VirtualCare: The Future of Virtual Healthcare

The Project submitted to

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Towards partial fulfillment of the Degree of

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In

Information Technology

Guided by
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SHRI SANT GAJANAN MAHARAJ COLLEGE OF ENGINEERING, SHEGAON

2022-2023

CERTIFICATE

This is to certify that **Mr. Ganesh Rahate, Mr. Aditya Band, Mr. Saurav Borle, Mr. Pratik Warulkar** students of final year B.E. (Information Technology) in the year 2022-2023 of the Information Technology Department of this institute have completed the project work entitled **"VirtualCare: The Future of Virtual Healthcare"** based on syllabus and has submitted a satisfactory account of his work in this report which is recommended for the partial fulfilment of the degree of Bachelor of Engineering in Information Technology.

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CERTIFICATE

This is to certify that the project work entitled **"VirtualCare: The Future of Virtual Healthcare"** submitted by **Mr. Ganesh Rahate, Mr. Aditya Band, Mr. Saurav Borle, Mr. Pratik Warulkar** students of final year B.E. (Information Technology) in the year 2022-2023 of the Information Technology Department of this institute, is a satisfactory account of his work based on the syllabus which is approved for the award of the degree of Bachelor of Engineering in Information Technology.

Internal Examiner	External Examiner
Date:	Date:

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ABSTRACT

A Multi-speciality Hospital has created a vision to provide 24/7 Primary Care at Doorstep of Patients using a panel of high quality doctors. Further, the Hospital has decided to provide quality medicines vide authorized Pharmacies at the door-step at discounted prices as well as give door-step Laboratory services wherever possible vide specimen collection. The aim is to help elderly and infirm people as well as people who need regular monitoring services to get access to quality healthcare services at affordable prices at the Door-step. It is envisaged that preventive and regular monitoring services can reduce the hospital admissions and reduce the suffering in General.

Keywords - *Multi-speciality Hospital, 24/7 Primary Care, Doorstep, Patients, doctors,Elderly, Infirm people, Regular monitoring services.*

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1. INTRODUCTION

1.1 Preface

In recent years, there has been a significant increase in the use of virtual healthcare services, including virtual clinics. Virtual clinics are digital extensions of traditional medical facilities such as hospitals, nursing homes, and clinics, providing patients with access to healthcare services from anywhere and at any time. These services can range from remote consultations with healthcare professionals to online prescription services and follow-up appointments. Virtual clinics have become a popular choice for patients seeking convenience, flexibility, and cost-effectiveness.

They have also proven to be a valuable tool for healthcare providers, enabling them to reach a wider patient population, reduce healthcare costs, and improve patient outcomes. The COVID-19 pandemic has further accelerated the adoption of virtual clinics, as they provide a safe and efficient alternative to traditional in-person healthcare services. However, the virtual healthcare landscape is still evolving, and there are many challenges and opportunities that need to be addressed to fully realize its potential.[21]

This project aims to develop a virtual clinic platform that addresses some of these challenges and leverages the opportunities offered by digital healthcare to improve patient outcomes and increase access to healthcare services .

1.2 Statement of Problem

Despite the many benefits of traditional healthcare services, such as hospitals, clinics, and nursing homes, they are often constrained by geographical barriers, limited resources, and high costs. These constraints can result in unequal access to healthcare services, with many individuals unable to access the care they need. Moreover, traditional healthcare services often require patients to physically visit a healthcare facility, which can be challenging for individuals with mobility issues or those living in remote areas.

To address these challenges, virtual clinics have emerged as an increasingly popular alternative, providing patients with access to healthcare services from anywhere and at any time. However, the virtual healthcare landscape is still evolving, and there are many challenges and limitations that need to be addressed to fully realize its potential.
One of the main challenges facing virtual clinics is ensuring the security and privacy of patient information. With sensitive patient information being transmitted over the internet, there is a risk of data breaches and cyber-attacks, which can compromise patient confidentiality and undermine trust in the virtual healthcare system.

Another challenge facing virtual clinics is providing patients with access to high-quality care. While virtual consultations can be an effective way of delivering healthcare services, they can also be limited by technical issues such as poor internet connectivity, low-quality video and audio, and limited communication channels. These limitations can result in reduced patient satisfaction and lower quality of care.

Moreover, virtual clinics can also be limited by the availability of healthcare professionals. With virtual clinics being accessible from anywhere in the world, healthcare professionals may face challenges in managing their workload and ensuring that they can deliver high-quality care to all patients. This can lead to long waiting times, delayed diagnoses, and reduced patient satisfaction.

1.3 Objectives of Project

The aim of this project is to address some of these challenges and limitations by developing a virtual clinic platform that addresses the security and privacy concerns of patients, provides access to high-quality care, and ensures that healthcare professionals can manage their workload effectively. By developing a robust, user-friendly, and secure virtual clinic platform, this project aims to improve patient outcomes and increase access to healthcare services for all individuals, regardless of their location or socioeconomic status.

The primary objective of this project is to develop a virtual clinic platform that can provide remote healthcare services to patients. The key objectives of the project are as follows:

- To design and develop a user-friendly virtual clinic platform that can be accessed from anywhere and anytime.
- To integrate essential features such as video consultations, telemedicine, electronic health records (EHRs), and online prescription services.
- To ensure the security and privacy of patient information by implementing robust data protection measures.
- To conduct usability testing to evaluate the effectiveness and efficiency of the virtual clinic platform.
- To provide a cost-effective and accessible healthcare solution to patients.

1.4 Scope and Limitations of the Project

The scope of this project is to develop a virtual clinic platform that addresses some of the challenges and limitations of traditional healthcare services and leverages the opportunities offered by digital healthcare to improve patient outcomes and increase access to healthcare services. The virtual clinic platform will be designed to provide remote healthcare services, such as virtual consultations, telemedicine, and online prescription services, from anywhere and at any time.

The virtual clinic platform will be designed to be user-friendly and intuitive, with a focus on delivering high-quality care to patients. The platform will be designed to integrate essential features and functionalities, such as secure patient registration and login, virtual consultation scheduling, online payment systems, and secure communication channels between patients and healthcare professionals.[16]

The project will also involve developing robust data protection measures to ensure the security and privacy of patient information, such as encryption and multi-factor authentication. The virtual clinic platform will be designed to comply with all relevant data protection regulations and standards to ensure patient confidentiality and privacy.

Limitations:

Availability may be limited by factors such as their workload, geographic location, and technical limitations.

The platform will be designed to meet the specific needs and requirements of the selected healthcare specialty, which may differ from other healthcare specialties.

The project will be limited by technical constraints such as internet connectivity, device compatibility, and software requirements.

1.5 Organization of the project

The project is organized as follows:

Chapter 1 gives Introduction about the project.

Chapter 2 gives Literature survey of the project.

Chapter 3 provides analysis of project.

Chapter 4 provides design phase of project.

Chapter 5 provides how project is implemented.

Chapter 6 gives conclusion with future scope of the project.

2. LITERATURE SURVEY

A virtual clinic, also known as telemedicine or telehealth, is a healthcare service that allows patients to receive medical care remotely, through the use of telecommunication technologies. As such, it has become increasingly popular in recent years, due to the benefits it offers in terms of convenience, accessibility, and cost-effectiveness. In this literature survey, they will review some of the key research papers that explore the concept of the virtual clinic, and its applications in health care.

Paper 1: Modeling Healthcare Logistics in a Virtual World Craig W. Craig W. Thompson is a professor and the Charles Morgan Chair in the computer science and computer engineering department at the University of Arkansas.

Description: The 3D virtual world Second Life provides a free computing platform for to terraform virtual landscapes, build imaginative buildings or spaces, meet, socialize, and collaborate. Some universities and businesses have experimented with virtual classrooms and virtual stores. This article describes the beginnings of an experiment to use Second Life as a modeling platform for understanding pervasive computing in the domain of healthcare, specifically by building a "hospital of the future," complete with virtual RFID for tracking and providing location-aware services, smart networked equipment, restocking robots and the beginnings of workflow automation for modeling many hospital business processes. The same technology could be used to optimize hospital supply chains, test technologies like RFID in a model before full scale deployment, educate and train personnel, and simulate applications in other domains like retail or battlefields. This virtual world platform gives us insight into a future world where humans can communicate with the things as easily as they do with other humans.[1]

Paper 2 : Health Related Web Application: Virtual Hospital, Hiren Chafekar
School of Computer Science and Engineering, Ajeenkya D Y Patil University, Pune, India

Description : Coronavirus has affected the world to a great extent. The number of cases has been increasing since the beginning of 2020. People are scared and trying to save themselves. Although many vaccines are designed to prevent disease, many governments across different countries have not been able to control the virus. Coronavirus has changed the way people live. It has a profound impact on parts of North America, South Asia and African countries. Even European countries have begun to adapt to the “new standard”. However, due to mismanagement and lack of essential facilities, the health care system in South Asian and African countries has collapsed. In India, there is scarcity of hospital equipment's such as Ventilators, beds, Oxygen bottles. According to WHO, India has only 5 hospital beds per 1000 persons and is ranked at 155th position among 167 countries. Although, the government has been trying their best to add hospitals beds and equipment's but they are not adequate enough to balance the rising cases of Coronavirus. Even after setting up only 3000 hospitals for the purpose of containing coronavirus and reducing its spread, many people in India died as a result of mistreatment by city officials and improper implementation of the rescue program. Apart from Coronavirus, there are many other diseases out there which are harmful and contagious, but such disease can be cured at home itself just by having a remote treatment from doctor. The patients do not need to visit a hospital, thus saving the beds and equipment's for the others who are in more need of it. To implement this idea, technology can be a blessing. In everyday life, people order food and cab within minutes and watch live stock market points and sports results on their mobile phones from time to time; where many businesses are successful only because they are able to meet the needs with greater management our technology can be used to provide people around the world with a simple Virtual Hospital web system that simplifies the Hospital Health Care process to help patients, doctors, labs, and chemists. This will not only help the people but also the hospital staff by reducing their paperwork and administrative responsibilities. Patients can easily book their appointments and can arrange an online examination with a doctor. The web application can be easily accessed from mobile phones, laptops and desktops and can be useful to people in such difficult times. In addition, the application can be partnered with authorized pharmacies to provide quality medicines at the discounted price. The aim is to help the elderly and the disabled and people who have simple flu or other disease to gain treatment from doctors at low Doorstep rates. It is thought that this evaluation services may reduce hospital admissions and reduce general distress.[3]

Paper 3: Connecting the World of Healthcare Virtually: A Scoping Review on Virtual Care Delivery,Cindy (Zhirui) Li School of Health Information Science, University of Victoria, Victoria, BC V8P 5C2, Canada

Description : Virtual care extends beyond the walls of healthcare organizations to provide care at a distance. Although virtual care cannot be regarded as a solution for all health-related inquiries, it provides another care delivery channel for specific patient populations with appointments that do not require in-person physical examinations or procedures. A scoping review was conducted to define the meaning of virtual care, understand how virtual care has influenced the healthcare industry and is being expanded to complement the existing healthcare system, and describe the outcomes of using virtual care for patients and providers. Findings from the scoping review suggest that virtual care encompasses the provision of care using advanced video conferencing technology to support remote care that takes place between patients and providers and the use of virtual reality technology to simulate care environments. Some of virtual care's use in healthcare includes application to pain and anxiety management, virtual consultations and follow-up visits, rehabilitation and therapy services, outpatient clinics, and emergency services. Lastly, from a provider and patient perspective, while both saw benefits of virtual care and scored the service relatively high on satisfaction after using virtual care, the greatest barrier to using virtual care may be technological challenges.
they appraise the likely user-subjective expected benefit, the entertainment factor of the paradigm, the feasibility of a within- or across-session reward system, and the feasibility of a direct performance feedback to the user. Task adaptability is assessed with respect to the creation of parallel versions, the (automated) grading of task difficulty, and the possibility to modify the task to induce sufficient performance variance in the target population. Next, they address if outcome variables to quantify user performance exist or can be derived, if these are validated, and if they can be measured and evaluated independent of the experimenter administering the task. Moreover, they examine task and system factors that influence the likelihood of creating the sense of being present in the virtual environment. Importantly, they address the paradigm‘s feasibility for

cognitive training with regard to factors that may hinder repeated application and minimum requirements of task adaptability. The possibility of supporting cognitive strategies is assessed, and the likelihood and quality of transfer effects (especially near vs. far) is estimated, ideally based on prior evidence. Finally, they address predictable pitfalls to examine adherence to task requirements.[4]

Paper 4: "A conceptual IoT-based early-warning architecture for remote monitoring of COVID-19 patients in wards and at home" by Antonio Iyda Paganelli.

Description : Public health systems are going through unprecedented challenges due to the COVID-19 pandemic. The American Center for Disease Control and Prevention (CDC) estimated that 14% of the confirmed cases of SARS-CoV-2 infections required hospitalization .The virus is transmitted through respiratory droplets through direct and close contact with infected individuals or indirect contact with contaminated surfaces or objects. The implementation of social distancing policies, use of masks, and basic hygiene measures were shown to be effective policies in controlling the virus' spread with several countries applying such measures to prevent extensive hospital surges due to COVID-19.While social distancing is essential to reduce the spread of the virus, they also have a severe impact on economies, which is more pronounced in developing countries where income inequality is high.[22] For example, economic issues, misleading information, and lack of infrastructure to sustain the isolation of families leads to the relaxation of social distancing and an increase in the number of cases in Brazil. All these factors contribute to an increased demand for health services. Health professionals and resources are scarce given the number of critically ill patients, causing disruptions in hospital procedures and affecting the quality of care. The capacity of health teams to observe patients is affected both due to necessary distancing procedures and the need for more attention by patients, leading to increased response times in case of an emergency. Monitoring patients is traditionally a fundamental practice in hospital wards, as a decline in vital signs often precedes health deterioration . The monitoring frequency of patients by hospital staff increases as health condition deteriorates, ranging from 12 h intervals to half an hour visits in critical situations . In such cases, a multi-parameter monitor device is linked to several sensors attached to the patient. The infrastructure comprises sensors, patients, and monitors that typically restrict a patient to bed, reducing mobility. Moreover, these technologies are expensive, and cumbersome to better optimize resources, the continuous monitoring of patients is usually reserved for critical cases. In this scenario, sudden changes in physiological parameters may not be easily and quickly noticed as they depend on direct observation during visits from hospital staff.

Moreover, non-severe cases are not equipped with monitoring devices, which is concerning for COVID-19 patients as conditions can quickly deteriorate . Solutions that can support smart, early-detection and real-time remote monitoring functionalities are essential to ensure a high quality of care for COVID-19 patients inside hospitals.

In many situations, the patients may not be admitted to an infirmary or be treated in a hospital setting. People living in rural regions will have difficulty accessing health services facilities, such as several regions of India , and many people with suspected COVID-19 symptoms avoid going to hospitals due to the risk of contagion and choose to stay at home without monitoring or support. Further, since health facilities are overcrowded, patients with mild symptoms are often sent back home to self-isolate. These situations highlight the importance of an efficient and affordable patient monitoring solution during epidemics . Moreover, keeping track of infected patients allows the study of disease development and treatment responses. Combining the acquired epidemiological data with context information, such as climate, localization, and direct contacts can further help health officials plan precise counter-measures to mitigate the pandemic. For example, a recent study used data from wearable devices to predict COVID-19 trends and trigger early alarms. In the last few years, the increased adoption and use of Internet of Things (IoT) devices enabled the development of IoT-based remote health monitoring solutions . Several studies addressed the technological challenges of keeping track of patients' health and detecting risk situations based on physiological markers. For example,

IoT-based Health Monitoring Systems (IoT-HMS) combine the use of sensors, information and communication technologies, generation of massive data, applications of big data algorithms, and artificial intelligence to provide efficient and continuous remote monitoring of patients with real-time notifications. IoT-HMS have the potential to minimize healthcare costs while improving patient care. Moreover, the monitoring of vital signs allows the extraction of detailed information from patients' health status. These data, in turn, can be used to monitor changes in symptoms during treatment, detect risk conditions early, and trigger alarms in case of a worsening in the patient's health conditions. Thus, the IoT-HMS aims to act as an intelligent preventive tool that detects and acts on sudden changes in health status . Another major benefit of remote monitoring systems is the reduction of in-person contact; during COVID-19, this advantage provides critical protection to health professionals .

Given the potential of IoT-HMS, such systems must correctly identify the degree of illness severity and efficiently detect sudden changes in a patient's health condition. To this end, the National Early Warning Score-2 (NEWS-2), created in the United Kingdom and used in healthcare settings worldwide, can be incorporated. The NEWS-2 provides a score based on several monitored variables to identify the severity of a patient's condition. Specifically for COVID-19, NEWS-2 was found to be an efficient tool for stratifying patients and a good predictor of ICU admission, and in-hospital mortality. Moreover, the World Health Organization (WHO) recommends using NEWS-2 to recognize and escalate treatment of COVID-19 patients early . Therefore, a remote system that supports early warning scores, particularly of NEWS-2, can effectively monitor the health status of COVID-19 patients.

A final consideration of IoT-HMS includes the confidentiality of patients' information. The use of sensors increases the number of data collection points, and the type of health data that can be collected from patients. Both aspects make it difficult to know "what, why, and how data are being collected" . While data gathered within hospitals is usually protected in the hospital network and used to treat patients internally, considerations on patient privacy become essential when considering the remote monitoring of patients in external clinical settings. Moreover, pandemics increase the need to share patient data for research studies and public health agencies. Hence, the IoT-HMS must be able to manage patient consent efficiently for data collection. Several jurisdictions have different acts that regulate the collection and use of identifiable information, and a remote monitoring solution must ensure that patient privacy is being preserved. Despite the extensive literature addressing the challenges of monitoring patients using IoT-based solutions, there is a lack of an integrated and configurable method for predicting and detecting clinical changes in patients using connected devices, particularly for COVID-19 monitoring.[23] The goal of this paper is to present a conceptual architecture of a comprehensive early warning health monitoring system for COVID-19 with integrated and unified mechanisms for collecting, handling, recording, and analyzing a patient's data within hospitals and non-clinical environments.[4]

Paper 5: "IoT-Based COVID-19 Health Monitoring System: Context, Early Warning and Self-Adaptation" by Paulo Alencar, Donald Cowan David R. Cheriton School of Computer Science, University of Waterloo, Waterloo, Canada.

Description : The Internet of Things (IoT) has enabled novel solutions for monitoring patients' health through wearable sensors. Notably, it has also made possible the collection, monitoring, management, and analyses of disease symptoms in a remote manner .In the case of COVID-19, this is especially important, in which health resources are burdened to capacity, the number of patients in critical conditions is increased, and in-person monitoring may be difficult due to risk of contagion. In this paper, the report work in progress involving the development of our sensor module of an IoT-based COVID19 health monitoring system that can effectively monitor the essential physiological functions of a patient through wireless sensors. The paper provides three main contributions, as it includes: (i) a brief description of the current IoT-based system for remote monitoring of COVID-19 patients; (ii) a description of embedded characteristics of our device, including its contextual functions, early warning score mechanisms and self-adaptive features; and (iii) a description of our preliminary experimental results. Provide some background on context awareness, early warning score systems, and self-adaptation. IoT-enabled health monitoring involves sensing context information. In this case, context is defined, for example, as a patient's physiological status determined by wearable sensors. Systems that can sense and adapt to context are called context aware. Early warning score systems (EWS), such as NEWS2, are systems for scoring physiological measurements that are recorded at a patient's bedside and identify patients at risk of death in hospitals. In the case of the NEWS2, for example – which has shown promising evidence in monitoring COVID-19 patients' health status. Self-adaptation refers to the ability of a system can have of modify its runtime behavior to achieve its objectives. A self-adaptive system continuously monitors itself and, based on the data it gathers and the analysis of this data, decides whether adaptation is required. These systems need to make changes at runtime and fulfill the system requirements satisfactorily describe our ongoing work on the development of a novel IoT-based COVID-19 health monitoring system enabled by wireless sensors. In-depth details of the system's components are described in Paganelli et al.. The system has three layers: (i) the Data Acquisition Layer involves small IoT devices responsible for acquiring data from patients; (ii) the Application Layer contains control processes, user applications, and legacy systems; (iii) the Data Distribution Layer supports data. Communication between different modules while supporting scalability.

The Data Acquisition layer is responsible for collecting sensor data from the patient's monitoring devices, named wearable kit (W-Kit), and forwarding them to the Data Distribution layer. The connection to the Data Distribution layer is made through a Gateway component, which may include software agents that interact with each other to achieve device customization and remote configuration features . This layer is also responsible for processing features related to context, early warning scores, and self-adaptation. The Data Distribution layer serves as a message broker, managing data messages between the other layers of the system. This layer also contains an External API module that collects sensor data from third-party devices. Finally, the Application Layer integrates the collected data from different layers and sources, manages events, and performs complex processing according to the system's needs, such as data mining. Although security and privacy are major concerns when discussing remote health monitoring systems, our solution involves the collection of informed consent for specific data types and periods. The details of this consent module are described elsewhere .

Due to the COVID-19 pandemic, health services around the globe are struggling. An effective system for monitoring patients can improve healthcare delivery by avoiding in-person contacts, enabling early-detection of severe cases, and remotely assessing patients' status. Internet of Things (IoT) technologies have been used for monitoring patients' health with wireless wearable sensors in different scenarios and medical conditions, such as noncommunicable and infectious diseases. Combining IoT-related technologies with early-warning scores (EWS) commonly utilized in infirmaries has the potential to enhance health services delivery significantly. Specifically, the NEWS-2 has been showing remarkable results in detecting the health deterioration of COVID-

19 patients. Although the literature presents several approaches for remote monitoring, none of these studies proposes a customized, complete, and integrated architecture that uses an effective early-detection mechanism for COVID-19 and that is flexible enough to be used in hospital wards and at home. Therefore, this article's objective is to present a comprehensive IoT-based conceptual architecture that addresses the key requirements of scalability, interoperability, network dynamics, context discovery, reliability, and privacy in the context of remote health monitoring of COVID-19 patients in hospitals and at home. Since remote monitoring of patients at home (essential during a pandemic) can engender trust issues regarding secure and ethical data collection, a consent management module was incorporated into our architecture to provide transparency and ensure data privacy. Further, the article details mechanisms for supporting a configurable and adaptable scoring system embedded in wearable devices to increase usefulness and flexibility for health care professions working with EWS.[5]

Paper 6: "IoT-based e-Health Framework for COVID-19 Patients Monitoring" by Fahad Albogamy.

