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Transforming Healthcare Industry by Implementing Cloud Computing

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ABSTRACT

In the present generation, healthcare has become the foremost imperative sector in today's medicinal eon. The massive private documents, responsive details are kept in a scalable manner. The healthcare industry has become more competitive in the digital world. As a thriving industry, it's challenging for doctors to understand the moving technology in the healthcare sector. This also deals with the patient's nursing and maintains their portfolios. The overview of the project depicts a role played by the doctors, patients, management, and resource suppliers by implementing cloud-technology in the healthcare industry. The platform was designed and developed for user- friendly interactions where patients can connect with the management and doctors at any corner of the world. The peculiarity of the project was to withdraw the pen- paper method followed by the sector for ages. Cloud computing (CC) has played a vital role in the project that helped and managed to store, secure large data files. The features while operating the system were QR codes, generating e-mails, SMS text, and free-trunk calls. This approach assists on track with each individual's health- related documents, henceforward approving with the doctors to access the knowledge throughout the flow of emergency and firmly access policy. Besides the facts, it rescues the lifetime of the patients and mutually helps the doctors figure it out comfortably. The utilization of mobile aid applications may be a dynamic field and has received the attention of late. This development provides mobile technology additional enticing for mobile health (m-health) applications. The m-health defines as wireless telemedicine involving the utilization of mobile telecommunications and multimedia system technologies and their integration with mobile health care delivery systems. As well as human authentication protocols, whereas guaranteeing, has not been straightforward in light-weight of their restricted capability of calculation and remembrance.

KEYWORDS: *QR Code Technology, QR (Quick Response) Code, Cloud Computing (CC), healthcare, Health Monitoring, mobile health (m-health), Medical Records, etc*

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I. INTRODUCTION

Hybrid skeptics remain in the cloud, but many are concerned about the privacy of confidential information that they do not wish to share with third-party vendors, such as IT staff in many other industries, hospitals, and other healthcare organizations in the days. Healthcare declines as an operational move to cloud- based servers. Software proponents of the change (and many) say it means a lot, including cost reduction and clinical capacity. Accelerating the analysis of healthcare components such as notes ideally leads to a deployment base, and healthcare in the cloud market classifies into public,

private, and hybrid cloud deployments. The absence of a large in- house IT team dramatically speeds up data processing which abruptly reduces staff eliminates or makes significant compromises in the unlikely event of an accident. There are no server onsite natural disasters or malicious cyber- attacks. Automated scalability is also important. Best of all, doctors, nurses, and other health care providers can easily access detailed patient data from different resources, eliminating the need for large networks and complex communications, and security. As a result, patients can get the information, medications, and treatments they need more quickly and accurately. Amazon web services (AWS) platform provides the elasticity to launch the application regardless of the individual use case based on the project or industrial needs. Meanwhile, Green- computing technology implementation is the priority of usage.

A. Objectives of the system

The objective of this work is to design a proposed system which has:

- To identifies and analyses the views of correlations (health care workers and CC) on the factors involved in CC implementation in the health sector.
- Healthcare CC based on partners is concerned with issues such as availability, security concerns, and expense, efficiency and privacy concerns.
- To implement proposed system to reduce paperwork and save time.
- To access patient's data easily with the help quick response code i.e. unique id.

II. EASE OF USE

In this project we are firstly, a QR Code generates the ticket to maintaining the patient's personal data. The records are maintained safely for many years in the cloud. Cloud computing has become a growing technology in the healthcare industry. Overall, the aim of the project is to digitalize the health industry and ease the facilities being in any corner of the world.

- Reduce pen paper method.
- Cloud computing technology used to store large data.
- Features like; QR Code generation, SMS, less usage of the internet and high security system.
- Privacy maintained between hospital management and the patients.

