

Revolutionizing Healthcare: A Comprehensive Survey of Advanced Healthcare Applications for Digital Transformation

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Abstract—This survey paper provides information about different healthcare applications that are built to develop the healthcare sector digitally with the help of modern technologies. We have also discussed the need for making the particular application with its advantages and disadvantages. Though there are many health record management systems existing for electronic health record management, the accuracy and efficiency are not up to the level that we need. We see a much amount of time wastage in maintaining the records manually. Also, Patients find it difficult to track their previous records. So, our system “Medicard” is an application for interaction between doctors, patients, and pharmacists. It is a multi-tasking application for all healthcare tasks like centralized storage of patient health records, Drug analysis, allergy analysis, online payments, Online receipt generation, community creation, and booking of doctor’s appointments. It has three different interfaces for doctors, patients, and pharmacists.

Index Terms— Machine learning, Healthcare applications, Digital healthcare, allergy analysis, Drug Analysis, Artificial Intelligence.

I. INTRODUCTION

The information about centralized health record storage and our proposed web application, Medicard, is provided in this survey paper. Thanks to the internet and current technologies, every field is becoming digital and contemporary nowadays. India is also creating new methods to improve the lives of people.

The Indian healthcare industry is likewise going towards contemporary digitalization. We are well-known for our diverse drug distribution platforms, online consultation tools, test scheduling apps, etc. The fact that these are all distinct applications adds to the users' bewilderment. Compared to all of these applications, this Medicard goes one step beyond. Medicard has many features, including an AI-based drug detection system, an online appointment booking system, a community for patients, an AI-based patient health record management system, and a payment system, Digital Prescription Generating System.

II. RELATED WORK

Over the years, there has been a lot of analysis about such integrated applications over various platforms and different modules. These applications were designed in such a way that they focused on managing the patient's

record on a digital platform. Many solutions have come out but the accuracy has still not met the need. People need easier usability of the platform which will be easier to learn and understand. Existing Systems are providing less information and have no combination of all processes. Every task has its application which is difficult for people to use. Some of the systems are explained below.

In 2021 Indian government launched a health card known as ABHA [6] which stands for Ayushman Bharat Health Account. ABHA was earlier known as Ayushman Bharat Health ID. The main aim of the Indian government behind launching this ABHA card was to provide a digital health ID to the population of the country and take the country one step ahead in digitalization. The government authority behind launching this ABHA card was the National Health Authority (NHA) which comes under the Ministry of Health and Family Welfare. According to the Indian government, ABHA is the “first step towards creating safer and efficient digital health records for the people of the country. The drawback noted in Ayushman Bharat health account was that the individuals have to upload their documents manually on the account and it can only be accessed by the patient and not by the doctors and pharmacist [1]. Figure 1 is the home page of the ABHA Card website describing the different features and uses of the card.

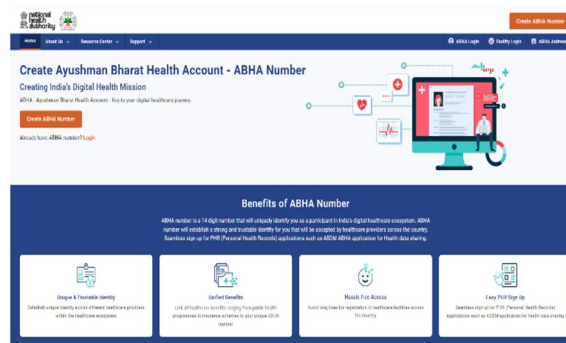


Fig.1 User Interface Of ABHA Card

Another system that is been used to store the health records of patients is Electronic health records. Electronic health record is the electronic version of a patient healthcare record. An electronic health record gathers, creates, and stores the health records of the patients electronically. Electronic health records have been leisurely adopted by healthcare providers the idea behind electronic healthcare records is that it will improve clinical documentation, quality, healthcare utilization tracking, billing, and coding and make health records portable. The core components of electronic health records include administrative function, computerized physician order entry, lab system, radiology system, pharmacy system, and clinical documentation. The standard communication technology utilized by electronic health records is HL7. The benefits offered by electronic health records include a gain in healthcare efficiencies, large gains in quality and safety, and lower healthcare costs for consumers. challenges faced by electronic health records include costly software packages, system security, patient confidentiality, etc. Future technologies for electronic health records include bar coding, radio-frequency identification, and speech recognition[2].

