Ai Driven Personalized Healthcare Recommendation System

CH. Rishitha[1], J. Jyothsna[2], P. Sireesha[3], G. Venugopal[4], Dr.U.Uma Maheswara Rao[5]
[1,2,3,4]*Student, Department of Electronics and Communication Engineering Sasi Institute of Technology and Engineering, Tadepalligudem*
[5.]*Assistant professor, Department of Electronics and Communication Engineering Sasi Institute of Technology and Engineering, Tadepalligudem*

***Abstract*—This paper describes to help users manage their medial information; this project offers a full-stack healthcare application. The system analyses uploaded medical data using Google's Generative AI (Gemini) to extract important information like possible conditions, prescription regimens, and doctor's recommendations. An automatic email reminder system is then powered by these drugs, sending patients timely notifications according to the recommended frequency (e.g., once, twice, or thrice daily). Strong user management with role-based access restriction (patient/admin), safe authentication with JWT, and administrative tools for system supervision, such as user management and AI usage tracking, are all included in the platform. MongoDB is used for data durability, and pinecone is used for possible vector search features. To ensure system dependability and maintainability, a number of utility scripts support database seeding, report re-indexing, email testing, and API model validation.**

***Index Terms*—Healthcare, Full stack, Rule-Based, AI, Recommendation System, Web Application, Alerts, Remainders.**

I. INTRODUCTION

Despite fast technological improvements in other areas of society, the way people engage with their medical information has remained virtually constant for decades. The paperwork that arises from a patient's medical testing or diagnosis--laboratory reports, imaging data, and clinical notes--is usually provided in formats that put clinical accuracy ahead of patient accessibility. Although the vocabulary and style used in these documents require a level of medical understanding that most individuals do not possess, they do provide important information regarding the patient's health status. For example, a standard complete blood count report contains a large number of data along with reference ranges, acronyms, and medical terms that are difficult to understand without specific training.

After receiving this record with minimal context, the patient frequently leaves the doctor's office with more questions than answers on the implications of the findings for their health. This situation fundamentally disrupts the healthcare delivery systems. Patients, who are the primary recipients of medical knowledge. Often lack direct access to it. As a result, they must rely entirely on medical professionals to interpret findings, explain their significance, and guide treatment decisions.

So, this platform bridges a vital gap today in healthcare: it's potential to decode complicated medical finding and translate them into the simple and understandable practical information. The system collects vital data, especially suspected condition, severity levels, extensive findings, and prescribe medicine schedules, by automating the collection and analysis of documents related to health, comprising laboratory reports, diagnostic reports, prescriptions. This system has ability in producing step-by-step next steps and ability to generate doctors' advice stands it apart from others, helping people to obtain medical insights without need for in-depth medical knowledge. The methodology uses smart medicine reminder services, designed to handle the complex nature of real-world prescription instructions, going beyond static analysis. It ensures that patients receive timely,

personalised email remainders by automatically assigning medication timings (such as “once daily,” “twice daily,” or specific times like” morning”) to suitable reminder intervals. This feature improves use of medications and improves health outcomes through transforming one-time report analysis into an ongoing care management solution.

II. RELATED WORK

In fact, there currently exists numerous kinds of medical services technology aimed towards helping people with managing medications and medical reports. These kinds of systems range among one of the three main classifications: prescription reminder apps, health-related tracking platforms and medical report analysis tools. Each of these alternatives possesses significant drawbacks along with significant perks of its own.

A particular kind of currently available choices are electronic health record system and medical report analysis techniques like IBM Watson Health [1]. These advancements were effective in hospital environments while experienced people are using tools as they have the capacity to effortlessly analyse massive numbers of hospital paperwork while retrieving well-organised information such as laboratory readings and diagnostics [2].

