A Secure Integration Approach for Distributed Healthcare Information Systems

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Abstract— **Data integration is the technique of making a unified view of heterogeneous data from different repositories. The issue of providing an integrated view of data can be handled using Semantic data. That is the data stored in a way that is understandable by machines and integrable without human intervention. However, integrating data using semantic web technology without enforcing any access management will raise privacy and confidentiality concerns. Different data owners store data in heterogeneous format based on their requirements. This leads to the data interoperability problem. We propose a system to provide integration of multiple hospital databases. The integration of databases are taken by the process of secure semantic data integration (SDDI) technique. It overcomes the problem of data heterogeneity by storing data in a single format. It is mainly used to find out new emerging diseases that occurs in any hospital. The security to the integrated database is given by Elliptic Curve Cryptographic (ECC) Algorithm.**

Index Terms- **Integration, interoperability, heterogeneity, Elliptic curve cryptography**

I. INTRODUCTION

In the real world the data is stored and managed in different forms. Based on a variety of requirements, users prefer different methods and format of data storage. The combination of data from these different sources can bring many useful and hidden results that may not be obtained from a single data source. This technique to combine data residing in different sources and providing a consolidated view of data to the users is known as Data Integration.[1]

Data integration is of great importance in solving many problems in commercial as well as scientific domains. Commercial domains include when two organizations integrate their data to get results that would help to earn more revenue. Scientific domain includes integrating data to get better results that would use for the betterment of human society. In database domain, various data integration technologies are available, which include combining data from several disparate sources, then storing it using various technologies and provide a unified view of the data. A data warehouse is used to provide a unified view of data from two or more enterprises. Ref [2]The need for data integration increases proportionally with the recent increase in volume of data and need for sharing of data. Integrating information from multiple sources leads to many obvious advantages.

It reduces the efforts of data gathering and enables to infer information that would otherwise be impossible. Data collection is done using different methods and techniques. Hence a large amount of information is stored in this way. By applying proper techniques to combine and integrate this data, much useful information can be retrieved. This useful information can help in assisting many tasks that otherwise would be impossible.

II. RELATED WORKS

Several integration methods are discussed are as follows,

Healthcare Act Indexing Information Model (HAIIM) [1]: HAIIM build a centralized index of heterogeneous clinical data. It organizes these data effectively according to the act-centered view of healthcare form health level seven(HL7) reference information model(RIM). The resulting model into building of a "virtual" clinical data center, which enables the integrated query of heterogeneous

clinical data. Based on HAIIM, an integrated viewer to visualize clinical data according to the two dimensional act-time relationship.

A Virtual Database Approach [2]: Virtual database integration approach mainly used in database integration needed in hospital. This approach will bring multiple databases into a logically integrated whole without causing much disruption to current hospital operations. This approach will also provide a high level of flexibility.

Hybrid Ontology Approach [3]: This approach is mainly used for the integration of computer based patient record (CRP) systems. It effectively eliminates the heterogeneity among CRP systems by means of constructing mapping and provides a good basis for achieving the sharing of CRP data.

NoSQL Database Approach [4]: The NoSQL database is used for providing a scalable data analytics. This approach facilitates accessible, efficient and always available knowledge bases for collaborative systems and reduces redundancy and costs by sharing the knowledge between individuals and experts.

XML Schema Mapping Approach [5]: XML Schema mapping build a virtual database for medical data based on querying by XQuery. On application layer, web-based application integration which allows medical information systems uniformly exchange information easily by web services.

III. EXISTING SYSTEM

The Existing System furnishes secure semantic data integrator (SDDI) framework which overcomes the issues of interoperability of database.

SSDI Architecture

The main emphasis of this research is on data integration technique. SSDI uses the strength of semantic data to address the issue in data integration technique.

SSDI framework is divided into the following modules based on their functional properties.

➢ Data integration
➢ Data store
➢ Access control management
➢ Interface

1) Data integration

This module is responsible for integration of data from different sources. Data sources are responsible to provide data along its conceptual model manifested in ontology. Data is then converted into semantic Data. RDF is used for the representation of semantic data. Semantic data will resolve the issue of interoperability. This involves resolving the compatibility issues along with integrating data from heterogeneous sources. Data integration is sub-modules into Collect module used has Interface between data owners and this module is via web services. Data owners will interact with web services to provide data and security policies. Convert module main responsibility is to provide conversion facility. Combine module
in which data will be transformed into an RDF graph.

2) Data store

Data is stored in an RDF store after conversion into RDF format. Update or retrieval of data can be made through web services based interface.

3) Access Control Management

Access Control Management is the backbone of SSDI. It controls the access to data and limits it to only authorized users. Users will request for data and after verification for that user's access to the data, result data set will be sent back to users. It has data access cycle which includes retrieving data results using web services. User request to access data is sent to the "Set Query", processing the query is done through "Query rewriting" and results are delivered through "Send Results".

4) Interface

SSDI framework has a main role of interfaces. It is not only the communication point between user and the system but also provide communication between the different modules.