Analysis of Health Record Management System in Private Hospitals was the study conducted by the National Health Policy of India in 2017 which emphasizes that at the district level, there should be an electronic database in all healthcare systems by 2020. The National Health Policy of India conducted the study at selected private hospitals in Karnataka state of India to assess the usage and challenges in implementing an electronic health management system. Karnataka is the eighth largest state of India by area. The study found that it was easier to use EHR in healthcare centres where there are a smaller number of patients when compared to health centres where large number of patients are to be treated every day. In a very few private hospitals, EHR was not implemented and manual record system was in use. Majority of them looked forward to moving to using EHRs, but some of them were not understanding the need to shift from manual system as they were at ease at using it for many years. Also, some of the respondents were not aware to use computers for such work and thus, found it difficult to make entries on the system in a digital way [3].

Ensuring the integrity and authenticity of health facility records in Upper Denkyira, Ghana requires a structured system for data collection, management, and preservation. This study looked at how health facilities in Ghana's Upper Denkyira West District managed their records. The study's primary research instruments were observation and a questionnaire. A total of 60 staff members were included in the sample, of which 40 were selected by stratified random sampling and 20 were chosen through the use of purposive sampling at the records

management unit. According to the study, ineffective records management had a major impact on providing timely, efficient, and high-quality healthcare services. Of those surveyed, half claimed that ineffective record management practices cause delays in patient care, 25% claimed that they have an impact on the standard of medical care, and 8.3% claimed that incompetent record keeping results in the release of private patient information. Every responder acknowledged that efficient records administration facilitates quick access, reduces hospital wait times for patients, and fosters continuity and high-quality healthcare delivery. The report suggested that all healthcare facilities implement electronic records management practices and hire biostatisticians and other professionals with the necessary training and experience to handle health information [4].

With the aid of procedures at the Federal College of Education (Special), Oyo Medical Centre, [5] article investigates the topic of student health record management in academic institutions. Its specific goals were to ascertain the availability of student health records, assess the efficacy of students' health record-keeping practices, and look into the difficulties records officers encountered in properly managing the health records of the surveyed students. The medical centre under investigation encountered several significant obstacles when managing health records, including insufficient computers and other ICT devices, unreliable power supplies, and insufficient funds for health records management training. Therefore, the paper concludes that sufficient funding should be made available to support improved health records management procedures. Additionally, management at the medical institution under investigation ought to step up their efforts to motivate their staff to maintain appropriate record-keeping and handling practices.

In 2009, the Medical Smart Card System for Patient Record Management was researched. The concept of smart hospitals was to evolve the healthcare landscape, marked by increased integration of information technology systems. Traditional hospitals were grappling with challenges such as heightened competition, constrained physical spaces, staff retention issues, and reduced reimbursements. Smart hospitals aim to infuse intelligence into the existing healthcare system, ensuring that patient information is accessible across all hospital resources and locations while cards, enhancing both security and efficiency. Ultimately, smart hospitals are designed to improve healthcare delivery by optimizing acute care hospital design and operations for increased efficiency and enhanced patient safety.

TABLE I : THE KEY DIFFERENCES BETWEEN THE ABHA CARD (EXISTING SYSTEM) AND MEDICARD (PROPOSED SYSTEM)

Criteria	ABHA Card	Medicard
Unique Identifier	Generates a new unique number	Links Aadhar card, using Aadhar number as identifier
Data Access	Requires showing the phone to the doctor	Doctor and pharmacist access through ID and OTP
Online Transactions	Does not support online transactions	Enables online payments to doctors and pharmacists
Accessibility	Limited to smartphone users	Accessible to everyone with card number or details
User Access	Grants access only to the user	Provides access to Doctors, Pharmacists, and Patients
Record Management	Only the patient can upload and edit records	Both doctor and user can upload and edit records
Prescription Method	Manual paper prescriptions	E-prescriptions
History Upload	User uploads history; incomplete if not done	Automatically updates complete history, doctor consultations, and allergies

