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A Combined Approach Using IoT and Cloud for the Efficient Data Retrieval in Medical Technology

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ABSTRACT: IoT is one of the most rapid development technology and it helps to connect numerous smart objects via the internet. Recently numerous researchers found that there is a heterogeneous problem of the data in the IoT platform. There is a rapid use of IoT technology in the real time applications leads to store and access data is difficult and time consuming process. Hence the proposed solution shows that how the real time data can be easily stored and retrieve without any difficulty at easy manner. Here it is clearly shown that how the data can be collected, processed, and integrated for the IoT data flexibility mainly for the use of real time and medical emergency services. The results show that storage and retrieval is very effective in the complicated real time distributed heterogeneous environment.

KEYWORDS: IoT, Cloud Computing, Ubiquitous Data Accessing, Medical Services

I. INTRODUCTION

IoT is one of the most important and rapidly advanced technology in the day to day life. The advancements in the technology shows that ease of use for the real time scenario. This technology is mainly used in the medical servicing such that health care monitoring, medication checking, etc. This technology is very useful in accessing the very critical medical data easily via online services which helps the doctor to make the decisions very soon and also reduces the cost of accessing the information.

Accessing the data for medical services is the most challenging tasks in the day to day life. With the help of cloud environment today the medical data can be easily shared and accessed at any place at anywhere in the world. Even though the data can be accessed via online services instantly, most of the time it does not support for diagnosing where numerous data needs to be accessed very rapidly in a short span of time. In the past decade, large numbers of researches have been conducted in IoT technology to acquire data without any interruption and ubiquitous access to process data in the very short manner [1]. With the ease of this technology, M-health concepts which are a combination of mobile communication technology and IoT which uses 4G technology [10]. The metadata model for IoT note is shown in figure 1.

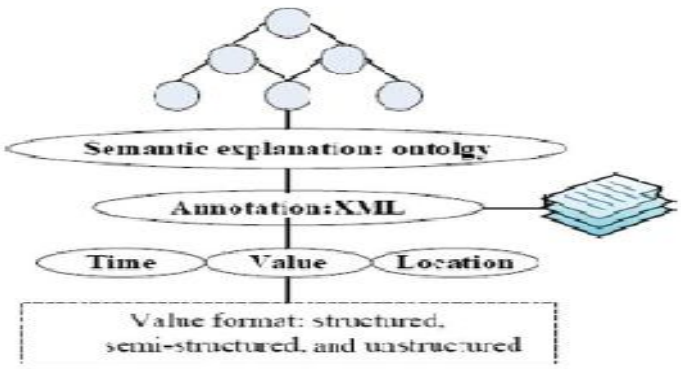

Fig 1. Metadata model for IoT note

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In the above diagram, the raw data is present variably at the top levels. The data has to be processed and stored in the form of XML format for further processing. Three main components that deals with the XML format are time, value and location. Finally all the data stored in the XML are value formatted for further processing and it is categorized into three broad categories namely 1) Structured 2) Semi-structured and 3) Unstructured. On the whole the processed data of a metadata model for the IoT note is obtained.

II. RELATED WORK

The research work related to these topics is yet to be identified in the reference. Already some of the work carried forward to check whether it achieves greater performance in terms of both cost and time. We will see some of the topics related to this technology.

A. *RFID and GPS techniques*

IoT technology is most need at any point of time in the medical serving process. Nowadays all medicines are efficiently bar-code labelled, so that is efficiently delivered to the patients. The most advancements in the technology are the GPS (Global Positioning System) and RFID (Radio frequency Identification) [3][4]. Nowadays all the ambulances operated widely in different parts are working on the GPS principles only. Also the additional RFID is connected to every ambulance and hence it is used to locate the ambulance very quickly.

The medical field is widely developed and let us take an example such that, all the ambulances are GPS connected. All the patients and the doctors using their ID which is used for identification. All the medicines used in the hospital are bar-code scanned for verification. Al the medical instruments and apparatus use RFID tags for exact location identification.

B. *Meta Data Model for Ubiquitous data Accessing*

The following are some of the functions of UBA (Ubiquitous Data Access) [5] for IoT. They are

1) Support for the access of the data in different heterogeneous environment.
2) For building numerous applications in the real time application system.
3) To ease of accessing the big data.

The three important layers in the metadata model are value, annotation and semantic explanation. The value shows that the range of data to be accessible for the patients. Annotation is the caption for the data retrieval [13]. Semantic explanation shows the important general information about the data. In IoT each IoT note comprises two important functionalities such that time tag and location tag. The time is used for real time applications and the location tag is used to identify the location of the medical instruments.

III. OUR CONTRIBUTION

Hence the propose data model which has a self explanation for each data part to access the data ubiquitously. Each data item of the IoT is given unique notation and defined in the XML format, such that the data can be accessed easily from the web [6]. Also, this shows that it has more advantage than the previous work tasks. The big data can be easily accessed through this technology. The data volume is very large for all IoT applications. Even though it is very large all the data item are successfully stored in the SQL database

IV. OPERATIONAL DESCRIPTION

A. *Mapping Between IoT Physical Entity EOR and Information Entity*

Generally the IoT physical entities are linked to the information system through tags and sensors. Normally the information system cannot able to transfer the physical entities.

