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RESEARCH ARTICLE

AI and EHR Innovation: A Smart Approach to Medical Prioritization and Patient Care

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ABSTRACT

With the rapid advancement of digital technologies, the convergence of Artificial Intelligence (AI), Machine Learning (ML), Deep Learning (DL), and Cloud Computing is transforming the landscape of biomedical engineering and healthcare delivery. Among the persistent challenges in modern healthcare is the effective management of Electronic Health Records (EHRs), particularly in prioritizing patient cases, segmenting heterogeneous clinical data, and enabling timely, data-driven medical decisions. Existing EHR systems often suffer from fragmentation, inefficiency, and limited interoperability, which can delay diagnosis and treatment. This research proposes an AI-enhanced EHR framework designed to streamline healthcare workflows, improve information accessibility, and support clinical decision-making. The system integrates AI-driven algorithms for automated patient prioritization, intelligent data segmentation, and predictive analytics to enhance medical decision support. A functional prototype was developed, deployed, and tested in a simulated healthcare environment using real-world inspired datasets. The framework was implemented through a modular design, ensuring scalability and adaptability for various clinical contexts. Experimental evaluation demonstrated substantial improvements in response time, diagnostic accuracy, and system scalability compared to conventional EHR systems. The proposed solution addresses critical gaps in medical data management by enhancing efficiency, reducing clinician workload, and enabling faster, evidence-based decision-making. This study contributes to the growing body of work on intelligent healthcare systems, offering a practical, efficient, and scalable model for next-generation EHR integration. The findings underscore the transformative potential of AI-powered solutions in driving digital transformation and improving patient care outcomes in biomedical engineering.

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1. Introduction

In recent years, the rapid evolution of digital technologies has brought transformative changes to the medical field, particularly in healthcare information systems. One of the most impactful innovations is the development and widespread adoption of Electronic Health Records (EHRs), initially introduced in the United States to enhance the management and accessibility of patient health information [1–3]. EHR systems have proven instrumental in organizing vast amounts of clinical data, reducing paperwork, improving communication among healthcare providers, and enhancing overall administrative efficiency. Despite these advancements, the exponential growth of medical data—driven by increasing disease prevalence, population growth, and the rising demand for healthcare services—has made it increasingly challenging to manage, prioritize, and analyze patient records efficiently [4–6]. While many countries have integrated EHRs into their healthcare infrastructure, the quality and effectiveness of these systems remain inconsistent. In particular, infrastructural, technological, and administrative barriers continue to hinder EHR optimization in low- and middle-income countries.

Developing nations such as Bangladesh face significant limitations in the implementation of digital healthcare solutions. The strain placed on healthcare systems by the COVID-19 pandemic further exposed the inadequacies of existing EHR infrastructures, underscoring the urgent need for intelligent, scalable, and locally adaptable health information systems [7–9]. Current EHR platforms often lack advanced functionalities such as automated prioritization, predictive analytics, and decision support, which are critical for ensuring timely, accurate, and efficient care delivery [10–12]. This research aims to address these challenges by designing and developing a prototype EHR system integrated with Artificial Intelligence (AI)–based optimization techniques. The proposed solution incorporates machine learning algorithms to enhance data segmentation, patient prioritization, and clinical decision-making processes. By tailoring the system to the specific requirements of under-resourced healthcare environments, this study contributes to the advancement of smart healthcare infrastructure in developing regions. Through experimental deployment and evaluation, the system demonstrates its potential to significantly improve the efficiency, accessibility, and responsiveness of healthcare services.

2. Methods and Experimental Analysis

This research follows a systematic, step-by-step methodology to investigate the impact of Artificial Intelligence (AI) and Electronic Health Record (EHR) systems within the field of Biomedical Engineering. The methodology is structured into multiple stages to ensure a comprehensive and data-driven approach:

(1) Background Research Investigations and Gap Identification: The study begins with an extensive analysis of existing available information to gather background knowledge on AI-driven EHR systems. This stage identifies research gaps, potential challenges, and areas requiring further exploration.

(2) Data Collection and Preprocessing: Relevant datasets were collected and structured using the KNIME data analytics platform. The data underwent segmentation, preprocessing, and post-processing to ensure accuracy, consistency, and relevance to the study objectives. Various data mining techniques were applied to extract meaningful insights while maintaining data integrity.

(3) Feature Engineering and Prototype Development: Key performance features were identified and engineered to enhance the AI-driven EHR system. A prototype model was developed and programmed to illustrate the system's design, functionality, and usability.

(4) Performance Evaluation and Comparison: The developed model was evaluated using appropriate performance metrics and compared against traditional EHR computing approaches. Data visualization techniques were employed to assess system efficiency, accuracy, and scalability.

(5) Result Analysis and Interpretation: The experimental results were analyzed in alignment with the research objectives, providing key insights into the impact of AI on EHR optimization. The findings were discussed in the context of Biomedical Engineering advancements, highlighting practical implications and future possibilities.

(6) Discussions and Conclusions with Future Research Directions: The study concludes by summarizing the findings, acknowledging limitations, and suggesting potential future research directions to further improve AI-integrated EHR systems.

This structured methodology (**Figure 1**) enables a comprehensive exploration of how AI-driven EHR solutions can enhance Biomedical Engineering applications, ultimately contributing to improved healthcare efficiency, decision-making, and digital transformation within the field.

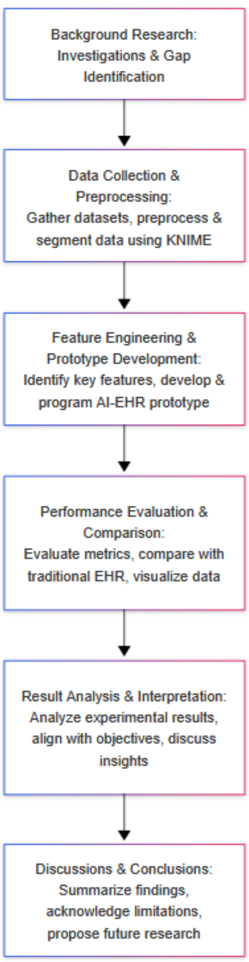

Figure 1. The block diagram for the methods and experimental analysis.

3. Background Research and Investigative Explorations for Available Knowledge

Electronic Health Records (EHRs) represent the systematic digital collection of patient and population-level health information. These records are stored electronically and can be shared across different healthcare settings, subject to national policies and regulatory frameworks. EHRs typically include a wide array of data types such as patient demographics, clinical history, medication records, allergy information, immunization status, laboratory test results, radiological images, vital signs, and billing information. Initially developed in the United States to improve clinical documentation and healthcare administration, EHRs have now become integral to many health systems worldwide. By enabling structured, centralized, and accessible patient information, EHRs significantly reduce paperwork, enhance data accuracy, and support timely decision-making[1–11]. Their adoption has allowed clinicians to stratify patients, particularly those with chronic illnesses, based on historical health data, leading to more targeted and effective care delivery.

Despite their potential, EHR systems present several challenges. One of the key issues is the overwhelming volume of medical data, which continues to grow rapidly due to increasing disease incidence and expanding healthcare access[12–22]. Many healthcare systems, especially in low- and middle-income countries, lack the infrastructure and resources to deploy and maintain efficient EHR platforms. In countries like Bangladesh, digital health solutions remain underdeveloped, and EHR implementation is still in its early stages. Compounding these challenges are critical concerns regarding data privacy, ethical handling, and cybersecurity. Although many developed nations, including the United States and EU member states, have enacted strict data protection laws—such as mandatory breach notifications and patient access rights—there remains public skepticism about centralized health data repositories[23–32]. Studies by the World Health Organization (WHO) have emphasized the need for strong governance to prevent misuse and breaches of sensitive health information. In some instances, governments have faced backlash over fears that centralized systems could be used for purposes beyond healthcare[33–40]. The terminologies EHR, Electronic Medical Record (EMR), Electronic

Patient Record (EPR), and Personal Health Record (PHR) are often used interchangeably, though they serve distinct functions. While EMRs are digital versions of paper charts maintained within a single healthcare provider's system, EHRs encompass a broader longitudinal record that spans multiple providers and care settings. PHRs, on the other hand, are patient-controlled digital health records that may or may not be integrated with institutional EHRs. The adoption of EHRs in Asia, and specifically in Bangladesh, remains limited due to infrastructural, economic, and educational barriers. In rural regions, low digital literacy and inadequate access to reliable internet services hinder implementation. Moreover, there is a considerable gap in doctor-patient communication, which affects EHR adoption and awareness. While urban healthcare providers are gradually embracing digital systems, a significant portion of the population—particularly those living below the poverty line—remain excluded from these innovations.