In a comprehensive survey conducted in 2017, the challenges associated with Electronic Medical Records (EMRs) were identified, encompassing concerns related to patient privacy, issues arising from the integration of legacy records, and constraints imposed by budgetary considerations. To address these issues, the authors proposed the implementation of a smart assistant system. This innovative system was designed to securely retrieve and manage patients' personal health information stored in the cloud. The key security feature incorporated into this solution involved the utilization of smart cards for authentication, ensuring a robust and reliable access control mechanism. Notably, each patient retained control over their medical records through collaboration with healthcare providers. The overarching goal of the system was to facilitate secure and scalable access to users' health records in the cloud, with a particular emphasis on streamlining key management processes[15]. This proposed arrangement not only prioritized security concerns but also aimed to enhance the efficiency of accessing and managing electronic health data. The literature review highlights the significance of such a system in addressing prevailing challenges within the realm of EMRs[12].

The study conducted by Margaret Hansen, EdD, MS, RN [13]delves into the pivotal aspects surrounding Smart Card Technology (SCT) in the healthcare domain, with a specific focus on two key dimensions : Healthcare Smart Cards.

(HSC) are sophisticated plastic cards with a memory chip, securely granting access to patient's comprehensive medical information, including records, lab results, medications, allergies, insurance coverage, and registration details for healthcare providers. The primary benefits of HSCs include safeguarding patient information through authentication methods like a personal photograph, ID pin, or fingerprint. These cards can access online repositories for seamless data retrieval. Patients can easily access their records on any Java-enabled computer, ensuring privacy. Simultaneously, healthcare providers, with consent, can access vital patient information, streamlining processes, saving time in registration and data retrieval, and contributing to cost reduction[21].

III. TECHNOLOGICAL FOUNDATIONS FOR HEALTHCARE SOLUTIONS

A. Web Development

Any organization always needs a user-friendly website. As a result, we are building a website for the user interface so that the user can navigate through its various features. The JS React framework with HTML, CSS, and JavaScript are used as the front-end tools.

B. App Development

Along with the website, we are also using Android Studio for developing an Android application to provide a simpler user interface [16].

C. Security

The "Defence in Depth" or "Onion Model" is a security approach that combines several security controls to safeguard a software system or application. The security paradigm that is employed is the onion model, which has five layers that provide more effective protection. Firewall, IDS/IPS, Authentication, Authorization, and Cryptography are the five levels. The concept is that even if one layer is compromised, there are still layers in place to offer protection. Each layer stands for a distinct security component. One benefit of this strategy is that accessing the data becomes increasingly challenging as the number of levels increases.

D. Machine Learning

One of the technologies that is developing the fastest is machine learning, which applies to practically every software. It can be applied to image processing, natural language processing, searching strategies, recommendations, and much more. With Medicaid, machine learning will assist in recommending to patients the best physicians and chemists, enabling them to select the right one. It will return accurate results for the specified search parameters. Essentially, client segmentation and tailored search results will be obtained by machine learning[24].

E. Artificial Intelligence

AI is essentially the intelligence of the machine. The software has intelligence embedded in, just like the human mind does. AI will review the patient's medical records to see if there are any allergies or potential negative effects. One of Medicaid's greatest features is its AI-based medication identification. Among its many uses are voice search and the creation of intelligent chatbots.

IV. OVERVIEW OF MEDICARD

Physicians, patients, and chemists can all utilize the Medicaid web program. Every user will have a distinct ID that they may use to access their account and log in. To access the medical records, the chemist and doctor will input that special ID. Additionally, a health care card called "Medicaid" with a unique ID number will be given; the chemist and doctor can scan it. Each of the three interfaces for the patient, doctors, and pharmacist will assist them select the appropriate position.

The various roles are listed below:

A. Patients

Patients can schedule an appointment, upload their medical history, make online payments to doctors and chemists, join a patient community where they can communicate with other patients, exchange thoughts and experiences regarding any illness, obtain all of their records in one location, and more. Without wasting any time, patients can look for the closest medical professionals, hospital clinics, or early therapies[23].

