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AI-Based Booking Doctor Appointment for Holistic Health Care

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Abstract

The proposed system, AI-Based Booking Doctor Appointment for Holistic Health Care in Semenyih, Kajang, Selangor, Malaysia helps to tackle the difficulties faced by holistic health care. The problem statement focuses on existing manual booking doctor appointment processes, such as the manual creation of reports, the informal patient registration process, and appointment scheduling delays caused by diagnosis procedures. The integration of AI image enhancement helps to overcome booking appointment delays. To overcome these problem, three objectives have been formulated; to design the system using object-oriented approach, develop a web-based booking doctor appointment, to test the system using user acceptance testing. The waterfall model was applied. The combination of PHP and MySQL together with Convolutional Neural Network used to develop this project which enhance iris image for pre-diagnosis procedure. The project automates manual process, improving patient experience and efficiency of the holistic health care's administration efficiency.

1. Introduction

The Holistic Health Care prioritizes using holistic system treatment over segmental approaches which is common in modern medicine [1]. The integration of Iridology [2], Ganotherapy [3] and the Human Holistic System [4] for comprehensive treatment of chronic and high-risk cases such as Covid-19 and various types of cancers [5]. The Holistic Health Care is located in Semenyih, Kajang, Selangor, Malaysia.

The existing system of the holistic health care facing difficulties in managing patient acquisition, appointments delay due to diagnosis procedure and manual generation of report. To address these difficulties, AI-Based Booking Doctor Appointment for Holistic Health Care was developed. The informal patient acquisition process has been difficult in managing the appointment booking of patient for the Holistic Health Care. Moreover, diagnosis procedure causes delays in an appointment and often causes overlapping of schedules with other patients causes the quality of the services of the holistic health care. The receptionist faces challenges in tracking the performance of the holistic health care due to the existing system lacks the comprehensive details.

The AI-Based Booking Doctor Appointment for Holistic Health Care aims to develop and design a web- based AI-Based Booking Doctor Appointment for Holistic Health Care using object-oriented approach. The key users include the patient, doctor and receptionist. The system incorporates important modules such as manage advertisement module, login module, appointment module, manage supplement inventory module, manage prescription module, generate digital receipt module and generate data analytics module to deliver a comprehensive solution that encompasses various user roles and functionalities, ultimately improve the experience of a doctor, receptionist and patient. The significance of the AI-Based Booking Doctor Appointment for Holistic Health Care is booking doctor appointment progress and usage of AI to improve iris images for diagnoses procedure.

2. Literature Review

This section provides an overview of the healthcare industry, booking doctor appointment method and conducts a comparative analysis of the proposed system and the existing system.

2.1 HealthCare Industry

Conventional medicine [6] and unconventional medicine [7] are distinct approaches within the healthcare industry, each characterized by its own set of beliefs and methods. Conventional medicine refers to the evidence-based, widely accepted practices in the medical business. The field utilizes a range of treatment modalities, including pharmaceuticals. Surgical interventions, radiation therapy, and medical advancements, to effectively diagnose, cure, and potentially even prevent illness. In current healthcare system, conventional medicine is conducted according to recognized medical norms and procedures. Unconventional medicine, also known as complementary and alternative medicine (CAM), includes a wide array of treatment methods and approaches that fall outside the scope of standard medicine. These treatments are often not considered to be part of mainstream medical practice due to lack of empirical evidence confirming their effectiveness. Conversely, individuals who are interested in unconventional methods to enhance their well-being often search for alternative types of medical therapy. Ganotherapy and Iridology also known as complementary and alternative medicine is the method used by the holistic health care to provide holistic approach to health and wellness towards patient.

2.2 Booking Doctor Appointment Method

Booking a doctor's appointment [8] is the first and most important step towards obtaining personalized healthcare. The appointment entails setting aside a specific time and date to meet with a doctor to discuss a variety of health-related issues. This process establishes a vital link between individuals and the healthcare system, from routine check-ups for preventive care to addressing specific symptoms, obtaining medical advice and obtaining necessary prescription. Doctor appointments are usually schedule during the healthcare provider's regular office hours. The scheduling may vary depending on the urgency of the medical issue, the type of appointment required and the availability of both the patient and the doctor. Several methods are used in the booking process which is traditional appointment booking method [9] and web-based appointment booking system [10]. Traditional appointment booking methods include calling the doctor's office directly or physically visiting the clinic to schedule an appointment with the receptionist's assistance whereas web-based appointment booking system make use of technology to allow patients to book appointments online via the healthcare's providers website or specialized mobile app.

2.3 Convolutional Neural Network

In the fields of computer vision and image processing, convolutional neural networks have been at the center, changing the way we do difficult visual tasks. CNN were first made in the 1980s, but they became very popular in the 2010s, mostly because they worked so well in so many different situations [11]. These networks are based on how humans see things and can easily learn hierarchical features from data, so feature engineering doesn't have to be done by hand as much.

There are different types of architecture in CNN, but they all have some things in common. The architecture that used to enhance the iris image is Generative Adversarial Network (GAN). GAN consist of two neural networks which are the generator and the discriminator which compete against each other in a game-theoretical scenario. The generator learns to generate plausible data. The generated instances become more indistinguishable from the real data over time. The generator would learn to produce high-resolution and enhanced iris images from lower-quality inputs. The discriminator attempts to distinguish between the real data and the fake data produced by the generator. The job is to identify whether a given image is a real iris image or a synthetic one created by the generator.

The decision to use CNN using GAN architecture for enhance iris images is these networks are flexible and adept at acquiring hierarchical features. CNN save significant development time and resources by quickly adjusting to pre-trained models or optimizing pre-existing architectures. Effective blur reduction relies heavily on their innate capacity to recognize little elements in an image.

2.4 Comparison with the Existing System

In this section, three existing systems that are comparable to the system being developed will be analyzed. An analysis is conducted on the characteristics and operations of the current systems, followed by a comparison with the AI-Based Booking Doctor Appointment for Holistic Health Care that was developed. Three comparable existing systems that have been selected are WeHealth [12], BookDoc [13] and QMedAsia [14]. **Table 1** shows the comparison between existing system and developed system.

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Table 1 *Comparison between Existing Systems and Developed System*

Features/System	WeHealth(UM APP)	BookDoc	QMedAsia	AI-Based Booking Doctor Appointment for Holistic Health Care
Manage advertisement module	√	√	√	√
Login module	√	√	√	√
Appointment module	√	√	√	√
Manage supplement inventory module				√
Generate data analytics report module				√
Manage prescription module				√
Generate digital receipt module				√

3. Methodology

Waterfall model is the methodology selected for the proposed system. Waterfall model is systematically straight approach particularly well-suited for AI-Based Booking Doctor Appointment for Holistic Health Care with well-defined requirements and a clear end goal. The waterfall model easy to manage as each phase is to implement and complete without overlapping with other phases. This method consists of six phases in which each phase consists of several task to achieve such as requirement analysis, system design, implementation, testing, deployment and maintenance. Figure 1 shows the Waterfall model. The project starts on 8/10/2023 and end 27/6/2024.

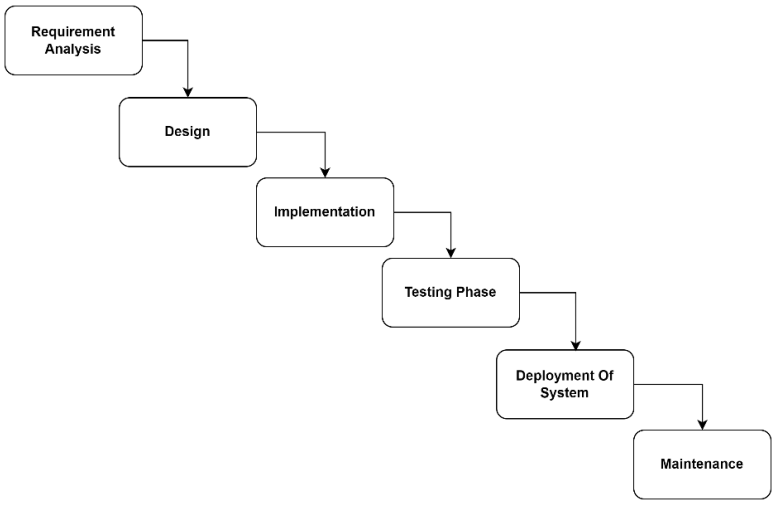

Fig. 1 *System Development Life Cycle (SDLC)*

4. Analysis And Design

The system analysis and design of the study are presented such as functional requirements (7 modules), non-functional requirements such as performance, reliability, security and usability, user requirement analysis which

are under system requirements analysis section. In addition, the use case diagram can help to define the scope and context whereas class diagram helps to define the refine and implement the functional requirements of the proposed system. Moreover, the architecture and interface design are discussed in detail.

