

# Develop an Extended Model for Effective of Online Medical Consultation on the Performance of Hospital and Clinics Case Study: Chuk

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**Abstract:** This study presents groundbreaking findings on the development and evaluation of an extended model for an online medical consultation system, designed to improve the operational performance of hospitals and clinics. By leveraging interdisciplinary research in healthcare management, information systems, and patient engagement, the proposed framework provides a detailed understanding of how online medical consultations can be integrated into traditional healthcare environments. Key factors influencing the system's effectiveness, including technological infrastructure, patient satisfaction, healthcare outcomes, operational efficiency, and financial sustainability, are thoroughly explored.

Data collection and analysis were conducted using Google Colab and Python, enabling efficient handling and interpretation of large datasets. The research draws insights from literature reviews and field responses, highlighting the need for a centralized online consultation system that connects regional hospitals—specifically Masaka, Kibagabaga, and Nyarugenge—with CHUK (the Centre Hospitalier Universitaire de Kigali). This system ensures seamless access to and sharing of patient information, thereby improving healthcare service delivery for patients, particularly those located far from major healthcare facilities.

The findings and practical recommendations presented in this study offer valuable insights for healthcare administrators, policymakers, and IT professionals seeking to enhance telemedicine solutions and adopt innovative approaches for patient-centered care in the digital era.

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## I. INTRODUCTION

Healthcare systems worldwide are undergoing a rapid transformation driven by advancements in technology and the increasing demand for accessible, efficient, and patient-centered care. Rwanda, a country with 30 administrative districts, faces unique challenges in delivering healthcare services across its vast and diverse regions. The need for seamless coordination and information sharing among hospitals has become crucial for improving service delivery, reducing patient waiting times, and ensuring timely medical interventions.

The advent of online medical consultation and integrated information management systems offers a promising solution to address these challenges. This research presents the development and implementation of an innovative e-Doctor Consultation Management System designed to connect key hospitals across Kigali, including CHUK, Kibagabaga, Masaka, and Nyarugenge, with the potential for nationwide adoption. The system enables healthcare providers to access, update, and manage patient information in real-time, regardless of their location. This capability is particularly significant in Rwanda, where patients often face long travel distances to access specialized care.

The system's functionalities include patient registration, online video consultations, laboratory test management, prescription issuance, and secure data sharing across multiple hospitals. By integrating video conferencing tools such as Zoom and Google Meet, the platform enhances the doctor-patient interaction experience, enabling remote consultations without compromising the quality of care. Furthermore, features such as automated appointment scheduling, doctor verification, and secure prescription handling contribute to operational efficiency and improved patient satisfaction.

The primary objective of this study is to assess the impact of this system on healthcare service delivery in Rwanda, focusing on its potential to streamline operations, enhance communication among healthcare providers, and improve patient outcomes. Through comprehensive data collection and analysis, the study evaluates the system's effectiveness and provides practical insights for scaling its implementation to all 30 districts in Rwanda.

By examining the integration of digital health solutions in Rwanda's healthcare system, this research aims to contribute valuable knowledge to the field of health informatics and offer actionable recommendations for policymakers, healthcare executives, and technology developers. Ultimately, the e-Doctor Consultation Management System represents a significant step toward the realization of a more efficient, accessible, and patient-centric healthcare system in Rwanda.

## II. METHODOLOGY

### A. Data Collection Methods and Instruments/Tools

Data collection involves obtaining information through pre-defined methodologies to address the research objectives. In this study, a questionnaire will be employed as the primary research tool, alongside secondary data analysis. According to Walliman (2021), utilizing surveys is an effective approach to gather both quantitative and qualitative data. The study adopts the survey method as its core data collection technique.

### ➤ Google Collaboratory

Google Collaboratory, also known as Colab, is a cloud-based environment for running Jupyter notebooks. It is particularly useful because it doesn't require installation and allows for collaborative editing, similar to Google Docs. Colab supports numerous machine learning libraries, which can be quickly integrated into notebooks, making it an efficient tool for data analysis.

### ➤ Python

Python is a high-level, interpreted programming language known for its simplicity and readability. It is designed to prioritize clear syntax, making it highly accessible for both beginners and experts. Python's dynamic typing and automatic memory management further enhance its versatility. For this study, convenience sampling will be employed, where participants are selected based on their availability and willingness to take part, which is a non-probability sampling technique (Hope, 2021).

### B. Data Analysis

Data analysis refers to the process of investigating and interpreting collected data to uncover meaningful insights. This process helps researchers comprehend survey results and administrative data, and it plays a critical role in making sense of the findings. The analysis will offer valuable perspectives on the research topic, enhancing understanding and engaging readers. The data will be processed and analyzed using Google Colab, which provides a platform for applying various scientific analysis tools (Burns, 2022).

### C. Research Design

A research design serves as a detailed framework that outlines how the necessary data will be collected and analyzed to address the study's research questions. In this study, a mixed-method approach combining descriptive and correlational research designs will be adopted. This design will facilitate an in-depth examination of the population characteristics under investigation and analyze how the different variables are interrelated. the impact of INTER-HOSPITALS data management system on health services provided. (Hardt,2016).