B. Doctors

Using a patient's unique ID, doctors may access their medical history, making it easier to treat them and reducing the risk of allergies and adverse effects. Predicting the necessary prescriptions will also be made easier by AI-based drug detection.

C. Pharmacist

To provide medication and accept digital payments using Mediacard exclusively, chemists will have access to the patient's most recent medical prescription through a unique ID. If necessary, he can also see the prior records with the patient's consent.

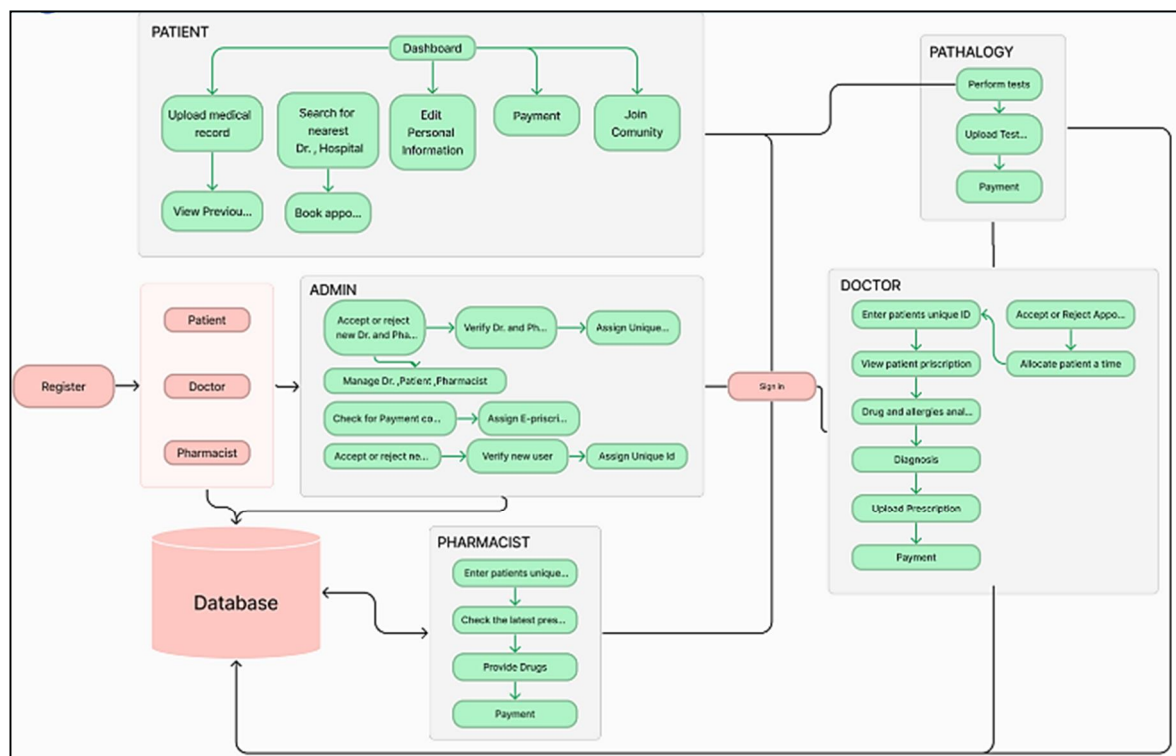


Fig.2 : System Architecture of Mediacard

V. INNOVATIVE FEATURES OF MEDICARD

Mediacard stands out in the realm of healthcare applications, boasting a range of distinctive features designed to enhance patient care, streamline processes, and foster a collaborative health community. Explore the unique facets that set Mediacard apart:

A. Centralized Storage of Patient's Health Records

Efficiency and accessibility are at the forefront with Mediacard's commitment to centralizing a patient's entire health history in secure cloud storage. This feature empowers healthcare providers to seamlessly access comprehensive patient records, aiding in more informed and personalized care.

B. E-Prescription

Revolutionizing the prescription process, Mediacard ensures that doctor's prescriptions are directly uploaded to the patient's account. This not only facilitates clarity through formal fonts but also contributes to environmental sustainability by reducing paper usage.

