Fynnect: Simplifying Doctor Consultations Across Bangladesh

By

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FINAL YEAR PROJECT REPORT

This Report Presented in Partial Fulfillment of the Requirements for the **Degree of Bachelor of Science in Computer Science and Engineering**

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APPROVAL

This Project titled **"Fynnect: Simplifying Doctor Consultations Across Bangladesh"**, submitted by **Nur Nahian Nahin**, ID No: **192-15-13150** to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on **14 May, 2025**.

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We hereby declare that this project has been done by us under the supervision of **Dr. Naznin Sultana, Associate Professor,** Department of Computer Science and Engineering, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for the award of any degree or diploma.

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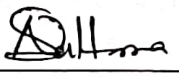

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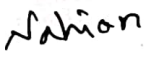

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ABSTRACT

Fynnect is a revolutionary doctor appointment booking platform developed to address the challenges of accessing healthcare in Bangladesh, where scheduling often requires multiple phone calls or personal visits to hospitals and clinics. This unified, user-friendly system allows patients to book medical consultations with doctors across various hospitals and clinics, simplifying the process by enabling searches based on specialty, location, consultation fees, and doctor availability. Through the platform, users can view detailed doctor profiles, including qualifications, years of experience, consultation fees, and hospital affiliations, and directly book available time slots with convenient payment options, either online via Stripe or as cash on delivery during the consultation. Fynnect offers administrators a full backend system for monitoring and managing doctor availability, patient bookings, and payments, as well as adding, editing, or deactivating doctor profiles, resulting in a versatile and scalable healthcare administration solution. The inspiration for developing Fynnect derives from the lack of a centralized and publicly accessible doctor appointment system in Bangladesh, where most hospitals and clinics use separate booking systems, limiting patient access to a diverse selection of medical providers. Fynnect's unified platform aims to lower barriers to healthcare, enhance convenience for patients nationally, and create a more efficient, time-saving, and resource-optimized healthcare booking experience. Developed using the MERN stack (MongoDB, Express.js, React, Node.js) and Agile development techniques, Fynnect aims to transform the healthcare landscape in Bangladesh by bridging gaps between patients and healthcare providers, ensuring better access and smoother operations for all stakeholders involved.

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Chapter 1

Introduction

This chapter introduces the Fynnect project, detailing its background, motivation, objectives, and development methodology. It also outlines the expected outcomes and the structure of the report.

1.1 Introduction

Fynnect is a web-based doctor appointment booking platform designed to address the lack of a centralized system for booking medical consultations in Bangladesh. Currently, patients in the country face difficulties when it comes to scheduling appointments, with most hospitals and clinics managing their own appointment systems, making it challenging for patients to access multiple healthcare providers through a single platform. Fynnect addresses this issue by providing a comprehensive platform that allows patients to search for doctors based on their preferences, view available time slots, and easily schedule appointments. The portal contains a comprehensive database of doctors, complete with information about their credentials, expertise, location, and fees. Fynnect also has a secure payment system that allows patients to pay online or with cash when they arrive at the clinic. The platform offers administrators powerful backend management capabilities, such as monitoring doctor availability, managing patient bookings, and overseeing payment processes.

This project aims to streamline the doctor appointment process by providing a user-friendly, accessible, and reliable service for patients across Bangladesh. By centralizing doctor profiles and appointment scheduling, Fynnect enhances the healthcare experience, making it more efficient and accessible to a wider population.

1.2 Motivation

The motivation behind developing Fynnect stems from the inefficiencies in the current healthcare booking system in Bangladesh. While some hospitals and clinics have rudimentary appointment systems, they are frequently scattered and poorly integrated with

other healthcare providers. This establishes a system in which patients must contact particular hospitals or doctors to schedule appointments, either by phone or in person. As the use of digital platforms grows in Bangladesh, there is an obvious need for a uniform solution to bridge this gap. Fynnect uses new web technologies to provide a centralized platform for people to quickly identify and book appointments with doctors across the country. This not only facilitates the booking procedure, but also fosters transparency and trust in healthcare services by providing patients with complete information about doctors.

Furthermore, as the healthcare sector in Bangladesh continues to evolve, Fynnect plays a crucial role in enhancing access to medical services, particularly in rural areas where access to doctors may be limited. By offering a seamless online booking experience, Fynnect aims to improve healthcare delivery, making it more accessible, efficient, and patient-centered.

1.3 Objectives

The primary objectives of the **Fynnect** project are as follows:

1. **Create a Comprehensive Doctor Directory**: Develop a platform where patients can easily browse and search for doctors based on specialty, location, consultation fees, and experience.

2. **Enable Easy Appointment Booking**: Allow patients to book appointments with doctors directly through the platform, ensuring real-time availability and convenience.

3. **Implement Secure Payment Options**: Integrate a secure payment system using Stripe to enable online payments for consultations, with an option for cash payments at the clinic.

4. **Develop an Admin Dashboard**: Provide administrative features to manage doctor profiles, monitor appointment bookings, track payments, and ensure the system's smooth operation.

5. **Improve Accessibility**: Ensure the platform is accessible across various devices, including desktops, tablets, and mobile phones, to cater to a wide range of users.

6. **Enhance User Experience**: Offer a user-friendly interface with clear doctor profiles, easy navigation, and a streamlined appointment booking process to enhance patient experience.

By achieving these objectives, **Fynnect** aims to modernize the appointment booking process and improve the overall healthcare experience for patients and healthcare providers in Bangladesh.

1.4 Methodology

The **Fynnect** project follows the Agile development methodology, which emphasizes iterative progress, flexibility, and continuous improvement. The development process is divided into multiple phases, starting with requirement gathering and system design, followed by the implementation of key features. The system is built using the MERN stack (MongoDB, Express.js, React, and Node.js) to ensure scalability, maintainability, and responsiveness.

Requirement Gathering and Design: In the first phase, the functional and non-functional requirements of the system were gathered, followed by the design of the user interface (UI) and system architecture.

Development: The development phase involved building both the front-end (React [1]) and back-end (Node.js [2]) components of the system. The integration of the payment system (Stripe) was also completed during this phase.

Testing and Evaluation: Extensive testing was conducted to ensure that the system functions as intended. This included functional testing, security testing, and usability testing to ensure a seamless experience for both patients and administrators.

Deployment and Maintenance: Once the platform was fully developed and tested, it was deployed for real-world use. The platform will continue to be maintained, with regular updates based on user feedback and evolving needs.

This methodology ensures that **Fynnect** is developed with a focus on user needs, system scalability, and continuous improvement to meet the goals of simplifying and improving the doctor appointment process in Bangladesh.

1.5 Project Outcome

The expected outcomes of the **Fynnect** project include:

- **A Functional Appointment Booking System**: Patients will be able to easily find and book consultations with doctors, reducing the complexity and time spent in the appointment process.
- **Improved Healthcare Access**: By offering a centralized platform, **Fynnect** improves access to healthcare services for patients across Bangladesh, particularly in underserved regions.
- **Administrative Efficiency**: Healthcare providers will benefit from an easy-to-use administrative interface that allows them to manage doctor profiles, monitor

bookings, and track payments.

- **User Engagement**: With the integration of transparent doctor profiles and convenient booking options, **Fynnect** is expected to enhance patient trust and engagement in the healthcare system.
- **Scalability for Expansion**: **Fynnect** is designed to be scalable, with plans for future expansion into additional cities and regions of Bangladesh.

Through these outcomes, **Fynnect** aims to revolutionize the way medical appointments are booked and improve the efficiency and accessibility of healthcare services in Bangladesh.

1.6 Organization of the Report

This report is structured as follows:

- **Chapter 1: Introduction** – Provides an overview of the **Fynnect** project, including its background, motivation, objectives, methodology, and expected outcomes.
- **Chapter 2: Background** – Reviews existing solutions, discusses related research, and identifies the gaps that **Fynnect** addresses.
- **Chapter 3: Research Methodology** – Details the design and development methodology, including the functional and non-functional requirements, system design, and project plan.
- **Chapter 4: Implementation and Results** – Describes the system implementation process, testing, and evaluation results.
- **Chapter 5: Engineering Standards and Design Challenges** – Discusses the engineering standards followed, design challenges encountered, and the project's societal and environmental impact.
- **Chapter 6: Conclusion** – Summarizes the key findings, discusses limitations, and suggests future work.
- **References** – Lists all the sources cited throughout the report.

