

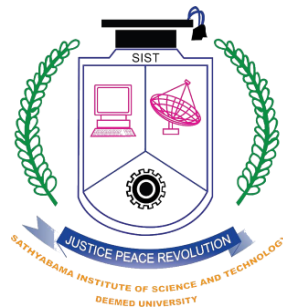
OMNICURE – AN APP FOR CONNECTING PATIENTS AND DOCTORS

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Technology degree in
Biomedical Engineering

By

Sindesh Shiva(38240035)

Rahul Nandy Majumdar(38240026)



**DEPARTMENT OF BIOMEDICAL ENGINEERING
SCHOOL OF BIO AND CHEMICAL ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade “A” by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

MAY 2022



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www.sathyabama.ac.in



DEPARTMENT OF BIOMEDICAL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **SINDESH SHIVA (Reg. No.38240035) & RAHUL NANDY MAJUMDAR (Reg. No. 38240026)** who carried out the project entitled “**OMNICURE – AN APP FOR CONNECTING PATIENTS AND DOCTORS**” under our supervision from **September 2021 to March 2022**.

Dr. J. PREM KUMAR, M.Sc., Ph.D.,
Guide and Supervisor

Dr. T. SUDHAKAR, M.Sc., Ph.D.,
Head of the Department

Submitted for Viva voce Examination held on 2ND May 2021.

Internal Examiner

External Examiner

DECLARATION

We, **SINDESH SHIVA**(Reg. No.38240035) & **RAHUL NANDY MAJUMDAR**(Reg. No. 38240026) hereby declare that the Project Report entitled “**OMNICURE – AN APP FOR CONNECTING PATIENTS AND DOCTORS**” done by us under the guidance of **Dr. J. Prem Kumar, Department of Biomedical Engineering** is submitted in partial fulfillment of the requirements for the award of **Bachelor of Technology** degree in **Biomedical Engineering**.

DATE:

1.



PLACE:

2.



SIGNATURE OF THE CANDIDATE

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ABSTRACT

This project is an app that provides a user-friendly interface that connects patients with multiple nearby clinics and practitioners which helps people to find medical care based on diagnostic symptoms, distance, cost, quality of service, crowd, etc. The app provides verified info on the clinics and specialist and allows the users to book appointments with the vast number of small to medium size medical services. The app provides one with a chat forum that connects users with their clinics and doctors. The schedule helps the patient track his appointments and medication. Your profile holds your general health info and clinical info and is authorized to the doctor by you. The app notifies availability of medication and provides delivery option nearby pharmacies. The app tracks some basic vitals with inbuilt sensors and displays this vital info graphically and chronologically. The interface that is provided to the clinic helps to obtain, manage and track bookings. It provides the doctor with the patient info which helps with the diagnosis (health records, clinical records, medication) as the app is scaled to provide a smart band that tracks users vitals for different medical necessities. Hence Omnicure becomes an ecosystem that enables a network of cheap effective medical services and pharmacies for essential urgent medical needs.

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LIST OF ABBREVIATION

ABBREVIATIONS	EXPANSION
FDA	Food and Drug Administration
C19CC	Covid-19 Caregiver Cockpit
HR	Heart Rate
ECG	Electrocardiograph
API	Application Programming Interface
IOT	Internet Of Things
MVP	Minimum Viable Product
UI/UX	User Interface/User Experience
QA	Quality Assurance
ESD	Electrostatic Discharge Prevention
PPG	Photoplethysmography
LED	Light Emitting Diode
MCU	Microcontroller Unit
LCD	Liquid Crystal Display
OLED	Organic Light Emitting Diode

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CHAPTER 1: INTRODUCTION

The higher cost of healthcare has led to a new phase of digital healthcare. Healthcare industry has considerably been centralized and privatized which has increased the cost of treatment at private healthcare industry. As application has enabled high scalability options for all industries in a digitized manner which has become more accessible to an average consumers. Health app is a whole category of apps which essentially digitizes the entire health care industry by making it efficient in terms of availability and accessible to newer regions and also hyperlocal where in terms of medicals services in your area becomes efficient and obtain the exposure and features to serve patients in a competitive manner using these applications these apps can make certain services and products affordable and accessible. Health apps has opened the curtain to personal health tracking and has energized the smart watch and smart devices industry which provide vital health info which becomes accessible to a whole set of audience which is younger and have a more health focused trend when it comes to diet , exercise , medication and healthcare in general. The FDA mentions that 1.7 billion smartphone users are going to adopt healthcare mobile apps by 2018. Thus, this is definitely the right time for healthcare mobile app development.

1.1 TYPES OF HEALTHCARE APPS

All healthcare applications can be divided into two categories: professional apps and healthcare apps for patients.

1.1.1 Professional healthcare apps

- Apps for medical research and database management.
- Apps for professional networking.
- Apps for tracking a patient's medical wellbeing.

- Apps for doctor appointments and clinical support.
- Apps for Telehealth on Mobile (doctor-on-demand apps).

1.1.2 Mobile health apps for patients

- Apps for patient medical education.
- Reminder apps -includes medical tracking apps or some health habit.
- Apps for diagnosis and prevention.
- Apps for a healthy lifestyle.
- Apps for chronic disease monitoring.
- Apps for mental health.
- Apps for dieting.
- Apps for women's health.

1.2 WEARABLE MOCKUP

1.2.1 Working Principle

A fitness tracker is a tiny data-acquisition system that detects bodily attributes using sensors. The sensor signals are conditioned before being digitised and saved. The recorded data is processed by a microcontroller, which drives a display. And, with most trackers, the data is wirelessly transmitted to a smartphone, where an app collects and analyses the data before presenting it in a useable format. Adequate data gathering from sensors necessitates signal conditioning such as amplification, filtering, and electrostatic discharge prevention (ESD). Here's a quick rundown of the sensors and what they're measuring.

- The accelerometer is a three-axis sensor that detects motion in all directions. It tracks your steps and reacts to other motions, such as those made while sleeping. Miles walked or ran, steps climbed, calories burnt, or sleep quality are

then calculated from step counts. A gyroscope is a sensor that determines motion such as rotation or physical orientation.

- Heart-rate monitor: This sensor, also known as an optical pulse oximeter, counts the beats of your heart. Heart rate is commonly used to assess not just physical activity but also stress, sleep efficiency, and overall well-being.

Photoplethysmography is a frequent measuring method (PPG). The sensor is often a green LED that illuminates the skin. A sensitive photodiode detects a reflection from the skin. The strength of the reflection fluctuates with the flow of the blood in the surrounding capillaries. The biggest difficulty with this method is interference from ambient illumination.

- Bioimpedance: Another element that may be evaluated is bioimpedance (BioZ). It is the resistance between two places on the skin. Two electrodes provide a voltage to the skin, while two additional electrodes detect current and resistance. This measurement may tell you how much you sweat, how hydrated you are, and how fast you breathe.
- Temperature: Although most trackers lack a temperature sensor, certain versions do. The sensor might be built-in or attached to the tracker via a patch.

Mock up



Figure 1: Modeled prototype smart watch to track and record vitals and metabolism.

The graphic is a simplified block diagram of the Omni FITT tracker. The sensors are linked to signal-conditioning circuits, which amplify, filter, and protect the device from ESD. An analog-to-digital converter converts the signals to digital form. Other forms of conditioning may also occur. The generated data signals are sent to an embedded controller, which analyses the data, saves it in flash memory, and controls a display. A variant of the popular Arm Cortex MCU is often utilised. The display is either LCD or OLED, including some touchscreens. Typically, a USB-C port is included. Take note of the Bluetooth transceiver, which is of the Low Energy (LE) variety. It communicates with a nearby smartphone, which receives the data and converts it into a suitable format for display. The tracker's power source is one of its most important components. Because of its compact size, a rechargeable battery is used, although its capacity is limited. There is also a built-in charger.