C. Online Appointment Booking

Mediacard puts the power of appointment scheduling in the hands of users, enabling them to book doctor appointments from the comfort of their homes[20]. This not only saves time for patients but also assists healthcare facilities in managing appointment schedules efficiently[19].

D. Community

A unique feature of Medicaard is its diverse community forums tailored to specific diseases. Users can share experiences, insights into home treatments, and foster a positive mindset regarding their conditions. Additionally, communities for general health enthusiasts provide a platform for sharing knowledge and facts about maintaining a healthy lifestyle.

E. Online Payment System

Simplifying the financial aspect of healthcare, Medicaard incorporates an online payment system. Users can effortlessly settle doctor fees and medical bills directly through the application, ensuring a convenient and secure transaction process.

F. AI-based Drug Detection

Harnessing the capabilities of Artificial Intelligence, Medicaard introduces an innovative tool for doctors to predict the most effective medicines for patient treatment. This forward-thinking feature enhances diagnostic accuracy and optimizes treatment plans.

VI. IMPLEMENTATION OF MEDICAARD

Medicaard, envisioned as a transformative web application, aims to revolutionize the healthcare sector by bridging the communication divide between patients, doctors, and pharmacists. With a comprehensive array of features, Medicaard focuses on optimizing healthcare processes and enhancing user experiences. Key components include centralized storage of health records, drug and allergy analysis, online payments, receipt generation, community engagement, and seamless appointment bookings.

The user onboarding process is meticulous, requiring individuals to specify their roles. Doctors and pharmacists undergo a rigorous verification process based on their certifications, while users are authenticated through their Aadhar number or phone number. Upon verification, users are assigned a unique ID and a virtual card, which becomes the gateway to accessing their health records stored securely on the platform.

Patients can effortlessly book appointments with doctors and pathologists through Medicaard. During doctor visits, patients provide their unique ID, granting the doctor access to their comprehensive health history, including previous prescriptions, drug consumption, and allergies. After the consultation, doctors can upload prescriptions directly to the patient's account, facilitating a seamless and efficient healthcare experience. Payment for services is streamlined through an online payment method.

Similarly, when patients visit pathology labs for prescribed tests, the results are promptly uploaded to their Medicaard account. The billing process is simplified with online payment options. When interacting with pharmacists, patients provide their unique ID, enabling pharmacists to access the latest prescription details. Medications are dispensed, and payments can be made online, ensuring a secure and convenient transaction.

Medicaard is not just a technological innovation; it is a significant stride toward a digitally empowered India. By leveraging cutting-edge technology to enhance healthcare interactions, Medicaard embodies the future of healthcare accessibility and efficiency. Explore the possibilities of a connected healthcare ecosystem with Medicaard.

VII. CONCLUSION

This paper has been a journey through the diverse technologies employed to ensure the secure and efficient management of patient medical records in the digital realm. A comprehensive review of research papers spanning different authors and countries has yielded valuable insights, providing the foundation for our innovative solution – 'Medicaard.' Through the amalgamation of best practices derived from global research, Medicaard emerges as a transformative digital application designed to simplify and enhance the entire process of patient treatment. From facilitating the discovery of the most suitable doctor to expediting access to prescribed tests and medications, Medicaard represents a significant leap toward streamlining healthcare interactions. This application not only showcases technological advancements but, more importantly, addresses the limitations of existing systems that struggle to meet user needs. Medicaard aims to be a solution that transcends mere convenience, positioning itself as a catalyst for progress in the healthcare sector. By overcoming current drawbacks and inefficiencies, Medicaard aligns seamlessly with the vision of Digital India. It stands as a testament to our commitment to improving and developing the healthcare sector, promising a future where healthcare is not only digitized but also user-centric and responsive.

In conclusion, Medicaard serves as a beacon of innovation, heralding a new era in healthcare management. We endeavor to contribute to a healthcare landscape that is not just technologically advanced but also accessible, efficient, and tailored to the evolving needs of patients. The strides made with Medicaard mark a transformative step towards a healthier, digitally-driven India.

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