4.1 Use Case Diagram

The use case diagram of the AI-Based Booking Doctor Appointment for Holistic Health Care is shown in the Figure 2. The users are patient, doctor and receptionist. The system allows patient to register, login, manage their profile, book appointment and view advertisement whereas the doctor able to login, manage profile, view patient's current list and upcoming list for prescription and diagnosis procedure. The receptionist able to login, manage appointment, manage supplement inventory, generate analytics report and manage advertisement.

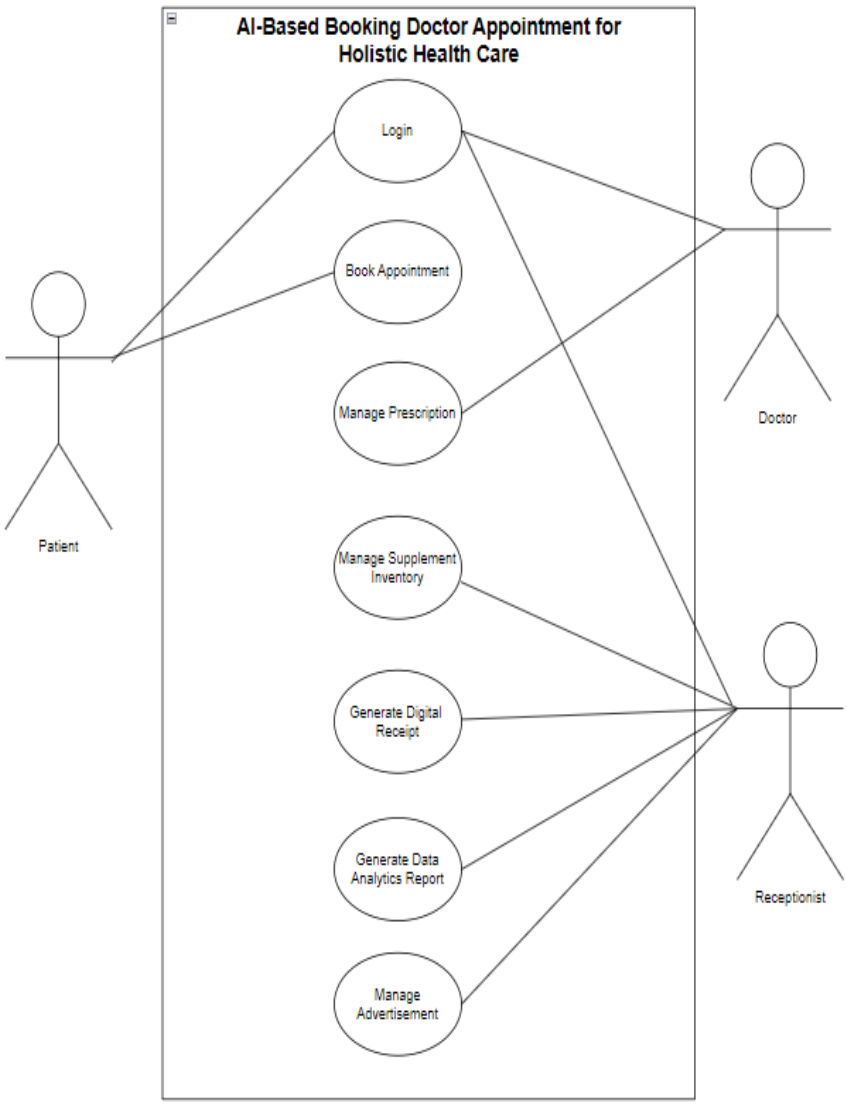

Fig. 2 *Use Case Diagram*

4.2 Sequence Diagram

The AI-Based Booking Doctor Appointment for Holistic Health Care has a sequence diagram that shows the interactions between different components in a dynamic and sequential manner while a patient is being scheduled for an appointment. The diagram provides a step-by-step overview of the entire system workflow by graphically representing the messages that are exchanged between actors and system elements. The booking system, database, and users are the entities that are symbolized by lifelines, which are vertical dashed lines. Messages, represented by arrows, show how these entities communicate with one another and highlight the dependencies and sequence of events. Combining fragments to represent decision points and conditional logic

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enables the representation of alternative pathways contingent on certain conditions. Figure 3 shows the sequence diagram of book appointment for AI-Based Booking Doctor Appointment for Holistic Health Care.

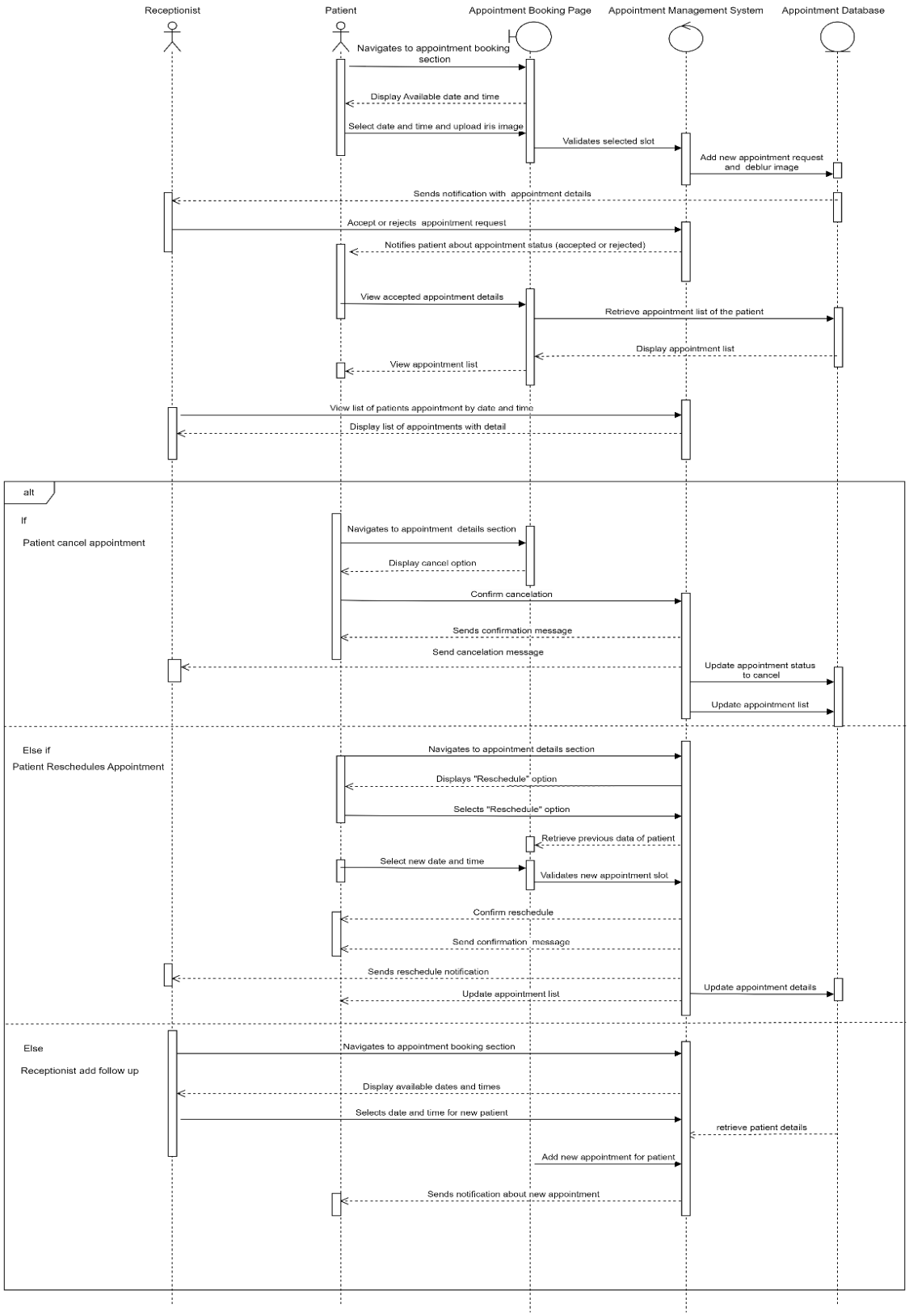

Fig. 3 *Sequence diagram of book appointment*

4.3 Class Diagram

The class diagram assists in the development progress of the system. The class diagram shows the name, properties and relationship of the class. Figure 4 shows a class diagram that employs object-oriented techniques. As a result, class diagrams are critical for the system development. The class diagram describes the AI-Based Booking Doctor Appointment for Holistic Health care's class name, attribute list, function list and relationship.

