TeleHealth: Healthcare Technologies and TeleHealth Emergency (THE) System

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ABSTRACT

India is one of the fast developing country in the world. Healthcare is one of the factor which is considered for any developing countries. TeleHealth can partially fulfill this area of healthcare. TeleHealth and Telemedicine are broadly refer to healthcare services that provide medical information or healthcare across distances, providing patients with access to locally unavailable medical services or even substituting entirely for face-to-face contact with physicians in emergencies. (Many writers prefer the term “TeleHealth” for broad applications such as education and dissemination of health information, and telemedicine for provision of medical services to patients). There are many healthcare technologies which have been implemented around the globe. Amongst these technologies, very few are used for an emergency case. In this paper we are going to introduce TeleHealth Emergency (THE) System which is not yet implemented anywhere which will do Locate-Diagnose-Move. THE system is the collaboration of GSM/GPRS, GPS, sensors (wearable device) and P2P technology. This system is initially proposed for the emergency movement and diagnoses the roaming heart (Cardiac) patients as well as accidental victim. The main aim of THE system is to provide urgent provisional medication and movement of patient to the hospital which can save lives of many before the contact of expert doctors. This system can be implemented in urban areas of India immediately because of the availability of more availability of hospitals, health clinics, ambulances and specialist too.

KEYWORDS

India; TeleHealth; Telemedicine; GSM, GPRS; GPS; P2P (Peer to Peer); Cardiac; healthcare; THE System; clinic.

1.INTRODUCTION

The famous Time Magazine has called telemedicine as healing by wire. In brief, telemedicine means the use of medical expertise, medical equipment, computer hardware and software, telecommunication infrastructure and internet as a system. Another way to define telemedicine is organizing and integrating information technology in such a way that resources outside the local organization can be used systematically in the activities of health services [1]. TeleHealth is the delivery of health-related services and information via telecommunications technologies. TeleHealth delivery could be as simple as two health professionals discussing a case over the telephone, or as sophisticated as using videoconferencing between providers at facilities in two countries, or even as complex as robotic technology.

TeleHealth is an expansion of telemedicine, and unlike telemedicine (which more narrowly focuses on the curative aspect) it encompasses preventive, promotive and curative aspects. Originally used to describe administrative or educational functions related to telemedicine, today TeleHealth stresses a myriad of technology solutions. For example, physicians use email to communicate with patients, order drug prescriptions and provide other health services.

Clinical and nonclinical uses of TeleHealth technologies are categorized in three modes of it as shown in Figure 1. First, the store-and-forward TeleHealth, where full information of patient will be stored on the storage devices and will be referred by the clinic and doctors time-to-time. In many store-and-forward specialties, such as dermatology, radiology and pathology an immediate response is not critical and are conducive to store-and-forward technologies. Automated screening and diagnostic tele-audiology is fast becoming another specialty conducive to store-and-forward audiology. Second, the real-time
TeleHealth, where a telecommunications link allows instantaneous interaction. Real-time TeleHealth includes videoconferencing. Tele-audiology, Telecardiology, Teledentistry, Telemental Health, Teleneurology, Telenursing, Teleradiology, Telehabilitation etc. [2].

Third, Remote patient monitoring, in this, sensors are used to capture and transmit biometric data. For example, a tele-ECG device monitors the electrical activity of a patient’s brain and then transmits that data to a specialist. This could be done in either real time or the data could be stored and then forwarded. Examples of remote monitoring include: Home-based nocturnal dialysis, Cardiac and multi-parameter monitoring of remote ICUs, Home TeleHealth, Disease management [2]. TeleHealth Emergency (THE) system is the combination of store-and-forward, real-time and remote patient monitoring TeleHealth technologies which will be the best amongst others.

2. MOTIVATION
The feasibility of TeleHealth adoption and implementation is growing with positive changes in public policy on infrastructure and sponsorship. Given that India’s telecommunications infrastructure is largely government owned, telemedicine initiatives are constrained by existing state-sponsored networks, varying only in terms of equipment and software applications. Until recently, telemedicine remained contingent upon India’s meager high-bandwidth landline telecommunications infrastructure. The popularity of wireless and India’s home-grown satellite technologies developed by Indian Space Research Organization (ISRO) offers critical infrastructure to support teleapplications. The INSAT satellite system established in 1983 created one of the world’s largest domestic communication systems with seven satellites and 130 -band transponders linking many hundred earth stations in remote and rural areas along with thousands on very small aperture terminals (VSAT). This infrastructure enables the country to reach over 65% of the Indian landmass and 80% of its population[3].

About 11 % of the world's population, which reside in the rural areas of India, remain devoid of quality healthcare [5] In India, where there is shortage of good medical facilities in rural areas, the emerging trend is to provide solution to health care problems via telemedicine. Majority of the population (72.2%) in India are living in isolated villages [4] Telemedicine shortens the distance and put even the rural and remote areas close to the best medical centres, which are generally located in big cities. It partially relieves the pressure on the health care management due to less number of physicians in the rural areas and makes available the most advance medical facilities everywhere. Web based telemedicine solutions are gaining popularity owing to low cost and universal availability of internet. The systems are developed in such a way that an expert physician can monitor the patient stationed at a distant location, and at the same time may even consult some other experts for second opinion. While everyone needs quality medical services, the only way to reduce the costs is to increase its efficiency. This demands maximum utilization rate of the medical equipments and medical personnel and minimization of the non medical expenses of the clinic.

On the contrary, urban health problems are more even though the availability of more health care facilities people die without the in-time treatment as compare to rural areas in cases like heart disease and road accidents. Because of extreme traffic and pollution, urban life is in more danger. From this we have motivated and decided to develop a system which will help urban lives and at least they should get the medical treatment in time. In all metros of India, number of heart patients and accidents is highly increasing. Taking this in to consideration, we propose this TeleHealth Emergency (THE) system to Locate-Diagnose-Move purpose.

