Telemedicine and e-health technology

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Abstract
Fast advances in the information technology (IT) revolutionize practically every aspects of human life. The field of medicine and overseas mission are not exceptions. This session introduces the emerging IT application field known as telemedicine and e-health. After brief introduction to the computers and internet technology to cover basic concepts and terminologies, the following topics will be explained.

- Application of computer vision on medical science.
- In-depth view of Telemedicine technology.
- TPN (Telemedicine Provider Network)
- e-health system need for third world
- Open-web telemedicine resources—pros and cons
- Future of IT technology

Overview of Computerized Information Technology (IT)
- Computer technology is the second phase industrial revolution
- Information – Facts and ideas
  - Data – Information in processable form --number, text, image, sound, concept
- Computer System– Hardware/software
  - Hardware -- device
  - Processor
  - Input/output device
  - Storage device
- Software
  - System Software – Operating system, language (Fortran, C, Java, PHP)
  - Application software --Office, Graphics, Publisher, Special purpose: Design, animation, etc

Internet
- Information superhighway
- Development of telecommunication technology
- LAN, MAN, WAN, VAN
  - Architecture --Peer-to-peer, Star network, Fully connected, Bus. Hypercube

Medical Application of Computer Vision
- Human Vision vs Computer Vision (CV)
- Pros and cons of CV – Avoid illusion or mistake due to fatigue but less efficient
- CV in medical field – automated processing in diagnosis, treatment and surgery
- Melanoma early detection using CV and fractals
Telemedicine and e-Health

e-health -- healthcare practice which is supported by electronic processes and communication
Often used interchangeably with “Health Informatics”.

Subfields of e-health
1) Electronic Health Record Management – convenient and efficient communication between different healthcare providers
2) Telemedicine – Rendering medical services to patients without being in same location.
3) Consumer Health Informatics (Citizen-Oriented Information Provision) – Disseminate medical information for both patients and healthcare providers.
4) Health knowledge management (Specialist-oriented information provision) disseminate latest medical information to specialists. (e.g. Medscape, MDLinx)
5) Virtual health care teams – consisted of healthcare professionals who collaborate and share information on patients using digital equipments and telecommunication.
6) M-health – Use of mobile devices in collecting aggregate and patient level health data to provide information to practitioners, researchers and patients. Often called mobile telemedicine.
7) Medical research – Using eHealth grid and powerful server, researchers can use handle large quantity of heterogeneous data.
8) Health Information System: Just like MIS(Management Information System), medical service is managed using complicated software to make intelligent decision based on the availability of relevant data. This includes appointment scheduling, patient data management, work schedule management, budget management and other administrative decisions.

Telemedicine
Definitions
- the ability to provide interactive healthcare utilizing modern information technology and telecommunication. (General)
- clinical services where medical information is transferred through interactive audiovisual media for the purpose of consulting, and sometimes remote medical procedures or examinations (Wiki)

Different names: In absentia medicine, distance medicine, non-Face-to-Face medical care, asynchronous medical service

Old in absentia health care
Ancient Egypt, China, Mideast
Galen (129-200 A.D.)
Renaudot (1584-1684)
Schppach (1707-1781), Boerhaave, Cullen, Morgan, etc
Modes of operation
1) Store and send: Capture medical data and transmit to distant location via telecommunication network grid.

2) Remote network monitoring (RMon): Constant data transmission and remote self monitoring via LAN protocol.

3) Interactive mode: real-time interactions between patient and provider, to include phone conversations, online communication and home visits.