III. LITERATURE SURVEY

Lejiang et al. (2019) CC is a new field of research, with several researchers actively participating in CC and E- Health to date developing a new computer-based management system. This paper aims to introduce a crippling standard hospital management system. The writers conclude that attaining better patient inspection relevant to IT, cloud networking will enhance the productivity of official documents provided by the hospital. Extended use of mobile Health facilities is mandatory for an authorized and decent domain that verifies the data privacy, security, and non- public. When reciprocating specialty information or the medical background that belongs to a patient, there should be equal consideration for human privilege and isolation. The purpose is to test and explain the best methods, yet explanation and making the outcomes bigger. From the findings, it is a concern that privacy, security, availability, efficiency, and costs are features. [1]

Hans et al. (2019) Contemporary IT is progressively rising in healthcare. To improve medical services and reducing expenses, such as easy and ubiquitous access to medical proof and opportunities for new business models; however, they pose risks and raise challenges in terms of security and privacy. PHRs required for the maintenance of the patient's documents, Electronic Health Records (EHR) secured by health professionals only. Overseas this involves different authorized documents and a transparent distinction between PHRs and EHRs. On account of this, infrastructure construction involving EHR is generally trickier than a straightforward mobile health cloud deployment model. [2]

Gottlieb et al. (2019) Prompt study of electronic health records will help physicians become aware of the patient's current medical history and current medical emergencies. EHRs have been at the forefront of development and use in medical facilities since their restoration by major EHRs. While the use of EHR has increased, physicians are preparing to work in an EHR-controlled country. Non- psychological matters were non- observed by formalistic, technical, communal, diplomatic, and lawful subjects and the requirements to comply with quality information certainty. Significant progress showcased for an assumption for EHRs has not met the current EHRs does not meet the present environmental essentials for health transformation. The present use of EHRs introduced by new technologies may be difficult to predict. The latest and innovative EHR automation will support by providing international principles for interactive applications utilized in health, digital data to transfer, translate and work smartly into sophisticated health care data to promote accurate health and health education systems. [3]

Leah C. Osterhaus.et al (2018) the use of a cloud paradigm in health care helps to share and consolidate

patient reports. Although, the cloud paradigm supplies various advantages and health risks and warns of health information. Practically, cloud platform providers are informed to address cloud safety issues to increase trust between patients and healthcare providers whereas, CC technology results in health supervision and the intimation of secrecy and the collection of hospital portfolios. Several health care departments implement CC with guidance because of the threat encompassed in unapproved utility or attacked confidential, delicate hospital information by reducing security and privacy concerns. For example, HIPAA (Health Insurance Portability and Accountability Act) is a federal foundation that protects the healthcare industry. HIPAA requires the HHS secretary to establish rules, guidelines, and measures to protect the privacy and security of health information. As a result, HHS issued the HIPAA Security Rule under HIPAA privacy law. [4]

Ajay et al. (2020) Strong similarities between general public performance and cloud- based operations and the proposed framework based on the CC model suggested and considered to control electronic service bugs faced by growing nations. CC is a materialized and developed field in Information Technology and is a service- focused approach. Cost reduction, fast processing, easy access, and distribution are the most attractive components of CC technology. It is also defined as a high- quality secure provider and expands its reach to several critical areas such as healthcare industries where data privacy and security remain at the forefront. The problem faced when installing a cloud solution are; the reliability of the new system, data confidentiality, security, storage, and the significant way of sharing the data between different data centers in parts of the world. These services provide as Software as a Service (SaaS). Cloud is a combination of hardware and software requirements. When we make these clouds in the form of payment forums they are called public clouds. When we own data storage users, they call the cloud privately and are not publicly available. [5].

IV. RELATED WORK

We intend to conduct a survey where the respondents are researchers in the field and medical practitioners along with people who are utilizing the healthcare services. Surveys were done by visiting the doctors and knowing their views regarding the storage of the patient's records and the methods being followed. Results of these two surveys were analyzed using data tabulation and disaggregation of data methods.