This structure ensures a comprehensive presentation of the **Fynnect** project, from its inception and development to its evaluation and impact.

Chapter 2

Background

This chapter reviews existing healthcare appointment platforms like DocTime, Square Hospital, and Lab Aid Hospital, analyzing their services and identifying key gaps. It highlights how Fynnect addresses these gaps by offering a more inclusive, flexible, and scalable solution for booking doctor appointments across multiple clinics and hospitals.

2.1 Introduction

The healthcare sector in Bangladesh is rapidly evolving, with technology playing an increasingly important role in improving access to healthcare services. However, there are still significant gaps in the digital healthcare landscape. Many existing platforms focus either on specific healthcare providers or limit their services to a narrow range of options. For instance, platforms like DocTime [3] offer telehealth consultations but are restricted to certain doctors and services, while Square Hospital [4] and Lab Aid Hospital [5] provide appointment booking systems but only for in-house doctors within their own facilities.

Fynnect seeks to fill these gaps by providing a complete platform that allows people to arrange appointments with doctors at a number of clinics and hospitals in their location. Unlike existing platforms, Fynnect focuses on offering access to a diverse selection of healthcare providers, giving patients more options and freedom. Furthermore, Fynnect offers both in-person consultations and telemedicine services, allowing patients to pick based on their preferences and needs. Fynnect aspires to make healthcare more equitable and accessible by solving current system limitations and delivering a seamless, one-stop solution for medical visits across Bangladesh.

2.2 Literature Review

The following table summarizes and compares the key features, services, and limitations of existing healthcare appointment platforms such as DocTime, Square Hospital, and Lab Aid Hospital. It provides a clear overview of how each competitor operates and where Fynnect fills the gaps in the current system.

Competitor	Services Offered	Key Features	Limitations
DocTime	On-demand GP and specialist consultations, online prescriptions, medicine delivery, diagnostic tests, EHR.	• Telehealth consultations with verified doctors • Integration with pharmacies, labs, and payment providers • AI-based healthcare solutions • Medicine and test results delivered to home	• Focuses mainly on telehealth • Limited to specific healthcare providers • No access to a variety of local clinics and hospitals
Square Hospital	In-house doctor appointments for patients.	• Appointment booking with in-house doctors • Medical services including diagnostics and surgery	• Only offers appointments with in-house doctors • Limited to Square Hospital's facilities
Lab Aid Hospital	In-house doctor appointments for patients.	• Appointments with internal doctors • Diagnostic and laboratory services • High-quality medical care	• Restricted to in-house doctor appointments • Limited choice for patients seeking doctors outside the hospital

Table 2.1: Comparison of Competitors' Services, Features, and Limitations

2.3 Similar Applications

Several applications and platforms have emerged to provide online healthcare services, including appointment booking, telehealth consultations, and medical diagnostics. These platforms, however, often target specific healthcare providers or regions, limiting their accessibility and flexibility for users. Below, we discuss a few prominent platforms and their offerings:

1. **DocTime**:

DocTime is an online healthcare company that offers on-demand GP and specialist consultations, online prescriptions, medication delivery, and diagnostic testing. It works with pharmacies, labs, and payment providers to create a comprehensive digital health experience. The platform's main feature is its capacity to deliver telehealth consultations, which allow customers to access healthcare services remotely. DocTime, on the other hand, is largely focused on telehealth and only works with a restricted number of healthcare practitioners. Patients are unable to access a larger pool of doctors from other hospitals and clinics in their city, limiting their options [3].

2. **Square Hospital**:
   Square Hospital has an in-house doctor appointment system that allows patients to book appointments with doctors from their hospital network. While this ensures the availability of trusted professionals, the platform's limits include access to just in-house doctors. Patients seeking consultations outside of Square Hospital cannot use this system, providing a barrier for those who may prefer alternate specialists or locations [4].

3. **Lab Aid Hospital**:
   Similar to Square Hospital, Lab Aid Hospital offers an appointment booking system for its in-house doctors. It provides high-quality healthcare services, particularly in diagnostics, but like Square, it only caters to its internal network of doctors. Patients are limited in their choices and are confined to the services provided within the Lab Aid network [5].

While these platforms offer significant healthcare services, they all share limits in terms of accessibility and choice. DocTime's focus on telehealth precludes a wide range of in-person doctor bookings, whereas Square Hospital and Lab Aid Hospital are limited to in-house doctor visits. Fynnect, on the other hand, provides a comprehensive solution that enables customers to schedule appointments with doctors at numerous hospitals and clinics, giving them more freedom and options.

2.4 Gap Analysis

Despite the presence of digital platforms like **DocTime**, **Square Hospital**, and **Lab Aid Hospital**, there are significant gaps in the current healthcare appointment booking ecosystem in Bangladesh that Fynnect aims to address. Below are the key gaps identified:

1. **Limited Doctor Availability**:
   DocTime, Square Hospital, and Lab Aid Hospital each offer appointment booking services, but they are confined to specific hospitals or healthcare providers. This restricts patients from exploring a wider range of doctors or clinics. In contrast, Fynnect's platform is designed to aggregate a broader selection of doctors from

various hospitals and clinics in a city, ensuring that patients can access a diverse pool of healthcare professionals.

2. **Focus on In-House Services**:
   Square Hospital and Lab Aid Hospital focus solely on in-house doctors. While these hospitals are reputable and offer high-quality services, their appointment systems are restrictive, limiting patients to only their in-house specialists. Fynnect breaks this limitation by enabling patients to book appointments across multiple clinics and hospitals, allowing them to select doctors based on their preferences and needs.

3. **Lack of Flexibility in Service Delivery**:
   DocTime is primarily focused on telehealth consultations, which can be a great option for many patients, but it lacks an integrated system for booking in-person consultations with doctors. Fynnect, however, provides both telehealth and in-person consultation booking, offering patients the flexibility to choose the type of appointment that best suits their circumstances.

4. **Transparency and Access**:
   While DocTime provides access to telehealth services and Square Hospital and Lab Aid provide appointment booking for in-house services, none of these platforms offer the same level of transparency and access to detailed doctor profiles, including experience, fees, and specific clinic or hospital affiliations. Fynnect's platform, on the other hand, provides a more transparent approach, allowing patients to view doctor profiles in detail, ensuring that they make informed decisions when booking appointments.

5. **Scalability and City-wide Access**:
   Currently, platforms like DocTime, Square Hospital, and Lab Aid Hospital are primarily focused on specific locations or hospitals. Fynnect, by contrast, is designed to scale and operate across multiple cities in Bangladesh, giving users access to doctors and clinics in various locations. This makes Fynnect a much more versatile and inclusive platform for booking medical consultations.

By addressing these gaps, Fynnect offers a more comprehensive, flexible, and inclusive healthcare booking solution, providing a seamless experience for patients and a wider selection of healthcare providers.

2.5 Summary

This chapter reviewed the existing healthcare appointment platforms in Bangladesh, such as **DocTime**, **Square Hospital**, and **Lab Aid Hospital**, which have each made strides in digital healthcare by offering appointment booking systems and telehealth services. While these platforms provide value in their respective niches, they each have limitations

that Fynnect seeks to address. DocTime focuses primarily on telehealth, and Square and Lab Aid only offer appointment systems for in-house doctors within their respective hospitals.

The gap analysis identified several key areas where Fynnect stands out:

Broader Access: Unlike the competitors, Fynnect aggregates doctors from multiple clinics and hospitals, giving patients more choices and flexibility.

In-Person and Telehealth Options: Fynnect integrates both in-person and online consultation booking, unlike DocTime, which is limited to telehealth.

Transparency and Information: Fynnect offers more detailed doctor profiles, helping patients make more informed decisions about their healthcare.

