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Conceptual design of web application for a comprehensive Health Care Management System

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Abstract: In spite of high economic growth, the health care services in India are far from satisfaction. In our country there is no such provision or database whereby we cold know the performance and the health status of the citizens. The health care programs for the citizens are planned without any scientific analysis and by suitable data analysis. As a result some of the highly ambitions healthcare programs have failed or have not produced desired result. In this paper a health management system is proposed which will not only store the health record of every citizen but also the sophisticated analytical capability of the system will present accurate analysis to the policy makers so that the health care programs are planned on based on scientific analysis there by reducing the chance of failure.

Keywords: Health care, OLAP, MPP

I. INTRODUCTION

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In this digital age, communication and information technology influence almost all spheres of our lives: business, finance, education, governance, entertainment etc. The service sector has tremendously benefited by the use of technology. Among all the spheres of human life health care plays a vital role as it is concerned with life and death. Healthcare services are highly information intensive. In most of the healthcare facilities the use of computer technology is merely limited to billing, scheduling, result reporting, diagnostic resources etc. India had impressive economic growth in past decades and still continues to be one of the countries with high economic growth. As a result, political commitment towards social sector like health has increased. Even though the life expectancy has almost doubled in India compared to the pre independent era, the healthcare services is still inadequate compared to other countries with similar economic growth. The healthcare in India is becoming expensive and majority of the population can't afford such expensive healthcare. Even now the healthcare system in India is far from equitable, accountable and affordable1. Even though there has been some increase in government budgetary allocation in health sector in past few years, it is still very less compared to the population density. The allocated funds are often underused or inefficiently used. Any dependable and affordable healthcare program launched by the government should be scientifically analyzed and planned based on the actual data. Unfortunately in our country there is no such provision of collecting, storing and analyzing such data for healthcare purposes. Access to appropriate, adequate and affordable health care is the legitimate right of every citizen for a democratic country like India. This will be possible only if some radical transformation is done in the healthcare system that increases the efficiency, effectiveness and accountability in this sector. Health care should occupy the front seat among all other services because of its usefulness to the citizens. This paper takes a holistic system view of the use of the modern technology in health care involving collection and management of the health records of every citizen and suggests the conceptual design of a integrated web application based health management system which is efficient and beneficial to all the stakeholders

II. ARCHITECTURE

Technology Innovation in health care is not new rather it has been considered as another important driver of growth. The doctors, patients often adopt the new technology as it is presumed to provide the required benefits. We propose a comprehensive model for health management system for the doctors, nurses, professionals, managers, citizens and policy makers in the field of health care. The health care services in India Showing a steady growth. For a country of more than one billion people the challenge is to provide affordable, quality health care services. In India the medical services provided can be categorized as:

1) Central Govt. Hospitals
2) State Govt. Hospitals
3) Private Hospitals/ nursing homes.
4) Health care services provided by the doctors in individual capacity.