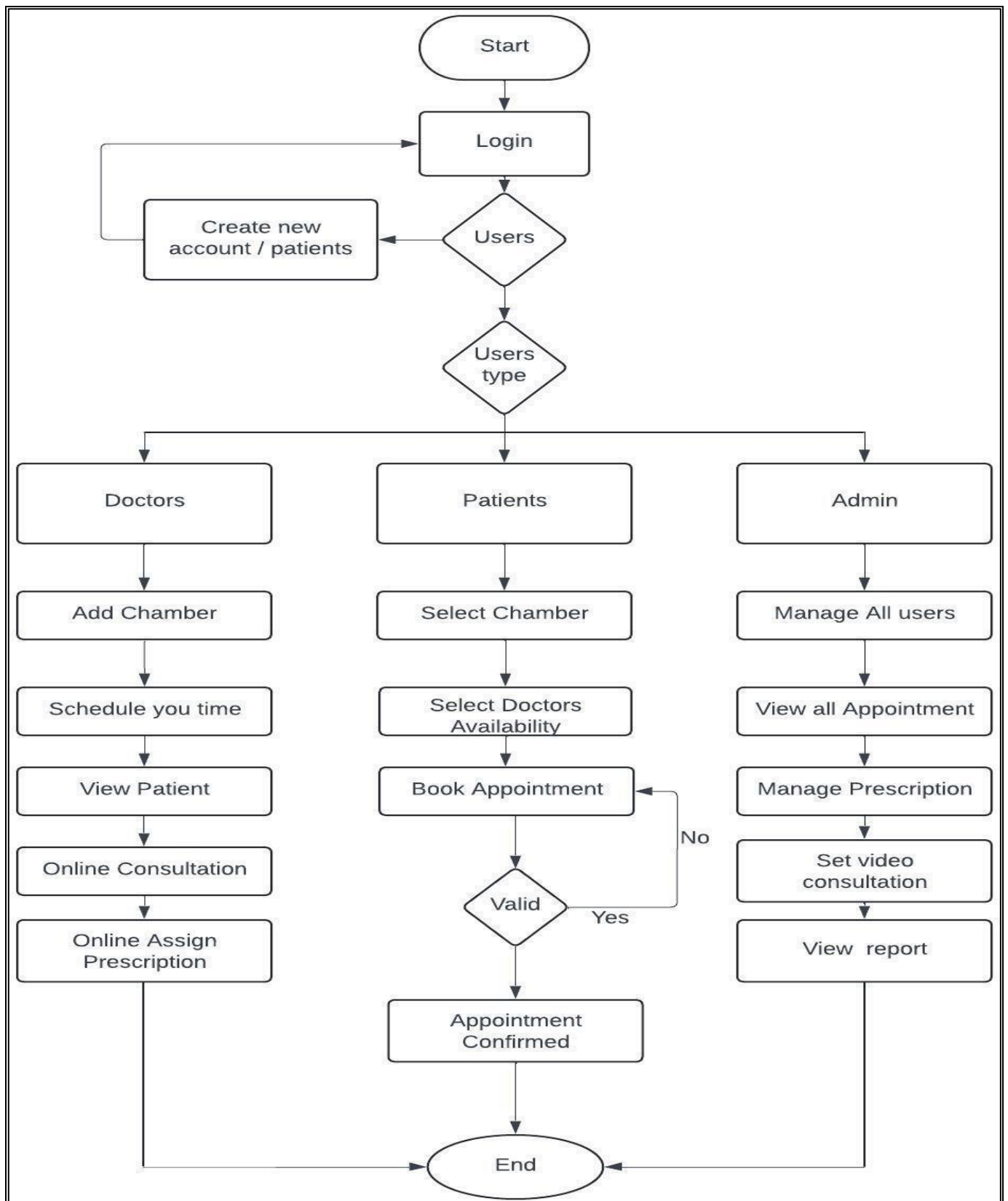


Fig 1: E-Doctor Consultation Management System Flowchart Diagram

The system flowchart demonstrates the process where doctors log in, manage patient records, conduct consultations, request and review lab tests, and provide treatments. Doctors

can also search for returning patients using their IDs, with the system applicable across Kibagabaga, Masaka, Nyarugenge, and CHUK hospitals.

### III. CONCEPTUAL FRAMEWORK

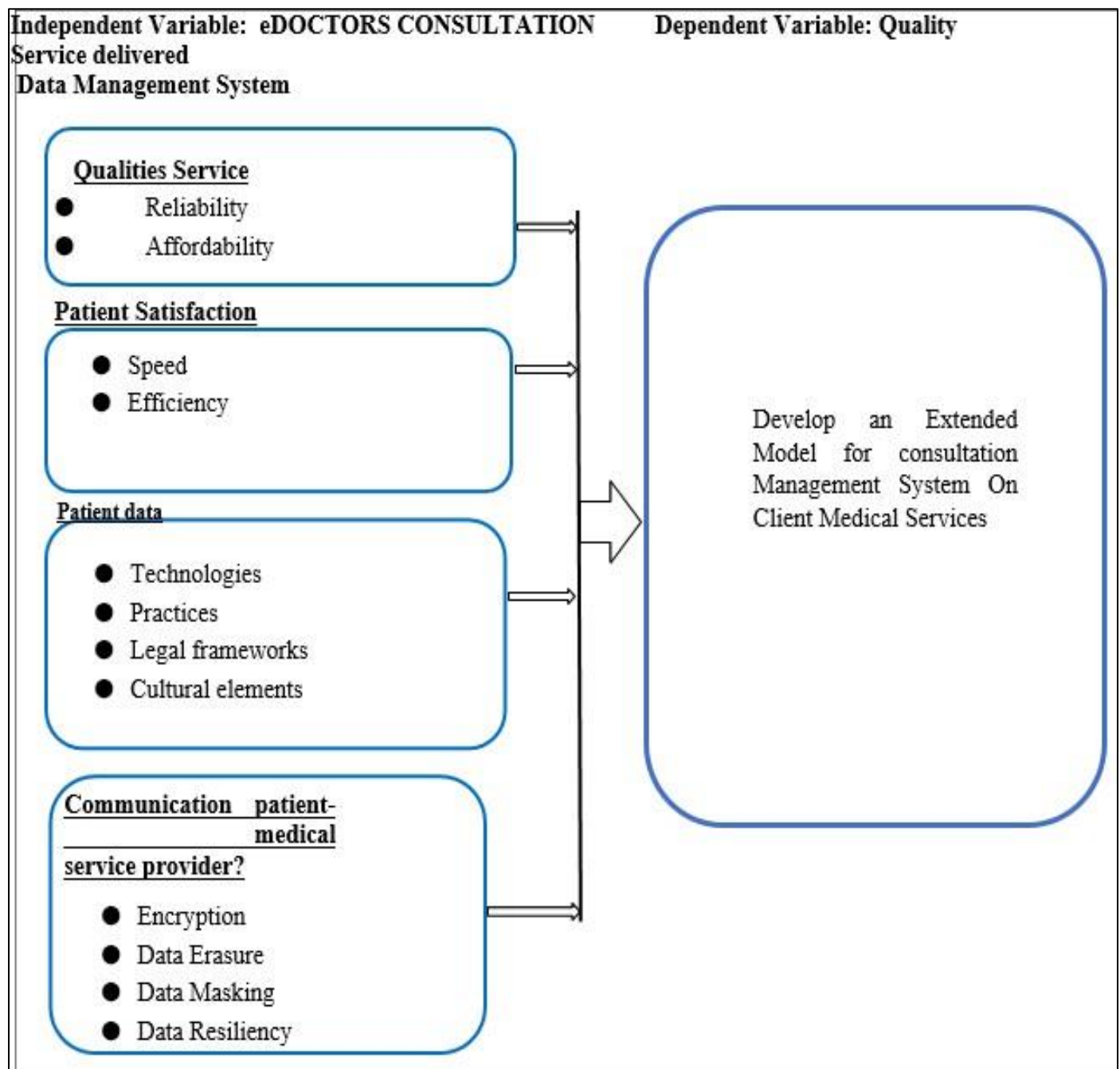


Fig 2: Conceptual Framework

### IV. PRESENTATION, ANALYSIS ANINTERPRETATION OF FINDINGS

This chapter presents the data and provides an interpretation of the findings regarding the influence of the eDOCTORS CONSULTATION information management system on the quality of client services, specifically in both public and private hospitals in Kigali. The data was analyzed in relation to this context on objectives of study. The data collected served as tool to measure the results obtained from the field. Also includes a brief overview of the technologies used to make the application, operation, tests that have been applied, the weakness observed in the online consultation

