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Mobile Cloud Diabetic Control System

B.V.RamaKrishna[1], B.Sushma[2]
[1]CSE-Department, Acharya Nagarjuna University, India
[2]M.Tech-Student, CSE-Department, Vardhaman College of Engineering, India
[1] bhvrama@gmail.com; [2] sushma@yahoo.co.in

Abstract— Human Computer interfacing becoming more popular in this era. The technology growth and advancements in nano-Technology reduced the electronic device physical metrics in such a manner they can be enclosed into very thinnest layers also. In this paper a mobile computing and Cloud computing fusion based architecture proposed to support the Diabetic patients in maintaining their health checkups and receive doctors advises on move. The technology benefits and architecture assistance with its functional structure briefly explained. A case study work done on performance statistics among both traditional and proposed model. This paper promoted the new generation medical assistance system to provide health assistance for critical diseases in prompt timing with real-time patient monitoring.

Keywords – Human Computer Interface, Sensors, DAC/ADC Convertor, Cloud Server, Wireless

I. INTRODUCTION

The Human Computer Interface (HCI) technology advancement introduced microelectronic devices which can be embedded into human bodies are stripped over surface of human body more flexibly without any inconvenience to daily life activities. The Cloud Computing [6] technologies facilitating users high end application level computing capabilities by establishing virtual servers covering all the computational grid network devices of users. Mobile Computing [1] services creating a platform to assist diabetic patients in receiving medical therapy round the clock in rambling. Cloud services sing mobile computing support facilitates data storage, grid computing and resource sharing from remote computing devices. Wireless LANs [2][3] acts as backbone for Cloud based health care systems in many organizations. Diabetic patients in modern days facilitated with smart sensor technology based diagnostic tools, which can be easily wearable over body [8][13]. The patient body turns into a Wireless network [12] based collective system which enables data transmission and receiving among smart devices within the network area. Many medical apps available to interface the diagnostic tools with health care system. The Cloud Servers bring the hospital services [4] into the door steps of patient's mobile computing devices. The large data like medical images, transcription data, diagnostic data, CT-Scans and MRI data can be stored on Cloud Servers [5][11] with secured memberships by patients. They can use this data as local storage from their Mobile Cloud computing devices [7]. The wireless LAN [9] using radio frequencies allotted to private networks provide patient data security, secured login and secured data transmission among registered group of networks managed by cloud servers of hospitals [10].

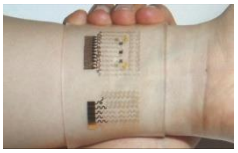
II. TECHNOLOGY OVERVIEW

A. Diabetic Sensor Devices

The Diabetic electronic sensors helpful to collect diagnostic metrics to calibrate conditions of disease temporal or current statistics based. Basically sensors are classified as 'Internal Sensors' and 'External Sensors'.

Internal sensors are implanted into human body and behave like integral parts. They are highly expensive and maintenance free. External Sensors are cheaper with low maintenance and can be detached from body anytime. External Sensors are highly sophisticated for transmission of data over Smart Devices. Table 1 provides the information about various metrics supported by Diabetic external smart devices.

TABLE 1
DIABETIC SENSOR DEVICES

Instrument	Output Metrics
 Wrist Panel	• Pulse rating • Blood Pressure • Sugar Level (Symmetric, Current)
 Wrist Band	• Heart Beat • Pulse rating • ECG real-time
 Patch Strip	• Blood Sugar level • Pulse rating • Insulin release rate • Blood Pressure
 Sweat Sensor	• Blood Sugar level • Heart, Pulse rate • Diabetic diagnosis • Automated Control over Diabetic sensor devices
 Insulin Regulator	• Self automated Insulin injector • Timed control • Real time monitor of blood sugar levels • Interfacing to smart devices
 Diabetic Transmitter	• Interfacing to smart devices • Blood sugar automated control • Pulse, Heart metric scan • Real time blood monitoring

B. Data Transmission Support

Current technology of devices support both Analog/Digital data transmission to other smart devices like Computers, smart-phones, PDAs and Tablet PCs. Special software tools are available to support Diabetic diagnostic services with interfacing to sensor devices. The tools enable wireless data exchange between smart devices using Bluetooth, Infrared and Wi-Fi modes.

C. Computation Technology

The Cloud Server technology supports services to enable patients to send and receive diagnostic data over Cloud Servers. The synchronization among Diabetic smart devices and mobile phones supported with a special Diabetic-App collaborated with Cloud Computing technology. The Data Clouds transmitted among wireless networks to 'Medical Cloud Server' to enable patient diagnostic analysis with integrated mobile computing smart devices established over hospital network. The proposed system supports Intelligent Decision support system to automate the Diabetic data diagnosis and transcription generation with cloud server assistance.