Description : Currently, the Internet of Things (IoT) is one of the technologies that have been widely disseminated in different application contexts .IoT can be defined as a technology that consists of millions of devices that are connected to the Internet . This network of devices exchange, add and process information about their physical environment to provide value-added services to the end users. Thanks to the advantages provided by IoT, its use has been made possible in different sectors such as industry, tourism, health, and the environment, which has made possible the construction and formation of smart cities . There has been a remarkable growth in the number of connected devices in recent years. Since 2008, these have already surpassed the number of inhabitants on earth, and could reach 75 billion connected devices by 2025 . An example of this scenario is the smart lamps, which even when they are not emitting light must remain connected, waiting for a switch on, whether from a human user or from another computer system. Another example is wearable devices , which constantly monitor a person's physical activity, and can issue alerts if any of the indices fall outside the desirable range . With this view, the trend is that it is increasingly necessary for isolated items to connect to share information. Therefore, just as it is now uncommon to have a computer disconnected, it will soon be unusual to have an air conditioner or a coffee maker in this same situation. Worldwide, the commercial automation and home automation areas are, among the IoT technologies, those that currently attract the most investment and with the largest installed IoT parks in the world .

Despite this, many other areas can also take advantage of the growth, evolution, and cost-effectiveness of this technology to expand its possibilities. Health care is one of these areas, where the use of IoT can help in various fields, whether streamlining medical care, emergency response time, predicting the occurrence of serious events, among other possibilities. In all cases, the expected benefit is the improvement in the quality and life expectancy of the public using IoT technology. Coronavirus is a new disease that comes from the group of coronaviruses which has seven distinct types in this family. four types of this family are mild, like a catarrh. COVID-19 was primary identified in Wuhan City, China, and has been officially named "SARS-CoV2." It causes cough, fever and difficulty of breath. The incubation period is officially two to fourteen days after exposure. Infection can range from very mild to advanced pneumonia, but it appears that 80% of cases are mild . With the COVID-19 pandemic, the researches on personal health sensing equipment became even more intense . Thermometers and pulse oximeters, for example, have become even more popular. One of the impacts of this was that many wearable devices, such as smart watches, incorporated these features into their latest models. using these devices, it is possible to monitor interesting data about the user's health, such as heart rate, blood oxygenation and body temperature - depending on the device model .

The demands of the health area that can be supported by IoT are extensive, ranging from the needs in hospitals and health care establishments, through ambulances and emergency environments to home care environments. Even with all these possibilities, the healthcare area still does not make full use of IoT technologies . In intensive care unit environments, for example, patients are routinely monitored by hospital equipment that usually displays data on parametric monitors, located within sight of healthcare professionals. Its main function, arguably, is to display the values obtained in real time, as well as to provide audible and visual alerts when values leave the normal range. In general, the generated historical data is stored in the equipment for a few hours, just so that it is possible to observe the average, maximum and minimum values for the period. However, the definitive record is made by the nursing team: periodically a professional must go near the monitor to write down the information presented in the patient's medical record .

As for ambulances, operating protocols may vary according to the management and purpose of the displacement. A common case of use of ambulances is when a patient is transferred in a state of urgency or emergency to a specialized hospital. When an emergency call is received requesting, for example, an ambulance to go to the home of a patient in home care, the ambulance environment (equipment and professionals) is quickly prepared based on the health status information that was provided when the call was made. If the patient (before the arrival of the ambulance) experiences any sudden change of state (for example, cardiac arrest), it will be necessary for the ambulance team to be notified by telephone, while still on the outward journey. In a perfect setting , during the COVID-19 pandemic, it became necessary to simultaneously monitor millions of infected people, to monitor their symptoms and carry out, if necessary and at the right time, their hospitalization. In this scenario, there is a great benefit in using IoT devices to collect and analyze patient health data in real time, which is the possibility of predicting the capacity of sectors and scheduling internal patient transfers. Not only that, but there could also be an optimization in the process of external transfers, as the team could, through real-time patient data, choose the ideal moment to perform each transfer. These factors indicate that the current way of using health sensing data can be improved, with the objective of generating benefits for both the patient and for the professionals and health services involved. These benefits are related to the agility in identifying health problems, measurable by sensors, the quick notification of health caregivers and the possibility of obtaining prognoses about the patient's health. The contribution of this paper is to propose an IoT-based monitoring framework that can help the health caregivers to obtain useful information during the current pandemic of COVID-19. Moreover, a prototype system is developed and evaluated.

The Internet of Things (IoT) has enabled novel solutions for monitoring patients' health through wearable sensors in conditions of both non-communicable and infectious diseases. In this paper, the report work in progress involving the development of an IoT-based COVID-19 health monitoring system that can effectively monitor the essential physiological functions of a patient through wireless sensors, thus supporting the early detection of severe cases and the continuous assessment of the patient status. The work provides several main contributions, as it includes: (i) a brief description of the current IoT-based system for remote monitoring of COVID-19 patients; (ii) a description of embedded characteristics of our device, including its contextual functions, early warning score mechanisms and self-adaptive features; and (iii) a description of our preliminary experimental results. Our proposed solution drastically reduced the amount of redundancy in data and still maintains monitoring accuracy. Given the COVID-19 scenarios, in which human resources are extended to the limit, and the number of patients in severe conditions is often high, a system that can support IoT-based continuous monitoring is essential to identify changes in clinical status promptly and accurately and can potentially transform the way patients are monitored.

The COVID-19 pandemic, produced by the SARSCoV-2 virus, has caused global public health emergency, with the rapid evolution and tragic consequences. The fight against this disease, whose epidemiological, clinical, and prognostic characteristics are still being studied in recent works which is forcing a change in the form of care, to include transforming some face-to-face consultations into non-face-to-face. Recently, various initiatives have emerged to incorporate the Internet of Things (IoT) in different sectors specially the health sector generally and in e-Health systems specifically. Millions of devices are connected and generating massive amounts of data. In this sense, based on the experience in the health sector in the management of the pandemic caused by COVID-19, it has been determined that monitoring potential patients of COVID-19 is still a great challenge for the latest technologies. In this paper, an IoT-based monitoring framework is proposed to help the health caregivers to obtain useful information during the current pandemic of COVID-19, thus bringing direct benefits of monitoring patient's health and speed of hospital care and cost reduction. An analysis of the proposed framework was carried out and a prototype system was developed and evaluated. Moreover, evaluated the efficacy of the proposed framework to detect potentially serious cases of COVID-19 among patients treated in home isolation.[6]

Paper 7 : "Remotely Monitoring COVID-19 Patient Health Condition Using Metaheuristics Convolute Networks from IoT-Based Wearable Device Health Data" by Jaber, M.M.; Alameri.

Description : COVID is a critical and challenging disease to identify in its earliest stages One solution is to minimize its effects by taking mitigating steps to reduce the disease's spread with the help of the Potential Infected Patient (PIP) monitoring process . PIP monitoring is achieved by using the Internet of Things (IoT) , which monitors a patient's activity via a wearable device. IoT devices collect, analyze, monitor, and manage disease symptoms remotely. As a result, the time is ripe to implement IoT solutions that could. improve identifying those with COVID-19 and contact trace (identifying people exposed to infected people). IoT systems can track medication prescriptions, monitor patients remotely, and send and receive medical information via wearables. Thus, practitioners can more readily examine, diagnose, and treat patients by using IoT-based telemedicine technology without physical engagement. An IoT platform can be used to control drones monitoring crowds, make public announcements, screen crowds, spray disinfectants, and convey medical supplies and other essentials with minimum human involvement. Wearable technologies monitor COVID-19 symptoms using a sensor device that records the patient's temperature, oxygen saturation, heart rate, and other respiratory information. Indeed, some healthcare systems widely utilize IoT wearable devices to identify COVID-19 in the current pandemic . The collected health details are stored in the cloud via the Internet, and clinicians can investigate the information. illustrates the IoT with cloud-based COVID-19-patient health monitoring. Wearable devices continuously record a patient's physical activities and collect data that are then transferred to a healthcare center. The gathered details are investigated using the learning and classification model to identify abnormal activities.

Several researchers have used the deep-learning model because it can examine high-dimensional sensor data. The integration deep-learning model in the IoT reliably impacts a healthcare center. The IoT devices play a critical role in the COVID19-

patient monitoring process because COVID-19 has various stages. The first stage is asymptomatic, in which patients do not display any symptoms. In the second stage, patients have a cough, cold, and fever. In the third stage, the virus spreads to other people. Last, patients recover from the disease in the fourth stage. The basic symptoms should be monitored to reduce COVID-19 impacts and help reduce the virus' spread. Novel coronavirus symptoms , such as SpO2 (oxygen saturation), body temperature, and pulse rate, should be monitored to determine the symptoms. These health parameters are monitored with the help of the Internet of Medical Things (IoMT), and wearable devices monitor a patient's health. According to recent research, 162 million devices are currently utilized in the medical field to capture patient health conditions. During the data-collection process, edge and fog computing are incorporated in IoT sensor devices to ensure high availability, low latency, and patient location. A deep-learning model processes details to recognize the vital signs of patients. Authorities can use the information to restrict the area in which a person travels to avoid spreading the virus .

Distraction, signal or battery failure, and reliance on the US Department of Defense, Privacy Issues, and Crime Commercial Exploitation are some issues that might arise when using a GPS device. Additionally, GPS, designed for outdoor use, cannot be used indoors because GPS signal attenuation in interior environments reduces precision. Wearable sensors measure various metrics, such as motion activity, respiration rate, heart rate, body temperature, stress, cough symptoms, and oxygen saturation level. A person can communicate with a computer system through its user interface characteristics. Anything in this category can be a screen or page. Examples of user interfaces include desktop software and programs and mobile apps. These physiological measurements are stored in the cloud environment that clinicians request for clinical analysis. [7]

Paper 8: "A novel approach to IoT based health status monitoring of COVID-19 patient" by 2021 International Conference on Science & Contemporary Technologies (ICSCT)

Description : A recently detected corona virus, has resulted in a global respiratory disease pandemic, called COVID-19. It originated at the beginning of December 2019 near Wuhan City of China. On 31 December2019, the China Health Authority reported the World Health Organization (WHO) of some pneumonia cases of an unidentified etiological disease . A total of 113 million cases were recorded around the world as at 27 February 2021, with 2.5 million deaths. In the early stages of the pandemic, rate of death or fatality in the whole world was measured at approximately 2%, and survival rate was 41.8%. . As the total number of cases each day changes, the numbers differ often. When the pandemic broke out, lockdowns were imposed in almost all areas worldwide, closing down events involving human interaction and communication, including colleges, universities, malls, temples, banks, major airport and metro stations . As a result it took more than 2 months for cases to go down from 20 to 40 million. As the world is now adopting a 'New Normal' policy, post lockdown scenario is different. It took just 1 month for cases to go from 80 million to 100 million . Compared to pre-lockdown stages, the use of internet services has risen from 40% to 100%. Amazon, an international tech company, announced a 70% increase in earnings in the first nine months of 2020. At a time of crisis technologies should still look forward to responding effectively and improving their ability to face new challenges. Remote monitoring technology has immense potential to do so regardless of COVID-19.

COVID-19 is a SARS-CoV-2 virus infection that almost always damages a person's respiratory system. Moderate symptoms often include fever, low saturation, and soreness, which frequently lead to severe conditions. An individual with mild breathing difficulties will perhaps not know when to go to a hospital or need oxygen. This is why people must get accurate information about their current condition. Many patients with COVID-19, even if they feel well, have a low concentration of oxygen in their blood. Low oxygen saturation levels can be an early warning sign that emergency medical assistance is required. The four key indicators that medical and healthcare providers regularly track include body temperature, heartbeat, respiration, and blood pressure. As the number of patients is increasing rapidly, it has been difficult to provide treatment in hospitals due to the limited number of seats, especially in a third-world country like Bangladesh. So, COVID-19 patient treatment should not only be centralized in treatment centers and outpatient facilities, but it is also equally important to develop remote monitoring strategies to monitor and advise the patients remotely. The proposed device involves multiple sensors for the tracking of vital signs and the results of the sensor will be transmitted in the cloud, which will be made available to health professionals for comprehensive analysis. [8]

Paper 9 : "Monitoring COVID-19 Patients Using Cardio-Pulmonary Stethoscope RF Technology" by 2021 IEEE International Symposium on Antennas and Propagation.

Description : COVID-19 is a respiratory disease caused by SARS-Co V2 virus that infects the airways and lungs. It damages the lungs by filling the airsacs with fluid that results in hypoxemia. Patients with moderate to severe case of COVID-19 require frequent monitoring. Imaging measures like x-ray, and CT scan have been employed to visually assess the damage done by COVID-19 to the lungs of affected people. Regular monitoring of the damage with these methods overtime, however, is difficult due to the associated cost, the risk of exposure to other patients and medical personnel, the time lost during decontamination of the imaging room after receiving COVID-19 patient, and the risk of overexposing the patient to radiation. Cardiopulmonary Stethoscope (CPS) is a medical monitoring device developed and patented on 2016 and on 2020 by Hawaii Advanced Wireless Technology Institute (HAWTI) that consists of a pair of sensors to couple energy into the human body at 915 MHz and a microcontroller unit (MCU) equipped with signal processing capabilities to extract real time information on human's vital signature based on the measurement. The device has proven to provide continuous and non-invasive measurement of the change in lung water content along with heart and respiration rate through successful clinical trials and by matching the measurement results with that of benchmark devices .CPS sensor and MCU that processes this data into vital sign information which is transmitted to the mobile app through Bluetooth. In this paper, present the results for use of CPS to continually measure the COVID-19 afflicted lungs. look at the resolution of the inflammation that CPS can detect and its sensitivity to the property of the inflammation. The simulations were done using FDA approved realistic Human Male model in Ansys® Finite Element High Frequency Structure Simulator (HFSS), and the lung inflammations were made to mimic some of the CT scans images of lungs affected by COVID-19.[9]

Paper 10 : "Smart Covid-19 detection system using Max30100 and MPU6050 Sensors" by International Journal of All Research Education and Scientific Methods

Description : With the rise in number of COVID-19 cases and the virus has greatly caused economic and social disruption which is devastating. Based on the data reported by state authorities and federal health minister that is by the end of June 2021, the virus has led to 191 million cases and around 4 million deaths worldwide, whereas in India the total number of deaths due to COVID-19 is around 4 Lakhs. Coronavirus is a contagious disease caused by a group of RNA-related viruses. The main cause of transmission of the virus is droplets that are produced when an infected person coughs, sneezes, or exhales. As the virus has pneumonia-like symptoms it is often misunderstood to be a common cold. Since the disease is highly communicable, it has an exponential rate of escalating and hence created a pandemic raising the death rate to such an extent that it has hugely impacted over 185 countries within a matter of just a few months. The fundamental architecture of this project basically consists of a combination of hardware and software components where in the Arduino and various sensors contribute for the hardware part and the software component which is subdivided into frontend and backend technologies. The frontend contains Arduino and various other sensors whereas the backend includes Arduino IDE. Basically the idea lies in the fetching of data from sensors and pushing it to a secure server on the cloud where it can be conveniently viewed by the person. As a result, this project is primarily focused on the conveyance of a low cost system that is not only accurate but sustainable and low in maintenance and dissimilar its predecessors this system not only delivers an accurate plan but does at a small cost of the previous system [10]

Paper 11: "Design of Reflectance Pulse Oximeter and BPM using the Max30100 Sensor in Early Detection of Hypoxemia in Patients with Cardiovascular Disorders" by John W Berkenbosch MD and Joseph D Tobias MD.

Description : body locations, including centrally. A recently developed reflectance sensor, the Max-Fast forehead reflectance sensor (Nellcor/Tyco Healthcare, Pleasanton, California), may offer advantages over both conventional digit-based oximetry and older reflectance sensors. First, though limited, some data suggest that perfusion to the forehead region is better maintained during conditions of poor perfusion, 10, 11 suggesting that oximeter dropout might be less with fore-head oximetry. Second, sensors placed on the forehead appear to respond more rapidly to changes in oxygenation than do digit-based sensors, 12 which suggests that fore-head oximetry may allow earlier detection of desaturation. Third, there may be less motion artifact with forehead sensor-placement, so there may be less dropout. Preliminary data suggest that the Max-Fast forehead sensor accurately estimates oxygen saturation in critically ill, poorly perfused adults.13 However, though the sensor has received approval from the Food and Drug Administration for use with patients 10 kg, there are no pub-lashed data to date regarding its accuracy with pediatric patients. The present study compares the accuracy of this sensor to that of a conventional digit-based oximetry sensor with pediatric patients, regardless of perfusion status. The primary study goal was to compare the Max-Fastsensor's ability to estimate arterial oxygen saturation (as measured via CO-oximetry [SaO2]) to that of a conventional digit sensor. hypothesized that this new fore-head sensor would estimate SaO2as accurately as a com-manly used, new-generation, digit-based transmission-type sensor in pediatric patients[11]

Paper 12 : "Comparison of a new forehead reflectance pulse oximeter sensor with a conventional digit sensor in pediatric patients" by Conference proceed Annual International Conference of the IEEE Engineering in Medicine and Biology Society.

Description : During conditions of poor perfusion, the accuracy of conventional extremity-based pulse oximeters may be limited. Limited evidence suggests that forehead perfusion may be better preserved during such periods, but pediatric experience with newer forehead reflectance sensors is limited. prospectively compared the accuracy of a forehead reflectance sensor, the Max-Fast, with a new-generation digit sensor in pediatric patients. Pediatric patients > 10 kg and who had arterial catheters were eligible for enrollment. Blood oxygen saturation was simultaneously measured with forehead and digit sensors, and compared to corresponding CO-oximetry-measured arterial oxygen saturation values (S(aO2)) taken at the same times. Bland-Altman analysis to calculate the bias and precision of the forehead sensor and the digit sensor relative to the S(aO2) values. obtained 116 sample sets from 28 patients. The S(aO2) values ranged from 84.1% to 99.2%. The bias and precision of the forehead-to-S(aO2) difference were 0.6% and 2.7%, respectively, versus 1.4% and 2.6%, respectively, for the digit-to-S(aO2) difference ($p < 0.05$). Bias and precision were 0.7% and 2.6% versus 1.7% and 2.3% for the forehead and digit sensors, respectively, ($p < 0.05$) in patients who received vasoactive medications, compared with 0.5% and 2.8% versus 1.1% and 2.8% (p = not significant), respectively, in patients who did not receive vasoactive medications. The Max-Fast sensor estimated S(aO2) as accurately as did a new-generation digit sensor in well-perfused pediatric patients.[12

Paper 13: "Software to Assist a Health Practitioner in Caring of Covid-19 Home Isolated Patients" by 2021 National Computing Colleges Conference (NCCC). **Description :** This research uses modern communication and sensor technologies to allow health practitioners to monitor patients at home. It designed a component based software to address the problem of overcrowding in hospitals during covid-19 pandemic. It helps health practitioners in monitoring patients by measuring and testing patient's vital signs remotely with a potential for earlier guidance of treatment and transform patients to hospital in emergency cases only. This software uses wristband which placed around the patient wrist and sends vital signs data to the software using Bluetooth. Then the software analysis patient data and automatically send a notification to both health practitioners/hospital and patient family when patient symptoms get worse. Healthcare application system is a mobile application that receives the Body Temperature, Heart Rate and Blood Pressure from the wristband vital signs measurement system component and displays these data digitally in the application interface. This application also displays the patient private data such as name, gender, age, etc., all of that of course is done after the patient is registered in the application. This Application sends a patient daily vital sign data report to the emergency system component. It also contains a chat box that allows patient to live communicate their medical concerns with health practitioners. This helps health practitioners to determining urgent and emergent status. When patient data register critically abnormal vital signs such as Temperature less than 35∘C or greater than 38.9∘C and Heart rate greater than 120 beats/minute, this application automatically send an emergency notification to both health practitioners/hospital and patient family.

The emergency system is a hospital system where the patient data are imported from the healthcare application system. Patients data with critically abnormal vital signs are shown on the application home page. This allowed health practitioners to deal with urgent and emergent status quickly and send an emergency team immediately to the patient's location. Critically abnormal vital signs which indicates an emergent statues and activates emergency team are [10]: (1)Temperature less than 35◦C or greater than 38.9◦C, (2)Heart rate less than 60 beats/minute or greater than 120 beats/minute, (3)Blood Pressure less than 74 mmHg or greater than 125 mmHg.However, all of the existing once did not used smart wristband for patients remote health monitoring which play a main role in decreasing emergency care system crowding numbers and increases system's ability to function, as well as patients outcome. This research proposed a component healthcare software system that addresses this problem. It uses a smart wristband to help the health practitioners in monitoring patients to reduce death cases and improve the health care of COVID19 patients by measuring and testing patient's vital signs remotely with a potential for earlier guidance of treatment and sending a notification to emergency when patient health status gets worse. A prototype of the proposed system s was implemented using java.[13]

Paper 14 : "Monitoring COVID-19 Patients Using Cardio-Pulmonary Stethoscope RF Technology: Computer Simulation Study Using CT Scans of Patients" by IEEE Access (Early Access)

Description : The present study is based on 2D cross sections of an average male model and emphasis is placed at location across from a suspected injured lung with the COVID-19 disease. To determine the effectiveness of the proposed CPS RF wireless technology, additional simulations are needed and presently ongoing to quantify the effectiveness, signal sensitivity, and resolution on a variety on human models, males, females, and children, of all ages, sizes, and Body Mass Index (BMI). Preliminary results indicate that due to the chest patch-based measurements of the CPS device, the size of the human body has minimal effect on the effectiveness of the proposed COVID monitoring approach. Furthermore, in placing the CPS sensors near the suspected COVID-19 injury of the lung, it is assumed that an initial CT or Xray scan of the patient is available or could be made. The complementary function of the CPS would be on monitoring changes in patient status including favorable response to medication and treatment, or the need for alternatives and more urgent treatments. Some studies also suggested that water volume in lungs does not only depend on age, sex, size, and BMI of patients, but also on patient's height This clearly suggests the need for more specific 3D simulations regarding COVID inflammations and possibly additional guidelines regarding the RF sensors placement for optimized COVID monitoring. Experimental validation and conducting clinical studies on COVID patients are our next steps, as intend to follow the same approach used in the NIH-funded clinical trials on dialysis and heart failure patients .

