

## Analysing Security and QOS for IOT-Based Electronic Health Records using Public Cloud Platform

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### Abstract:

Paper-based record-keeping systems in small medical practices create significant obstacles in handling patient information, scheduling, and medication management. These outdated methods result in inefficiencies that negatively impact both patients and healthcare professionals, including missed appointments, prescription errors, and increased administrative work-load. This literature review examines a proposed digital solution aimed at optimizing clinic operations through electronic prescriptions, remote healthcare services, protected data handling, and increased patient involvement. By implementing cloud-based systems, medical practices can boost their operational productivity, enhance patient care, and minimize administrative responsibilities. The transition to digital systems offers numerous benefits, including improved data accuracy, stream-lined workflows, and enhanced communication between health-care providers and patients. By leveraging electronic health records (EHRs), small medical practices can significantly reduce the risk of medical errors and improve overall patient safety. Additionally, the implementation of telemedicine capabilities can expand access to healthcare services, particularly for patients in remote areas or those with limited mobility.

**Keywords:** Electronic Health Records (EHR), Digital Solutions, Cloud-based Systems, Data Accuracy, Medication Management.

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## 1. Introduction

Manual processes and paper-based record-keeping often create inefficiencies and errors in small medical practices. This study examines a proposal to digitize small clinics by implementing a comprehensive electronic system that tackles major challenges in managing prescriptions, scheduling appointments, accessing health records, documenting patient information, and handling billing. By utilizing advanced technologies such as cloud computing, APIs, and web-based solutions, healthcare facilities can revolutionize their services, enhancing accessibility, efficiency, and security in healthcare delivery. In recent years, the healthcare industry has witnessed a significant shift from traditional

paper-based systems to electronic health records (EHRs) for record-keeping. This transition has been propelled by various factors, including the desire to enhance patient care, improve data management, and facilitate better communication between healthcare providers. EHRs have shown numerous advantages, such as better patient outcomes, more efficient data handling, and improved collaboration among medical professionals. However, the widespread adoption of EHRs has encountered resistance from healthcare practitioners due to factors like implementation costs, training requirements, and worries about data security, privacy and Quality of service (QOS). This paper seeks to examine the current landscape of EHRs, investigate the challenges associated with their implementation, and explore potential solutions to overcome these obstacles. The analysis will concentrate on crucial aspects, including the design of EHR systems, data interoperability, and methods for addressing resistance to adoption.

## 2. Literature Review

Electronic Wellbeing Record (EHR) frameworks innovations have brought not as it were productivity in healthcare delivery but indeed opened entryways to understanding care personalization and real-time bits of knowledge into medication through information [1]. For case, cloud-based EHR frameworks empower farther get to to medical records and telemedicine and in real-time observing, hence streamlining the collaboration handle of care providers, patients, and analysts in reshaping traditional health conveyance models [2]. However, with these propels come critical security and security issues. The capacity of touchy quiet data within the cloud makes unused challenges in information get to control and authorization components, confirmation, and administrative compliance [3]. Healthcare information is intrinsically complex, covering a wide extend of information sorts such as therapeutic histories, imaging, genomic information, and real-time patient monitoring streams. This data has to be ensured from unauthorized get to, breaches, and cyberattacks: that prevents losing the believe of patients but moreover meets directions such as the Wellbeing Protections Movability and Responsibility Act (HIPAA) or the Common Information Assurance Direction (GDPR) which are strict almost the necessity for information assurance in healthcare [4].

Traditional get to control models, like Role-Based Access Control (RBAC) and Attribute-Based Get to Control (ABAC), give the establishment for overseeing get to to data inside the healthcare division. RBAC awards permissions based on the part or relationship that an person has in an organization, while ABAC is much more nitty gritty because it grounds get to consents on a few traits, including the part of the requester, the affectability of the resource, and natural conditions [5]. In spite of the fact that ABAC provides the required adaptability in complex situations, relying on such expansive numbers of traits can lead to increased administration overheads, arrangement complexity, and delay indecision-making related to get to [6], [7]. Other than, static models of get to control regularly fall flat to serve the dynamic need of get to in modern healthcare, where access to information may alter with real-time changes in contextual information, such as the area of the client or the particular healthcare situation they are confronting [8].

