Excel Journal of Engineering Technology and Management Science
(An International Multidisciplinary Journal)
Vol. I No. 7 December - January 2014-15 (Online) ISSN 2277-3339

"ADOPTING CLOUD COMPUTING IN E-HEALTH FOR EARLY DETECTION OF DIABETIC"

Mrs Naziya Pathan, Assistant Professor Maulana azad college Aurangabad.

Introduction:

In recent years technologies innovations have lead to the development of new computing. According to National Institute of standards and Technology "Cloud computing is a model for enabling convenient on demands network access to share pool of configurable computing resources(e.g network, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or services provider interaction". Cloud computing delivers reliable and high quality services to users on a scalable and elastic infrastructure it can be a set of heterogeneous computing units organized together , but it work like a homogenous single machine. Cloud computing system can be easily scaled up and down so it provide huge potential for solving complex problem and ensures quality of service. Cloud computing is a large scale parallel and distributed complex system .It consists of a collection of interconnected and virtualization computing resources that are managed to be one computing resources. Services are delivered on demand to the end users over a high speed internet as three types of computing architecture, namely software a service(SAAS) ,platform as a service(PAAS) and infrasture as a service(IAAS).The software as a service(SAAS) architecture provides software applications hosted and managed by a service provider for the end user with web service applications. In the infrasture as a service (IAAS) service includes management of hardware and software for processing data storage, network and any required infrasture for deployment of operating system and applications which is needed in a data centre managed by the user. In the platform as a service (PAAS) service include programming language and tools and an application delivery platform to support development and delivery of end user applications. Cloud computing in e-health offers the potential of easy access to electronic medical record .Quick access to a person's medical history could speed up treatment help to avoid complications and even saves lives. The cloud could make it easier for the patients to locate and keep track of their own medical history. Patient also wants privacy and guarantees that their health information is secure.

BACKGROUND

Chronic diseases, such as diabetes, chronic obstructive pulmonary disease and cardiovascular disease, have become a main challenge to health sectors around the world. According to the report by WHO almost 1 in 10 adult has diabetes in the world, and over 90% of all diabetes cases are type 2 diabetes. Diabetes is a metabolic disorder characterized by high levels of blood glucose in the human body that originates from the defects in the insulin production, insulin usage or both. The insulin hormone secreted by pancreatic beta cells regulates the uptake of the glucose from the blood into most cells of human body. The inability of the human body to produce or properly use the generated insulin hormone results in increased level of blood glucose which eventually leads to many health complications such as damage of heart and stroke; high blood pressure; and many more. There are three prominent classes of diabetes .Type 1 diabetes or Insulin-Dependent diabetes mellitus(IDDM), Type 2 diabetes or Non-Insulin-Dependent diabetes mellitus (NIDDM) and Gestational diabetes. Type 1 diabetes results from the body failure to produce insulin and therefore requires the person to inject insulin for survival. Type 2 diabetes arises from the inability of the body to efficiently utilize the insulin. It is the most prevalent form of diabetes in adults. Gestational diabetes, a form of glucose intolerance diagnosed during pregnancy. Fasting plasma glucose (FPG) test and Oral glucose tolerance test

(OGTT) are used for diagnosing diabetes. They measure blood glucose after a person fasts at least eight hours. In OGTT the person must drink a glucose containing beverage two hours before the test. FPG and OGTT detect diabetes and pre-diabetes. OGTT can be used to detect Gestational diabetes where the glucose levels are measured four times during the test.

Table (1) presents FPG

Plasma Glucose Result (mg/dL)	**Diagnosis**
99 or below	99 or below Normal
100 to 125	Pre-diabetes (impaired fasting glucose)
126 or above	Diabetes

Table (2) presents OGTT

2-hour Plasma Glucose Result (mg/dL)	**Diagnosis**
139 or below	Normal
140 to 199	Pre-diabetes (impaired glucose tolerance)
200 or above	Diabetes

Table (3) presents OGTT with Gestational.