In 2020, the COVID-19 pandemic claimed 3 million lives worldwide in span of a year; the death toll is still on rise as of writing of this article. Hospitals around the globe overwhelmed with COVID-19 patients faced medical resource shortages preventing them from providing services to even severe cases, leaving patients to selfcare. The identified COVID-19 patients had to observe the symptoms escalation or take imaging tests such as CT scans to determine the disease progression. While these imaging methods provide detailed accounts of damage inflicted to lungs by COVID-19, they have their own limitations and risks. In this article, use computer simulations to examine the possibility of using the Cardio-Pulmonary Stethoscope (CPS) to continually monitor the COVID-19 afflicted lungs. [14]

Paper 15: "Two case studies of virtual reality therapy effect on CRPS patients in Occupational Therapy outpatient clinic" by Uty H. Ostrei Occupational Therapy service at Soroka medical center, Be'er-Sheva, Israel

Description : CRPS diagnosis is treated by qualified Occupational Therapist in Soroka medical center for decades. In this case study report, they will suggest short term protocol based on innovative rehabilitation VR technology, and conservative treatment in ADL apartment. The fundamental approach in Occupational Therapy for chronic pain includes playfulness, mirror therapy, conservation and improvement of the upper extremity functional abilities. they will focus on two case studies of short-term intervention, including innovative VR rehabilitation technology, and functional treatment in ADL Occupational therapy department. Complex Regional Pain Syndrome (CRPS) is a health condition causing unexplained pain after a minor orthopedic trauma in the extremities. The pain might additionally lead to limb contractures, and abnormalities of sensation, changes in the autonomic nervous system, joints range of motion, bones and skin appearance. Today, Occupational therapy provides long-term rehabilitation, to out-patient diagnosed with CRPS. Most of the treatments last longer than 12 months and spread over 24 treatment sessions. Current case studies will examine innovative short-term approach, including main elements given today, by using ADL apartment and Virtual Reality (VR) technology. VR technology can be used for treating CRPS, by isolate the user from the outside world, and easily engage the patient into alternative Virtual Reality . Sato et al (3) used VR as advanced method of Mirror Therapy on small CRPS participants group, showed feasibility of better results in short term VR intervention. Immersive VR is considered a fourth-generation computing system and differs from third generation systems (Kinect) in its ability to fully control and monitor both the patient environment, and to generate closed biofeedback loops for rehabilitation. Oculus Rift station with touch controllers was used in this study .It's intended for tracking motion and movement kinematics and guiding patients in the performance of physical and cognitive exercises according to the treating medical practitioner's guidelines .All data from the study's training is collected in real-time to a medical server, including raw motion data and event marks from within the game. VRHealth software-only medical devices are cleared for marketing in the U.S. by the Food and Drug Administration (FDA), Europe (EC certification) and Israel (AMAR).[15]

Paper 16: "Two case studies of virtual reality therapy effect on CRPS patients in Occupational Therapy outpatient clinic" by Uty H. Ostrei; Revital Uzan; Omer Weissberger

Description: CRPS diagnosis is treated by qualified Occupational Therapist in Soroka medical center for decades. In this case study report, they will suggest short term protocol based on innovative rehabilitation VR technology, and conservative treatment in ADL apartment. The fundamental approach in Occupational Therapy for chronic pain includes playfulness, mirror therapy, conservation and improvement of the upper extremity functional abilities.they will focus on two case studies of short-term intervention, including innovative VR rehabilitation technology, and functional treatment in ADL Occupational therapy department. Complex Regional Pain Syndrome (CRPS) is a health condition causing unexplained pain after a minor orthopedic trauma in the extremities. The pain might additionally lead to limb contractures, and abnormalities of sensation, changes in the autonomic nervous system, joints range of motion, bones and skin appearance. Today, Occupational therapy provides long-term rehabilitation, to out-patient diagnosed with CRPS. Most of the treatments last longer than 12 months and spread over 24 treatment sessions. Current case studies will examine innovative short-term approach, including main elements given today, by using ADL apartment and Virtual Reality (VR) technology. VR technology can be used for treating CRPS, by isolate the user from the outside world, and easily engage the patient into alternative Virtual Reality . Sato et al used VR as advanced method of Mirror Therapy on small CRPS participants group, showed feasibility of better results in short term VR intervention. Immersive VR is considered a fourth-generation computing system and differs from third generation systems (Kinect) in its ability to fully control and monitor both the patient environment, and to generate closed biofeedback loops for rehabilitation. Oculus Rift station with touch controllers was used in this study.[25]

Paper 17: "Multidimensional assessment of virtual reality applications in clinical neuropsychology: The "VR-Check" protocol" Stephan Krohn;Johanne Tromp;Eva M Quinque;Julia Belger;Felix Klotzsche;Michael Gaebler;Angelika Thöne-Otto;Carsten Finke

Description: The rapidly growing literature on Virtual Reality (VR) applications for clinical purposes has recently led Rizzo and König to suggest that clinical VR may be "ready for primetime". Similarly, a consortium of international VR experts has just put forward a catalogue of best-practice recommendations for running clinical trials with VR healthcare tools. In clinical neuropsychology, the increasing relevance of VR applications presents researchers with the challenge of evaluating these applications systematically in order to optimize paradigm design for their specific research question. Moreover, the extensive design possibilities of VR yield qualitatively new task features that are not adequately captured by classical psychometric quality criteria (objectivity, reliability, validity), highlighting the need of an extended paradigm evaluation framework. Here they propose such a framework for VR applications in form of a multidimensional checklist: VR-Check. VR-CHECK DIMENSIONS summarizes the proposed evaluation criteria. Domain specificity is judged in light of existing evidence regarding the domain of interest (e.g., relation to other assessments with well-established specificity) and foreseeable domain confounds. Next, they assess how relevant the virtual world, the experimental stimuli, and the activities performed to solve the task are to the user's everyday life. Technical feasibility concerns whether implementation of the task is feasible in a virtual environment in general and specifically in the desired head-mounted display (HMD), 2D display, or both. User interaction and navigation in the virtual environment are judged with respect to the feasibility and necessity of input devices such as VR controllers or a mouse. Next, the paradigm is assessed with respect to its feasibility in healthy subjects, the target patient population and different age groups. Here, potential caveats due to navigation and interaction complexity must be addressed. Similarly, long task duration or high attentional demands may restrict feasibility in some user groups and must thus inform paradigm design. Likelihood and severity of adverse effects (e.g., cybersickness) in the user groups of interest are considered. Potential ethical concerns are also made explicit here. Regarding user motivation, they appraise the likely user-subjective expected benefit, the entertainment factor of the paradigm, the feasibility of a within- or across-session reward system, and the feasibility of a direct performance feedback to the user. Task adaptability is assessed with respect to the creation of parallel versions, the (automated) grading of task difficulty, and the possibility to modify the task to induce sufficient performance variance in the target population. Next,they address if outcome variables to quantify user performance exist or can be derived, if these are validated, and if they can be measured and evaluated independent of the experimenter administering the task. Moreover, they examine task and system factors that influence the likelihood of creating the sense of being present in the virtual environment. Importantly, we address the paradigm‘s feasibility for cognitive training with regard to factors that may hinder repeated application and minimum requirements of task adaptability. The possibility of supporting cognitive strategies is assessed, and the likelihood and quality of transfer effects (especially near vs. far) is estimated, ideally based on prior evidence. Finally, they address predictable pitfalls to examine adherence to task requirements. [26]

Paper 18: "Immersive Virtual Reality for the Assessment and Training of Spatial Memory: Feasibility in Individuals with Brain Injury" by Julia Belger; Stephan Krohn; Carsten Finke; Johanne Tromp; Felix Klotzsche; Arno Villringer; Michael Gaebler; Paul Chojecki; Eva Quinque; Angelika Thöne-Otto

Description: Neuropsychological assessment aims to measure specific cognitive functions while, ideally, being ecologically valid and predictive of an individual's performance in everyday life. To achieve this aim, Virtual Reality (VR) – and particularly immersive VR – holds a high potential to achieve this aim as virtual environments (VE) can present an everyday-like world and realistic objects to a user, while task difficulty can be parametrically increased, and behavior can be precisely measured. Therefore, VR may be a suitable tool to measure cognitive function in individuals with acquired brain injury. With rapid technological advancements and increasing availability of VR systems, clinical VR applications are increasingly being used as diagnostic as well as rehabilitation tools to detect and train cognitive, psychological, and motor impairments. Preliminary work in this field provides support that VR interventions high in ecological validity lead to behavioral changes in daily life, confirming the transfer from the virtual to the real world. Individuals immersed in VEs can interact with virtual objects in real-time through multiple sensory modalities . Therefore, virtual worlds combine experimental control with the potential to enhance the real-life transfer by providing interactive and realistic stimuli . Nevertheless, with respect to the applicability in a clinical population, several questions remain: To what extent are individuals with motor, perceptual, and/or cognitive deficits able to adjust to the interaction with the VE and do they tolerate head-mounted displays (HMD) that are necessary to present immersive scenes, psychologists, and software engineers jointly develop and evaluate ecologically relevant diagnostic and training VR scenarios. Realistic VEs – resembling subjects' everyday lives – are used to assess cognitive functions and apply individually tailored immersive training programs. With visual input delivered through an HMD and controller-free interaction in the VE, the project investigates (and aims to maximize) the feasibility of immersive VR in individuals with neurological diseases. One branch of the VReha project focuses on the cognitive component of spatial memory. Since the natural space is 3D, it is challenging to examine spatial memory with traditional 2D paper-and-pencil or computerized tasks. they therefore developed a VR task, the immersive Virtual Memory Task (imVMT), to assess (visuo)spatial memory in a both sensitive and ecologically valid manner. Spatial memory deficits occur early in Alzheimer's and in a number of other neurological diseases . Therefore, measures to sensitively detect deficits in spatial memory are of high clinical relevance. The objectives are to determine the feasibility of an immersive VR task, the imVMT, in individuals with acquired brain injury and estimate the extent to which immersion, and sense of presence, usability, general motivational aspects, and side effects affect user experience.[27]

Paper 19: "Battling the Fear of Public Speaking: Designing Software as a Service Solution for a Virtual Reality Therapy" by Justas Salkevicius; Lukas Navickas 2018 6th International Conference on Future Internet of Things and Cloud Workshops (FiCloudW)

Description: According to World Health Organization the anxiety disorders are reaching rates as high as 28.8%. The fear of public speaking is a form of social anxiety disorder (SAD) and is classified as DSM-IV condition (DSM-5 when it's limited only to the formal public speaking). The latest research has shown that cognitive behavioral therapy (CBT) in combination with exposure therapy (ET) is an efficient way of treating SAD. ET requires patient to face their fears in a safe environment by vivo and imaginal exposure. Virtual reality exposure therapy (VRET) achieves similar effect by transferring the patient to the controlled 3D environment. From 2012 to 2015 at least 24 VRET studies have been made and reviewed. These studies showed that VRET can help patients to deal with the anxieties faster compared to the traditional CBT approaches. However, it is necessary to note that the impact of VRET session is correlating with the quality of the headsets . So it's important to evaluate capabilities of the new consumer-grade devices. Multiple researches successfully employed VRET for the treatment of the fear of public speaking. Still, more research is needed to investigate VRET applications that can provides wider control capabilities to the therapist. Growing popularity of the software as a service (SaaS) solutions around the world enabled professionals to work more efficiently. Despite that there aren't many widely available VRET cloud services. Therefore, additional research can help to push forward this type of VRET solutions. A systematic review of the recent advancements in the area of VRET was done by Botella et al. They observe that VRET can be equivalent to the traditional therapy methods and even increase the efficiency of the treatment. Moreover, they note that the main limiting factor of VRET is the acceptance by the clinicians and it should be solved with reduced hardware cost, development of ease-to-use solutions and additional training programs for medical personnel. Levvy et al. conducted a study of VRET in the online (remote) setting. Authors concluded that VR can be used in acrophobia treatment. However, they noted limitations of VR that some applications could require for a patient to have access to high power PC and knowledge how to install and setup VR applications. Manju et al. used VR to reduce social anxiety for kids with autism. Computer controlled environments provided a repeatable way of social interactions which had helped young patients to concentrate into a single action. Miloff et al. describes a methodology how VRET can reduce cost of traditional one-session exposure therapy (OST).[19] During OST the patient is gradually exposed to the stimuli for up to 3 hours and normally requires big effort to maintain them while VRET can help to automate this process. Several authors proposed methods how VRET can be enhanced with supplementary stress management tools. One study suggests diaphragmatic breathing as additional way to improve effectiveness of VRET sessions. This would result into even higher reduction of the phobia after the treatment. Other authors have used visual feedback to indicate user stress level in the 3D environment. Patients by seeing their heart beat visualized in the VR scene managed to reduce their stress levels easier. Seol et al. expanded their VRET 209 2018 6th International Conference on Future Internet of Things and Cloud Workshops solution with haptic feedback device which would imitate heart beat in order to calm down the patients and help them with panic disorder. In their pilot study authors concluded that this could even further improve multimodal approach in VRET.[28]

Paper 18: “A radicalized phenomenological transformation of Greek/Unani humoral theory into a virtual reality based game engine” by Muqeem Khan 2015 Digital Heritage

Description: The domain of this study is interdisciplinary. Through 'Design Thinking' it integrates ideas from DIH, emerging technologies and focuses on Unani physician's experiences when GreekiUnani humoral theory transform into a Phenomenological Diagnostic System (PDS). Based on the anticipated interactive content for the prototype, the study is also an attempt to bring theatricality and performativity inside the clinic. Consequently, user interaction and patient both turn into an agent, cultural carrier and transmitter of Intangible Cultural Heritage (lCH). Therefore, it is also another form of contextualized cultural performance as mentioned by Clavir and Simpson . It is also an attempt to heal the frustration that nations and communities are more focused on proclaiming their ICH rather than on focusing on the encountered challenges in order to sustain their ICH. The proposed interaction is intended to provide vitality to the indigenous methodology and it is another form of contextualized intangible heritage related representation inside the clinic. In different pockets all over the world, communities are also consciously aware of ICH and its digital documentation. For example, the website was launched by the Flemish government in 2012. This tool provides services to the Flanders community to collaboratively interact with ICH-related content on the Internet. The online tool exchanges cultural knowledge and expertise with identification and safeguarding ICH. The aim is to strengthen the community and provide an opportunity for members to learn from one another. A similar project, i-Treasures, was also launched in 2013 for 48 months. The aim of this online project is to capture rare ICH-related knowledge. ICT and similar technology are also deployed in the case of "Cantu a Tenore", a typical artistic expression from Sardinia, Italy. In order to reduce anxiety and promote the visibility of indigenous peoples, some web-based tools are also introduced so that the community shares their knowledge and wisdom. Similar to online systems on the Internet, researchers constantly investigate and experiment with information retrieval strategies for DIH. One example is a management information system developed by the researchers at the School of Xiamen University. The aim is to archive ICH-related information normatively to fulfill the desire of a specific heritage-related investigator. The system works as a buffer between users over the Internet but also creates links with the administrative staff of museums. The system is proposed to adopt three main modules; Retrieval and navigation; Registration and log; and Management and System settings. The idea is to use VR and mocap technologies embedded in archiving methodology. In order to represent intangible heritage, mocap technology and VR are also used. Relics and other media characters are embedded in the system for cross-referencing purposes. The idea is to provide a visually appealing environment in which users can retrieve and play with intangible content. Researchers acknowledge the fusion of intangible heritage and digital technology, its humanistic approach and visual pleasure by injecting knowledge from other sciences. The above practices are unique not in the way they are utilizing technologies, but in the way they create linkages and relevancies to the technologies.

This unique merging of technology and art creates particular content, form, ethics, aesthetic and phenomenology. Chatzichristodoulou & Zerihan talk about technology and performances and say that media arts are not just arts that incorporate media into their practice. A media art is a byproduct of ever-developing technology.[29]

Paper 19: "Computer-aided surgery planning and rehearsal at Mayo Clinic" by R.A. Robb; D.P. Hanson; J.J. Camp Computer

Description: Designing surgical procedures this way is invaluable in complex cases where, in the past, complications were not readily visible until after surgery had begun. And now, surgeons can combine 3D images of patients with virtual reality equipment to practice surgical procedures and effectively evaluate the results of their operations.[18] An important factor in the increased use of computers to improve the effectiveness of :surgical procedures has been advancements in hardware and software technology. The improving accuracy and resolution of medical imaging technology, such as the computerized tomography (CT) and magnetic resonance imaging (MRI) systems, have also been important. The combination of these factors has yielded powerful, practical systems for surgical and medical treatment, planning, and eva1uation.l Computerized 3D imaging has demonstrated significant promise in several clinical applications, such as surgery simulation, radiotherapy planning, and quantification of tissue path~logy.~ Techniques in minimally invasive surgery,4 surgery performed remotely using robotic c~ntrols,~ and computer-assisted planning and rehearsal6 are also proving to be effective. Using improved technology, computers have been able to generate accurate 3D images of entire body parts7 or just their surfaces* for surgery or treatment planning. The Biomedical Imaging Resource at Mayo Clinic has been involved in the design and implementation of computer-based techniques for comprehensive and fully interactive display and analysis of biomedical images since the 1970s. The algorithms and programs Mayo Clinic has developed have been integrated into a software system called Analy~e.~ This system has been used in the planning and rehearsal of numerous operations, including some special surgeries, such as the separation ofjoined twins. More than 10 years experience using computers to plan operations has led Mayo Clinic to design the Virtual Reality Assisted Surgery Program (VRASP) for eventual use during craniofacial, orthopedic, prostate, and neurologic VRASP will let surgeons view 3D renderings of CT and MRI data and permit interactive virtual display manipulation. In essence, the vir1 ual reality program will bring presurgery planning and rehearsal in line with what happens on the operating table to make the surgical procedure more effective, less risky, and less expensive.[30]

Paper 20: "Mixed Reality Therapy Clinic Design" by John Francis Leader 2018 IEEE Games, Entertainment, Media Conference (GEM)

Description: Psychological therapy is a facilitated experiential process designed to assist participants in making better subjective sense of themselves, the world and others. Throughout history similar processes, not always labelled therapy, have often been embedded in culture, community or spiritual practice offering the advantage of a highly integrative form of support. However, these same processes have often suffered from a lack of systematization and empirical backing. Through the work of early therapists such as Sigmund Freud (1856-1939) the classical notion of therapy – and specifically the therapy room – were crystalized in the public consciousness. Over the last century therapeutic methodology has developed substantially, but for the most part the design of the therapy room has remained unchanged. With an increasing emphasis on experiential learning and a more physiotherapylike, interactive approach to psychotherapy, as well as the advent of immersive technologies, the opportunity exists to update the norms of therapy room design. The fields of gaming, entertainment and multimedia are already well aware of the affective power of the right narrative-based content, and psychological therapy stands to gain from incorporating these existing insights. The average therapy room is an intentionally calm and private space, featuring a seat for the therapist and a couch for the client or patient. Seat positioning can vary depending on the modality: for example face-to-face, at a 90-degree angle, or the traditional, psychoanalytic layout of the therapist sitting behind the client as shown in. The room is typically decorated neutrally, with caution exercised in including art, objects or ambient conditions that may prove distracting or contraindicative to clients who attend with a variety of sensitivities. An exception to this; however, is in certain approaches – such as psychoanalytic therapy – that utilize various stimuli as a part of the process to illicit responses from the client, akin to the use of a Rorschach ink blot While some modifications have been made over the last century – for example with modern couches often replacing the fully reclined therapist's couch – the classic layout persists, along with its inherent affordances. Though this simple design has worked well;

that very simplicity can act as something of a repellant towards the introduction of technology. With the use of technology can come a concern about workflow, and therefore a need that such systems are either well-integrated or not present at all. This is true of many experiential technologies; for example, a trip to the cinema is not all about the projector even though it is of central importance. Consequently, the task of introducing mixed reality technology into the therapy room becomes more of an ergonomics question than just a technical one. After all, even much older technologies like projection are not typically used as part of the therapeutic process, suggesting that something other than availability is obstructing their uptake. These concerns become even more pronounced in the case of more obvious technical interventions such as room-scale virtual reality (VR).[17] A bridge is therefore needed: retaining a sensitivity to traditional approaches, while not allowing them to limit therapeutic potential or impede an embracing of the enabling possibilities of multimedia technology. The emphasis is on deep integration even if that means favoring slightly less cutting-edge iterations of a given technology. In practice the suitability of going high tech or low tech will vary; for example, a lower fidelity of graphics may be preferable to prevent the GPU from being overworked, delivering a more seamless experience. However, newer wireless head-mounted displays (HMDs) for VR may be of great benefit. The common theme here is putting the client's experience first. In considering these factors, drawn from qualitative feedback on prototypes built within the Cognitive Science Program at University College Dublin and the author's own psychology practice, three templates have been designed. All templates incorporate a modern equivalent to the therapist's couch but discretely add other facilities, such as screens, tablets, VR and augmented reality (AR) systems. As each installation will vary depending on the characteristics of a given site, the templates have been designed around the smallest floorspace considered practical to still remain effective, and can be scaled up as a location allows.[31]

Paper 21: "Surface generation for virtual reality displays with a limited polygonal budget" by B.M. Cameron; A. Manduca; R.A. Robb Proceedings., International Conference on Image Processing

Description: The term virtual reality (VR) refers to a human-computer interface that facilitates highly interactive control over a three dimensional scene of sufficient detail so as to evoke a response similar to that of the real scene. To sustain the illusion of reality, a VR system needs to be able to generate smoothly animated images. To do this, the system must be able to sustain a display update rate of at least 30 frames per second, and must respond to the user's commands in near real time; that is, the delay between user input and system response must be less then 100 milliseconds, and would, ideally approach 10 milliseconds. Due to the limitations of currently available computer hardware, these requirements limit the possible complexity of the displayed images. they are interested in virtual reality for surgery planning, and therefore wish to generate realistic displays of objects representing a patient's internal organs. The use of biomedical data as the basis for patient-specific models within a virtual environment poses some unique problems. While currently available rendering algorithms can generate photorealistic images from the rather dense volumetric data generated by medical imaging systems, ray tracing algorithms cannot sustain the visual update rate required for real time display, and most surface display algorithms generate polygonal surface representations with extremely high numbers of polygons. To be successful, a medical VR system needs to accurately segment a desired object from volumetric data, detect its surface and generate a good polygonal representation of this surface from a fixed polygonal "budget" (defined as the constraint on the number of polygons for effective real time display rates). Currently available hardware is able to render and manipulate approximately 20,000 complex polygons (a complex polygon includes shading, texture mapping and anti-aliasing) per frame at real time display rates. Polygonization algorithms such as marching cubes, spiderweb, and the wrapper produce high resolution surfaces using typically 40,000 to several million polygons. Current techniques for pruning these polygons down to a more manageable number are cumbersome and do not always yield satisfactory results. In this paper, they present a method for the production of a polygonal surface containing a selected number of polygons from volumetric data, based on extracting a set of curvature weights from the volumetric data and using these weights as the input vectors to a 2-D Kohonen network. The adaptation of the network to the input vectors results in a polygonal surface of 1000 to 20,000 polygons that preserves useful detail and produces realistic geometric models from patient-specific volumetric data. The generation of polygonal surfaces occurs in 4 phases: segmentation, surface detection, curvature calculation, and polygonization. In our current processing, segmentation consists of a series of three dimensional mathematical morphological operations that extract an object from a data set with little user interaction. Surface detection is presently based on simple thresholding. The object is considered to be the collection of voxels whose value is greater than or equal to some value, and the object's surface is the set of voxels where the change between background and object occurs. Prior to curvature calculation, the data is thresholded so that object voxels have a value of 1 and background voxels have a value of 0. Curvature calculation transforms the binary object into a set of surface curvature weights which represent how much the local surface curvature at each point deviates from being flat. By eliminating those voxels where the surface is locally flat, the number of voxels that have to be tiled can be reduced without eliminating the structural detail (points of high curvature) of the surface. The calculation is done. Patients by seeing their heart beat visualized in the VR scene managed to reduce their stress levels easier.[18] Seol et al. expanded their VRET 209 2018 6th International Conference on Future Internet of Things and Cloud Workshops solution with haptic feedback device which would imitate heart beat in order to calm down the patients and help them with panic disorder. In their pilot study authors concluded that this could even further improve multimodal approach in VRET.[32]

3. ANALYSIS

3.1 Detailed Statement of the problem

Access to healthcare services is a challenge for many individuals worldwide, and it becomes even more difficult in situations where patients need medical attention urgently. Patients residing in remote areas, elderly individuals, and people with disabilities are among those who face significant challenges in accessing medical care. Additionally, the traditional healthcare model that requires patients to visit a doctor physically is time-consuming and may cause inconvenience, especially to those with busy schedules. This project aims to address these challenges by providing a virtual clinic that offers medical consultations online.

