CLOUD BASED ARCHITECTURE TO IMPLEMENT ELECTRONIC HEALTH RECORD SYSTEM

Submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Computer Science

and Engineering by

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING SCHOOL OF COMPUTING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY) Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

MARCH-2021



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DEPARTMENT OF COMPUTER SCIENCE AND

ENGINEERING BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **B.BHARGAV KRISHNAMA NAIDU(Reg. No. 37110090), B.S.S.GANGADHAR(Reg. No.37110066)** who carried out the project entitled "CLOUD BASED ARCHITECTURE TO **IMPLEMENT ELECTRONIC HEALTH RECORD SYSTEM**" under my supervision from November 2020 to March 2021.

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DECLARATION

I B.BHARGAV KRISHNAMA NAIDU(Reg. No. 37110090) hereby declare that the Project Report entitled "CLOUD BASED ARCHITECTURE TO IMPLEMENT ELECTRONIC HEALTH RECORD SYSTEM" done by me under the guidance of Dr. A. Christy M.E., Ph.D., is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Computer Science and Engineering.

DATE:

PLACE:

SIGNATURE OF THECANDIDATE

ACKNOWLEDGEMENT

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ABSTRACT

The Internet has been a steady source of medical data previously; it has just as of late been utilized for online private patient-doctor consultations. As of late, the market has seen a surge in applications providing healthcare services on the go. An online consultation has secured a foothold in the market and individuals are opening up to the likelihood of substituting a visit to a physical facility with an online option. This study reports a review of the literature on online medical consultation from various databases as well as various surveys and reports published. As per published work/reports/surveys, the various factors which led to a sudden surge in the online medical consultation are the convenience, shift in disease patterns, cost- effective, privacy and second opinion. Therefore, it is important to accomplish remote data integrity auditing on the condition that the sensitive information of shared data is protected. A potential method of solving this problem is to encrypt the whole shared file before sending it to the cloud, and then generate the signatures used to verify the integrity of this encrypted file, finally upload this encrypted file and its corresponding signatures to the cloud. This method can realize the sensitive information hiding since only the data owner can decrypt this file. However, it will make the whole shared file unable to be used by others.

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CHAPTER 1

INTRODUCTION

Online medical consultation (OMC) is the term utilized as a part of this paper to allude to web-based remote patient-specialis (consumer-provider) medicinal discussions. With the approach of broadband and video conferencing, numerous people have swung to online web-portals to get an online consultation. Utilization of this technological innovation has numerous advantages for both the doctor as well as the patient; including cost savings, comfort, accessibility, and enhanced privacy and communication. This idea is for patients with a variety of medical needs originating from different areas of a country or several nations. Patients may pick or be assigned to any specialist/general duty doctor who is accessible on the web. They are not limited to a particular care provider either by past learning or by geographical closeness. All you have to **do** is tell us your symptoms or

health problems, choose the speciality, make a payment. Once payment is made, we alert our panel of verified, high-quality doctors and allocate a doctor to your consultation.

ABOUT AWS AND AWS COMPONENTS

Amazon Web Services (AWS) is the world's most comprehensive and broadly adopted cloud platform, offering over 200 fully featured services from data centers globally. Millions of customers—including the fastest-growing startups, largest enterprises, and leading government agencies—are using AWS to lower costs, become more agile, and innovate faster. AWS has significantly more services, and more features within those services, than any other cloud provider–from infrastructure technologies like compute, storage, and databases–to emerging technologies, such as machine learning and artificial intelligence, data lakes and analytics, and Internet of Things. This makes it faster, easier, and more cost effective to move your existing applications to the cloud and build nearly anything you can imagine. AWS also has the deepest functionality within those services. For example, AWS offers the widest variety of databases that are purpose-built for different types of applications so you can choose the right tool for the job to get the best cost and performance. AWS has the most extensive global cloud infrastructure. No other cloud provider offers as many Regions with multiple Availability Zones connected by low latency, high throughput, and highly redundant networking. AWS has 80 Availability Zones within 25 geographic regions around the world, and has announced plans for 15 more Availability Zones and 5 more AWS Regions in Australia, India, Indonesia, Spain, and Switzerland. The AWS Region/Availability Zone model has been recognized by Gartner as the recommended approach for running enterprise applications that require high availability.