For example, if a person wants to know the room number 103 in the hospital, then he/she can directly access the physical entity of the room number 103 in the information system. It is nothing but EOR (Entity oriented Resource) [8][14]. The general definition of EOR is shown below,

EOR : = (URI, AttrSet : = (Attributes), Persistence
: = (Driver, Address, Authentication))

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B. *Data Access in the IoT with Cloud*

To maintain a large data set of the medical data, the cloud platform is herewith used with multitenant data management where the architecture compose of three layers namely, tenant database layer, data accessing control layer and business layer.

The tenant database layer, is the lowest layer which is used to share the multitenant databases. Control layer is the middle layer which is used to organize the distributed medical data [16]. The business layer is the topmost layer which is used to control the business activities and workflow management tasks. The four major activities take place in the retrieval of the medical data is as follows.

1) Cloud application sends the request to access the healthcare data.
2) If the request is approved, business layer checks the data access rights and finally send the request to the REStful web service.
3) The resource control mechanism provides the resource access request which is to be sent to the database location where the database is processing the request.
4) Finally, with the help of the database connection, the Database connecting layer retrieves the data from the shared and distributed databases.

C. *Mapping between Business function and Transitive resource*

The EOR and cEOR both models can be able to describe the attributes of the IoT but the functionality of the IoT are still needs to be identified which are very important for the IoT applications. Hence, to achieve this a new model is identified which is known as TOR (Transition Oriented Resources) [9]. The definition of TOR is shown below,

TOR: = (URI, Input: = (EORs / cEORs / Output
: = (EORs / cEORs), Pre-condition, Effect
: = (TORs))

The address of the TOR is accessed by the Uri. Post method is used to start the TOR service through HTTP protocol. During the execution process, DELETE method is used to cancel the execution of TOR [15]. Input is nothing but the resources which are activated during the transition resource. Similarly the output is the generated entity resource which is produced after the transitive resource service is executed. The effect is the identification or response needs to take place for the replacement activity

The cloud platform for multitenant data storage is shown in figure 2.

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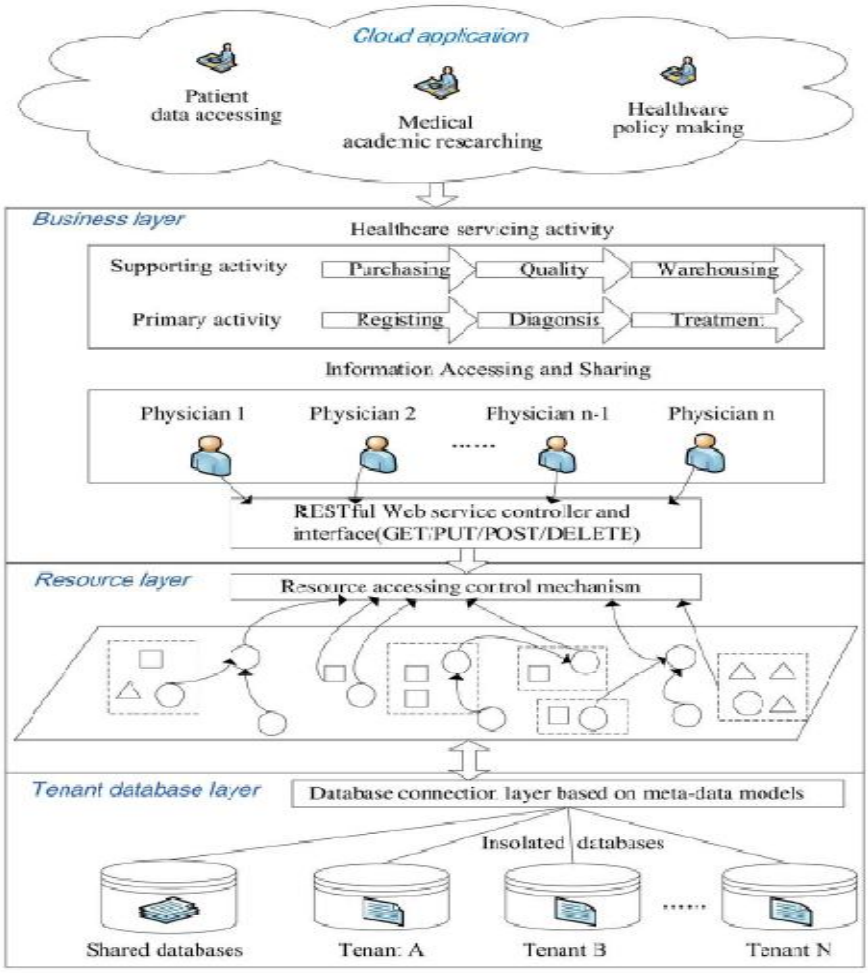

Fig 2. Cloud Platform for Multitenant Data storage

The above diagram clearly depicts how the multitenant data is stored across the cloud platform. The tenant database layer is the bottom layer where it transforms information to the upper resource layer through database connection. The topmost layer is the business layer where all the business users reside. The information is transferred from resource layer to business layer via resource accessing control mechanism. Now all the business transactions happens in this layer only. On the whole the business layer is connected with cloud application where all the process like patient's data accessing, medical academic researching and healthcare policy making, etc are carried. Thus in this way, the whole data is processed from database domain to the cloud application.