3.2 Requirement Specification

The Virtual Clinic project has the following requirements specifications:

Platform: The virtual clinic should have a platform that patients can use to access medical consultations online.

Medical professionals: The virtual clinic should have qualified medical professionals who will provide medical advice and consultations to patients.

Medical records: The virtual clinic should keep patients' medical records and history for easy reference during subsequent consultations.

Payment systems: The virtual clinic should have payment systems that allow patients to pay for consultations and other medical services online.

3.2.1 Software Requirement

- PHP
- MySQL
- HTML
- CSS
- Java Script
- Laravel
- JQuery
- Ajax

3.2.2 Hardware Requirement

The hardware platform used for the virtual clinic project plays a crucial role in ensuring its successful development and deployment. In this section, they will discuss in detail the various components that make up the hardware platform used for the project and how they contribute to its functionality.

Processor: 1 GHz or higher
RAM: 4 GB or higher
Hard Disk Space: 10 GB or higher
Operating System: Windows, Linux or macOS
Cameras and Microphones

3.3 Functional Requirement

The Virtual Clinic project's functional requirements include the following:

- Registration: Patients should register on the virtual clinic platform by providing their personal information such as name, address, phone number, and email address.
- Consultation: Patients should be able to access medical consultations online by selecting a qualified medical professional from the list of available doctors.
- Medical records: The virtual clinic should store patients' medical records and history for easy reference during subsequent consultations.
- Payment systems: Patients should be able to pay for consultations and other medical services online through the virtual clinic platform.
- Prescription: The virtual clinic should be able to generate prescriptions online that patients can use to purchase medication from their preferred pharmacy.
- Referral: The virtual clinic should refer patients to a physical medical facility if the doctor determines that a physical examination is necessary.

3.3.1 Data Flow Diagram

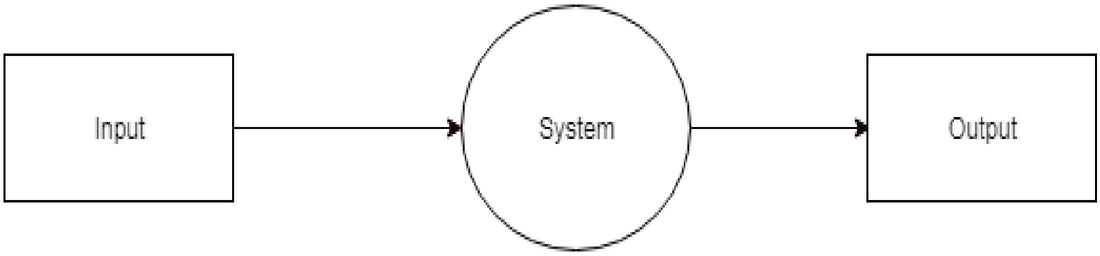


Fig 3.1 : Level 1

DFD level – 1

Here. Figure 3.1 shows DFD level – 1 indicates the basic flow of data in the system. In

this System Input is given equal importance as that for Output.

- Input: Here input to the system is giving values sensor data.
- System: In system it shows all the details are processed.
- Output: Output of this system is it shows the result.

DFD level- 2

DFD Level – 2 gives more in and out information of the system. Where system gives detailed information of the procedure taking place. It will get to know what kind of information as shown in Figure 3.2.

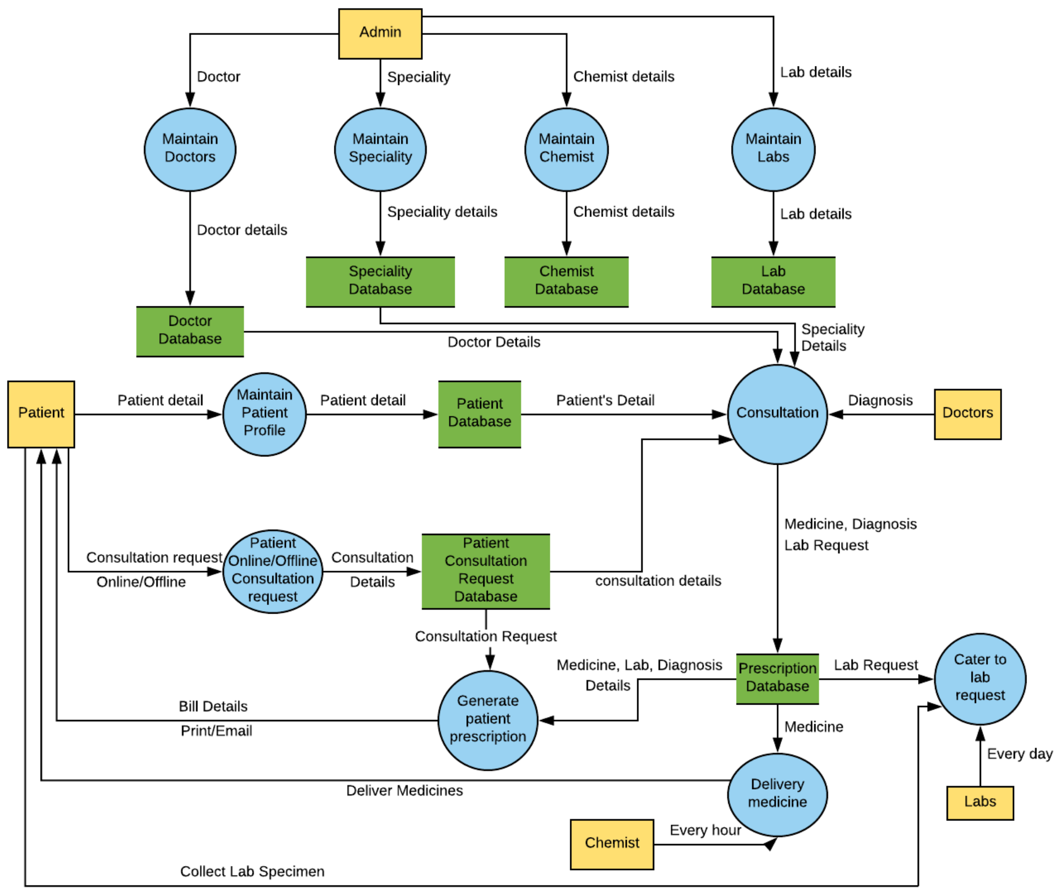


Fig 3.2 : DFD Level 2

3.4 Non-Functional Requirements

The Virtual Clinic project's non-functional requirements include the following:

- Security: The virtual clinic should ensure that patients' medical records and personal information are secure and not accessible to unauthorized persons.
- Availability: The virtual clinic should be available 24/7 to allow patients to access medical consultations at any time.
- User-friendly: The virtual clinic platform should be easy to use for patients of all ages and technical backgrounds.
- Reliability: The virtual clinic platform should be reliable and not prone to downtime that may inconvenience patients.

- Speed: The virtual clinic platform should be fast to allow patients to access medical consultations promptly.
- Bandwidth: Sufficient bandwidth is essential for a high-quality virtual clinic experience. This includes both upload and download speeds to support video conferencing, file sharing, and other data-intensive activities. A reliable internet connection with at least 10 Mbps download and 5 Mbps upload speeds is recommended.
- Latency: Latency, or the delay in data transmission, can cause issues such as frozen screens, dropped calls, and delayed response times. A latency of less than 100ms is recommended for real-time communication.
- Hardware and software requirements: The virtual clinic platform should be compatible with a range of devices, including laptops, tablets, and smartphones. The platform should also support various operating systems and browsers. Adequate RAM, processing power, and graphics capabilities are necessary for smooth video conferencing.
- Security: Virtual clinics handle sensitive patient data, and therefore, must ensure the highest level of security. Encryption, firewalls, and other security protocols should be in place to prevent data breaches.
- Scalability: The virtual clinic should be designed to accommodate a growing number of patients and healthcare professionals. The platform should be able to handle an increased volume of data and users without compromising performance.

Overall, the performance requirements for a virtual clinic are critical to ensure a seamless and effective patient experience. Healthcare providers should carefully evaluate their needs and select a platform that meets their specific requirements.

3.5 Feasibility Study

The Virtual Clinic project's feasibility study assesses the project's viability by considering the project's technical, economic, and operational feasibility .A feasibility studies is carried out from following different aspects:

3.5.1 Technical Feasibility

The technical feasibility of a virtual clinic depends on the availability of appropriate technology, infrastructure, and resources. In general, a virtual clinic requires the following technical components:

Video conferencing technology: The virtual clinic platform should support high-quality video conferencing with features such as screen sharing, file transfer, and chat capabilities.

Electronic health records (EHRs) and patient portals: EHRs allow healthcare providers to store and access patient medical records electronically. Patient portals enable patients to securely access their medical records and communicate with healthcare providers.

Secure network and data storage: The virtual clinic platform should have robust security measures to protect patient data from unauthorized access, data breaches, and cyber attacks.

Reliable internet connectivity: A virtual clinic requires reliable and high-speed internet connectivity to support video conferencing and other data-intensive activities.

Support staff and technical resources: A virtual clinic requires trained support staff and technical resources to ensure that the platform is functioning correctly and to address any technical issues that arise

3.5.2 Economic Feasibility

The economic feasibility of a virtual clinic depends on several factors, including the cost of implementing and maintaining the virtual clinic platform, the potential revenue generated by virtual visits, and the impact of virtual care on operational cost.

Overall, the economic feasibility of a virtual clinic depends on several factors, including the costs of implementation and maintenance, the potential revenue generated by virtual visits, and the impact of virtual care on operational costs. Healthcare providers must carefully evaluate these factors to determine the economic feasibility of implementing a virtual clinic.

3.5.3 Operational Feasibility

The operational feasibility considers the project's ability to operate efficiently. The project requires qualified medical professionals who will provide medical consultations and advice.

3.5.4 Scheduling Feasibility

the operational feasibility of a virtual clinic depends on its ability to integrate with existing workflows, staffing and training requirements, patient access, technical support, and quality assurance standards. Providers should evaluate these factors carefully to ensure that the virtual clinic can operate effectively while meeting the needs of patients and providers.

3.6 Use Case Diagram

The purpose of a use case diagram is to capture the dynamic aspect of a system. Use case diagrams are used to gather the requirements of a system including internal and external influences. These requirements are mostly design requirements. Hence, when a system is analyzed to gather its functionalities, use cases are prepared and actors are identified as shown in fig 3.3.

In the Unified Modelling Language (UML), a use case diagram can summarize the details of system's users (also known as actors) and their interactions with the system. To build one, you'll use a set of specialized symbols and connectors. An effective use case diagram can help team discuss and represent:

- Scenarios in which system or application interacts with people, organizations, or external systems.
- Goals that system or application helps those entities (known as actors) achieve.

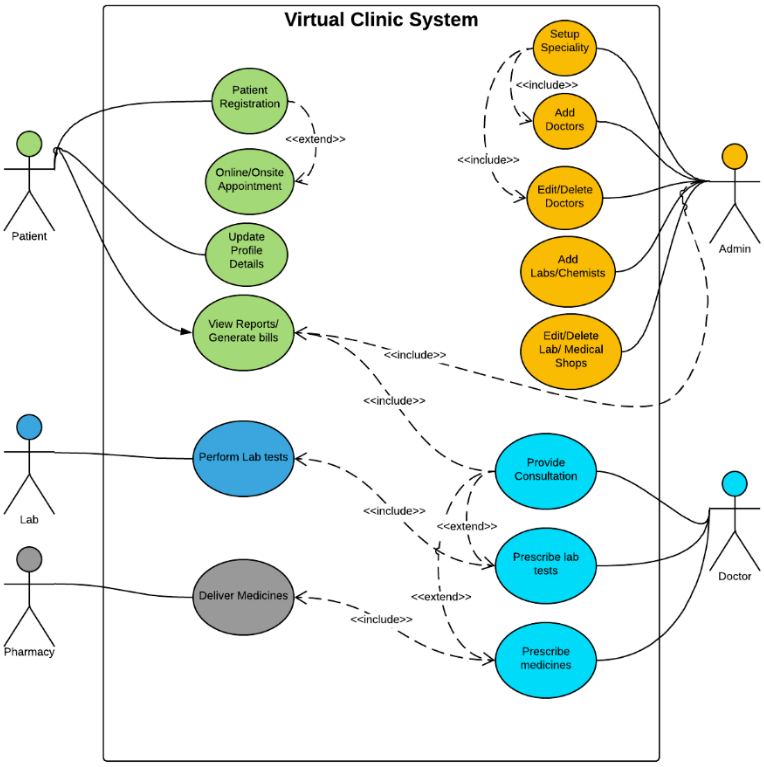


Fig 3.3 Use case View

3.7 Use Case Specification

To provide a comprehensive platform for patients to register, schedule appointments, update their profiles, view medical reports, perform lab tests, receive medicines, and consult with doctors and chemists online.

Users:

- Patients
- Doctors
- Chemists

Features:

- Patient Registration: A patient can register on the platform by providing their basic details like name, age, gender, email, phone number, and medical history.
- Appointment Scheduling: Patients can schedule appointments with doctors for consultation and lab tests. They can choose the date and time of the appointment as per their convenience.
- Profile Management: Patients can update their personal information, medical history, and insurance details. They can also view their appointment history, medical reports, and prescription history.
- Lab Tests: Patients can perform lab tests from the comfort of their homes. They will receive a kit containing the necessary materials and instructions for performing the test. Once the test is done, they can send the sample to the lab for analysis.
- Medicine Delivery: Patients can order medicines prescribed by doctors from the platform. The medicines will be delivered to their doorstep.
- Doctor Consultation: Patients can consult with doctors online. They can share their medical history, symptoms, and reports with the doctor. The doctor can diagnose the condition and prescribe medicines or lab tests if required.
- Prescription Management: Doctors can prescribe medicines and lab tests for patients. The prescriptions will be stored on the platform, and patients can view them anytime.
- Chemist Management: Patients can add chemists to their network. They can order medicines from their preferred chemist, and the chemist will deliver the medicines to their doorstep.

- Doctor Management: Doctors can register on the platform and provide consultation services to patients. They can view patient information, medical history, and reports. They can also prescribe medicines and lab tests.

- Chemist Management: Chemists can register on the platform and provide medicine delivery services to patients. They can view patient prescription history and deliver medicines as per the doctor's instructions.

- Consultation Management: The platform will manage doctor-patient consultations. Patients can view their appointment history, and doctors can manage their appointment schedules.

Assumptions:

- Patients have access to a stable internet connection.
- Patients have the necessary hardware to perform lab tests.
- Doctors and chemists have the necessary licenses and certifications to practice in their respective fields.
- Patients can pay for consultation and medicines online.

Constraints:

- The platform will be available only in select countries where online medical consultations are legal and regulated.
- The platform will follow all necessary data privacy and security laws and regulations.

Future enhancements:

- Integration with wearable devices for remote patient monitoring.
- Expansion to more countries.
- Integration with electronic health records (EHR) systems.

4. DESIGN

4.1 Design Goal

The design goal of the Virtual Clinic platform is to provide patients with a seamless and convenient healthcare experience. The platform should be designed to enable patients to access remote healthcare services with ease and flexibility. It should also be user-friendly, so patients can navigate the platform quickly and efficiently.

In addition, the design goal of the platform is to ensure the security and privacy of patient information. The platform should have robust data protection measures in place to safeguard patient data and prevent unauthorized access. The design should also comply with relevant healthcare regulations and standards, such as HIPAA (Health Insurance Portability and Accountability Act).

Moreover, the design goal of the Virtual Clinic platform is to provide a cost-effective and accessible healthcare solution to patients. The platform should enable patients to access healthcare services without incurring significant costs associated with traditional healthcare delivery models. By eliminating the need for physical appointments and visits, the Virtual Clinic platform can reduce the time and cost associated with accessing healthcare services.

Overall, the design goal of the Virtual Clinic platform is to improve the quality of healthcare

4.2 Design Strategy

The design strategy for the Virtual Clinic platform is crucial to ensure the success and effectiveness of the platform. The platform's design strategy should enable the platform to achieve its design goals while also addressing potential design challenges and limitations.

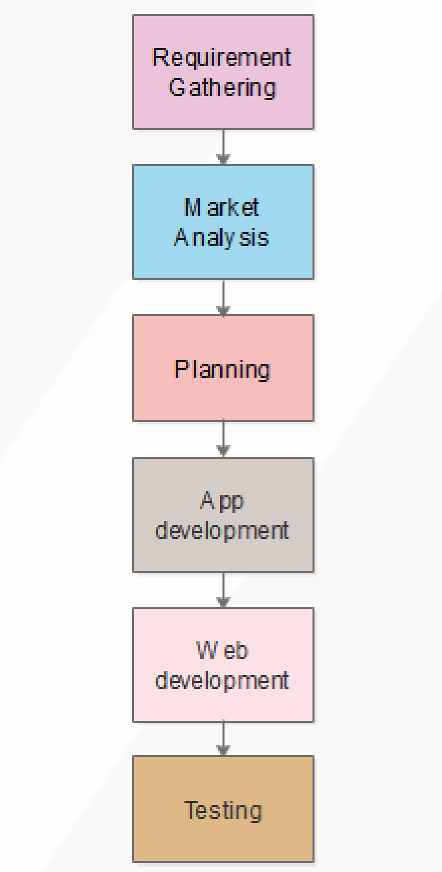


Fig 4.1: Strategy Diagram

To achieve the design goal of a user-friendly platform, the design strategy should prioritize user experience and user-centered design. This involves conducting user research to understand patient needs and preferences, designing intuitive interfaces that enable easy navigation, and incorporating user feedback into the design process.

In addition, the design strategy should incorporate emerging technologies such as artificial intelligence, machine learning, and natural language processing. These technologies can improve the platform's functionality, enable personalized healthcare delivery, and enhance the patient experience.

To ensure the security and privacy of patient information, the design strategy should prioritize data protection measures such as encryption, multi-factor authentication, and secure data storage. The design should also comply with relevant healthcare regulations and standards, such as HIPAA, to mitigate potential legal and financial risks.

Moreover, the design strategy should prioritize scalability and flexibility to enable the platform to adapt to changing patient needs and technological advancements. This involves designing a modular architecture that can accommodate future updates and expansions, leveraging cloud-based infrastructure to enable easy scalability, and incorporating feedback loops to enable continuous improvement.

Overall, the design strategy for the Virtual Clinic platform should prioritize user experience, emerging technologies, data protection, scalability, and flexibility to enable the platform to achieve its design goals effectively and efficiently.

4.3 Architecture Diagram

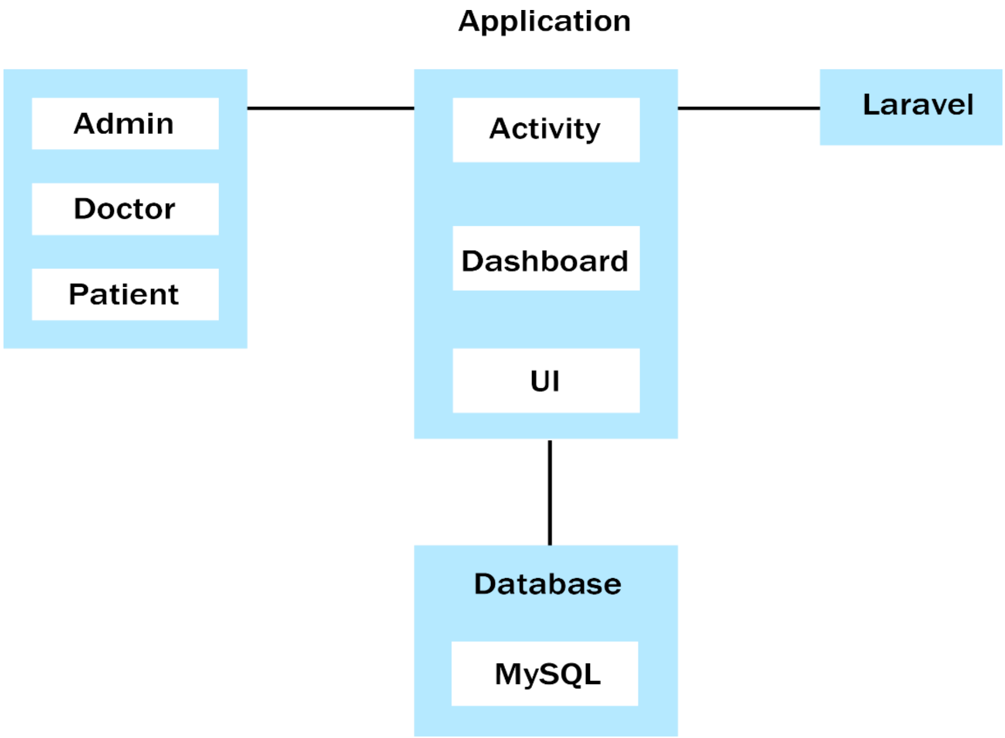


Fig 4.2 Architecture Diagram

The virtual clinic platform has several layers, each responsible for a specific set of tasks. At the topmost layer is the presentation layer, which provides the user interface that patients, doctors, and chemists can use to access the platform's services. This layer communicates with the application layer, which is responsible for handling user requests, processing data, and managing business logic.

The data layer stores and manages all the data required by the platform, including patient information, appointment details, medical reports, prescriptions, and other relevant data. The security layer ensures that the platform is secure and compliant with data privacy regulations, protecting it from cyber threats.

The integration layer allows the platform to communicate with external systems and services, such as payment gateways, electronic health record systems, and laboratory information systems. Finally, the infrastructure layer provides the necessary hardware and software to support the platform's operations.

Overall, the architecture diagram for a virtual clinic platform is designed to be scalable, secure, and flexible, allowing developers to add new features and functionalities without affecting the entire platform. By using a layered architecture approach, the platform can handle a large volume of requests, process data efficiently, and ensure the security and privacy of patient information.

4.4 Class Diagram

Class diagram is a static diagram. It represents the static view of an application. Class diagram is not only used for visualizing, describing, and documenting different aspects of a system but also for constructing executable code of the software application.

Class diagram describes the attributes and operations of a class and also the constraints imposed on the system. The class diagrams are widely used in the modeling of objectoriented systems because they are the only UML diagrams, which can be mapped directly with object-oriented languages.

Class diagram shows a collection of classes, interfaces, associations, collaborations, and constraints. It is also known as a structural diagram.