Scalability: While competitors are often confined to specific cities or healthcare providers, Fynnect is designed to scale across multiple locations, expanding access to medical professionals across Bangladesh.

By filling these gaps, Fynnect offers a comprehensive solution that improves healthcare accessibility, flexibility, and choice for patients, positioning itself as a more inclusive and adaptable platform in the rapidly growing digital healthcare landscape in Bangladesh.

Chapter 3

Research Methodology

This chapter outlines the methodology used in the development of Fynnect, including requirement analysis, system design, and the technologies employed. It also discusses the project plan, including key milestones, tasks, and timelines for successful implementation.

3.1 Methodology/Requirement Analysis

3.1.1 Overview

The development of the **Fynnect** platform follows a structured approach, ensuring that all user requirements are met, and that the system is both scalable and safe. The project was created to fulfill the growing demand for a uniform doctor appointment booking system in Bangladesh. The primary goal is to develop a system that centralizes appointment bookings, allowing customers to access doctors from several hospitals and clinics through a single platform.

Fynnect's architecture has been designed to handle a wide range of healthcare providers, payment systems, and user interfaces, ensuring patient convenience and efficient management for healthcare providers. The platform adheres to the Agile Development Methodology to ensure that iterative feedback and continual improvements are included into the system.

The methodology focuses on the use of latest web technologies to provide a seamless and dynamic user experience. The system has been created with flexibility in mind, allowing for future scaling and adaptation to changing user needs.

3.1.2 System Design

The proposed methodology for developing **Fynnect** involves several key steps to ensure the creation of a robust and user-friendly doctor appointment booking platform. The system design is structured into different layers, each responsible for specific functionalities. The following sections outline the design:

1. Requirement Analysis:

Conduct a thorough analysis of user needs, including patients, doctors, and administrators.

Identify functional and nonfunctional requirements.

Define key use cases and expected user behavior.

2. Design and Planning:

User Interface (UI) Design: Designed with React for responsiveness and user-friendliness, allowing patients to search for doctors, check availability, and make appointments.

Admin Dashboard: Developed for administrators to manage doctor profiles, monitor bookings, and view payment histories.

3. System Architecture:

Frontend Layer: Built with React.js for a responsive, intuitive design [1].

Backend Layer: Powered by Node.js and Express.js for handling business logic such as authentication, doctor management, and appointment scheduling [2].

Database Layer: Uses MongoDB for secure, scalable storage of patient, doctor, and appointment data [6].

Payment Layer: Integrates Stripe for secure online payments, also offering cash payment at the clinic.

4. Development:

Frontend Development: React.js for dynamic, responsive interactions.

Backend Development: Node.js and Express.js to manage business processes.

5. Database Setup: MongoDB for secure data storage and management. Payment Integration: Stripe for secure online payment processing.

6 Testing and Validation:

Ensure functionality, performance, security, and usability.

Verify appointment scheduling workflows and secure payment processing.

Validate user interface across devices and browsers.

7. Deployment and Maintenance:

Deploy using Vercel for scalable hosting [7].

Perform regular updates and maintenance.

Implement continuous monitoring for stable system operation.

8. System Design Overview:

User Interface Layer: Handles patient and admin interactions.

Application Logic Layer: Manages backend processes and payment handling.

Database Layer: Stores and manages all system data. Payment Integration Layer: Pro-

cesses secure transactions through Stripe.

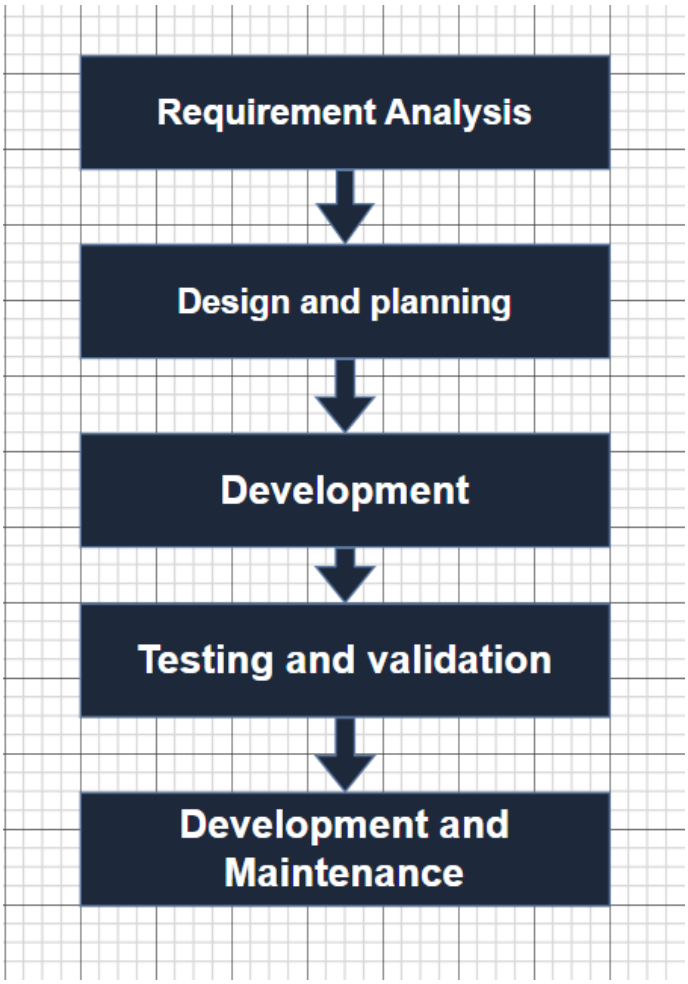

Figure 3.1: System Design Overview Diagram

This layered design ensures modularity and scalability, allowing independent updates or scaling as the platform grows.

3.1.3 Functional and Nonfunctional Requirements

Functional Requirements The functional requirements define the key features and capabilities of the **Fynnect** platform:

- **User Authentication:** Secure user login and registration with options for patients and doctors.
- **Doctor Directory:** A searchable database of doctors, with filters for specialization, location, fee, and availability.
- **Appointment Booking:** Functionality to book appointments based on doctor availability, time slots, and consultation fees.

- **Payment System:** Integration with Stripe for online payments and cash on delivery as an alternative option.
- **Admin Dashboard:** Administrative functionality for managing users, doctor profiles, appointments, and payment records.

Nonfunctional Requirements These requirements address the overall quality and attributes of the system:

- **Performance:** The system must handle multiple simultaneous users without performance degradation.
- **Scalability:** The platform must be scalable to handle increasing user base and growing database.
- **Security:** The system must ensure robust data encryption and secure payment processing.
- **Usability:** The platform should provide an intuitive and responsive user interface.
- **Reliability:** The system must be reliable, with minimal downtime.

3.1.4 Context Diagram

The Context Diagram outlines the interaction between the Fynnect system and its external entities (users, doctors, admins, and payment gateway).

- **Patients** interact with the platform to:
  - Find and book doctor appointments.
  - View doctor profiles.
  - Make payments.
- **Doctors** manage:
  - Their availability.
  - Consultation fees.
  - Other details.
- **Admins** oversee:
  - All platform activities.
  - Ensure smooth operation.
- **Payment Gateway (Stripe)** handles:
  - Processing of secure online payments.

3.1.5 Data Flow Diagram

The Data Flow Diagram (DFD) provides a more detailed view of how data flows through the system:

- **Patients**:
  - Search for doctors.
  - Select time slots.
  - Make payments.
- **Doctors**:
  - Update their profiles.
  - Manage availability.
- **Admins**:
  - Manage doctor profiles.
  - Handle appointment bookings.
- **Stripe Payment Gateway**:
  - Handles transactions between patients and doctors.