- 1. AWS EC2
- 2. AWS EC2 INSTANCE
- 3. AWS S3
- 4. AWS LAMBDA
- 5. AWS ELASTICBEAN
- 6. AWS CLOUDWATCH etc...

FEATURES OF AWS:

- Identity and Access Management (IAM)
- Virtual Private Clouds(VPC)
- Data Encryption
- Direct Connect
- AWS Cloud Trail
- Aws Trust Advisor
- Aws Web Services Security

IDENTITY AND ACCESS MANAGEMENT(IAM):

Using <u>Identity and Access Management (IAM)</u>, you can create users, groups, and roles, and use permissions to allow and deny their access to AWS resources such as EC2, RDS, and VPC. IAM enables you to grant unique credentials to every user within your AWS Account, allowing individual access only to the AWS services and resources required.

With IAM Mutifactor Authentication enabled, a user trying to access an AWS resource will be prompted for normal authentication (user name and password), but also for an authentication code available only through their MFA-configured device.

IAM can be used to grant your employees and applications access to the AWS Management Console and AWS service APIs. IAM is also compatible with your existing Active Directory.

VIRTUAL PRIVATE CLOUD(VPC):

Amazon's VPCs allow you to provision compute resources, like EC2 instances and RDS deployments, inside isolated virtual networks. VPCs give you complete control over all inbound and outbound network traffic. You can (and should) use VPCs to secure your application by restricting, where appropriate, access to and from the Internet. Using Virtual Private Network (VPN) connections, you can connect on-premise servers directly to your cloud-based VPC, bypassing public networks.

Security Groups and Network ACL's:

Using <u>Security Groups</u>, you can create firewall rules controlling incoming and outgoing traffic at the instance level. You can restrict traffic by protocol type (TCP, UDP, ICMP), IP address, and port.

Access Control Lists (ACLs) work at the network subnet level. Network ACLs can be especially useful in the prevention of DDOS attacks when you have a particular need to blacklist traffic from specific IP addresses.

Data Encryption:

AWS provides Data encryption for EBS volumes, S3 buckets, and Relational Database Service (RDS) and Glacier data stores.

When you create an encrypted EBS volume and attach it to an instance, data on the volume, disk I/O, and snapshots created from the volume, are all encrypted. When so configured, AWS encrypts each S3 object with a unique key. Amazon S3 server-side encryption uses one of the strongest block ciphers available – 256-bit Advanced Encryption Standard (AES-256).

RDS generates an SSL certificate for each DB Instance. Once an encrypted connection is established, data transferred between the DB Instance and your application will be encrypted during transfer.

Direct Connect:

You can use AWS Direct Connect to establish a private virtual interface between your on-premise network and your Amazon Virtual Private Cloud. Direct Connect provides a private and secure high-bandwidth network connection.

AWS Cloud Trail:

CloudTrail provides you with a history of all API calls made against your account resources, including API calls made via the AWS Management Console, SDKs, and command line tools.

Trusted Advisor:

AWS Trusted Advisor inspects your AWS environment and makes recommendations for saving money, improving system performance and reliability, or closing security gaps.

Even without upgrading to a paid support plan, Trusted Advisor will warn you about weaknesses like security groups allowing unrestricted access (0.0.0.0/0) to specific ports or S3 buckets with open access permissions. Trusted Advisor can provide a highly effective summary of your overall Amazon Web Services security profile.

AWS SECURITY: THE NEXT STEP:

Besides the built-in Amazon Web Services security services, there are many open source and commercial software packages available through the <u>AWS</u> <u>MarketPlace</u>.

But all these powerful tools will have no value if you don't take the time to learn how to use them properly to protect the confidentiality, integrity, and availability of your cloud data.

