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Telemedicine for Body Scanner Based on 4G Technology

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Abstract: *Telemedicine can be used for the present and future prediction and prevention of diseases. Current and emerging developments in wireless communications integrated with developments in perceive and wearable technologies will have a radical impact on future health-care delivery systems. Telemedicine is the use of electronic information and communication technology to provide and support healthcare when distance separates the participants. Furthermore, wireless technologies play significant roles in telemedicine, and therefore, it is called wireless telemedicine or mobile-heath. This paper discusses the telemedicine in 4G Communication network.*

Keywords: ***electroencephalography*** *(EEG), electrocardiography (EKG), magneto-encephalography (MEG), Magnetic resonance imaging (MRI), nuclear magnetic resonance (NMR)*

I. Introduction

The popularity and evolution of mobile devices like laptops, mobile phones and Personal Digital Assistants (PDA), and the evolution of fast mobile networks in the last decade, have made it possible to increase the complexity of mobile applications and increase the telemedicine services provided to end-users. It is also a spectacular growth in multimedia communication especially via the World Wide Web for the application in the field of Telemedicine. This paper explore some of the current technology of mobile devices, mobile networks and multimedia systems, and is based on the exploration outline some issues for design and development of mobile multimedia systems in 4G Mobile Communication System for the application in Telemedicine. Fourth-generation mobile communication systems will combine standardized streaming with a range of unique services to provide high-quality content (Multimedia) that meets the specific needs of the rapidly growing mobile market. By offering higher data-transmission rates up to 20 Mbps more than 3G for wide-area coverage and local-area coverage, 4G systems will be able to provide high quality streamed content to the rapidly growing mobile market.

Telemedicine means `medicine at a distance'. In other words, it is a technique, not a technology. It is an Umbrella term for many separate applications of medical care, including diagnosis and clinical management, treatment and medical education, whenever they are carried out at a distance. Similarly, Tele-care involves the provision of nursing and community support to a patient at a distance. The fundamental basis is the transmission of clinical information from one location to another, almost always by electronic means. For example, Tele-radiology involves capturing a digital X-ray image and transmitting it to a different site for display. Tele-pathology requires a system which can capture an image from a microscope, transmit it and display the image at a remote site. Tele-consulting (e.g. Tele-psychiatry) involves video conferencing equipment installed at both the local site and the remote site so that the doctor and patient can see and talk to each other. Medical imaging is the technique and process used to create images of the human body (or parts and function there of) for clinical purposes (medical procedures seeking to reveal, diagnose or examine disease) or

medical science (including the study of normal anatomy and physiology). Although imaging of removed organs and tissues can be performed for medical reasons, such procedures are not usually referred to as medical imaging, but rather are a part of pathology. Telemedicine applications are a valid method to improve the quality of the delivered sanitary assistance. Mobile telemedicine is in particular useful both in places where standard telephone service is not easily available, and when emergency care is required. In order to build a global architecture for providing remote Tele-consulting, collaborative diagnosis and emergency situations handling, many different technologies are required.

Measurement and recording techniques which are not primarily designed to produce images, such as electroencephalography (EEG), magneto encephalography (MEG), electrocardiography (EKG) and others, but which produce data susceptible to be represented as maps (i.e. containing positional information), can be seen as forms of medical imaging. Up until 2010, 5 billion medical imaging studies had been conducted worldwide. Radiation exposure from medical imaging in 2006 made up about 50% of total ionizing radiation exposure in the United States.

I.1. Imaging technology comes under Multiple Scanner are

Radiography - Two forms of radiographic images are in use in medical imaging; projection radiography and fluoroscopy, with the latter being useful for catheter guidance.

Magnetic resonance imaging (MRI) - A magnetic resonance imaging instrument (MRI scanner), or "nuclear magnetic resonance (NMR) imaging" scanner as it was originally known, uses powerful magnets to polarize and excite hydrogen nuclei (single proton) in water molecules in human tissue, producing a detectable signal which is spatially encoded, resulting in images of the body.

Fiduciary Markers - Fiduciary markers are used in a wide range of medical imaging applications. Images of the same subject produced with two different imaging systems may be correlated by placing a fiduciary marker in the area imaged by both systems.

Nuclear medicine - Nuclear medicine encompasses both diagnostic imaging and treatment of disease, and may also be referred to as molecular medicine or molecular imaging & therapeutics.