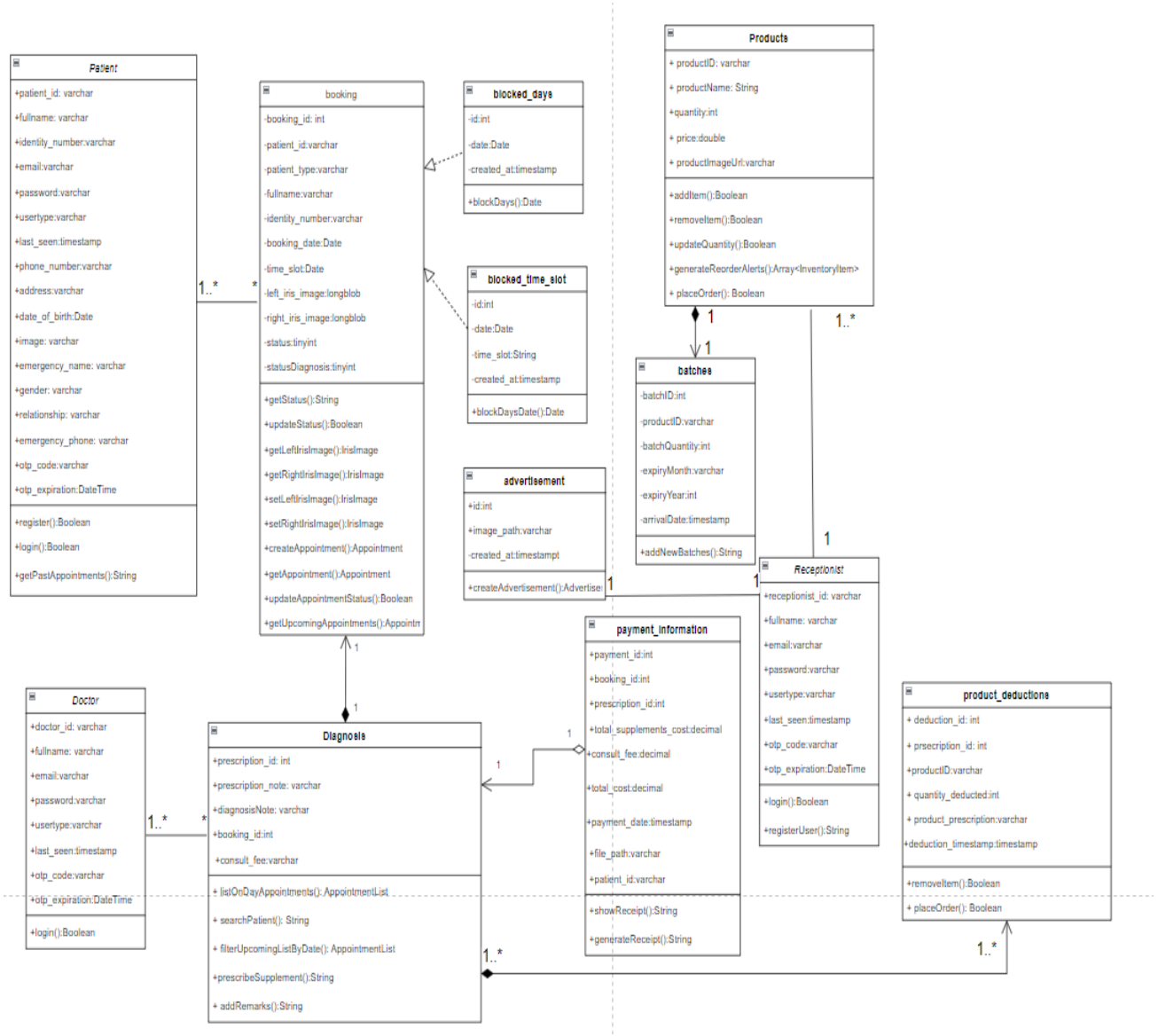

Fig. 4 *Class Diagram*

4.4 Architecture

The AI-Based Booking Doctor Appointment for Holistic Health Care utilizes the Model-View-Controller (MVC) architecture. The system divides into three components which is the Model for data management and business logic. In this proposed system, the model booking-doctor-appointment. Next, the View which is user interface of the AI-Based Booking Doctor Appointment for Holistic Health Care. The Controller is for managing interactions between the Model and the View as in Figure 5 which represents the API of the system. The MVC architecture ensures effective data management, responsive user interface and supports system extensibility, providing a structured and reliable foundation for the holistic health care.

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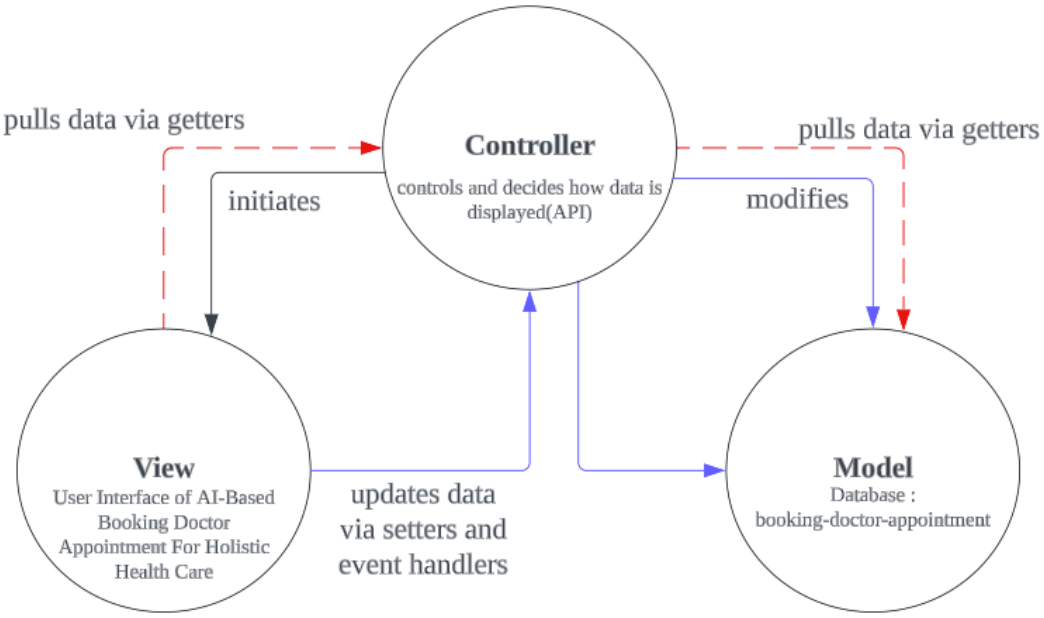

Fig. 5 *Model View Controller*

4.5 Interface Design

User interface design intended to give a basic understanding of the implementation and working of each module that is used throughout the system. User interface design often involves wireframing or prototyping. display the user interfaces of the system. Doctor, receptionist and patient login to the system by accessing the login page and if the patient is a new user of the system, the user have to register their information. The users are directed to their respective dashboard. In the booking doctor appointment section as in Figure 6 the patients have an option as myself and others. When the patients click on myself, patient name and identity number filled out automatically whereas the appointment which booked for other than account user, the patient's name and identity number have to fill-up manually. According to the patient's own choice and the patient have to choose a date and time for their booking doctor appointment. The time slot will be from 9.00AM until 5.00PM by giving each slot will complete in 20 minutes. Moreover, as the doctor for a diagnose procedure a patient's iris information is needed. Thus, before completing the booking the patient has to upload their iris image for a preview procedure for the doctor as the doctor can do pre-diagnosis as shown in Figure 7. Once the patient booked a successful pop-up message will appear as shown in Figure 8 where when patients click okay, the patient can view their appointment status (Booked, Cancel, Rejected) as shown in Figure 9. The booked appointment slot either accept or reject by the receptionist. If the booking confirmed, the patient has an option to either accept or reject the booking slot at the view status.

