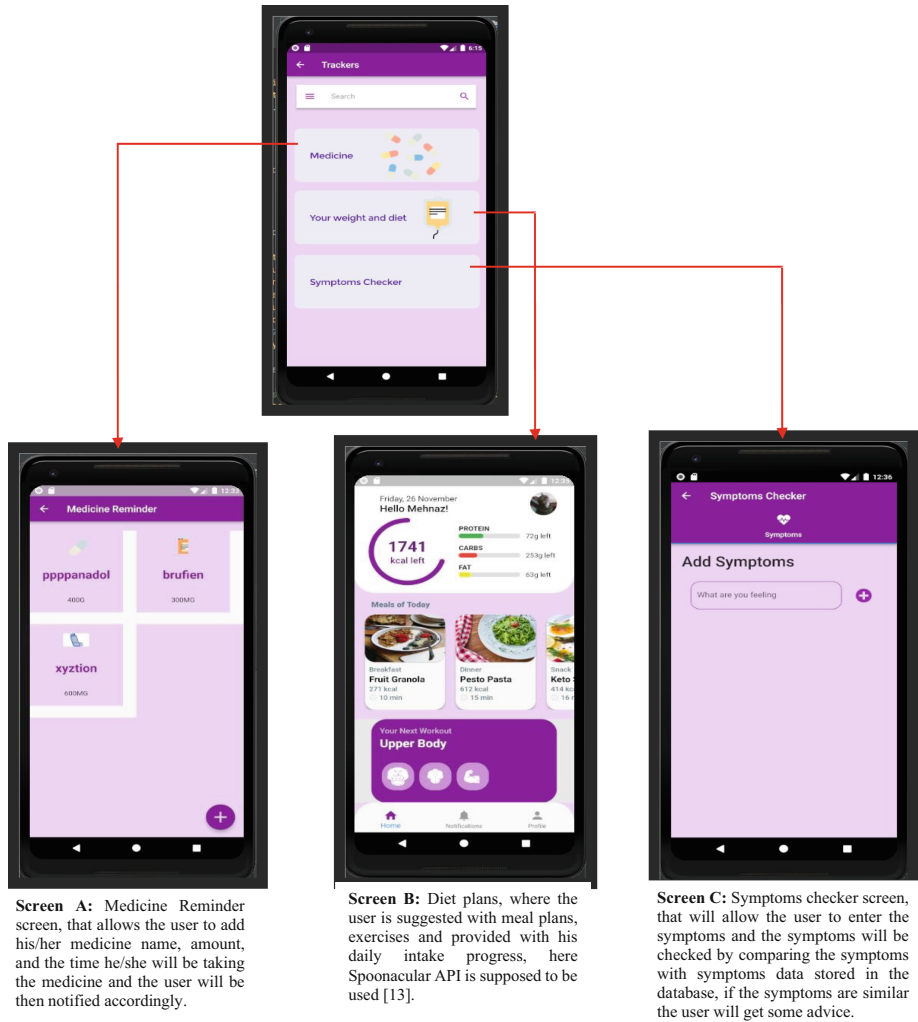


Fig. 6. Trackers Screen in OHS

5 Testing of Obesity Healthcare System (OHS)

The application has been tested using the TestProject software. Successfully reports resulted as shown in Figure 7:

The OHS has a user-friendly and intuitive interface, provides 24/7 services, and quick and easy access to the information. It can store all the health-related information in one place, remote access to the medical records of the hospitals, improve the feedback and reviews by providing a feedback section, make the application available on different platforms, and keep the user data secure. Creating this usable system that is convenient for the users to make their lives easy and how to stay healthy longer is important.