1.3 DO WE REALLY NEED THESE APPS FOR IMPROVING HEALTHCARE?

In India, the rising concern over the health of many people is due to the sedentary jobs. To cope with the health challenges faced by them due to their deskbound jobs, fitness apps help in improving the healthcare.

Due to the physical inactivity that their workplaces often deprive them of, this inactivity results in obesity, cardiovascular diseases, and high blood pressure. Considering these dangers to health, fitness apps have become a need for many people.

By keeping a track of your heart rate, calorie level, the steps you walked all such parameters help in keeping you aware of the functioning of your body. These health and fitness apps help in keeping the users physically active by using techniques to create changes in their behaviour.

1.4 HOW IS 5G TRANSFORMING DIGITAL HEALTHCARE?

With recent advancements in connection speeds, the interaction between patients and physicians is altering dramatically. Because of the quicker connection speeds, the integration of electronic communication into medical treatment has totally transformed the relationship between physicians and patients. Patients, for example, may now wear remote medical monitors from the comfort of their own homes, transmitting crucial signals to health care experts. This information is essential to clinicians in the following ways:

- Medics can dynamically manage treatment plans of the patients.
- Allows physicians and caregivers to screen various vitals of the patients.
- Conduct discussion or even intervention over webcam.

However, with the recent emergence of 5G networks, this new medical trend will be carried to the next level, considerably benefiting the medical fraternity economically.

According to IHS Markit, the global healthcare sector will generate more than \$1 trillion in products and services by 2035.

1.4.1 Impact on medical devices – IoT, Wearables, Data exchange

5G is an altogether new strategy that will allow you to meet all digital networking requirements while also improving your healthcare services. It provides you with three capacity areas to keep your wellbeing.

1.4.2 Massive Internet of Medical Things(IoMT)

Massive IoT assists you in maintaining your health. Massive IoT is inextricably linked to the internet of medical things ecosystem, which contains poor bit rate, billions of low-energy connected medical and health-monitoring devices, clinical wearables, and remote sensors. These tools are particularly important to doctors since they depend on them to instantly record, gather, and receive patient's medical data, such as physical activity, vital patient signs, and they can also check if patients are taking medicine according to prescriptions.

The IoT/IoMT industry is expected to rise as the patient wearable market, which will include both remote and on-site devices, grows from 8 million shipments in 2017 to 33 million in 2021.

Furthermore, the worldwide income of IoT in health care is expected to exceed \$27 billion by 2025. (Gold Sachs, 2017).

1.4.3 Enhanced Mobile Broadband (eMBB)

5G eMBB technology is on its way to saving you a trip to the doctor. Those who dislike frequent doctor visits will find that with the 5G enabler establishing its position in the medical industry, the doctor will now come to you. 5G is planned to employ significantly increased data speeds and high connection, allowing doctors to thoroughly examine

and analyse a number of patient medical data at the same time. Doctors may now compete for individual patients by bidding high.

eMBB can support a personalised healthcare application as well as involvements such as simulated reality (SR) and live video streaming. Doctors will utilise these tools to provide distant virtual treatment to patients while working in bedless hospitals. It will be accomplished through the use of 3D/UHD visual telepresence. Similarly, 5G will go above and above to provide training services to medical students, particularly in the fields of physiology and stroke diagnostics.

1.4.4 Data exchange or mission-critical services

5G mission-critical services have the potential to save your life. 5G has empowered devices and networks to communicate and preserve mission-critical communications, allowing doctors to provide remote health care. The 5G New Radio unified air interface, for example, is designed to provide deep and overlapping coverage to link medical sensors across various network nodes. This has the impact of raising dependability, e.g., one out of every 100 million packets lost, lowering latency, e.g., to as little as one millisecond, and ensuring that vital transmissions, including such medical emergencies, are prioritised above other broadcasts.

CHAPTER 2: LITERATURE SURVEY

The methods used in this project were - The COVID-19 Caregiver Cockpit; This study(Unstructured interviews with physicians in different countries involved in COVID-19 patient care were conducted to identify all the scenarios where telemedicine or connected care solutions could improve patient care). The aim of the COVID-19 Caregiver Cockpit (C19CC) was to implement a free-of-charge, web- and app-based tool for patient assessment to assist health care professionals working in the COVID-19 environment (TimoSchinköthe et al., 2020)

The methods used in this project were - Study Participants; Data Collection; Intervention Using the Wearable Device; Statistical Analysis. This study aimed to examine the objective effects of the use of these devices on metabolic syndrome resolution (Up Huh, et al., 2019)

The methods used in this project were - An anonymous 21-item e-survey was administered to family medicine or obstetrics and gynecology (n=28) providers at a rural health clinic; while a 21-item paper survey was administered to pregnant women (n=103) attending the clinic for prenatal care. This study aimed to examine the perceptions of pregnant women and their providers at a rural health clinic on the use of wearable technology to monitor health and environmental exposures during pregnancy (Jennifer Runkle et al., 2019).

The methods used in this project were - Patients diagnosed with MetS were recruited. Subjects were prescribed regular exercise with a wearable device (Coffee WALKIE +Dv.3, GC Healthcare CI, Korea) on their wrist or waist for 12 weeks. Subjects received self-feedback on the amount of their exercise through an application on their smartphone. The information on physical activities of the subjects was uploaded automatically on a website so that a trained nurse could provide individuals with feedback regarding physical activity via telephone consultation on alternate weeks. Blood pressure (BP), body composition, fasting plasma glucose, and lipid profiles were

recorded. The primary outcome was MetS resolution. The secondary outcome was an improvement in the components of metabolic impairment. This study aimed to examine the objective effects of the use of these devices on MetS resolution(Young JinTak et al., 2019).

The method used in this project was - Real time monitoring, offline monitoring, probable input, data logging, HR, ECG. This study aimed to understand market use cases and feature trends and health needs(Duarte Dias et al., 2018).

The method used in this project was - An up-to-date systematic review on studies assessing patients' use of mHealth apps for communicating with the health care team in the perioperative period was performed following the PRISMA statement. This study aimed to carry out a literature review of studies that evaluate patients' experience on the use of perioperative mHealth apps(Martha F. I. De La Cruz Monroy et al., 2019).

The methods used in this project were - The goal-directed design method was applied to guide study design. We divided the study into 4 stages. Stages 1 to 3 comprised the development process. In stage 1, personas of hypertensive patients were built using qualitative and quantitative methods. In stage 2, several functional modules were designed to meet the needs of different groups based on the results from stage 1. In stage 3, prototypes of functional modules were designed and implemented as a real app. Stage 4 was the deployment process, in which we conducted a pilot study to investigate patient compliance after using the app. The goal of this study was to develop a mobile health app to improve patient compliance with hypertension self-management and evaluate the effectiveness of the app in terms of patient compliance(HuilongDuan et al., 2019).

Successful clinical outcomes involve both clinician and patient factors such as good decision making, accurate diagnosis, patient compliance, effective monitoring of the condition, and accurate interpretation of clinical results. With a general trend in healthcare towards personalized medicine, the smartphone holds great potential to play a role in personalized care and aid in the above mentioned factors. Through the use of

apps, the increasingly powerful smartphone may be a useful aid in the healthcare and clinical industries. This review surveys the currently available apps in Google and Apple app stores that are purposed for aiding healthcare and clinical use, and discusses how they may also help transform the smartphone in a medically relevant device (Samuel Ken-EnGan et al., 2016).