Nevertheless, the integration of advanced machine learning and natural language processing techniques offers new possibilities for analyzing EHR data more efficiently. AI-powered systems are increasingly capable of scanning clinical notes, predicting disease progression, and even estimating patient mortality rates using models such as convolutional neural networks and graph-based learning methods. Mobile technology has also contributed to this evolution, enabling physicians to access and update records remotely through smartphones and tablets—further increasing the usability and responsiveness of modern EHR platforms. However, successful EHR deployment requires not just software solutions, but also adequate hardware infrastructure, end-user training, and ergonomic work environments. Device security, charging logistics, data entry processes, and user interaction protocols must all be considered in designing a practical EHR ecosystem.

In the context of Bangladesh, implementing an AI-integrated EHR system poses both a challenge and an opportunity. While the country has made progress in embracing digital technology, significant gaps remain in awareness, policy, and technical readiness. Bridging these divides will require a combination of government commitment, public health education, and the development of scalable, user-friendly EHR solutions tailored to regional realities. This study builds on these foundational insights to explore a prototype AI-powered EHR system, designed specifically to enhance medical prioritization, data segmentation, and clinical decision-making in resource-constrained settings.

4. Prototype Designs and Experimentations

The development of the prototype followed established standards and concurrent computing principles, with a primary focus on task handling, patient prioritization, and optimized scheduling—key requirements for an effective Electronic Health Record (EHR) system. The prototype was designed and implemented using the C# programming language within the Visual Studio runtime environment, ensuring an efficient and scalable platform. The data processing and analytics components were built from scratch, utilizing custom priority-based data mining algorithms.

4.1. Prototype Features and Development Approach

1. AI-Driven User Interface & Real-Time Data Handling: The user interface was designed with a focus on ease of access and user-friendliness, catering to both patients and healthcare professionals. The prototype was equipped with pre-built features to handle real-time, dynamically generated patient data based on system usage and activity. The AI-driven system ensures optimal interactions while allowing for future enhancements and feature expansions based on evolving user needs.
2. Intelligent Patient Prioritization System: A key innovation in the prototype is the AI-integrated patient prioritization system, which categorizes patients based on severity levels. The system dynamically evaluates patient conditions and assigns priority rankings to optimize healthcare resource allocation. For instance, a cardiac emergency is classified as Priority 1, ensuring immediate attention, whereas a mild fever case is allocated a lower priority, allowing for efficient scheduling without overwhelming the system.
3. Optimized Server System for Performance Efficiency: The server infrastructure was designed to manage concurrent data transactions efficiently, ensuring seamless interaction between patients, doctors, and health-

care providers. This system not only maintains data integrity but also facilitates automated medical scheduling, real-time updates, and AI-assisted decision-making for healthcare professionals.

4. Dynamic Payment Processing for Global Scalability: Recognizing the variability in healthcare payment systems across different countries, the prototype includes a flexible payment integration module. This feature ensures compatibility with multiple currency formats, reducing transactional inefficiencies. Future iterations of the system can further expand global adaptability by incorporating region-specific financial regulations and digital payment methods.
5. Parallel Task Synchronization for Maximum Efficiency: The scheduling mechanism was designed to facilitate parallel execution of operations, ensuring that task processing, patient diagnosis, and medical consultations occur in a synchronized manner. This approach enhances system responsiveness, reduces wait times, and optimizes overall healthcare service delivery.

4.2. Scalability and Future Enhancements

While the current prototype successfully integrates AI-driven prioritization, real-time data handling, and optimized scheduling, it remains a work-in-progress. Future updates will focus on incorporating advanced machine learning models, predictive analytics, and expanded interoperability with global EHR systems. The system is designed to be modular and adaptable, allowing for continuous improvements based on real-world user feedback and evolving healthcare needs.

5. The COVID-19 Pandemic: Bangladesh Perspectives

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, had a profound impact on Bangladesh as part of the global health crisis. The first confirmed cases in the country were reported on March 8, 2020, by the Institute of Epidemiology, Disease Control and Research (IEDCR). From that point onward, the virus spread rapidly, placing immense pressure on an already fragile healthcare system. By mid-2020, Bangladesh became the second-most affected country in South Asia after India.

To mitigate the outbreak, the government implemented a nationwide lockdown from March 23 to May 30, 2020, alongside public awareness campaigns promoting preventive measures such as mask usage, social distancing, and hygiene practices. Despite these early interventions, the rate of infection escalated sharply in April, with a 1,155% increase in confirmed cases during the week ending April 11—marking the highest weekly growth rate in Asia at that time. By May 6, all 64 districts had reported cases, indicating widespread community transmission. By July 2020, the total number of confirmed cases in Bangladesh had surpassed both China and France, with more than 160,000 infections and over 2,000 reported deaths. While recovery rates improved by mid-July, the crisis revealed several underlying weaknesses in the national healthcare infrastructure. Limited diagnostic testing capacity, especially in the early stages of the pandemic, resulted in underreported cases and unverified COVID-19-related deaths. Many symptomatic individuals were unable to access timely medical care, leading to preventable fatalities in isolation centers and homes.

One of the most pressing challenges during the pandemic was the shortage of medical-grade oxygen. With a daily estimated demand of over 200 tons, the country struggled to maintain adequate supply as cases surged. In response, the government and IEDCR collaborated with the Department of Public Health Engineering (DPHE) to develop an oxygen demand forecasting model for crisis management.

To improve public communication, authorities launched dedicated helplines, online platforms, and social media channels via IEDCR to disseminate information, facilitate case reporting, and provide medical guidance. While these efforts enhanced information flow, the overall response exposed the limitations of traditional healthcare systems in handling large-scale emergencies.

Critically, the pandemic highlighted the absence of a unified, digitized health information infrastructure (**Figures 2** and **3**). A nationwide Electronic Health Record (EHR) system could have significantly improved data-driven decision-making, accelerated diagnosis, facilitated patient tracking, and optimized resource allocation. The lack of integrated digital tools led to inefficiencies in patient management, case reporting, and emergency response.

As Bangladesh continues to recover and prepare for future public health crises, the experience of COVID-19 underscores the urgent need for strategic investments in digital healthcare infrastructure. Implementing a robust, AI-integrated EHR system would enhance the country's capacity to respond to similar outbreaks, support clinicians with real-time data, and ultimately improve patient outcomes.

This case study reinforces the core argument of this research: modernizing healthcare through smart digital systems is no longer optional, but essential for national health resilience and preparedness.