IV PROPOSED SYSTEM

The main objective of the system is to provide a secure integrated hospital management database system. The different databases are integrated using Secure Semantic Data Integrator technique. The integrated data are stored in a server using oracle database. The integrated database is protected

through Elliptic Curve Cryptographic technique. Through ECC algorithm the data in the database are encrypted and stored in the database. An alert system is introduced in the database to identify the intruders of the database.
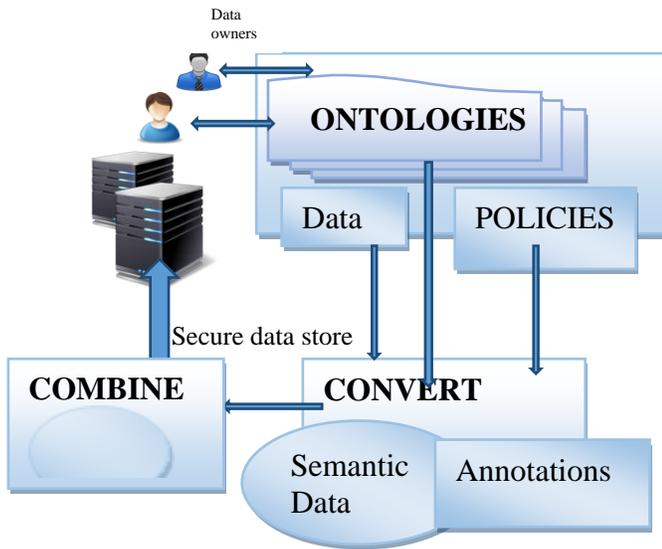
SYSTEM ARCHITECTURE

Fig. 1 Architecture based on integration of different hospital databases

The above architecture diagram represents different heterogeneous hospital databases are integrated to form a single database. The databases are integrated by secure semantic data integrator technique. The data is secured using elliptic curve cryptographic technique and it is stored in a single oracle database server.

With the help of this secured integrated database any new upcoming diseases can be identified quickly. The patient record is maintained and it can be used to treat the other patients with that diseases with ease. The data in the database is encrypted using elliptic curve cryptographic technique. An alert system is

introduced to find out the intruders in the database server.

The proposed system includes the following modules

➢ User Profile Creation

➢ Database Integration
➢ Server creation and Security for the database
➢ Attack Detection
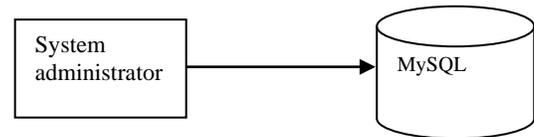
1. User Profile Creation

Fig. 2 User profile creation in single hospital database

Individual user profile is created in the hospital database management system. Through the system administrator in the hospital, the complete details of each individual user is entered and stored in the database. Three types of users present in the hospitals: doctors, patients and staff members. All the users can view their details by the username and password provided to them individually.
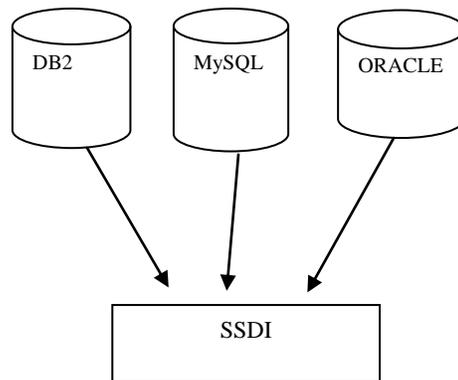
2. Database Integration

Fig. 3 Integration of databases using secure semantic data integrator

This module is responsible for integration of data from different sources. Data sources are responsible to provide data along with its conceptual model manifested in ontology. Data is then converted into semantic data. Resource description framework

(RDF) is used for the representation of semantic data. Semantic data will resolve the issue of interoperability. Regardless of the data original format, after conversion to semantic data, data will be compatible with the rest of the data. This involves resolving the compatibility issues along with integrating data from heterogeneous sources.

Three sub modules used in this module are collect, convert, combine. The collect module is responsible to collect data and security policies from data owners. Interfaces between data owners and and this module via web services. The convert module main responsibility to provide conversion facility. Data, ontologies and data owner information are the input to this sub module. Data is converted into semantic format using this module. In combine module all the data will be transformed into an RDF graph.

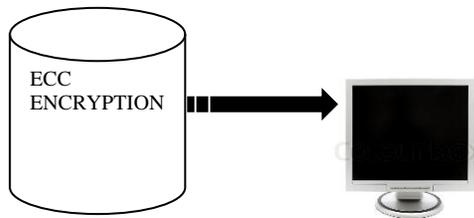### 3. Server Creation and Security for the database

Fig. 4 Server creation and security for the database

The field of privacy in the database is the major factor nowadays. The data in the database has to be protected using some cryptographic technique. The elliptic curve cryptographic plays a major role in encryption of the database. ECC is used to import the values of the database by using the encryption techniques. The data stored in the database are protected by encrypting the data using elliptic curve cryptographic algorithm. ECC has become more efficient to protect the database when compared to the other encryption techniques.
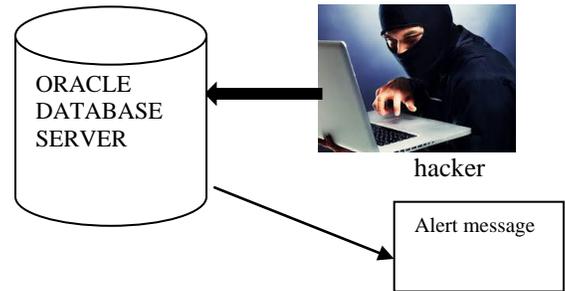
4. Attack Detection

Fig. 5 Identification of alert message

Other than the authorized user who tries to access the database are called as unauthorized user or intruders. The authorized user are identified by the token values generated to the user uniquely by the server. If the intruders tries to access the database it should be detected by the database administrator. The intrusion in the database is detected by introducing an alert system in the database.

V. CONCLUSION

The design of the proposed work could be efficiently used to identify new upcoming diseases or emerging new diseases from the integrated hospital database system. It can efficiently converts any different type of database into a single database system. Our approach achieves three advantages. Firstly, the interoperability of data in the database is overcomed i.e uniformity of storing of data are maintained in the database system. Secondly, security to the database is achieved by providing elliptical curve cryptographic algorithm by encrypting the data stored in the database system. Thirdly, an alert system is introduced to find out the intruders of the database system.

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