EMERGING ROLES & APPLICATIONS OF WIRELESS/MOBILE COMMUNICATION IN PUBLIC HEALTHCARE & SAFETY
(A Step To Have More Healthy & Safer Life)

Manish yadav[1], Shashank Tiwari[2]

[1]*Amity School of Engineering & Technology, Amity University.*
[2] *Amity Institute of Pharmacy, Department of Pharmaceutics, Amity University.*

ABSTRACT

There is still a lot of scope of wireless/mobile communication in many known & unknown sectors for the public benefits. This paper is an approach to identify the various innovative & emerging wireless/mobile applications in one of such well-known & popular sector i.e. healthcare engineering. Whether at a doctor's office, clinic, hospital, outpatient facility or long-term care facility, the business of healthcare always offers a delicate balancing task that is to be performed under consideration of risk involved, demand or level of urgency, required accuracy, confidentiality, on time experts presence, some other resources and advance technology. This balancing act can make solving issues in the healthcare industry seem like a difficult task, but with the right wireless solution, many improvements can be seen quickly and easily. This paper presents a thorough discussion on the current & futuristic role of wireless cum mobile communication in public healthcare. The paper covers important aspects including introduction, no. of unified applications of wireless/mobile communication in health care engineering with proper explanation, and at the end its seeks possibility of further identification of many other applications in the same sector. At the end, this paper penlights the impact of advancement of related communication technologies on public healthcare engineering in both positive as well as in negative terms & gets a final touch with some remarkable suggestions to minimize the adverse effect of wireless technology on health .

Introduction

The term "wireless communication" basically refers to all types of communications in which information is transmitted without the existence of any physical media between the two points i.e. air is the only medium between source & destination points of information. Mobile communication itself is an example of wireless communication. The area of wireless communication applications is extensively wide. Today mobile communication industry alone is considered as one of the biggest & the fastest growing industry in the world & is expected to touch the figure of $2.7 trillion by the year 2013. This fact is sufficient to get an idea about the reach & the importance of wireless communication in today's people life. Since the applications of wireless communication are growing day by day, its impact on diverse fields can't be neglected. One of such popular field is public healthcare where wireless communication has immense scope & opportunities. Many wireless communication applications have been identified in public healthcare engineering.

Generally 'health' & 'engineering' are two independent subjects, but when fundamentals of engineering are applied in the field of health science in order to draw some positive & purposeful results, it becomes healthcare engineering. The basic objective behind the development of healthcare engineering is to enhance the overall public health & make public healthier than ever. This involves the use of engineering technologies in proper taking care of the patient's health inside & outside hospital with full accuracy & privacy. Introduction of wireless/mobile technologies in public healthcare enable the

patients to get the proper & timely treatment even in case of great emergency where availability or unavailability of immediate treatment can make the difference between patients' life and death.

Current Status

The days are gone when any of engineering technology was dedicated to the specific field only. In current scenario all fields, that affect the human beings, revolve around one another i.e. technology of one field has an immense scope & applications in another field too. For an example communication technologies have equal scope in IT sector & vice-versa. Similarly, wireless/mobile technology has an equal contribution in the development of healthcare engineering. Today, many healthcare devices are commercially available in the market which uses the concept of above said technologies in its operation. Smart shirts, smart watches, smart life mobile phones are the name of few. These all are the examples of those devices used in public healthcare where wireless/mobile communication is the principle idea behind their operation.

Thus, wireless/mobile technologies have already been entered in the field of public healthcare. Now a day's by giving doctors, nurses and other caregiver's access to correct up-to-the-date health information every minutes wirelessly, many hospitals, in different countries, are working more efficiently and virtually eliminating potential mistakes. But in India, due to the slow progress in adaptability of technology, this is not in much use yet. In India, there is still a great need to work in this direction to make the full use of wireless technology in order to build an advance & strong healthcare infrastructure.

