



Wireless Health: A Primer

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Abstract Health is regarded as one of the global challenges for mankind. A modernized healthcare system should provide healthcare services to people at any time and from anywhere. This is achieved by taking advantage of modern computer networks (Internet connectivity), wireless technologies, and mobile networks. The introduction of wireless technologies in healthcare will lead to an increased accessibility to healthcare providers and a higher overall quality of healthcare services for the patients. Wireless health provides constantly vigilant health monitoring and guidance towards wellness for individuals. This paper provides a brief introduction to wireless health.

Keywords wireless technologies, healthcare system, wireless health

1. Introduction

Wireless health (which was known as telehealth several years ago) is the marriage of the healthcare system and wireless technology. The World Health Organization (WHO) regards sound health as a fundamental right for an individual. Healthy individuals contribute greatly to the economy and to tax revenues. They also reduce pressure on the already overloaded healthcare system [1]. Staying well and avoiding hospitalization is good for patients as well as the healthcare system.

The wireless technology relies on a network of fixed antennas or base stations. Wireless networks that allow high-speed Internet access, such as wireless local area networks (WLANs or Wi-Fi), and are also increasingly common in homes, hospitals, offices, airports, schools, residential areas, etc. [2]. If you enter any hospital today, you will see various forms of computers, indicating that computing technology has become commonplace in today's healthcare system. For maximum utility, these computers need to be connected. Thus, hospitals are increasingly becoming connected and turning to wireless technologies to operate more efficiently.

Why Wireless Health

Doctors, nurses, staff, patients, and medical devices are constantly on the move.

There is increasing number of wireless devices being used by both hospital staff and patients. There has been an exponential rise in the Bring Your Own Device (BYOD) trend within the healthcare practitioners. Patients bring with them their wireless smart devices and expect the hospital to provide wireless Internet services for free. These devices must be able to coexist with all other devices found in the environment and be compatible with other wireless-based systems [3].

The traditional healthcare is confined to hospitals and other fixed places, making it inconvenient for patients or healthcare practitioners to move. In order to achieve to continuously monitor the patients' physiological information wireless health is needed [4].

Wireless health is the integration of wireless technology into the healthcare system allowing devices in the system to be connected anywhere, anytime. Wireless technology creates highly connected healthcare



environments and helps hospitals to address some of their challenges such as aging population, patient safety, data accuracy, and mobility. Services provided by in wireless health system include remote monitoring, disease management, rehabilitation guidance, etc. With the aging population comes an increased demand for quality access to healthcare and remote patient monitoring.

Applications

Wireless health can be used in diagnosis, monitoring, and treatment of illness.

- Remote Monitoring:** Remote monitoring technology can simultaneously monitor vital signs while keeping track of the users' location. It can continuously measure key parameters of patient including electrocardiograph (ECG), blood pressure, heart rate, body temperature, respiratory rate, and patient's body movement, and transmit the information to the doctor. Such ambient health-monitoring could avert a medical crisis (such as a heart attack or stroke) and keep you out of the hospital and save money. The system makes healthcare applications available in remote areas, such as homes, schools, nursing homes, military camps, etc. Each care coordinator can monitor several patients simultaneously. Remote monitoring will improve the treatment of diabetes and heart disease [5]. It can also help special populations such as seniors through home monitoring of chronic diseases. The monitoring environment must ensure that the infrastructure is sending the correct information at the correct time to the correct place. The most popular monitoring systems available in the market consist of a small monitoring device in the form of a watch or tag and a base station installed in the home [6]. (Wireless glucose monitors are already on the market.) By using the monitoring system the healthcare professionals can monitor, diagnose, and advice their patients all the time. The monitoring system can be used for all ages and can continuously, wirelessly monitor the health of the patients. A typical remote monitoring system is shown in Figure 1 [7].

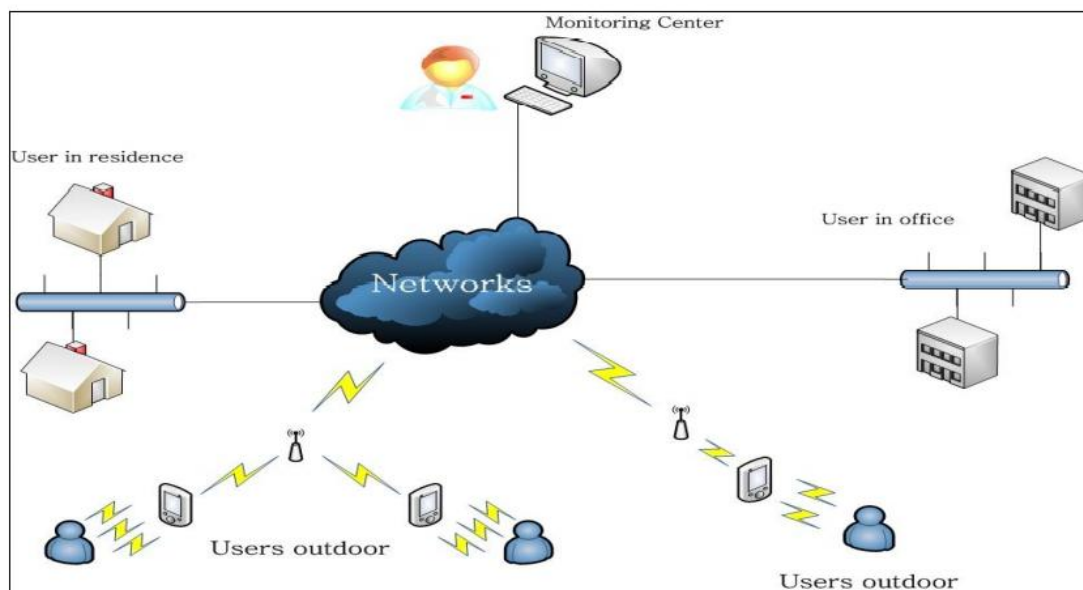


Figure 1: A typical health remote monitoring system [7]