Yet, when the time comes to patient utilisation, these developments face major problems [3]. They contain confusing medical terminology that is unfamiliar to the ordinary people and serves the purpose mainly for professionals compared to patients [4]. Moreover, patients acquire analytics besides no follow-up support with consuming their prescribed medicines as these advancements are not compatible with medication reminder systems [5].

The proposed system serves as a personalised healthcare recommendation technology developed by AI that practically reviews the way individuals deal with their medical information [6]. As opposed to present systems functioning standalone, the one we created delivers a comprehensive, seamless experience that integrates electronic, medication reminders, personalised health statistics, and medical report analysis into a one, streamlined platform [7].

III. SYSTEM ARCHITECTURE

The system comes with a functional client-server architecture featuring various levels segregation. This architecture supports an excellent user experience yet ensuring security, scalability, and maintainability. Figure1 illustrates the overall framework of the system, demonstrating the way that various modules interact and how data moves through the structure of the system.

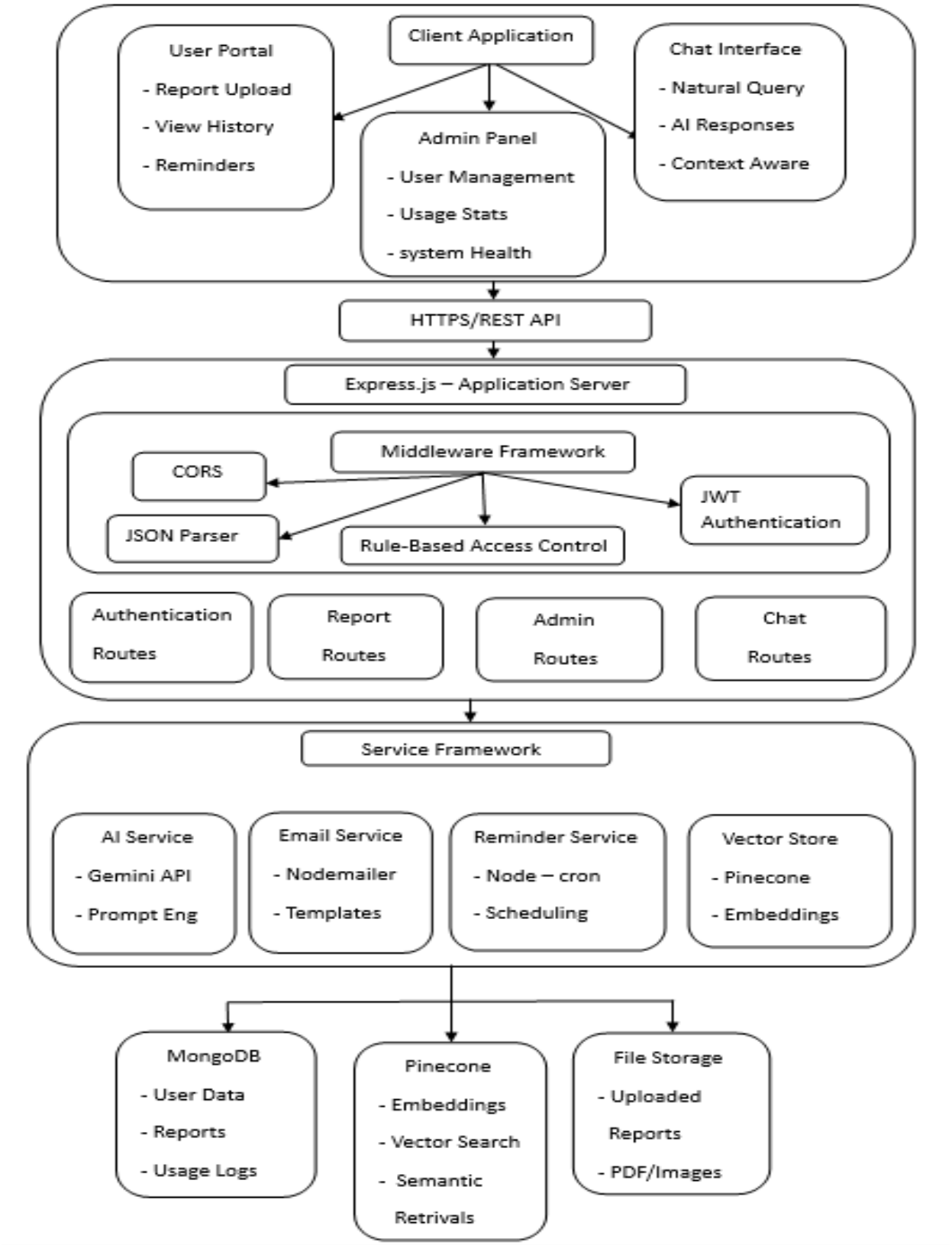

Figure 1: System Architecture

Each of the four fundamental frameworks that contributing to making architecture comes with specific functions. The design of the user interface is implemented by the client framework, and this has been developed using TypeScript and React and constitutes administrators and ordinary individual's discrete experiences. By applying the Express.js application software, the server framework controls HTTP requests, routing and authentication. The important part operational logic, which includes email delivery, AI integration, and reminder scheduling, takes place at the service framework. And finally, the data layer handles the file system for the uploaded medical reports, pinecone for vector incorporation, and MongoDB for database structure.

IV. METHODOLOGY

The technologies adopted had a focus on the scalability, security, ease of development, and their compatibility using AI Services. A concise overview of the technological stack and the justification supporting every option is presented in Table 1

COMPONENT	TECHNOLOGY	PURPOSE
Frontend	React.js/HTML, CSS, JS	Interactive user interface for users
Backend	Node.js + Express	Handles Server logic, API
Database	MongoDB	Store user's info and report history
AI Model	Gemini flask 2.5	Analyze user's medical reports, Health prediction & recommendation
Notifications	Nodemailer	Timely alerts/reminders for medicines

Table 1: Technology Stack

V. DATABASE DESIGN

