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ENABLING SECURED HEALTH MONITORING SERVICES USING HYBRID MOBILE CLOUD COMPUTIONAL MODEL

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ABSTRACT

The prices of healthcare expenses increased with increase in personal medical treatment as it demands for innovative solution which is being flexible, affordable and precise. One such service is telemedicine that exploited mobile technologies advancement that manages and monitors the health status of patient [1]. But due to low computation power of mobile devices and its inherent limitations this solution became ineffective for data intensive operations like medical monitoring. So another technique was developed that transcends traditional mobile based medical monitoring in terms of accuracy in diagnostic, efficiency in execution and energy, and gaining it's in hold in analysing large scale data for personalized healthcare. This technique uses the combination of mobile and cloud environment for computation of personalized healthcare. Cloud computing environment provides a high quality, low cost pay per use model where users can run their application without installation and access to personal files at any location. But a major disadvantage cloud computing faces is the data security which is required critically to preserve integrity and confidentiality. So in this study a hybrid-mobile cloud computational model is proposed. It ensures the security of data and increase the computation power of mobile devices.

Key Words - Mobile cloud, telemedicine, security

I. INTRODUCTION

Expensive of healthcare services put a demand for innovations in healthcare which is required to be affordable and highly available to all [3]. World health Organization (WHO) has estimated that the United States spends huge amount for better healthcare services [2].

For the process of diagnostics patient's vital signs and physiological signs like heart rate, body temperature needs to be monitored properly. However, the monitoring devices available in hospitals are expensive which are inaccessible and costly, hence effective way of home care to address the severely chronic disease was ineffective [4].

As the growth of mobile devices increased it opened an opportunity for a new idea called "Pervasive healthcare". Pervasive healthcare is the provisioning of healthcare facility at any time and any location irrespective of location, time and limits [7]. One such implementation of pervasive healthcare was "mHealth" where the mobile devices and wireless body sensors took the responsibility of monitoring health and signals alert information was sent for critical conditions. To implement these mobile based medical monitoring, devices capable of processing various classes of physiological signals were developed [8][9]. But unfortunately this

solution became ineffective due to limited computation power and energy supply of mobile devices resulting in either high false alarm rate or short battery life, leading to failure of effective medical monitoring [10].

Recently new paradigms known *as Mobile Cloud Computing* made the Pervasive healthcare efficient by amalgamation of mobile and cloud computing technologies. This paradigm manifolds the computation advantages of Pervasive healthcare enabling the users to get the availability of personalized medical diagnosis and treatment efficiently and accurately. This solution promotes mobile devices to be used in healthcare and increases the cloud computing advantages [1].Cloud computing is the internet based service delivery model which provides internet based services. . Cloud computing relies on sharing of resources to achieve coherence and economies of scale. Clouds computing also focus on increasing the effectiveness of shared resources.

Mobile cloud computing is the combination of cloud computing and mobile networks to deliver the benefits for users, network operator and cloud computing providers by allowing rich mobile application to get executed in any mobile platform providing a rich user experience[1]. Fig.1 [1] shows the offsite personalized medical diagnosis and treatment which is accurate.

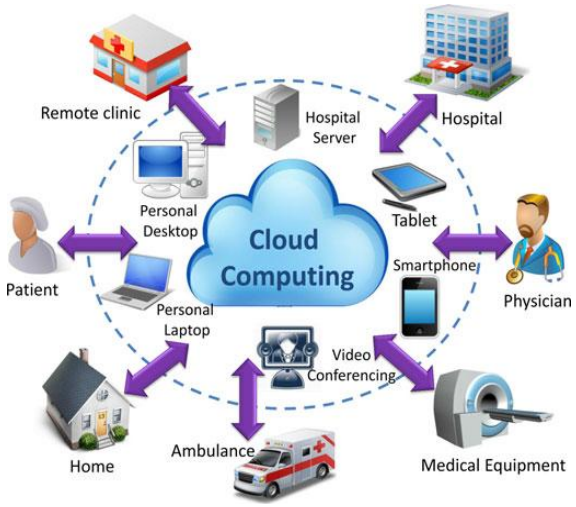

Fig. 1. Diverse telemedicine applications based on the cloud.