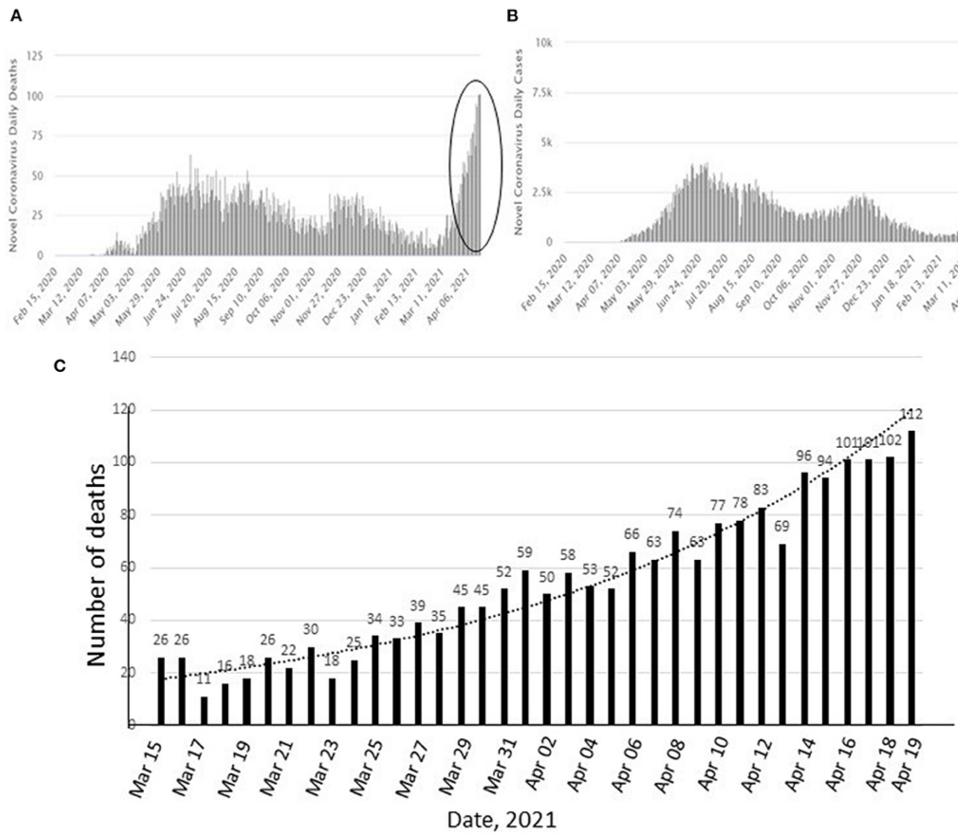

Figure 2. Case diagram on the COVID-19 pandemic within Bangladesh.

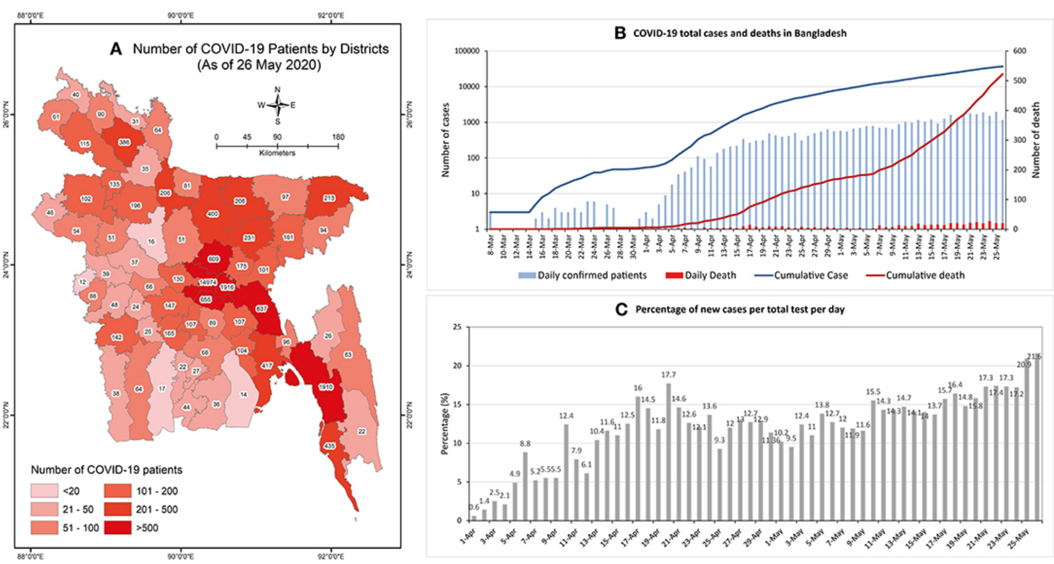

Figure 3. The COVID-19 pandemic dashboard for Bangladesh.

6. Priority-Based Patient Entry System: Prototype Design and Experimental Analysis

The challenges of data manipulation and exceeding data limitations significantly impact computing efficiency at multiple levels. In real-time hospital environments, patient data is transmitted and received every split second from various nodal points, leading to server overload and inefficiencies in patient entry management.

To address this issue, this research introduces a priority-based patient entry mechanism that optimizes patient scheduling through a classification-based system integrated into a simulated environment.

6.1. Concept of Priority-Based Scheduling

The proposed system categorizes each patient based on medical urgency, ensuring those with critical conditions receive immediate attention. For example:

Case 1: A patient with coronary heart disease (Priority 1) and another with fever and headache (Priority 5) arrive simultaneously. The system prioritizes the heart patient first due to the higher risk of stroke or heart failure.

Case 2: A patient with a burn injury (Priority 2) and another with a digestive issue (Priority 6) require treatment. The burn patient is treated first, following the predefined priority segmentation.

This priority-based approach allows the software to automate patient scheduling, ensuring efficient resource allocation and faster emergency response times. Hospitals and clinics can customize the priority framework based on their specific requirements and emerging medical conditions. The priority queue remains adaptive and modifiable, with doctors overseeing updates based on new medical cases and treatment protocols.

6.2. AI Integration and System Architecture

To enhance the system's efficiency, artificial intelligence (AI) techniques are integrated for data processing, patient classification, and predictive analytics.

The prototype consists of:

Figure 4: A visual representation of the system mechanics.

Figures 5–7: AI implementation architecture.

Figure 8: A global experimental design for future integration.

Additionally, the system can incorporate biometric-based disease identification using IR and MRI sensor data, enabling computer vision-based patient recognition. The integration of machine learning (ML) and deep learning (DL) allows the system to analyze historical patient data and predict potential health risks.

For instance, a patient's five-year medical history, hospital visits, treatments, and prescribed medications can be processed using ML algorithms to forecast potential future health conditions. Over time, this approach will enable early disease detection, improving healthcare outcomes.

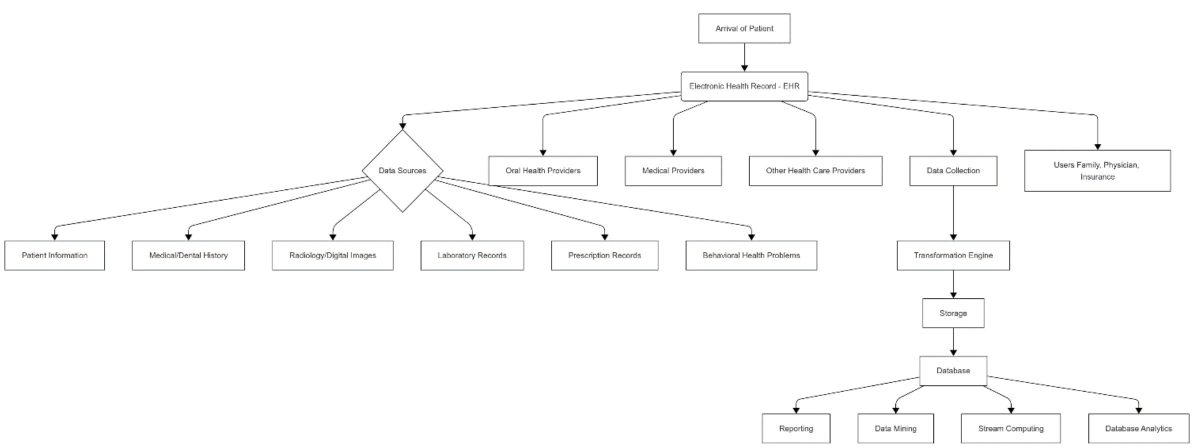

Figure 4. Diagram of the designed prototype (1).