management system current systems, screenshots of how the system works. Last but not leastIn this chapter, we will outline the step-by-step development of the system and how it was tailored to assist hospitals both within Kigali and beyond, using them as case studies. These hospitals are located across various districts of Rwanda: Masaka Hospital in Kicukiro District, Nyarugenge Hospital and CHUK Hospital in Nyarugenge District, and Kibagabaga Hospital in Gasabo District.

This map demonstrates where all hospitals the research based are located in Rwanda

➤ *E-Doctor Management System Homepage*

In this page it is the first page which is displayed when you are going start to use the system, there you can see all

main section you need like to select doctors and to book an appointment. Online Doctor Consultation Management System Homepage

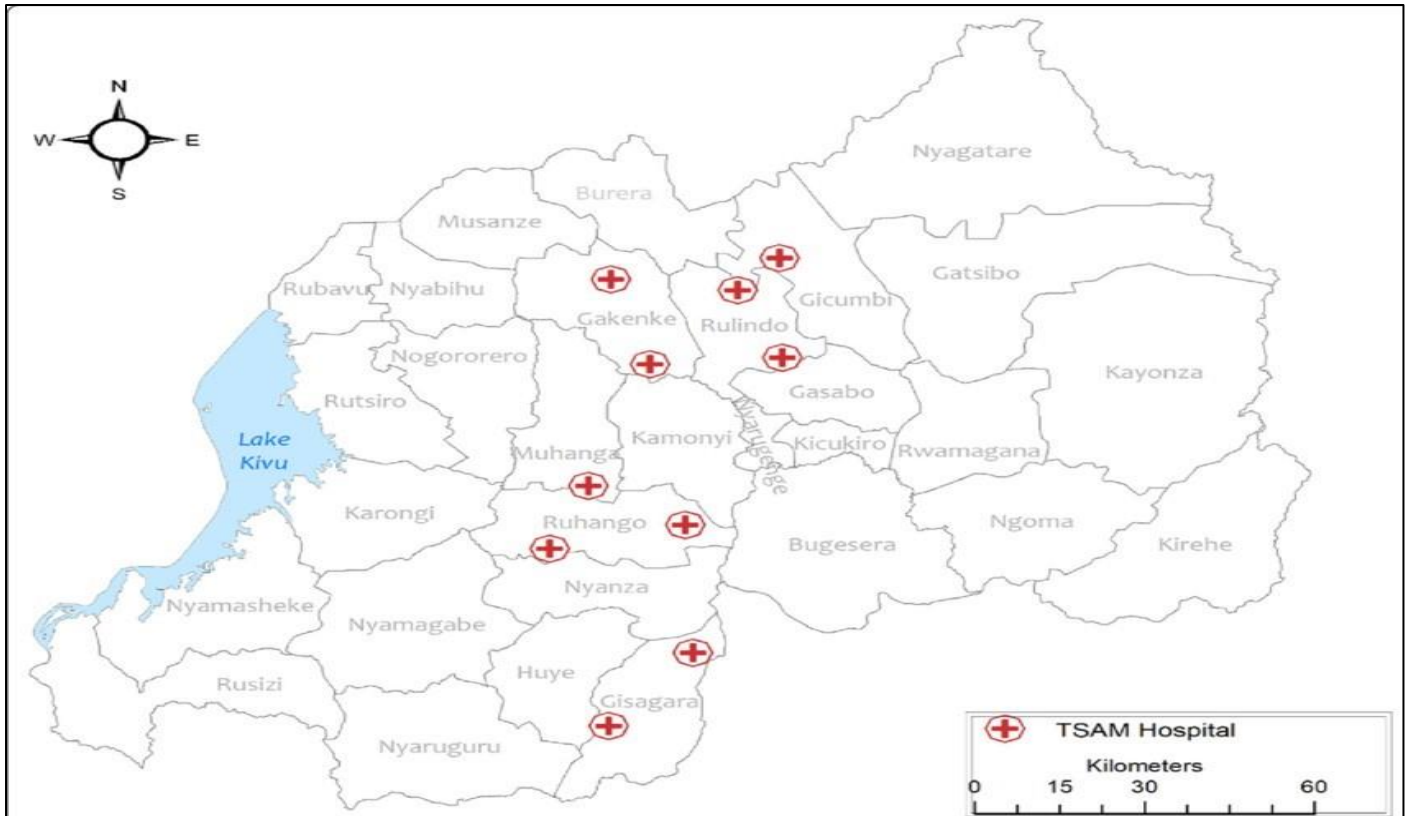
➤ *E-Doctor Management System*

Fig 3: Geographic Data Collection for the eDOCTORS Consultation System in Rwanda

➤ *E-Doctor Management System Homepage*

In this page it is the first page which is displayed when you are going start to use the system, there you can see all