Purpose of Class Diagrams

The purpose of class diagram is to model the static view of an application. Class diagrams are the only diagrams which can be directly mapped with object-oriented languages and thus widely used at the time of construction.

UML diagrams like activity diagram, sequence diagram can only give the sequence flow of the application, however class diagram is a bit different. It is the most popular UML diagram in the coder community.

The purpose of the class diagram can be summarized as −

- Analysis and design of the static view of an application.
- Describe responsibilities of a system.
- Base for component and deployment diagrams.
- Forward and reverse engineering.

Figure 4.3 shows class diagram for virtual clinic

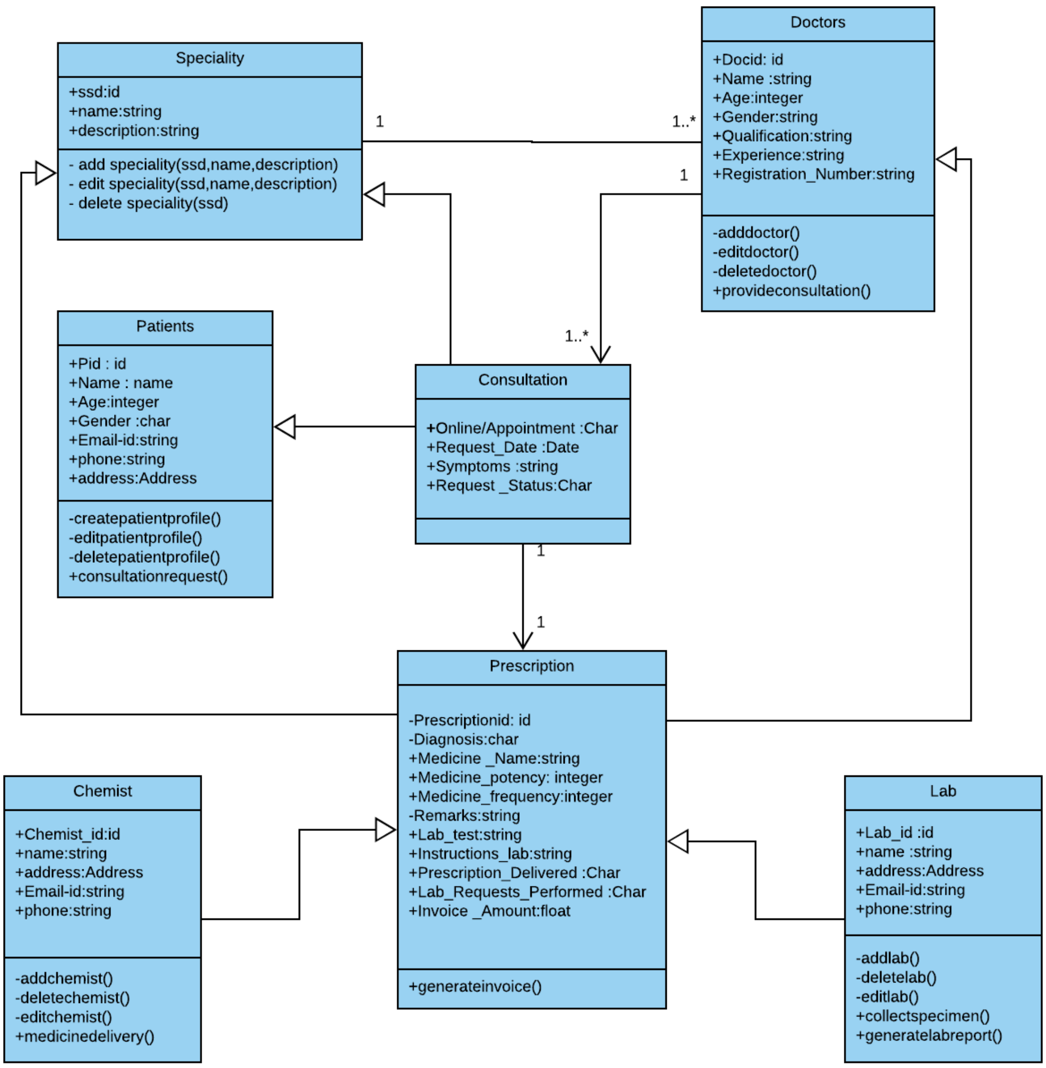


Fig 4.3 Class Diagram

4.5 Sequence Diagram

Sequence diagrams are a popular dynamic modeling solution in UML because the specifically focus on lifelines, or the processes and objects that live simultaneously, and the messages exchanged between them to perform a function before the lifeline ends.

They are the most commonly used Interaction diagrams. The sequence diagram represents the flow of messages in the system and is also termed as an event diagram. It helps in envisioning several dynamic scenarios. It portrays the communication between any two lifelines as a time-ordered sequence of events, such that these lifelines took part at the run time. In UML, the lifeline is represented by a vertical bar, whereas the message flow is represented by a vertical dotted line that extends across the bottom of the page. It incorporates the iterations as well as branching.

Purpose of State Chart Diagrams:

- To model high-level interaction among active objects within a system.
- To model interaction among objects inside a collaboration realizing a use case.
- It either models generic interactions or some certain instances of interaction.

As shown in fig 4.4 it shows the sequence diagram for Virtual clinic
It shows how it works.

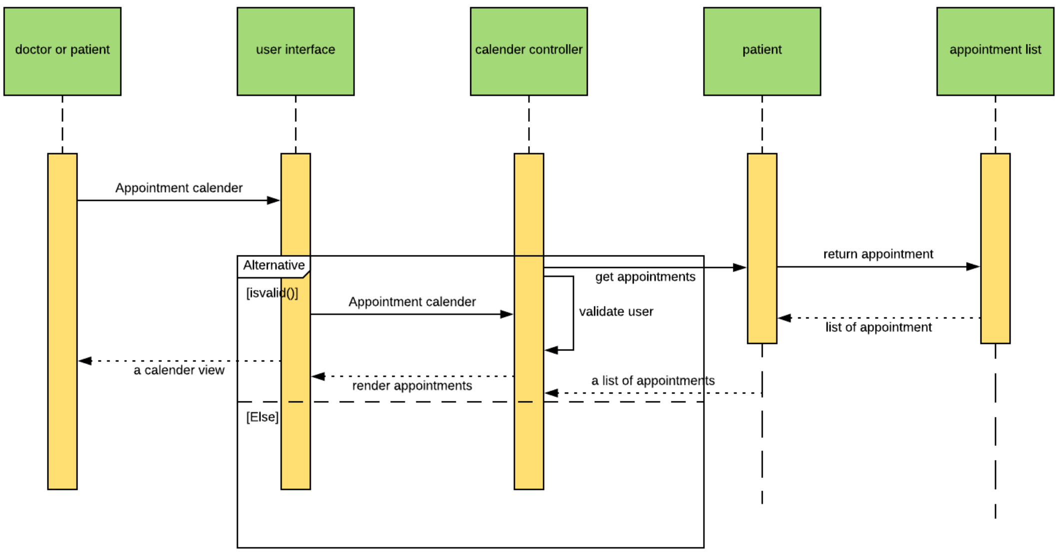


Fig 4.4 Sequence Diagram for appoitment

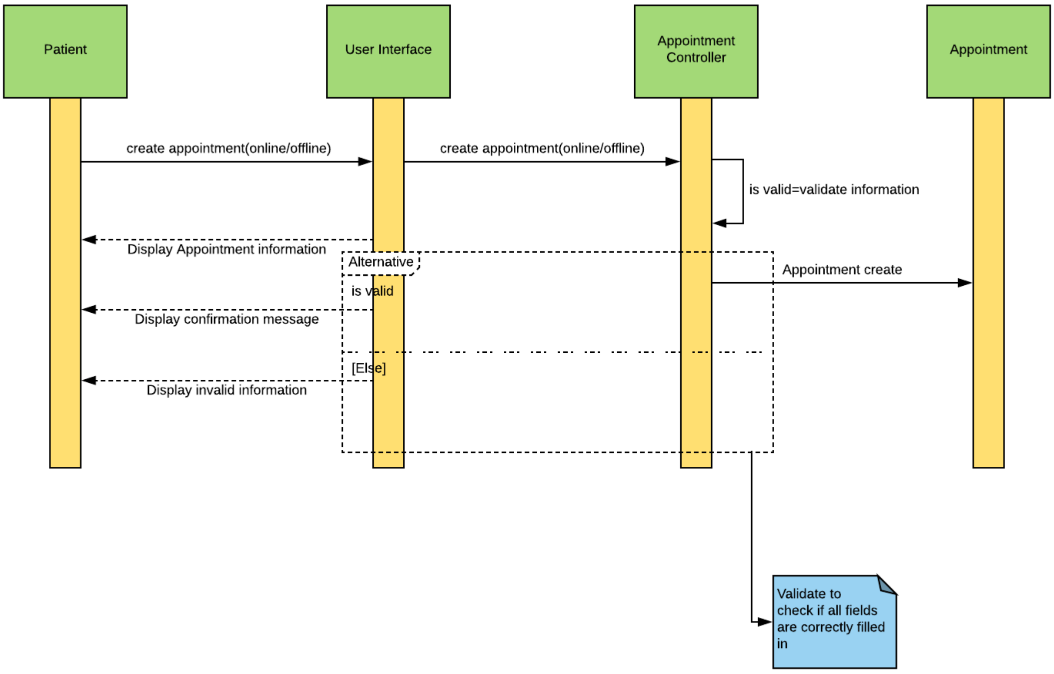


Fig 4.5 Sequence Diagram for create appoitment

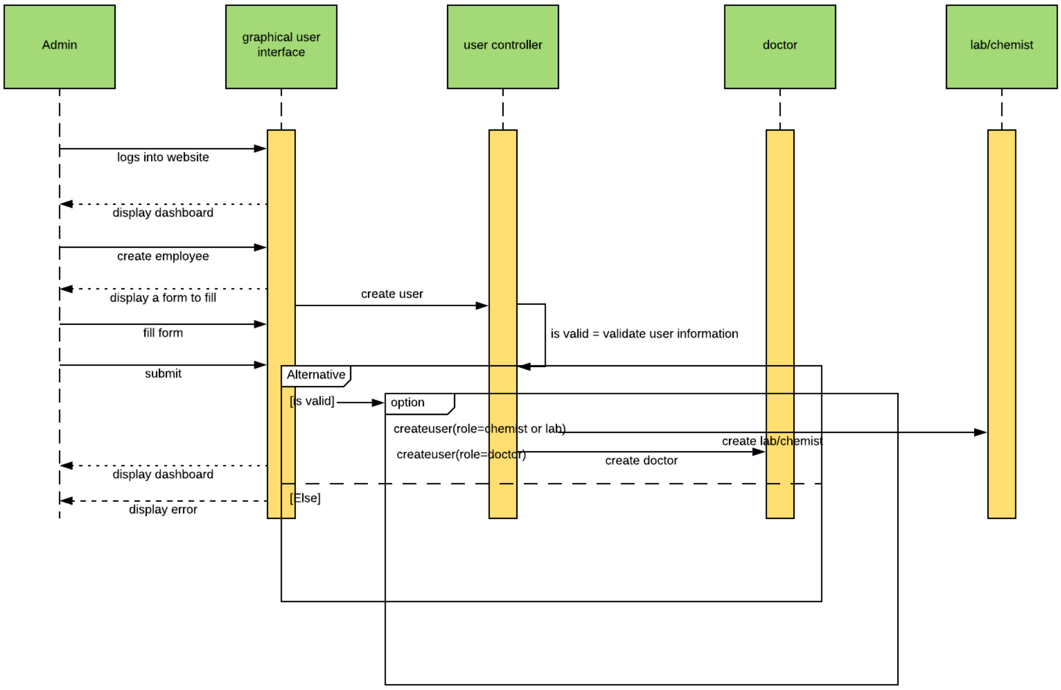


Fig 4.6 Sequence Diagram for create employee

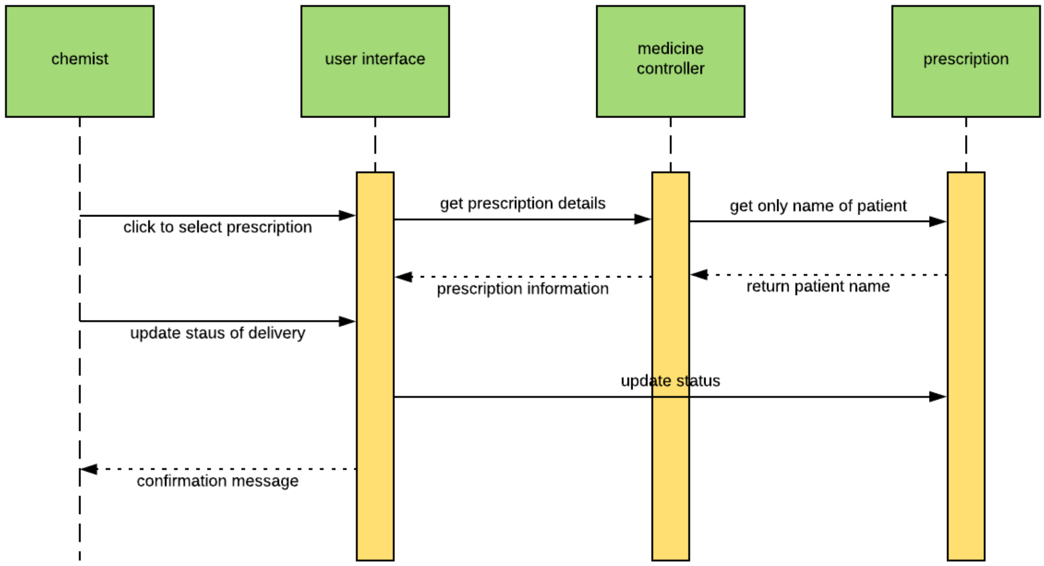


Fig 4.7 Sequence Diagram for medicine delivery

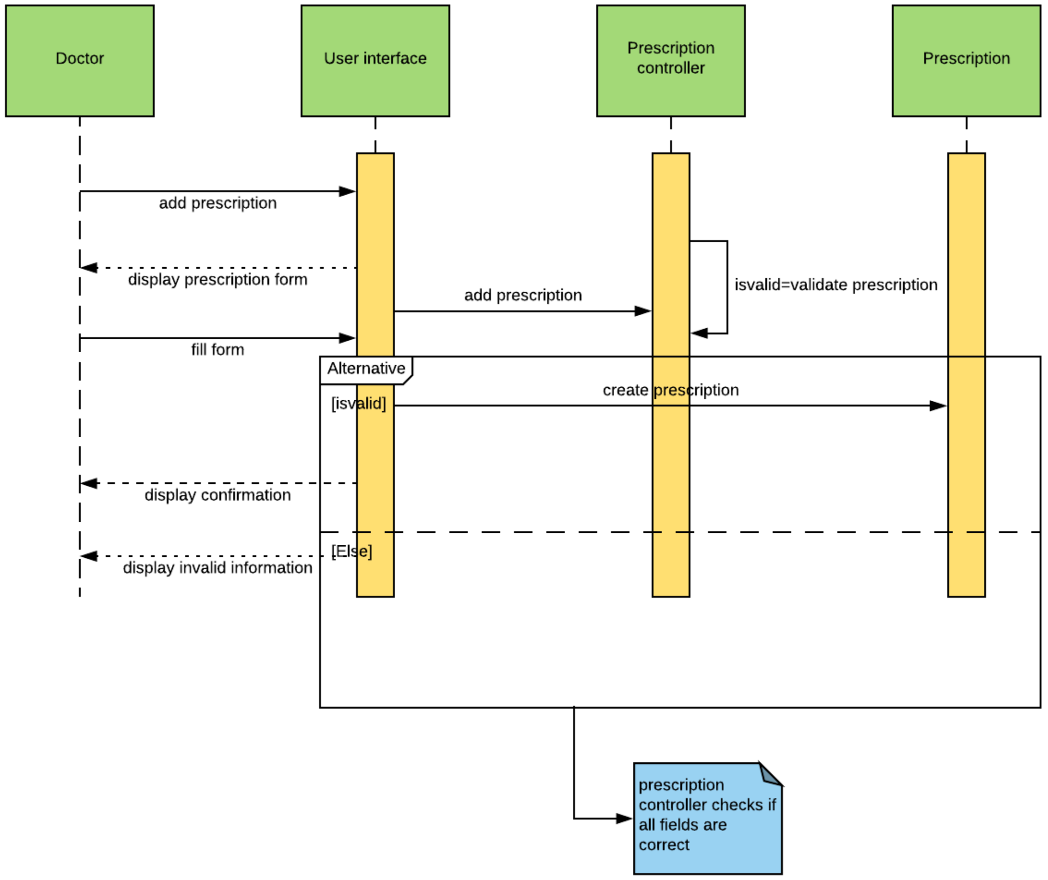


Fig 4.8 Sequence Diagram for prescription

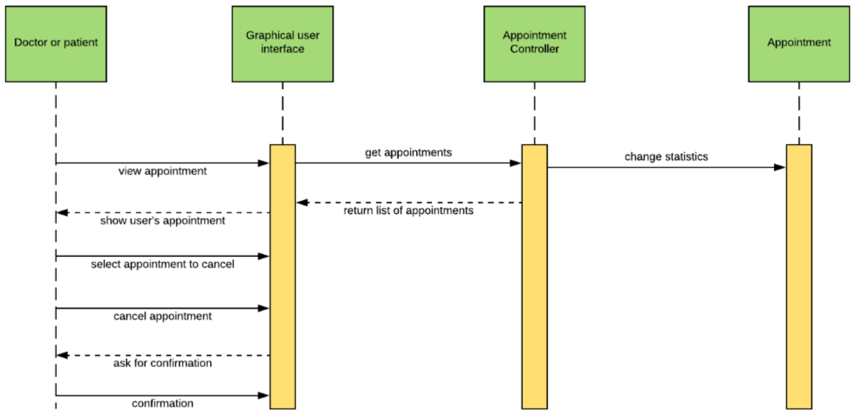


Fig 4.9 Sequence Diagram for virtual clinic

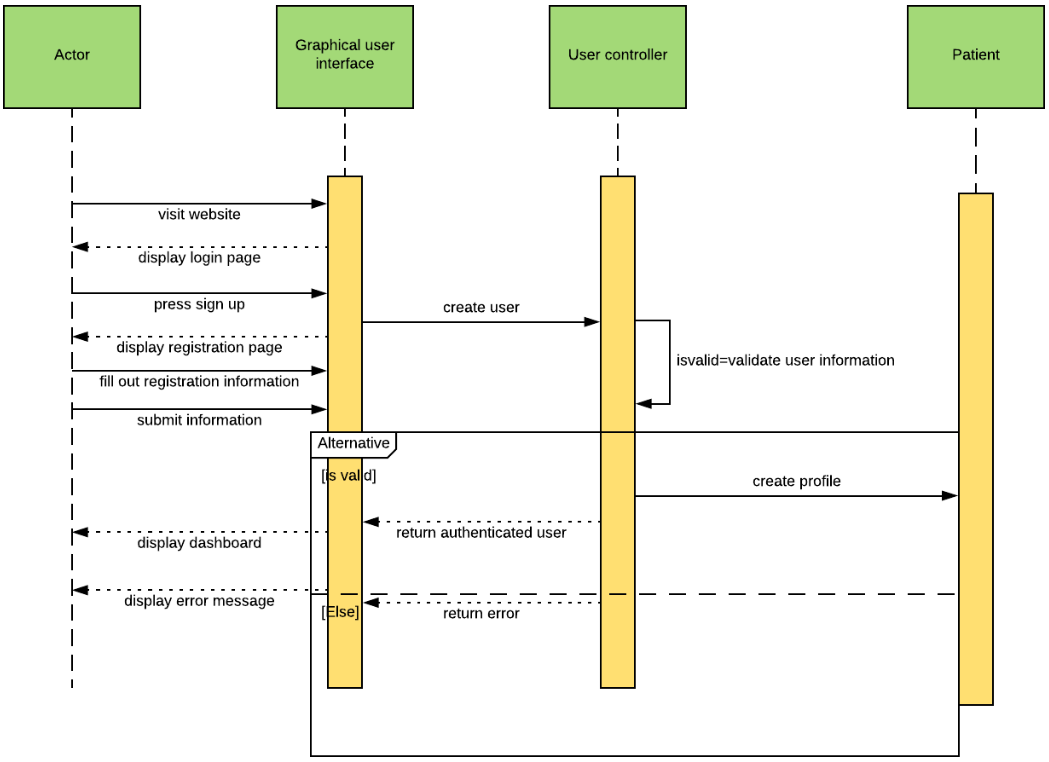


Fig 4.10 Sequence Diagram for user registration

4.6 Collaboration Diagram

A collaboration diagram is a visual representation of how different components of a system interact with each other to accomplish a specific task. In the context of a virtual clinic platform, a collaboration diagram can be used to illustrate how patients, doctors, and chemists collaborate to perform various tasks on the platform.

Let's take the example of a patient booking an appointment with a doctor on the virtual clinic platform. The following steps would be involved in the process:

- The patient logs into the platform using their username and password.
- The platform displays the patient's profile, which contains their personal and medical information.
- The patient selects the option to book an appointment and provides the required information, including the preferred date and time.
- The platform validates the information provided by the patient and checks the availability of the doctor.
- If the doctor is available, the platform confirms the appointment and sends a notification to the doctor.
- The doctor reviews the appointment details and accepts the appointment.
- The platform sends a confirmation notification to the patient, along with the appointment details.
- On the day of the appointment, the patient logs into the platform and joins the virtual consultation with the doctor.
- During the consultation, the doctor reviews the patient's medical history and symptoms, performs a diagnosis, and prescribes medication or lab tests if required.
- The platform sends a notification to the chemist with the prescription details.
- The chemist reviews the prescription and delivers the medication to the patient.

This is a simplified example, but it illustrates how different components of the virtual clinic platform interact with each other to provide a seamless experience for patients, doctors, and chemists.

The collaboration diagram would include each component involved in the process, such as the patient interface, doctor interface, appointment scheduling service, prescription management service, and notification service. The diagram would also show the flow of data between these components, indicating which components are responsible for processing the data and what actions they perform on the data.