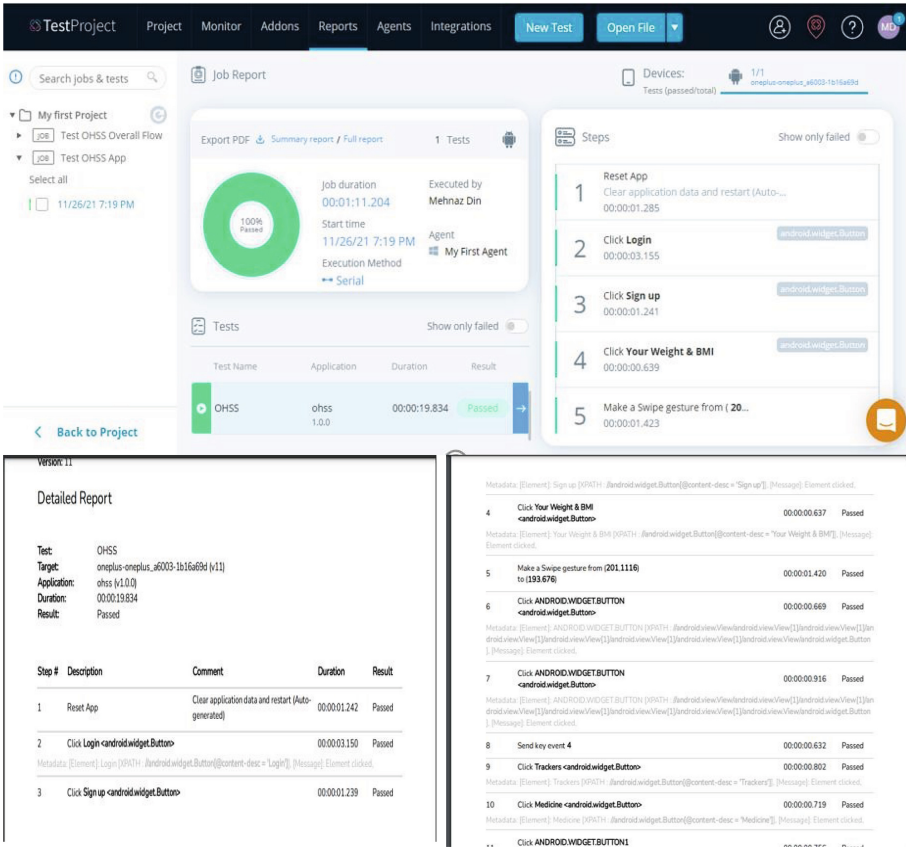


Fig. 7. Generated Report on the OHS testing

6 Conclusion and Recommendations

The recent focus on sustainability has made consumers more aware of our joint responsibility for conserving environmental resources and building systems for health awareness such as Mobile applications. Mobile applications are taking a strong and essential place in the market, these applications enable us to stay connected socially and provide with the technological content to keep us up to date. Since smartphones are the most usable devices in this era. The Obesity Healthcare System (OHS) is specially designed for obese people, using the Flutter mobile application development environment for the management of all the aspects related to obese people. OHS is created in Android Studio using the Dart programming language, a virtual device, and an Android SDK build emulator and has a user-friendly interface. This novel system has a lot of benefits such as a BMI calculator, health tracker, symptoms checker, reminders, and access to medical records that would be a full pack package to help obese people with their weight, also it integrates with external entities such as users, symptom's checker, tracker, hospital appointment

and Medical Records. Therefore, providing a full fledged health kit for obese people enabling them to track their health and keep their medical records in handy.

The OHS fulfills the needs and the requirements of the consumer and to improve its performance; feedback forms can be provided to the customer so any suggestions from them can be taken and implemented in the system development stage so the OHS application will be upgraded based on these reviews and feedback. Use the Key Performance Indicator (KPI) to measure the performance of the OHS application. Appropriate marketing tools and advertisement techniques should be used to increase customer retention. To make the OHS a successful application identifying the target customers will help us in determining the marketable feasibility of the OHS application and even help determine how to involve the users and which communication channels to use. Further, once the OHS is internationally marketed proper advertising tools should be used to advertise the application, social media platforms such as Facebook, Instagram and Twitter will be the best platforms for where the OHS application can be advertised. Next in the future, the OHS application should be upgraded allowing the users to communicate with doctors worldwide and be able to get genuine advice on any disease that they are suffering from.

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