When	**Plasma Glucose Result (mg/dL)**
Fasting	95 or higher
At 1 hour	180 or higher
At 2 hours	155 or higher
At 3 hours	140 or higher

TABLE 1 DIABETES EXAMINATIONS

Examination	Definition	Type	Unit	Levels
Urine	Look for glucose and ketones from breakdown of fat	Lab test	N/A	N/A
HbA1c	Monitor how well patients are controlling Blood glucose by checking the Haemoglobin A1c in the cell Check every 3 months	Lab test	%	Normal: Less 5.7% Pre-diabetes: 5.7%-6.4% Diabetes: 6.5% or higher
Fasting blood glucose level	Check the blood sugar when person is fasting (not eating)	Personal test	mg/dL	Normal: 100 -126 mg/dL Diabetes: 126 mg/dL or higher
Oral glucose tolerance test	Check the blood sugar after 2 hours from eating	Personal test	mg/dL	Diabetes: 200 mg/dL or higher
Random (non-fasting) blood glucose level	Random time and accompanied by classic diabetes symptoms (increased thirst, urination, and fatigue). Must be confirmed with a fasting blood glucose level test	Personal test	mg/dL	Diabetes: 200 mg/dL or higher
Blood pressure	Check blood pressure	Personal test	mmHg	Diabetes: 130/80 mmHg or higher
HDL cholesterol	Check High Density lipoprotein (HDL) cholesterol	Lab test	mg/dL	Diabetes: Less than 40 mg/dL
LDL cholesterol	Check Low Density lipoprotein (LDL) cholesterol	Lab test	mg/dL	Diabetes: more than 100mg/dL
Total cholesterol	Check cholesterol in blood	Lab test	mg/dL	Diabetes: more than 100mg/dL
Triglycerides	Check Triglycerides in blood	Lab test	mg/dL	Diabetes: more than 150 mg/dL
Waist circumference	Measure the length of around the waist	Personal test	Inches	Diabetes Men: 40 inches or more Diabetes Women: 35 inches

The risk factor for diabetes in Indian are

- **Age**—Indians develop diabetes at a very young age, at least 10 to 15 years earlier than the western population. An early occurrence of diabetes gives ample time for development of the chronic complications of diabetes. The incidence of diabetes

increases with age. In India, the life span has increased hence more number of people with diabetes are being detected.

- **Family History**— The prevalence of diabetes increases with a family history of diabetes. The risk of a child developing diabetes with a parental history increases above 50 per cent. A high incidence of diabetes is seen among the first degree relatives. Indians have a high genetic risk for diabetes as observed in Asian Indians who have migrated to other countries. They have been found to have a higher rate of diabetes as compared to the local population.
- **Central Obesity**—The association of obesity with Type II Diabetes is well known. Even with an acceptable body weight range, weight gain could increase the risk of diabetes . An excess of body fat specially concentrated within the abdomen has an increased risk of diabetes. The cut-off limits for waist circumference for Indians have been recommended to be 90 cm for males and 80 cm for females. Abdominal obesity is defined by waist circumference above these limits.
- **Physical Inactivity and Sedentary Living**—There is enough evidence to demonstrate that physical inactivity as a independent factor for the development of type II diabetes. The availability of motorised transport and a shift in occupations combined with the plethora of television programmes has reduced the physical activity in all groups of populations.
- **Insulin Resistance**—Asian Indians have been found to be more insulin resistant as compared to the white population. They have a higher level of insulin to achieve the same the blood glucose control. A cluster of factors consisting of abnormal fats, high blood pressure, obesity, and abnormal glucose levels known as metabolic syndrome is highly prevalent in Asian Indians.
- **Urbanisation**—The developing countries like India are undergoing rapid urbanisation Urbanization is associated with increasing obesity, decreasing physical activity due to changes in lifestyle, diet and a change from manual work to less physical occupations.
- **Stress**—The impact of stress both physical and mental along with lifestyle changes has a strong effect of increasing incidence of type II Diabetes amongst persons is a strong genetic background.

Sharing health information through cloud the patient health information is very sensitive. It include personal information the detail of medical history, symptoms, treatment, associated diseases and family health history. In cloud deployment model cloud system can be divided into four categories from the view of deployment model: public cloud, private cloud, community cloud and hybrid cloud. Each deployment model has different organizational structure and different provisioning location.