Photo acoustic imaging – Photo acoustic imaging is a recently developed hybrid biomedical imaging modality based on the photo acoustic effect. It combines the advantages of optical absorption contrast with ultrasonic spatial resolution for deep imaging in (optical) diffusive or quasi-diffusive regime.

Breast Thermography - Digital infrared imaging thermography is based on the principle that metabolic activity and vascular circulation in both pre-cancerous tissue and the area surrounding a developing breast cancer is almost always higher than in normal breast tissue.

Tomography - Tomography is the method of imaging a single plane, or slice, of an object resulting in a tomogram.

Ultrasound - Medical ultrasonography uses high frequency broadband sound waves in the megahertz range that are reflected by tissue to varying degrees to produce images.

II. Research Elaboration

Inspired by recent advances in the provision of health care and medical education through the use of Information and communications technology, Recognizing the common interest of the health and community welfare of the people of India, Believing that the promotion of Telemedicine will contribute to the availability of high quality medical service to the needy irrespective of socio economic and geographical disparities, Believing that the Telemedicine services envisaged in the country should be available for the benefit of all people located in rural, remote and inaccessible places, and to further enhance its end-to-end capability, Recognizing the advancement in the communication and information technology in India, which is the forerunner for its adaptation in Telemedicine, Desiring to contribute to broad international cooperation in the scientific, legal, and ethical aspects of the use of Telemedicine.

Need for Telemedicine standard: With the advances in technology the delivery of healthcare of healthcare to even remote locations has become feasible through methods like Telemedicine interoperability and interconnection become difficult to achieve. With Telemedicine services being developed into multiple and disparate networks in an operational mode in the country, there is an imminent need to evolve standards and guidelines to facilitate growth of practice of Telemedicine that is uniform and scientific.

Key Objectives in defining standards:

- To promote the growth of Telemedicine
- To Increase availability of quality medical service to those in need
- To Improve quality of medical services as it facilitates access to expert opinion leading to better diagnosis, treatment and Telemedicine services within the country
- Prognosis.

- To provide a framework for interoperability and scalability across Telemedicine services within the country and outside.

For health care providers and their patient's advances in medical technology make health care increasingly personal in terms of managing chronic diseases, predicting catastrophic ones and enabling patients to live out their final months or years in the comfort of their homes. These advances also allow health care to become a routine part of daily life.

II.1. some examples

Bathroom fixtures with embedded devices that can detect potential problems, such as a toilet that analyzes urine to identify kidney infections or the progression of chronic conditions such as diabetes and hypertension. Another example is a bathroom scale that detects sudden changes in weight or body fat. These devices could automatically upload data to the patient's physician and schedule appointments based on the physician's predetermined criteria.

Connected diagnostic devices such as retinal scanners could be coupled with patients' existing consumer electronics products, such as digital cameras, to provide additional diagnostic and treatment options and make information available to proper medical personnel.

Sensors in the home could measure how a person is walking to determine if he or she may be a candidate for a medical episode, such as a seizure. This is another example of how health care can be preventative and move deeper into the home without significant tradeoffs in quality of care.

Remote surgery, where a world-renowned specialist operates on a hologram that's used to control a surgical robot thousands of miles away. This approach spreads the best care around the world, allowing patients to be treated by world-renowned specialists without requiring them to travel thousands of miles.

II.2. Benefits of telemedicine

The growing use of telemedicine is giving rise to a great number of benefits, which are in the following summarized from three different points of view: Economic development and quality of life, Patients, and Providers (Benefits of Telemedicine)

II.2.1 Economic development and quality of life

- Advancements in delivery of services :

Certain health services can be greatly enhanced via telemedicine. For example, home health services are receiving a great deal of attention and investment in some states. Telemedicine technologies enable home health providers to redefine patient treatment plans, as they are able to increase patient visits due to elimination of a significant percentage of travel to patients' homes. Rural patients can now have access to specialists.

- Keeping money in the local economy :

Telemedicine helps provide service locally so people don't have to travel out of the community for care. Spending on health care is an especially significant portion of any economy, especially rural economies. The more the money that can be kept locally the better off the local economy will be. Standard economic multiplier effects also apply here; any money spent locally ripples through the local economy.

