Materials Today: Proceedings xxx (xxxx) xxx

Contents lists available at ScienceDirect

Materials Today: Proceedings

journal homepage: www.elsevier.com/locate/matpr

Cloud computing based generic medicine recommendation system for advanced E-Healthcare

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ARTICLE INFO

Article history:
Received 1 February 2021
Accepted 11 March 2021
Available online xxxx

Keywords:
Generic medicine
Healthcare
Cloud computing
Drugs
Patient information

ABSTRACT

Many health institutes manually record and collect patients' data may be misunderstood and at times, inconsistent. Also, patients' alienation from medical details leaves them unaware of the necessary medical costs and inevitably causes them to pay long and ineffective bills. Therefore, it is very important and important to consider the consumers of generic medicinal products – medicinal products of the same chemical composition, but available at low cost. This device proposes a method for sensing the physical wellbeing of patients using sensors after they are admitted to the hospital. This is added to a "cloud" server that stores the health parameters of patients and accesses them whenever possible. The patient's cloud-based databases also include the medicine prescribed by physicians, the diagnosed condition of the patient and the tests suggested by the doctors. The software interfaced between the cloud and the patient data entry displays the results of 'cost-effective generic drugs,' the necessary tests needed for the patient and the hospital to be qualified for further treatment, which are shown to the patients or their associates. Few well-equipped healthcare facilities follow data centralization and database approaches, but their accuracy remains a matter of reliability. Our proposed system offers a way for patients to track their medical costs within their boundaries, using sensors and cloud computers as their technological resources.

Selection and peer-review under responsibility of the scientific committee of the Emerging Trends in Materials Science, Technology and Engineering.

1. Introduction

Cloud computing is a technology recognised as the 3rd post-PC and IT Internet revolution. Cloud computing's basic principle is to execute operations on a variety of remote computers, but not on local computers. Cloud computing may integrate and use the public cloud to help customers. Patient information is stored on various computers and not on local computers.

1.1. Challenges for health care organizations on cloud computing

Ensuring that the cloud provider complies with the privacy and protection standards placed on health care organizations is a major challenge. Healthcare is a highly regulated industry, which has several federal and state laws that control personally defined health records, employee data, data on credit cards, and other confidential information for the data used and retained by medical institutions. While these laws lay down some common protections for the protection of privacy, they also lay down discrete criteria, resulting in legal principles that are generally consistent but dissimilar to the particulars.

Protected Health Information (PHI) is to be guaranteed under the Health and Insurance Portability and Accountability Act (HIPAA of 1996), as amended by the HITECH Act and its implementing legislation, by health insurers, health-care centers, and regulated health-care providers (i.e. covered institutions). These laws have a comprehensive legislative framework for the privacy and protection of PHI. The HIPAA safety rule sets out 22 separate technology-neutral safety standards, including administrative, physical, and technical security for PHI (ePHI). These standards include a range of implementation conditions that need to be met to protect the protected organization's ePHI from reasonably expected threats and hazards.

Health insurers are required to keep their financial details private, as described in the Gramm-Leach-Bliley Act, as "nonpublic personal information" (GLB Act). Credit card data-saving organizations will have to protect such information by the most acceptable

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https://doi.org/10.1016/j.matpr.2021.03.342
2214-7853/
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practices specified by the Payment Card Industry Data Security Norm by contracts with major credit card companies or by State law (PCI DSS). Some healthcare firms may have authority over the security and privacy of personal data under the Fed's Federal Trade Commission and could be subject to the ban on unfair commercial practices being implemented by the FTC.

Health information is typically subject to State privacy and/or protection legislation in addition to federal requirements. There are very different national regulatory and statutory systems. All states have data protection regulations, some of which regulate information on state citizens and others that relate to information kept by companies operating in the state. Many states have comprehensive privacy laws for health records, like California and Minnesota. The other States, including the states of Massachusetts and Nevada, also have laws on data privacy that include personal data security controls, though many have laws or regulations that govern access to medical records and on the confidentiality of sensitive health information (e.g., mental health data, genetic data, transmittable disease data, and HIV test results).

1.2. Cloud computing in healthcare

Traditionally, the healthcare industry has been considered a late adopter of technology, and its conservative attitude is justified and evident. Many healthcare players have not yet fully embraced technology in their environments and their key emphasis is on back-office processes automation, payments and reimbursements, medical records digitization, and market intelligence to control enforcement and accreditation. IT budgets are very limited in many emerging and developing countries such as India. Investments in IT clash with other objectives, such as radiological equipment or organizational expansion.