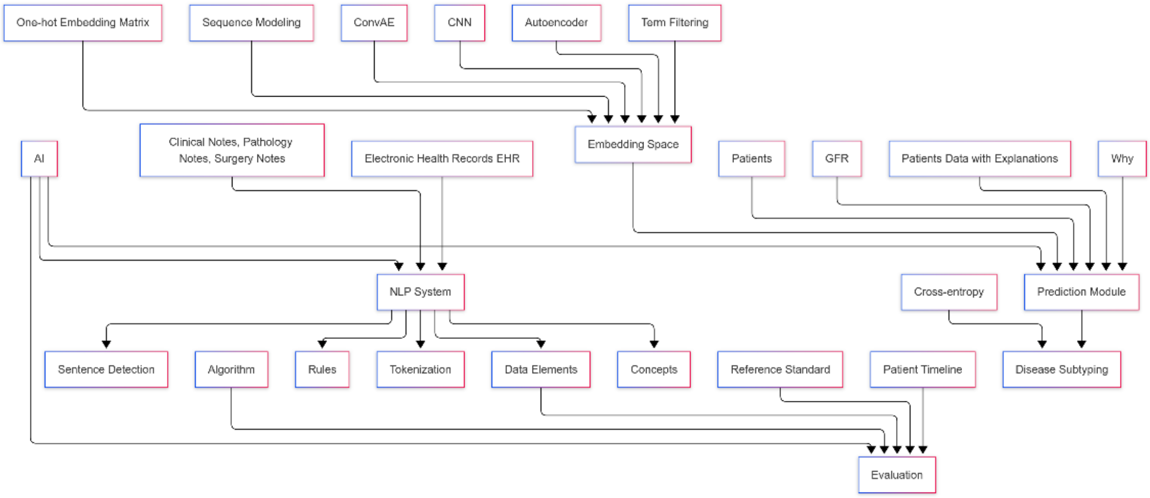

Figure 5. Diagram of the designed prototype (2) [AI & EHR].

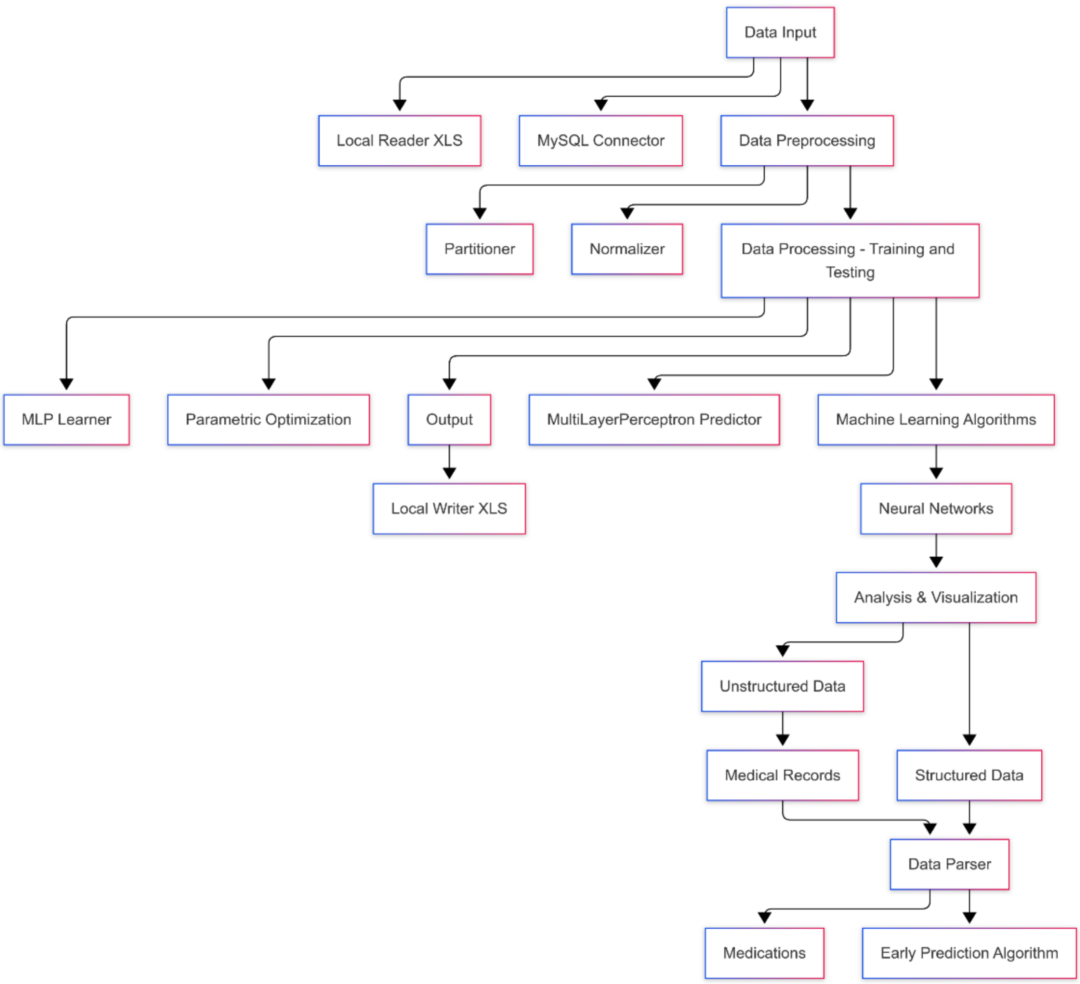

Figure 6. Diagram of the designed prototype (3) [KNIME].

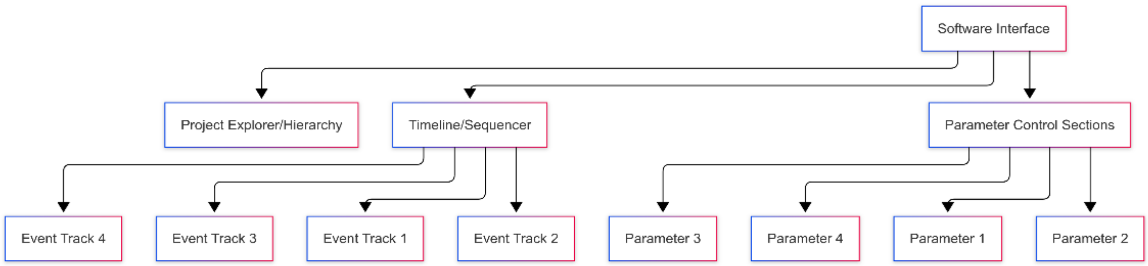

Figure 7. Diagram of the designed prototype (4) [User Interface].

Figure 8. Futuristic designed prototype if global (Experimental).

6.3. Challenges and Ethical Considerations

Despite the potential benefits, data acquisition remains a critical challenge. During the research, multiple hospitals were surveyed, but few agreed to share patient data, citing privacy concerns and a reluctance to adopt new systems that could disrupt traditional processes.

Some stakeholders opposed the system, fearing it could eliminate profit-driven inefficiencies in healthcare management. However, the system's potential extends beyond hospital management to government healthcare planning, medical research, and AI-driven disease modeling. With comprehensive datasets, AI can identify patterns in disease progression and improve treatment protocols.

System Implementation and Experimentation

KNIME software was used for data analytics and medical data mining ecosystem development.

Visual Studio Code provided the runtime environment for prototype testing and troubleshooting.

A priority queue database was designed and developed to optimize patient entry processes.

The experimental results demonstrate that priority-based scheduling improves patient management, reduces server overload, and enhances hospital workflow efficiency. Further research can refine AI-driven patient diagnostics, real-time disease prediction, and personalized treatment recommendations.

6.4. Future Scopes

The system's adaptability allows for continuous evolution, integrating biometric analysis, IoT-based patient monitoring, and AI-driven healthcare predictions. With sufficient medical data, the system can predict future disease probabilities and medical requirements, enhancing patient care and hospital efficiency.

The research findings emphasize the need for wider adoption, secure data sharing, and governmental support to fully realize the potential of AI in healthcare management. The priority queue model is a significant step toward a smarter, data-driven healthcare system that prioritizes patient well-being over procedural inefficiencies.

7. Prototype Designs & Experimental Results (1)

7.1. Data Management and User Identification

The prototype system was developed with an integrated server system to manage data efficiently. Each user, including doctors and patients, is assigned a unique ID generated within the system's source code. This ensures data integrity by preventing duplication, redundancy, or misplacement of records.