However, these confinements have driven the health care industry to embrace a more progressed get to control model, referred to as Role and Rule-Based Get to Control (RRAC) model. RRAC speaks to the finest of both RBAC and ABAC, though it combines role-based consents with rule-based conditions that permit for much more precise and flexible access control arrangements. This

demonstrate is especially valuable in health care settings, as get to consents must be at once granular and flexible-enough to adjust to different client needs and the levels of information sensitivity-guaranteed inactivity minimization and approach compliance [9]. One of the foremost imperative applications of machine learning to address the expanded complexity and energetic nature of healthcare information get to lies in progressing frameworks about access control. Machine learning calculations can be learnt to designs of information get to changes and identify anomalous behaviour that seem possibly debilitate security. The utilize of Machine Learning (ML) models can be connected to get to logs to discover sporadic get to endeavours and naturally issue alerts or alter get to authorizations to invalidate such potential threats. With the application of ML-driven prescient analytics, security measures can be adjusted agreeing to behavioural patterns as well as relevant components of a client for streamlining get to whereas guaranteeing most extreme security through strong protocols [10], [11]. Therefore, compelling get to control instruments that ensure security and productivity must be connected in healthcare data security. Progressed ponder of combining RRAC with ML-driven peculiarity discovery to supply an coordinates healthcare data administration arrangement is additionally required [12]. The development of this system will be based on the most recent enhancements in cloud computing, cryptography, and technologies in ML to guarantee the security of patients while enhancing the operational effectiveness and compliance with industry directions [13]. Hence, to meet such an new prerequisite, in building a secure and effective health care ecosystem, this system will handle the particular security issues of cloud-based EHR frameworks that will keep abreast of the changing needs of healthcare suppliers, patients, and regulators [14]. More thinks about are required to create a comprehensive, secure, and proficient get to control framework for healthcare applications, giving progressed innovations such as cloud computing, cryptography, and machine learning [15]

### 3.Methods

The development phase involved breaking down the system into smaller, manageable modules, each focusing on a specific function. This modular approach allowed for more efficient development and testing and ensured that future updates or additional features could be integrated seamlessly.

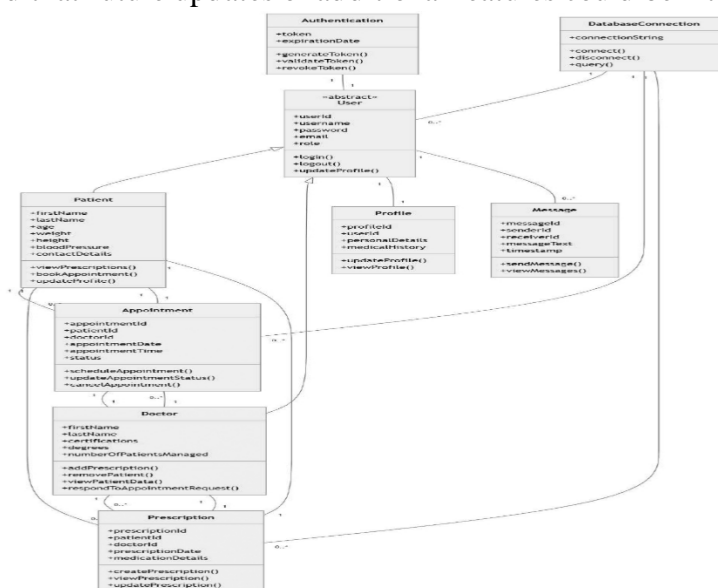


Fig1: Cloud based real time healthcare model

1. Prescription Management Module This is a module designed specifically to revolutionize and rationalize prescriptions by dispensing with traditional error-prone paper-based prescriptions and facilitating this shift to a digitized, automated system. The e-Prescription Feature ensures easy electronic prescription creation and forwarding directly to pharmacies. This reduces the risk of errors far more characteristic of handwritten prescriptions, particularly illegibility or wrongful dosages. Moreover, it had an auto-complete feature with most often prescribed drugs; therefore, prescription writing was expedited. Another important feature was the integrated check-up of drug interactions that worked to ensure patient safety. Automatic Refill Reminders-the system mailed automated notifications to refill prescriptions in time. In addition to ensuring a continuity in the medication therapy, this proactive system aimed at the prevention of disruption of the treatment regimen, hence improving patient outcomes and general health care efficiency.