But even though the cloud computing delivers this advantage major issues it faces is security. Users are concerned about their data so security becomes a critical factor [1]. Private cloud is found to be the best deployment model than public and hybrid. Public cloud is not very expensive and has a flexible Secure License Agreement (SLA) but the challenges it faces are security, and reliability. Setting of connection is a challenge in hybrid but has the advantage of better communication among clouds. Private clouds are secure with strict Secure License Agreement (SLA) but are costly. In these three deployment model private clouds is found to be the best one to be deployed [22]. The data stored in data center would be stored somewhere which does not allow direct control of user making it exposed. In e-Health it is mandatory that the record or data of patient be secured say for instance if a politician gets admitted to hospital his status of health should be secured from media. Many organizations are delaying the acceptance of cloud computing in e-health due to issues in data security [22].

II. RELATED WORK

Mobile cloud computing has played a pivotal role to improve access to healthcare using telemedicine [12] improving the cost effectively through the use of cloud computing. First initiative was given by IBM in 22 Nov 2010 when it developed the TClouds which was an Advanced Cloud Computing Project with Hospital and Smart Power Grid Provider [15].It remotely monitors, diagnoses and assists patients away from hospital settings. It set an example for an in home healthcare which is cost effective using cloud computing. TClouds assisted the physicians to access the medical records which would be stored securely and is accessible for patients, physicians, and pharmacy staff [15].

Another example for mobile cloud computing was designed by Hsieh and Hsu [16] presenting a 12-lead ECG telemedicine in 2012 that managed the transfer and store ECG records via Internet connection of clinically used ECG devices through web access.

Storage of “SickleRemote”[17] and “caREMOTE” [18] facilitated the care of pediatric sickle cells and understanding the health related quality of life of cancer patients. These apps were developed in Google app engine.

Other studies like Cloud-Based Cross-Platform Mobile Health System with HTTP 2.0 [20] and secure open cloud architecture (OpenCloudCare) [22] tapped the potential of mobile and cloud-based

telemedicine enabling the monitoring of patients and regular timing of medication with care.

III. EXISTING SYSTEM

Wearable body sensors and mobile devices are used to monitor health and trigger alarms during urgent medical need. Cloud computing delivers new opportunity to solve the problem inherent in mobile devices like limited computation power and short span of battery life by taking advantage of real time, on-site monitoring and better computation power of the cloud.

Fig. 2.Telemedicine in a mobile cloud.

Psychological body sensors gets connected to the mobile device wirelessly, and collects the data like blood pressure, heart rate and ECG[23].Those collected data are sent to the physician or computer aided diagnostic program that evaluates and identify any abnormalities in physiological measurements and signals an alarm[24].Fig.2 represents the architecture of telemedicine[1]. This enables patient's health status to be monitored without visiting hospitals. This system gave an effective management of chronic diseases like diabetes, hypertension and cardiovascular diseases (CVD) which has reduced the rate of mortality and hospitalization [25].

The mobile devices will transmit the data from wearable body sensors to the clouds which can be vital signs and physiological changes which performs computation-intensive algorithmic processing [24].

Machine learning algorithm is one such training procedure whose result would be patient-specific, which is deployed on mobile devices with a consistent interaction between mobile and the cloud. Such an interaction will enable detection of physiological abnormalities and thus raising alarms by mobile device itself [1]. But this system has the disadvantage of keeping the data secured due to open nature of cloud computing environment. So it became difficult to classify data based on confidentiality.

IV. PROPOSED SYTEM

Most users are unable to afford android systems. Proposed system for developing and deploying mobile health care applications is explained below. The application uses cloud computing.

