



International Journal of Advanced Research in Computer Science and Software Engineering

Research Paper

Available online at: www.ijarcsse.com

Emergency Telemedicine Service using Computer Communication Network and 4G Mobile Networks through Internet Challenges in Cloud Computing Systems to Ambulance bus and Consultancy

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Abstract - This paper provides Emergency Internet Telemedicine service in Ambulance Bus and consultancy by using computer communication network and 4G Mobile for Telemedicine service of live , store and forward transmitted of ECG, EMG, Pulse Respiration, Temperature, Blood pressure, X-ray image and CT scan image of patient's[1][4][5][6]. The computer communication network supports node to node of live video conferencing from Ambulance's Bus Doctors to consultancy of specialist Hospitals. The medical image of X-Rays, CT Scan and Medical information sharing , exchanging by "Cloud computing".

Index term: Ambulance Bus, Emergency Telemedicine service , Internet , 4G Mobile, Cloud computing.

I. INTRODUCTION

Telemedicine service in Ambulance Bus need in the future will be the delivery of early treatment for large accident by vehicles and earth quake. The large capacity treatment equipments space is need for implemented in X-ray machine and CT scanner , so Ambulance bus is suitable for the large capacity treatment equipments space. We need low cost maintenance Telemedicine service in Ambulance bus to avoids most of the accident death. In this paper presented Emergency telemedicine service by 4G Internet and Telemedicine using computer communication network and Cloud computing technology in Ambulance bus[1][5][6]. The medical image of X-Rays, CT Scan and Medical information stored in "Cloud computing[1][4]".

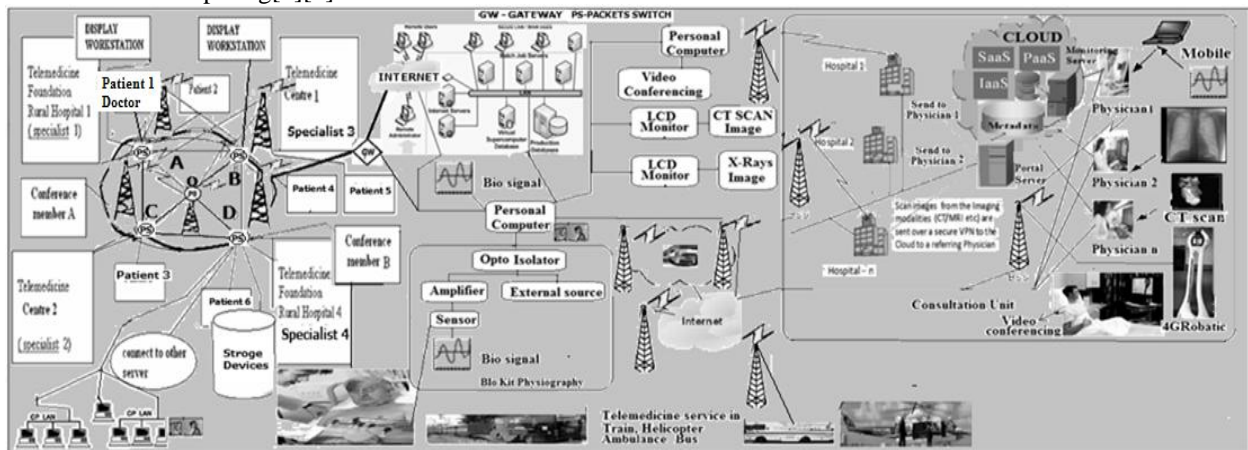


Fig.1 Method of Cloud Telemedicine network using computer communication network.

II. METHODS

Method of Cloud computing to Telemedicine service using computer communication network as shown in Fig. 1. [4][5]. My research is using the Bio- Kit Physiograph System and Biokit Physiograph software version 3.0 , captured and analyzed Biomedical signals like ECG,EEG,EMG and pulse etc. The Physiograph System has two models, one is Built-in Amplifier has built in amplifier for ECG,PCG,EEG etc and another is Non-Amplifier system systems have not amplifiers within the system and has to connected appropriate amplifier modules for receiving the signals. The System can be received biosignals into Data Acquisition Unit acquires the amplified data and converts into a digital format which would be input to the Personal Computer through a Serial Port(RS232) and Opto-Isolation Unit optically isolates the Biokit Physiograph System from the mains power especially from the PC, so that human safety is achieved. The Amplifier Unit amplifies the Bio Signals with the help of Electrodes, Sensors and Transducers. The Physiograph is accepted inputs from external source .The outputs from the external systems should be connected to the Physiograph's

