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A Robust Framework for Securing Public Healthcare Centres Based on Cloud

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ABSTRACT: Within the literature, we have witnessed in the healthcare sector, the growing demand for and adoption of software development in the cloud environment to cope with and fulfil current and future demands in healthcare services. In this paper, we propose a flexible, secure, cost effective, and privacy- preserved cloud-based framework for the healthcare environment. We propose a secure and efficient framework for the government Electronic Health Record system, in which fine-grained access control can be afforded based on multi-authority ciphertext attribute-based encryption (CP-ABE), together with a hierarchical structure, to enforce access control policies. The proposed framework will allow decision makers in the market to develop the healthcare sector, which is responsible for delivering shared services through a highly efficient, reliable, and safe environment. This framework aims to provide health services and facilities from the government to citizens (G2C). Furthermore, multifactor applicant authentication has been identified and proofed in cooperation with two trusted authorities. Security analysis and comparisons with the related frameworks have been conducted.

I. INTRODUCTION

The traditional health system (paper) has been replaced by an electronic health information system because the traditional system has been found to be ineffective due to several issues, including low storage capacity, high operating and maintenance costs, and system integration. The computerized health system was then replaced by cloud computing because it relies on a more efficient infrastructure, as well as the many benefits of cloud computing in IT, such as cost, scalability, flexibility, and other features. The use of cloud computing in electronic health records reduces costs in the provision of health services, maintenance costs, networks, licensing fees, and infrastructure in general, and this will therefore encourage developers to adopt the cloud in healthcare.

The rapid shift to the cloud and its use in healthcare systems has raised concerns about crucial issues of privacy and information security. The adoption of the cloud in IT increases the focus and concern of healthcare providers on clinical and patient-related services and reduces attention on infrastructure management. The sharing of personal and health information across the Internet and various servers outside the safe environment of the healthcare institution has led to several problems related to privacy, security, access, and compliance issues. In the literature, there are no existing powerful frameworks that clearly address all viable schemes and interrelationships between cloud computing and healthcare. Improving the framework for healthcare in cloud computing has been studied by several researchers. Further developments and solutions in these challenges will increase the adoption of cloud healthcare and encourage healthcare providers to move forward with cloud-based services.

Objectives of the paper:

Providing a flexible, secure, cost-effective, and privacy-preserved G-cloud-based framework for government healthcare services by: Applying, using, and modifying the most recent encryption and decryption mechanisms suited for cloud based EHR systems. The proposed scheme does not use the standard encryption system, which is not suited to the cloud environment. Achieving scalability of computing resources that can be expanded and controlled according to the required health services. The EHR can support massive data exchanges.

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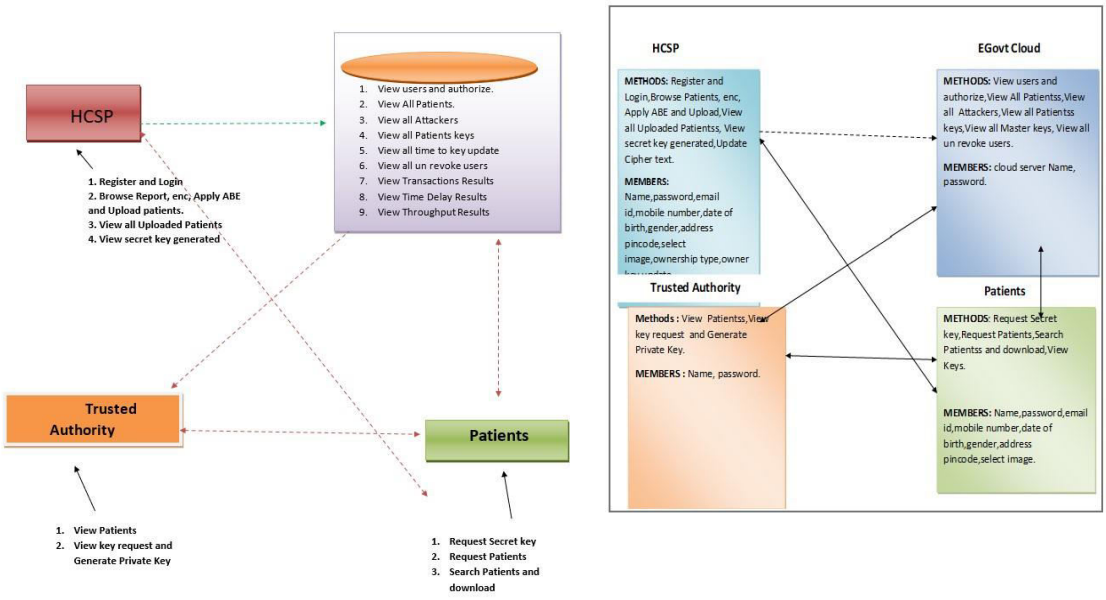
1.1 Architecture Diagram:

An Architectural diagram is a visual representation that maps out the physical implementation for components of a software system. It shows the general structure of the software system and the associations, limitations, and boundaries between each element. An architecture diagram is a diagram that depicts a system that people use to abstract the software system's overall outline and build constraints, relations, and boundaries between components. It provides a complete view of the physical deployment of the evolution roadmap of the software system.



1.1.a. Input Design:

The input design is the link between the information system and the user. It comprises the developing specification and procedures for data preparation and those steps are necessary to put transaction data into a usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having people keying the data directly into the system. The design of input focuses on controlling the amount of input required, controlling the errors, avoiding delay, avoiding extra steps, and keeping the process simple. The input is designed in such a way so that it provides security and ease of use with retaining the privacy. Input Design considered the following things:

- What data should be given as input?
- How the data should be arranged or coded?
- The dialog to guide the operating personnel in providing input.
- Methods for preparing input validations and steps to follow when error occur.

Solutions:

Input Design is the process of converting a user-oriented description of the input into a computer-based system. This design is important to avoid errors in the data input process and show the correct direction to the management for getting correct information from the computerized system. It is achieved by creating user-friendly screens for the data entry to handle large volume of data. The goal of designing input is to make data entry easier and to be free from errors. The data entry screen is designed in such a way that all the data manipulates can be performed. It also provides record viewing facilities. When the data is entered it will check for its validity. Data can be entered with the help of screens.

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Appropriate messages are provided as when needed so that the user will not be in maize of instant. Thus, the objective of input design is to create an input layout that is easy to follow.

1.1.b. Output Design:

A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users and to other system through outputs. In output design it is determined how the information is to be displaced for immediate need and the hard copy output. It is the most important and direct source information to the user. Efficient and intelligent output design improves the system's relationship to help user decision-making.

1. Designing computer output should proceed in an organized, well thought out manner; the right output must be developed while ensuring that each output element is designed so that people will find the system can use easily and effectively. When analysis design computer output, they should Identify the specific output that is needed to meet the requirements.
2. Select methods for presenting information.
3. Create document, report, or other formats that contain information produced by the system.

The output form of an information system should accomplish one or more of the following objectives.

- Convey information about past activities, status, or projections of the
- Future.
- Signal important events, opportunities, problems, or warnings.
- Trigger an action.
- Confirm an action.

1.2 The System Entities:

The proposed cloud-based framework, which consists of four fundamental entities. These entities interact with one another directly and indirectly to perform their tasks in the cloud based EHR framework.

The Patient:

The patient is the main entity in our proposed framework. The patient has the following main tasks: A new patient must apply for an authentication request to the trusted authority to get his or her identification number (ID), and then he or she will be able to use the system services. Creates the patient history record (PHR) and stores it at the cloud server. Ensures the PHR is fully secured and protected by defining an (attribute-based) access policy that can be used for encrypting the data before it is distributed.