Purpose of collaboration diagram

- The collaboration diagram is also known as Communication Diagram.
- It mainly puts emphasis on the structural aspect of an interaction diagram, i.e., how lifelines are connected.
- The syntax of a collaboration diagram is similar to the sequence diagram; just the difference is that the lifeline does not consist of tails.
- The messages transmitted over sequencing is represented by numbering each individual message.
- The collaboration diagram is semantically weak in comparison to the sequence diagram.
- The special case of a collaboration diagram is the object diagram.
- It focuses on the elements and not the message flow, like sequence diagrams.
- Following figure 4.11 shown as Collaboration diagram for Virtual Clinic

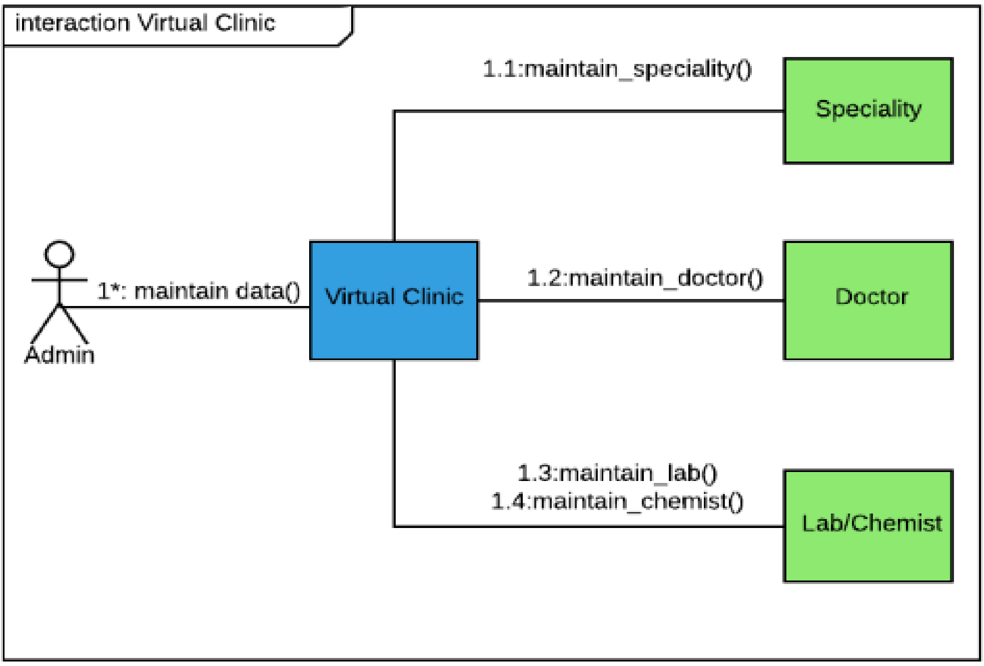


Fig 4.11 Collaboration Diagram for admin

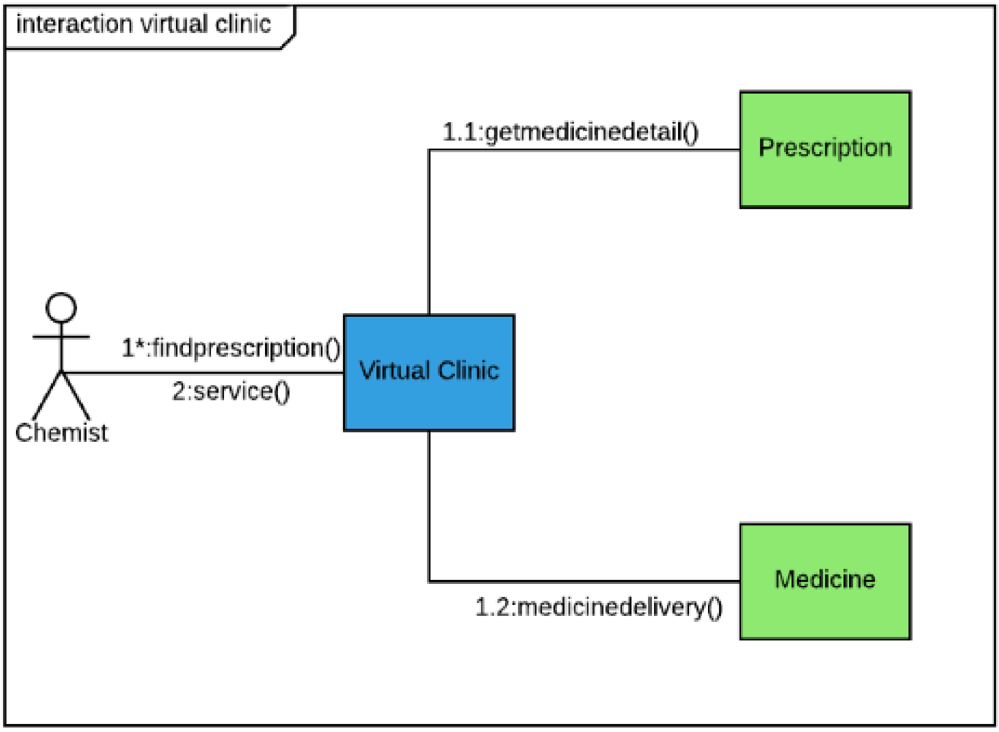


Fig 4.12 Collaboration Diagram for chemist

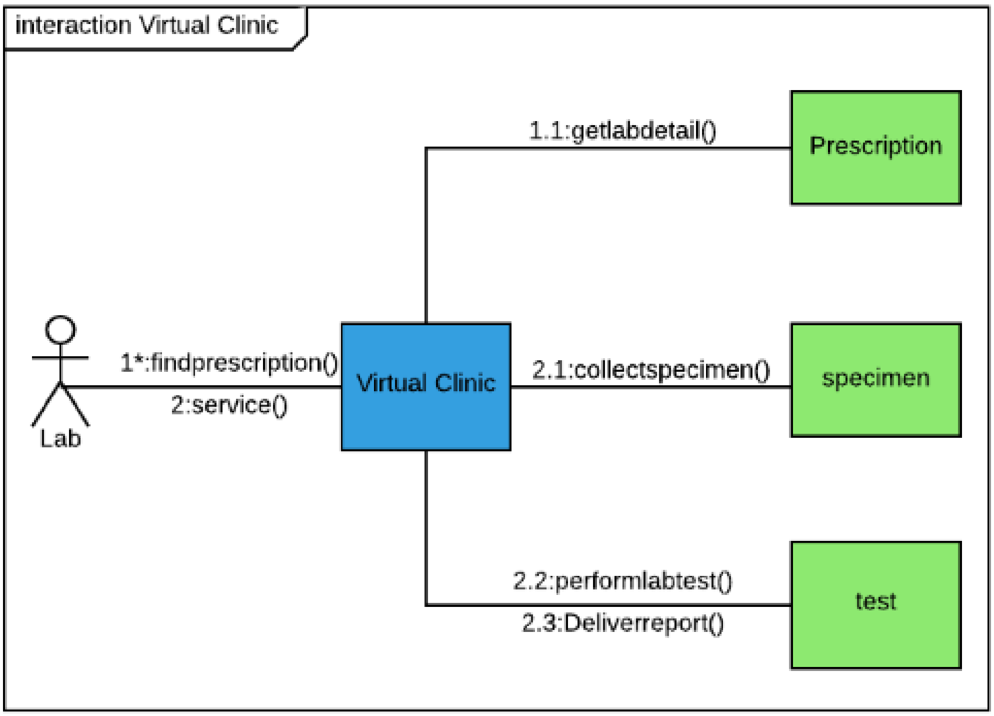


Fig 4.13 Collaboration Diagram for lab

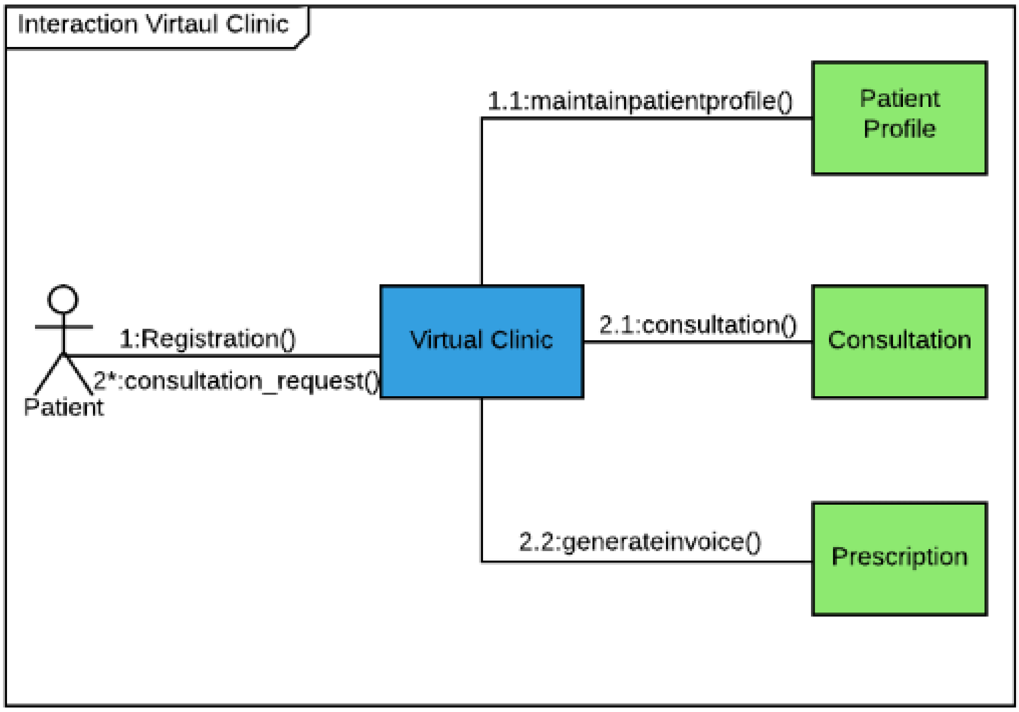


Fig 4.14 Collaboration Diagram for Patient

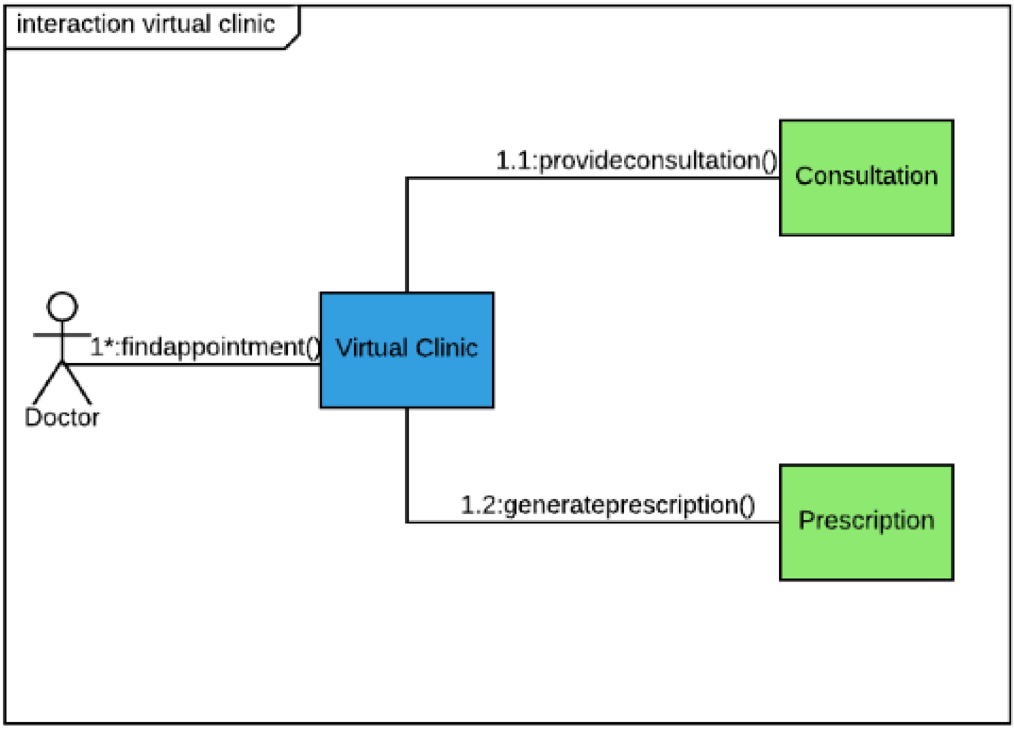


Fig 4.15 Collaboration Diagram for Doctor

4.7 State Chart Diagram

State chart diagrams provide us an efficient way to model the interactions or communication that occurs within the external entities and a system. These diagrams are used to model the event-based system. A state of an object is controlled with the help of an event. State chart diagrams are used to describe various states of an entity within the application system. A state diagram, also known as a state machine or state chart, is a graphical representation of a system or process that describes its behavior through a set of states and transitions. It is commonly used in computer science, engineering, and other fields to model the behavior of complex systems, such as software applications, control systems, and communication protocols. In a state diagram, each state represents a condition or mode of the system, while transitions describe the events or actions that cause the system to move from one state to another. State diagrams can be used to analyze and optimize system performance, detect errors and inconsistencies, and design efficient control algorithms. They are also useful for communicating system behavior to stakeholders and end-users. State diagrams can be created using various tools and notations, such as UML (Unified Modeling Language), Petri nets, and finite state machines. UML state diagrams are widely used in software engineering to model the behavior of object-oriented systems, where each state corresponds to a class or object and transitions represent method calls or events. Petri nets are a more general-purpose formalism that can be used to model a wide range of systems, including manufacturing processes, communication protocols, and biological systems. Finite state machines are a simplified version of state diagrams that are used for modeling simple systems with a limited number of states and transitions. Overall, state diagrams are a powerful tool for modeling and understanding complex systems, and are an essential part of modern systems engineering and design.

Purpose of State Chart Diagrams

State chart diagram is one of the five UML diagrams used to model the dynamic nature of a system. They define different states of an object during its lifetime and these states are changed by events. State chart diagrams are useful to model the reactive systems. Reactive systems can be defined as a system that responds to external or internal events. State chart diagram describes the flow of control from one state to another state. States are defined as a condition in which an object exists and it changes when some event is triggered. The most important purpose of State chart diagram is to model lifetime of an object from creation to termination. State chart diagrams are also used for forward and reverse engineering of a system. However, the main purpose is to model the reactive system.

Following are the main purposes of using State chart diagrams :

- To model the dynamic aspect of a system.
- To model the life time of a reactive system.
- To describe different states of an object during its life time.
- Define a state machine to model the states of an object.

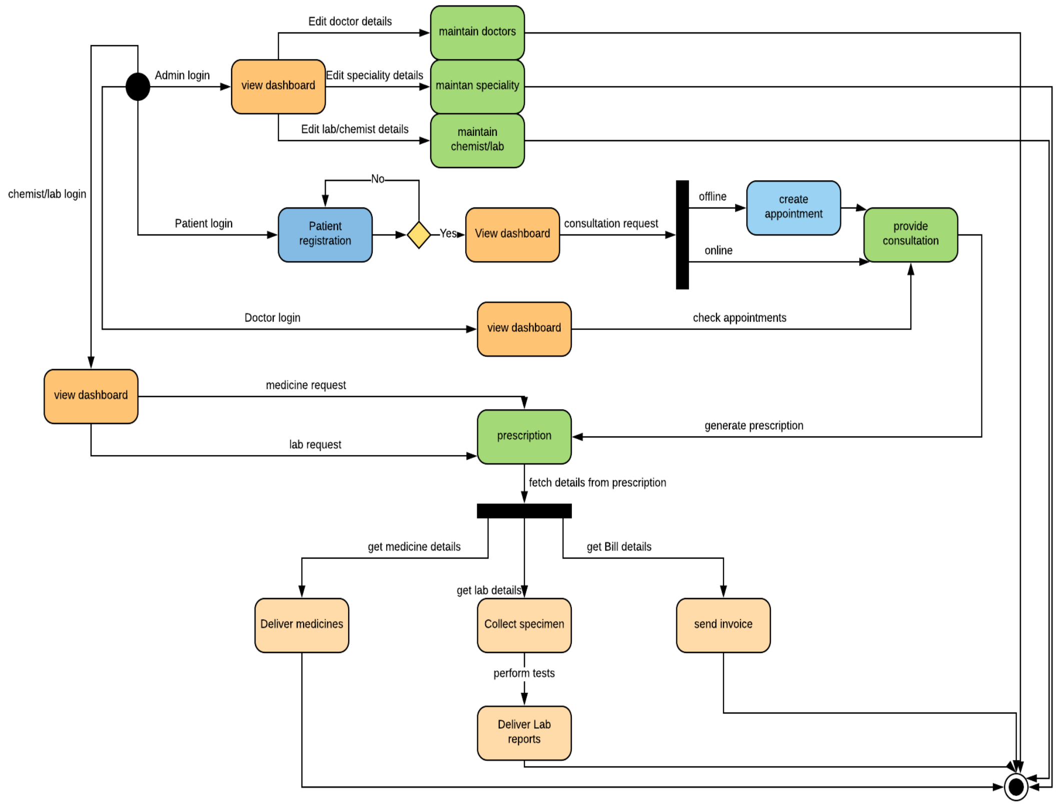


Fig 4.16 State Chart Diagram for virtual clinic

4.8 Activity Diagram

The general work-flow of the planner can be graphically represented in an activity diagram. Figure 4.17 shows how user will use the Virtual clinic and the step-by-step process they will go through as they progress through the site. The diagram shows the workflow for all average users. The system will load the user GUI. The user is then able to interact with selected modules, or open new modules. Activity diagram is basically a flowchart to represent the flow from one activity to another activity. The activity can be described as an operation of the system. The control flow is drawn from one operation to another.

When the system starts, the admin/patient logs into the system,only if they are valid credentials they are lead to the system interface to perform more actions onto the system, else they are again lead back to the login/registration page. Admin has the power to add doctors, chemist, lab. Once their credentials are shared with the corresponding stakeholder, they login to the system. Admin can further also view system statistics, add speciality of doctors to the system. Patient stakeholder can update his/her profile, view previous appointments/requests done and also make a new appointment. Doctor stakeholder can also update his/her profile details, view the appointments in his/her dashboard and provide consultation, prescribe medicines/lab test. Chemist stakeholder on logging into the system can view the medicines to be delivered to a particular patient and upon delivery update the status of delivery. Lab incharge stakeholder on logging into the system can view the lab tests to be done for a particular patient and update the reports after test for patient to view. An activity diagram is a type of UML (Unified Modeling Language) diagram used to model a workflow or process. It depicts the activities, actions, and decision points involved in a particular process, and can be used to describe both high-level and detailed processes.

Activity diagrams are often used in software development as part of the analysis and design phases to help visualize the flow of activities in a system. They are also used in business process modeling to document and analyze business processes. In an activity diagram, activities are represented by rounded rectangles, while actions are represented by rectangles with straight edges. Decision points are represented by diamonds, and the flow of the diagram is represented by arrows. Activity diagrams can also include swimlanes to indicate which actors or groups are responsible for each activity or action. In addition, they can be used to show concurrency, or the ability for multiple activities to be performed simultaneously

Purpose of Activity Diagrams :

The basic purpose of activity diagrams is similar to other UML diagrams. It captures the dynamic behavior of the system. Other UML diagrams are used to show the message flow from one object to another but the activity diagram is used to show message flow from one activity to another.

Activity is a particular operation of the system. Activity diagrams are not only used for visualizing the dynamic nature of a system, but they are also used to construct the executable system by using forward and reverse engineering techniques. The only missing thing in the activity diagram is the message part.

It does not show any message flow from one activity to another. Activity diagram is sometimes considered as the flowchart. Although the diagrams look like a flowchart, they are not. It shows different flows such as parallel, branched, concurrent, and single.

The purpose of an activity diagram can be described as:

- Draw the activity flow of a system.
- Describe the sequence from one activity to another.
- Describe the parallel, branched and concurrent flow of the system

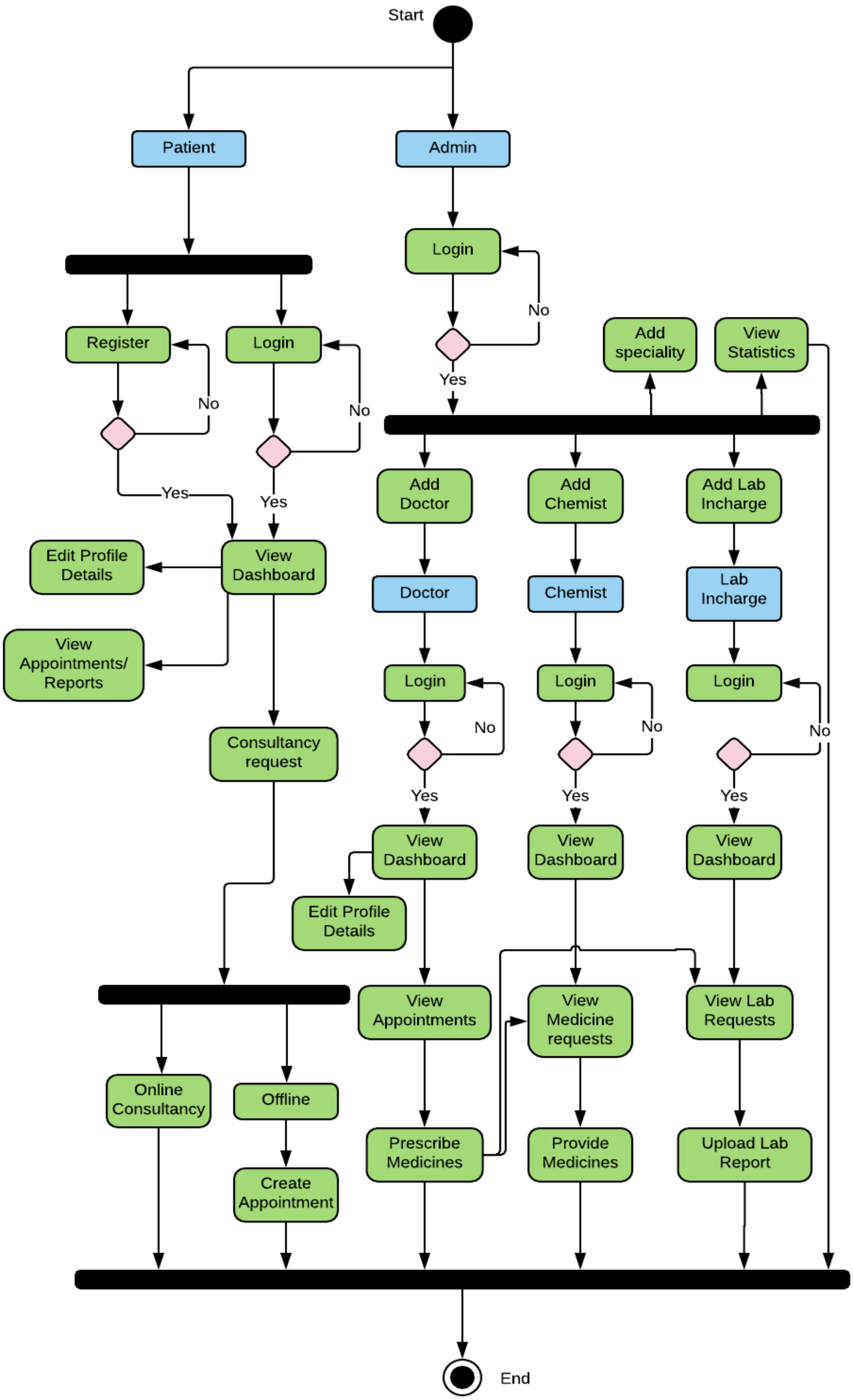


Fig 4.17 Activity Diagram For Virtual Clinic

5. IMPLEMENTATION

5.1 Implementation Strategy

The first step in implementing a virtual clinic platform is to define the requirements. This includes identifying the features and functionalities that the platform should offer, such as patient registration, appointment scheduling, medical records management, prescription management, and teleconsultation. It also includes defining the user roles and permissions, such as patient, doctor, chemist, and administrator. Once the requirements have been defined, the next step is to choose the technology stack for the platform. This includes selecting the programming language, database system, web framework, and other tools and technologies required to build the platform

With the technology stack in place, the next step is to develop the platform. This involves building the different components of the platform, such as the user interface, backend services, and database system. It also involves testing the platform to ensure that it meets the requirements and works as intended. Deploy the platform: Once the platform has been developed and tested, the next step is to deploy it to a production environment. This involves setting up the servers, network infrastructure, and other hardware and software required to run the platform. It also involves configuring the platform for optimal performance and security. With the platform deployed, the next step is to train the users. This includes training patients, doctors, and chemists on how to use the platform, including how to register, schedule appointments, view medical records, and perform other tasks. Monitor and maintain the platform: Once the platform is in production, it's important to monitor it regularly to ensure that it's functioning as intended. This includes monitoring system performance, security, and user feedback. It also includes performing regular maintenance tasks, such as updating software, patching vulnerabilities, and optimizing performance

implementing a virtual clinic platform requires careful planning, development, and deployment to ensure that it meets the requirements and provides a seamless experience for users. By following a structured implementation strategy, organizations can build a platform that is secure, scalable, and easy to use.