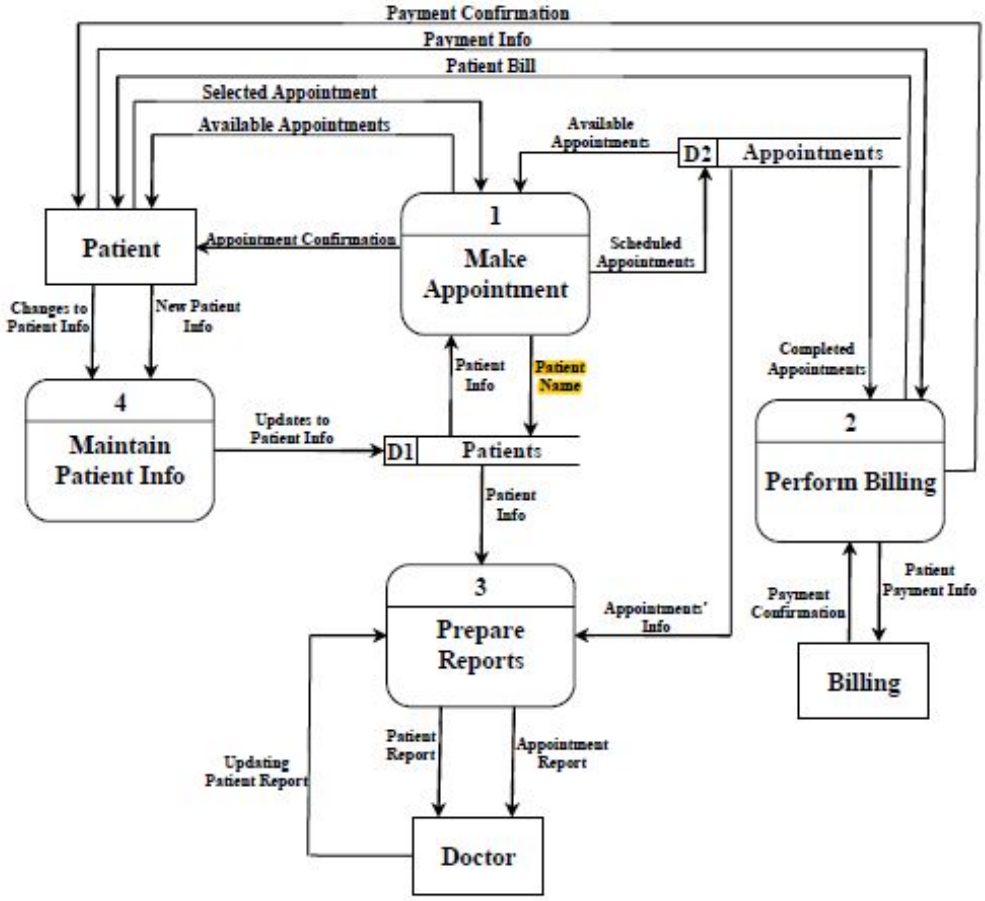

Figure 3.2: Data Flow Diagram

3.1.6 UI Design

The user interface of Fynnect is designed to be user-friendly and responsive. It includes the following core components:

- **Homepage:** Features a clean and welcoming landing page with options for logging in or registering.
- **Doctor Search Page:** Allows patients to filter doctors based on specialty, location, fees, and available time slots.
- **Appointment Booking Page:** Displays doctor availability and allows patients to confirm bookings and make payments.
- **Admin Dashboard:** Provides a secure management interface for administrators to oversee all platform activities.

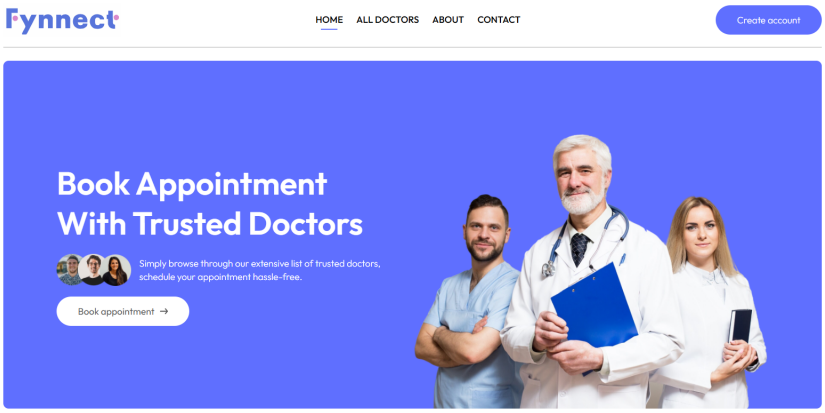

Figure 3.3: Homepage

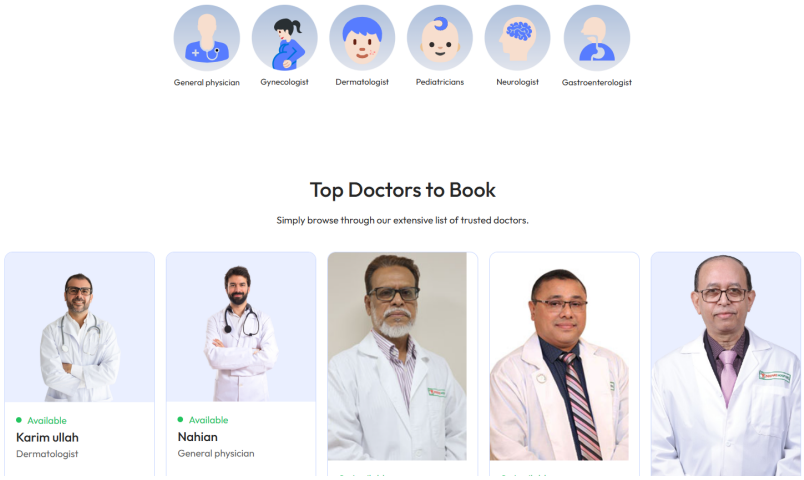

Figure 3.4: Homepage (Alternate View)