1.3. Generic drug

The generic medication is defined as a medicinal drug that is similar in nature, strength, route of administration, consistency, performance, and intended use to the medicinal product brand/reference of the medicinal product. The word also applies to any medication marketed without ads under its chemical name. Generic pharmaceutical products must have the same active ingredients as the original formula. The United States of America has reported. The generic medicines of the Food and Drugs Administration (FDA) in terms of pharmacokinetic and pharmacodynamic properties are comparable or in the acceptable bioequivalent range of the brand name homologue. Generic drugs will save you money. It costs much less than medicines with a big name. However many people worry that generics are not as good. Generics are pure, strong, and sound as goods. They aren't like "generic" cereal, soap, or frozen food, where the brand is a better product in general. The main goal towards bringing this system is to easily bring down the inconsistency in data entry of patients and to make a clear objective towards bringing generic medicine to a patient's vicinity by using sensors and cloud computers as reliable resources.

2. Literature survey

Today, as some of the richest countries in the world are facing one of the most serious financial problems of the past decades, the crucial position of generic drugs has become more apparent than ever before. Based on the new IMS Health Report, generic use, which has hit about 80 percent in the United States, is responsible for savings of about US$192.8 billion (savings-$1 trillion over 10 years. Generic Medication Savings in the United States). As mentioned in one of the articles in this issue of the Journal, the value of pharmaceuticals is increasing in government budgets. In this context, unfortunately, where the quest for means of maximising generic usage is of paramount significance, generic manufacturers are waging unequal battles provided the postponement tactics sought by pharmaceutical firms. This allows them to participate in needless disputes and delays and the selling of generic goods impacting some firms, consumers, and health care providers. The Commission's inquiry into the pharmaceutics industry was conducted as a matter of concern for a delay in generic entry, which was one of the above-mentioned articles and included in this question. The study also found several practices to hinder the introduction of generic rivals. Many articles published in this topic often address problems expected to be addressed as follow-up biologics are unlikely to be a common target for consumers, health professionals and policymakers due to the absence of consistent regulatory protocols that may also continue to hinder the entry of follow-up biologics and unnecessary shortages on the market of general products and medicinal products.

Yunyong Guo et al. [1] addressed the essential research method related to the exchange and incorporation of health information in HC and examined emerging problems and issues. Roma Chauhan et al. [2] demonstrated the advantages and drawbacks of using cloud-based healthcare systems. Discussions on the various healthcare clouds and models which the healthcare industry can adopt are also implemented. The cloud-based Intelligent Health Care Monitoring System (CIHMS) provided cloud-based medical support to the patient by Khyamling A. Parane et al. [3]. Nimmy John et al. [4] outlined a framework that provides a range of cloud computing services. The document also demonstrates how one service was introduced as part of the mentioned framework. Masrom et al. [5] studied the adoption of cloud computing in the healthcare sector through a SWOT (Strength, Vulnerability, Opportunities and Threats). The research team Karthika Devi et al. [6] clarified the problems of important, confidential health information obtained, handled, processed and secured by healthcare providers. In terms of weights on security and insurance points, Harika et al. [7] clarified that there were few distributed listing contributors. Kumar-Pandey [8] has rendered the difficulty of knowing if the maximum likelihood calculation is idle with multiple imputation or full knowledge, but both techniques are better than conventional missing information techniques. Inderpreet [9] proposed a model for grouping the Administrative Cloud-based adaptable e-health services platform. The security concerns of data in the cloud network and servers are concerned by Saran et al. [10].

2.1. Cloud computing in healthcare service model existing system technique

In the conventional practice, automate the process of collecting vital patient data through a network of sensors connected to legacy medical equipment and provide this information to the "cloud" medical centre for storage, processing and distribution. It focuses on basic components built on commodity computing devices. Commercially available wireless routers that allow the Linux solution to replace the operating software we used the Linksys WRT54 router – and a simple application that collects data from a serial port (connected to a medical device), converts and loads this information on an exchange server. We suggest that the same functionality can be replicated in a number of hardware/software combinations. Content Service Application is a standard interface used to access information to medical staff that is forwarded to an exchange of resources to request pre-processed data.

The exchange acts as an intermediary between local and remote services. It is responsible for collecting data from the sensors and sending it to the appropriate cloud-based storage service. It also accepts requests from the content service to access data from the

cloud service, whose functionality is twofold: (1) it is responsible for providing data storage services; and (2) it provides a platform for the creation, testing, and deployment of applications required by medical staff. Remote and stationary computers connect with service providers. This service is used as a "door" where all available information is scanned by medical staff.