5.2 Hardware Platform Used

The hardware requirements for running a simple web application project will depend on several factors, including the programming language, web framework, database, and expected traffic. However, for a basic web application project, you can get started with the following minimum hardware requirements:

Processor: 1 GHz or higher
RAM: 4 GB or higher
Hard Disk Space: 10 GB or higher
Operating System: Windows, Linux or macOS
Keep in mind that if web application project involves heavy processing, extensive database operations, or high traffic, you may need to upgrade hardware accordingly to ensure that the application runs smoothly.

5.3 Software Platform Used

- PHP
- MySQL
- HTML
- CSS
- Java Script
- Laravel
- JQuery
- Ajax

5.4 Hardware Specification

Hardware specification is an essential consideration for any software platform. In the case of Sport Strides, the hardware requirements will depend on the scale of the platform and the number of users it is expected to serve. As a web-based application, Sport Strides will require both server and client hardware to function optimally.

For the server-side hardware, the following specifications are recommended:

Processor: A high-performance multicore processor is recommended to handle the heavy load of user requests and data processing. A minimum of 2 cores is recommended, with speeds of at least 1 GHz.

RAM: A minimum of 4 GB of RAM is recommended to handle the application's memory requirements.

Storage: A minimum of 10 GB of storage is recommended to store the application's database and other related files.

It is important to note that the hardware specifications mentioned above are only a general guideline, and the actual requirements may vary depending on the scale and complexity of the application. Additionally, hardware requirements may change as the application evolves and new features are added. Therefore, it is recommended to regularly assess and upgrade the hardware to ensure optimal performance of the application.

5.5 Software Specification

The software specification for final year project is an important document that outlines the requirements and functionality of the system. It provides a clear and concise description of what the software should do and how it should behave. The following is a brief overview of the software specification for project: Purpose: The purpose of the software is to provide a web-based platform that allows users to perform various tasks related to a specific domain.

Functionality: The software should provide the following functionality:

User authentication and authorization

User profile management

Data input and retrieval

Search functionality

Data analysis and reporting

Integration with external systems (if applicable)

Technology Stack: The software will be built using PHP, MySQL, HTML, CSS, JavaScript, Laravel, jQuery, and Ajax.

Constraints: The software should be scalable, secure, and user-friendly. It should also be compatible with different web browsers and devices

Web Development

For web development, we used HTML, CSS, and JavaScript. HTML is the standard markup language used to create the structure of web pages, while CSS is used to add style and layout to the pages. JavaScript is used for adding interactivity and dynamic functionality to the pages. These three technologies are the backbone of web development, and they are used in almost every web development project. HTML provides a basic structure for web pages, while CSS is used to make the pages visually appealing. JavaScript provides the interactivity and dynamic functionality needed to create a rich user experience.

PHP: PHP stands for Hypertext Preprocessor, and it is a server-side scripting language used for web development. It is a popular programming language and has been used to build various websites, web applications, and content management systems (CMS). PHP is open-source, meaning that it is free to use and distribute, making it accessible to developers worldwide.

PHP is a powerful language that can handle complex tasks such as generating dynamic content, interacting with databases, and performing server-side scripting. It can also be embedded into HTML code, making it easy to create dynamic web pages.

One of the significant advantages of using PHP is its compatibility with various web servers and operating systems. It can run on almost all popular operating systems such as Windows, Linux, and macOS. PHP can also interact with multiple databases such as MySQL, PostgreSQL, and Oracle.

MySQL: MySQL is an open-source relational database management system (RDBMS) used for web applications. It is one of the most popular databases used in web development due to its speed, reliability, and ease of use.

MySQL is a relational database, which means that it organizes data into tables that are related to each other. It uses SQL (Structured Query Language) to manage and retrieve data from the database. MySQL is known for its scalability, which makes it an ideal choice for applications that require handling large amounts of data.

HTML: HTML stands for Hypertext Markup Language, and it is the standard markup language used for creating web pages. HTML is used to structure content on a web page and provide semantic meaning to it. It uses tags to define elements such as headings, paragraphs, links, images, and forms, among others.

HTML provides a basic structure for web pages, and it is an essential part of web development. HTML is a simple language to learn, and it is compatible with all web browsers, making it accessible to a wide audience.

CSS: CSS stands for Cascading Style Sheets, and it is a stylesheet language used to describe the presentation of a web page. CSS is used to define the layout, style, and appearance of HTML elements on a web page. It can be used to control the font size, color, background, borders, and spacing, among others.

CSS provides a separation between content and presentation, which makes it easier to maintain and update web pages. It also allows for a consistent look and feel across web pages, making it easier for users to navigate and understand the content.

JavaScript: JavaScript is a programming language used for web development. It is a client-side scripting language, meaning that it runs in the user's browser and interacts with the HTML and CSS to create dynamic and interactive web pages.

JavaScript is a versatile language that can handle various tasks such as form validation, animations, and interactions with APIs. It can also interact with HTML and CSS to manipulate elements on a web page, making it a crucial part of web development.

Laravel: Laravel is a PHP web application framework used for building web applications. It is known for its simplicity, efficiency, and scalability, making it a popular choice among developers. Laravel is a popular open-source PHP web application framework designed for building modern web applications. Developed by Taylor Otwell in 2011, Laravel follows the Model-View-Controller (MVC) architecture pattern and provides a wide range of features and tools that enable developers to create scalable and robust web applications quickly and easily. Some of the key features of Laravel include a powerful ORM (Object-Relational Mapping) system, a built-in command-line interface (CLI) called Artisan, automated testing tools, and a modular structure that allows developers to build reusable components and packages. Laravel also comes with a vibrant and active community that provides support, documentation, and third-party packages and libraries. Overall, Laravel is a versatile and flexible framework that is widely used in the web development community and continues to evolve with new features and improvements.

Laravel provides a set of tools and libraries that streamline the development process, making it easier to build web applications quickly and efficiently. It also provides a structured approach to web development, which makes it easier to maintain and update web applications.

jQuery: jQuery is a JavaScript library used to simplify the process of writing JavaScript code for web development. It provides a set of functions and methods that can be used to manipulate HTML and CSS elements, handle events, and interact with APIs.

jQuery is designed to be easy to use and cross-browser compatible, making it a popular choice for web development. It also provides a wide range of plugins and extensions that can be used to enhance the functionality of web pages. jQuery is a fast, small, and feature-rich JavaScript library that simplifies HTML document traversing, event handling, and animating for rapid web development. It was created by John Resig in 2006, and has become one of the most widely used JavaScript libraries, powering millions of websites worldwide. jQuery simplifies the process of writing JavaScript code by providing a simple and intuitive API that allows developers to manipulate HTML documents, handle events, and create animations with ease. Some of the key features of jQuery include DOM manipulation, event handling, AJAX support, and cross-browser compatibility. jQuery also has a large and active community that provides support, documentation, and a vast array of plugins and extensions. Overall, jQuery is a powerful tool for building interactive and dynamic web applications, and is an essential part of modern web development

5.6 Deployment Diagram

A deployment diagram for a virtual clinic would typically include the hardware and software components that make up the system and their interconnections. The diagram may show how the system is deployed across different machines or nodes and how they interact with each other. he deployment diagram for a virtual clinic shows how the different hardware and software components of the system are connected and how they work together to provide a seamless user experience. The web application handles user requests, the application server processes those requests, and the database server stores and manages all patient data. The load balancer helps ensure that the system can handle increased traffic and provide better performance, while the backup and recovery services on the database server help ensure that patient data is safe and available at all times.

A deployment diagram is a type of UML (Unified Modeling Language) diagram that shows the physical arrangement of hardware and software components in a system. It illustrates the relationships between software components, hardware components, and the environment in which they run. The main purpose of a deployment diagram is to show how a system is deployed in a physical environment, such as a network, a server, or a set of computers.[19] Deployment diagrams are often used in software engineering to help developers and architects understand how a system is deployed and to plan for the deployment of software components. They can also be used to identify potential issues and to optimize the deployment of a system for performance and scalability.

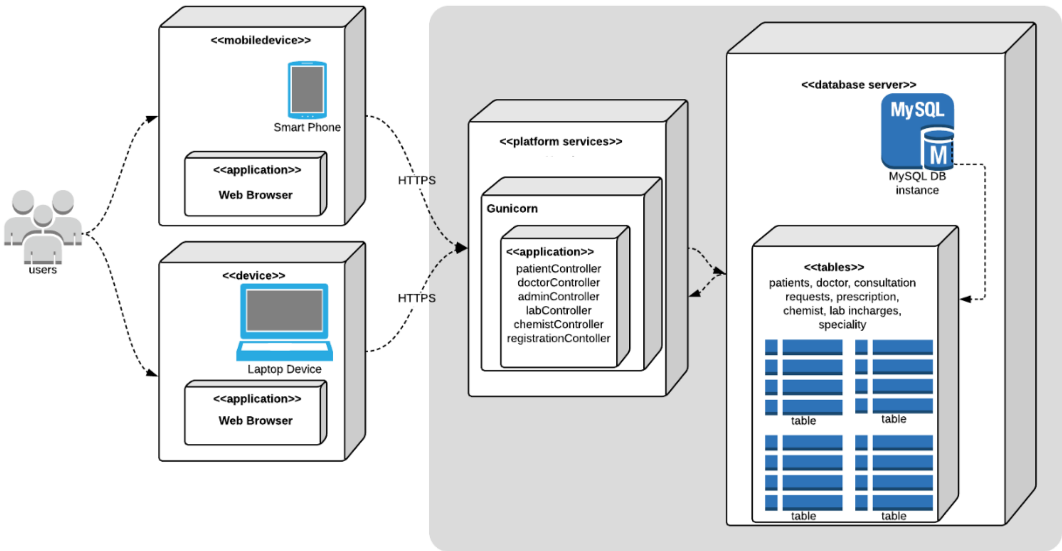


Fig 5.1 Deployment Diagram

5.7 Implementation Level Details

The implementation model for a virtual clinic would typically involve several stages, including requirements gathering, design, development, testing, deployment, and maintenance. stage involves understanding the goals and objectives of the virtual clinic and defining the requirements for the system. This could involve working with healthcare professionals and other stakeholders to identify the features and functionalities that the system should have.

stage involves creating a high-level design for the virtual clinic system, including the hardware and software components, the user interface, and the database schema. This could involve creating diagrams and other visual aids to help communicate the design to stakeholders. stage involves implementing the design by writing code for the various components of the system. This could involve using programming languages such as Java or Python to build the web application and the business logic, and using database management systems such as MySQL to create and manage the database.

This stage involves testing the system to ensure that it meets the requirements and works as expected. This could involve writing test cases and using tools such as Selenium or JUnit to automate testing. stage involves deploying the system to the production environment and making it available to users. This could involve using cloud computing platforms such as Amazon Web Services or Microsoft Azure to host the system, and using deployment tools such as Docker or Kubernetes to manage the deployment process. stage involves maintaining and updating the system to ensure that it continues to work as expected and meets the changing needs of users. This could involve monitoring the system for issues and using tools such as log analysis and performance monitoring to identify and resolve problems. It could also involve adding new features and functionalities to the system as needed.

5.8 Testing

GUI testing: Graphical User Interface (GUI) testing is the one of the mechanism in which user interface developed System Under some graphical rules. GUI testing includes checking various controls- menus, buttons, icons, dialog boxes and windows etc. Proposed system is tested for user inputs against different modules, validations are done.

Unit Testing: It is the testing of individual software units of the application .it is done after the complexion of an individual unit before integration. Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. This is a structural testing that relies on knowledge of its construction and is invasive. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results .

Integration Testing: Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfactory, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

System testing: System testing tests a completely integrated system to verify that the system meets its requirements. For example, a system test might involve testing a logon interface, then creating and editing an entry, plus sending or printing results, followed by summary processing or deletion (or archiving) of entries, then logoff.

Performance Testing: This type of testing is used to evaluate the system's performance under different conditions, such as high traffic, heavy load, or stress. The goal is to identify any bottlenecks or performance issues and optimize the system for better performance.

Security Testing: This type of testing is used to identify vulnerabilities in the system and ensure that it is secure against attacks. It could involve testing for different types of security risks, such as SQL injection, cross-site scripting, or unauthorized access.

Usability Testing: This type of testing is used to evaluate the system's usability and user-friendliness. It could involve testing the system with users to identify any usability issues or areas for improvement.

Acceptance Testing: This type of testing is used to ensure that the system meets the user's requirements and specifications. It could involve testing the system with users to get feedback on whether it meets their needs and expectations.

Regression Testing: This type of testing is used to ensure that changes made to the system do not have any unintended effects on existing functionality. It could involve testing the system with a set of predefined test cases to ensure that all existing functionality works as expected after changes are made.

Exploratory Testing: This type of testing is used to test the system in an ad-hoc and informal manner, without predefined test cases. The goal is to explore the system and identify any issues or unexpected behavior that may not be covered by other types of testing.

6. CONCLUSION

In conclusion, the virtual clinic project has the potential to revolutionize the way healthcare services are delivered. The use of technology to bridge the gap between patients and healthcare providers is a significant step towards achieving better healthcare outcomes for patients.

The virtual clinic project is an innovative approach that leverages digital platforms to provide remote healthcare services to patients. With this project, patients can receive medical consultations, diagnoses, prescriptions, and referrals from the comfort of their homes or workplaces. This means that patients no longer have to physically visit healthcare facilities, which can be costly, time-consuming, and inconvenient.

The virtual clinic project has numerous benefits for patients, healthcare providers, and the healthcare system as a whole. For patients, the project provides access to quality healthcare services regardless of their geographical location. Patients can receive medical consultations from highly qualified healthcare providers without leaving their homes, which is particularly beneficial for patients who live in remote or underserved areas.

For healthcare providers, the virtual clinic project provides an opportunity to expand their patient base and offer their services to a wider audience. The project also allows healthcare providers to provide services more efficiently, as they can manage patient consultations and follow-ups remotely, saving time and resources.

Future Work

The virtual clinic project has the potential for further development and improvement to provide even better healthcare services to patients. Future work for the virtual clinic project could include:

Expansion of Services: The virtual clinic project could expand its services to include more specialized medical consultations, such as mental health, nutrition, and physiotherapy. This would provide patients with a more comprehensive healthcare service and cater to their specific healthcare needs.

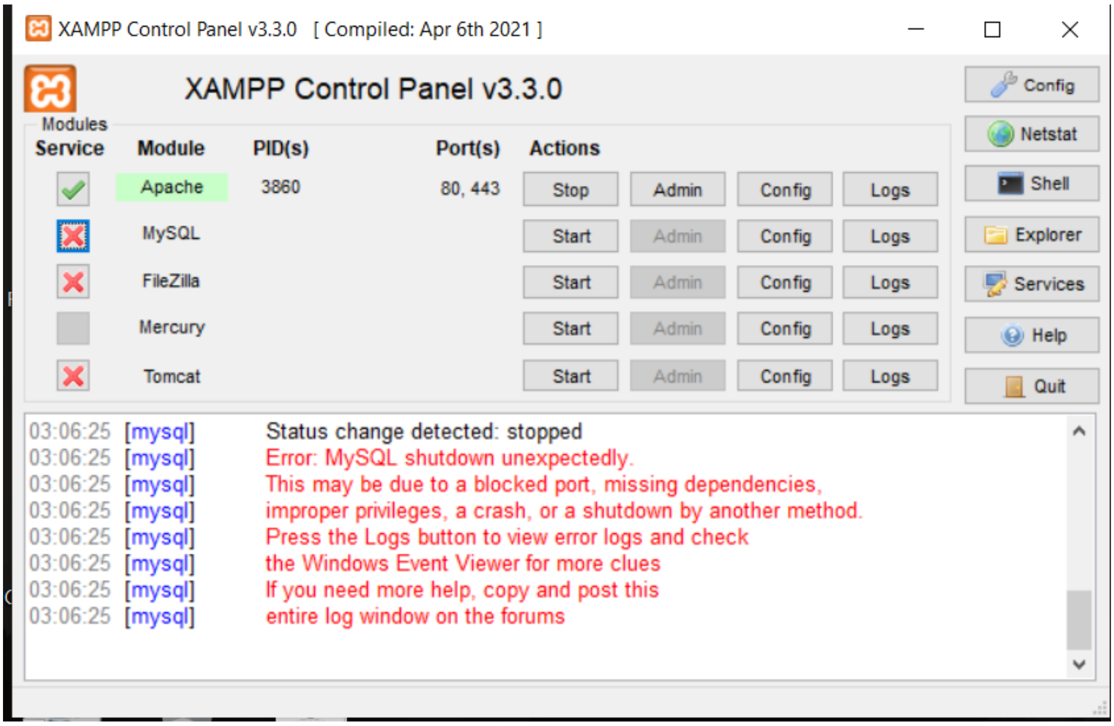
Integration of AI and Machine Learning: The integration of AI and machine learning in the virtual clinic project could improve the accuracy of medical diagnoses and enable healthcare providers to provide more personalized medical consultations. This could also reduce the workload of healthcare providers and enable them to provide more efficient services to patients.

Integration of Wearable Devices: The integration of wearable devices in the virtual clinic project could provide healthcare providers with real-time information about patients' health status. This could enable healthcare providers to monitor patients remotely and provide early interventions, leading to better healthcare outcomes.

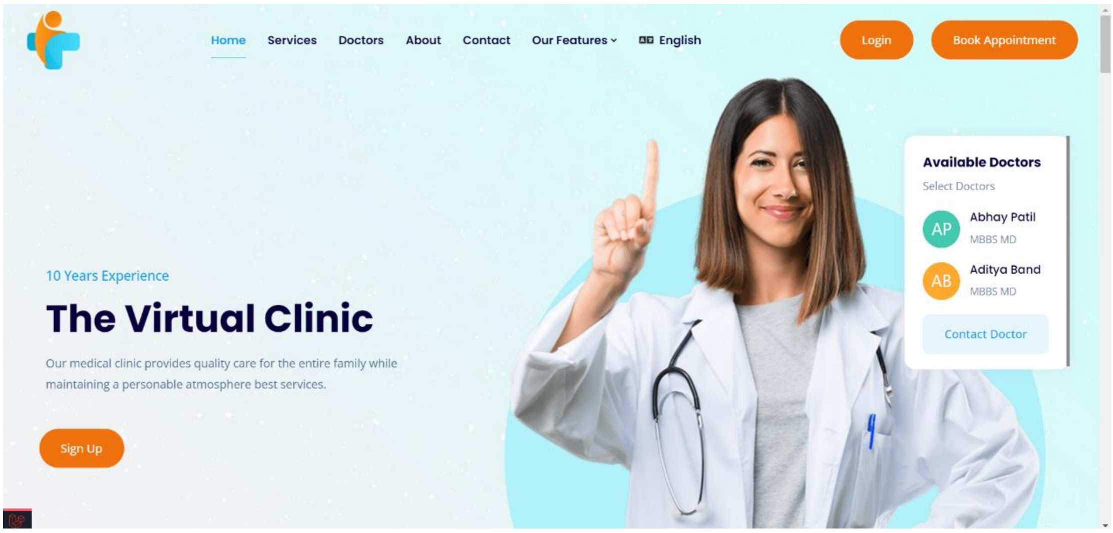
Improved Security and Privacy: The virtual clinic project could enhance its security and privacy protocols to protect patient data and comply with healthcare regulations. This would ensure that patients' confidential information is kept safe and secure and build trust between patients and healthcare providers.