III.SYSTEM ARCHITECHTURE

The proposed Diabetic Medical Advisor System Architecture is shown below Fig. 1 Patient network governed by a smart phone loaded with 'Diabetic-App'. All the external sensor devices must be equipped and connected with Wi-Fi network established using smart phone. The patient must be authenticated by medical Cloud Server as a registered patient with a valid identity.

A. Medical Cloud Server

A secured cloud server managed by trusted hospital network. Data transmitted by patient (mobile) client accepted only after authentication of mobile client. Each client provided with a record in 'Patient database' to store his diagnostic data. The server also maintains 'Doctors database' which holds advices and diagnosis suggestions of doctors for each registered patient. Two major service modules interlaced in this server named 'MTG-System' and 'IDS-System'.

B. (MTG)Medical Transcription Generator System

Medical Transcription Generator (MTG) system collects the details of doctor recommendations and diagnostic report based advices to prepare automated transcription sheet. The system updates the patient record status with current diagnostic statistics and prescriptions of doctor.

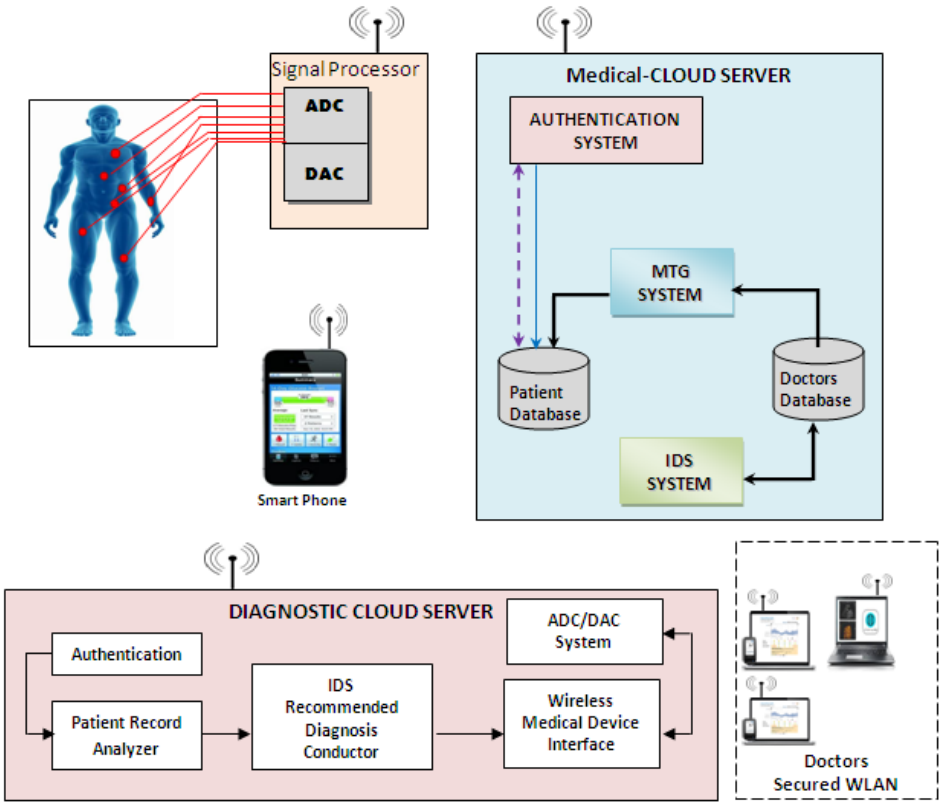


Fig. 1 Mobile Cloud Technology based Diabetic Control System Architecture

C. (IDS)Intelligent Decision System

Intelligent Decision Support (IDS) support vital services like updating doctor database and communicating with Diagnostic Cloud Server for recommended diagnosis automation process. The system interacts with secured doctors WLAN. Patient information can be forwarded to doctor system where he can provide suggestions and diagnosis queries. IDS system tracks suggestion details and if any diagnostic queries issued by doctor IDS collaborate with Diagnostic Cloud Server. Once IDS receives diagnostic data from Diagnostic Cloud Server it forwards information to concern doctor system. After analysing the reports doctor issues final suggestions for patient. These recommendations are transferred directly to MTG system.