We have the physical infrastructure managed by cloud storage facilities and it also performs operations. The cloud service model handles and queues user requests and the cloud platform interface is connected to this cloud service model. The user account, accessibility and billing issues are handled by the Cloud infrastructure module. These works now include the communication with cloud Computing Platforms and also web service communication is supported by the proposed model.

The proposed work consists of the following modules

1. Administrator module
2. Cloud module and
3. Patient module

A brief explanation of the functions of each of these modules is given below

A. Administrator module-: A person with sound medical background acts as the administrator

Administrator operations:-

- Patient ID generation;- The administrator accepts request for registration of a patient after verifying the documents and then provide a unique patient ID thereby making the patient an authorized customer
- Patient authentication: - Administrator use patient ID to verify the patient.
- Data update in cloud: - Data can be accessed by the client from the cloud but no modification can be performed. Only administrator has the authority to change the data.
- Managing accounts:- The accounts of customers with their user id and password are managed by the administrator and the administrator has all the backup files.
- Issues in billing:- The customer bill details are handled by the administrator.

B. Cloud module -: Patient records are stored in the cloud. On request from client the data is sent from the cloud to the client

C. Patient module -: Here the client is the patient so patient module also pertains to client module.

Patient module operations:-

Subscribe:-The patient or client must subscribe to the administrator in order to avail the healthcare services.

V. ENCRYPTION FOR SECURITY

RC5 algorithm is used for proposed model which helps to encrypt the patient details set to cloud storage. RC5 is a symmetric encryption algorithm whose plaintext and cipher text are fixed-length bit sequences. A major advantage of RC5 is its simplicity like five lines of C code can be used to encrypt or decrypt plaintext. It requires less memory space providing users the flexibility and versatility offering users the choice to change the number of rounds performed, key size, and block size. Trade off between speed and security is adjusted. A unique aspect of RC5 is the usage of data-dependent rotational shifts. Data-dependent rotational shifts involve manipulating bits with the shift amount determined by a block of data, instead of a fixed integer value. Each encryption and decryption function accepts two blocks (32 bits for each block) of data, either as cipher text or plaintext. When the data manipulation occurs, the function outputs two blocks of cipher text or plaintext, depending on whether the function encrypts or decrypts. Just like other algorithms, RC5 has a set-up process, and the set-up time is dominated by the creation of an expanded key table whose elements are used as a second argument in XOR operations during encryption and decryption. A thirty-two bit word, sixteen round and four-byte sized key configurations was used in this analysis [24].

The RC5 algorithm for encryption and decryption is given below:

Encryption Algorithm-:

Input: Plaintext in two 32-bit variables A and B
Number r of rounds
Expanded key table S
Output: Cipher text stored in A, B A=A+S[0]
B=B+S [1]
For i=1 to r
A= ((A XOR B) <<< B) +S [2*i]
B= ((B XOR A) <<< A) +S [2*i+1]

Decryption Algorithm-:

Input: Cipher text in two 32-bit variables A and B
Number r of rounds
Expanded key table S
Output: Plaintext stored in A,B
For i=r to 1
B= ((B-S [2*i+1]) >>>A) XOR A
A= ((A-S [2*i]>>>B) XOR B
B=B-S [1];
A=A-S [0];
>>> /* rotational right shift*/
<<< /* rotational left shift*/

The proposed system helps the patients around the globe and to help the hospitals in maintaining the hospital records easily and securely at the clouds [24].

VI. CONCLUSION

The proposed system enables patient records management and utilizes the Cloud Storage Service. The challenges faced by cloud computing environment are data locking and offline connection problem, so solving these issues can be further investigated in future. There are situations where online data access won't be possible all the time. Hence a possible investigation of how to keep the data available to overcome offline data connection is an issue. The future improvements could be done by implementing advanced security in the mobile device and also by deploying the system in real time environment in order to test the application for acceptability and performance.

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