3. Proposed system

There are two key features of the system: the Local System and the Generic MedCloud (GMC). The Local Machine serves as an input and output console for the cloud and GMC is the real cloud that calculates the job. The local system also makes it easier for users to look at the cloud and how it operates. It can be installed in a medical facility and in the cloud, the native users and hospital management have an abstract feature. We describe the framework that can be modeled on other collaborators for one single medical institution. The GenericMedCloud (GMC) offers information on the local system's patient information and the cloud service provider's generic medicines data. The local device consists of a console that displays the output, the cloud interface, or the input console, the sensor module, and the GPS. Our proposed system has the capability of automating the process of collecting patient data through sensors linked to medical devices. The unit that diagnoses the patient is connected to a sensor or sensor module if a patient is admitted for an illness. The sensor module includes elements for extracting, converting, and loading data from attached hardware; the program offers a common set of control interfaces that can be easily configured for various medical devices. This data, therefore, uploaded to the cloud, can be used for two purposes. Fig. 1 shows the block diagram for our proposed system.

a) A patient can obtain a digital copy of his cloud service medical records, which can be accessed anywhere.
b) When admitted to a hospital other than the previous one the Doctor will review this digital copy of the results.

The second goal is to decrease the burden of repeated patient evaluations for the diagnosis of the disease. The local system's most important role is to offer cloud information on medicine. The patient may have the privilege of entering the details of the medication prescribed by the doctor that is sent to the GenericMed Cloud via the cloud interface given. The GenericMed Cloud checks and retrieves the appropriate generic medication from the databases thereof. This is seen in the console output. The cloud, therefore, has a complex database that stores numerous brand names and their associated generic medication. Effectiveness and precision must be treated in the database. While patient specifics and generic medicine are segregated, it is abstracted under the "GenericMed Cloud" single parable (GMC).

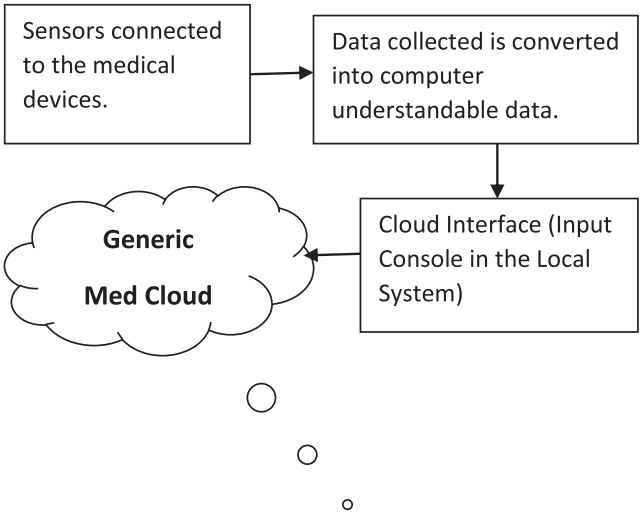

Fig. 1. Block diagram of local system.

The GPS in the Local System helps to find the hospital's location and sends it to the cloud. There can be many uses regarding it. This will attach the details of the treatment center or the Health-care Institution where the patient has received his treatment. If the service is extended to another level and if the cloud gets the luxury of having details of various hospitals and its certified treatments, it can give the information to patient whether the hospital is eligible for undertaking the treatment the patient is currently undergoing or about to undergo it. Hence, using this GPS facility should be well aware to the patient before he gets into the treatment. This can be always checked and verified when the case is not an emergency one. The Generic MedCloud (GMC) holds the structure of any cloud that is capable of providing IaaS and SaaS.

The GPS in the local device helps to locate the location of the hospital and sends it to the cloud. There can be a lot of uses for it. This will provide details of the treatment facility or the health care institution where the patient has undergone the treatment. If the service is expanded to another level and the cloud enjoys the privilege of providing details of different hospitals and their certified treatments, it may provide the patient with information as to whether the hospital is eligible for or about to be handled by the patient. Therefore, before the patient begins the treatment, use this GPS facility should be well aware of it. This can still be tested and validated if there is no emergency. Generic MedCloud (GMC) carries the framework of any cloud capable of delivering IaaS and SaaS.

As a service which GMC's saaS is the tool that differentiates GMC from others, it provides and provides general medical data. The striking feature of GMC is that it can extend other SaaS services including centralization of other personal data that patients and physicians can access remotely. The GMC is connected to the local machine interface or device. Therefore it is very important to subscribe to GMC. The GMC function is abstract because it is a server and workstation array that is abstract. GMC's conceptual attribute is the server community that holds multiple databases – a common drug database, a patient-database, and a hospital information database. All of them have different roles. Cloud computing with user knowledge, software, and computing offers remote services.

End-users can use a web browser, lightweight desktop, or smartphone app to access cloud-based applications while company and customer information is stored in remote locations on their servers. Proponents contend that cloud computing helps organizations to avoid upfront maintenance costs and concentrate on initiatives that separate their businesses from infrastructure. Proponents further argue that cloud computing enables businesses to work efficiently, enhanced management and maintenance, and helps IT to adapt its resources to the fluctuating and volatile market demand more quickly.