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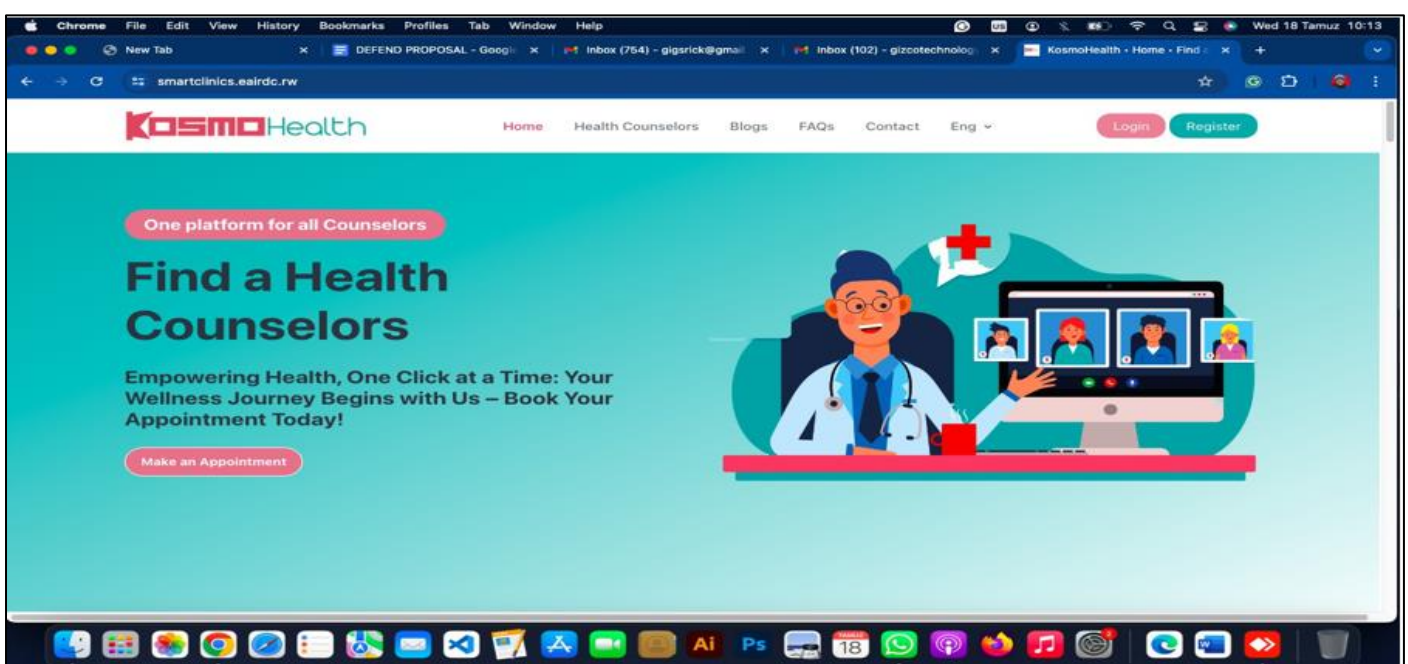


Fig 4: Online Doctor Consultation Management System Homepage.



### ➤ Doctor Management System

This section outlines the entire process of setting up the online consultation information management system, starting from when the patient view the doctors profile they can choose her availability and then patient book an appointment on that stage doctors dashboard they get notification on email

and on the dashboard, when the time on online consultation comes system it configure zoom meeting on google meet then patients and doctors they make an appointment after that when doctor they finish consult automatically he create prescription.

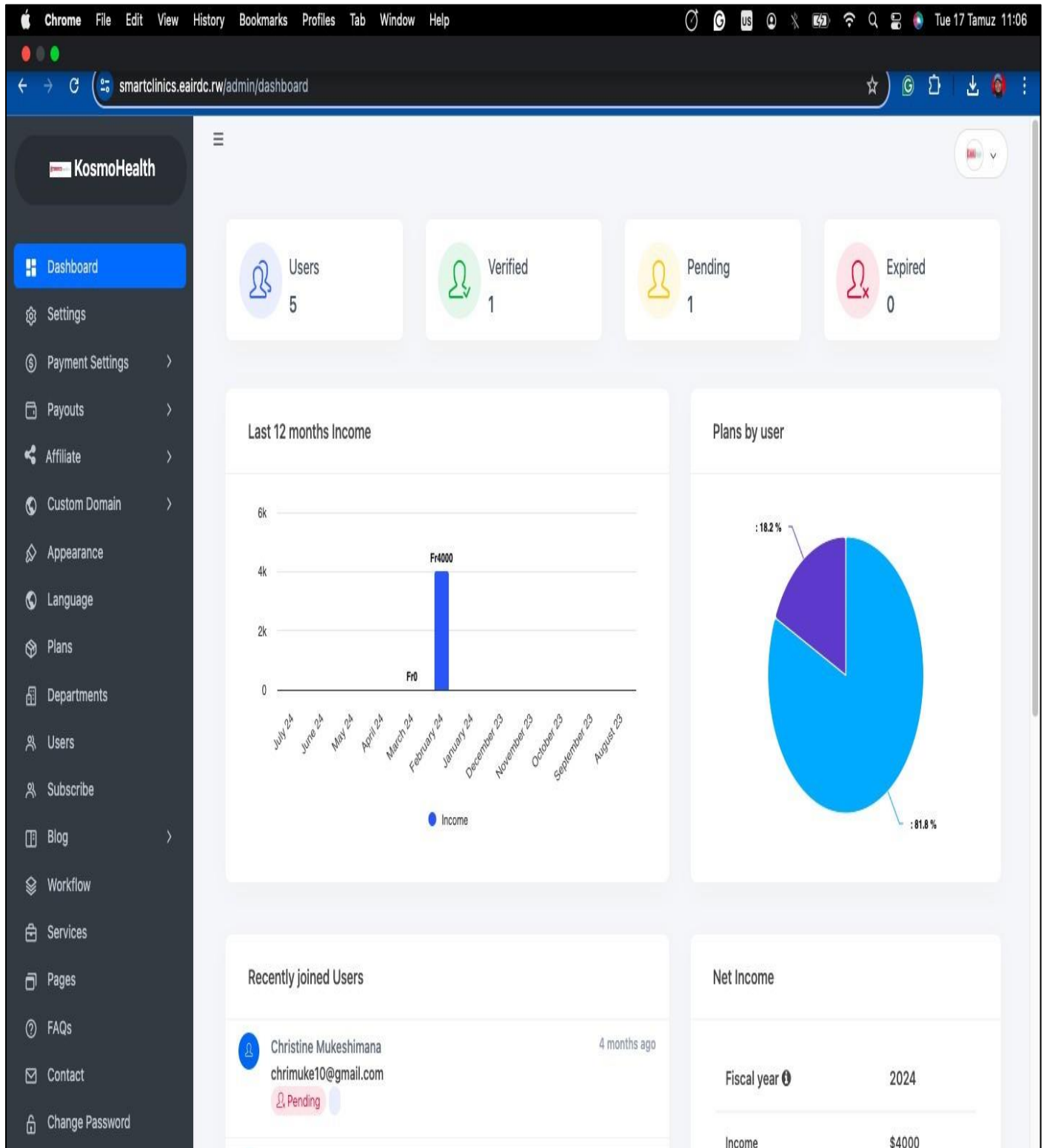


Fig 5: Online Doctor Consultation Management System Dashboard

### ➤ Search Patient Search on Dashboard

On the dashboard, doctors have the ability to search for patients by their name or by entering the patient ID, especially if the patient returns for a follow-up. The system then allows

the doctor to view patient details, add a new consultation, and proceed with the necessary steps. If a lab test is required, the doctor can request the test and forward it to the relevant department.