External source input. The output range is 0V to 5V and 0.5 A can be fed to the Analog Digital Circuit. The External measuring device that can be used on the Physiograph are the multimeters ,digital storage oscilloscope/spectrum Analyzer and the PC is

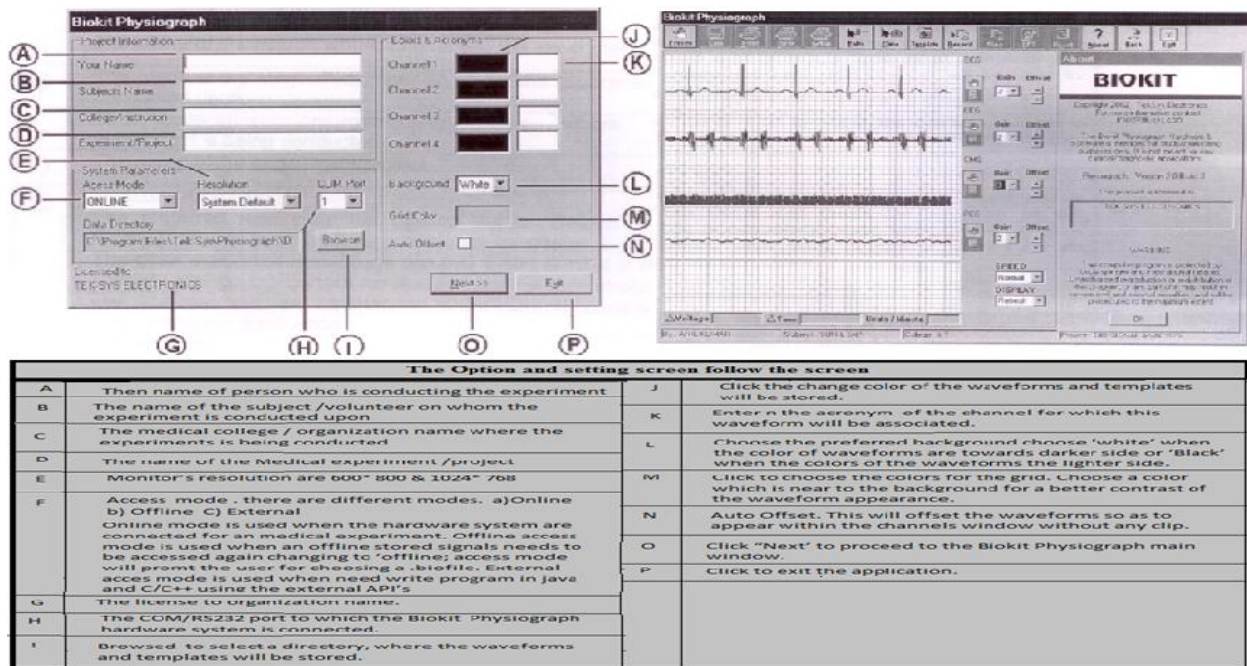


Fig.2 The option and setting of Bio-Physiograph software and screen

interface through the Optoisolator unit to 230 V mains supply and switch on through a serial cable connected to the PC. The various Bio signals monitoring by 4G Internet mobile through internet sharing of computer communication network. The captured Bio-medical analog signal to digital signal by ADC channels (1 to 4) then monitor by Bio-Kit software. The Physiograph software is provided along with the Physiograph System is an advanced tool for grabbing monitoring recording and analyzing various Bio signals are measured and live transmission through Internet that supports transmit Ambulance bus and train to specialist Doctor in consultancy . The required sensors is connected to the amplifier and run the Physiograph software. The option and setting of Bio-Physiograph software and setting screen as shown in Fig 2[4][5].

III. TELEMEDICINE COMPUTER COMMUNICATION NETWORK USING CLOUD SERVICE

Cloud Computing Technology is employs a service-driven to Telemedicine service and developed from virtualization, utility computing, IaaS (*Infrastructure as a Service*), PaaS (*Platform as a Service*), SaaS (*Software as a Service*) to implemented in Telemedicine service using computer communication network and 4G Mobile.[2][3][4][10]. The cloud computing hardware and platform level resources are provided as services on an on-demand basis utilizes the high-speed Internet to deliver the computing, storage, software and services which are distributed all hospital Telemedicine service, to serve the Telemedicine service users with Medical data, Medical application and IT resources through internet with using computer communication network. Cloud computing technology is also one methodology for infrastructure, i.e. the cloud computing platform integrates the mass computing of Telemedicine resources to compose one Telemedicine resource pool and serve the users dynamically with virtualized Telemedicine resources including computing, Medical storage and Telemedicine maintenance.[2][4][10].