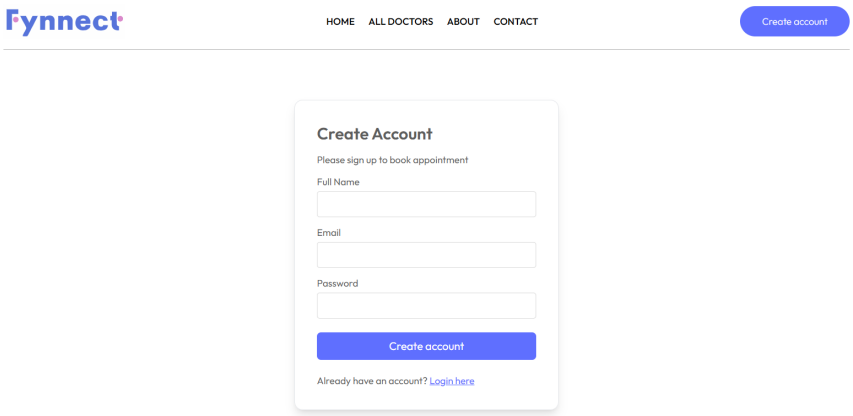

Figure 3.5: User login

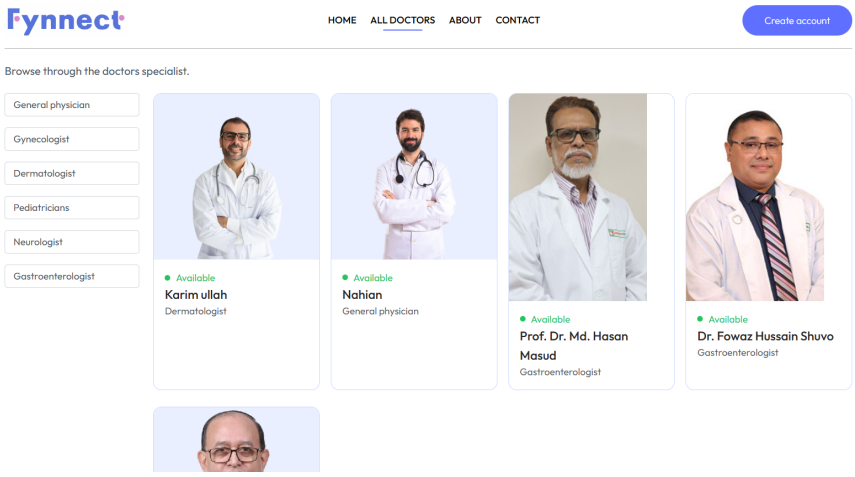

Figure 3.6: Doctor List page

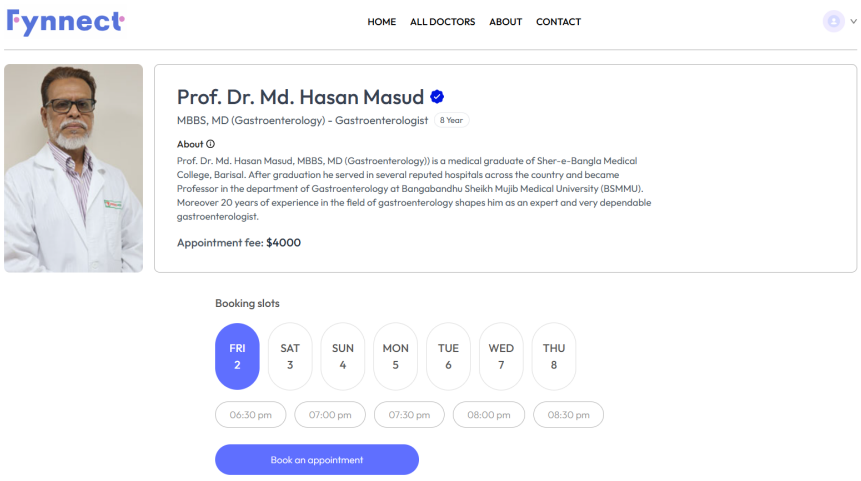

Figure 3.7: Doctor Profile and booking page

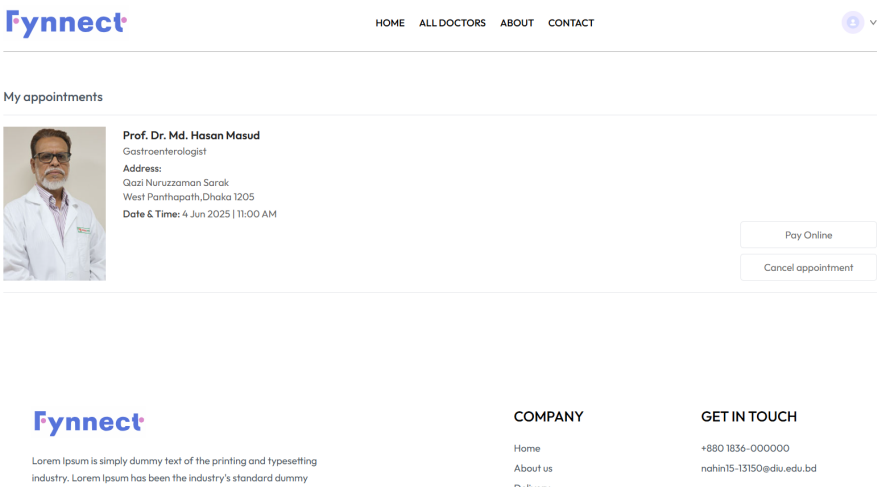

Figure 3.8: Booked Doctor List

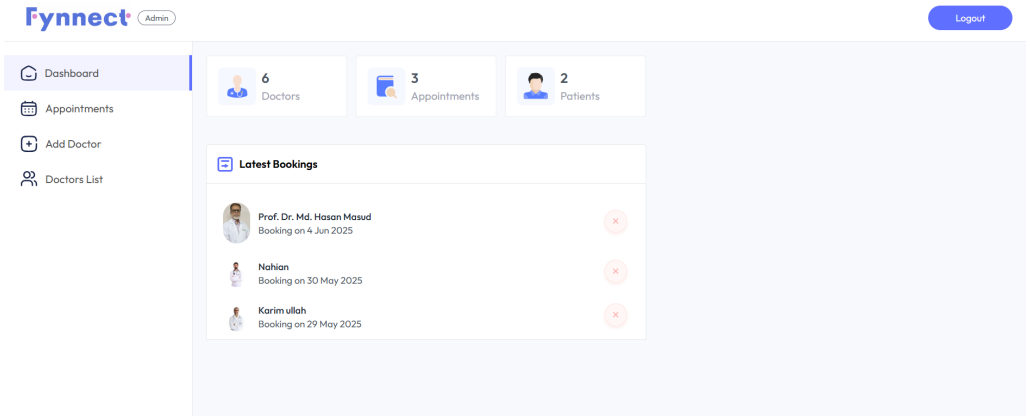

Figure 3.9: Admin Dashboard

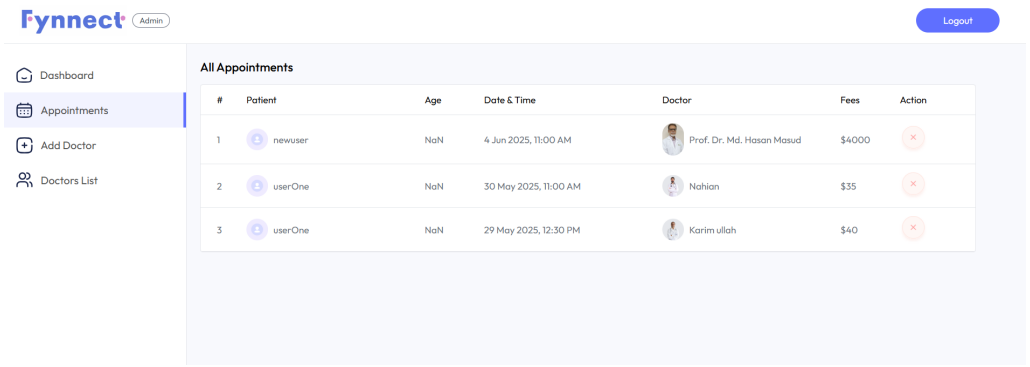

Figure 3.10: All Appointment List (Admin panel)

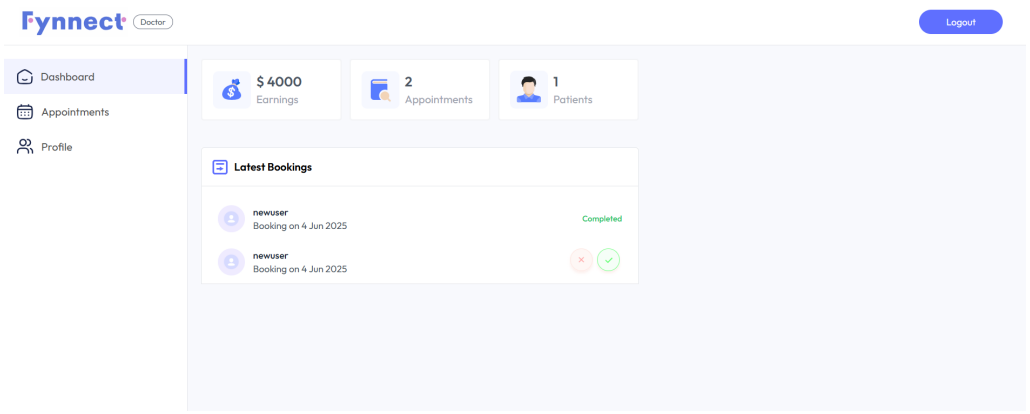

Figure 3.11: Doctor Dashboard

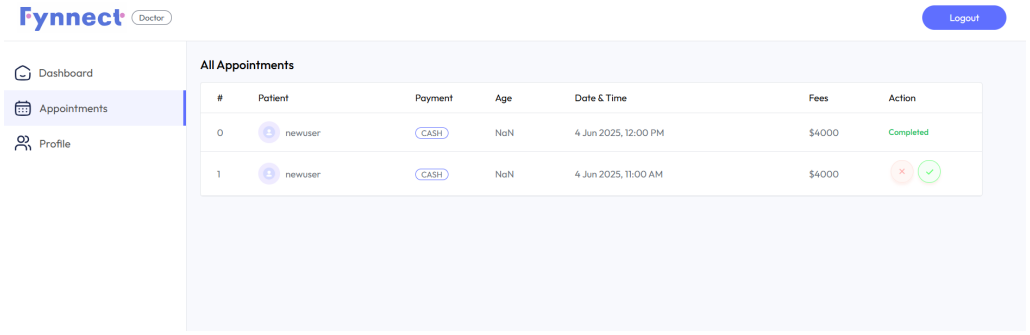

Figure 3.12: Appointed Patient List (Doctor panel)