The study consisted of usability tests of a high fidelity prototype with 7 cancer patients where the objectives were to identify existing design and functionality issues and to provide patients with a real look-and-feel of the mobile system. In addition, we conducted semistructured interviews to obtain participants' feedback about app usefulness, identify the need for new system features and design requirements, and measure the acceptance of the mobile app and its features within everyday health management. The study revealed a total of 27 design issues (13 for mobile apps and 14 for tablet apps), which were mapped to source events (ie, errors, requests for help, participants' concurrent feedback, and moderator observation). We also applied usability heuristics to identify violations of usability principles. The majority of violations were related to enabling ease of input, screen readability, and glanceability (15 issues), as well as supporting an appropriate match between systems and the real world (7 issues) and consistent mapping of system functions and interactions (4 issues). Feedback from participants also showed the cancer patients' requirements for support systems and how these needs are influenced by different context-related factors, such as type of access terminal (eg, desktop computer, tablet, mobile phone) and phases of illness. Based on the observed results, we proposed design and functionality recommendations that can be used for the development of mobile apps for cancer patients to support their health management process (Jelena Mirkovic et al., 2014).

This study consisted of 4 phases. In phase 1, individuals with SCD and health care providers participated in an optimization digital workshop. In phase 2, patients completed surveys pertaining to their interest in mHealth use, barriers and facilitators to hydroxyurea use, and health literacy. Phases 3 and 4 involved semistructured interviews and focus groups, respectively, and used the Health Belief Model (HBM) as the framework to investigate drivers of poor hydroxyurea adherence and to inform the

development of an app prototype. In addition, in phase 4, we have incorporated the patients' feedback on the preliminary app prototype and its features. This study aimed to design a mHealth intervention for individuals with SCD to improve adherence to hydroxyurea, using a user-centered design that was informed by specific barriers to hydroxyurea adherence and utilization in this population(Nicole M Alberts et al., 2020).

Physicians providing end-of-life care are subject to a variety of stresses that may lead to burnout and compassion fatigue at both individual and team levels. Through the story of an oncologist, we discuss the prodromal symptoms and signs leading to burnout and compassion fatigue and present the evidence for prevention. We define and discuss factors that contribute to burnout and compassion fatigue and consider factors that may mitigate burnout. We explore the practice of empathy and discuss an approach for physicians to maximize wellness through self-awareness in the setting of caring for patients with end-stage illness. Finally, we discuss some practical applications of self-care in the workplace(Michael K. Kearney et al., 2009).

The methods used were - We interviewed a convenience sample consisting of 9 patients and 5 nurse educators. Before interviews, Droobi was downloaded to participants' mobile phone, and their profile on the application was created. To ensure optimum usage experience, all participants received education on how to use Droobi. Participants used Droobi for 6 to 12 weeks. All interviews were audio recorded, transcribed by professionals, and thematically analyzed. The study aimed to explore experiences of patients and educators about their communication before and after implementation of Droobi, a diabetes management app(AlaaA.Abd-alrazaqa et al., 2021).

In today's modern world cardiovascular disease is the most lethal one. This disease attacks a person so instantly that it hardly gets any time to get treated with. So diagnosing patients correctly on a timely basis is the most challenging task for the medical fraternity. A wrong diagnosis by the hospital leads to earning a bad name and losing reputation. The purpose of this work is to develop a cost-effective treatment using data mining technologies for facilitating a database decision support system. The diagnosis of

heart disease using different features or symptoms is a complex activity. In this work two data mining classification techniques like Artificial Neural Network(ANN) and Naive Bayes are used to assist in the diagnosis of the heart disease and medication is provided accordingly. It is very important to monitor various medical parameters and post operational days. Hence the latest trend in Health care communication method using IoT is adapted. In this work the AVR-328 microcontroller(Arduino board) is used as a gateway to communicate to the various sensors such as temperature sensor, heartbeat sensor, ECG sensor, sensor for keeping a track of drip levels(blood or saline) and a sensor to keep track of motion. The micro-controller picks up the sensor data and sends it to the network through WiFi and hence provides real time monitoring of the health care parameters for doctors. The data can be accessed anytime by the doctor. The controller is also connected with buzzer to alert the caretaker about variation in sensor output. At the time of extremity situation alert message is sent to the doctor through the android app connected to the cloud server. Hence quick provisional medication can be easily done by the doctor by using NFC tags without manually searching for history of patient. This system is efficient with low power consumption capability, easy setup, high performance and time to time response(Aieshwarya B. ChavanPatil et al., 2017).

Direct shifts of a new start-up need an android application or web application to overcome their connectivity issues among their customers. This start-up faces difficulties in connecting the patients, doctors, and hospitals. To overcome this problem this start-up requests a project which connects patients, doctors, and hospitals. So to fix their connectivity issues this research work presents a mobile application. This mobile application has a dynamic work function of registration, hiring, reviewing, and appointment fixing. In registration, the details of clinicians are obtained and stored in our database for validation and later uses. Then by using the data given on the registration the clinicians are segregated according to the area of specialization and recruit according to the purpose work given. The availability and fixed appointments of the respective doctors are presented simply. Finally, the patients are connected to the doctors. Through these applications, the patient can see the available slots of a doctor

and their area of specialization. They can also fix their appointments with the respective doctor. Patients are asked to give their reviews and star rating of that doctor which is displayed to other patients and stored in our database. It is used for ranking the doctors in that locality(F Margret Sharmila et al., 2021).

The method used was based on the stimulus-organism-response (SOR) model and online trust theory, we proposed a research model to explain the influence of physician information on patients' choice of physician. The model was based on cognitive trust and affective trust and considered the moderating role of patient expertise. Study 1 was an eye-tracking experiment (n=42) to identify key factors affecting patients' choice of physician. Study 2 was a questionnaire study (n=272); Partial Least Squares Structural Equation Modeling was used to validate the research model. This study aimed to identify the types of physician information that play a key role in patients' choice of physician and to explore the mechanism by which this information contributes to this choice(Wei Shan et al., 2019).

The method used was - Adult cancer patients and survivors who are Calm users (N=82) were recruited through the Daily Calm Facebook page. Participants completed a Web-based survey related to Calm app use and satisfaction, interest in and ideas for a cancer-specific Calm app, and demographic characteristics. Open-ended responses were inductively coded. This study aimed to gather information to advise the development of a cancer-specific meditation app in a small convenience sample of cancer patients and survivors who currently use the Calm app(Jennifer Huberty et al., 2019).

This study proposes a telehealth device that can be used by nurses, attendants and physicians to differentiate between patients who need timely or urgent consideration. Home-bound patients with minimal portability and decreased capacity can use this gadget to call for appropriate assistance. The proposed telehealth-internet of things (IoT) device automatically generates caution for supplying patients with auspicious health treatment under incessant clinical circumstances. A real-time android app, namely 'village doctor app (VDA)' is developed and connected to a cloud network

server. This App is associated with a few wireless sensors. Based on the sensor data, a doctor can take the appropriate measures to look at specific patients' details(Md. Rokonzaman et al., 2021).

The methods used were - Patients with type 1 diabetes mellitus (T1DM) or latent autoimmune diabetes of the adult (LADA) using a multiple daily injection (MDI) regimen with carbohydrate counting (n = 25, Subgroup B) or fixed insulin dose (n = 25, Subgroup C) were allocated to use the application (app) for 12 weeks. Both subgroups were compared with each other and against a control group (n = 25, Group A) comprising patients with T1DM or LADA treated with continuous subcutaneous insulin infusion (CSII) in a parallel-group, open-label, clinical treatment trial. All patients had glycated hemoglobin (A1C) levels measured and were asked to fill out the Diabetes Self-Management Profile (DSMP) questionnaire at study start and end. The patients were instructed to measure capillary glucose six times daily in study weeks 4, 8, and 12. The main aim of the study was to evaluate the patients' glycemic control and adherence to self-care tasks(Felipe Martins de Oliveira et al., 2021).