3. PROPOSED SYSTEM
Heart failure is generally regarded as the inability of the heart to provide adequate blood flow to the body [6]. This progressive disorder affects over 5 million people in the United States and around 15 million worldwide [7]. There is a 20% lifetime risk of developing heart failure for both men and women [8]. Mortality rates of 30%−40% during the first year after diagnosis have been published, and after 5 years, this percentage increases to 60%−70% [9]–[11]. Out of these, more that 50% dies without the in-time treatment or emergency movement.

If we talk about road accidents in metros, average 30% to 40% victims die on road because of lack in communication and tracking systems. 10% die because of first-aid treatment. To avoid this type of death, a strong emergency system is required. Our proposed TeleHealth Emergency (THE) system is the best example of collaborative TeleHealth technologies. This is the first TeleHealth system which will locate the roaming victim or patient and provides the first aid facilities at the location of the patient and also moves patient to the hospital for further treatment. We call this system as Locate-Diagnose-Move system. In this paper we are going to introduce our main TeleHealth device known as Wearable Tele-Bio Watch and the architecture of THE system.

A. Wearable Tele-Bio Watch
Wearable Tele-Bio Watch is the master device of our THE system. Figure 2 shows the components of this device. This watch is not a normal wrist watch, it is a multipurpose device as its name indicates. Tele-Bio means, this device works as a telephone using GSM/GPRS, for locating patient GPS etc. as well as to measure few biological parameters like pulse rate (PR), blood pressure (BP), body temperature etc. Components of Wearable Tele-Bio Watch are as follows:
1. Red Alert Button, which will alert the heart patient that something is going wrong. That might be abnormal pulse rate or BP or body temperature or combination of any parameters. This alert will be for specific time of 30 sec., after that automatic call goes to Monitoring Center.
2. Speaker, which is used for telephonic conversation.
3. Call Button, which is useful for talking with Monitoring Center or with the relatives in emergency when the red alarm starts.
4. Display, which is useful to display normal time, phone numbers as well as other bio-parameters like BP, pulse rate, body temperature etc. time-to-time with the help of motion keys.
5. Bio-Belt, which has sensors to get bio-parameters of your body like BP, pulse rate and temperature. This belt will provide this information to the processor of watch.

Figure 2. Wearable Tele-Bio Watch

B. TeleHealth Emergency (THE) system Architecture

In the architecture of THE system, we will discuss about system requirements and working of system.

System Requirements:
We require Wearable Tele-Bio Watch which can be produced by bio-informatics company and can be marketed by health organization with the collaboration with telecom company. Wearable Tele-Bio Watch should be enabled with GSM/GPRS services along with GPS. Monitoring Center is required to monitor patient or accidental victim. This center can be a health clinic or private service provider should able to Locate-Diagnose-Move the victim to the hospital in-time. This Monitoring Center should keep the medical records of the person who is going to buy Wearable Tele-Bio Watch. Main requirement of the system is teleambulance nearby victim’s or patient’s location along with a team with medicinal kit of first-aid.

Figure 3. TeleHealth Emergency (THE) System Architecture

Working of THE system:
Service provider will sell this Wearable Tele-Bio Watch along with a package. The working THE system starts with buying Wearable Tele-Bio Watch and register yourself in one of the service provider clinic or health care center. These partner healthcare centers will make the full checkup of every buyer and stores the information on their database. After storing the health related information of heart patient or of ordinary person, they will allot you a service ID that will be referred in emergency diagnosis.

Once your Wearable Tele-Bio Watch and you gets registered to the THE database, you have to wear this watch for 24/7. This watch will be charged automatically using inbuilt solar panel. Red Alert Button, which will alert the heart patient that something, is going wrong. That might be abnormal pulse rate or BP or body temperature or combination of any parameters. This alert will be for specific time of 30 sec., after that automatic call goes to Monitoring Center in case of unconscious heart patient or accidental victim.

If you are cautious, when alarm is on, you can press green button to talk with Monitoring Center for further action or you can call your relative for help by dialing number. These calls can be made through GSM/GPRS network. When you call, Monitoring Center will get your ID. With that ID they trace your information from Internet (Central Database Server). In case of patient in unconscious condition, automatic call/ SMS will reach to the Monitoring Center. This SMS will carry your ID, other bio-parameters like BP, pulse rate and temperature of the body.

From this SMS, Monitoring Center will locate you using your real-time GPS service they also locates nearby TeleAmbulance and forwards this alert to them. Ambulance team can make use of their handheld healthcare device to get you location and you health details from your ID forwarded by Monitoring Center. Within few minutes, this ambulance will locate you, diagnose you and take you to the hospital for further treatment i.e. Locate-Diagnose-Move service.
THE system can make use of P2P technology for locating and information forwarding over the communication network in future enhancement completely.

CONCLUSION AND FUTURE WORK
With the help of small portable device like wrist watch and TeleHealth Emergency (THE) system will play an important role in the TeleHealth system by providing Locate-Diagnose-Move services to the roaming heart patients and accidental victims to save their lives. If we utilize the available resources in Indian metros (initially) like GSM/GPRS network, GPS services (ISRO) etc. Using this THE system, we can save up to 50% lives that are losing it without primary treatment in emergency.

I future, we will come with P2P-THE system. Further we would like to propose Wearable Tele-Bio Watch with additional facilities to reduce the rate of mortality without treatment. We are suppose to add facilities like speed alarm, which will alert you if you are crosses the speed limit to avoid accidents. Another facility of display your location, which will help you to locate yourself in emergency. In future this device can replace your mobile phone completely.

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