2. Appointment Scheduling Module In small practices, effective scheduling is necessary to ensure that the patient flow runs smoothly and the no-shows are at a minimum. Another approach that can be considered really innovative is the Integrated Telemedicine Scheduling, wherein the patients can book virtual appointments with the system. This module will not only be able to automatically schedule virtual visits but also integrate video conferencing tools for the convenience of the patients in remote or under-served areas. Further, with the adoption of Digital Check-In, patients can even complete the intake forms electronically before the appointment that then cuts down on the wait time at the clinic. The approach does not only ease the check-in but also reduces the face-to-face contact, an ultimate feature of the modern trend of healthcare in minimizing time spent by patients within the clinics. Advances in scheduling and the check-in process contribute to the efficiency of small practices and improve the experience of its patients.

3. Patient Portal and Access to Health Records By the use of secured patient portals, patients will have the simplest method of accessing their health information. A dedicated portal will allow a patient to view all the important data related to himself, such as lab results, prescription histories, and medical advice. Strong security features therefore ensure that sensitive health information is strictly accessible only to the patient and his other authorized caregivers, thus respecting their privacy and confidentiality. Encrypted connections also add on to this kind of protection, reinforcing it by including yet another layer of security measures for preventing unauthorized access. This combining of user-friendly access with strict measures makes patient portals an incredibly invaluable tool in modern healthcare, furthering transparency, convenience, and the protection of personal health data.

4. Documentation and Note-Taking Module Customizable Templates: The module for documentation provides doctors with predefined templates that are applied to typical consultations: they may be annual checkups, or they may be diabetes control. They systematize the whole process of documentation, which reduces the time spent on record keeping and increases the accuracy of the input data. Simplifying the process of note-taking will give health care providers more time for patients' needs and less time spent on paperwork.

5. Patient Portal and Access to Health Records Centralized Patient Portals: The patient portal is a safe and centralized place where patients can log on to access their health records. Such details might include important aspects like lab reports, prescription lists, or treatment suggestions the patient has been given. Robust security ensures that sensitive health information can be accessed only by the

patient and authorized caregivers. Furthermore, connections are encrypted to provide further layers of protection for personal data from unauthorized access. The patient portal empowers patients to take charge of their health by consolidating all the health records into one place, hence making it easier for people to make informed decisions, thus enhancing total patient engagement.

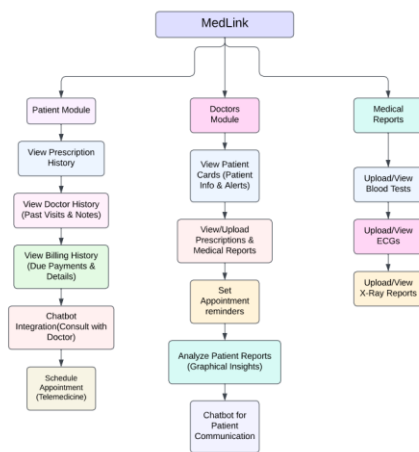


Fig 2:Implementation of Online model for Electronic Health Records

6. Communication and Feedback Module Integrated Doctor-Patient Communication: The module emphasizes establishing direct communication between patients and doctors, thereby reducing the nos. of visits to the clinic for minor queries or clarifications. The system initially uses a chatbot to handle routine questions - appointment confirmations or reminders for medication - to reduce the clerical workload of staff at the clinic. The system also incorporates a more advanced communication tool that allows communication of non-emergency consultations between the patients and doctors. This capability allows the patients to ask questions about the drugs prescribed, to reassess the treatment plan and to clarify minor health concerns, even if the doctor is not in a position to answer them immediately. This provides for ongoing communication with the patient while getting the patient more involved in their own care during trips on the road by doctors, thereby reducing associated risks from uncontrolled procedures.