The database design provides the integrity of data, security, and efficient querying through following the standard procedures for applications related to healthcare. In view of its adjustable record format, that additionally takes into consideration for changeable nature of medical records and AI analysis conclusions, MongoDB was chosen. The data model consists of three main collections which form the data model and references are employed to establish connection between them.

The registered email addresses has to always be unique if you want to avoid fraudulent registrations. In addition, data regarding authentication and authorisation can be found within the user collection. The login credentials in plain text cannot be saved in the password field; consequently, encrypted passwords used. Role based access restriction is made possible by the role field, and is Blocked enables administrators another layer of protection for handling users.

The AI Service's complete examination data is maintained inside the report collection, considered the quite comprehensive. A organised document organization which reflects the JSON outputs from Gemini AI could be located in the AI analysis field. Database deployments are not allowed due to this design, and this facilitates adaptive modifications to the data analysis model. The reminder system relies upon the medication database in AI analysis recommending multiple medications for each report, which have specific scheduling information.

The system detects behaviour among users for the purpose of analytical and commercial reasons. During all interactions with the AI, it gathers what was done and mark execution. Administrators have access to this data to monitor system efficiency and highlight who are the most active users.

VI. IMPLEMENTATION OF AI

The underlying functionality of the system is developed through the incorporation of Google Gemini AI. The Gemini, that can provide the ideal balance among responsiveness and computational speed, has been implemented throughout system. In an effort to guarantee the smooth processing of medical reports data, the AI has been configured to produce JSON schema that calls for standardised response.

Multer verifies the file uploads via reviewing file dimensions and formats prior entering the AI analysis process. The AI follows up the instructions to look over the medical records and submit detailed information with querying the Gemini API by sending a properly written request. All essential data field gets properly contained in the final result according to the JSON response structure. Medications require special attention processed for use in the reminder system while the information that was obtained is stored in MongoDB and attached to the user accounts.