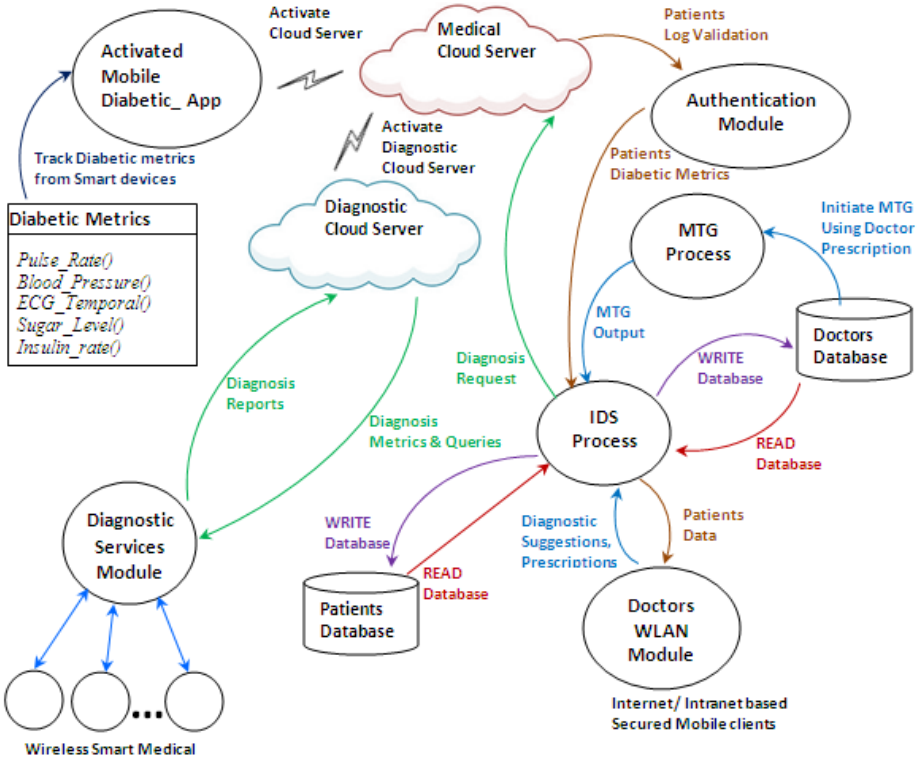


Fig. 2 DFD of proposed system Architecture

D. Diagnostic Cloud Server

The services are initiated only by supported IDS-System request calls. The list of services as follows

TABLE 2
DIAGNOSTIC CLOUD SERVER SERVICES

Authentication	Valid authentication verified for service access
Patient record Analyser	Access Patient record current statistics
IDS diagnosis conductor	Performs diagnosis by accessing medical devices on demand of IDS service
Wireless medical device interface	Controls medical equipment with wireless data transmission during diagnosis
ADC/DAC system	Converts data between digital to analog and vice versa during I/O operations

The Diagnostic Cloud Server interfaces to medical diagnostic devices with wireless media. Based on the request query issued by IDS it initiates several electronic machines for diagnostic analysis on metrics provided by IDS along with Doctors suggested diagnosis tests. It accepts all the reports from medical machines and transfers the data to IDS system.

The overall process of proposed system depicted through Fig. 2 with control flows among various interlaced modules.

IV. CASE STUDY

A case study performed against patient diagnosis and diabetic control between traditional diabetic diagnostic based treatment and proposed system. In traditional treatment patient need to approach diagnostic centre for health check up. After receiving reports he needs to consult doctor where he receives dietary and medicine prescriptions. Patient needs to attend checkups at regular interval of days. The tests must be conducted at specific timings in a day which causes more stress over patients and they need to wait for prolonged time for reports. In this proposed architecture based system patients can activate diagnostic services at any time as mobile clients. The diabetic metrics are instantly transmitted to doctor's desks via cloud servers. The suggestions and additional diagnostic services are activated upon doctor recommendations on the fly. Once the doctor analyzed the reports of patient based on his advices medical transcription generated instantly and forwarded to patients mobile app. The app also supported with automatic insulin regulator to control the insulin flow into the patient blood. A set of metrics are observed over traditional and 'Mobile Cloud Diabetic Control System (MCDCS)' are shown below as Tables 3 and 4.

TABLE 3
DIABETIC METRICS DIAGNOSTIC TIME

System	Blood Sugar	Heart Beat	Pulse Rate	Blood Pressure
Traditional	4 Hrs	15 Min	5 Min	10 Min
MCDCS	25 Sec	15 Sec	15 Sec	5 Sec

TABLE 4
DIABETIC PRESCRIPTION TIME

System	Consultation	Diagnosis	Prescription
Traditional	2-3 Hrs	15-30 Min	5 Min
MCDCS	5 Sec	5-10 Min	25 Sec