Healthcare industry has proven its technically abundant applications at par other industries with the help of many concepts like IoT and cloud computing. It has transformed its techniques by using intelligent gadgets that can be acquainted with patients in different configurations. The data obtained from devices like pulse rate monitors, weighing scales, blood glucose measuring devices, etc. is to be stocked and tracked as awareness of health statistics is vital for all. A hefty portion of these measures requires a follow-off with a specialist. This commences the preference of using IoT based smart devices to deliver more valuable data to the patient and drop off the necessity for direct patient-doctor interaction. Improving the standard of service, it brings particularly high value for the patients requiring constant supervision and quick data access and analysis. This paper will demonstrate automatic communication between the smart devices and android mobile application via Bluetooth and data storage on Cloud. Also, it shows automatic control over oxygen cylinder using mobile app for admitted patients who require supplementary oxygen. Thus, our system serves the purpose of minimizing doctors' efforts and providing seamless experience to the

patient with IoT, Cloud and Wireless Technology like Bluetooth helping in saving millions of lives(Chaitanya Kulkarni; SnehaKenjale et al., 2018).

Gartner speculates that by the year 2020, 20.8 billion devices will have access to the internet. When you compare this estimated number, with the current estimated connected devices which stands at 6.4 billion, the gap is too big and therefore that calls for many devices to be connected within less than two years. Wireless communication is taking the world at an unprecedented move, and soon it will dominate everything, everywhere and mainly the 5G radio networks technologies are behind this dominance. Machine to machine (M2M) communications now stands at 600-800 million active cellular M2M devices by 2018. The most significant of this is that 5G will be driven further to application powered connectivity which will be deployed to different technologies, users, and devices, towards realising the concept of the Internet everywhere(Dr. Hempel Digital Healthcare Network , 2019).

CHAPTER 3: AIM AND SCOPE

3.1 AIM

Our primary aim with this project is to theorize the usage of digital application to democratise digital solutions from a few wealthy hospitals that use this technology to increase output, efficiency, and, ultimately, profits, while we wish to create a user-friendly app that allows people to obtain the same output and efficiency and to allow users to get user-friendly knowledge on their vital health info in the palm of their hands. Certain firms and start-ups have begun to provide their services in a more competitive manner to increase the availability and decrease cost of medical services and products to these patients directly through these applications. This broadens and improves access to healthcare innovation and creativity.

3.2 SCOPE

A project covers digital healthcare solutions that are highly scalable and promote high conversion leads, and this data could be used for large-scale healthcare research that could not be done without the use of applications and API integration of IOT into the healthcare field, has brought in the integration of apps with other devices that can track and record data that can later be analyzed to form a data sets that brings forth solutions with respect to to problems faced in the healthcare field . Omnicure is used to bridge the gap between conventional middle to small-scale clinics and practitioners and patients who are nearby and in need of medical consultation and the small-scale practitioners and clinics who are generally cut-off or inaccessible to these people due to a lack of exposure and services. Developing an app that provides an open channel for a person or user to record his medical status or clinical records, so that this data, which becomes a vital source for future medical consultation, can be presented to medical personnel in order to better diagnose and further evaluate the patient's status. Integration of smart devices, particularly smart watches, has grown popular, and this project wants to go further into device modification for diagnostic purposes, including integration to

application software.

CHAPTER 4: METHODOLOGY

4.1 STRATEGY

The first step in the mobile app development process is to determine your plan for transforming your concept into a successful app. Although the objectives of one app may differ from those of another, there is still an app-specific effect to the mobility strategy that must be addressed during the development process.

During this stage, you will:

- Identify the app users.
- Investigate the competition.
- Set the aims and outcomes for the app.
- Choose a mobile platform for your application.

Your approach assists in focusing the vision on a clear image of your app concept. You may forward to the following stage of the mobile app development process.

4.2 PLANNING

At this point, your app concept begins to take shape and develops into a full-fledged project. The process of analysis and planning begins with the definition of use cases and the capture of precise functional requirements. Prepare a product plan when you've determined the needs for your app. This involves prioritising the needs for the mobile app and categorising them into delivery milestones. If time, resources, or money are an issue, identify your minimum viable product (MVP) and prioritise it for the first launch.

Part of the planning step includes defining the talents needed for your app development endeavour.

4.3 USER INTERFACE / USER EXPERIENCE DESIGN

The goal of app design is to provide seamless and effortless user experiences with a professional appearance.

The success of a mobile app is evaluated by how successfully users accept and utilise all of its features. The purpose of mobile app UI / UX design is to provide exceptional user experiences that make your app interesting, intuitive, and easy to use. While beautiful UI designs will aid in early adoption, your app must also provide straightforward user experiences to keep users interested.

4.3.1 Workflows and Information Architecture

The first phase in your mobile app design process is to decide what data your app will display to users, what data it will gather, how users will interact with the end product, and how they will navigate inside the app. Enterprise mobile solutions for businesses include users with varied responsibilities and rights, and it is critical to include these rules as part of your app's information architecture. Workflow diagrams aid in the identification of every conceivable interaction a user has with the app as well as the app's navigation structure.

4.3.2 Wireframes

Sketches on paper are a common starting point for mobile app designers. Wireframes are digitised versions of drawings. Wireframes are conceptual layouts, often known as low-fidelity mockups, that provide visual structure to the functional requirements of a programme.

The emphasis with wireframes is on aesthetics and user experience rather than colour schemes and styles. Creating wireframes is a rapid and low-cost method for generating app layouts and iterating through them during the design review process. When building wireframes, keep device specific design in mind. So, regardless of whether your app is used on an iPhone, iPad, or Android phone or tablet, it delivers straightforward and device-specific user experiences.

4.3.3 Design Guide

Style guides are "dynamic papers" that detail an app's design guidelines, from your company's branding regulations to the navigation symbols.

Style guides include topics such as:

- What font family will your app's text use?
- What colour scheme will be used?
- How will the app design represent your company's brand?

Style guides add to the design approach of an app. Creating a style guide early in the mobile app development process increases the efficiency of your mobile app developers. Simultaneously, adhering to a style guide can assist keep your app's appearance and feel consistent. App design guidelines from Apple for iOS applications and Google for Android apps should be considered as part of your app design.

4.3.4 Mockups

Mockups, also known as high-fidelity designs, are the ultimate visual depictions of your software. Mockups are made by slapping your style guide onto the app wireframes. As the design of your app nears completion, expect further changes to its information architecture, workflow, and aesthetics. Adobe Photoshop is the most widely used software for making high-fidelity mockups.

4.3.5 Prototype

Mockups, which use static designs to demonstrate the functionality of your mobile app, may be transformed into click-through prototypes utilising tools such as Invision and Figma. Prototypes are extremely beneficial for replicating the user experience and app operations that will be delivered in the final product. While prototype creation might be time-consuming, the work is well worth it because it allows you to test the design and operation of your app at an early stage. Prototypes frequently aid in the identification of changes to the app's projected functionality.

Some people prefer to create prototypes during the wireframing stage, especially when the functional needs of an app are not thoroughly thought out. Alternatively, a focus group may be required to examine the app's planned functionality.

4.4APPLICATION DEVELOPMENT

Planning is still an important element of the mobile app development process at this stage. Before you begin any development/programming work, you must:

- establish the technological architecture.
- choose a technological stack; and
- establish development milestones.