Unified Applications Of Wireless/ Mobile Technology In Health Care

A. Wearable or Pocket Health Monitoring Devices

Wireless communication technology has given birth to various wearable health monitoring devices such as 'smart shirts', 'smart wrist watches', and any other wearable item for example rings, ear rings, bracelet, necklace, belt, locket etc. can also be used as health monitoring devices. Wearable health monitoring systems integrated into a telemedicine system are novel information technology that supports early detection of abnormal conditions and prevention of its serious consequences. Many patients can benefit from continuous ambulatory monitoring as a part of a diagnostic procedure, optimal maintenance of a chronic condition or during supervised recovery from an acute event or surgical procedure. A wearable health-monitoring device using a Personal Area Network (PAN) or Body Area Network (BAN) can be integrated into a user's clothing. Recent technology advances in wireless networking, micro-fabrication, and integration of physical sensors, embedded microcontrollers and radio interfaces on a single chip, promise a new generation of wireless sensors suitable for many applications, such as stroke rehabilitation, physical rehabilitation after hip or knee surgeries, myocardial infarction rehabilitation, and traumatic brain injury rehabilitation.

B. Smart Life Mobile Phone

Since mobile phones have become an integrated part of human life, hence 'smart life mobile phones' are now the best suited choice for a person to carry with. These are the mobile phones with wireless sensors that can sense the various changes in the body such as sugar level, blood pressure & reads pulses(ECG) when user press his/her finger on a receptor. It collects & sends all the results to a 24-hour medical call centre. This medical call center either sends an SMS to the user when result is normal or makes a call to the user to suggest him/her to go the doctor as early as possible. In certain emergency cases, it sends an ambulance to the user's place too. The smart mobile life mobile phones are commercially available in the market now. The cost of these mobile phones is around $700. However, a mini $99 version with small receptor is also available in the market that links via Bluetooth connection to user's smart phone.

Thus, it is a unique initiative in public healthcare engineering keeping in mind that people often carry their mobile phones with them all the time.

C. ***Wirelessly Controlled Nano Robots***

Currently scientists are working in the direction to successfully develop the 'nano robots' that can perform those different difficult surgery tasks which are either not possible to be performed by doctors because of human-limitations or the tasks involve high level of risk for its successful conduction. The primary idea behind this concept is that these nano robots will be designed for performing only specific task/s, doctors will make enter those robots into the human body either with blood/glucose transfer or with any medicine injected in the liquid form. Once a nano robot is inside the body, doctors can see it on their computer screen & can control its movement & working wirelessly. As soon as its work is over, the doctor sends it a 'dead command' & then the nano robot comes into the state of rest. Soon after its operation either it gets dissolved automatically or can be brought out the body via the way of urine.

These 'wirelessly controlled nano robots' can be used in surgery related to brain, skin (e.g. cancer, paralysis) & other sensitive organs of the body. In fact, doctors have successfully performed the removal of cavities from the teeth using such nano robots. In near future these wirelessly control nano robots will be certainly helpful in cure some incurable diseases may be aids too.

D. ***Live Video Conferencing for Treatment***

This is an important application of wireless technology in public healthcare. Now hospitals have the online guidance treatment facility through live video conferencing. By this way, doctors can directly contact to the national & foreign experts & can perform operations/surgery in operation theatre virtually in front of those experts. Thus this saves time of experts, greatly minimizes the expenditures required to call the experts from outside the hospital & ensures timely treatment for surviving the patients especially in emergency cases. Some hospitals have this sort of facility even in their ambulance too so that proper first aid can be provided to the patient just after the moment that patient enters into the ambulance. Many medical institutions use live video conferencing facility for conducting the online classes/seminars for their students. Thus this is another milestone set by the wireless technology in healthcare sector.