- Aiding business recruitment and retention :

Telemedicine provides the capability to deliver clinical services in the community. Locally available quality health care and quality schools are two important factors in the recruitment of new businesses, especially for businesses in rural communities. So there is a potential business recruitment and retention factor to consider.

- Workforce development/jobs :

There is a severe shortage of medical staff, particularly nurses, in rural hospitals. At the same time there is high poverty and unemployment in rural communities. One way to address that problem is to equip local healthcare facilities with advanced telecommunications services for telemedicine purposes and then to appropriately share the videoconferencing capability in a partnership with educational institutions to train more local people for the jobs in health care that are available locally. Local jobs for local people could be a significant economic impact particularly for people who could not afford to travel outside the community for training.

- Quality of life and longevity gains are worth a lot :

Use of telemedicine can have a significant impact on individual health and can therefore favorably impact longevity. The value to the economy of improvements in life expectancy is about as large as the value of all other consumption goods and services put together. It is an intriguing thought to contemplate that the social productivity of health-care spending might be many times that of other spending.

II.2.2. Patient's perspective

- Access to healthcare :

Access to quality, state of the art health care in underserved areas, such as rural communities, is one of the most important promised benefits of telemedicine. Rural residents are not second-class citizens; they

deserve access to health care services that those in metropolitan areas enjoy.

- Saving time, travel, and other expenses :

Telemedicine entails moving from a service delivery system in which patients (and often parent or guardian) physically travel from a rural area where they reside to an urban area to consult with a medical specialist, to a system in which the specialist consults with the patient and rural primary care provider using telecommunications facilities. An obvious opportunity is the potential for transportation cost savings.

- Healthcare at home :

Home care and community based health services are becoming an increasingly important part of the healthcare service continuum. There are many reasons for this including: patients are leaving hospital sooner and need some additional care at home while they recover, treating patients at home is less expensive than treating them in the hospital, many patients prefer to stay in their homes as long as possible before moving onto a higher level of healthcare service, e.g. nursing home, hospice.

- Health provider integration :

Improved collaboration between providers (e.g., shared access to electronic medical records and provider to provider consultations) provides patients with enhanced confidence that all that can be done is being done.

II.2.3. Provider's perspective

- Emergency Room "front line" support :

Instant access to information, whether it be about a certain patient or a certain topic, can be essential or even life saving.

- Accuracy of diagnosis: reduction of medical errors :

Reduction of medical errors is a huge concern for the medical community. Getting it right on the first try is obviously the preferred way of doing things. With "Tele-assistance"
(e.g., communication with specialists), it is hoped that it will be easier for a doctor to get a "second opinion" on their diagnosis of a patient. With greater access to help, more patients will be treated correctly, the first time. This leads to even more benefits, such as quicker average recovery time, less use of unneeded medicines, and reduced costs to patients and hospitals.

- A multifold increase in efficiency :

Travel times for patients and doctors could be significantly reduced as well as research time and "paper handling" of medical records (which can be unbearably slow). It has already been seen that telemedicine on foreign military bases has sped up the whole process of treatment for soldiers abroad. Consultations from major medical centers to the military bases make diagnosis quicker and more accurate. Telemedicine saves time over traditional "paper-based" data transfer.

- Continuing Medical Education / Lifelong learning :

Telemedicine can enhance educational opportunities for health care providers, patients, and families, improving clinical outcomes and reducing hospitalizations. The opportunity to participate in continuing education on the latest in medical advances without having to travel long distances saves providers time, money and minimizes air pollution.

II.2.4. Discover the difference in Tele-health innovation

- More than 20% of global mortality is caused by respiratory diseases which will become the third leading cause of death. According to the WHO 210 million people's lives are affected if not entirely ruined by COPD and 300 million by asthma.
- Roughly 20% of the adult population suffers from OSA, which represents a severe risk factor of mortality, stroke and metabolic syndrome (hypertension, cardiovascular diseases, obesity, diabetes etc.).
- Due to respiratory diseases every year billions of dollars are wasted due to loss of productivity and increased health costs

III. Expected Results and Findings

As the need for communication rather fastest communication is the foremost priority of present era also the need of quick data transfer. Distant business correspondence by sharing data becomes very important. Ever growing technology is the example of one such step towards the fastest transmission of data. 4G stands for Fourth Generation is the latest technology with high speed transferability of data with security measurements. It is coming with wireless broadband for the instant download.