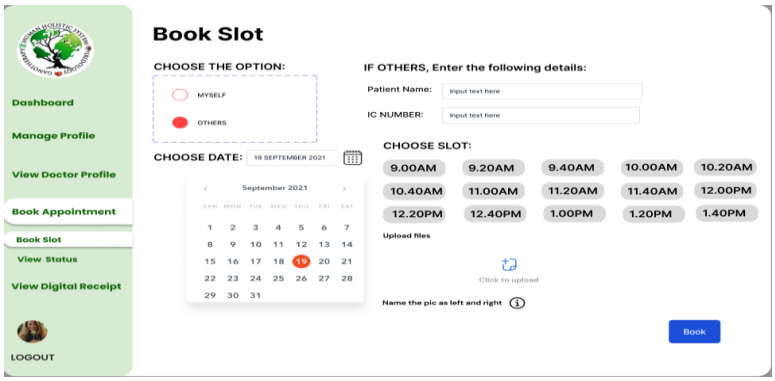

Fig. 6 *Interface of Book Slot for Appointment*

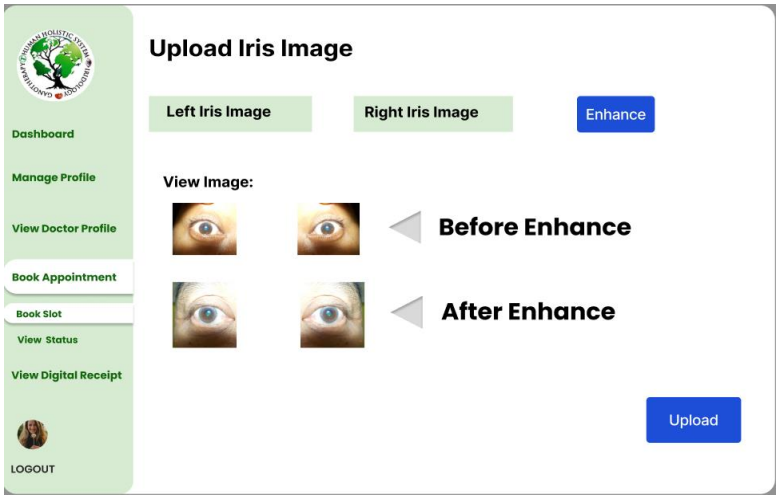

Fig. 7 *Interface of AI image enhance for pre-diagnosis*

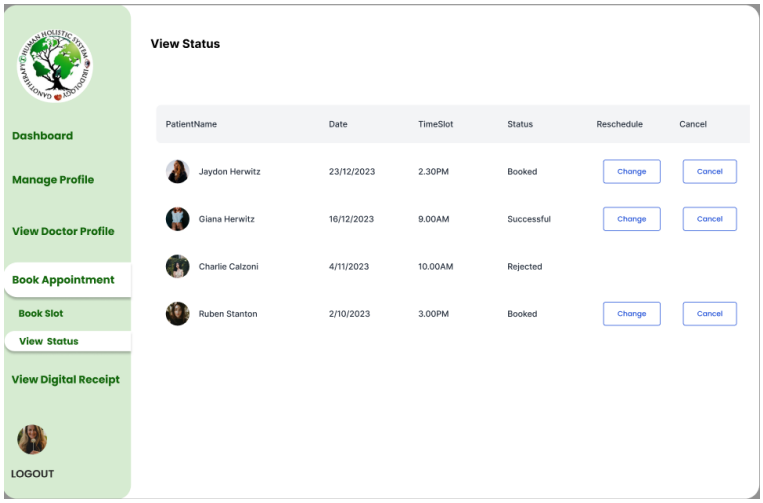

Fig. 8 *Interface of view appointment status*

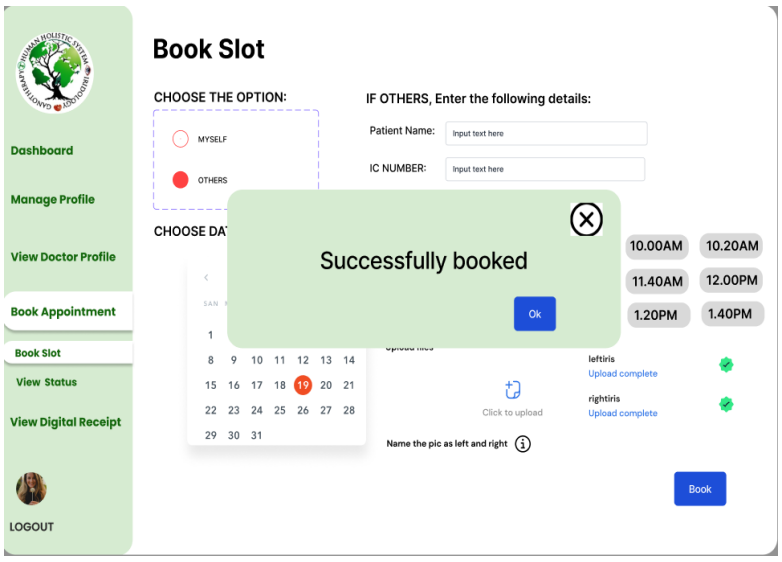

Fig. 9 *Interface of pop-up book success message*

5. Implementation and Testing

This design used to create AI-Based Booking Doctor Appointment for Holistic Health Care implemented in the implementation phase. In section 5.1 the system development discusses about how the system was implemented using various technologies and the integration of the AI image enhancement model in the web-based booking doctor appointment. Section 5.2 divided into two parts of the section where one discusses about system testing and another one is about user acceptance testing.

5.1 System Development

The AI-Based Booking Doctor Appointment for Holistic Health Care, began immediately after finishing the analysis design phase. The system was developed using a combination of tools and technologies including VSCODE, XAMPP, Django Framework, and Google Collab. The application employs coding languages like HTML, CSS, Javascript, PHP, and Python. XAMPP includes the required server and database components, with Visual Studio Code acting as the integrated development environment for creating the web-based system. Google Collab is a cloud computing platform that assists in training artificial intelligence models using cloud technology. The Google Collab is utilized for specific functions, so a free version is used for training and testing models because of financial restrictions.After the model was trained and tested, it was incorporated into the website using the Django framework. Google Chrome was utilized as the primary browser for observing the code's results.

5.1.1 Software used for development

In this section, there is a brief explain some of the technologies used for system development. In terms of technologies used was VSCODE, XAMPP, Django Framework and Google Collab and the programming used was HTML, CSS, Javascript, PHP and python.

VSCODE is a lightweight but powerful code editor that's supports many languages, extensions, and platform. Visual Studio Code is a code editor redefined and optimized for building and debugging modern web and cloud applications. To create the web-based system, first the folder named booking-doctor-appointment is created in the laptop and later we able to start to write the code by naming the file such index.php where the HTML, CSS, Javascript and PHP code was able to write. Figure 10 shows the example on how the VSCODE will look alike.

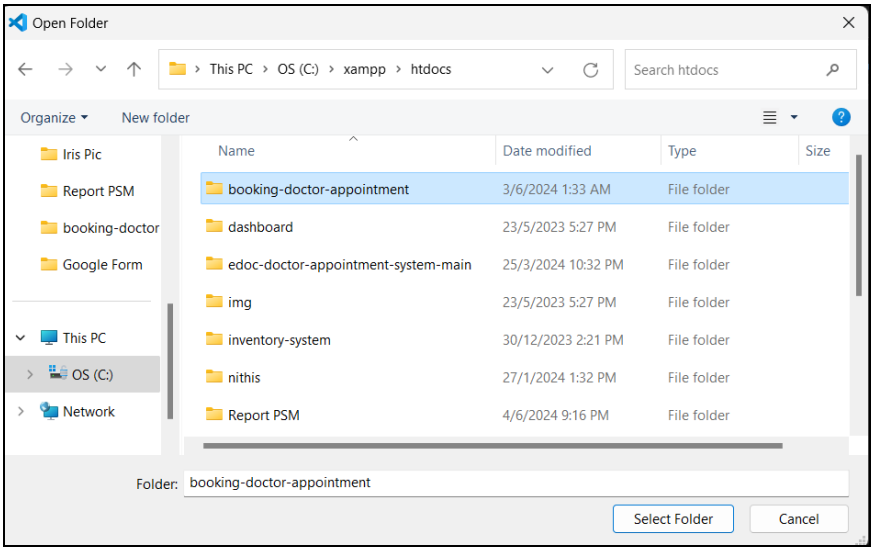

Fig. 10 *Folder of saved coding files*

The output of these file is viewed through the Google Chrome web browser, while server-side files are processed using software provided by the XAMPP distributor. XAMPP is a software distributor that includes all the essential modules required to set up a server and execute sever-side coding. In this project, the Apache server and MySQL database, provided by the XAMPP distributor, were utilized. Figure 11 and 12 illustrate the user interface of XAMPP and the MySQL database respectively Morever a database file created database,php in the booking-doctor-appointment folder in order to have an established connection with the MySQL as shown is Figure 13.