Back-end/server technologies, API(s), and the mobile app front-end are all essential components of a typical mobile app project.

4.4.1 Technology for the Back-End/Server

This section contains database and server-side objects required for your mobile app's supporting functions. If you're utilising an existing back-end platform, you may need to make some changes to enable the necessary mobile capabilities.

4.4.2 API

An Application Programming Interface (API) is a way for the app to communicate with a back-end server/database.

4.4.3 Front-End of a Mobile App

The native mobile app that an end-user will utilise is the front-end. Most mobile applications are interactive user experiences that employ an API and a back-end to manage data. When an app has to allow users to function without internet connectivity in some instances, the programme may employ local data storage.

For the backend, you may use practically any web programming language and database. You must select a technology stack required by each mobile OS platform when developing native mobile apps. Objective-C or Swift programming languages can be used to create iOS apps. Android apps are often written in Java or Kotlin. With new versions of mobile platforms, mobile technologies progress significantly quicker. Furthermore, every few months, new mobile gadgets are introduced. With platforms and devices continuously evolving, agility is critical for developing mobile apps on time and under budget. Use an agile development method if time-to-market is a top goal. This method allows for frequent software releases with complete functionality. Defining development milestones as part of an agile development plan facilitates iterative development of your mobile application.

Each development milestone is completed and sent to the app testing team for confirmation.

4.5 EVALUATION

Thorough quality assurance (QA) testing during the mobile app development process ensures that the applications are reliable, useful, and secure. To achieve thorough QA

testing of your app, you must first build test cases that cover all elements of app testing. Test cases drive mobile app testing in the same way that use cases drive the development process. Test cases are used to carry out test procedures, record testing results for software quality evaluation, and track fixes for retesting. Involving your QA team in the Analysis and Design stages is a recommended practise technique. Knowing your app's functional requirements and objectives can aid in the creation of realistic test cases. To provide a high-quality mobility solution, your app should go through the following testing procedures.

4.5.1 User Experience Evaluation

The final implementation must match the user experience defined by the app design team, which is a vital phase in mobile app testing. Your app's visuals, workflow, and interaction will provide your end consumers a first-hand experience of your app. Make sure your app uses consistent fonts, style treatments, color schemes, data padding, icon design, and navigation. Making sure your software adheres to the original design principles will have a direct influence on its user adoption!

4.5.2 Functional Evaluation

The precision with which your mobile app functions is vital to its success. Predicting every end user's behaviour and use circumstance is tough.

Your app's functionality should be tested by as many users as feasible in order to cover as many potential testing circumstances as possible. When two separate users try the same functionality but receive different results, you may be startled to find issues. For example, two users can complete out the same form, but they may submit different data, which may lead to the discovery of a flaw.

The goal of functional testing is to guarantee that your app's features and functioning are usable by users without any problems.

4.5.3 Performance Evaluation

There are several quantitative metrics that may be used to assess the performance of your app:

- How well does your software respond to user input?
- How quickly do the app's displays load?
- Is your app consuming phone battery life or generating memory leaks?
- Does your software make good use of network bandwidth?
- Is your app's size larger than it should be?

Even if your app meets the fundamental performance standards, simulate the maximum number of concurrent users to test the app, API, and backend for load. Even when usage surges, your app should be able to handle the load and function properly.

4.5.4 Device and Platform Evaluation

Every 12 months, new mobile devices with fresh hardware, firmware, and design hit the market. Every few months, mobile operating systems are upgraded.

Several mobile device makers, including Samsung, LG, HTC, and Motorola, utilise the Android platform, but they adapt it for their devices (since Android is open source). The gadgets are available in a variety of sizes and forms.

Compare that to Apple, which has a far more regulated environment since they control both the hardware and the operating system. However, there are several iPhone and iPad (Apple iOS) devices available on the market.

This is where testing throughout the mobile app development process differs dramatically from testing during the web app development process. You can get away with only testing your web app in a Windows environment using the Chrome browser.

However, your mobile app must be tested on a variety of mobile devices or device emulators to verify that it works properly for all users.

The complexity of testing mobile apps on all mobile devices, continuous maintenance expenses, and the difficulties of mobile device management are the key reasons why businesses opt to design enterprise mobile apps for a single mobile platform (and often provide mobile devices to their users). In our experience, most businesses begin by developing their corporate mobile app on Apple's iOS mobile platform. They only create apps for the Android platform when they are required.

Testing is critical to an app's future success; it accounts for a significant portion of our total mobile app development process. A complete mobile testing plan is required for providing a high-quality mobile app.

4.6 SWOT (STRENGTH, WEAKNESS, OPPORTUNITY, THREAT)

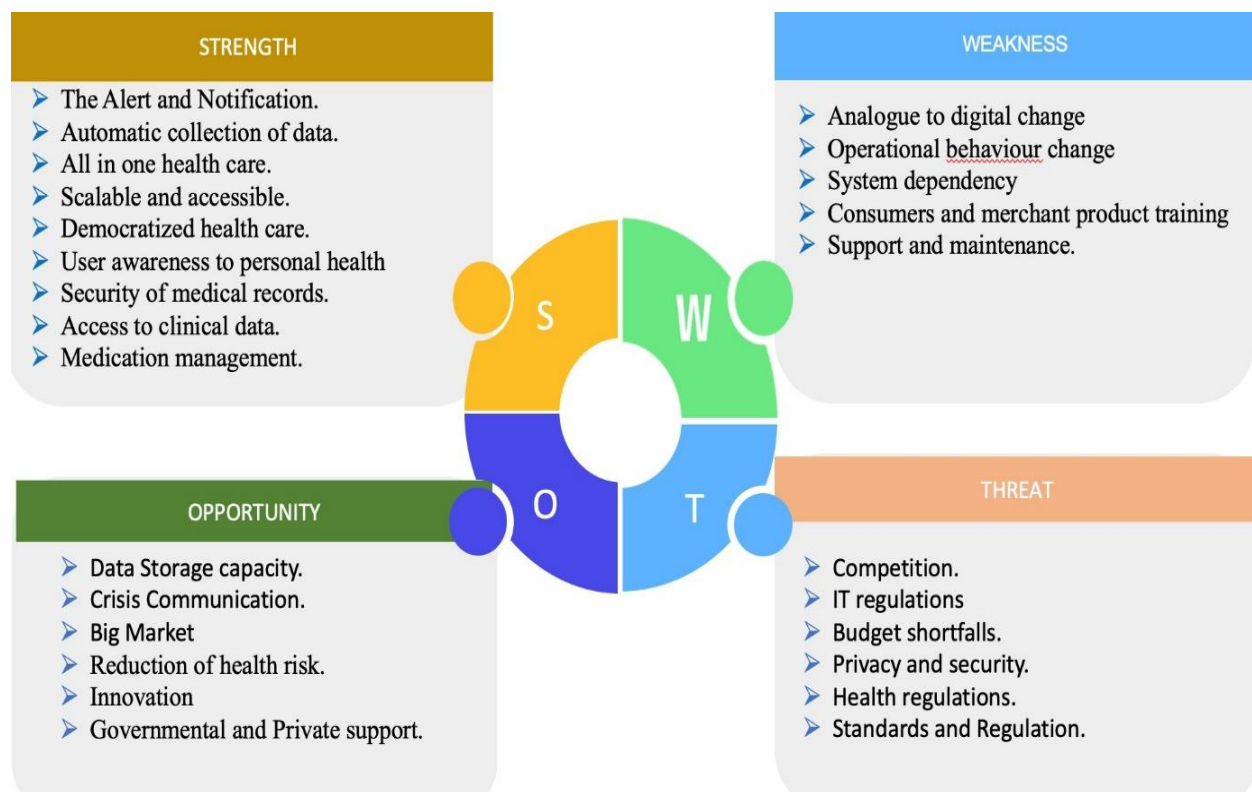


Figure 2: SWOT analysis done on product with respect to market sector and industry