VII. INTELLIGENT MEDICATION

Remainder System

For instance, to properly understand naturally written prescription intervals as well as translate their content to specific reminding slots, the scheduled reminder system employs an innovative timed mapping algorithm which is capable of processing sophisticated wordings, such as “once daily”, “twice daily”, and “three times a day” irrespective of a requirement on traditional programming formats.

VIII. SECURITY IMPLEMENTATION

The medical related applications, in which confidential information related patients get processed and maintained, encryption is essential. In order to protect user data and privacy reliability, the system incorporates multiple security tiers. JSON Web Tokens (JWT) are employed to the system for stateless authentication purposes.

The web server generates a token with the user ID and role upon a successful login. The token used expires within seven days and is gets signed with a secret key stored in environment variables. The token needs to be included inside the authorised header for each ensuring request.

IX. RESULTS AND DISCUSSIONS

A. Admin Dashboard

The Admin Dashboard is for monitoring the activity of the users as well as the control centre of operation of different operations in

the Nidano platform. Here he can access the total user’s database and he can also block/unblock the users if needed. Mainly, this admin dashboard provides comprehensive control over usage analytics, users, and system health.

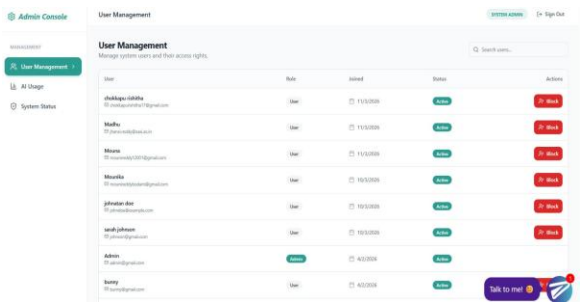

Figure 2: Admin Console(User Management)

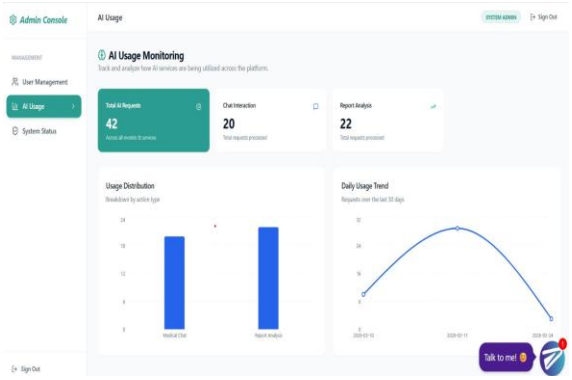

Figure 3: Admin Console (AI Usage)

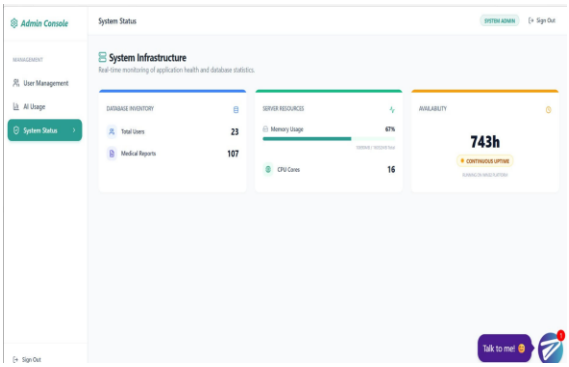

Figure 4: Admin Console (System Status)

B. User Login

The Login Page offers an easy and safe interface where the user, the administrator enters his or her basic credentials to register and login to access their respective accounts on the Nidano platform. Secure login authentication verifies registered users before accessing the system. Input validation prevents incorrect/incomplete data during registration. Authentication helps in maintaining data privacy and personalized user information.