7. Report and Analytics Module Centralized Access Module for Reports: There is a module for centralized access to reports through which physicians can directly access the patient’s lab results and diagnostic reports. This access module streamlines the process of access for quicker diagnostics so better decisions could be made to improve the outcomes for the patient. This module provides easy, timely access to consolidated information that supports efficient clinical decision-making and enhances the quality of care provided for the patients.

#### 4.Results

The EHR system employs key security protocols to protect sensitive health information. OAuth 2.0 ensures secure user authentication, allowing only authorized personnel to access patient data. SSL (Secure Sockets Layer) encryption secures data during transmission, safeguarding it from interception. Additionally, the system is designed to comply with healthcare regulations like HIPAA, which establishes strict standards for patient privacy and data security. These measures collectively help maintain the confidentiality of sensitive health information. The EHR system has been built and is in

full operation. The cloud storage of the patient's information is secured, appointment scheduling, and prescription management capabilities are maintained. The users generally feel that the system is user friendly although the performance cannot be ascertained at this stage. The system stands as a great improvement over the clinic operations. The system performs the analysis based on different IOT security models. The IOT Deep Learning is used for increased security and quality of service as shown in fig below

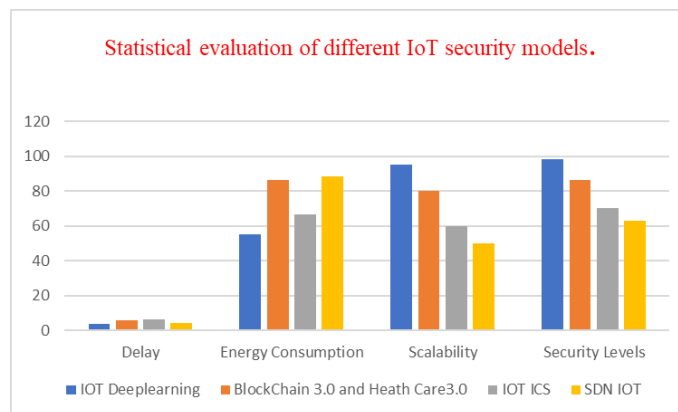


Fig 3: Statistical evaluation of different IoT security models.

## 5. Discussion

The successful implementation of EHR systems in small clinics offers numerous benefits, but ongoing evaluation is crucial. Regular integration of user feedback and system modifications ensures that EHRs align with daily operations and effectively meet user needs. To improve usability, healthcare and administrative staff must provide input on system weaknesses that disrupt workflow, such as cumbersome data entry and access to patient records (Ministry of Health and Family Welfare, 2016).

Monitoring performance metrics, including error rates and time savings, demonstrates that EHRs enhance operational efficiency and improve patient care and safety (Office of the National Coordinator for Health Information Technology, 2020).

Continuous improvement through system updates based on user feedback is essential. Agile development cycles facilitate timely adjustments, keeping the system current with evolving technologies and clinical needs (Ghosh et al., 2019).

Integrating telemedicine with EHRs increases healthcare accessibility, particularly in remote areas, enabling seamless consultations and improving patient satisfaction (Verma et al., 2020).

## Conclusion

The implementation of Electronic Health Records (EHR) systems in small medical practices offers significant benefits in improving patient care, operational efficiency, and data security. By employing a structured methodology focused on user-centered design, stakeholder engagement, and modular development, the EHR system was tailored to meet the specific needs of small clinics. Key features such as telemedicine integration, automated reminders, and secure patient portals enhanced both provider and patient experiences. The evaluation phase demonstrated the system's effectiveness in reducing errors, streamlining workflows, and increasing patient satisfaction. Overall, the successful

design and development of this EHR system not only optimize clinical operations but also contribute to delivering high-quality, accessible healthcare, positioning small practices to better meet the challenges of modern medical environments.

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