REVIEW 1:

Dr. Chandrashekhar Yavagal owns a Private Dental Clinic. When we had been to survey regarding, his way of handling the records and attending the patients, he stated that he strongly believes in cloud storage and supports it. He agreed that the cloud storage is always safe, secure and no other data regarding the patient will be deleted once the treatment is done. All the details will be stored in the Private Cloud and for a long period. The doctor had implemented the Cloud storage for his Clinic 3 years ago to maintain the patient's records by having an external cloud system. He stated that this system was not implemented to be aware of the COVID precautions, instead was done years ago to make it easy for the patients as well as the doctors to view the records anytime if necessary. He ensured that the records are safely stored and are timely shared with the patient through an application. His system had also developed an application that would help the patients to directly contact the doctor in case of any emergencies or if any doubts with the medications. The records will help the patient when he comes for the treatment even after a year, in case the doctor who treated the patient last time isn' t available, and then the other doctor will be finding it easy to treat the patient and prescribe necessary medications depending on his previous and present health reports. The moment the patient registers for an E-Consult with the doctor, a zoom link will be created. From this survey, we learnt how the cloud system has been implemented and used by the clinic.

REVIEW 2:

Dr. Kadasiddeshwar Byakodi, Government Hospital HOD, and Private Hospital Owner; According to his words, many villagers from the surrounding villages come to the government hospital for treatment. As usual, for years, the traditional paper pen records have been followed. Few of the patients come with the complaint that they have lost their previous reports and request for the generation of the new reports. This makes it difficult for the hospital staff management team to maintain every paper record and keep it safe. It also creates confusion and is time-consuming to search particular patient records when necessary. In this case, a Cloud system is very much necessary for the storage of the records which will indeed help the patients, doctors as well as staff of the hospital. The doctor stated that the Government hospitals usually lack such facilities which will boom the service for the patient treatment. The reason for the lack of systems is cost management and a large number of systems to install if being

implemented in the states. This made us know that development of the system is necessary to be done which will be useful for all the patients and which will cost less for the hospitals to implement it.

V. CLOUD COMPUTING

The CC is "An emerging It development, deployment, and delivery model, enabling real-time delivery of products, services and solutions over the internet (i.e. enabling cloud services) [8]."

A. Deployment models of Cloud Computing:

1. **Private cloud:** This ensures a high level of safety. Only one organization has access to available private network infrastructure resources.
2. **Public cloud:** In the data centre is managed and the general public can cloud service provider easily access all services on the Internet.
3. **Hybrid cloud:** The private cloud and public cloud are combined with one another. It offers more flexibility and efficiency. Public or private cloud resources can be used in according to business requirements.

B. Service models of Cloud Computing:

1. **IaaS (Infrastructure-as-a-service):** "It allows users to run any application on cloud hardware of their own choice" [8].
2. **PaaS (platform-as-a-service):** "This model allows users to create their own cloud application using supplier-specific tools and languages" [8].
3. **SaaS (software–as-a-service):** "The SaaS model is the easiest way allow users to run their existing online application" [8].

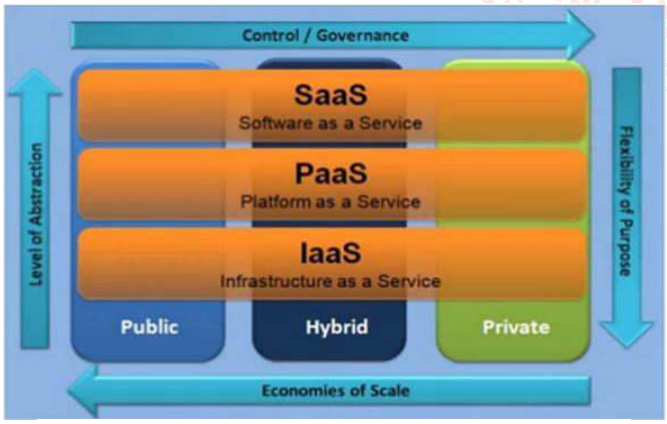


Fig.1: Model of CC service and deployment

VI. PROPOSEDSYSTEM

A broad range of technology and knowledge are used in medical management to improve the efficiency of work. In order to provide basic patient information and medicine, e.g. a hospital information management system is plays an important role. To read or enter a patient id, a 3D QR code is used quickly and soon. Information technology is easier to use, while in some ordinary circumstances certain safe interference occurs because of immature technology or risk management, like emerging health record rewards the privacy of users, access to a medical record is not rigorously monitored, fusion verification is done without proving technical authenticity, It is easy to make patient wrist ID, payment is not always easy. We use an app that uses a sign- in form to authenticate the user on its account when it provides all of his/her personal information and structure. The data is saved in a database and a QR code created.