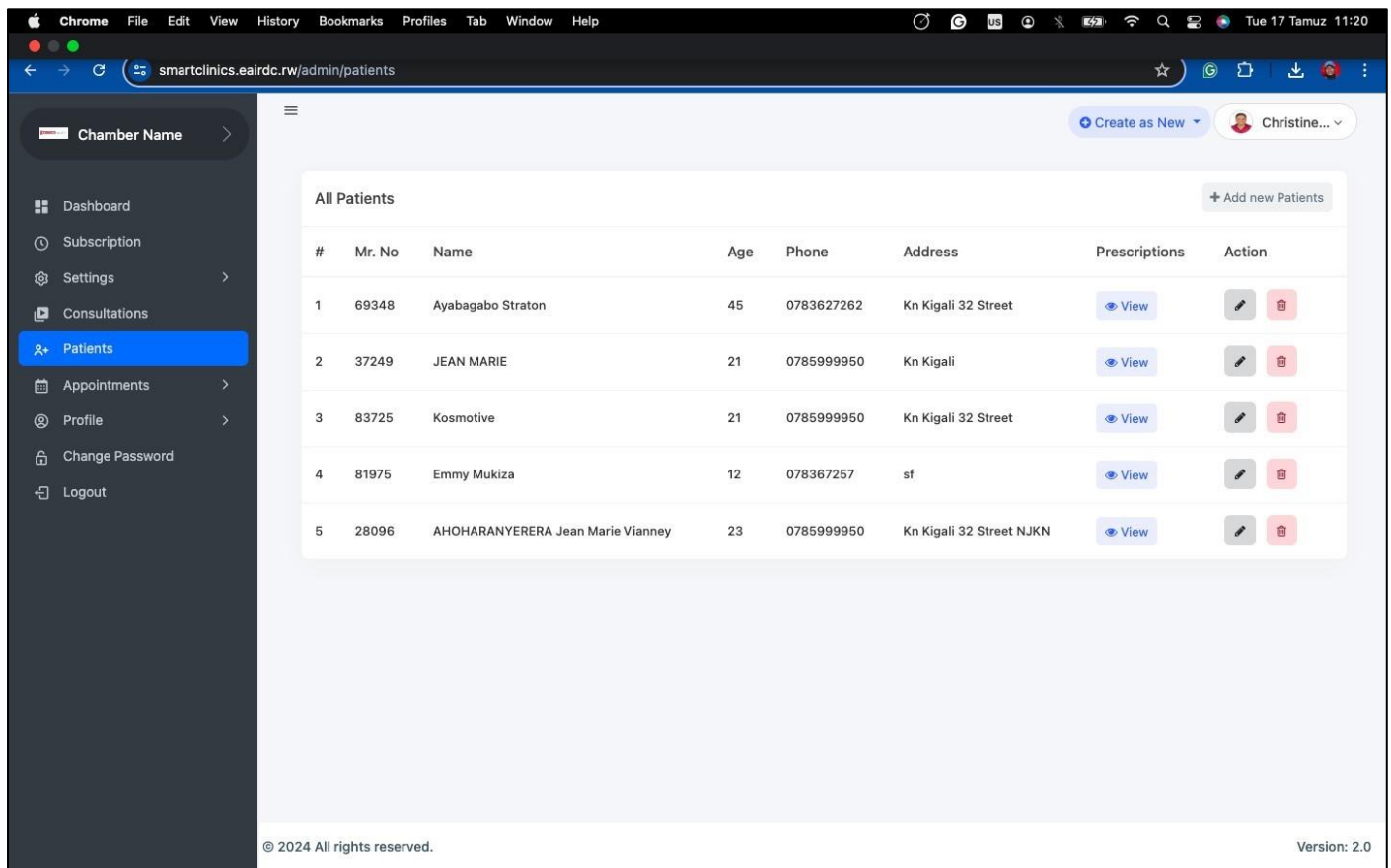


Fig 6: Login on the System

First of all, when you open the system, it requires to Login by putting the Username and password or to create account as Doctor as 2<sup>nd</sup> option.

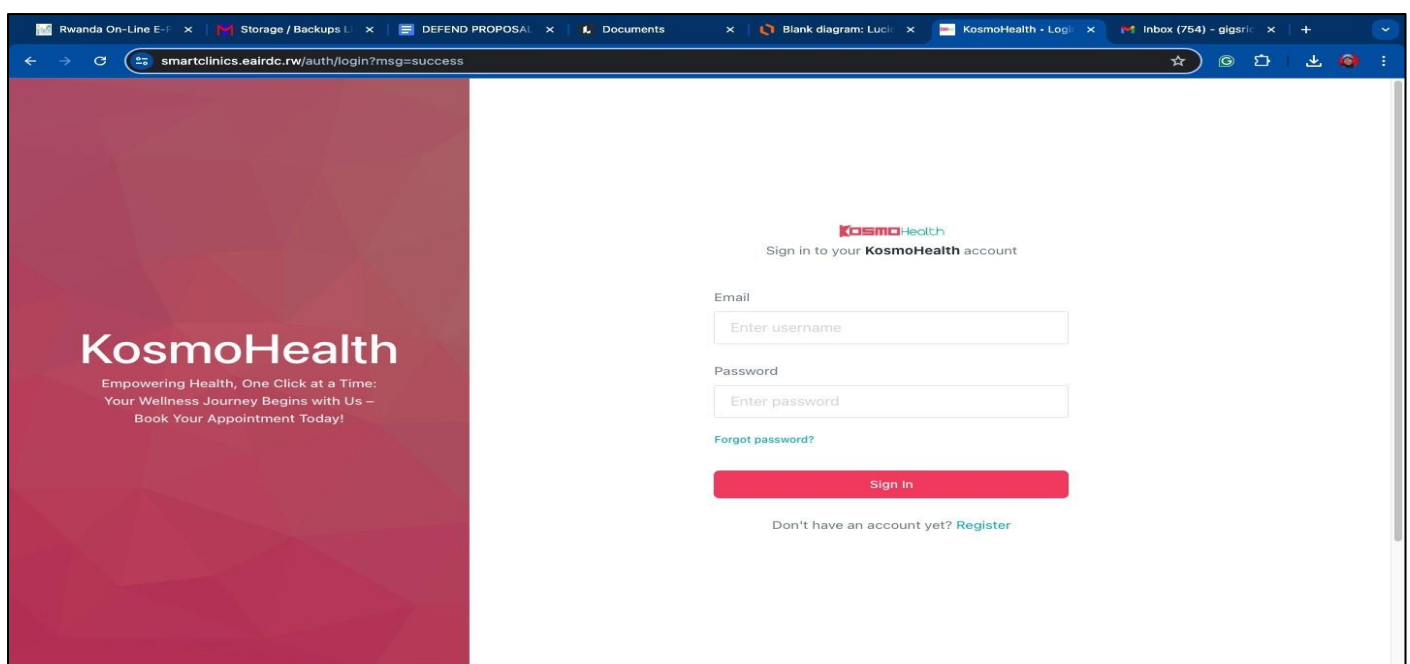


Fig 7: Login on The System

### ➤ Create Account as Doctor

The figure below shows us how to create account as Doctor on the system where it requires to fill the form by Their entities (DoctorID, DoctorUsername, DoctorEmail,

DoctorPassword) then after filling all click on Register to save the Doctor. After save the notification “Livehost says instead” will display automatically.