AWS EC2:

Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides secure, resizable compute capacity in the cloud. It is designed to make web-scale cloud

computing easier for developers. Amazon EC2's simple web service interface allows you to obtain and configure capacity with minimal friction. It provides you with complete control of your computing resources and lets you run on Amazon's proven computing environment.

Amazon EC2 offers the broadest and deepest compute platform with choice of processor, storage, networking, operating system, and purchase model. We offer the fastest processors in the cloud and we are the only cloud with 400 Gbps ethernet networking. We have the most powerful GPU instances for machine learning training and graphics workloads, as well as the lowest cost-per-inference instances in the cloud. More SAP, HPC, Machine Learning, and Windows workloads run on AWS than any other cloud.

EC2 INSTANCE:

An EC2 instance is nothing but a virtual server in Amazon Web services terminology. It stands for Elastic Compute Cloud. It is a web service where an AWS subscriber can request and provision a compute server in AWS cloud. ... AWS provides multiple instance types for the respective business needs of the user.Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instance types comprise varying combinations of CPU, memory, storage, and networking capacity and give you the flexibility to choose the appropriate mix of resources for your applications.

AWS S3:

Amazon Simple Storage Service (Amazon S3) is a scalable, high-speed, web-based cloud The is storage service. service designed for online backup and archiving of data and applications on Amazon Web Services (AWS). Amazon S3 was designed with a minimal feature set and created to make web-scale computing easier for developers. S3 provides 99.999999999% durability for objects stored in the service and supports multiple security and compliance certifications. An administrator also link S3 to other AWS security and monitoring can

serviceincluding CloudTrail, CloudWatch and Macie. There's also an extensive partner network of vendors that link their services directly to S3.

Amazon S3 can be used by organizations ranging in size from small businesses to large enterprises. S3's scalability, availability, security and performance capabilities make it suitable for a variety of data storage use cases. Common use cases for S3 include the following:

- data storage;
- data archiving;
- application <u>hosting</u> for deployment, installation and management of web apps;
- software delivery;
- data backup;
- disaster recovery (<u>DR</u>);
- running big data analytics tools on stored data;
- <u>data lakes;</u>
- mobile applications;
- internet of things (<u>IoT</u>) devices;
- media hosting for images, videos and music files; and
- website hosting -- particularly well suited to work with <u>Amazon CloudFront</u> for content delivery.

MYSQL:

MySQL, officially, but also called "My Sequel" is the world's most widely used open-source relational database management system (RDBMS) that runs as a server providing multi-user access to a number of databases, though SQLite probably has more total embedded deployments. The SQL phrase stands for Structured Query Language. The MySQL development project has made its source code available under the terms of the GNU General Public License, as well as under a variety of proprietary agreements. MySQL was owned and sponsored by a single for-profit firm, the Swedish company MySQL AB, now owned by Oracle Corporation. MySQL is a popular choice of database for use in web applications, and is a central component of the widely used LAMP open source web application software stack (and other 'AMP' stacks).

LAMP is an acronym for "Linux, Apache, MySQL, Perl/PHP/Python." Freesoftware-open source projects that require a full-featured database management system often use MySQL. For commercial use, several paid editions are available, and offer additional functionality. Applications which use MySQL databases include: TYPO3, MODx, Joomla, WordPress, phpBB, MyBB, Drupal and other software. MySQL is also used in many high-profile, large-scale websites, including

Wikipedia, Google (though not for searches), Facebook, Twitter, Flicker and YouTube. Microsoft is the vendor of SQL Server. We have different editions of SQL Server, where SQL Server Express

is free to download and use. SQL Server uses T-SQL (Transact-SQL). T-SQL is Microsoft's proprietary extension to SQL. TSQL is very similar to standard SQL, but in addition it supports some extra functionality, built in functions, etc

SQL SERVER MANAGEMENT STUDIO

SQL Server Management Studio is a GUI tool included with SQL Server for configuring, managing, and administering all components within Microsoft SQL Server. The tool includes both script editors and graphical tools that work with objects and features of the server. As mentioned earlier, version of SQL Server Management Studio is also available for SQL Server Express