When a patient consults a specific doctor and receives treatment, they may choose to share their ID with the doctor for future reference. However, the system maintains strict privacy policies, allowing access to this information only if both parties mutually agree to share their ID numbers. Without explicit user consent, neither party can retrieve the other's ID, ensuring enhanced data privacy and security.

7.2. Data Storage and Access Control

User information is stored only when explicitly saved in the respective portal profiles. Patients have full control over their medical records, including the ability to upload, modify, or delete medical reports. While doctors can view patient histories for medical assessment, they cannot edit or modify patient data. This maintains data authenticity and prevents unauthorized alterations.

Patients must ensure accuracy when entering medical information, as treatment decisions rely on the data provided. If insufficient or incorrect data is supplied, the responsibility lies with the patient, not the doctor. To optimize healthcare outcomes, patients are encouraged to provide comprehensive and accurate medical details.

7.3. Appointment Scheduling and Doctor-Patient Interaction

The system facilitates direct communication between patients and doctors through an appointment scheduling feature. Patients can select available time slots from a doctor's schedule and confirm appointments. If a patient does not book an appointment, their profile remains inaccessible to the doctor.

Hospitals and doctors have the discretion to share their availability within the system. If they choose not to provide this information, patients will not have access to doctor listings. This feature ensures that both parties retain control over their data and interactions.

7.4. Ethical and Practical Considerations

The prototype emphasizes ethical data handling, user consent, and security. Patients have exclusive control over their medical records and can choose what to share with their doctors. However, medical consultations require comprehensive patient data for accurate diagnosis and treatment.

Doctors and hospitals participating in the system must acknowledge an agreement to uphold ethical standards and provide professional medical assessments. While differences in medical opinions may arise due to varying expertise levels, open communication and ethical considerations help ensure effective healthcare delivery.

7.5. Experimental Observations and User Feedback

A survey conducted during the research phase revealed mixed reactions. While many professionals appreciated the direct communication approach, some healthcare organizations were hesitant due to potential financial impacts and accessibility concerns.

The system's ability to prevent third-party interference and facilitate direct patient-doctor interactions was highly valued. However, concerns regarding information consistency across multiple doctors and potential miscommunication were highlighted. The system addresses these concerns by allowing patients to share medical records at their discretion. The prototype system was designed with a focus on data privacy, accessibility, and ethical healthcare practices. By providing patients control over their medical data while ensuring secure doctor-patient interactions, the system enhances transparency and efficiency in healthcare communication. Future iterations of the system may incorporate advanced data validation mechanisms and AI-driven recommendations to further optimize patient care.

8. Prototype Designs & Experimental Results (2)

The implementation of the Electronic Health Record (EHR) system, particularly in the context of Bangladesh, presents a range of challenges and opportunities. The complexities arise due to multiple factors, including governmental policies, political influences, and socio-economic conditions. To put things into perspectives each of the designated features and functionalities with their associated device peripherals integrations were experimented with for multiple iterations in order to fully align the fundamental understanding and core idea concerning the prototype so that each type of user based on their ability to interact with the systems stays within real-time dynamics.

These aspects played a significant role in defining the research scope, which was adjusted accordingly to accommodate the existing constraints within Bangladesh's medical landscape. However, despite these challenges, the study also revealed substantial positive implications, as many stakeholders recognized the potential of EHR as a transformative digital innovation for public health administration and safety.

8.1. User Portal Design and Functionality

The developed prototype system incorporates a structured user portal that enhances accessibility and ease of use for both doctors and patients. The system generates a unique identification number for each user, ensuring secure data management and preventing duplication, redundancy, and misplaced records. The ID is assigned based on user requirements and priorities, and it is not automatically shared between users unless both parties consent to exchange their information. This privacy-first approach ensures data security while allowing flexibility for patients and doctors to interact within their respective portals.

When a patient consults a doctor and receives a diagnosis or treatment, they have the option to share their ID with the doctor. If both parties agree, they can retrieve each other's information within the system. However, the system does not automatically disclose user data, reinforcing the importance of individual consent. Moreover, medical reports and diagnostic records are stored only when explicitly uploaded by the patient. The patient retains full control over their data, including the ability to update or modify their medical history. Doctors, on the other hand, can view but cannot edit patient information, ensuring data integrity and reducing the risk of unauthorized modifications.

8.2. Privacy and Data Management

To safeguard privacy, a doctor can only access a patient's medical history if the patient chooses to share it. The system emphasizes the importance of accurate and comprehensive data entry by patients, as missing or misleading information can impact diagnosis and treatment outcomes. Patients are responsible for ensuring the authenticity of the data they provide, as any discrepancies could lead to incorrect medical recommendations.

Appointments must be scheduled from the patient's end, with a confirmed time frame. If a patient fails to attend their scheduled appointment, the doctor cannot be held accountable. The system allows patients to view available doctors and their respective schedules, but only if the doctor or hospital has opted to share this information within the system.

8.3. EHR Implementation Challenges and Benefits

In Bangladesh, the adoption of EHR faces challenges due to political and governmental influences, as well as public perception regarding data privacy and digital transformation. Despite these barriers, the system has been widely acknowledged as a major step toward modernizing healthcare administration. The structured implementation of an EHR framework could bridge the gap between doctors and patients, improving communication and reducing medical mismanagement caused by third-party involvement.

One notable concern raised during the research was the differing opinions and methodologies among doctors when interpreting medical data. While experience levels and individual perspectives may vary, the system encourages transparency and ethical considerations to facilitate collaboration. By integrating a structured agreement for doctors and hospitals opting into the system, the platform ensures that medical professionals adhere to ethical standards and prioritize patient-centered care.

8.4. Visualization of System Design and EHR Benefits

The user portal and its associated functionalities are illustrated in **Figures 9–16**, highlighting the interface layout and key features. Additionally, **Figure 17** provides a visual representation of the benefits of EHR implementation over the past decade, demonstrating its impact on healthcare efficiency, patient safety, and data management.

This research underscores the importance of ethical considerations, user consent, and structured data management in developing an effective EHR system. While challenges persist, the findings indicate that a well-implemented system could significantly enhance healthcare services, providing long-term benefits for both doctors and patients.

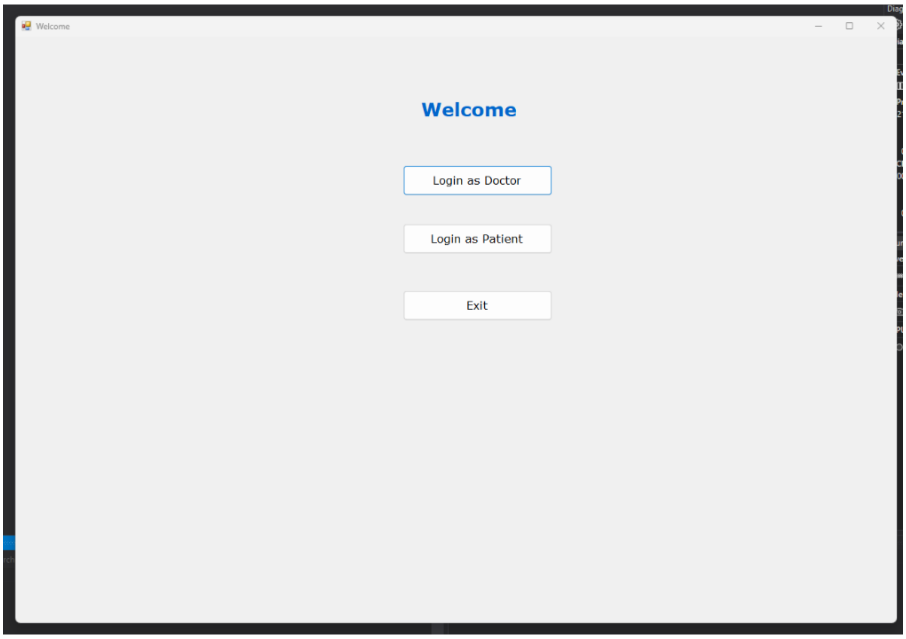

Figure 9. Designed prototype (Login View).