SaaS (Software as a Service) i.e. SaaS (Software as a Service) i.e. the software is as a Service solutions are at the top end of the Cloud computing stack. SaaS of cloud computing includes SaaS soft-ware and trusted applications refers to providing on demand applications over the Internet, e.g. Salesforce.com is one famous SaaS provider; it delivers ERP, SCM, CRM soft-ware and etc. through Internet with SaaS mode[2][10].

PaaS (Platform as a Service) provides one platform as a Service solutions provide an Telemedicine users with Telemedicine application framework that will run on the Cloud and development for the Telemedicine service for Medical application development, test and deployment.The platform includes database, middleware and development tools, and all Telemedicine services can be composed through Internet. For example, the Google Map platform supports identify the spot of patients treatment in Ambulance Bus at accident place and nearest hospitals and APP platform all are the PaaS cloud platform.[2][3][10].

IaaS (Infrastructure as a Service) is to provide the Hardware as a Service (HaaS) that refer to the Telemedicine practice of delivering IT infrastructure based on virtual or physical resources as a commodity to Telemedicine users or Telemedicine Ambulance servers for Medical data storage and hardware through Internet. The IaaS platform is created based on virtualization technology as server and storage virtualization, so virtualization, cluster and dynamic

configuration software are also includes IaaS. e.g. EC2(Amazon Elastic Compute Cloud) of Amazon is one famous IaaS platform of cloud computing technology.

IAAS Private Cloud only serves for one Telemedicine Hospital or Telemedicine consultancy. Generally IAAS private cloud is composed by IT infrastructure of one hospital consultancy. It contains their Medical data center and all other devices, hardware and software linked in Internet. The private cloud is managed by the IT fellow and with high-level security. Private cloud demands the entire control of Telemedicine resources, and react the users with different priorities. So the users can have specific demands to resources. But generally, the public cloud looks the users with same priorities. The widely used private cloud includes VCloud, VSphere of VMware and XEN Cloud of Citrix[2][3].

IAAS Mixed Cloud owns the properties of public cloud and private cloud. It connects the Telemedicine resources of private clouds including its medical data, medical application and medical service through public cloud, e.g. private cloud connects into one public cloud and provide one access interface through one agent server. So it can guarantee the telemedicine security of private cloud and support the permitted Telemedicine resources can be exposed into Internet. Open Nebula is one of the famous mixed cloud plat-form.[2][3].

IAAS Public Cloud IaaS public cloud is one of the important Telemedicine application mode of current cloud computing technology to telemedicine storage service. With the appearance of Amazon EC2, more and more platforms come out to provide computing and storage resources. The aim of the platforms is to provide the telemedicine users on demand with the virtual machines for ordered CPU frequency, quantity of core, storage space and memory size[2]. logically one IaaS public cloud owns three main elements as follow:

1) *Cloud Telemedicine Center* is the access interface to Internet and also the Telemedicine management, scheduling and monitoring center of the Telemedicine resources within the cloud. The Telemedicine center of one IaaS public cloud accepts the Telemedicine resources request from the Internet users and create the demanded resources.

2) *Cloud computing Telemedicine Resources Center* is composed by the physical computing resources. To one IaaS platform, the physical Telemedicine resources will be used as the host machines to be administrated by the cloud Telemedicine center. The scheduling server will select the optimal resources according to the user demands to create virtual machines. In general, multiple cloud computing resource centers access the administration center with agent servers which can also be used to support the monitoring and scheduling of the computing resources.[2][3][10].

3) *Cloud Storage Resources Center* is composed logically by the physical storage resources. To one IaaS platform, virtual machine template, Medical images of X-rays, CT Scan and snap-shots are also stored in the storage center which is administrated with network storage systems as NFS, S3, ISCSI and etc. The virtual machine image of users is transferred to one specific physical machine from the storage center and then is loaded into it through internet. To the platform, the physical and virtual machines are loosely coupled. And it also is the difference of public and private cloud and the overview of cloud computing as shown in Fig 3.[2][3][10].