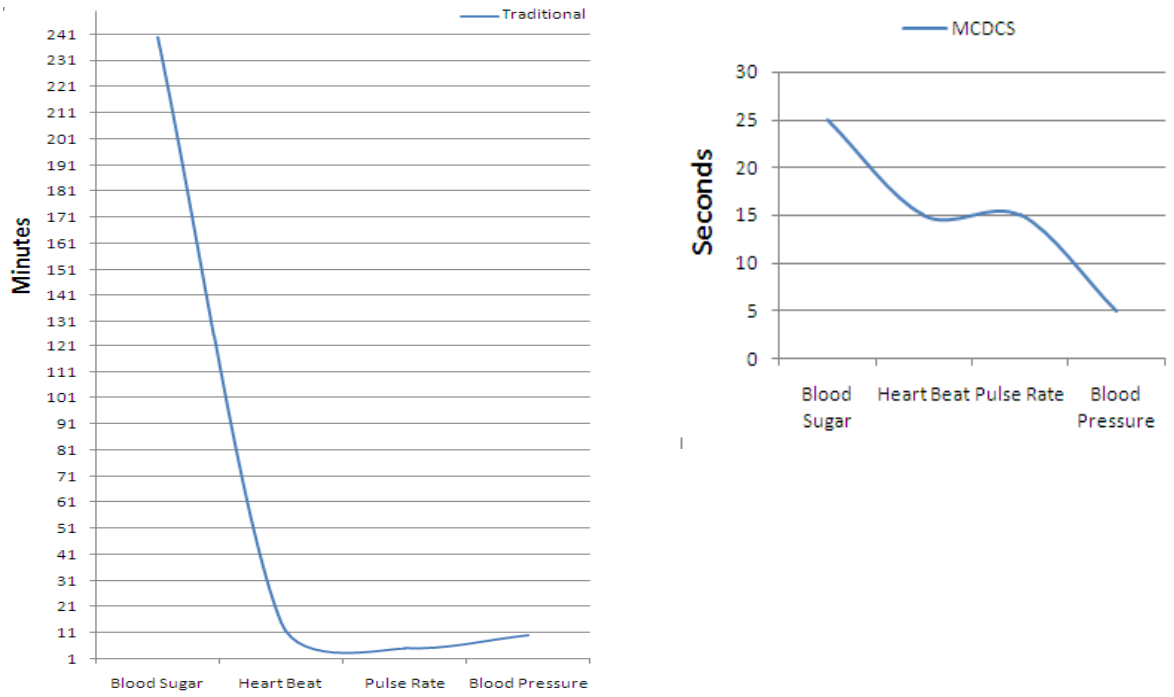


Fig. 3 Traditional Vs MCDS Diabetic metric Process time

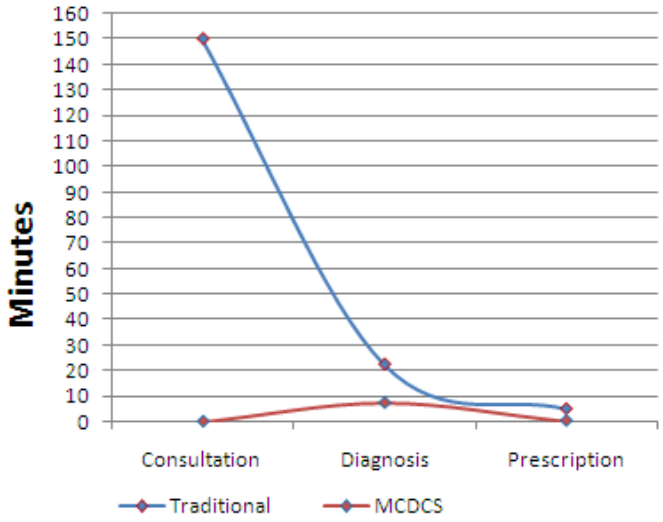


Fig. 4 Traditional Vs MCDS Prescription Process time

The observations from the case study proved that compared to traditional diabetic treatment mechanisms MCDS shown greater performance in accuracy, process time metrics. The recommended system improves the monitorization of diabetic metrics with greater reliability also improved the patient and doctor co-ordination in controlling diabetes. The overall diagnosis and prescription time for traditional is 6.95 Hrs and for MCDS it is 8.92 Minutes from the Tables 3 and 4.

V. CONCLUSIONS

The architecture model proposed in this paper uses the Cloud and Mobile computing services to moderate the medical services for diabetic patients in future. The case study proved that real time diagnosis and prescription supports patients to overcome diabetic problems more effectively. This proposed system model supports patients monitoring round the clock and instantly supports highly qualified doctor's prescriptions for mobile clients. There was no need to conduct tests weekly in hospitals as the patients diabetic metrics are updated every day with current statistics. Proposed system architecture shown great performance in reduction of process time as well as improving diagnostic accuracy. In future we are going to apply machine learning techniques to perform knowledge engineering on medical diagnostic data to support decision support systems more efficiently.

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AUTHORS PROFILE

Currently doing his research in Data Mining Area. His areas of interest are Cloud Computing, E-Commerce and Mobile Computing. He received his M.Tech.(IT) from PU, M.Tech.(CSE) from JNTUK and M.Sc.(CS) from AU. He is working as Assoc. Professor in CSE-Department.

She is doing her M.Tech. (CSE) from JNTUH in Vardhaman College of Engineering. Her areas of interest are Mobile Computing and Cloud Computing.