Tele Doctor creates and saves images and data using its own Tele Doctor Document (TDD) and Tele Doctor Document Comment (TDDC) format. This is the default format and is not recognized by any other program or application. Tele Doctor uses encryption algorithm for its data storage and retrieval. Documents will not open at other end even if one bit information is lost or altered while transmitting data. Each Telemedicine application will have its own requirements for image quality. Image quality depends on several factors, including the acquisition device, image compression etc. The compression is a very

significant aspect for Telemedicine software. Besides this, Tele Doctor has selection of image quality which is directly related with file size. In many instances, the Telemedicine images are giving more readability than conventional methods, as one can use powerful software tools to enhance images. E.g. X-Ray images from Tele Doctor can be interpreted more conveniently and accurately as one can zoom and/or flip the image; can add annotations to image etc.

Tele Doctor transmits images from one site to other as is, without alteration of a single bit. You do not lose information by using a poor communication medium; however it might takes a slightly longer time for transferring information due to poor communication media. The poor quality communication media will effect Real Time Telemedicine applications, resulting in reduced quality pictures during video conferencing. The transmission of data and images is directly allied to the file size and communication media used for transmission. Tele Doctor has a unique technology to support faster transmission of information than any ordinary system. At the same time, Tele Doctor adopts a loss-less compression technique which makes Tele Doctor's images and data file size very small.

We can exchange images and data with anyone who has a Microsoft Windows based computer system, by archiving them to a file format that that can be recognized by the other user's application. This important feature will help you in sharing the data with the experts who don't have a Tele Doctor System. Here, the limitation is that, due to an absence of a database on his/her system, the non Tele Doctor user will receive database information (such as patient demographical information) in a text format. The vector graph data like 12 lead ECG will not be available in binary format for non Tele Doctor Users. Also note that Tele Doctor doesn't keep track of such transmission.

Tele Doctor can directly integrate any machine with video output like sonography machine or endoscope. Some equipments will become video based by addition of hardware such as a pathology microscope with digital camera. Other equipments with vector graph like 12 lead ECG requires a special software module to integrate with Tele Doctor. If you require any of your equipment to be integrated with Tele Doctor you may confidently contact us. Tele Doctor has an integrated video conferencing system. If you want to use the features of integrated video conferencing, you have to purchase that particular video conferencing equipment. Besides that you can use any video conferencing system with Tele Doctor which has a data transfer facility or supports Microsoft Net Meeting for file transfer.
The programming language used will be MATLAB and based on 4G technology.

III.1. Expected Results

- Ortho Kinematics KineGraph Vertebral Motion Analyzer System Receives FDA Clearance

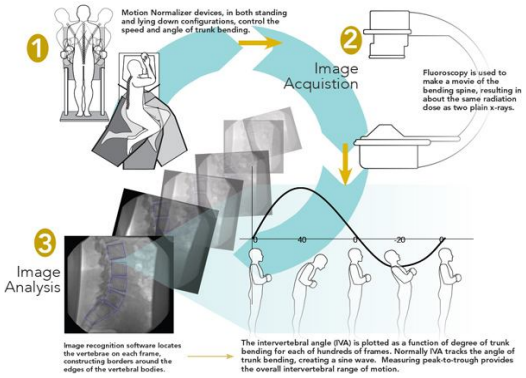

Fig.1.Varian Medical Systems

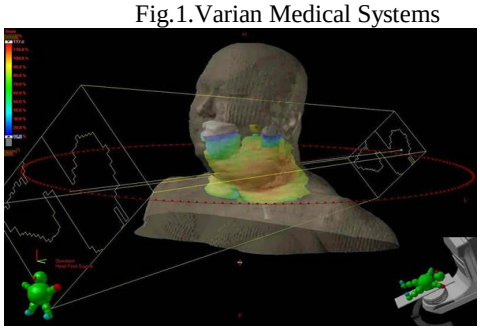

Fig.2 (a) Imaging

Varian Medical Systems, Inc., Palo Alto, CA, developed a new radiotherapy planning tool that automates and accelerates the treatment planning process. The smart segmentation knowledge-based contouring tool works with the company's earlier released Eclipse planning software. The Eclipse treatment planning system includes contouring and field set up, with the added benefit of 4D visualization throughout the process. Eclipse displays the motion of targets and critical structures using specially designed 4D tools. With Smart Segmentation Knowledge Based Contouring, two techniques are combined to make the contouring process as quick and accurate as possible. The 'Smart Segmentation' will automatically identify and visually outline organs and other anatomical structures. 'Knowledge Based Contouring' will accelerate the process by matching pre-contoured images from a database with those of the patient. The Knowledge Based Contouring tool contains an anatomy atlas that covers all of the areas of the body most commonly treated with radiotherapy.