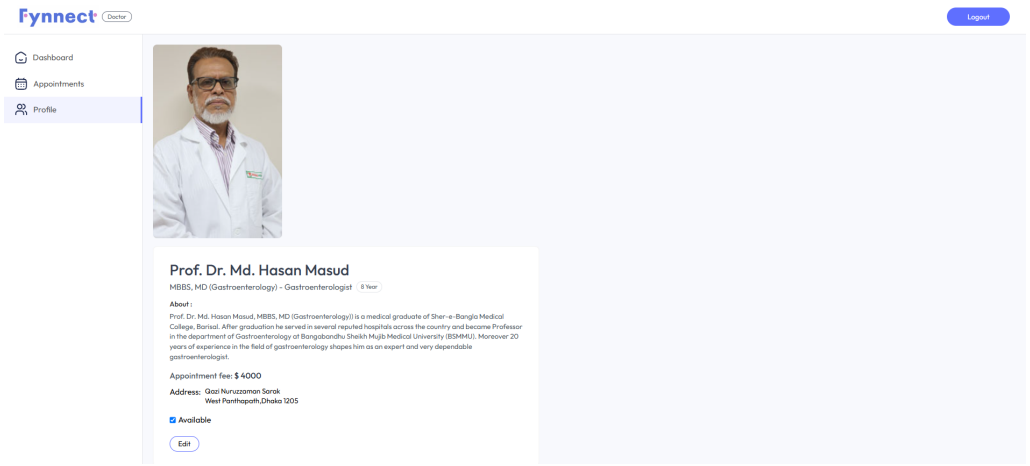

Figure 3.13: Doctor Profile (Doctor Panel)

3.2 Detailed Methodology and Design

3.2.1 Alternate Solutions Considered

Several alternate solutions were considered during the planning phase:

- **Manual Appointment Booking:** Traditional phone or in-person bookings at hospitals and clinics, which lack integration with other healthcare providers.
- **Individual Clinic Systems:** Some clinics have their own booking systems, but these are limited to specific locations and providers.
- **Pre-built Appointment Platforms:** Existing platforms, such as those used by individual hospitals, offer limited flexibility and integration with other healthcare systems.

3.2.2 Selected Solution

The selected solution was to build a centralized doctor appointment booking system that aggregates data from various healthcare providers. Fynnect's design integrates Stripe for secure payments and offers both online and cash payment options. It also includes an Admin Dashboard for managing doctor profiles and appointments, making the platform comprehensive and scalable.

3.2.3 System Design

Fynnect's system is designed in multiple layers to ensure modularity, scalability, and ease of maintenance. These layers include:

- **User Interface Layer:** Developed using React.js [1], ensuring responsiveness and ease of use for patients and doctors.
- **Backend Layer:** Developed using Node.js [2] and Express.js [8] to handle server-side logic, such as appointment scheduling and user management.
- **Database Layer:** MongoDB [6]is used to store doctor, patient, and appointment data.
- **Payment Integration Layer:** Stripe handles secure online payments, ensuring user data is encrypted and processed securely.

3.3 Project Plan

3.3.1 Milestones and Tasks

The project is divided into the following milestones and tasks:

1. **Milestone 1:** Finalize requirement analysis and system architecture.
2. **Milestone 2:** Front-end and back-end development, along with payment integration.
3. **Milestone 3:** Extensive testing (functional, usability, and security).
4. **Milestone 4:** Deployment and maintenance.

3.3.2 Timeline

The timeline for the project is approximately 6 months:
Requirement Analysis and Planning: 1 month
Front-end and Back-end Development: 2 months
Payment Integration and Testing: 2 months
Deployment and Maintenance: Ongoing

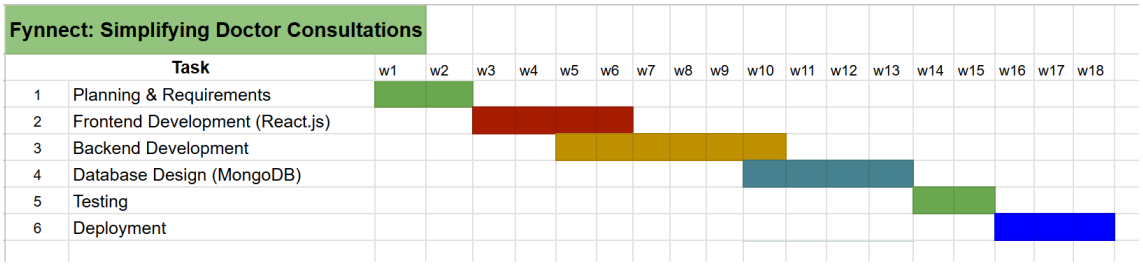

Figure 3.14: Gantt Chart or Project Timeline

3.4 Task Allocation

Team Member	Responsibilities
Nur Nahian Nahin (Project Developer)	- Project management and coordination. - UI/UX design and implementation. - Frontend implementation. - Backend development with Node.js and MongoDB. - Stripe payment system integration. - System testing and deployment.
Dr. Naznin Sultana (Supervisor)	- Providing guidance and feedback. - Reviewing progress and providing technical advice.

3.5 Summary

The development methodology for Fynnect combines Agile principles, modern web technologies, and a user-centric approach to ensure the platform meets the needs of patients,

doctors, and administrators. The platform's architecture prioritizes scalability, security, and usability, making it an excellent solution for doctor appointment booking throughout Bangladesh. Fynnect seeks to change the country's healthcare access by solving significant holes in the present system.

Chapter 4

Implementation and Results

The implementation of the Fynnect platform, including environment setup, technology stack, and testing methodologies. It also presents the results, highlighting system functionality, security, and user satisfaction.

4.1 Environment Setup

The environment setup for the Fynnect project involves configuring both the client-side and server-side components. The following technologies and tools were used to build the platform:

Frontend Technologies

- **React.js**: The frontend is developed using React.js to create a responsive, dynamic, and user-friendly interface [1].
- **Tailwind CSS**: For styling, Tailwind CSS was used to create a custom, responsive layout that adjusts seamlessly across all device sizes[9].
- **Vercel**: The frontend is deployed on Vercel, a platform that provides serverless deployment, ensuring scalability and fast global delivery [7].

Backend Technologies

- **Node.js**: The backend of the platform is powered by Node.js [2], allowing for efficient and scalable server-side operations.
- **Express.js**: Express.js is used as the backend framework to manage routing, middleware, and handling of API requests efficiently [2].
- **MongoDB Atlas**: For data storage, MongoDB Atlas is used. It is a cloud-based, fully managed database that allows secure, scalable, and highly available storage of patient, doctor, and appointment data [6].

- **Cloudinary**: Cloudinary is integrated for handling media storage, allowing users to upload and manage doctor profile images and other media content securely[10].
- **Stripe**: Stripe is integrated to process payments securely. It handles both online payments for consultations and the option for cash payments on arrival [11].

The environment setup is designed to be modular and scalable, allowing for easy integration of new features as the platform evolves.

4.2 Testing and Evaluation

The testing and evaluation phase was essential to ensure the Fynnect platform works as intended. A series of testing methodologies were employed to ensure the functionality, performance, security, and usability of the system.