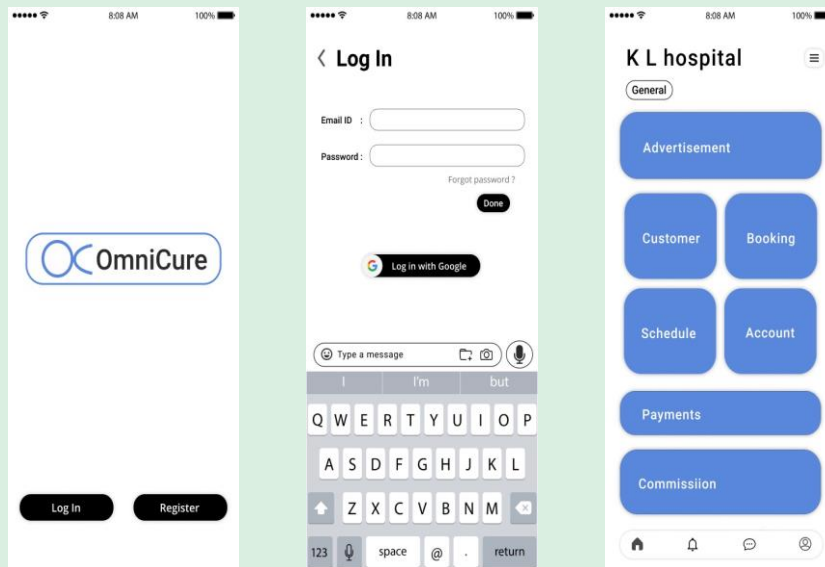
CHAPTER 5: RESULTS AND DISCUSSION

5.1 APP WIREFRAME

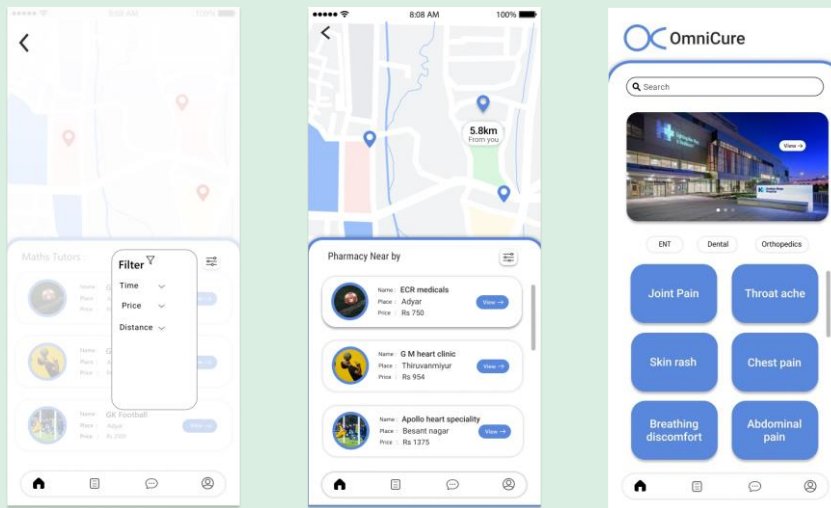
5.1.1 Use Case

- Search for clinics or doctors in your city
- Get info on doctors
- Book appointments online
- Manage communication, payments and schedule
- Track and record daily active data
- Live vitals monitoring by doctor
- Medication and daily routine alerts.

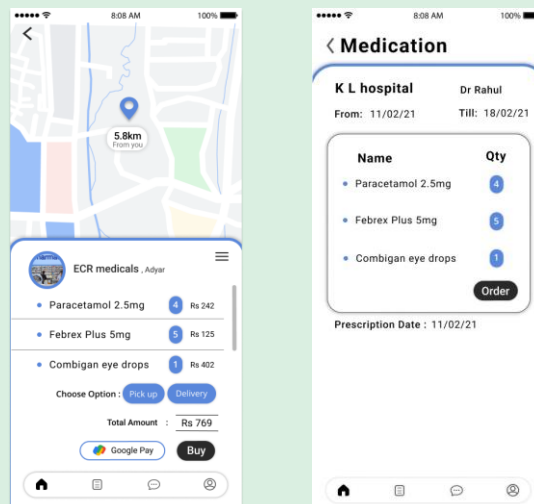
Log In (merchant)



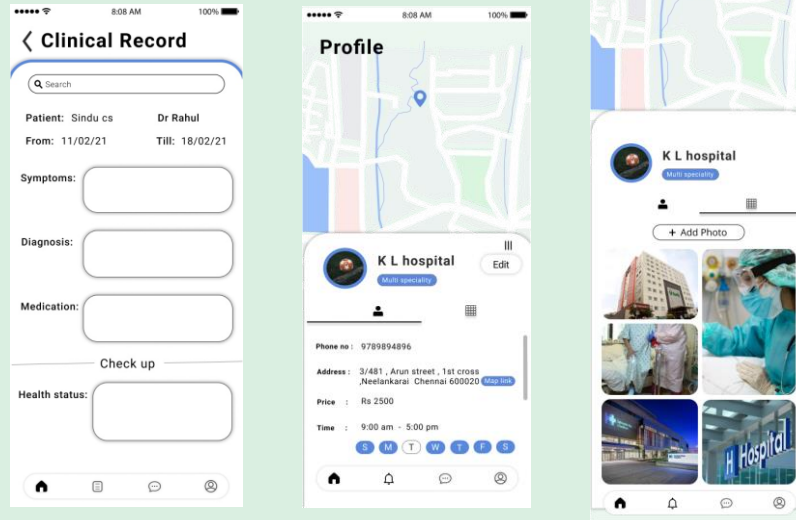
Find listed clinics



Medication



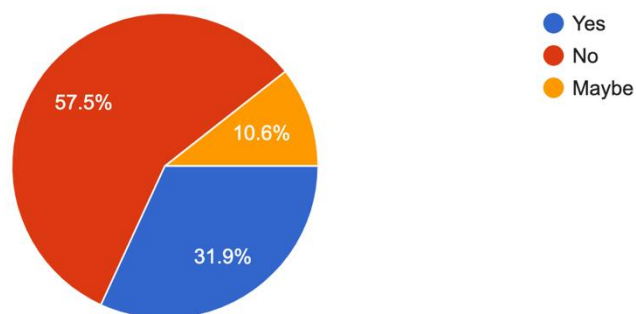
Clinic info and records



5.2 Stakeholder Survey

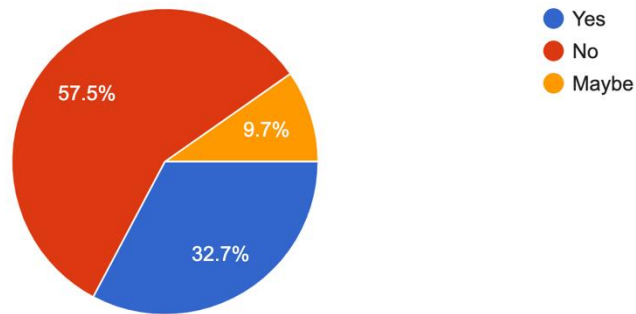
Do you have your health records easily accessible?