RELATED WORK

A recent fact sheet released by World Health Organization (WHO) revealed that 346 million people worldwide are suffering from diabetes. The number of diabetes deaths will double between 2005 and 2030. It clearly indicates the urgency of efficient strategies for identification and prevention of diabetes in a cost effective manner.

M. Hussain et al. proposed a Smart Clinical Decision Support System (Smart CDSS) . It gathers data from diverse modalities, such as sensors, patient profile information, social media, clinical knowledge bases and medical expertise, with cloud architecture to generate standards-based recommendations patients. But this CDSS lacks of some important health data from patient daily

life when adopting it to chronic disease patient, such as physiological measurements, diet or daily activities.

C. O. Rolim et al. proposed a cloud based solution in , which automates the collecting process by using wireless sensor networks. It makes the data collection real-time, and enables the data to be processed by expert systems or medical staff in the cloud. L. Fan et al. identified the concerns on service integration, large scale deployment, and security, integrity and confidentiality of sensitive medical data. For addressing these challenges, they proposed the cloud based solution Data Capture and Auto Identification Reference (DACAR). But in this solution, there is no concern on what actually be shared and what is the role of hospital.

AIM AND OBJECTIVES

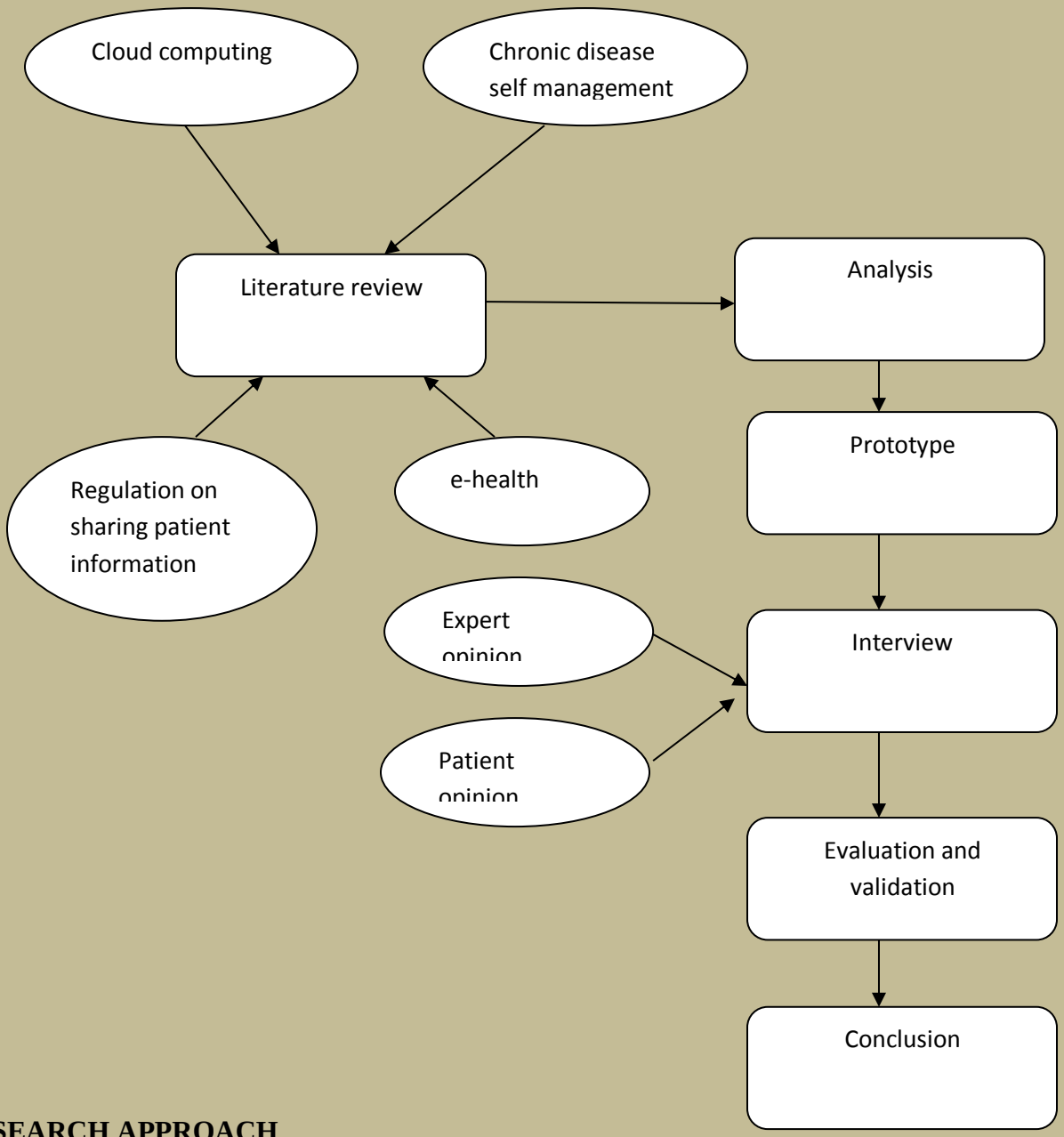
To identify a suitable form of health information sharing for early detection of diabetic. Figure out the use of cloud computing to achieve health data sharing among multi-groups, and find out a suitable solution to address these problems. The aims will be achieved by addressing the following objective: Using cloud computing analysis of patient's symptoms for early detection of diabetic and grading the levels of it.