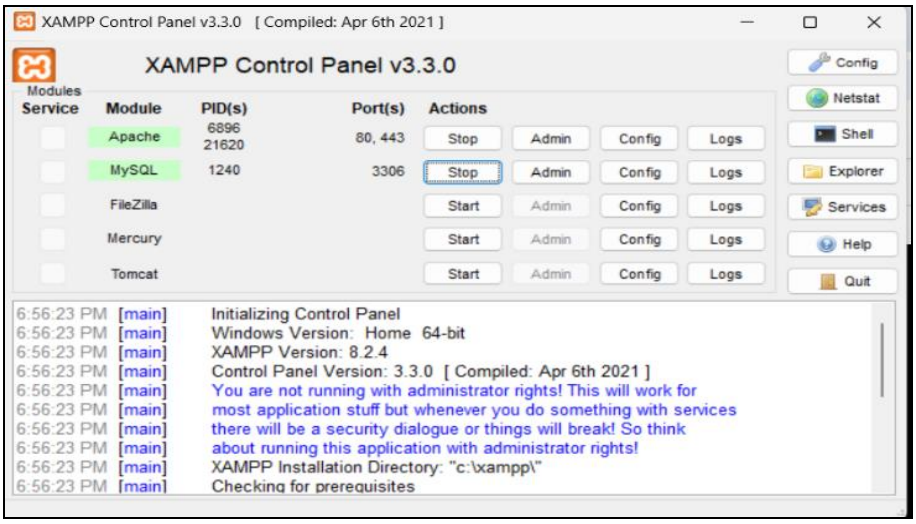

Fig. 11 *Interface of XAMPP control panel*

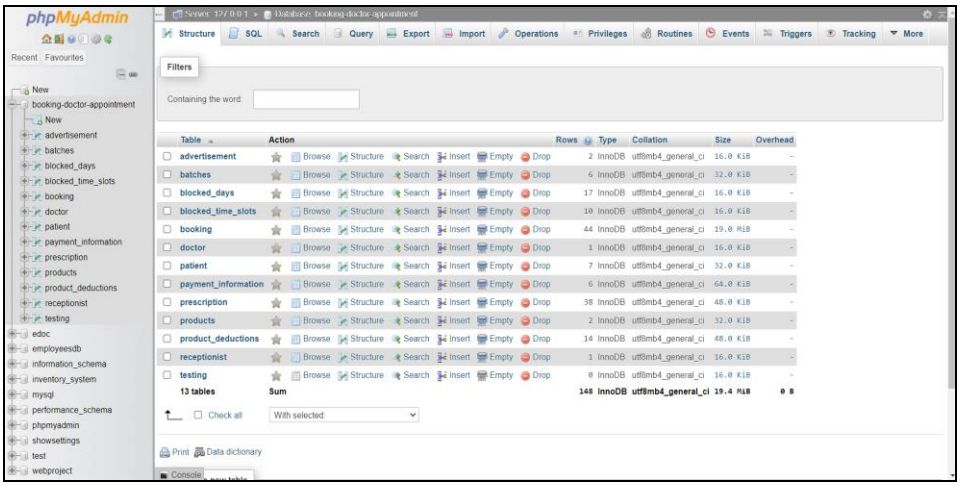

Fig. 12 *User interface of database MYSQL*

Fig. 13 *MYSQL database.php via VSCODE*

Google Collab is a free Jupyter notebook environment that runs in the web browser. This means Google Collab can use to write and execute code without needing to install any software and provides access to powerful computing resources like GPUs for machine learning task and premium features are available for premium subscriptions user. In order to train the artificial intelligence model, the script of the model which wrote using python is saved at google drive as shown in Figure 14 and during the training period the google drive is mounted in order to successfully train and test model as shown in Figure 15.

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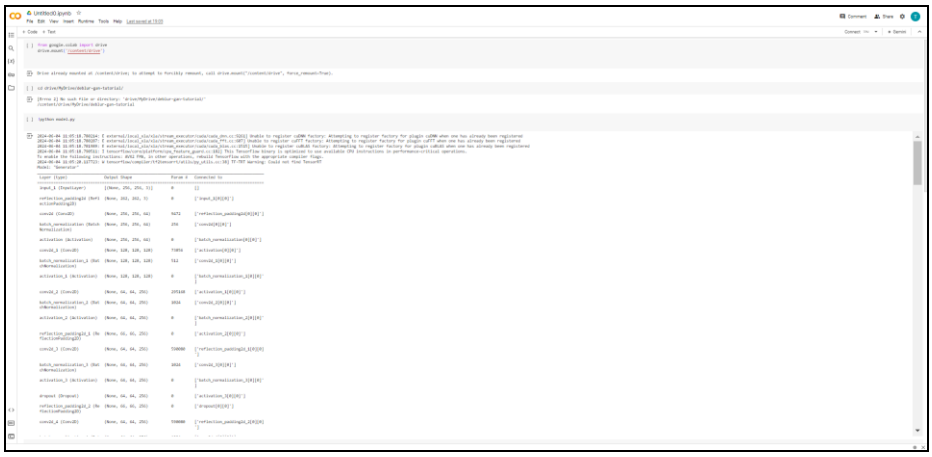

Fig. 14 *Interface of Google Collab*

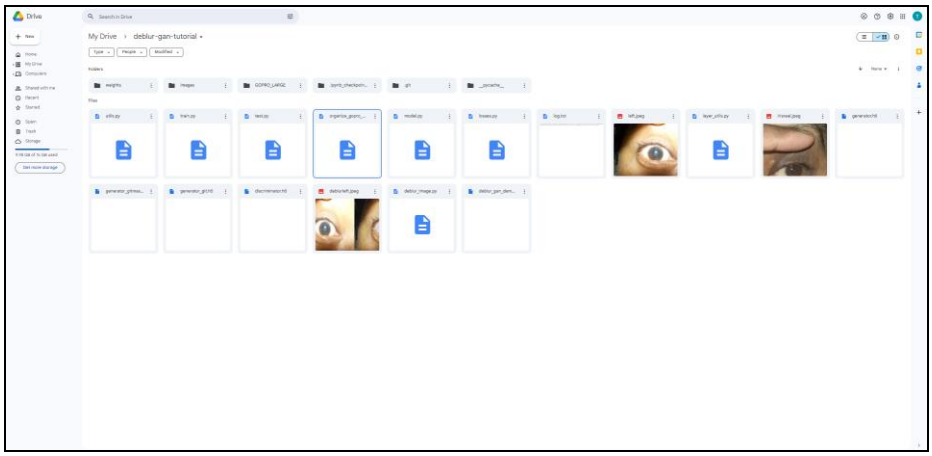

Fig. 15 *Interface of Google Drive*

Lastly, once the process of model completed a Django framework used to deploy the model in the website. The process of creating the folder was same as the procedure of the PHP file except the Django framework was installed through the terminal of VSCODE as shown in Figure 16 once the scripts was activated. Google Chrome is a well-liked web-browser that is created by Google and is well-known for being widely used to access and view web-based system because the compatible of web technologies like HTML, CSS, and Javascript.

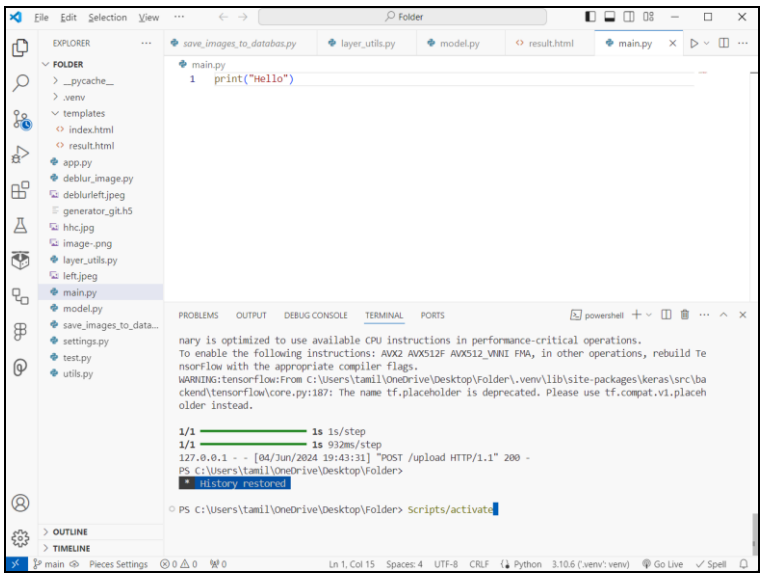

Fig. 16 *Django framework used through VSCODE*

5.1.2 Functional Modules

In this section, the proposed module focused on the development of the functional modules in the AI-Based Booking Doctor Appointment for Holistic Health Care. The system is built in sections where each part is focusing on a specific function. These modules likely handle task like appointment scheduling based on user preferences and doctor availability. To understand how these modules work, the system's code logic which involves the programming languages along with the screenshots of the user interface are presented which helps to visually demonstrate how users interact with the system of the booking appointments. Figure 17, 18, 19 and 20 shows the implementation of the appointment module where the patient have to go through several process in order to complete booking appointment whereas Figure 21 shows the code segment of upload iris image.