**KosmoHealth**  
Get started with a KosmoHealth account

Name  
Your full name

Email  
Your email address

Password  
Your password

☐ I have read and understood the [Terms and Conditions](#) and [Privacy Policy](#) of this site.

**Register**

Already have an account? [Sign In](#)

© 2024 All rights reserved. [Privacy](#) [Terms](#)

Fig 8: Create Account as Doctor

### ➤ List of the Doctors on the System

Here there is list of all doctors how registered on the system.

ID	Profile	Details	Verification	Chamber	Status	Date	Count
1		(in progress) University of Lay adventist of Kigali, 2023 Bachelor of Arts in Social Sciences Kigali Independent University, 2008 Diploma in Physiotherapy University of Rwanda, 2004 These academic achievements reflect my dedication to both social sciences and healthcare, providing me with a unique blend of skills and knowledge to address the diverse needs of the communities we serve.	Verify Documents Pending	KosmoHealth	pending Active	11 Mar 2024	103 I
2		Uwera Ndamukunda Olga Nadège uolganadege10@gmail.com Medical Doctor	Account Verified	KosmoHealth	verified Active	20 Feb 2024	125 I
3		IZERE Josiane josinizere10@gmail.com Medical Doctor Bachelor of Medicine and Surgery	Account Verified	Clinic	verified Active	20 Feb 2024	119 I
4		Yvonne UMURERWA yumurerwa10@gmail.com Registered nurse	Account Verified	KosmoHealth	verified Active	20 Feb 2024	125 I
5		Yvette NKURUNZIZA ynkurunziza10@gmail.com Medical Doctor bachelor's degree in nursing	Account Verified	KosmoHealth	verified Active	20 Feb 2024	219 I

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Fig 9: List of the Doctors on the System



### ➤ Dashboard of The System

The system's dashboard provides an overview of the hospital's homepage, showcasing the signed-in doctor's information along with features for managing both patients and doctors. On the left-hand side, various menu options are available, including the homepage, along with the user's username, role, and identification ID. The 'Appearance' section offers menus to manage doctors (add and edit), manage patients, view and modify consultation history, and

change the password. In the top-right corner, a logout button is available. Below, we will review some key menu functions, supported by a screenshot of the dashboard as seen after logging into Kibagabaga Hospital.

### ➤ Set Appointments Schedule

**Set Appointments Schedule** On this page doctor can set her availability using the system and you set Interval of meeting.

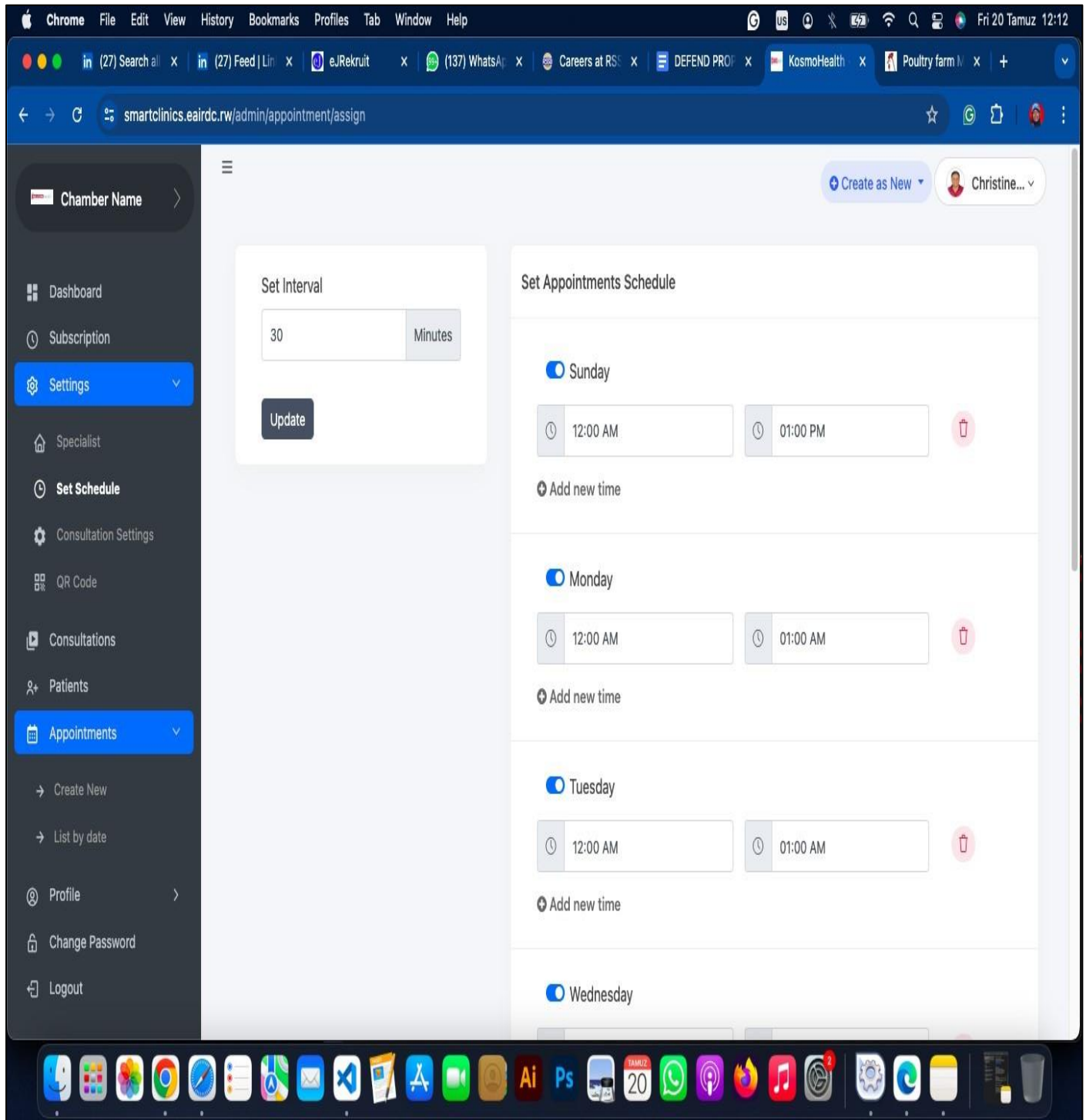


Fig 10: Set Appointments Schedule

➤ *Zoom Settings*

On Zoom Setting On this stage you can configure zoom api key which can help you to make online consultation on the system here you need to use zoom thirdpart using Zoom

Account id and Zoom Client Id and Zoom Client Secret Key if you finish to make it It can generate online consultation to all users who book appointment.