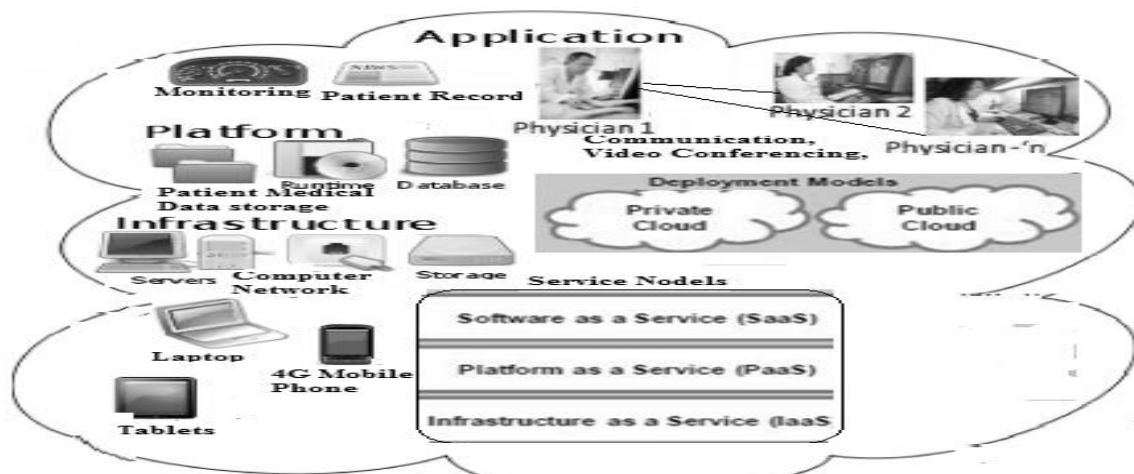


Fig.3 Overview of cloud computing

The Telemedicine users access the portal server and request the virtual machines with the parameters including quantity of core, frequency, memory, storage space, OS and etc. If the virtual machine starts successfully, the user can access the virtual machine through RDP, VNC, ICA or SSH. The agent server can monitor the Telemedicine resources registered within the computing or storage resources management center[2].

IV. 4G MOBILE INTERNET TELEMEDICINE SERVICE IN AMBULANCE BUS

4G mobile internet to connected personnel computer that allows tele-diagnosis such as ECG, EMG, Pulse, respiration, blood pressure, temperature images of X-rays and CT scan from Patients in Ambulance bus to communicate specialist Doctors in Hospital consultation unit[1][6][7][8]. Inside view of telemedicine Ambulance Bus as shown in figure 4 . 4G

Mobile Internet Telemedicine Service in Ambulance bus as shown in figure 5. The computer communication network supports live and stored Telemedicine service by point to point or one to many communication from Ambulance Bus to many specialist Doctor and details of patient's Medical diagnosis reports, X-ray image and CT scan image are stored and exchanged by cloud computing. The medical information in the cloud can provide the necessary details to the different branches of specialist Doctors in Hospital consultation unit and seek the details of injured patients details in Ambulance Bus. The emergency ambulance patient information details and the emergency call sheet as shown in Fig. 6 and Fig.7.



Fig.4 Inside view of telemedicine Ambulance Bus.