D. Mapping Between cEOR and Real Time Entity

The information of the physical entities is mentioned in the form of cEOR (composite EOR) [7]. Naturally the EOR's are dynamic. Since it is dynamic the EOR can be combined or destroyed to our need. The cEOR definition is shown below,

cEOR : = (URI, Composition
:= (EOR / cEOR, Type reference / aggregation) AttrSet
:= (attributes))

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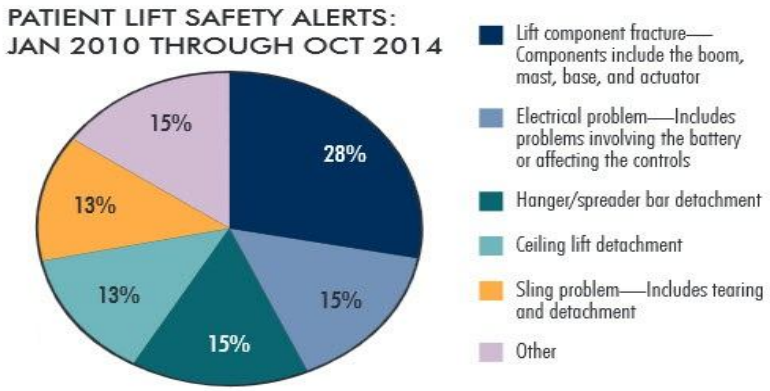
The general meaning of composition means nothing but the combination of some two or more resources. Here some other entity resources joined together to form a composite resource. Generally it is explained as compositing, aggregation and reference. The composed resources may either in the form of normal entity resources or composite entity resources. Let us consider the example, if the physical entity of the ambulance is called the entire information about the ambulance such as nurse, stretcher, oxygen cylinders, etc are accessed. If any medical instruments are out of access means, it is automatically decomposed or recomposed.

VI. PERFORMANCE EVALUATION AND RESULTS

A. *Data Integrity*

Generally the distributed database ensures the availability of data at each and every time during the retrieval by the users. It ensures that the data is available in a heterogeneous distributed manner and it can fetch during the emergency for the need of medical data. Hence this technique provides high integrity of data available for the medical users. The patient life safety alerts is shown in the figure 3.



The above pie-chart clearly describes that the patient's life safety alerts from October 2014 to January 2015. Almost each and every field is equally distributed between all the functionalities. From the most to the least, life component fracture and sling problem is presented between all the other functionalities respectively. Electrical problem, hanger and ceiling lift detachment is approximately presented as 13%.

B. *Average Waiting Time*

Nowadays the total time requires to fetch the content for medical data is slightly lower than the other techniques. So this technique is somewhat efficient in case of large data samples. In the following comparison diagram, the time required to fetch the data is very less compared in the past decades. The performance comparison of the total time required between different techniques is shown in figure 4.

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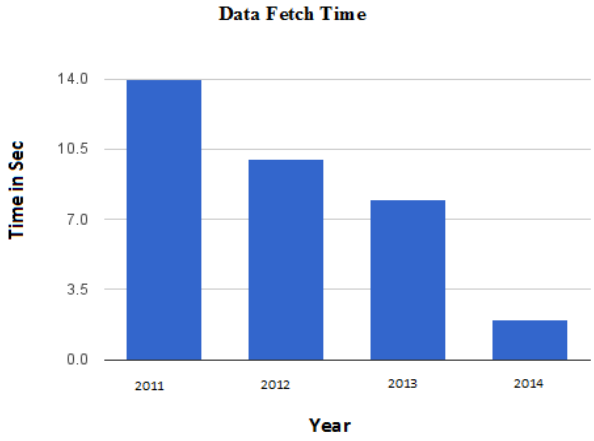

The above bar diagram clearly shows the data fetch time in seconds in various different years depending upon the requirements of the users. Users fetch their data at different levels where the time is varied among them. On the whole the total required to fetch the data in the recent years are obviously decreased than the past years.

VII. CONCLUSION AND FUTURE WORK

By using this IoT along with the cloud, it is very easy to access the medical data stored in the heterogeneous distributed environment. Hence it creates great benefits for the doctors and medical consultants to access the data. In future the work can be elaborate it to some extent of very critical and large datasets in the real time distributed environment for accessing the healthcare medical data.

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BIOGRAPHY

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