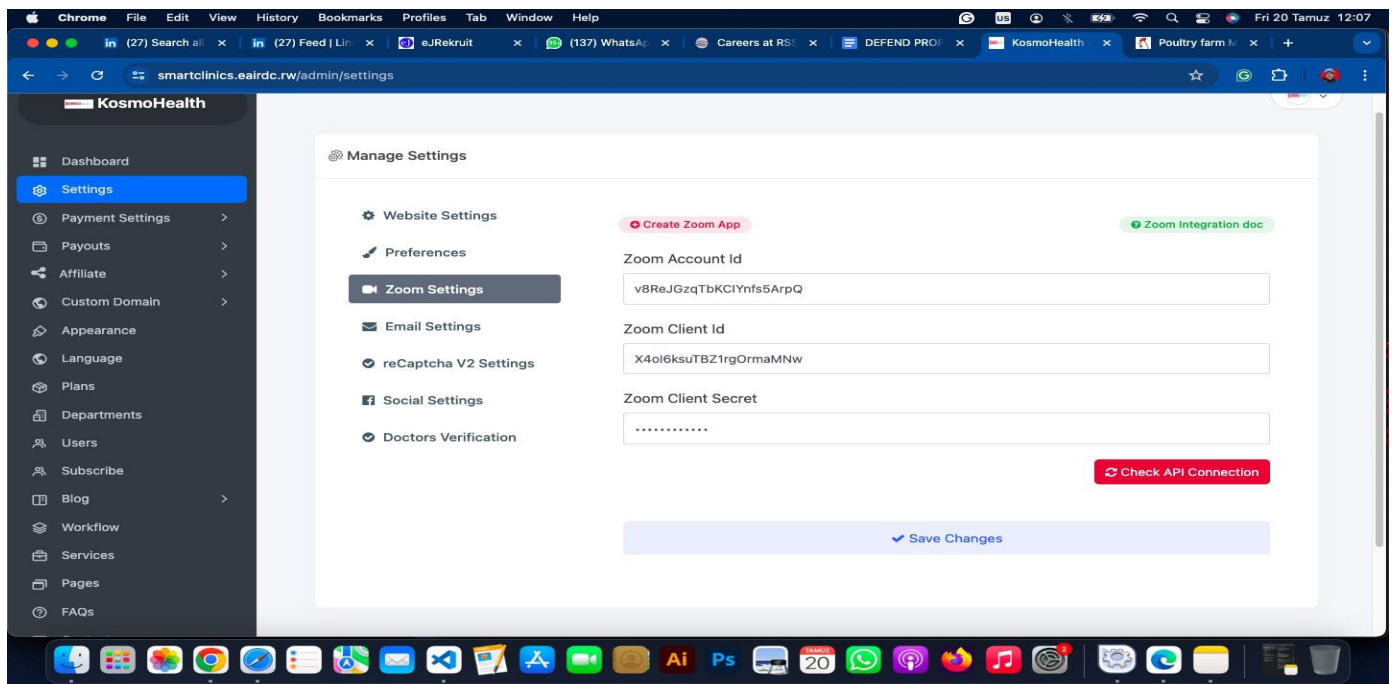


Fig 11: Zoom Setting

➤ *Email Configuration*

Email Configuration On this option admin can configure smtp inorder to receive notification to doctors and

patients here you can mail host, mail port, mail username and mail password.