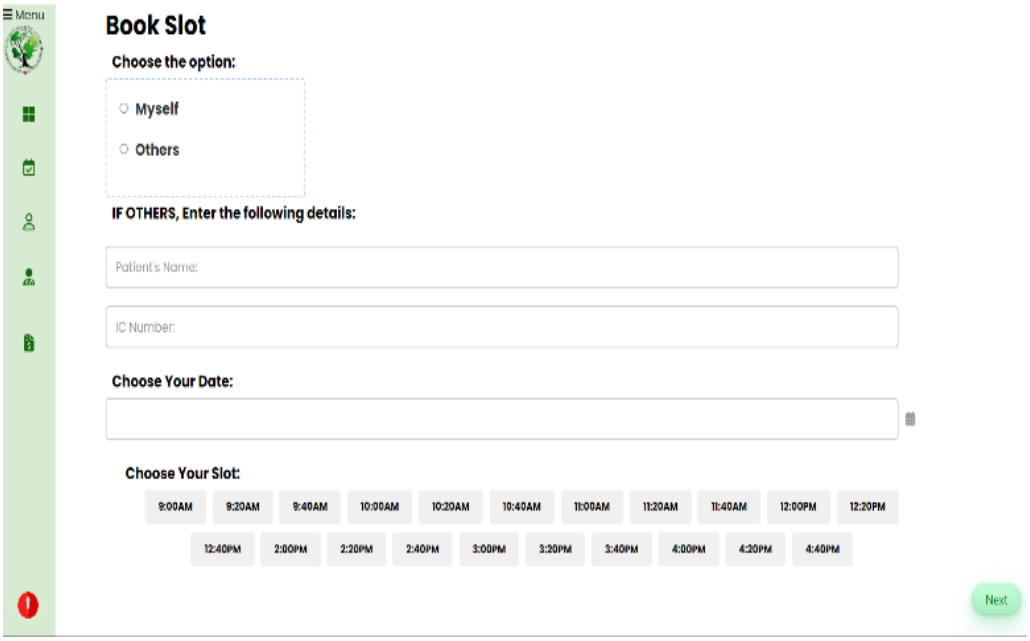

Fig. 17 *Interface of book doctor appointment*

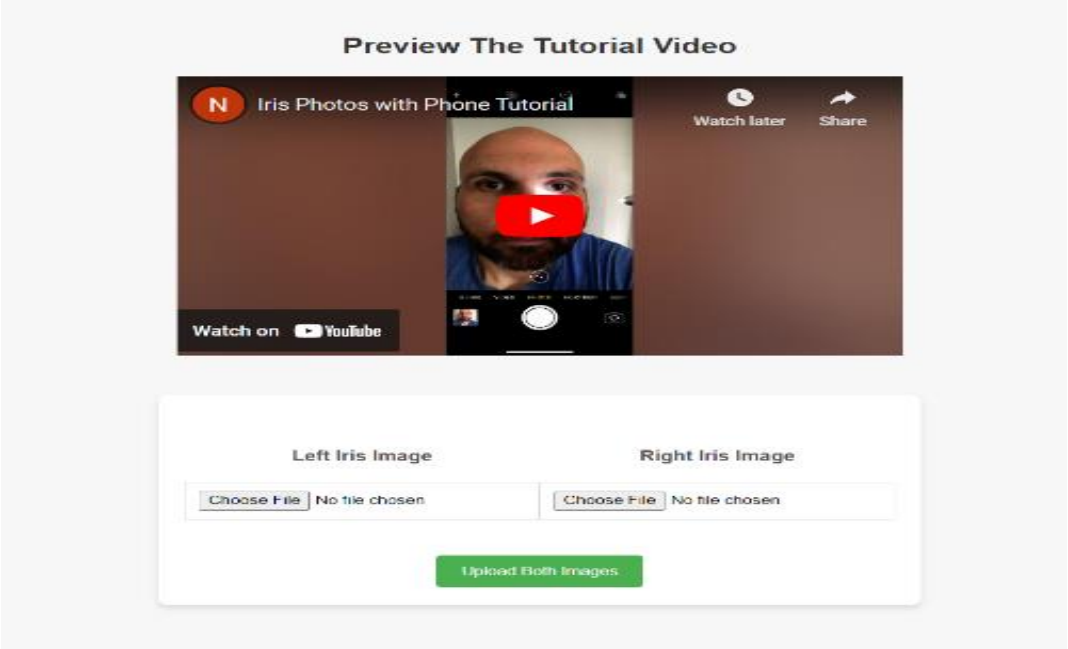

Fig. 18 *Interface of upload iris image*

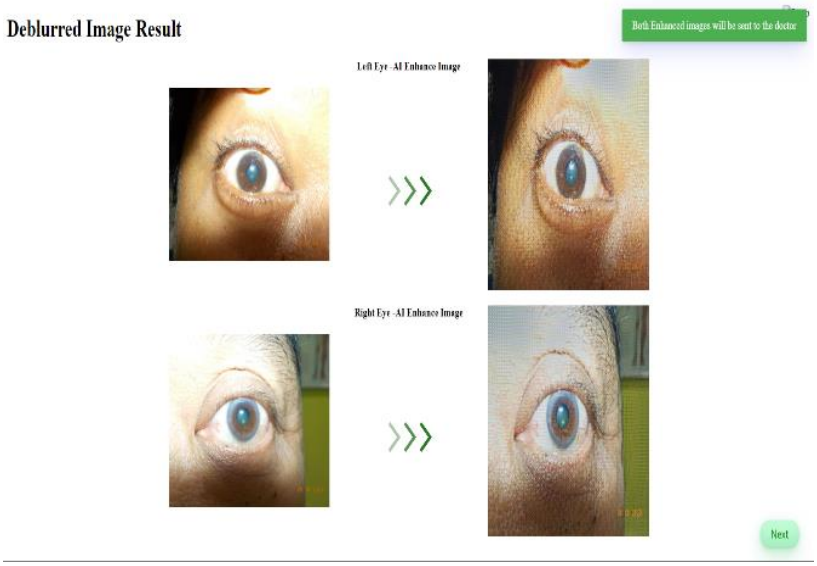

Fig. 19 *Interface of enhanced images*

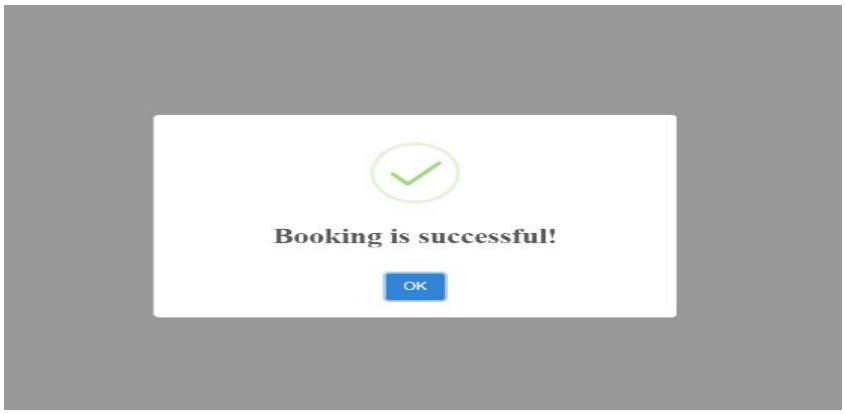

Fig. 20 *Interface of show pop-up book successful*

```
Pieces: Comment | Pieces: Explain
def deblur_image(image):
    processed_image = preprocess_image(image)
    g = generator_model()
    g.load_weights('generator_git.h5')
    generated_images = g.predict(np.array([processed_image]))
    generated_image = deprocess_image(generated_images[0])
    return generated_image

@app.route('/')
Pieces: Comment | Pieces: Explain
def index():
    patient_id = request.args.get('patient_id')
    booking_id = request.args.get('booking_id')
    return render_template('index.html', patient_id=patient_id, booking_id=booking_id)

@app.route('/upload', methods=['POST'])
Pieces: Comment | Pieces: Explain
def upload():
    patient_id = request.form.get('patient_id')
    booking_id = request.form.get('booking_id')
    left_iris_file = request.files.get('leftIris')
    right_iris_file = request.files.get('rightIris')

    if not left_iris_file or not right_iris_file:
        return redirect(url_for('index', patient_id=patient_id))

    left_img = Image.open(BytesIO(left_iris_file.read()))
    right_img = Image.open(BytesIO(right_iris_file.read()))
    left_deblurred_img = deblur_image(left_img)
    right_deblurred_img = deblur_image(right_img)
```

Fig. 21 *Implementation code of upload iris image*

In the doctor appointment booking process, the receptionist plays a crucial role in managing the scheduling of appointments. Once a patient requests an appointment, the receptionist's responsibility to either accept or decline the request. If the receptionist accepts the appointment request, the patient is officially scheduled for that time slot. However, if there are any conflicts or issues, the receptionist can decline the request, ensuring that the scheduling system remains accurate and efficient. This process is illustrated in Figure 22 and Figure 23, where the steps for accepting and declining appointment requests are depicted in detail.