E. ***Wheel Chair With Remote Control***

Now there are wheel chairs with remote control facility are available in the market. By using these wheel chairs, handicapped person can operate their own wheel chair movement with a remote rather than taking anyone else's help. This can give them a real sense of independency. A specifically designed circuitry is attached with the wheels of the chair that can be controlled either manually or with the remote. In future, we'll see the same wheel chair controlled by eyes, voice commands etc. because efforts in this direction are already in progress & now scientists are working to replace the wireless with biosensors & wireless sensors; so that this wheelchair can be operated by the eyes or by the voice commands.

F. ***Disease Surveillances Health Radar System***

The advancement of mobile technology is increasingly facilitating disease surveillance besides improving access to health. When it comes to disease surveillance, technology

Come in handy. One such technology is health radar, a mobile based near real time system to track the spread of diseases. The system allows health professionals to easily report disease related data - this data is then analyzed on the health radar server and later visualized on a mobile device used by the health practitioners/authorities.

G. *Advanced Scanning / Imaging Devices*

Currently exist technology is failed in the detection of decay in teeth. For the detection of bone decomposition dentist performs a test which depends on X-rays images received. The test exposes the specialist & patient to the harmful light. Similarly, mammograms are used for detection of breast cancer in females, yet current technology is fail to detect some cancer presence, especially in women having implants or who are significantly overweight. This misdiagnosis can provide enough time for cancer to spread into lymph nodes and surrounding tissue such that it transforms into a terminal cancer from one that could have been eliminated via surgery if detected accurately. The invention of 4G wireless technology is leading to enhance the development of scanning /Imaging devices to detect and provide clear resolution, without harmful radiation to the specialist or patient, of anatomical imaging. Additional benefits of 4G technology also include the ability to image a patient's vein and artery structure in early diagnosis and treatment of heart disease.

H. *Magic Carpet*

"Magic Carpet" is an especially designed carpet that records the sample of weight, angle and pressure of a person's steps and can help to predict and prevent a fall of that person. Thus it's a new invention for disabled persons. Now a day's Intel is investing in similar sort of projects & magic carpet is one of them.

I. *Radio-Controlled Biomolecules*

In future, there is a plan to apply nano scale antennas to the living systems & control the DNA via an electronic switching system. This requires attaching gold nano particles to specific oligonucleotides which, when added to a sample of DNA, would bind to complementary gene sequences, blocking the activity of those genes and effectively turning them off. When RF magnetic field is applied, it heats the gold particles & finally results a separation into the two small DNA strands. Thus genes can be turned on. By applying the right frequency, one can turn on the tags on one part of DNA but not other tags. Such a tool could give pharmaceutical researchers a way to simulate the effects of potential drugs which also turn genes on and off & the same concept opens up the possibilities of wirelessly controlling the more complex biological processes such as enzymatic activity, protein folding and bimolecular assembly.

J. *Bluetooth-Embeded Device for Safe Driving*

There are several products under development that are reportedly set for release soon. Keys2SafeDriving is a Bluetooth device which allows parents to embed car keys inside. When the key is in use, both voice calls and text messaging will be unavailable but emergency no's i.e. 100,101 and other designated numbers would still be accessible if you choose.
Another anticipated product is 'Drive Assist' which will provide the same type of functionality but will do it via sensing the motion of the car versus the embedding of the car keys.

K. *Smart Phone Application for Aids Prevention*

Due to the its commitment towards public health; in an effort to get a condom in everyone's purse or wallet, the New York City Health Department has released an iphone application (App) that will identify five places where you can get a free condom; the five places closest to your location. The key to stopping HIV and STDs in their tracks is a condom and this new app will help people locate condoms without worrying about cost. Sure, it may be unconventional but getting a condom to even one more person is an improvement that is worth the effort.

L. Advance Pedestrian Detection System

Recently a Swedish car manufacturer Volvo has claimed to develop a new pedestrian detection system which it says can bring a vehicle to a halt automatically whenever someone steps out in front of it. This system is based on radar & camera technology which uses specific kind of support function designed to avoid collision between vehicles & pedestrians. When collision is imminent, the system sends an audio warning to alert the driver & if within the no response, vehicle is brought to the stop. Thus the system is dedicated for public safety on the roads.