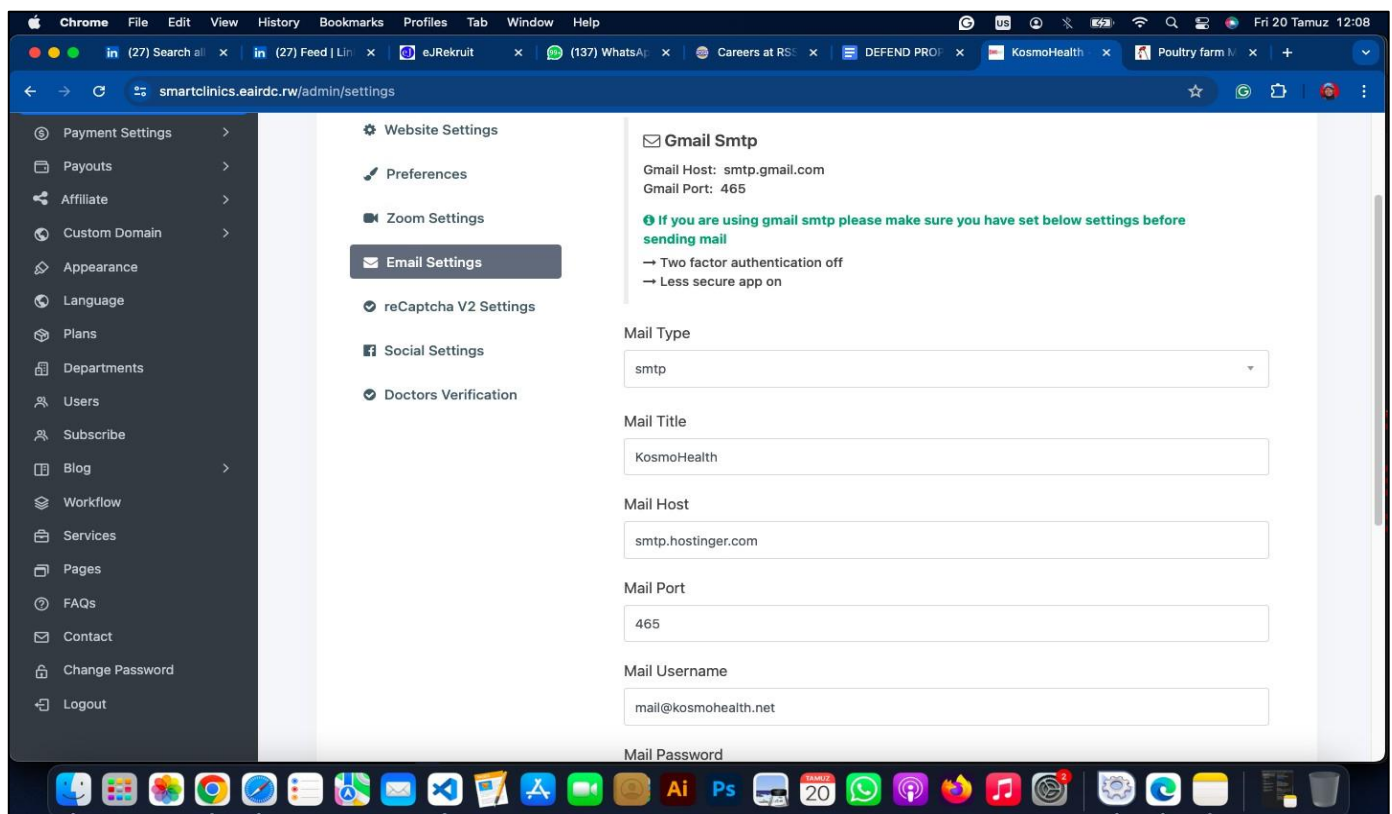


Fig 12: Email Configuration

### ➤ Consultation Settings

On this page doctors can set consultation setting where you can put consultation fee and you can activate video

meeting option when you have done you can add google meet invitation link and zoom meeting and you enable live consultation.

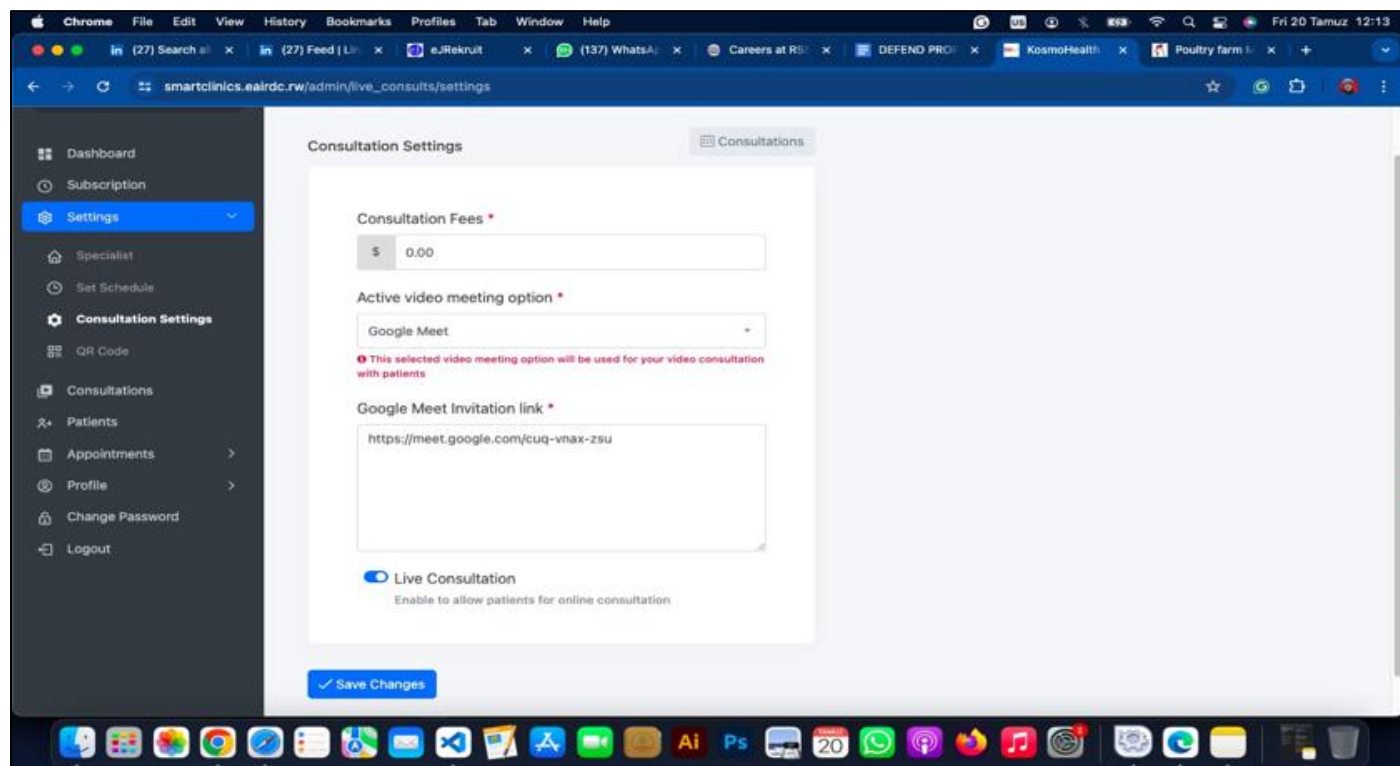


Fig 13: Consultation Settings

## V. CONCLUSIONS

The primary goal of this research was to create an enhanced model for the E-DOCTOR online consultation system aimed at improving client medical services. Following the project's implementation, we assure both the University of Kigali and the Rwandan Government that the data management system, which links three regional hospitals and facilitates the sharing of patient information with the CHUK General Hospital, enhances the quality of services offered to patients, particularly those treated within Kigali city. It can be concluded that the objectives of this project have been successfully achieved, as outlined below:

- To assess patients' perceptions of the quality of services provided in hospitals within Kigali City.
- To examine the influence of patient data on patient satisfaction levels.
- To design and develop a prototype for an online consultation management system.
- To foster improved communication between patients and healthcare providers through shared information within Kigali City Hospitals.

## RECOMMENDATIONS

In conclusion, it is essential to provide recommendations for the successful implementation of the Online Consultation Management System. Therefore, the following suggestions are put forward:

- The researcher advises that future studies on this topic should aim to expand the system to all health centers across the country, allowing patients from these areas to access their complete medical information.
- The researcher encourages the University of Kigali, particularly the Information Technology department, to explore projects related to the Internet of Things (IoT), which would enhance students' skills in both hardware and software.
- The researcher also recommends that the University of Kigali collaborate with health sector experts to incorporate valuable insights, ensuring that the project can be effectively implemented and utilized in the healthcare market, particularly within hospitals.
- Finally, the researcher urges the Republic of Rwanda, especially the Ministry of Health, to adopt and support the full implementation of this project, as it will be a significant asset to the healthcare system.

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