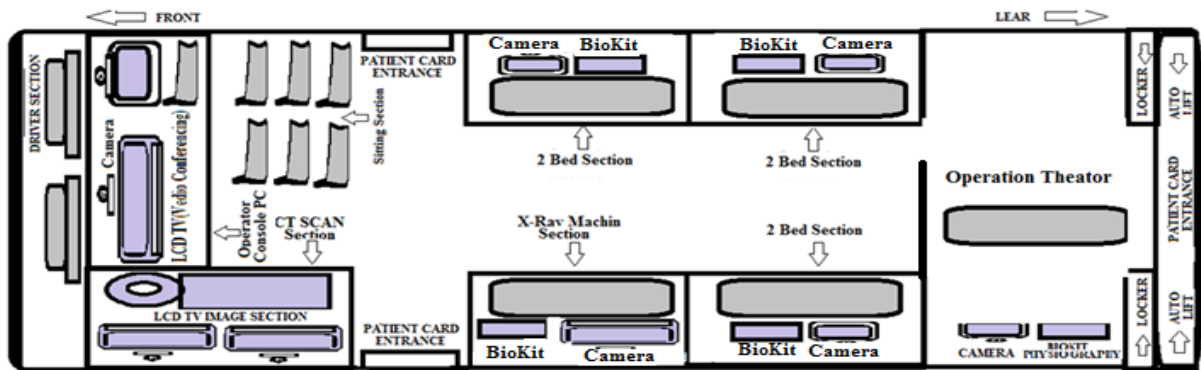


Fig.5 4G Mobile Internet Telemedicine Service in Ambulance bus

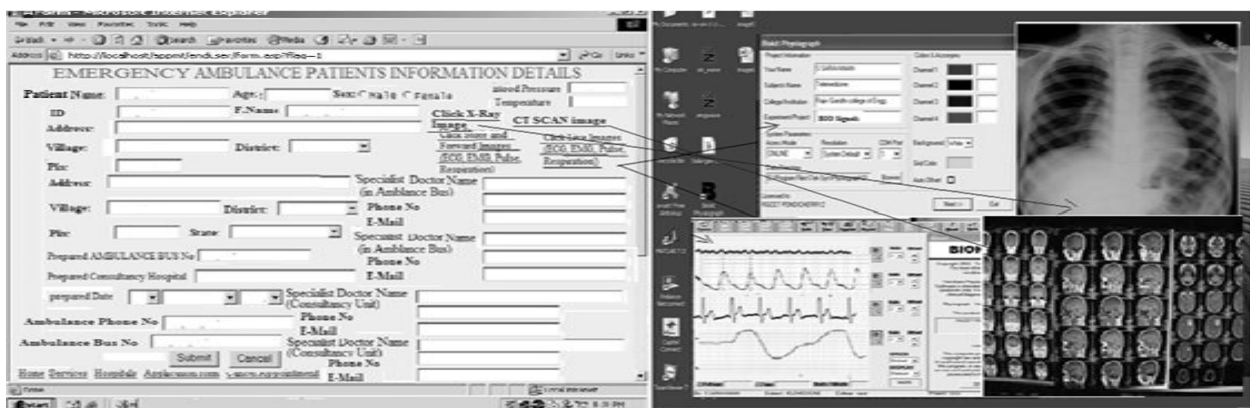


Fig.6 The emergency ambulance patient information details

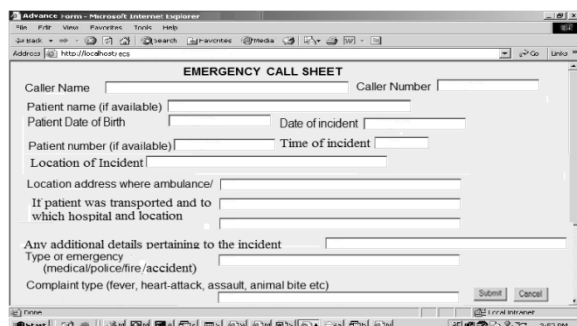


Fig.7 The Emergency call sheet Fig

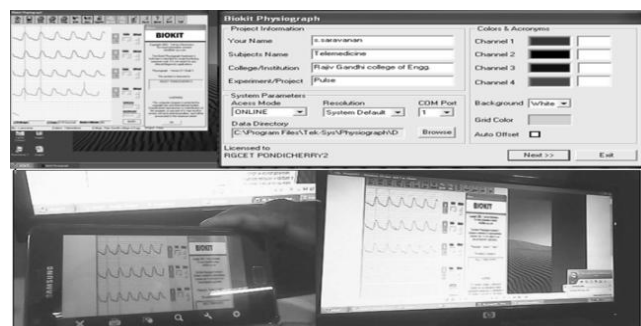


Fig.8 Pulse signals monitoring by mobile

V. RESULT and DISCUSSION

The Hospital Information System is an integrated computerized clinical information system for improved Telemedicine service in Ambulance Bus and hospitals for emergency patient health care Treatment. [4]. The proposed system uses the Cloud computing system for the Hospital Information System. This original research proposal is based on the concepts of cloud computing. The medical image (X-rays, CT Scan image) information sharing, changing in the Technology of "Cloud computing". The information (Medical Images) present in the cloud can provide the necessary details to the doctors and the patient can seek the emergency treatment in Ambulance bus and different branch hospitals. Cloud reduce the cost of servers and resources maintenance in the hospitals[4]. Heart beat sensor is designed to give digital output of heart beat when a finger is placed on it and measure the Beats Per Minute (BPM) rate, it is working on the principle of light modulation by blood flow through finger at each pulse as shown in Fig. 8.[7]. ECG signal from patient's fingers using the ring Electrode detected R wave detection circuits for sensing the QRS signal is taken from as shown in Fig. 9. The EEG (Electroencephalogram) signal is indicated the electrical activity of the brain and Breaths per minute Respiration signal from patient as shown in Fig. 10.