Edition, for which it is known as SQL Server Management Studio Express. A central feature of SQL Server Management Studio is the Object Explorer, which allows the user to browse, select, and act upon any of the objects within the server. It can be

used to visually observe and analyze query plans and optimize the database performance, among others. SQL Server Management Studio can also be used to create a new database, alter any existing database schema by adding or modifying tables and indexes, or analyze performance. It includes the query windows which provide a GUI based interface to write and execute queries. When creating SQL commands and queries, the "Query Editor" (select "New Query" from the Toolbar) is used (shown in the figure above). With SQL and the "Query Editor" we can do almost everything with code, but sometimes it is also a good idea to use the different Designer tools in SQL to help us do the work without coding (so much).

Create a new Database

It is quite simple to create a new database in Microsoft SQL Server. Just right-click on the "Databases" node and select "New Database..."

The OLAP Services feature available in SQL Server version 7.0 is now called SQL Server 2000 Analysis Services. The term OLAP Services has been replaced with the term Analysis Services. Analysis Services also includes a new data mining component. The Repository component available in SQL Server version 7.0 is now called Microsoft SQL Server 2000 Meta Data Services. References to the component now use the term Meta Data Services. The term repository is used only in reference to the repository engine within Meta Data Services

SQL-SERVER database consist of six

type of objects, They are,

- 1. TABLE
- 2. QUERY
- 3. FORM
- 4. REPORT
- 5. MACRO

Table

A database is a collection of data about a specific topic.

Views of Table

We can work with a table in two types,

1. Design View

2. Datasheet View

Design View

To build or modify the structure of a table we work in the table design view. We can specify what kind of data will be held.

Datasheet View

To add, edit or analyse the data itself we work in tables datasheet view mode.

Query

A query is a question that has to be asked in the data. Access gathers data that answers the question from one or more tables. The data that make up the answer is either dynaset (if you edit it) or a snapshot (it cannot be edited).Each time we run query, we get latest information in the dynaset. Access either displays the dynaset or snapshot for us to view or perform an action on it, such as deleting or updating.

FEASIBILITY STUDY

The feasibility of the project is analyzed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company. For feasibility analysis, some understanding of the major requirements for the system is essential.

The feasibility study investigates the problem and the information needs of the stakeholders. It seeks to determine the resources required to provide an information systems solution, the cost and benefits of such a solution, and the feasibility of such a solution.

The goal of the feasibility study is to consider alternative information systems solutions, evaluate their feasibility, and propose the alternative most suitable to the organization. The feasibility of a proposed solution is evaluated in terms of its components.

ECONOMICAL FEASIBILITY:

This study is carried out to check the economic impact that the system will

have on the organization. The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must justified. Thus the developed system as well within the budget and this was achieved because most of the technologies used are freely available. Only the customized products had to be purchased.

TECHNICAL FEASIBILITY:

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources. This will lead to high demands being placed on the client. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

SOCIAL FEASIBILITY:

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity.

CHAPTER 2

LITERATURE REVIEW

TITLE 1 :Securely Outsourcing Attribute-Based Encryption with Checkability. **AUTHOR**: Jin Li, Xinyi Huang, Jingwei Li, Xiaofeng Chen, and Yang Xiang Attribute-Based Encryption (ABE) is a promising cryptographic primitive which significantly enhances the versatility of access control mechanisms. Due to the high expressiveness of ABE policies, the computational complexities of ABE key-issuing and decryption are getting prohibitively high. Despite that the existing Outsourced ABE solutions are able to offload some intensive computing tasks to a third party, the verifiability of results returned from the third party has yet to be addressed. Aiming at tackling the challenge above, we propose a new Secure Outsourced ABE system, which supports both secure outsourced key-issuing and decryption. Our new method offloads all access policy and attribute related operations in the key-issuing process or decryption to a Key Generation Service Provider (KGSP) and a Decryption Service Provider (DSP), respectively, leaving only a constant number of

simple operations for the attribute authority and eligible users to perform locally. In addition, for the first time, we propose an outsourced ABE construction which provides checkability of the outsourced computation results in an efficient way. Extensive security and performance analysis show that the proposed schemes are proven secure and practical.