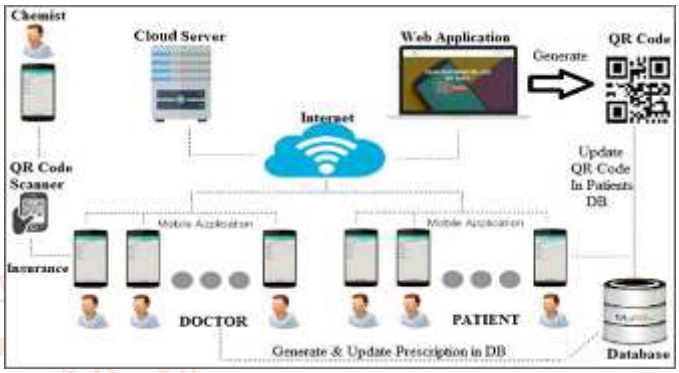


Fig.2: System Architecture

We create and implement an application that uses a log- in form to authenticate your user to your personal account, providing all the personal information and data about your medical records. The information is then saved into the database and a QR code containing the required user details is generated. The QR code can be scanned and the data stored in the database retrieved in the event of an emergency. This saves time to begin the treatment of an emergency patient. This saves time to complete all medical procedures to start surgery. The data storage and recovery is also safe and secure. This method not only saves the victim's life, but also helps doctors to work comfortably. We retrieve your scanned information with the aid of a QR code containing a link of the victim's emergency information stored in the database in order to shorten the paperless work procedures for a patient visiting periodically or visited in an emergency case. When patients visit the hospital for the first time, they register with the system. After that doctor scans QR Code, all the information that the previous treatment for that patient has been stored will be displayed. Doctor will perform check- up of patient and update current information into QR Code each and every time and also medical treatment task like (CT Scan, MIR, Blood Test, X ray) will also scan that QR Code and perform treatment and gives the medicine, if required we will add digital wallet for online and instant payment purpose. Using QR Code we generate unique tag for patients all information instated of carrying reports and documents.

A. QR Code Technology: - It is also known as Quick Response Code is a mark for the type of matrix barcode or two dimensional barcodes. A QR code uses four standardized modes for the efficiency of data. A quartz code includes black modules (square dots) arranged on a white background in a square grid and readable with a camera, scanner and other imagery device and processed by means of a Reed-Solomon error correction until the image can be properly interpreted. The required data are then extracted from patterns in horizontal and vertical image components [1].

Fig.3: Quick Response (QR) Code

B. QR Code Representation: - Nowadays, when cameras are used on smart- phones, and messages are popular via QR code. It was a sensible choice to implement this standard in order to transfer data from a document to a mobile phone in a viable manner. This standard, developed in 1994, can carry even 2953 bytes on a layout of 177 by 177 modules. It has a characteristic that is robust to small code distortions when encoding data. Four error correction levels have been established and the greater the level, the less capacity. [5] The L, M, Q and H levels allow the complete message to be recovered by up to 7, 15, 25 and 30 percent of the QR image is destroyed. The objective was to get as much room as possible for the data, not especially in the case of damage. For this reason, level L was considered enough.

C. One Time Password (OTP): - OTP is a unique identification and verification process of user's patient's accounts. It is generated randomly but each and every time it generates unique number or alphanumeric combination of the sequence. It is securely verification system use everywhere.

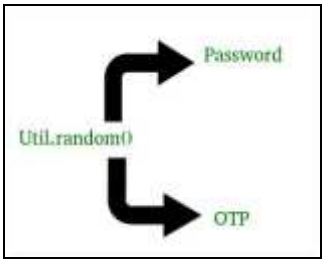


Fig.4: One Time Password (OTP)

D. AES Encryption: - Medical data up to 128 bits can be encrypted by the AES algorithm. If you want their laboratory report first of all, your first visit to the laboratory must take your personal key. So patient with labSeq- p application at that time to encrypt and decrypt data and load in their database.