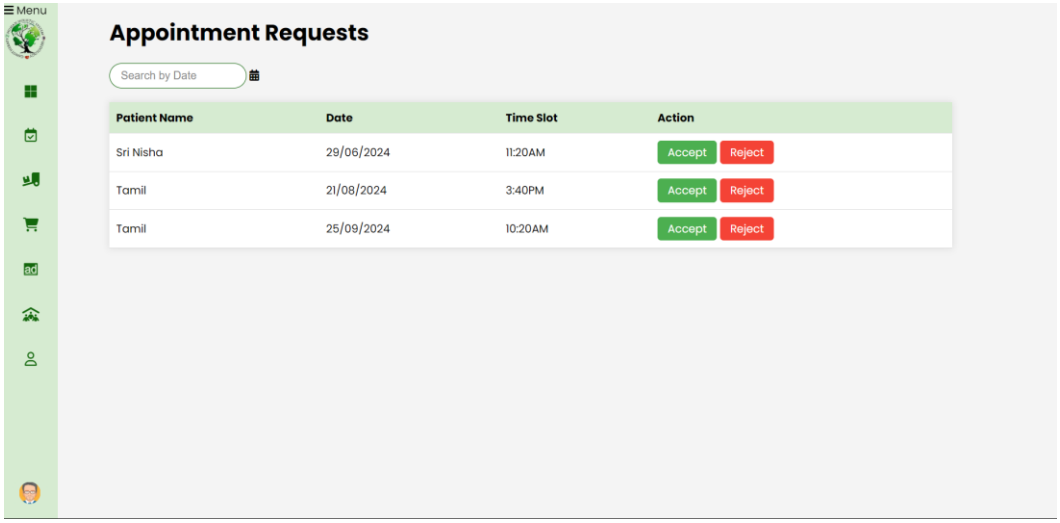

Fig. 22 *Interface of accept or reject receptionist page*

```
// Initialize Flatpickr for date selection
Flatpickr(searchDateInput, {
    altInput: true,
    altFormat: "d/m/Y",
    dateFormat: "d/m/Y",
    onChange: async (selectedDates, dateStr, instance) => {
        const selectedDate = selectedDates.length > 0 ? selectedDates[0].toLocaleDateString('en-GB') : null;
        const rows = tableBody.querySelectorAll('tr');
        let appointmentsFound = false;

        if (!selectedDate) {
            // If no date is selected, fetch all appointments
            fetchAppointments();
        } else {
            // Filter appointments by selected date
            rows.forEach(row => {
                const dateCell = row.querySelector('td:nth-child(2)');
                if (dateCell.textContent.trim() !== selectedDate) {
                    row.style.display = 'none';
                } else {
                    row.style.display = '';
                    appointmentsFound = true;
                }
            });

            const noAppointmentsMessage = tableBody.querySelector('.no-appointments-message');
            if (!appointmentsFound) {
                if (!noAppointmentsMessage) {
                    const noAppointmentsRow = document.createElement('tr');
                    noAppointmentsRow.classList.add('no-appointments-message');
                    noAppointmentsRow.innerHTML = `
                        <td colspan="4">No appointments for ${selectedDate}</td>
                    `;
                    tableBody.appendChild(noAppointmentsRow);
                }
            } else {
                if (noAppointmentsMessage) {
                    noAppointmentsMessage.remove();
```

Fig. 23 *Implementation of accept or reject receptionist page*

Once the receptionist accepts a patient's appointment request, they can easily trace and view the list of upcoming appointments. This capability helps the receptionist stay up-to-date with the patient's scheduled visits, thereby enhancing the efficiency of the appointment booking process in holistic healthcare. Additionally, the receptionist can block specific days or time slots when the doctor is unavailable for diagnosis procedures. Implementing features like calendar blocking not only improves the quality of service but also automates the appointment scheduling process, further contributing to the effectiveness of holistic healthcare as shown in Figure 24,25,26 and 27.

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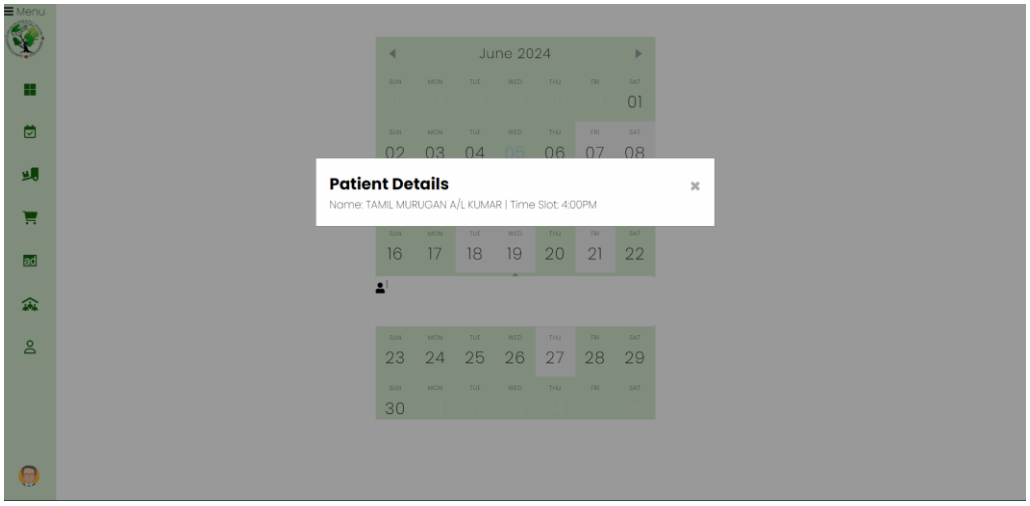

Fig. 24 *Interface of view patient list*

```
var bookingDate = day.format('YYYY-MM-DD');
var self = this;
var xhr = new XMLHttpRequest();
xhr.onreadystatechange = function() {
  if (xhr.readyState === XMLHttpRequest.DONE) {
    if (xhr.status === 200) {
      var bookingDetails = JSON.parse(xhr.responseText);
      if (bookingDetails.length > 0) {
        var popupTitle = document.getElementById('popup-title');
        popupTitle.innerText = 'Patient Details';

        var popupContent = document.getElementById('popup-details');
        popupContent.innerHTML = '';

        bookingDetails.forEach(function(booking) {
          var patientName = booking.fullname;
          var timeSlot = booking.time_slot;
          var details = document.createElement('p');
          details.innerText = 'Name: ' + patientName + ' | Time Slot: ' + timeSlot;
          popupContent.appendChild(details);
        });

        var popup = document.getElementById('popup');
        popup.style.display = 'block';

        var popupClose = document.getElementById('popup-close');
        popupClose.addEventListener('click', function() {
          popup.style.display = 'none';
        });
      }
    } else {
      console.error('Error fetching booking details');
    }
```

Fig. 25 *Implementation of view patient list*

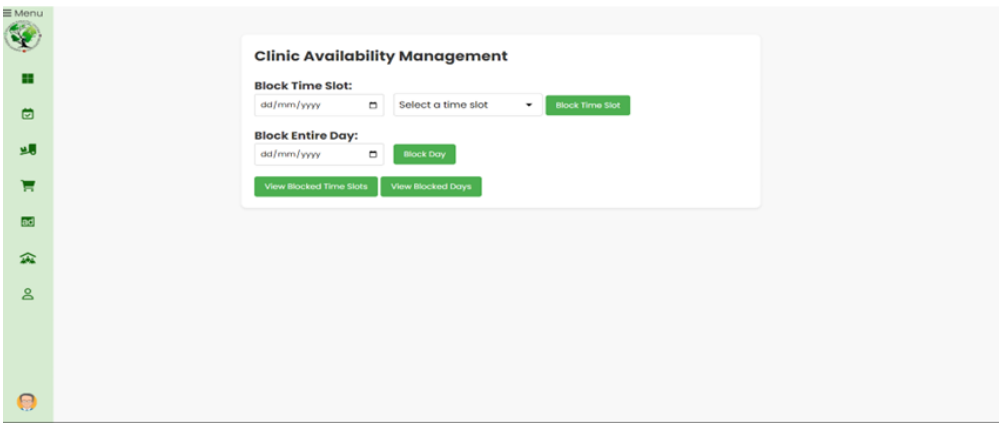

Fig. 26 *Interface of manage appointment calendar*

```php
// Function to retrieve blocked days from the database
function getBlockedDays() {
    global $conn;

    // Initialize an empty array to store blocked days
    $blockedDays = [];

    // Get the current date
    $currentDate = date('Y-m-d');

    // Prepare and execute SQL query to select blocked days for current and future dates
    $sql = "SELECT date FROM blocked_days WHERE date >= ?";
    $stmt = $conn->prepare($sql);
    $stmt->bind_param("s", $currentDate);
    $stmt->execute();
    $result = $stmt->get_result();

    // Check if the query was successful
    if ($result) {
        // Fetch associative array of blocked days
        while ($row = $result->fetch_assoc()) {
            $date = $row['date'];
            $blockedDays[] = $date;
        }
        // Free the result set
        $result->free();
    }

    // Return the array of blocked days
    return $blockedDays;
}
```

Fig. 27 *Implementation of manage appointment calendar*

5.2 Testing

Testing is a phase of the software development process because testing makes sure that the system works the way supposed to. This phase ensures that the system aren't any errors before release the system to the users. In this section, several kinds of testing starting with the requirement traceability matrix, system testing, and finally, user acceptance testing.

5.2.1 System Test

System testing for the Login and User Module is focused on validating the core functionalities that allow users to access and manage their accounts. This module is critical because it provides secure and seamless access to the system for a variety of users, such as patients, doctors, and receptionists. The testing process involves verifying user registration, login, profile management, and password-related functionality. Below table shows System testing for the Appointment Module ensures that both patients and receptionists can efficiently manage appointments in the system. This module is critical for keeping a structured schedule and providing a pleasant experience for patients seeking medical consultations. The testing process consists of verifying appointment booking, cancellation, modification, and status viewing, as well as AI enhancement of iris images. Table 2, Table 3 are the test cases designed for each user type.