TITLE: 2 Patient Controlled Encryption: Ensuring Privacy of Electronic Medical Records **AUTHOR:** Josh Benaloh, Melissa Chase, Eric Horvitz, and Kristin Lauter We explore the challenge of preserving patients' privacy in electronic health record systems. We argue that security in such systems should be enforced via encryption as well as access control. Furthermore, we argue for approaches that enable patients to generate and store encryption keys, so that the patients' privacy is protected should the host data center be compromised. The standard argument against such an approach is that encryption would interfere with the functionality of the system. However, we show that we can build an efficient system that allows patients both to share partial access rights with others, and to perform searches over their records. We formalize the requirements of a Patient Controlled Encryption scheme, and give several instantiations, based on existing cryptographic primitives and protocols, each achieving a different set of properties.

TITLE:3 CDPS: A cryptographic data publishing system

AUTHOR: T. Li, Z. Liu, J. Li, C. Jia, K. Li

The traditional data publishing methods will remove the sensitive attributes and generate the abundant records to achieve the goal of privacy protection. In the big data environment, the requirement of utilizing data (e.g., data mining) become more and more various, which is beyond the scope of the traditional method. This paper

provides a cryptographic data publishing system that preserves the data integrity (i.e., the original data structure is preserved) and achieves anonymity without deletion of any attribute or utilization of redundancy. The security analysis shows that our system is secure under our proposed security model.

TITLE 6: Identity-based encryption with outsourced revocation in cloud computing **AUTHOR:** J. Li, J. W. Li, X. Chen, C. Jia, W. Lou

Identity-Based Encryption (IBE) which simplifies the public key and certificate management at Public Key Infrastructure (PKI) is an important alternative to public key encryption. However, one of the main efficiency drawbacks of IBE is the overhead computation at Private Key Generator (PKG) during user revocation. Efficient revocation has been well studied in traditional PKI setting, but the cumbersome management of certificates is precisely the burden that IBE strives to alleviate. In this paper, aiming at tackling the critical issue of identity revocation, we introduce outsourcing computation into IBE for the first time and propose a revocable IBE scheme in the server-aided setting. Our scheme offloads most of the key generation related operations during key-issuing and key-update processes to a Key Update Cloud Service Provider, leaving only a constant number of simple operations for PKG and users to perform locally. This goal is achieved by utilizing a novel collusion resistant technique: we employ a hybrid private key for each user, in which an AND gate is involved to connect and bound the identity component and the time component. Furthermore, we propose another construction which is provable secure under the recently formulized Refereed Delegation of Computation model. Finally, we provide extensive experimental results to demonstrate the efficiency of our proposed construction.

CHAPTER 3

AIM AND SCOPE

AIM OF THE PROJECT:

To develop a secure cloud framework for accessing trusted computing and storage services in all levels of public cloud deployment model using AWS.

SCOPE OF THE PROJECT:

Achieves high level security to provide trustable computing and storage services. Provides data integrity, data confidentiality, authentication and authorization. Eliminates both internal and external security threats. Avoids both active and passive attacks in cloud network environment. Achieves different levels of security in cloud framework

CHAPTER 4

SYSTEM DESIGN AND METHODOLOGY

EXISTING SYSTEM

- Cloud computing security based on set of control-based technologies.
- Data level security for handling data in a secure manner.
- Platform level security for providing secure platform to process the data. Secure

framework for proving trusted environment to the user, but it lacks in high level security and different levels of security, less focus on insider threat, active and passive attacks

DISADVANTAGES

- Data confidentiality is less.
- Authentication and authorization is less.

PROPOSED SYSTEM:

- Your health care provider may be moving from paper records to electronic health records (EHRs) or may be using EHRs already.
- EHRs allow providers to use information more effectively to improve the quality and efficiency of your care, but EHRs will not change the privacy protections or security safeguards that apply to your health information.
- This project focuses on developing secure cloud framework for evolving and accessing trusted computing services in all levels of public cloud deployment model.
- Thus, eliminates both internal and external security threats.