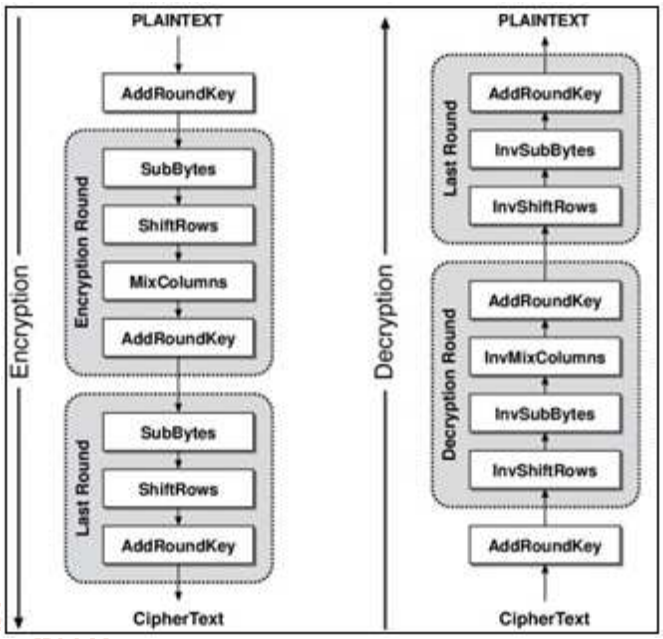


Fig.5: AES Algorithm Structure

AES is the algorithm used to encrypt patient or user data records. ASS is the most common type of encryption. Two main elements of encryption and decryption are present in AES algorithm. This encoding therefore means that the plain-text data is converted into cipher-text and humanly unreadable format, as opposed to the encryption process. The AES algorithm is on the basis of different key lengths per round or bit, thus 10 rounds for a key length of 128 bits, 12 rounds of key length for 192 bits, and the last round is 14 rounds for a key length of 256 bits, etc. Therefore, when encrypting users or patient' s data in rounds and their bits of the key-length data are encrypted, it means human unreadable form and should be decrypted in plain text means human readability when we want data records. To achieve such security, the AES algorithm is used to protect patient's confidential data records from any unauthorized users or attackers.

1. AES Encryption: The encryption of data records is according to fig.4. During this data, plain text is converted into cipher text by length and round of key expansion bits. In encryption and decryption, the key expansion process remains the same. The only difference is that the decryption process is inverse to encryption of data. The transformations used are:

1. Shift Rows
2. Sub Bytes Transformation
3. Mix Column Transformation
4. Add round key Transformation

2. Shift Rows: During this transformation phase first construct a matrix and move the data in that matrix.

The data in the first matrix then travel to the next matrix, however it is differently transported to the following matrix row by the first column.

3. Sub Bytes: In Sub Bytes transformation each and every bytes is replace with the specific entry in Look up Table or S- Box. Throughout decryption, one separate 256 byte look- up table holding these values of the inverse Sub Bytes transformation is used.

4. Mix Column: In the Mix Column transformation appropriates column in the polynomial form in that each and every column is multiplied by a fixed polynomial.

5. Add Round Key: In the particular encryption round, it consists of XORing every byte of the particular state. This is the last round of the AES algorithm if this round is achieved then the output is cipher- text. [7]

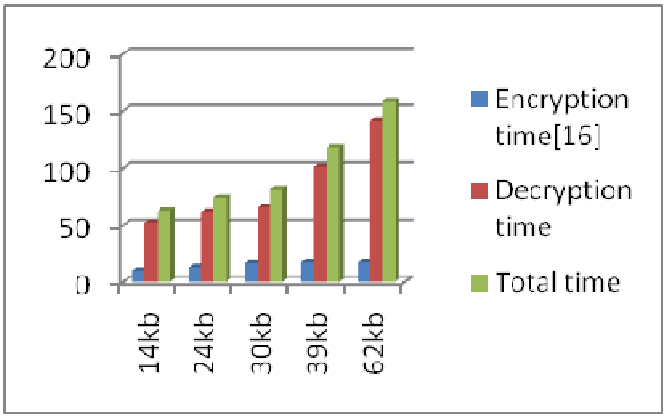
VII. RESULTS AND DISCUSSION

The results of this work are to design and develop proposed work which has:

- A novel QR Code Strategy based on encryption technique which can challenge the existing QR code strategy.
- Web and Android systems, which illustrate the applicability of our protocols in real-world deployment circumstances of System Implementations.
- In this application generate Quick Response code for each and every patient at one time, the system takes less time.
- Patents first register in any hospital that time generate patient' s unique identification key using a Quick Response (QR) code and it is used at everywhere; no need to carry any documents, reports, and prescriptions. It is totally paper less work, reduce time and money.
- In this E- Healthcare system provides better security of patent' s confidential data records, user friendly uses, easy to access at everywhere like Hospitals, Doctor, Pharmacy, Insurance and Patents side.
- Patient no needs to visit personally to the physician or at medical store.

A. Analysis of Existing Work:-

In this fig. we analyze the comparison of different Encryption and Decryption time also shows the total time for execution of existing system.



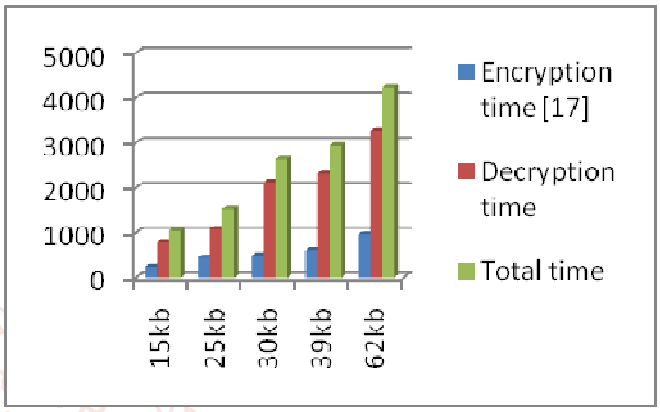


Fig.6: Analysis of Encryption & Decryption

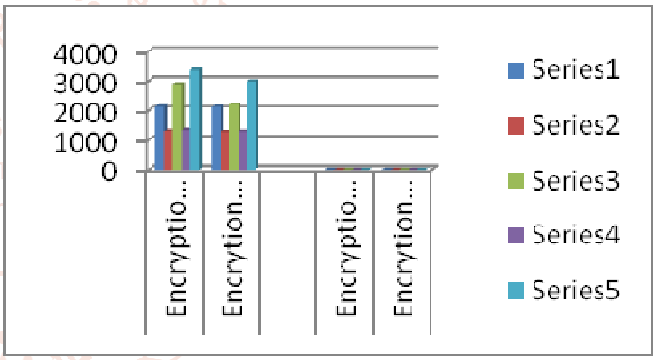


Fig.7: Time for Encryption

VIII. CONCLUSION AND FUTURE WORK

CC is an emerging technology that has all the resources but has certain constraints that restrict its health effectiveness. The aim of this concept was to study and then address the possibilities and constraints between CC and e Health. The authors examined the challenges included in the installation of CC, the associated concerns and factors related to the adoption of CC in e- health and eventually the future of computer in health in this study paper. The author undertakes book evaluations and one-on-one interview with his friends and coworkers to identify and obtain a deeper grasp of these challenges. Regarding e-Health cloud hosting: most of these concerns appear to be focused on data storage, patient trust and the location of the data centre; It was also noted that people choose cost-effectiveness and convenience of use when asked about the buying of a computer. Data storage and dependability have a major influence on CC acceptance.

IX. FUTURE SCOPE

Clear recommendations have been raised in this proposed study in terms of comprehending the challenges involved in CC adoption in e-Health. The proposed guidelines are based on the perspectives of health- care and CC partners. These guidelines will assist health care practitioners in deciding whether or not to use CC. There is a possibility of utilizing this information in future programming if the problem involved in CC and concerns linked to CC adoption in e- Health could be recorded and understood from a logical perspective.

In this study focused on CC and e-Health partners. In the future, there will be an opportunity to look into the opportunities for people with diverse backgrounds, such as different levels of schooling and different areas of competence.

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