- Wireless health care (home security):** The aging of the baby boomers is a common problem in both developing and developed nations as the number of aged people is increasing. Most elders live alone and experience falls occasionally. A wireless, wearable, low cost, and automatic health monitoring system could provide a suitable solution that can save lives. Elders can use the system to communicate with the central monitoring service center and request for service. Figure 2 shows a typical wireless health care system [8].

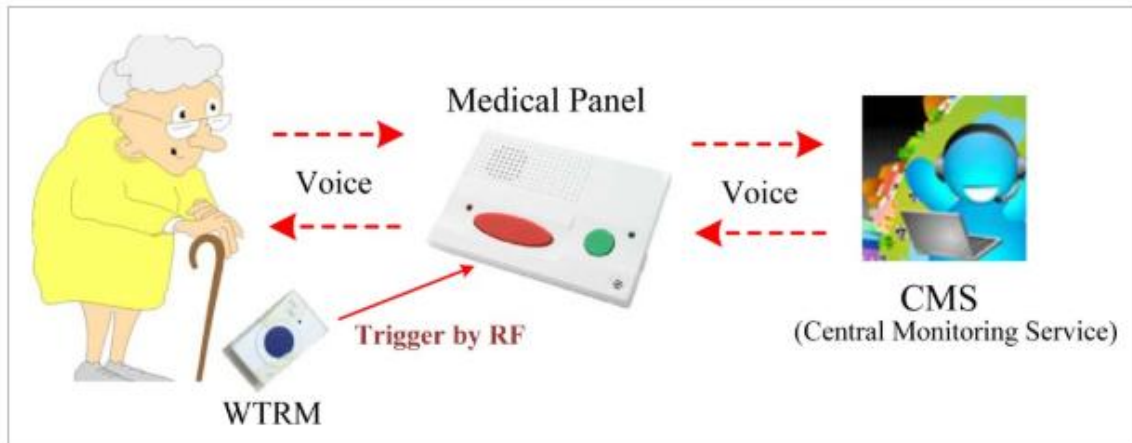


Figure 2: A typical wireless health care system [8]

- **Electronic Health Records:** In connected hospitals, every medical device is connected with the Electronic Health Records (EHR) for communicating accurate patient records and automatically sending data from devices to the HER. Connecting devices to HER systems drastically reduces the time it takes to enter vitals.

Benefits

Wireless health could fulfill the vision of healthcare to anyone, anytime, and anywhere. Wirelessly healthcare networks will achieve remarkable efficiencies in terms of quality patient care, patient safety, data accuracy, enhance security, increase patient/physician mobility, reducing costs, allowing healthcare professionals to remotely control devices, and handling higher patient volumes. In connected hospitals, wireless technologies allow caregivers and patients to roam within the hospital while providing timely monitoring. They also allow caregivers to use wireless devices to provide the best quality of care without being preoccupied by time-consuming administrative tasks. When doctors are empowered with real-time, up-to-date patient information, they can make better decisions which in turn lead to better treatment. In spite of these benefits, hospitals hesitate to adopt wireless devices due to security and patient safety concerns [9].

Challenges

Implementing wireless technologies brings some challenges. Security is a major concern to ensure patient safety and privacy. Access to hospital Wi-Fi networks and the resources must be controlled. All Wi-Fi connections must be secure to protect sensitive information. All data must be encrypted. Hospitals are well known for being complex with medical devices placing stringent requirements on Wi-Fi connections. Each hospital has its own unique wireless infrastructure and lacks standardization of interoperability. Since the airways are shared, preventing interference between all the access points in the hospital is challenging.

As shown in Figure 3, wireless radiation comes with risk [10]. There has been concern about possible harm or health consequences associated with the electromagnetic fields produced by the base stations and wireless technologies. The Federal Communications Commission (FCC) has required that all wireless devices (such as smartphones, car door remote controls, Wi-Fi devices, baby monitors, and personal computers) sold in the US meet its minimum guidelines for safe human exposure to radio frequency (RF) energy. These challenges must be overcome in order to fully realize the benefits of a connected hospital [9]. The healthcare community alone may not be able to manage these challenges. It will require the joint effort of manufacturers, government, and healthcare professionals.





Figure 3: Wireless radiation comes with risk [10]

Conclusion

The wireless medical devices are evolving at a much faster pace than our ability to figure out all the potential consequences. The wireless healthcare revolution does have a few obstacles in its path such as patient security and regulatory hurdles. These challenges must be addressed before realizing the ubiquitous use of wireless health systems. More information about wireless health can be found in the books in [11,12].

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