User Manual

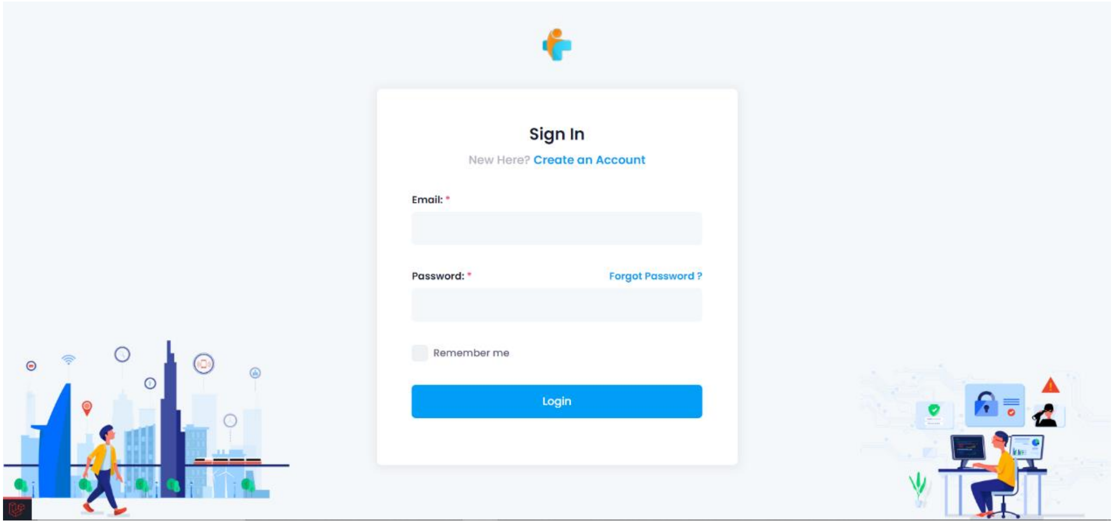
1. We have to install the code to xampp local web server and start the services of the apache and sql



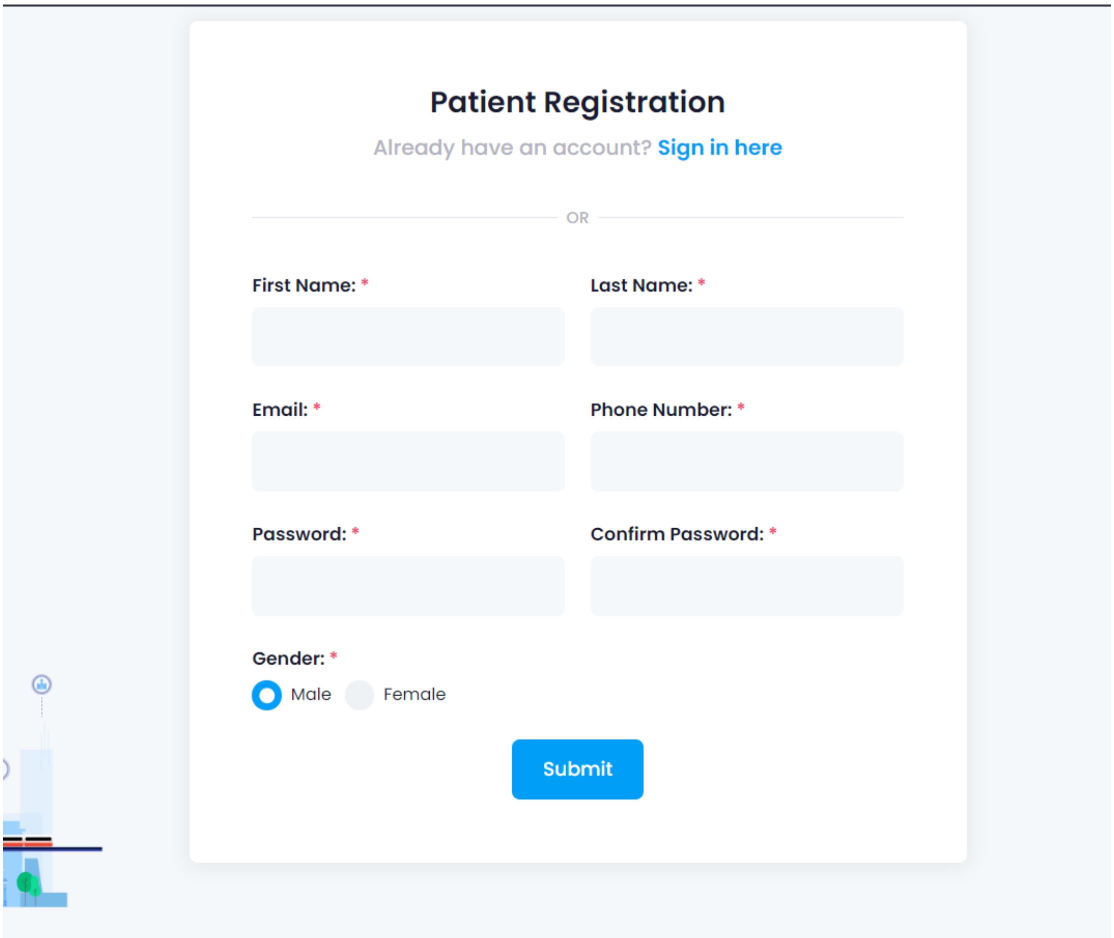
2. Now after starting the web server we have to open browser and in the url section type the localhost



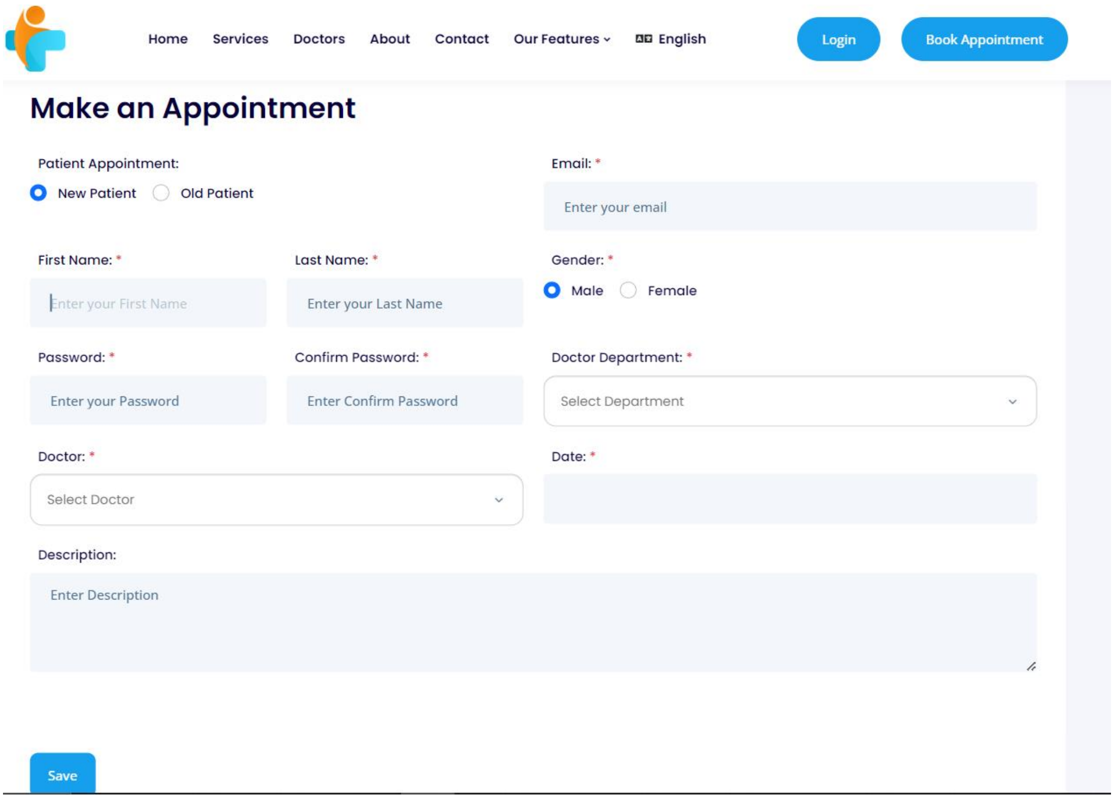
3. Now when we click on login there are different users like patient , admin, pharmasist, lab operator.



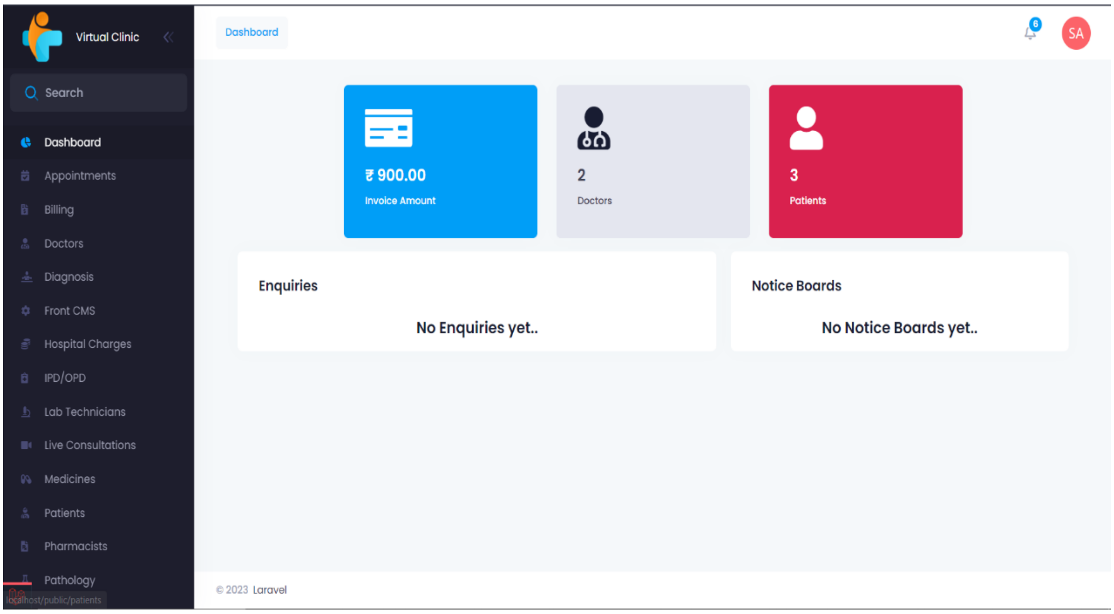
4. For new patient registration click on the create account



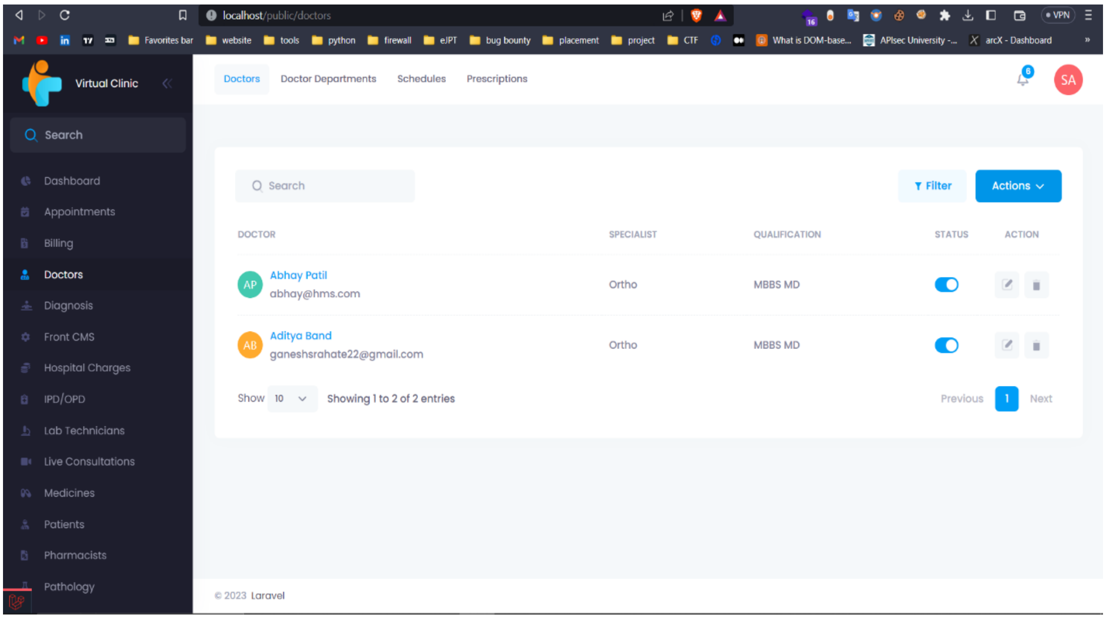
5. To make appointment with doctor patient has to click on the book appointment button and book the appointment.



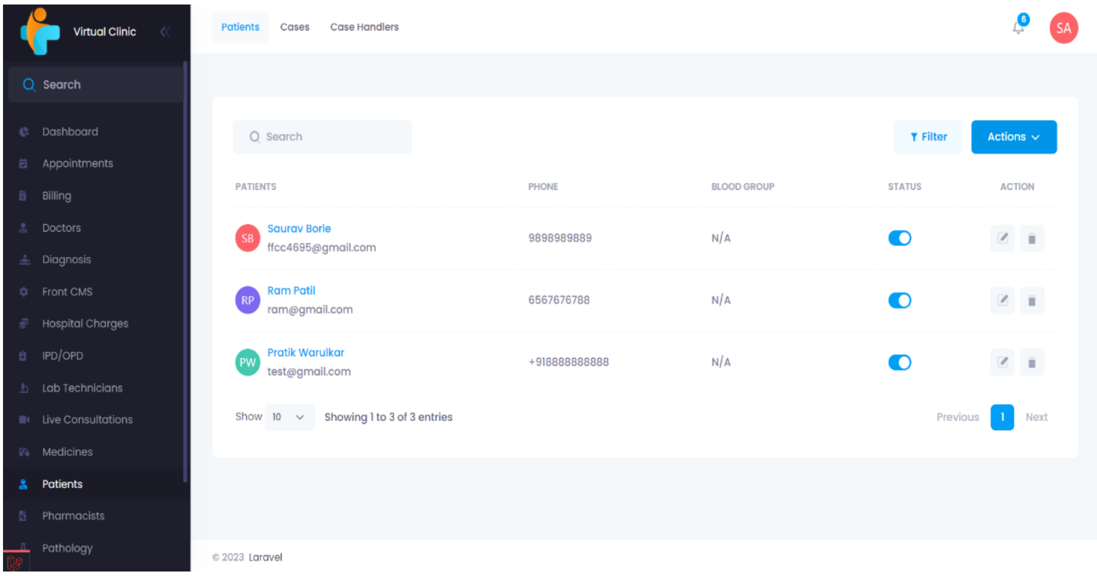
6. Now we are going to login as a admin to view all the available options



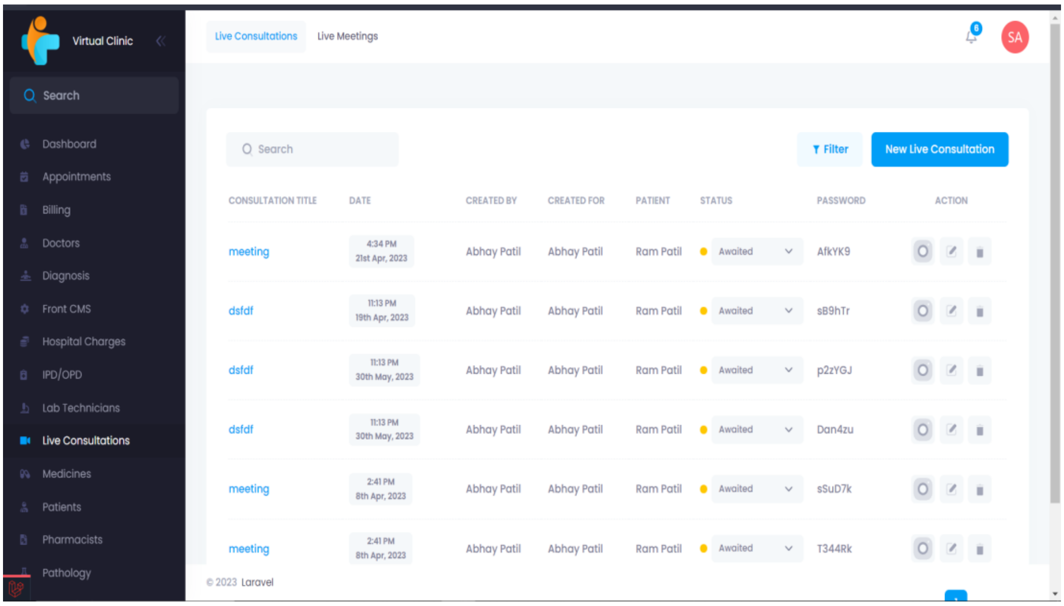
7. There are different pannel for each users in the admin pannel the admin can manage doctors



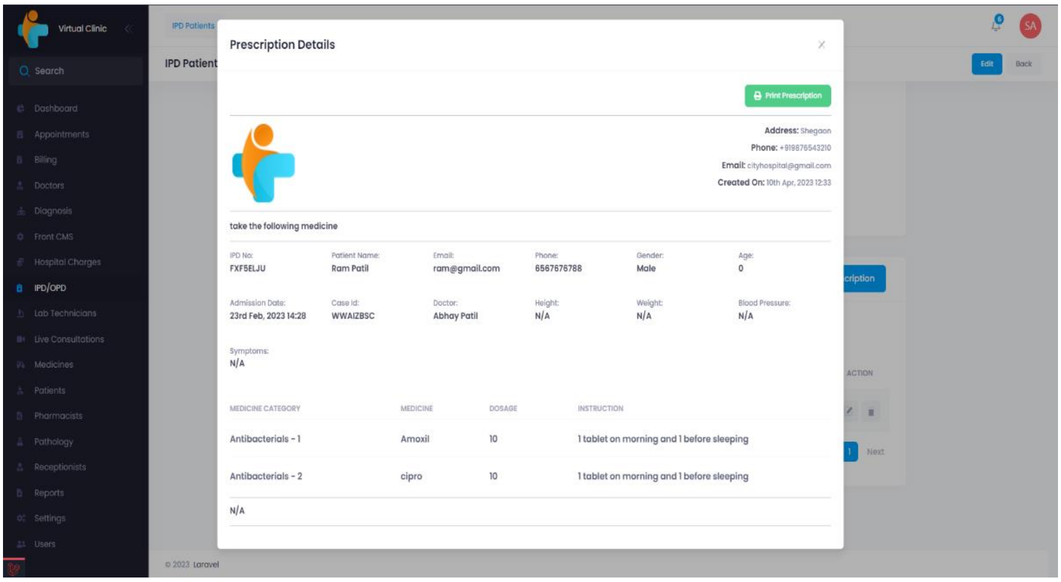
8. Also the admin can also manage the patient



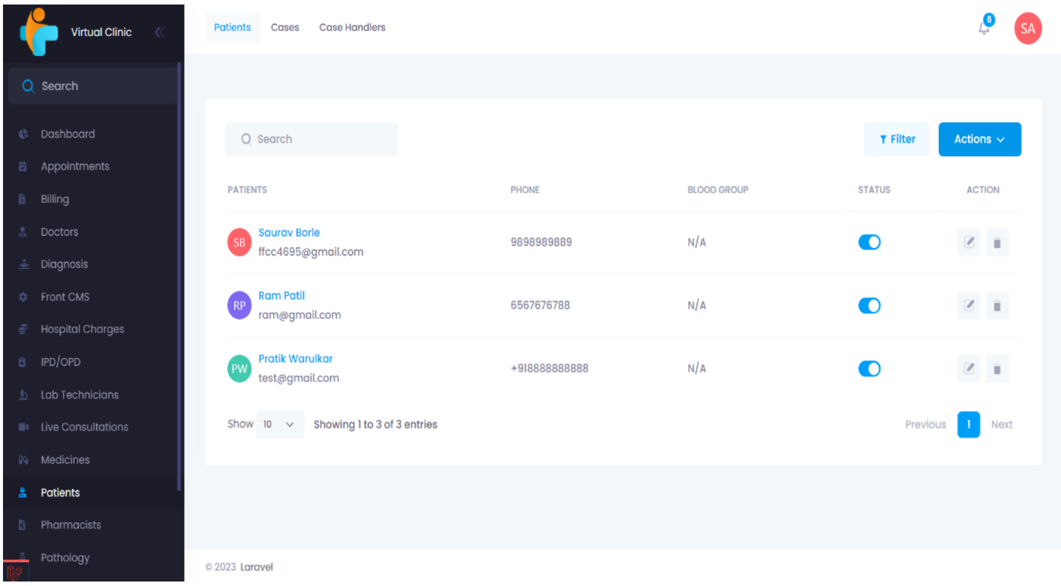
9. There are options for patient to live consultaion



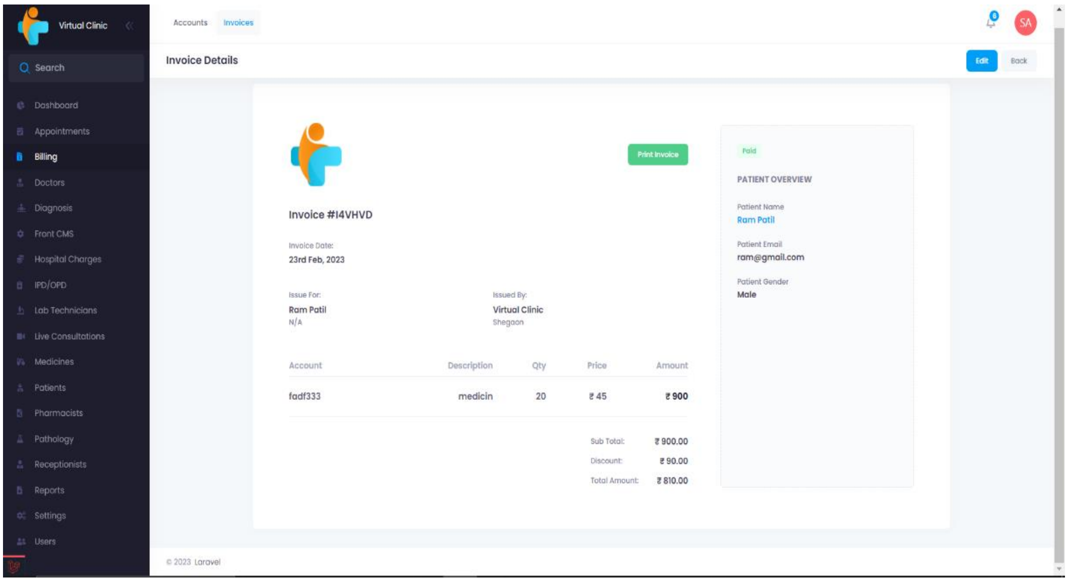
10. The doctor can give priscription to patient



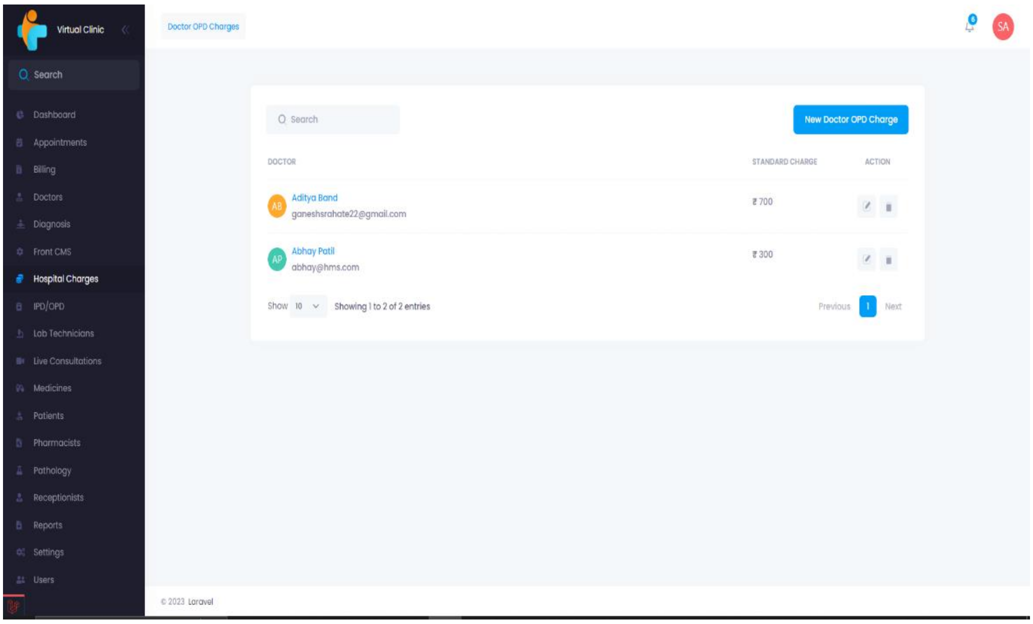
11. There are options for the chemist to add medicine to the store



12. There is option for clinic to generate invoice



13. There is option for every doctor to set their charges



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