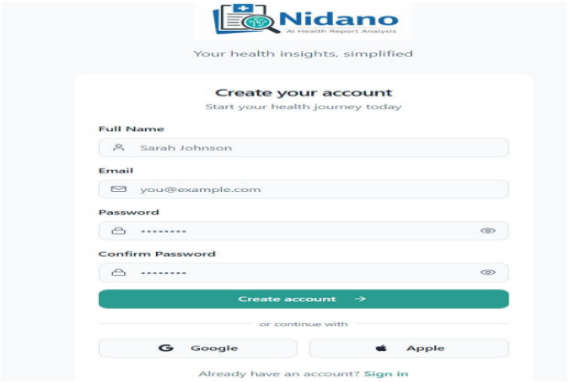

Figure 5: Account Creation

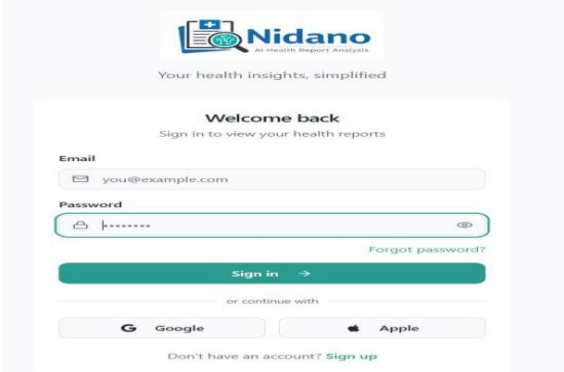

Figure 6: Account Login

C. User Dashboard

The system successfully redirects users to a personalized dashboard after the secure login. The User Dashboard highlights the important user health information such as total reports, monthly reports, last checkup, and health score. users can upload medical reports easily using the upload feature. This webpage shows recent reports and activity history for quick tracking of health updates. It also provides a simple and interactive interface for efficient and reliable health monitoring.

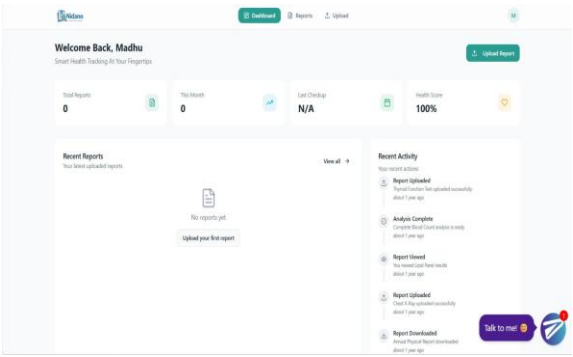

Figure 7: User Dashboard

D. Reports

The Reports webpage usually displays the data of the uploaded reports history. In the top of the webpage, we can see a search bar to easily search and access the upload report history. Here the reports are stored and filtered regarding the type of the report, size, date. By using this we can know about the report whether it is pending, analysing, complete or error. This page has a feature to view and download the reports whenever we need.

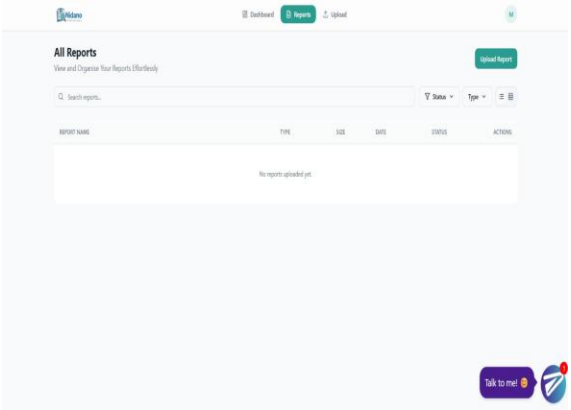

Figure 8: Reports Page

E. Upload

If a user opens a Upload webpage, the upper section displays and ask the user to fill the basic information about the report which includes the Patient Name, Age, Consulted doctor, Disease/Symptoms. In the lower section it shows an upload feature to upload/drop the files. In the ending section of the page, it displays the processing the document.