The medical history of patient is very vital for the diagnoses of the disease. Hence the article aims to have a countrywide health management system. This system will have high capacity servers located in suitable places which will store the medical history of each individual. The volume of information generated related to health care worth capturing is enormous. With each visit of a patient to any medical facility new information is generated which has to be captured and stored. It might be a challenge to cope with the high volume of information which is being generated at ever higher velocity and verities. The data handling capacity of this system should be sufficiently large enough to handle the huge velocity of data in real time. The architecture of the system is presented in the figure.1
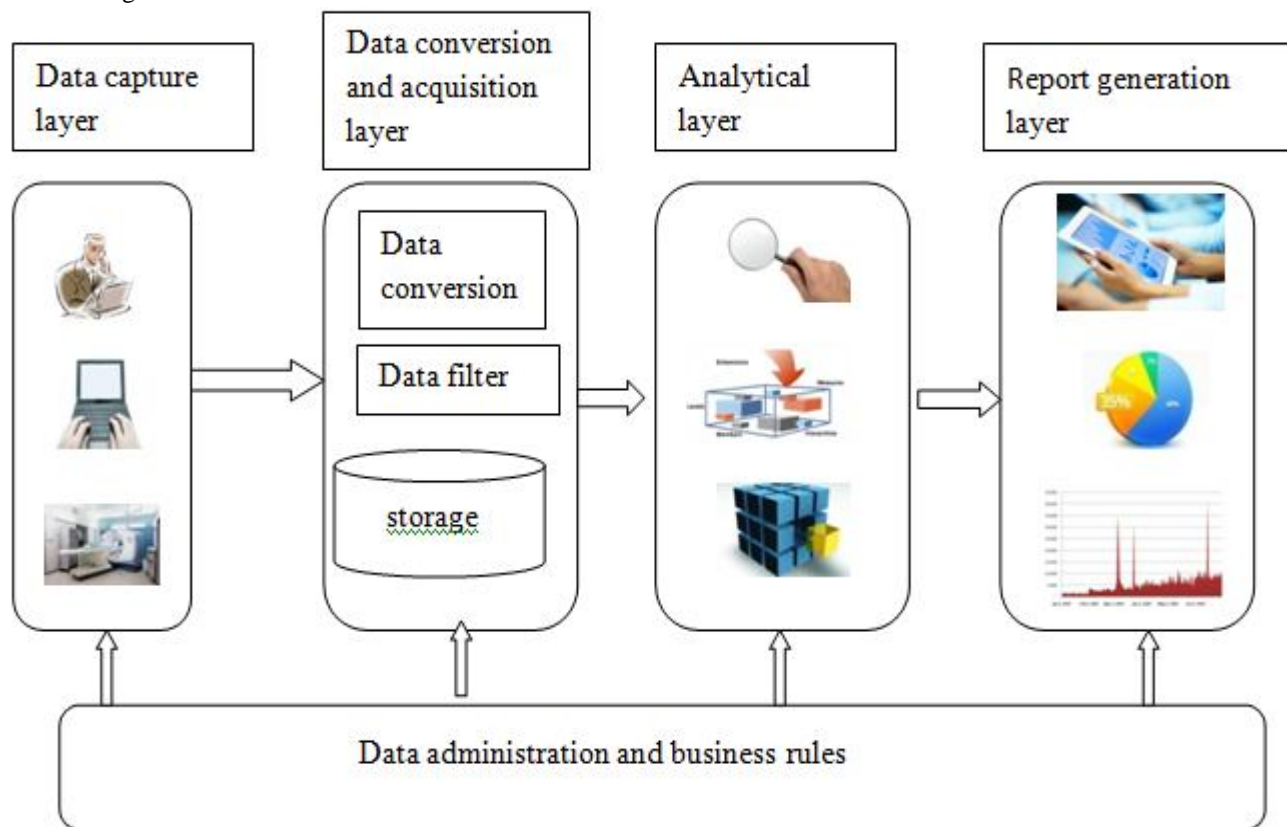

Figure 1: The architecture of the health management system

The purposed system consists of 4 layers
A.   Data capture layer
B.   Data conversation and acquisition layer
C.   Analytical layer
D.   Report generating layer.

III. DATA CAPTURE LAYER

This layer is the front side of the system. It captures all the data that is generated for a particular patient. This data is transmitted to the data conversation and acquisition layer for up-gradation of health record and stored.

This layer can also retrieve data about any patient based on the unique number. The data can be capture at any point where the patient consults the doctor. All the diagnosis reports of a patient also have to be transmitted to the Data conversation and acquisition layer. The process can be made automatic by installing suitable software so that the doctor /paramedics do not have to make extra effort for the sending data. The machine generated data like the ones from CT scan and other such scan report will be automatically transmitted to the data conversation and acquisition layer by click of a button. These days most of the pathological and other medical diagnostic tests are computerized. By using a machine readable format like bar code or QR code such data can be automatically can be transmitted to the system in a faster and reliable without much human intervention.

IV. DATA CONVERSATION AND ACQUISITION LAYER

This layer captures the data from the layer data capture layer and it converts the data to appropriate format suitable for storing in the data base. The data thus received will be updated within the existing data base on the unique allotted number. There are the special restriction to create a new record. The data comes from different hospitals located in different corner of the country. The data also comes from different medical equipments which generate the data in different format. The data which is captured is heterogeneous hence such data has to be converted to a common format so that the data repository us done in an efficient way. This type of conversion is the main responsibility of date conversion sub-unit. The data conversion may proceed with the data filter which makes the data more suitable for the conversion process. After the data filer and conversion the data is updated to the existing record based on the unique number identified by barcode or QR code. A new record can be created by the competent authority issuing the birth certificate and other required information. If possible such unique number can also be linked to Adhar number. When the birth certificate is issued anew born, the data is also transmitted to this layer where a new record for the infant created and it is maintained throughout his life. Similarly when a person is dead this record removed from the active database and put on archive.