These results in achieving data confidentiality, data integrity, authentication and authorization, eliminating both active and passive attacks from cloud network environment.

• To develop a secure cloud framework for accessing trusted computing and storage services in all levels of public cloud deployment model.

ADVANTAGES OF PROPOSED SYSTEM

- Provides data integrity
- Data confidentiality
- Authentication and authorization.
- Eliminates both internal and external security threats.
- Avoids both active and passive attacks in cloud network environment.

ARCHITECTURE DIAGRAM:



MODULES

- □ MODULE 1:Login/ Registration
- D MODULE2: APPLICATION FILLING
- □ MODULE3:APPOINTMENT FIXING
- MODULE4:DATA STORAGE

MODULES DESCRIPTION

LOGIN MODULE

This is the first activity that opens when user open the website. User needs to provide a correct contact number and a password, which user enters while registering, in order to login into the website. If information provided by the user matches with the data in the database table then user successfully login into the website else message of login failed is displayed and user need to reenter correct information. A link to the register activity is also provided for registration of new users.

APPLICATION FILLING:

In this module we have to add the details of the patient such as personal details, contact details, communication details, medical details and guardian details.

APPOINTMENT FIXING:

In this module we have to fix the appointment by selecting the date we want to fix the appointment by selecting the patients that have already been added or we can add new patient record.

DATA STORAGE:

In this module all the data that we have given before will be stored in database. All the data will be collected by the administrator and it will be stored in AWS S3 and encrypted by default.

SYSTEM REQUIREMENTS HARDWARE REQUIREMENTS:

System : Pentium Dual Core. Hard Disk : 120 GB. Monitor : 15"LED Input Devices : Keyboard, Mouse Ram : 1GB.

SOFTWARE REQUIREMENTS:

Operating system: WINDOWS 7 and Above

Coding language:python

Database:MySQL&AWS S3

CHAPTER 5

RESULTS AND DISCUSSION

SCREENSHOTS:

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PERSONAL DETAILS

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BILLING SETUP

CODE:

sudo apt-get update

sudo apt-get upgrade –y

sudo apt-get install mysql-server php php-xml php-mbstring php-mysql apache2 wget -y

sudo mysql_secure_installation

sudo mysql -u root -p

CREATE DATABASE openemr;

CREATE USER 'openemruser'@'localhost' IDENTIFIED BY 'PASSWORD';

CREATE USER 'openemruser'@'localhost' IDENTIFIED WITH mysql_native_password BY 'PASSWORD';

GRANT ALL PRIVILEGES ON openemr.* TO 'openemruser'@'localhost';

FLUSH PRIVILEGES;

exit

```
sudo nano /etc/php/7.2/apache2/php.ini
```

short_open_tag = Off

max_execution_time = 60

max_input_time = -1

max_input_vars = 3000

memory_limit = 512M

display_errors = Off

log_errors = On

post_max_size = 30M

```
file_uploads = On
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upload_max_filesize = 30M

error_reporting = E_ALL & ~E_NOTICE & ~E_STRICT

mysqli.allow_local_infile = On

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wget
https://downloads.sourceforge.net/project/openemr/OpenEMR%20Current/5.0.2.1/open
emr-5.0.2.tar.gz
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tar xvzf openemr*.tar.gz

mv openemr-5.0.2 openemr

sudo mv openemr /var/www/html/

sudo chown -R www-data:www-data /var/www/html/openemr

sudo chmod 666 /var/www/html/openemr/sites/default/sqlconf.php

CHAPTER 6

CONCLUSION AND FUTURE WORK

CONCLUSION:

These results in achieving data confidentiality, data integrity, authentication and authorization, eliminating both active and passive attacks from cloud network environment. To develop a secure cloud framework for accessing trusted computing and storage services in all levels of public cloud deployment model. The collected dat will be stored and made consultation easy for people and made everything deatailed and secured.

FUTURE WORK:

In the future study, it will be interesting to enhance the fine grained access control in cloud computing with a third party auditor to verify the cloud server that stores and process the PHRs.

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