4.2.1 Testing Methodologies

The following testing methodologies were used throughout the development phase:

1. **Unit Testing**
   Unit testing was performed using Jest for JavaScript to test individual components of the front-end and back-end. This ensured that each function and feature worked as intended before full system integration.
2. **Integration Testing**
   Integration tests were used to ensure that different components of the platform worked together seamlessly. For example, tests were conducted to ensure that the user registration process, doctor availability updates, and appointment bookings functioned together smoothly.
3. **Performance Testing**
   Apache JMeter was used for performance testing to simulate heavy traffic and ensure that the system could handle multiple simultaneous users without significant degradation in performance.
4. **Security Testing**
   Security testing was performed to ensure that sensitive information, such as patient details and payment data, was protected. The platform uses HTTPS for secure communication and JWT (JSON Web Tokens) for user authentication.

4.2.2 Evaluation Criteria

The platform's performance was evaluated based on the following criteria:

1. **Functionality**
   All features were tested, including user registration, doctor search, appointment booking, and Stripe payment processing. All features passed functional testing and operated as expected.

2. **Usability**
   User interface components were tested for ease of navigation. Feedback from beta testers indicated that the platform was intuitive and easy to use, with minimal learning curve.

3. **Performance**
   The system demonstrated excellent performance under load, with response times within acceptable limits during peak usage, as confirmed by Apache JMeter performance tests.

4. **Security**
   Security tests confirmed that user data was protected using encryption methods. Payment data processed through Stripe was secure, and all interactions involving sensitive data were transmitted over HTTPS.

5. **Compatibility**
   The platform was tested across different devices (desktops, tablets, and mobile phones) and browsers (Chrome, Firefox, Safari) to ensure compatibility. It was confirmed that the platform provided a consistent experience across all supported devices and browsers.

4.3 Results and Discussion

The implementation of Fynnect achieved the following key results:

4.3.1 Results

1. **System Functionality**

   - The platform's core functionality, including doctor search, appointment booking, and payment processing, was successfully implemented and tested.
   - The integration with Cloudinary for profile image management worked seamlessly, allowing doctors to upload their images without issues.
   - MongoDB Atlas efficiently handled large volumes of data for doctors and patients, ensuring fast retrieval and high availability of data.

2. **Payment Integration**

   - The integration of Stripe allowed for secure processing of online payments, and the cash-on-arrival option functioned properly.

- The payment system was tested in a staging environment and verified through multiple test cases, confirming that transactions were processed securely and accurately [12].

3. **User Experience**
   User testing feedback indicated a high satisfaction rate with the overall user experience. Patients found the doctor search function easy to use, and appointment booking was quick and seamless. The admin dashboard allowed easy management of doctors and appointments, with administrators able to monitor the booking system effectively.

4.3.2 Discussion

The results of the testing phase showed that Fynnect met its objectives of creating a user-friendly, scalable, and secure doctor appointment booking platform. Key highlights include:

- **Cloudinary Integration**: The integration of Cloudinary for media storage allowed for smooth handling of doctor profile images and other media content, contributing to a more dynamic user interface [10].
- **MongoDB Atlas**: The use of MongoDB Atlas provided high availability and scalability, ensuring that the platform could handle a growing user base and large volumes of data. The system was able to scale efficiently without performance issues [6].
- **Stripe Payment System**: Stripe proved to be an excellent choice for payment integration, offering a secure and reliable way to process payments. The feature allowing both online and cash payments provided flexibility for patients [11].

While the platform met functional requirements, there are areas for future improvement:

- **AI-based Recommendations**: Future versions of the platform could include AI-based features to recommend doctors based on patient preferences and past visits.
- **Mobile Application**: A dedicated mobile app could improve accessibility and provide push notifications for appointment reminders.

4.4 Summary

In this chapter, the environment setup, testing methodologies, and results of the Fynnect platform were discussed. The platform successfully met its objectives in providing a secure, efficient, and user-friendly system for booking doctor appointments in Bangladesh. Key technologies such as Cloudinary, MongoDB Atlas, and Stripe contributed significantly to the platform's functionality and scalability.

The platform is now fully functional, with secure payment processing and a robust backend. The positive results from testing and user feedback indicate that Fynnect has the potential to improve healthcare access across the country by simplifying the doctor appointment booking process.

Chapter 5

Engineering Standards and Design Challenges

The chapter provides an overview of the Fynnect project, detailing its successful implementation, testing, and functionality. It also addresses the limitations of the platform and proposes future enhancements to ensure its scalability and continuous improvement.

5.1 Compliance and Impact

5.1.1 Compliance with the Standards

In the development of Fynnect, several engineering standards were followed to ensure the quality, security, and scalability of the system. These standards help maintain a high level of professionalism and consistency in the software design, development, and deployment process.

Software Standards

The software standards implemented during the development of Fynnect focused on ensuring modularity, code maintainability, and security. These include:

- **Agile Development Methodology:** The platform was developed using an iterative and incremental approach, allowing for continuous improvement and regular updates based on user feedback [13].
- **Code Quality and Best Practices:** Industry-standard coding conventions and best practices, such as ESLint for JavaScript linting and Prettier for code formatting, were used to maintain clean, readable, and consistent code throughout the development process [14].
- **Testing Standards:** The platform underwent rigorous testing using Jest for unit testing and Apache JMeter for performance testing to ensure robustness and performance under load.

- **Version Control:** Git and GitHub were used for version control, ensuring collaborative development and seamless tracking of changes.

Hardware Standards

While the Fynnect platform is cloud-based, certain hardware standards are indirectly followed through the use of cloud services and their underlying infrastructure:

- **Cloud Infrastructure:** MongoDB Atlas and Cloudinary are cloud services used for database management and media storage, both of which are built on robust cloud infrastructure, ensuring high availability, redundancy, and scalability.
- **Payment Security:** Stripe, used for payment processing, follows the PCI-DSS (Payment Card Industry Data Security Standard) to ensure secure transactions and protect users' financial information.

Communication Standards

The communication protocols used in Fynnect ensure secure and efficient interaction between the user interface, backend services, and third-party APIs:

- **HTTPS Protocol:** All communication between the client-side (React.js) and server-side (Node.js) is encrypted using HTTPS to ensure data privacy and security.
- **RESTful API Design:** The backend follows RESTful principles for designing APIs, ensuring easy integration with external services and consistency in data access.

5.1.2 Impact on Society, Environment, and Sustainability

Impact on Life

Fynnect aims to significantly improve the healthcare system in Bangladesh by simplifying the process of booking medical appointments. This can have several positive impacts:

- **Improved Access to Healthcare:** By providing a centralized platform for doctor appointment bookings, Fynnect makes healthcare services more accessible to people across urban and rural areas.
- **Convenience for Patients:** Patients no longer need to visit hospitals or clinics in person to make appointments, saving time and effort.
- **Better Healthcare Management:** The system allows healthcare providers to manage their schedules more efficiently, improving their overall service delivery.

Impact on Society & Environment

Fynnect contributes to the digitalization of healthcare services, which has broader implications for society:

- **Digital Transformation in Healthcare:** By centralizing appointment bookings, Fynnect helps reduce the administrative burden on healthcare providers, allowing them to focus more on patient care.
- **Environmental Impact:** The platform reduces the need for paper-based appointment management systems, helping conserve resources and minimize waste in healthcare facilities.

Ethical Aspects

The ethical considerations of Fynnect's design and operation are focused on protecting user privacy and ensuring data security:

- **Data Privacy:** Fynnect complies with data protection laws, ensuring that user data is encrypted and securely stored. Personal information, such as medical history and payment details, is handled with the utmost care.
- **Transparency:** The platform provides transparent information about doctors, including their qualifications, fees, and availability, ensuring that patients can make informed decisions.

Sustainability Plan

Fynnect's sustainability plan ensures that the platform remains relevant and scalable in the long term:

- **Continuous Improvement:** The platform will be regularly updated based on user feedback and advancements in technology to meet evolving user needs.
- **Scalable Architecture:** The system is designed to scale as more healthcare providers join the platform, ensuring that the system can handle increased traffic and data in the future.
- **Environmental Responsibility:** The platform's cloud-based infrastructure, relying on providers such as MongoDB Atlas and Cloudinary, minimizes the environmental impact of physical infrastructure by using energy-efficient cloud data centers.