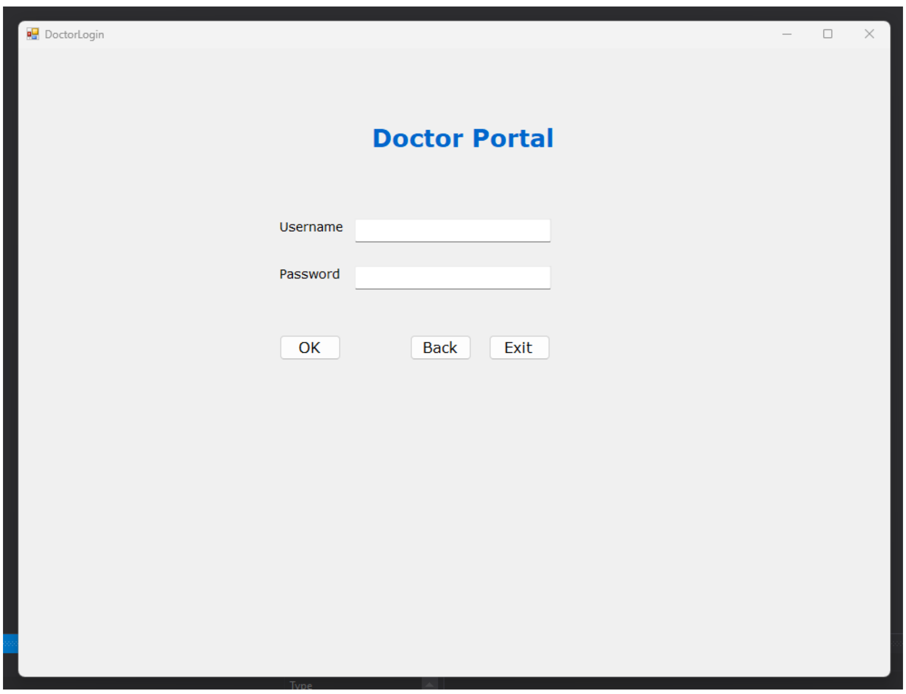

Figure 10. Designed prototype (Doctor Portal).

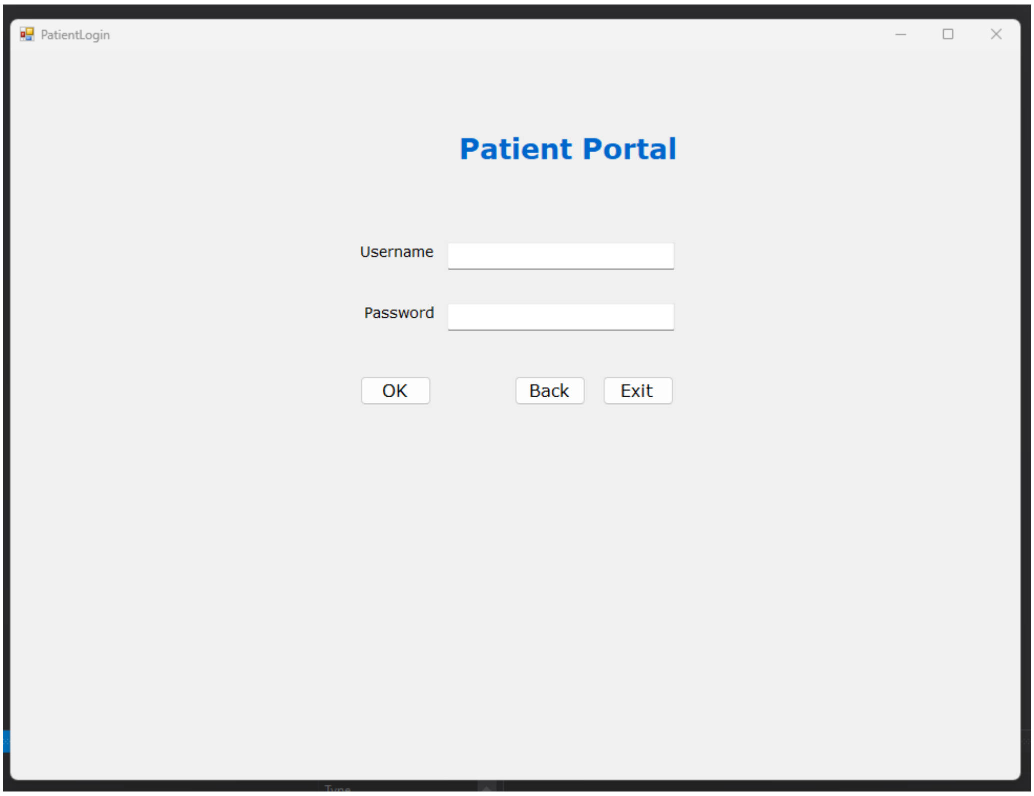

Figure 11. Designed prototype (Patient Portal).

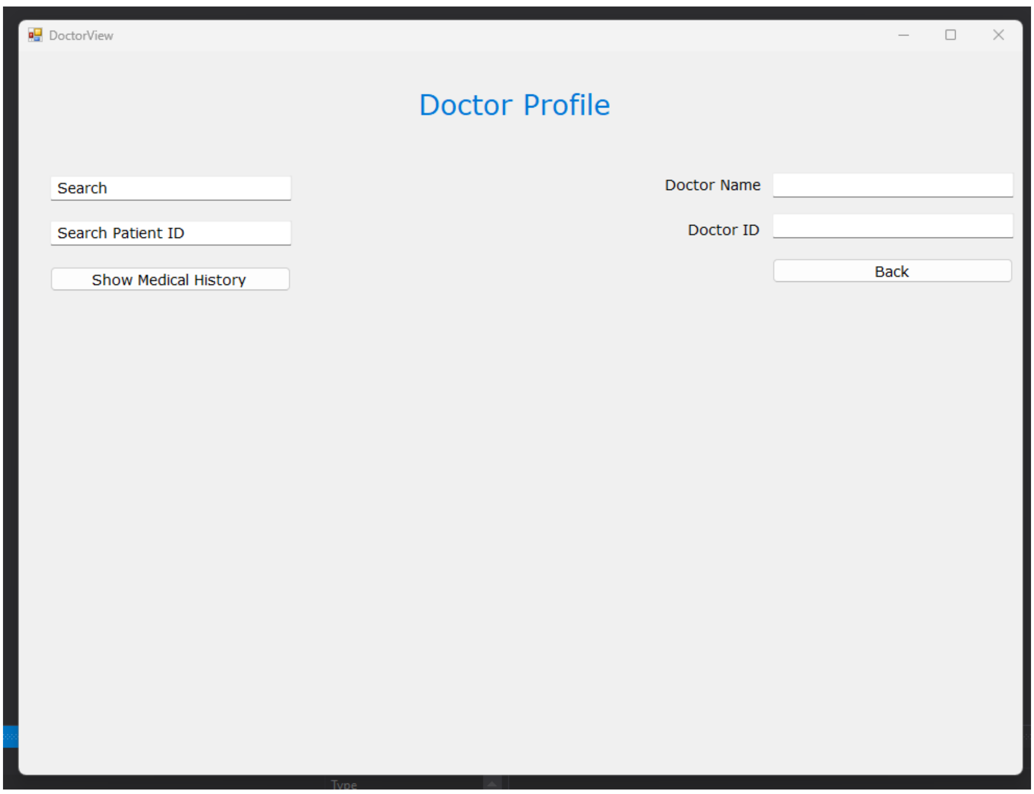

Figure 12. Designed prototype (Doctor Profile).