4. Module description

4.1. Cloud deployment module

Cloud is used to provide fast, on-demand network access to a common pool of configurable computing resources (e.g. networks, servers, storage, applications, and services) that can be easily distributed and released with minimal management effort or service provider involvement. The cloud is generated by OpenStack. Applications are built on a cloud server that you can use. The local com-

puter will be linked to the cloud server. OpenStack offers cloud software to serve customers. The structure containing the required data as per the requirements of the user data. Ubuntu The operating system used to build the OpenStack cloud. Begins the execution and automatically deploy, within a short period, the Resource Assignment Solutions outlined in the Policy Module and the Arbitration Module. If the user asks, some relevant information will be provided such as IP, username, and password. It just requires a network to act as a cloud server.

4.2. Data accessing from cloud

With their correct username and password, users log in to the cloud. The patient's records, including the blood group, diseases, and the physician prescribed medicines are also reported on the server. Sometimes drugs prescribed by physicians can be very expensive. Poor people can also purchase a low-cost drug employing generic medicine. Generic medicine has the same chemical elements as the drugs prescribed by physicians. The patients themselves can easily understand their diseases in the accompanying generic medicines. The generic medication application file is loaded into the cloud server.

5. Conclusion

As cloud computing is becoming increasingly popular, there is an exponential increase in the anthem of the Internet for information to make smooth decisions in all spheres. The primary goal is to help people around the world make their lives easier. Cloud-based openings that choose to share software that can be accessed from anywhere. In the future, everybody in our society will know about generic medicines and their purpose. Producing generic medicines in the cloud requires more hardware and software. By going to the cloud, we will enhance data security and data can be used for future reference by doctors as to what treatments are being administered to patients and their illnesses.

CRediT authorship contribution statement

R. Pitchai: Conceptualization, Methodology, Software, Visualization, Writing - original draft. **S. Anjanayya:** Data curation, Supervision, Software. **M. Maravarman:** Validation, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] Y. Guo, M. Kuo, T. Sahama, Cloud computing for healthcare research information sharing, in: 4th IEEE International Conference on Cloud Computing Technology and Science Proceedings, Taipei, 2012, pp. 889–894, https://doi.org/10.1109/CloudCom.2012.6427561.

[2] R. Chauhan, A. Kumar, Cloud computing for improved healthcare: techniques, potential and challenges, in: 2013 E-Health and Bioengineering Conference (EHB), Iasi, 2013, pp. 1–4, https://doi.org/10.1109/EHB.2013.6707234.

[3] K.A. Parane, N.C. Patil, S.R. Poojara, T.S. Kamble, Cloud based intelligent healthcare monitoring system, in: 2014 International Conference on Issues and Challenges in Intelligent Computing Techniques (ICICT), Ghaziabad, 2014, pp. 697–701, https://doi.org/10.1109/ICICICT.2014.6781365.

[4] N. John, S. Shenoy, Health cloud – healthcare as a service(HaaS), in: 2014 International Conference on Advances in Computing, Communications and Informatics (ICACCI), New Delhi, 2014, pp. 1963–1966, https://doi.org/10.1109/ICACCI.2014.6968627.

[5] M. Masrom, A. Rahimli, Cloud computing adoption in the healthcare sector: a SWOT analysis, Asian Soc. Sci. 11 (10) (2015).

[6] S.K. Devi, B. Arputhamary, Survey of Cloud Computing In Healthcare Sector, Int. J. Adv. Res. Comput. Sci. Software Eng. 7 (7) (2017) 337.

[7] P. Harika, N. Thirupathi Rao, A survey on cloud computing – investigative points, confronts, design and applications, Int. J. Cloud-Comput. Super-Comput. 5 (1) (2018).

[8] S. Kumar Pandey, R. Ram Janghel, A survey on missing information strategies and imputation methods in healthcare, in: 2018 8th International Conference on Cloud Computing, Data Science & Engineering (Confluence), Noida, 2018, pp. 299–304, https://doi.org/10.1109/CONFLUENCE.2018.8442884.

[9] I. Singh, D. Kumar, S.K. Khatri, Improving the efficiency of E-healthcare system based on cloud, in: 2019 Amity International Conference on Artificial Intelligence (AICAI), Dubai, United Arab Emirates, 2019, pp. 930–933, https://doi.org/10.1109/AICAI.2019.8701387.

[10] P. Saran, D. Rajesh, H. Pamnani, S. Kumar, T.G. Hemant Sai, S. Shridevi, A survey on health care facilities by cloud computing, in: 2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE), Vellore, India, 2020, pp. 1–5, https://doi.org/10.1109/ic-ETITE47903.2020.231.