5.1.3 Project Management and Financial Analysis

In the course of developing Fynnect, careful attention was paid to project management and budgeting to ensure that the system was delivered on time and within the allocated budget. The financial aspects were carefully considered to ensure sustainability and future growth of the platform.

Cost Analysis

The costs incurred in developing the Fynnect platform were kept within a reasonable budget, primarily due to the use of open-source technologies and cloud services that offer cost-effective pricing models. The major components of the cost analysis are as follows:

- **Development Costs:** The costs associated with building the platform, including front-end and back-end development, integration of third-party services (Stripe, Cloudinary), and cloud hosting services (MongoDB Atlas).
- **Testing and Validation:** The costs for conducting comprehensive testing (unit testing, performance testing, etc.) to ensure that the platform functions as intended.
- **Deployment and Maintenance:** The ongoing costs for deploying and maintaining the system, including cloud hosting fees, security updates, and regular platform updates.
- **Marketing and Outreach:** Initial costs for promoting the platform and gaining traction among healthcare providers and patients.

Expense Category	Estimated Budget (BDT)	Alternate Budget (BDT)
Development Costs	220,000	165,000
Testing and Validation	55,000	33,000
Deployment and Maintenance	30,000	20,000
Marketing and Outreach	25,000	15,000
Total	**350,000**	**230,000**

Table 5.1: Predicted Budget

5.1.4 Revenue Model

Fynnect's revenue model is designed to support its sustainability and long-term growth:

- **Subscription Model:** Healthcare providers may be charged a subscription fee for accessing premium features, such as advanced analytics or additional doctor profiles.
- **Transaction Fees:** A small transaction fee could be implemented for each appointment booked through the platform, helping cover operational costs and platform maintenance.
- **Partnerships:** Collaborations with hospitals and clinics for customized solutions and increased visibility.

5.1.5 Alternate Budget

An alternate budget scenario, with minimized costs due to using open-source tools and minimal hardware requirements, is presented in the table above. This allows the plat-

form to operate at a reduced cost during its initial stages, making it more accessible for healthcare providers to adopt.

5.2 Engineering Problem

5.2.1 Complex Problem Solving

In this section, provide a mapping with problem solving categories. For each mapping add subsections to put rationale (Use Table 5.2). For P1, you need to put another mapping with Knowledge profile and rational thereof.

Table 5.2: Mapping with complex problem solving.

EP1 Dept of Knowledge	EP2 Range of Conflicting Requirements	EP3 Depth of Analysis	EP4 Familiarity of Issues	EP5 Extent of Applicable Codes	EP6 Extent of Stakeholder Involvement	EP7 Interdependence
√		√	√	√	√	

Mapping with Knowledge Profile for EP1

This table 5.3) is designed to map the EP1 to the Knowledge Profile.

Table 5.3: Mapping with knowledge Profile.

K3 Engineering Fundamentals	K4 Specialist Knowledge	K5 Engineering Design	K6 Engineering Practice	K8 Research Literature
√	√	√	√	

5.2.2 Engineering Activities

In this section, provide a mapping with engineering activities. For each mapping add subsections to put rationale (Use Table 5.4).

Table 5.4: Mapping with complex engineering activities.

EA1 Range of resources	EA2 Level of Interaction	EA3 Innovation	EA4 Consequences for society and environment	EA5 Familiarity
√	√	√		√

5.3 Summary

The technical standards used in the creation of the Fynnect platform to ensure high-quality design, security, and scalability. It focuses on software, hardware, and communication standards, such as Agile methodology, MongoDB Atlas, Cloudinary, and Stripe for secure payments and data management. The chapter also emphasizes the platform's impact on society, the environment, and sustainability, as well as a financial analysis of development, testing, deployment expenses, and income streams. Finally, it discusses the difficult engineering challenges encountered, such as integrating third-party systems, preserving scalability, and assuring secure transactions.

Chapter 6

Conclusion

The conclusion discusses the achievements of the Fynnect platform in improving healthcare access and its successful implementation. It also highlights limitations and outlines future developments to enhance scalability, user experience, and functionality.

6.1 Summary

Fynnect is an innovative platform that addresses the challenges of accessing healthcare services in Bangladesh by providing a centralized system for doctor appointment bookings. The project has successfully implemented a web-based solution that enables patients to search for doctors, view profiles, and book consultations with ease. The system integrates several modern technologies, including **React.js** for the front-end, **Node.js** and **Express.js** for the back-end, **MongoDB Atlas** for database management, **Cloudinary** for media storage, and **Stripe** for secure payment processing.

Throughout the platform's development, extensive testing and validation were conducted to assure functionality, performance, and security. The system was created to be scalable, efficient, and user-friendly, giving patients and healthcare professionals a consistent experience. During the testing phase, users expressed high levels of satisfaction with the platform's usability, responsiveness, and convenience.

Fynnect has achieved its goal of expediting the doctor appointment booking procedure in Bangladesh, making healthcare more accessible to a larger population. The platform is now fully functional, with major features such as real-time appointment booking, payment integration, and admin administration that have been rigorously tested and work as expected.

6.2 Limitation

While Fynnect has achieved its primary goals, there are some limitations that should be addressed in future iterations:

- **Limited Features for Users**: Currently, the platform provides basic functionalities such as doctor search and appointment booking. Future versions could include more personalized features, such as AI-based doctor recommendations based on patient history and preferences.
- **Scalability Concerns**: Although the platform is designed to be scalable, as the number of users and healthcare providers grows, there may be additional performance and infrastructure optimization required to handle larger volumes of data and transactions.
- **Mobile Application**: The current platform is web-based, and while it is responsive, a dedicated mobile app could enhance the user experience and provide additional features such as push notifications for appointment reminders.
- **AI Integration**: Currently, Fynnect does not incorporate AI technologies for more intelligent doctor-patient matching. Future work could explore integrating AI-driven solutions for personalized healthcare recommendations.
- **Multilingual Support**: The platform is currently in English, but given the diverse linguistic landscape in Bangladesh, offering multilingual support could help reach a broader user base, especially in rural areas.

6.3 Future Work

The future development of Fynnect presents several opportunities to enhance the platform and extend its reach across Bangladesh. Below are some suggested areas for future work:

- **Mobile Application Development**: Developing a mobile application for *iOS* and *Android* platforms will improve accessibility, allowing users to book appointments, manage their profiles, and make payments directly from their smartphones. Push notifications for appointment reminders can also be integrated into the app.
- **AI Integration for Doctor Recommendations**: Using AI algorithms to deliver personalized doctor suggestions based on patient preferences, medical history, and reviews can greatly improve the user experience. This would make the site more user-friendly and useful for those looking for specific therapies.
- **Expanded Payment Options**: In addition to **Stripe** and cash payments, integrating other local payment gateways such as **bKash** or **Nagad** could make the platform more accessible to users who prefer mobile money services commonly used in Bangladesh.
- **Multilingual Support**: To expand the platform's reach and user base, adding multilingual support (e.g., Bengali, English) would cater to a larger section of the population, particularly in rural areas where English may not be widely spoken.

- **Healthcare Provider Dashboard Enhancements**: Expanding the **admin dashboard** to include advanced analytics and reporting features would help healthcare providers better manage their bookings, payments, and patient data. Integration of telehealth options for remote consultations could also be considered to make healthcare more accessible, especially in remote areas.
- **Healthcare Provider Network Expansion**: Fynnect can be expanded to include a wider network of healthcare providers, including specialists, pharmacies, diagnostic centers, and hospitals, allowing users to access a broader range of medical services from the platform.
- **User Feedback and Continuous Improvement**: Regular user feedback collection and analysis will be crucial to improving the platform. Implementing a continuous improvement cycle will ensure that Fynnect evolves based on user needs and emerging healthcare trends.

Fynnect has successfully proved the ability to transform healthcare accessible in Bangladesh by offering a scalable system that streamlines doctor appointment booking. While the project has met its core objectives, there is still potential for further innovation and improvement to guarantee that Fynnect remains relevant and benefits both patients and healthcare providers in the future.

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