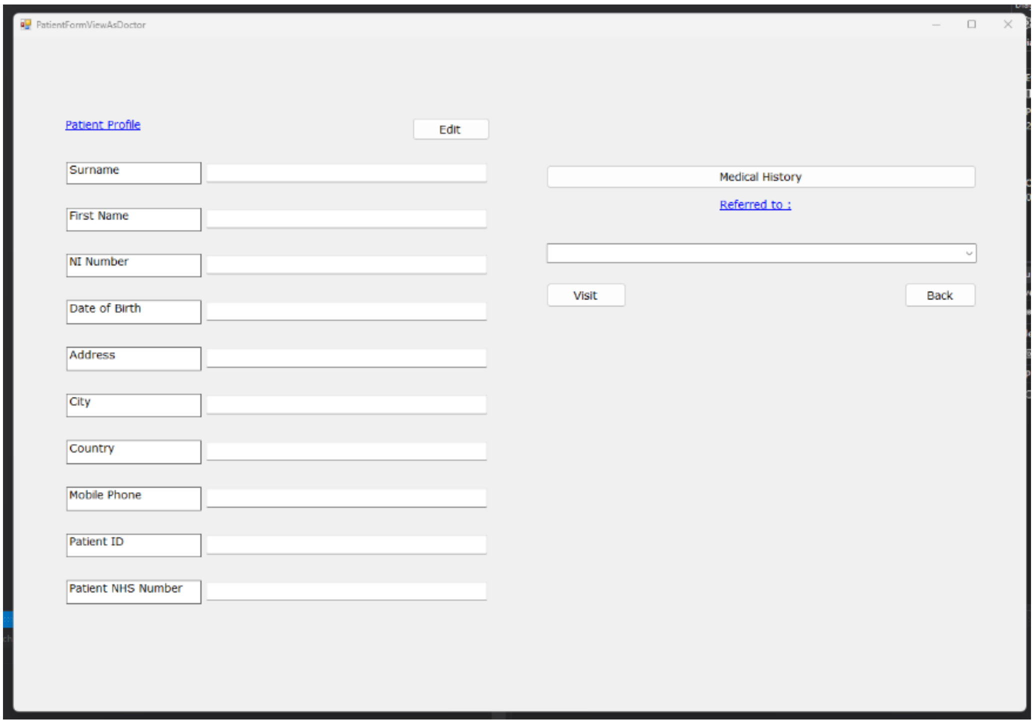

Figure 13. Designed prototype (Patient Profile).

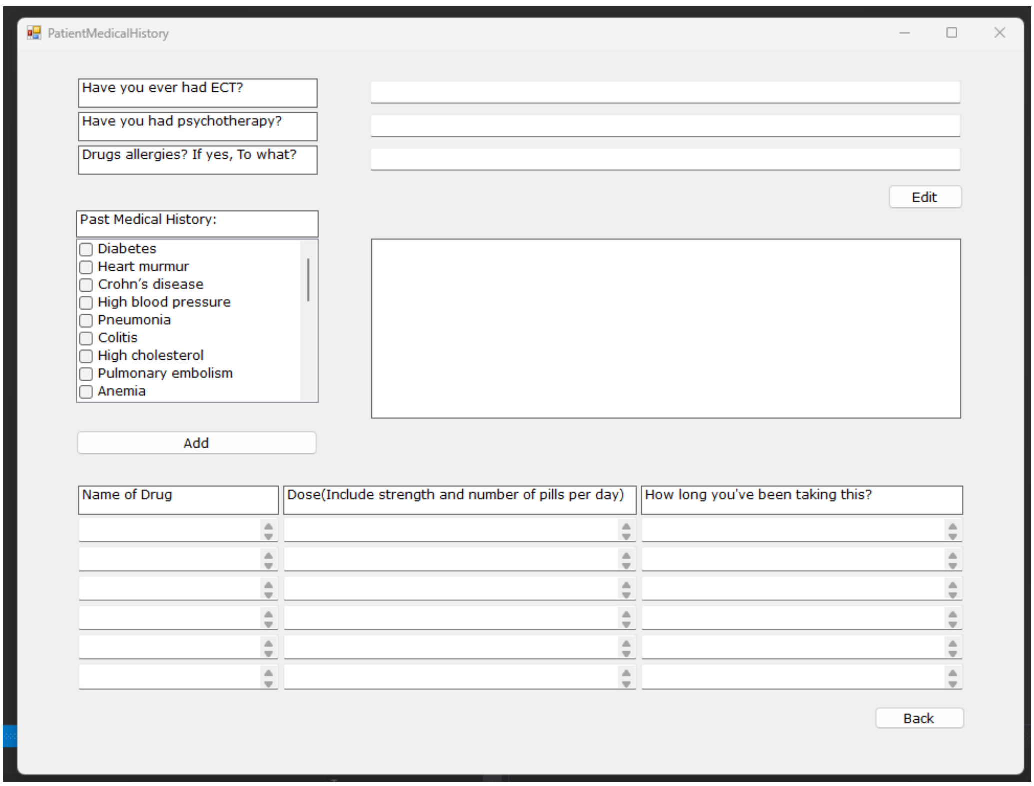

Figure 14. Designed prototype (Patient Medical History).

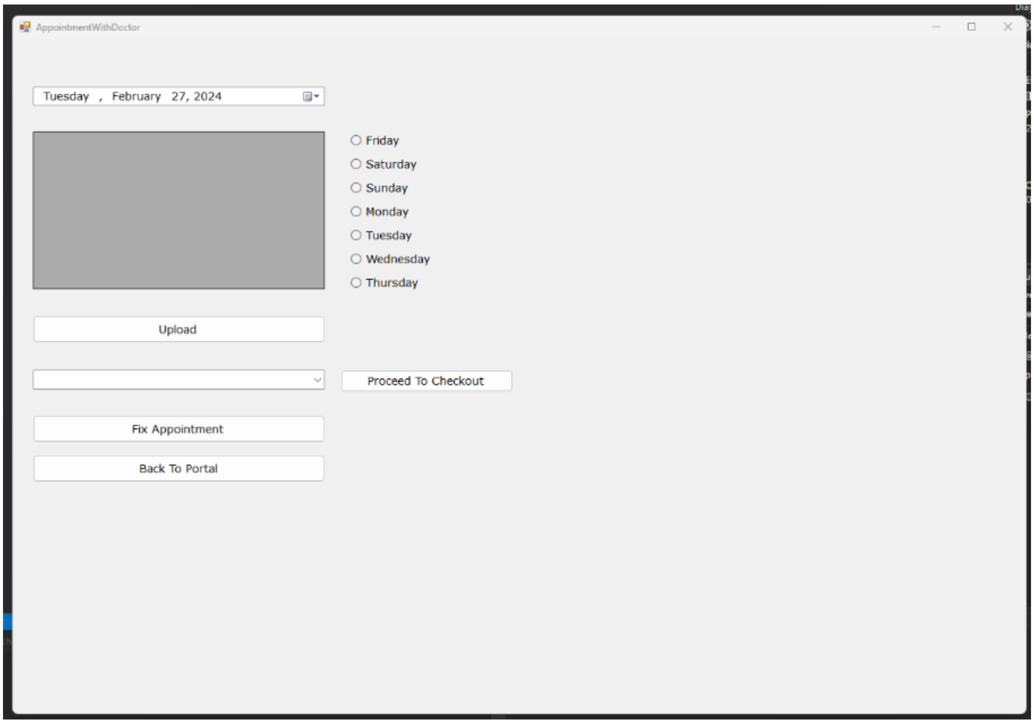

Figure 15. Designed prototype (Doctors List and Appointments).