Specialized telemedicine fields in activity
Telecardiology -- electrocardiograph transmitted using wire and wireless
Teleradiology -- Sending medical imaging data
Teledentistry -- Remote site dental care
Telemental Health -- the use of videoconferencing technology to connect a psychiatrist with a mental health client http://www.tmhguide.org/

Tele-audiology
Telenursing
Telenursing
Telerehabilitation

We will see some video clips of telemedicine usage(from You tube)

Organizations promoting telemedicine
American Telemedicine Association (ATA)-- http://www.americantelemed.org
Telemedicine Information Exchange -- http://tie.telemed.org/default.asp
Ontario Telemedicine Network (Canada) -- http://www.otn.ca/
NHS Direct (UK) -- http://www.nhsdirect.nhs.uk/
Medetel (Luxemburg) -- http://www.medetel.lu/index.php
Telemedicine information exchange -- http://atsp.org/default.asp
National Rural Health Association -- http://www.ruralhealthweb.org/
National Center for telehealth and technology -- http://www.t2health.org/
Universities promoting research and application of telemedicine
UCLA, U of New Mexico, U of Florida

Problems with telemedicine practice
Lack of confidence on telemedicine by patient and health service provider
Interstate license problem
Insurance reimbursement issue
Availability and cost of telemedicine equipments
The Challenge of Spreading Telemedicine over the Third World: Open-Web Telemedicine Framework
(excerpts from paper by A.O. San Salvatore at “Telemedicine and eHealth Conference 2006 BEYOND TOMORROW”)

Health in Third World: New diseases emerge from the Third World (developing and underdeveloped countries) where faltering economies arrested the introduction of the effective healthcare programs. The rapidly widening medical gap between the industrialized countries and the impoverished regions produced an “incubator” for medical and healthcare problems of potentially world-wide impact.

Health in Western World: The global population have hardly any access to even the most essential forms of medical care, while the richest countries spend a lot of money for new medical techniques to combat mainly “disorders of well-being.” The health product sector in the industrialized countries should also invest their budget to support and to aid the dissemination and improvement of healthcare in Third World.

Telemedicine in Third World: Telemedicine represents the solution for the Third World when referring to support long-distance medicine, and to delivery healthcare services and information to people in underserved communities. Its benefits can include local accesses to specialty care, enhance the primary-care services, and increase the availability of medical education and health information resources in not very medically areas.

TLM Needs in Third World: The Third World needs Telemedicine services with the following basic characteristics: simple, effective, supported and trained. The general situation of Telemedicine in the Third World is difficult and embarrassing: Outdated medical equipment, low-bandwidth, unsafe and difficulty.

TPN – (Telemedicine Provider Network) An international communication network grid for managing a set of “scope” elements of telemedicine projects through a common ICT framework: Subject (contents and applications) Connectivity (communication, integration and networking) Organization (managing and funding) Provision (resources and facilities) Equipment (ICT devices and technologies).

Why open-web sources?: Advantages: Freely available source code Right to redistribute modifications and improvements High motivation for developers Excellent support networks, but informal and unaccountable No license fees. Product release distribution is very easy. Clients do not need local installation. The TPN must maximize these advantages.
**Future of Telemedicine**

Here are major areas of technological advances that will affect e-health and telemedicine.

1. Communication – internet is already a vital part of our lives. Through internet, practically every spot in the world will be connected enabling telemedicine/e-health practices more feasible.

2. Ubiquitous services – almost every devices we use will be connected by signal exchanges between each other. This includes hand-held devices and built-in devices in each facility.

3. Cloud computing – This will allow the access of very powerful and rare devices (like special test equipments) as client-server model of computing is fully deployed. Cloud means the computing devices “anywhere in the world” and you are connected to them.

4. Smaller but more powerful computer hardware – As the level of integration advances, computers get more compact but faster in processing time and larger in storage capability. This enables processing of huge quantities of data in real-time. Therefore more sophisticated decision making (like Medical Information System) and “data mining” possible.

5. Software technology – engineered software (software engineering) will perform more complicated computation with minimum chance of error making. Recent trend is “agile” software development method which produces more flexible custom oriented software much faster and error-free.

6. Informatics – fast growth in the amount of biological and chemical information spun out new academic fields known as Bioinformatics and Chemoinformatics. Genomic is also well established and will produce more data which will be utilized in telemedicine.

7. More service providers for telemedicine is expected who will specialize in integrating all the necessary components of telemedicine and e-health.

8. Government agencies and academia are active in research and development of e-health/telemedicine software, hardware, database and communication network.