In order to create a customized treatment plan, a clinician must take the patient's anatomical images [Fig. 2(b)] and identify and outline the tumor and nearby organs in a process called contouring. This is

critical when specifying what is to be irradiated or protected during radiotherapy treatments. Traditionally, contouring has been a time-consuming process. Remodeling is generally faster because you have something to work from. Both of these tools give clinicians a head start, so that the contouring task can be more easily and quickly completed.

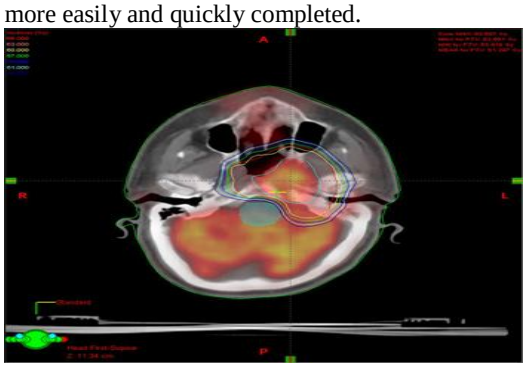

Fig.2 (b) Imaging

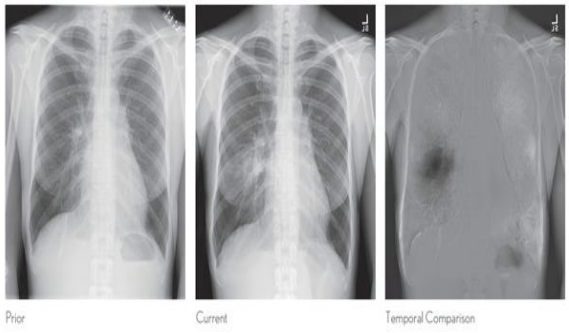

Fig.3 Rivera in Chest X-Ray Temporal Comparison Software Highlights Differences in Chest X-Rays over Time

Riverain Technologies has received FDA clearance for its Temporal Comparison software for chest X-rays. The software compares current and previous chest X-rays of the same patient and highlights the differences in order to improve detection of new nodules which may be early lung cancer.

The software uses pattern recognition and machine learning algorithms (including its existing bone suppression algorithms) to normalize each image to make it consistent with a standard format. The lung field is then identified for comparison. The current and prior image are then aligned and processed by subtracting the current image from the prior image. The system integrates seamlessly with the PACS system, saving the resulting difference image as an additional image in the patient's folder ready for the radiologist's interpretation.

III.3.2 Diagnostic devices and telemedicine applications

- MIR Medical International Research is a leader in diagnostic devices and telemedicine applications for respiratory function analysis.
- Our innovative products perform as mini laboratories by combining oximetry to spirometry testing, thus extending their use towards emerging diagnostic applications.
- MIR is a technology landmark for the miniaturization and integration of its sensors, for the software and for the telemedicine applications also applied to OEM devices in the field of pulmonology.

IV. Conclusion

With all of the technological advances in health care technology, it's easy to forget what they're really all about: the patient. But whether it's a retinal scanner in a bathroom mirror or a home ultrasound machine, it's the patient who is the greatest beneficiary. For latrophobics such as Emily Dickinson, new, noninvasive techniques that are increasingly available in the comfort of one's home can make all the difference in diagnosing and treating diseases before they become debilitating or life-threatening. These advances enable health care to become more personal and, for lack of a better term, user-friendly, with patients interacting with physicians through videoconferences from their homes or nearby clinics. They also help make health care more effective by providing ways to identify diseases and other conditions before they become untreatable. At the same time, these advances also allow health care to fade into the background and become a part of daily life: being scanned each morning while brushing one's teeth instead of only during an annual checkup. That's particularly valuable for patients with chronic or end-stage diseases because it may keep them from having to move into a hospice. In that sense, health care revolves around the patient, as it should. Someday soon, technology will be able to manage our chronic diseases, predict our catastrophic diseases and allow us to live out the last days of our lives comfortably.

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