Negative Impact Of Mobile Radiation On Health

Though wireless/mobile technologies have a great contribution public healthcare but it is said that it causes some negative impact on health too. Some of these impacts are:

- Radiation absorption through the mobile handset may cause some harmful effect on brain tissues. The radiation produced by wireless devices has some adverse effect on cognitive function of humans. It slightly increases the response time of the brain.
- Thermal effect may results in increase of device temperature by fraction of degree. However blood circulation is capable of disposing this excess heat by increasing local blood flow. But cornea of eye does not have this temperature maintenance facility, thus harmful effect.
- It has been found in recent researches that up to some extent mobile phones are responsible for wrinkles & other early ageing effects.

II. SOME MYTH & CONTRADICTIONS RELATED TO HEALTH ISSUES

There are many myths regarding the negative impact of mobile/wireless devices on health. This is because the researches & the studies carried out by different countries/scientists on the same topic results differently. So, there is a great contradiction in many of such health issues. Some of these issues are:

- Some studies suggested a link between exposure to radiation from cell phones and an increased risk of 'acoustic-nuroma'- a tumor of the nerve connecting the ear to the brain--but more recent research found no such links. However studies suggest one hour of cell phone use per day significantly increases tumor risk after ten years or more.
- The chances of brain cancer due to the use of mobile phones get increases because it causes the damage of DNA cells & creates genetic mutation that develops into cancer. This fact is a contradictory one because about 45-50% research reports available opposes the fact.
- Some researchers also conclude that the effect of radiation on brain can be minimized if the ear-phones are used instead of directly using the mobile phones for talking. On the other hand, many researches discarded these results.

III. STEPS TO BE TAKEN TO MINIMIZE THE NEGATIVE IMPACTS

The adverse effect of wireless technology on health can't be completely neglected. Hence, following steps are to be taken to minimize the negative impacts of wireless/mobile technology on health:

- Adoption of guidelines issued by 'International Commission on Non-Ionizing Radiation Protection' (ICNIRP) for wireless/ mobile devices imposing basic restriction in terms of SAR (Specific Absorption Rate).
- Manufacturers must be instructed to indicate the level of radiation on product itself to clearly communicate the potential danger of wireless devices radiation & exposure on health.
- Limit the uses of wireless devices especially mobile phones for children. Other devices except mobile phones should be kept in 'Off' mode to minimize radiation.

- However this is not possible for all the time but people should keep away such devices from their body as much as possible. For e.g. people often have the tendency to keep mobile phone below their pillow or onto the table beside the bed while sleeping, this should be avoided.
- People can minimize the no. of minutes/ hours that they spent on talking via mobile phone.

Conclusion

Seeking Possibilities In Future

The future of wireless technology in the area of public healthcare is very bright. Since this technology is directly involve in service to the mankind, hence it's always going to produce some fresh applications in the same area & will always be never-ending field of researches & inventions. The possibilities are also very high due to the fact that this technology offers a high degree of compatibility with other technologies. Many NGOs working with the motto to improve the public health have started several of their programs where they greatly need the wireless technology to conduct their tasks. Keeping in mind about the popularity of the technology & the researches that are being carried out currently, it can be expected that wireless/mobile technology will always continue to come up with new miracles to revolutionize the system of public healthcare.

References

[1] http://en.wikipedia.org/wiki/Wireless
[2] http://www.uneca.org/AU2010/docs/Impact_on_health.pdf
[3] http://healthcareengineering.usc.edu/
[4] http://www.motorola.com/web/Business/Solutions/Industry%20Solutions/Healthcare/Motorolahealthcarebrief_wireless.pdf
[5] Reports published in Times of India (page11) on 22 & 28 Feburary 2011.