113 responses



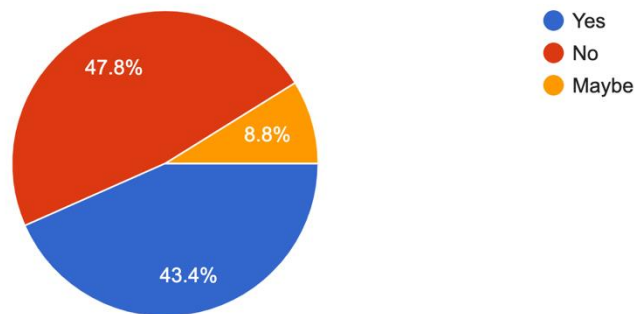
Are you able to find the info of all the clinics and specialists/doctors near you?

113 responses



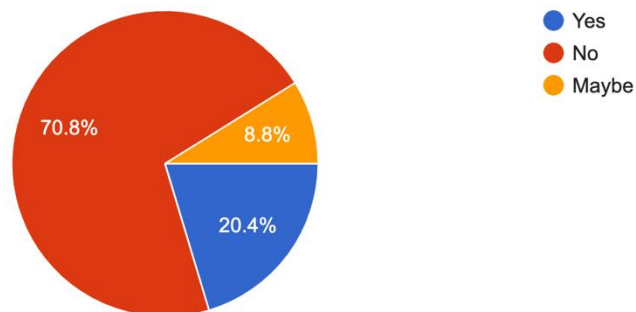
Are you able to book an appointment with your doctor easily?

113 responses



Do you know your daily health info?

113 responses



Do you have access to all the pharmacies nearby you who deliver the required medications for you?

113 responses

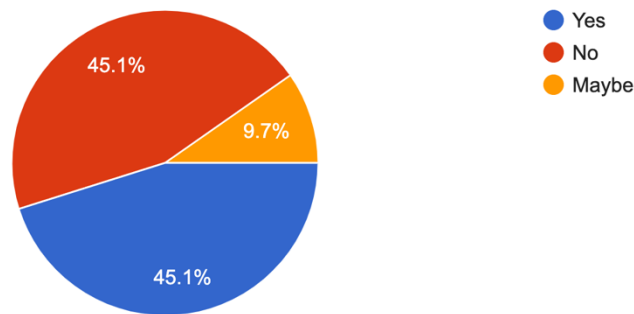


Figure 6: Graphical representation of product pain points.

The survey was taken with all the stakeholders considered. The pool of selected individuals were chosen to give responses based on their age, gender, profession, etc. In order to check consumer need in the health app market, the survey had a series of questions that was answered by the individuals for which the demand ratio was more than 60% which means that the demand for these digital health applications is proved as the problems are in existence according to the survey.

Consumerism of the new age audience has lead to the need of efficient , easy and cheap services which has transitioned to the digital forefront with newer companies, start ups or enterprise hospitals with vision to expand to the digital services industry to keep in trend with technological changes

CHAPTER 6: SUMMARY AND CONCLUSION

6.1 SUMMARY

6.1.1 HOW DOES THE FUTURE LOOK FOR HEALTH AND FITNESS APPS IN INDIA?

Everyone wants to be in a positive spirits and live a healthy lifestyle. Given the aforementioned benefits, fitness apps have become increasingly important in people's life in terms of their health. With the addition of technology improvements, the health and fitness business has resulted in an explosion of fitness applications in India. Every health and fitness app strives to offer fresh and unique features that are not available in previous applications. People in India are suffering as a result of their unhealthy lifestyles and the macroenvironmental circumstances. As a consequence, the future of fitness and health apps appears to be brighter since individuals may choose fitness applications depending on their own demands, and these apps give them with pleasing outcomes.

There is a need to spend more in this market to improve the future of health and fitness applications in India. According to a study published by a worldwide mobile analytics organisation, the growth of the health and fitness app sector was 178 percent between 2014 and 2015. However, its growth rate has slowed to 9% from 2016 and 2017. To determine the reasons for the industry's slowdown, the market for health and fitness applications was divided into four categories: general health apps, workout and weight loss apps, nutrition and fitness apps, and fitness apps.

In 2018, the fitness sector in India generated \$475 million in revenue, with the wearable segment accounting for the majority of the market. In India, the estimated number of app users by 2022 is 56.4 million.

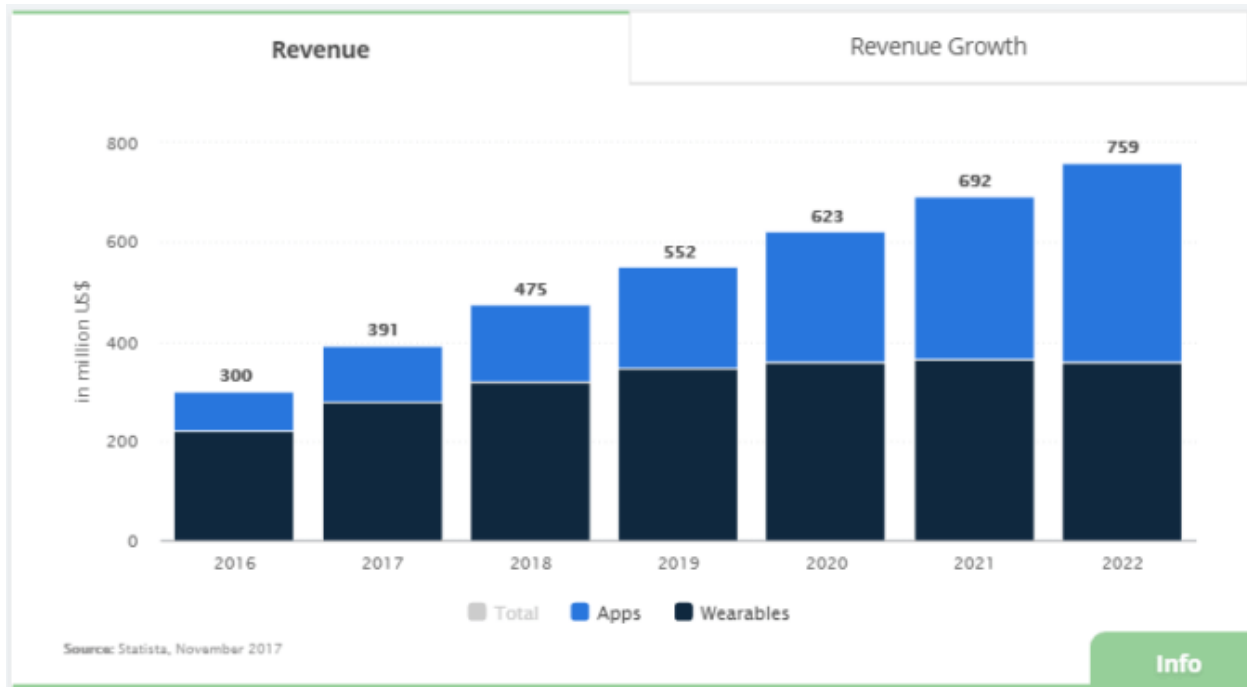


Figure 7: Growth of digital health application by revenue.

To ensure the success of health and fitness app businesses, it must be assured that the startups maintain their users by using creative ways that take into account the customers' expectations for that specific fitness app.

Digital health firms must also guarantee that their consumers find fitness applications useful and handy in their daily lives. Finally, these firms must prioritise the growth of their fitness apps while still retaining their customers.

6.2 CONCLUSION

The lack of information and connection between the doctor and a patient in order to provide the necessary assistance to priority patients.