Healthcare Providers:

Healthcare providers are individuals who provide healthcare services of all kinds in an organized manner to all members of a community. The healthcare providers could include

the following members: health practitioners and specialists, physicians, nurses, pharmacists, surgeons, medical technicians, laboratory workers, and other employees. Each of these members must have access to some part of the patient records for specific purposes.

The E-Government Cloud-Based HER

The proposed e-government cloud-based EHR consists of the following cloud services: The first service consists of two fundamental parts: data repository and computing resources. The first service is responsible for storing the encrypted EHRs that are accessible only by the authenticated healthcare providers through an access policy based on healthcare provider attributes. The second service is responsible for generating the access policies, providing efficient keys management, and performing other required computing processes. The third service is hosting the web-based portal. The developed web-based portal should be a secure online website that can be accessed by the stockholders from anywhere, with 24-hour a day access, through Internet connection, and can be accessed by any device.

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Patient and Hospital Service Providers (HSP) Identity Proofing

When applicants access the portal for the first time, i.e., patients and service providers, they must be registered from the trusted health authority to be able to interact with the system. Through the web portal in the e-government cloud, the applicants can send, update, and receive health information from the cloud's central database with limited access, depending on the end user's privileges.

Testing the applications:

All the modules of the system are successfully developed and tested based on the test plans discussed in the previous chapter and are found to be according to the previously laid out design specifications. The following are the successfully implemented and tested modules:

Functional test:

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

White Box Testing:

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure, and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

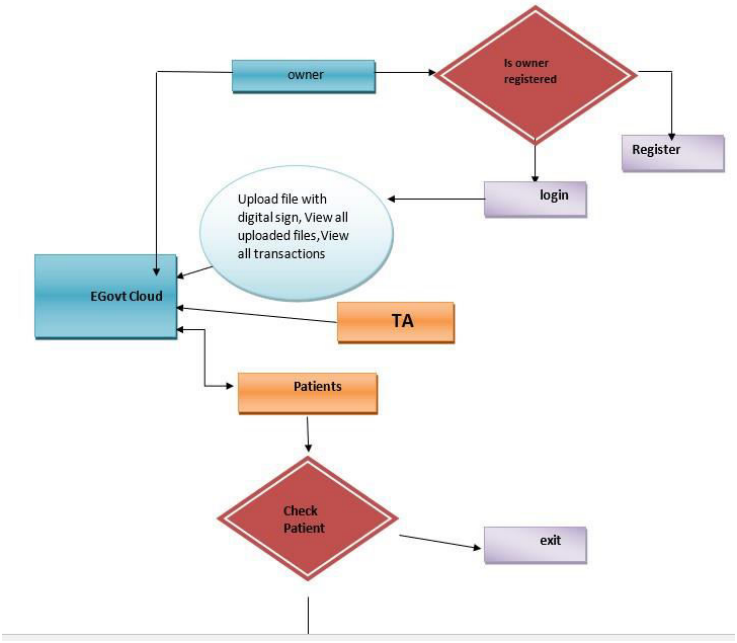
Black Box Testing:

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box. you cannot "see" into it. The test provides inputs and responds to outputs without considering how the software works.

Acceptance Testing:

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

Test Results: All the test cases mentioned above passed successfully. No defects encountered.



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II. CONCLUSION

In this paper, we proposed a secure cloud-based EHR framework that guarantees the security and privacy of medical data stored in the cloud, relying on hierarchical multi-authority Ciphertext-Policy Attribute-Based Encryption to enforce access control policies. The proposed framework provides a high level of integration, interoperability, and sharing of EHRs among healthcare providers, patients, and practitioners. In the framework, the attribute domain authority manages a different attribute domain and operates independently. In addition, no computational overhead is completed by the government authority, and multi-factor applicant authentication have been identified and proofed. The proposed scheme can be adopted by any government that has a cloud computing infrastructure and provides treatment services to most of the citizen patients. Future work includes implementing and evaluating the proposed scheme in a real-world environment.

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