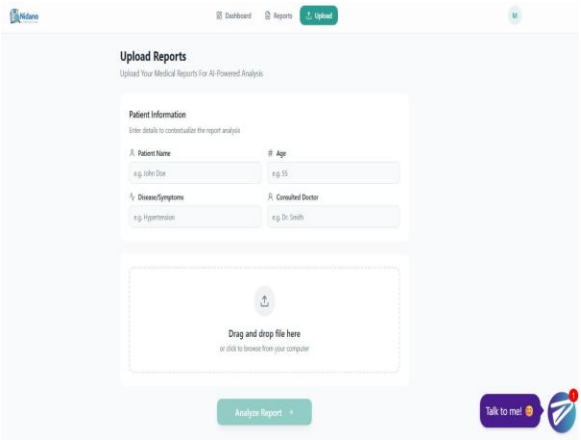

Figure 9: Uploaded File's Basic Information

Ater the successful analysis of the uploaded report it gives the results and major findings of the report which includes the possible identified condition, severity of the disease, suggested medication with the scheduled timing as well as the required amount of the dosage needed. Therefore, it recommends some steps based on the condition along with severity of the patient.

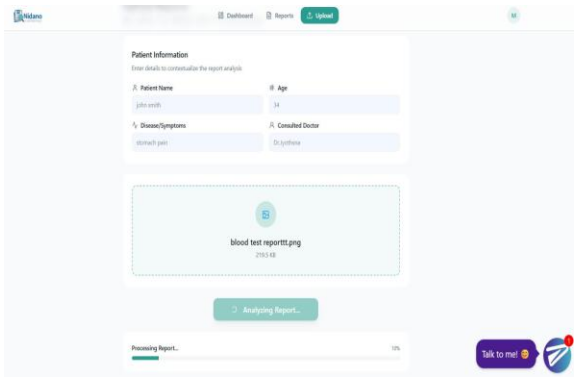

Figure 10: Upload File Analysis Processing

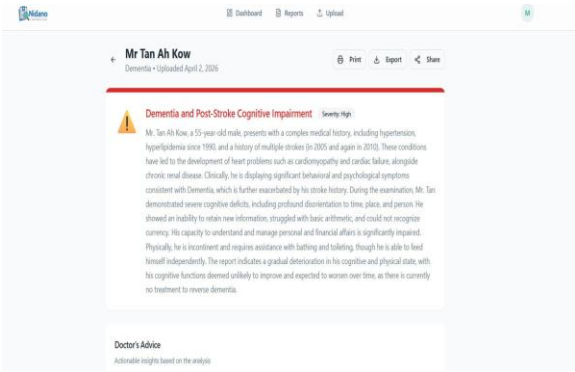

Figure 11: Results

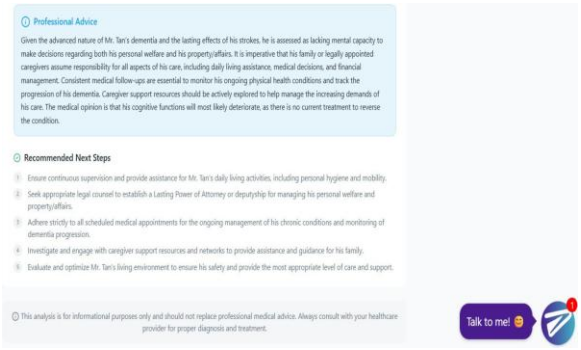

Figure 12: Personalized Recommendations

X. CONCLUSION

This project focuses on solving the problem of medical report understanding and medication non-adherence. By using an AI-Integrated MERN stack-based web application, the system makes it easy for the patients(users) to understand the clinical report conclusions. The integrated platform combining report analysis, scheduled reminders through email delivery, and conversational AI chat-bot offers a comprehensive, patient-centered solution that significantly outperforms technologies existing.

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