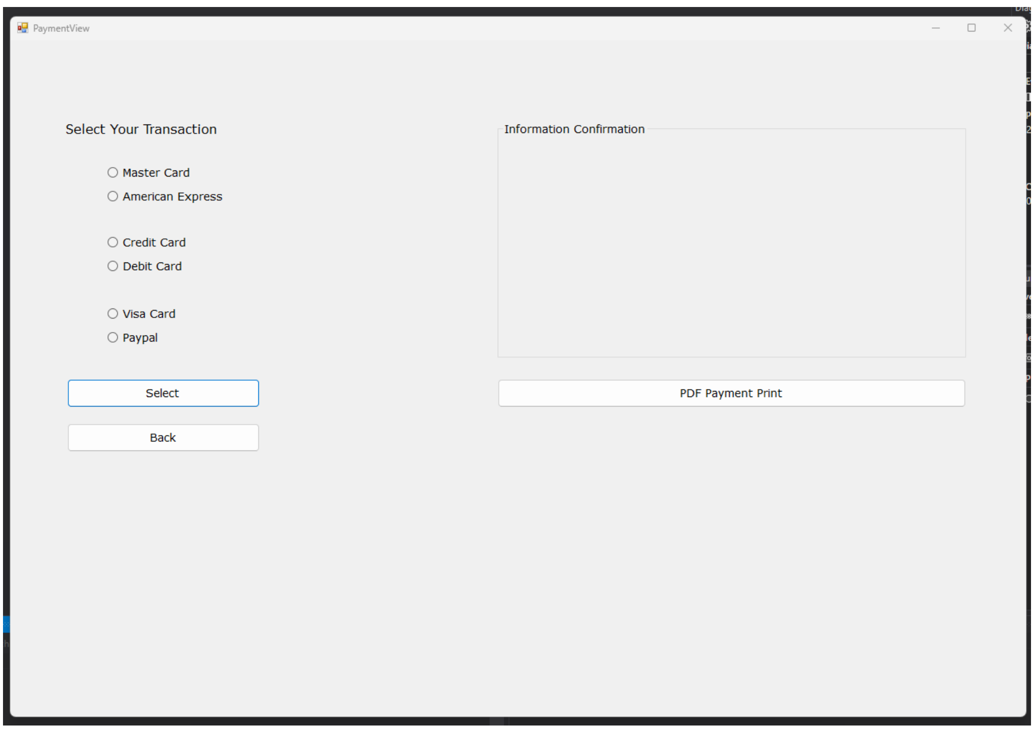

Figure 16. Designed prototype (Payments Portal).

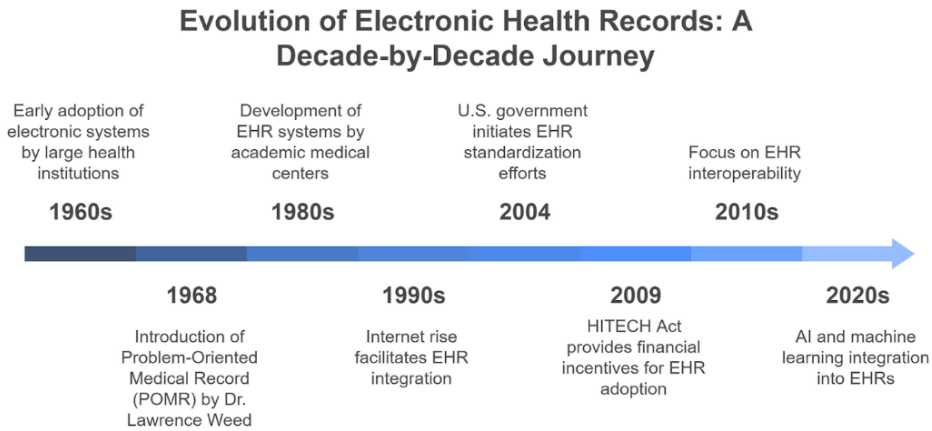

Figure 17. EHR implementations over the past Decade.

9. Results and Findings

The prototype was tested with various individuals, including both patients and doctors, to evaluate its usability from a user experience perspective. The data collected from user interactions were analyzed and visually represented to provide insights within an ethical framework for better comprehension. The study highlights that EHR systems can serve as a groundbreaking innovation in healthcare administration, offering a transformative toolkit for the medical sector.

However, challenges remain regarding the widespread adoption of EHR systems in Bangladesh. A significant concern is the lack of awareness and understanding at the national level, which raises questions about the feasibility of its immediate deployment. While its necessity might not be fully recognized today, the future holds promise for its development and implementation. The COVID-19 pandemic demonstrated the critical need for such advancements and underscored the potential impact of EHR systems in improving healthcare services. As a developing nation, Bangladesh is likely to embrace this technology in due course, and this research serves as a stepping stone towards that goal.

Health will always be a top priority in human society, particularly considering the evolving nature of diseases and the increasing risks associated with genetic mutations and anatomical degradation. Continuous research and advancements in healthcare technology are imperative to improving patient outcomes.

Even minor improvements can lead to significant advancements in disease prevention, treatment, and recovery. Thus, the ongoing enhancement and adaptation of EHR systems will play a crucial role in the future of medical science.

The research findings and prototype development provide a pathway towards this vision, aligning with the broader objectives of enhancing healthcare accessibility and efficiency. However, like any technological innovation, this initiative has faced both positive and negative perspectives during its experimental phase. Despite the challenges, the unique attributes and features of the prototype highlight its potential as a significant contribution to human health science and medical innovation.

10. Discussions and Future Directions

In the evolving landscape of medical science and biomedical engineering, continuous innovation is crucial for advancing healthcare solutions. The integration of Electronic Health Records (EHR) represents a significant milestone in this domain, offering a structured approach to managing medical histories and associated documentation. If implemented effectively, EHR systems can bridge existing gaps in healthcare infrastructure, facilitating seamless communication between medical professionals, patients, and government entities.

However, in the context of Bangladesh, several challenges persist. The healthcare sector has faced immense struggles in recent years, exacerbated by a surge in disease outbreaks and systemic inefficiencies. The COVID-19 pandemic particularly exposed vulnerabilities in medical communication, where mismanagement between hospitals, doctors, and policymakers led to significant disruptions in patient care.

These issues highlight the urgent need for a digital transformation in the healthcare sector. Despite these challenges, the adoption of EHR in Bangladesh presents an opportunity to modernize and enhance healthcare services. Moving forward, future research should focus on addressing key implementation barriers, such as infrastructure limitations, data security concerns, and the need for proper training among healthcare professionals. Additionally, policies promoting nationwide standardization of EHR systems will be critical for ensuring interoperability and long-term success.

Further studies should also explore the integration of artificial intelligence (AI) and machine learning (ML) in EHR systems to enhance predictive analytics, patient monitoring, and automated diagnostics. These advancements could significantly improve healthcare accessibility and efficiency, ultimately contributing to better patient outcomes.

As Bangladesh progresses towards digital transformation, it is essential to take a proactive approach in adapting to these changes. Investing in EHR infrastructure and ensuring stakeholder collaboration across governmental and private sectors will be crucial in making this vision a reality. With continued research and development, EHR systems have the potential to reshape the healthcare landscape, fostering a more efficient, transparent, and patient-centric medical ecosystem.

11. Conclusions

The implementation of an Electronic Health Records (EHR) system presents several challenges, particularly in terms of management, infrastructure, and public acceptance. However, the COVID-19 pandemic has significantly altered perceptions, highlighting the critical need for a unified digital healthcare system. As awareness grows, both the government and the public may come to recognize the indispensable role of EHR systems in enhancing healthcare efficiency, patient safety, and overall medical innovation.

This research was conducted with the objective of addressing these challenges and laying the groundwork for a robust and scalable EHR framework. The proposed prototype represents a significant step forward in digital health transformation, offering a model that, if further developed and refined, could be implemented on a national and even global scale. While the project was temporarily put on hold due to the author's transition to an international research environment, its core contributions remain relevant.

Despite the current challenges, this research offers a unique perspective on the future of healthcare innovation. With continued efforts and advancements in biomedical engineering and digital health systems, the envisioned EHR solution has the potential to become a reality. In terms of new innovations and experimental findings, one thing was made very much clear that even with the accelerated apex of computing diseases will still remain looming with the human biology condition and perhaps a new variety may arise which can come even with steady preparedness. The COVID-19 pandemic was a prime example of this retrospect concerning the matters of perspectives.

In the years to come, further research, policy support, and technological advancements will determine the extent to which this vision materializes into a transformative global healthcare initiative.

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Conflicts of Interest

The authors declare no conflict of interest.

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