LITERATURE REVIEW

A literature review is a suitable research method which is commonly used by researchers to explore the existing knowledge on a subject area. Literature review is a process to "collect, know, comprehend, apply, analyze, synthesize, and evaluate quality literature in order to provide a firm foundation to a topic and research method". Through this process we can develop the process which can help for early detection of diabetic by sharing patient information, the development situation of cloud computing. There are many relevant researches already proposed and published, information and ideas from existing researches such as what have been done in health data sharing in similar application scenario either based on cloud computing or other techniques, how different categories of cloud computing suited in different application areas. To search for the past and current researches and other supporting materials, the publications through the online databases. The help full data base includes IEEE (Institute of Electrical and Electronics Engineer), In spec (Ei Village 2) and springer link found relevant information from journals, eBooks, research reports, articles etc., relevant information and articles. Manual searched was also performed using Google and Google Scholar.

RESEARCH METHODOLOGY

There are different types of research approaches. These are qualitative, quantitative and mixed approaches. Based on research one had to select proper methodology and to be familiar with how it will be useful for our research before following it. A qualitative research gives the complex, detailed understanding of the issue which can be established by talking directly to people. While in quantitative approach is one in which the investigator primarily uses post positivist claims for developing knowledge i.e. cause and effect thinking, reduction to specific variables and hypothesis and questions, use of measurements and observations. We can perform qualitative interviews and survey to find both the current state and concerns detection of diabetic.
The detail will be described as follows



RESEARCH APPROACH

Prototype:- Prototype development is defined as the process of preparing a device, technique or system that demonstrates the feasibility of a solution to a problem. A prototype can achieve patient recorded health information sharing through a cloud. Cloud services provided by Amazon, Google or other enterprises, and open source cloud platform such as Openstack, Eucalyptus, could be used to support the development of prototype.

Interview:- for supporting and evaluating the proposed solution, there is a need to get more detailed and practical understanding and expert opinions from professionals in eHealth, cloud computing and healthcare. The expectation and opinion from patient who suffered from chronic disease are also necessary. For achieving this, a qualitative research method, interview, will be performed. Interview is a useful method for data collection with better response rate and closer judgment of people's experience, opinion, desire and feelings.

EXPECTED OUTCOME

The main expected outcome of this research is a suitable cloud-based solution which can be used to share patient recorded health information for early detection of diabetic.
The following out comes will be conducted through the process of this research.

- Important information about cloud computing.
- Suitable and valuable health information of a patient for detecting diabetic.
- The associates perception in e-health.
- A prototype of the cloud based solution for detecting diabetic.

CONCLUSION

Cloud computing is an emerging technology in which every services are available but still there are some limitations which are restricting its usefulness in e-Health. The aim of this paper is to explore the the opportunities and barriers between cloud computing and e-Health and later purpose it in the form of guidelines. Clouds computing solution or data storage are considered as unsecure, illegal and unreliable and that‘s why it is not progressing as it sound to be. Like any other systems Cloud computing adoption also requires prior understanding of human perceptions; human perception can be changed through series of training, workshop and demonstration of system security to the patient, health care.

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