V. ANALYTICAL LAYER

This layer is the essence and central to the health management system. The purpose of the layer to analyze the data and provide required up to date and accurate information so that they can take decision regarding the health care issues of the country. This layer process all kinds of data for appropriate analysis, the data analysis done in this layer should meet the requirements of Online Analytical Processing (OLAP). The level of sophistication of analytical processing presented to different types of users are different and governed by the appropriate data administration methodology and necessary business rules. The volume of data stored and processed is very huge as it should keep the records of one and quarter billion of people. The system uses a variety of analytical processing mechanisms to cater the different information needs of different types of decision makers. Considering this, appropriate modelling tools capable of handling Massively Parallel Processing (MPP) can be used in this layer. The analytical models should have the capability of meeting the standards of structured and unstructured decision making. More sophisticated analytical tools like stream computing can also incorporated for reliable stream data processing. The stream computing is very characteristic to this system in the sense that it will assist in predicting the frauds and deliberate misuse of the health records. The transaction and accounts details will be analyzed in real-time and red flags raised for any suspicious behaviour. The analytical layer has a special segment unit for pregnant women and children in the paediatric age to cater the needs of the children. The vaccination program is an integral part of the paediatric section. The analytical layer can generate reminder services to the next layer which will send the remainder regarding the vaccination to the parents. The reminder service also can be extended to the persons suffering from serious and life threatening diseases like cancer etc which require periodic check-up. The sophisticated unstructured analysis is done as per the requirement which is capable of performing "slice and dice" of the data so that the hidden patterns can be discovered based on demographic and geographic and biometric data and other data as per the requirement of policymakers.

VI. REPORT GENERATION LAYER

This layer generates the output of the of the analysis done in the previous layer in various forms. Additionally, this layer can also produces real time online activity monitoring information such as alerts and proactive notification, data navigation and operational key performance indicators. The reports generated in the system are transmitted to the appropriate user as per the laid down principle. This layer is responsible of sending the reminder message generated in the previous layer in an appropriate format and medium which may include messages to the cell phones. This layer uses traditional business intelligence platforms which allow the user to visualize the data in a meaningful way. Third party data visualization tools can additionally be incorporated in this layer for a meaningful representation of data

A better way to plan the different healthcare initiative and to prevent disease is to have a countrywide accurate up to date database with regard to the each of the disease of concern. The data for analysis presented in a user friendly interactive manner so that the health care professionals are equipped with the necessary tools for a better health care program planning and execution. The main objective of this system is to provide the health care professional with the insight of hidden trends and patterns so that necessary action can be initiated at their end.

When the government plans to introduce a special health care package for a particular disease, such system will be highly beneficial as the system can provide accurate information about that disease. In case of most of the dangerous diseases, the authorities do not have the exact number of patients their stages and their locality, hence the packages and the program are not as successful as it should be. When the government is planning to introduce a special health package for the AIDS patient the absence of proper and

accurate information with the authorities will not yield desired result. The program will be more efficient if the policy makers have the exact number of the AIDS patient and their geographic location. There are some diseases which are characteristic to some particular geographic location. By analyzing the data of all the patient of that particular disease the healthcare professionals will be not only get the insight of the disease but will know how to prevent the disease and the necessary precaution required to prevent the spread of the disease.

VII. BENEFITS

The benefits of such a system are enormous to the healthcare professionals, health insurance professionals, hospital administrators and policy makers. Such a collection of information is the priceless and will dramatically change the health care and administration including the formulation of policy and planning. The system is beneficial to the government doctors, hospitals and citizens. Most hospitals often struggle to the medical records of the patients. In some hospitals the patient record is simply not stored. Every time a patient visits such hospital, the patient is regarded as a new patient the patient chooses to do so and thus, the onus of keeping the medical records with the patient. Some of the hospitals which keep the patient record sometimes face new challenges as they have to migrate to new technology causing extra investment. In the proposed system the data will be stored in some place where the doctors or the hospital management should not worry about. The only responsibility on the hospital is to up load the data in real time as and when the data is generated.

VIII. THREATS

Even though the data is useful such data is very sensitive and can be misused hence it is very essential to impose stringent and rigorous data access control rules and mechanism. The responsibility of the data administrator and business rules module is to see that the data is securely stores and the data is presented to the authorized persons or institutions. The secrecy of medical record of citizen should be paramount and the priority of the system. If necessary, amendments to the existing law are required to increase confidence of the citizens to trust the system. The system will only be successful if the system can be made robust in terms of securing the system.

IX. CONCLUSION

The system will increase the effectiveness and efficiency of the healthcare management with lower cost. system can successfully accumulate the health record of all the citizens at one place for critical evaluation of health traits and trends. The professional engaged in healthcare can get instant patient history on the click of the button. The system will bring about strategic change in the health care system of the country. In future the system can be merged with the PAN card system and Adhar system making it easier and efficient. Every citizen can be issued just a smart health card where all the other information like PAN card details, biometric details, driving license information, voter information etc. can be merged into it. This system can also be implemented as mobile app to make it more accessible and beneficial

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