Table 2 *Appointment module patient test case*

Test Case ID	Description	Expected Result	Actual Result	Pass /Fail
TC002-01	Verify that a patient can successfully book an appointment	The patient should be able to book an appointment successfully	The patient should be able to book an appointment successfully	Pass
TC002-02	Verify that AI enhances the iris images uploaded by the patient	The AI should enhance the iris images successfully	The AI model able to enhance the iris image but still needed improvement to better booking process.	Pass

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Table 2 *(continued)*

Test Case ID	Description	Expected Result	Actual Result	Pass /Fail
TC002-03	Verify that a patient can cancel an appointment	The patient should be able to cancel an appointment successfully	The patient should be able to cancel an appointment successfully	Pass
TC002-04	Verify that a patient can change an appointment	The patient should be able to change an appointment successfully	The patient's changing appointment process should be more ease.	Pass
TC002-05	Verify that a patient can view the status of their appointments	The patient should be able to view the status of their appointments	The patient should be able to view the status of their appointments	Pass
TC002-06	Verify that a patient can view their past appointments details	The patient can view their past appointments details	The patient can view their past appointments details.	Pass

Table 3 *Appointment module receptionist test case*

Test Case ID	Description	Expected Result	Actual Result	Pass /Fail
TC002-07	Verify that a receptionist can accept a patient's appointment request	The receptionist able to accept a patient's appointment	The receptionist should be able to accept a patient's appointment request	Pass
TC002-08	Verify that a receptionist can reject a patient's appointment request	The receptionist should be able to reject a patient's appointment request	The receptionist should be able to reject a patient's appointment request	Pass
TC002-09	Verify that a receptionist can view the list of patient appointments	The receptionist should be able to view the list of patient appointments	The receptionist should be able to view the list of patient appointments	Pass
TC002-10	Verify that a receptionist can block a time slot on the patient's calendar	The receptionist able to block a time slot on the patient's calendar	The receptionist should be able to block a time slot on the patient's calendar	Pass

Table 3 *(continued)*

Test Case ID	Description	Expected Result	Actual Result	Pass /Fail
TC002-11	Verify that a receptionist can block a day on the patient's calendar	The receptionist should be able to block a day on the patient's calendar	The receptionist should be able to block a day on the patient's calendar	Pass
TC002-12	Verify that a receptionist can accept a patient's appointment request	The receptionist should be able to accept a patient's appointment request	The receptionist should be able to accept a patient's appointment request	Pass

5.2.2 User Acceptance Testing (UAT)

The User Acceptance Testing (UAT) process is an important stage in the software development life cycle. User Acceptance Testing consist of two parts which is alpha and beta testing. Alpha testing was done within the organization where functionality and usability are tested whereas beta testing allows to obtain real-world feedback ensuring the product is ready to be used. Both of the testing was carried out towards the end of a product life cycle.

Figure 28 shows the outcome of the User Acceptance Testing for various acceptance criteria related to the AI-Based Booking Doctor Appointment for Holistic Health Care from doctor as one type of user. All criteria have passed the test indicating that the system meets the required standard. The doctor added extra requirement during the process as the AI image enhancer should go several enhancement processes to work effectively. Moreover, the feature where the doctor add prescription should be improve which helps the doctor able to delete prescription or update prescription to avoid human error from happening during the prescription process. Next the doctor suggested to remove the currency symbol during the time adding the consult fee. Overall, the second chart represent the overall satisfaction rating given by the doctor, The system received a score of 8 out of 10, reflecting a high level of satisfaction with the usability and functionality.

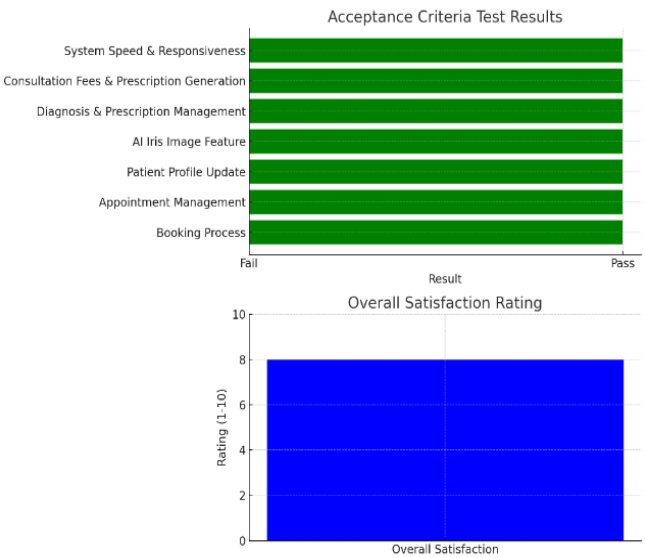

Fig. 28 *Summary of user acceptance testing for doctor*

Figure 29 shows the outcome of the User Acceptance Testing for various acceptance criteria related to the AI-Based Booking Doctor Appointment for Holistic Health Care from receptionist as one of the system users. All criteria have passed the test indicating that the system meets the required standard. The receptionist can

effectively manage and update patient appointments including booking, cancelling and rescheduling. The system displays and updates patient profile and appointment status in real time. Overall, the second chart represents the overall satisfaction rating given by the receptionist. The system received a score of 9 out of 10, reflecting a high level of satisfaction with the system's usability and functionality.

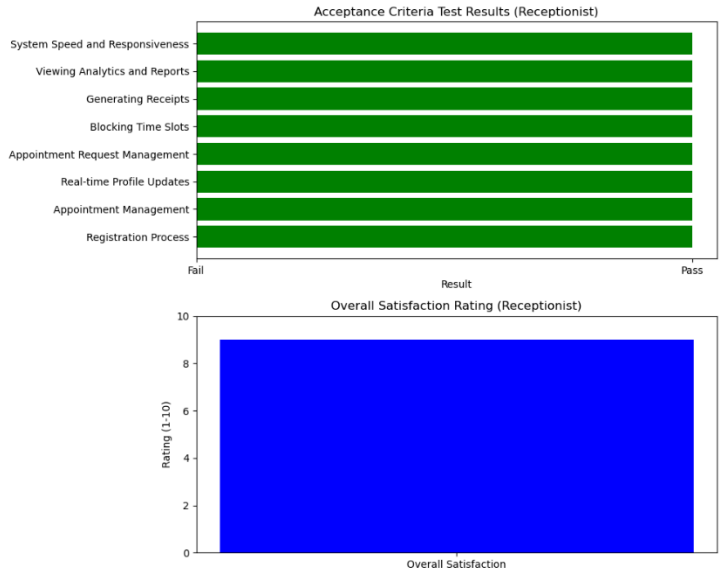

Fig. 29 *Summary of user acceptance testing for receptionist*

Moving to the end user of the AI-Based Booking Doctor Appointment for Holistic Health Care the beta test is conducted in a controlled parameter where the total seven patients were selected to conduct the user acceptance test. The patients used the system and answered the questionnaire through google form. The collected data was later turn into descriptive analysis to further analysis the data in order to improve the system in the future. Overall, the patients were satisfied with the system and this detailed analysis highlights the strength of the appointment booking system. Table 4 shows the summary of descriptive statistics for AI-Based Booking Doctor Appointment for Holistic Health Care.

Table 4 *Summary of descriptive statistics for AI-Based Booking Doctor Appointment for Holistic Health Care*

Question	Mean	Median	Mode	Standard Deviation
A	4.57	5	5	0.49
B	4.43	5	5	0.73
C	3.86	4	4	0.69
D	4.29	4	4	0.76
E	3.57	4	4	1.41
F	3.29	4	4	1.27
G	3.71	3	3	0.99
H	4.57	5	5	0.49
I	4.86	5	5	0.38
J	3.71	4	4	1.34
K	4.43	5	5	0.79

6. Conclusion

The objective of this AI-Based Booking Doctor Appointment for Holistic Health Care project was successfully achieved the goals through meticulous design, development and testing. The system began with a robust design

phase by implementing the object-oriented principles and generating detailed UML diagrams to achieve the system visualization. The core features of the system were developed and integrated successfully such as the AI Image enhancer, manage appointment booking and manage prescription module. One of the standout features of this project is the integration of artificial intelligence for image enhancement. The last objective was achieved through extensive user acceptance testing conducted to ensure the system met the end-users needs and expectation and the stakeholders such as doctor and receptionist. The testing phase concluded with positive feedback from user indicating high level of satisfaction with ease of booking appointment whereas there were few adjustments need to improve the system. These achievements highlight's the project's success in delivering a user-friendly solution for booking doctor appointment.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The author takes full responsibility for the following aspects of the study: conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

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