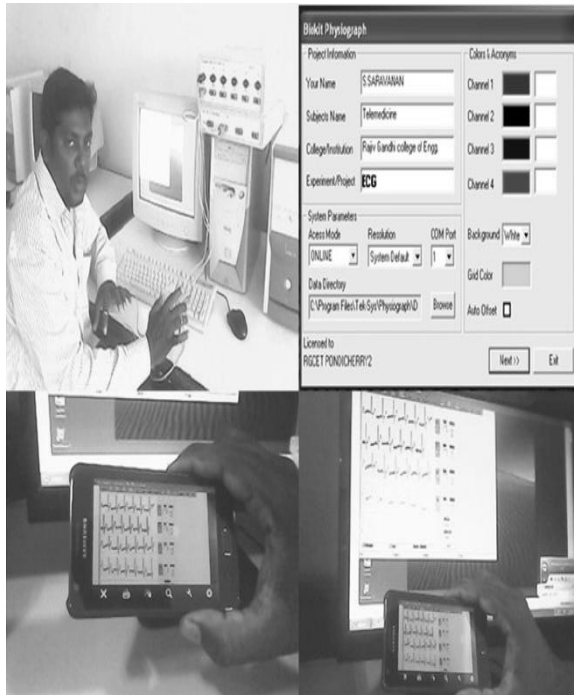


Fig.9 ECG signals monitoring by mobile

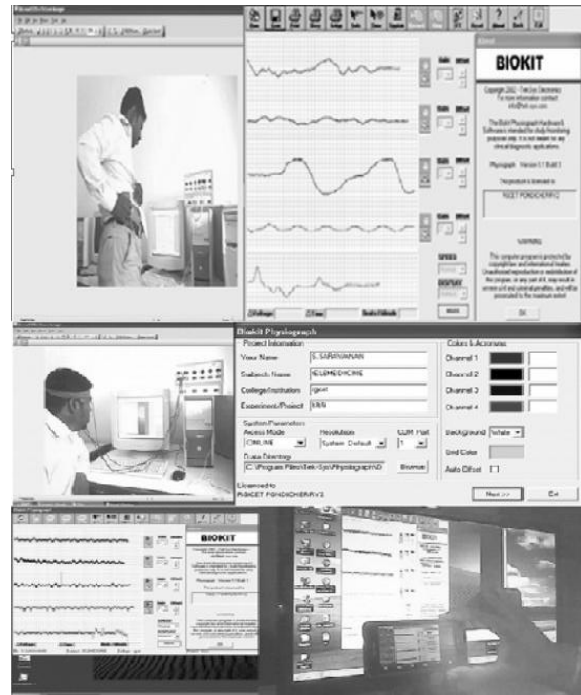


Fig.10 Respiration and EEG signal

VI. CONCLUSION

3G and 4G Mobile Telemedicine has been explored with a example setup in Ambulance bus[4][5][6][8][9]. This Mobile supports video-conferencing and live and store and forward of patients medical information of ECG, EMG, pulse, respiration, X-rays, CT scan transmission by remote view of device diagnostic reports helps Medical consultant a lot. As the cloud computing technology advances for storage purpose of images of x-rays and CT scan and large storage of patients details. The expense of telemedicine service and maintenance cost is very less in my research work compare satellite based Telemedicine system.

My research Website Link

(<http://www.iaeme.com/MasterAdmin/UploadFolder/Mobile%20Telemedicine.pdf>),

(http://link.springer.com/chapter/10.1007%2F978-3-642-29219-4_50),

(<http://www.csjournals.com/IJCSC/PDF2-2/Article%2063.pdf>)

(<http://www.techrepublic.com/whitepapers/telemedicine-using-computer-communication-network/3557251>)

(<http://www.ourglocal.com/keywords/?date=20120310>)

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ACKNOLEGEMENT

This original research was supported by Mobile Telemedicine Unit in Mahatma Gandhi Medical college of Research Institute and Rajiv Gandhi college of Engineering and Technology, Bio-Medical Engineering Department, kirumampakkam, Pondicherry, India.

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