Providing a digital application to the patient and the doctor in order to connect them by providing a chat forum, payment forum and schedule tab . A user searches for doctors

and obtains information and book appointments through the app which is synced with a wearable technology with monitoring sensors which records the patients live vitals and provide the data to the app of both the doctor and patient. This integration of a digital application into healthcare operations across large scale and small-scale across verticals of services and commerce in the healthcare industry would significantly enhance the customer experience of an average consumers and provide him access to information and services in the palm of his hand.

6.2.1 DO WE REALLY NEED THESE APPS FOR IMPROVING HEALTHCARE?

Sedentary employment are causing growing concern about many people's health in India. Fitness applications assist in improving healthcare by helping people cope with the health difficulties they confront as a result of their deskbound professions.

Obesity, cardiovascular illness, and high blood pressure are all outcomes of the physical inactivity that their employment frequently deprive them of. Given these health risks, fitness applications have become a need for many individuals.

Keeping track of your heart rate, calorie intake, and steps taken all assist to keep you aware of how your body is operating. These health and fitness applications help users stay physically active by applying tactics to influence their behaviour.

Fitness applications are quite important for those who are concerned about their health and wish to improve it. When users learn that they are making improvement in their health, these applications function as a motivator. Furthermore, the apps that track heart rates and monitor glucose levels in the body have been the most effective fitness apps owing to the ease and efficiency with which these things can be measured, as opposed to ordinary, physical activity trackers, which are of little benefit to users.

REFERENCES

Duarte Dias and João Paulo Silva Cunha; Wearable Health Devices—Vital Sign Monitoring, Systems and Technologies; Sensors MDPI; July 25, 2018; Page Nos.: 1 – 28.

Jennifer Runkle, Maggie Sugg, Danielle Boase, Shelley L Galvin, Carol C Coulson; Use of wearable sensors for pregnancy health and environmental monitoring: Descriptive findings from the perspective of patients and providers; SAGE Journals(Volume 5);February, 2019; Page Nos.: 1 - 14.

Up Huh, Young JinTak, Pusan(National University), Seunghwan Song, Sung Woon Chung;Efficacy of Wearable Devices for Resolution of Metabolic Syndrome: A Clinical Trial in Korean Adults; January, 2019.

HuilongDuan, Zheyu Wang, Yumeng Ji, Li Ma, Fang Liu, Mingwei Chi, Ning Deng, Jiye An; Using Goal-Directed Design to Create a Mobile Health App to Improve Patient Compliance With Hypertension Self-Management: Development and Deployment; JMIR Publication(Volume 8, No 2); April 22, 2019; Page Nos.: 113 - 132.

TimoSchinköthe, Mariano Rolando Gabri, Manfred Mitterer, Pedro Gouveia, Volker Heinemann, Nadia Harbeck, Marion Subklewe; A Web- and App-Based Connected Care Solution for COVID-19 In- and Outpatient Care: Qualitative Study and Application Development; JMIR Publication(Volume 6, No 2); April 01, 2020; Page No.: 653 - 659.

Up Huh, Young JinTak, Seunghwan Song, Sung Woon Chung, Sang Min Sung, Chung Won Lee, Miju Bae, Hyo Young Ahn; Feedback on Physical Activity Through a Wearable Device Connected to a Mobile Phone App in Patients With Metabolic Syndrome: Pilot Study; JMIR Publication(Volume 7, No 6); 18 June, 2019; Page No.: 144 - 158.

Martha F. I. De La Cruz Monroy, AfshinMosahebi; The Use of Smartphone Applications (Apps) for Enhancing Communication With Surgical Patients: A Systematic Review of the Literature; SAGE Journals(Volume 26, Issue 2); January 2, 2019; Page No.: 244 - 259.

Samuel Ken-EnGan, Cornelius Koshy, Phi-Vu Nguyen & Yu-Xuan Haw; An overview of clinically and healthcare related apps in Google and Apple app stores: connecting patients, drugs, and clinicians; Journal: Springer Open(Article no. 8); 19 July, 2016; Page No.:1 - 9.

JelenaMirkovic, David R Kaufman, Cornelia M Ruland; Supporting Cancer Patients in Illness Management: Usability Evaluation of a Mobile App; JMIR Publication(Volume 2, No 3); 13 August, 2014; Page No.: 1 - 21.

Nicole M Alberts, Sherif M Badawy, Jason Hodges, Jeremie H Estepp, ChinonyelumNwosu, Hamda Khan, Matthew P Smeltzer, RaminHomayouni, Sarah Norell, Lisa Klesges, Jerlym S Porter, Jane S Hankins; Development of the InCharge Health Mobile App to Improve Adherence to Hydroxyurea in Patients With Sickle Cell Disease: User-Centered Design Approach; JMIR Publication(Volume 8, No 5); 8 May, 2020; Page No.: 1 - 17.

Michael K. Kearney, Radhule B. Weininger, Mary L. S. Vachon; Self-care of Physicians Caring for Patients at the End of Life; 18 March, 2009.

AlaaA.Abd-alrazaqa, NoorSuleimanbc, KhaledBaagar, NoorJandali, Dari Alhuwaile, IbrahimAbdalhakam, SaadShahbal, Abdul-BadiAbou-Samra, MowafaHouseh; Patients and healthcare workers experience with a mobile application for self-management of diabetes in Qatar: A qualitative study; Elsevier(Volume 1); 22 January, 2021; Page No.: 1 - 7.

Aieshwarya B. ChavanPatil, Prof. S. S. Sonawane; To predict heart disease risk and medications using data mining techniques with an IoT based monitoring system for post operative heart disease patients; IJETT(Volume 4); July, 2017; Page No.: 1 - 8.

F Margret Sharmila, P Tharun Kumar, G DarwinArockiaDass, S. Subramanian; An Online Recruitment of Clinicians and Appointment of Patients using Mobile Application; IEEE Xplore; 31 March 2021.

Wei Shan, Ying Wang, Jing Luan, Pengfei Tang; The Influence of Physician Information on Patients' Choice of Physician in mHealth Services Using China's Chunyu Doctor App: Eye-Tracking and Questionnaire Study; JMIR Publication(Volume 7, No 10); 21 July, 2019; Page No.: 1 - 16.

Jennifer Huberty, Megan Puzia, Ryan Eckert, Linda Larkey; Cancer Patients' and Survivors' Perceptions of the Calm App: Cross-Sectional Descriptive Study; JMIR Publication(Volume 6, No 1); 5 November, 2019; Page No.: 1 - 15.

Md. Rokonzaman, Md. Imran Hossain, Tariqul Islam, ParthaPratim Sarkar, Md. Robiul Islam, Nowshad Amin; Design and Implementation of Telehealth Device: Linking IoT Sensors to Cloud Networks; IEEE Xplore; 14 April, 2021.

Felipe Martins de Oliveira, Luís Eduardo ProcópioCalliari, Cecília Kauffman RutenbergFeder, Maria Fernanda Ozorio de Almeida, Mariana Vilela Pereira, Maria Thereza Teixeira de Almeida Fagundes Alves, SôniaAparecida Dias Garcia, LigiaDinaraDonizeti Reis, João Eduardo NunesSalles; Efficacy of a glucose meter connected to a mobile app on glycemic control and adherence to self-care tasks in patients with T1DM and LADA: a parallel-group, open-label, clinical treatment trial; SciELO Brazil; 5 March, 2021; Page No.: 1 - 13.

Chaitanya Kulkarni, SnehalKenjale, ManasiPatil, Chinmay Kulkarni, S. R Hiray; Smart Self-regulatory health system; IEEE Xplore; 15 January, 2018.

Dr. Hempel Digital Healthcare Network; The critical role of 5G transforming digital healthcare; dr-hempel-network.com; 16 July, 2019.