Home-Based U-Healthcare Systems Architecture

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Abstract

Modernization of medical healthcare system using technology has become an important in research direction today. Transforming healthcare so as to better meet the needs of patients will require changes to strengthen delivery of care for patients who already have a good access to services, as well as changes to improve care for patients who find it harder to get the care they need.

Diagnosis is an important process in patient care. A suitable diagnosis helps a physician determine a precise treatment. A system that combines availability, cooperation and harmonization of all contributions in a diagnosis process will bring more confidence in healthcare for the physicians. Thus in this paper, we proposed an efficient architecture for u-healthcare diagnosis system which can be used from the patients’ side to diagnose the disease they suffering from and that will help the patient know what their possible ailments.

Keyword: Homecare, Wearable Health Monitoring

1. Introduction

Access to healthcare varies across countries, groups, and individuals, largely influenced by social and economic conditions as well as the health policies in place. Countries and jurisdictions have different policies and plans in relation to the personal and population-based health care goals within their societies. Healthcare systems are organizations established to meet the health needs of target populations. Their exact configuration varies between national and subnational entities. In some countries and jurisdictions, health care planning is distributed among market participants, whereas in others, planning occurs more centrally among governments or other coordinating bodies.

This paper aims to provide a pervasive architecture for u-Healthcare by optimizing the advantages of diagnosis system to perform continuous monitoring of patients under their natural physiological states. Thus, U-Healthcare diagnosis system architecture was designed to improve the reliability and efficiency of U-Healthcare Systems. The goals and objectives were based on the issues that focused on u-Healthcare systems in hospitals, homes, offices, and for travelling patients.

2. Related Background

This chapter provides an overview of the enabling technologies for ubiquitous Healthcare System. This examines the combination of enabling technologies, relevance of IP-Based technologies, and its application to the u-healthcare systems.

2.1. Innovation in Healthcare

Innovation in healthcare continues to be a driving force in the quest to balance cost containment and health care quality. Healthcare innovation can be defined as the introduction of a new concept, idea, service, process, or product aimed at improving...
treatment, diagnosis, education, outreach, prevention and research, and with the long term goals of improving quality, safety, outcomes, efficiency and costs [4].

The conceptual framework for innovation in healthcare is as shown in Fig. 1. The healthcare organizations serve six distinct purposes – treatment, diagnosis, prevention, education, research and outreach. In serving these purposes, healthcare organizations must manage quality, costs, safety, efficiency and outcomes. At the very core of healthcare innovation are the needs of patients and the healthcare providers who deliver care. Healthcare innovation focuses mainly on three areas— a) how the patient is seen, b) how the patient is heard, and c) how the patient’s needs are met.

![Figure 1. A Conceptual Framework for Innovation in Healthcare [5]](image)

2.1. Smart Healthcare

Using smart healthcare, simple medical service can be possible without visiting the hospital in the future. Through bio sensors attached to our bodies, our heart rate and ECG is monitored by real-time throughout our everyday life. Through this monitoring process, strange symptoms in our body will immediately be detected to send necessary messages. This will prevent losing opportunity of therapy time [5, 6]. Also, real-time monitored data will be analyzed based on medical information for simple diseases to be cured without going to the hospital.

2.2. U-Healthcare

U-Healthcare is an IT based technique which enables the management of diseases, health, and life anywhere and anytime and also makes a healthy and safe life possible. The ultimate goal of u-Healthcare is “the pursuit of improvement of the quality of life.” And to realize it, future u-Healthcare based on the generalization of IT/infrastructure such as the improvement of ICT and establishment of network, etc. will rapidly change due to the occurrence of new diseases, aging of the population, increase of consumers desires of health, data development of mass processing and storage technology based on broad band network technology, sensor network development such as RFID, business extension of medical solution providers, governmental health promotion policies, etc. Health care in the ubiquitous society is predicted to evolve based on intelligent health care providing medical and health care based on information acquired by sensors. U-Healthcare with the use of smart mobile health monitoring applications will emerge industry as a new medical
service paradigm which uses internet, mobile, among other information communication technology (ICT) in the existing medical system providing medical health information, knowledge, services and products to the consumers.


Wireless Sensor Network (WSN) technology plays a vital role in enabling communication capabilities and the visualization of ubiquitous healthcare systems to simplify the remote monitoring and treatment of patients. WSN technology can improve the quality of life of patients, provide early detection for certain ailments, and improve doctor-to-patient collaboration effectively. WSNs in u-Healthcare improve and expand the quality of healthcare across a wide range of situations and for different sectors of the society. For example, WSNs can enable early detection of clinical deterioration through real-time patient monitoring in hospitals (O. Chipara et. al.,) enhance emergency respond team’s capability to provide emergency care, improve the life quality of the elderly through smart environments (G. Virone et. al.,) and others.

A wireless sensor network (WSN) is defined as spatially distributed autonomous devices using sensors to monitor a physical or environmental condition (such as temperature, sound, pressure, etc.) that incorporates a gateway that provides wireless connectivity to remotely distributed nodes of devices (http://en.wikipedia.org/wiki/Wireless_sensor_network). Wireless sensors are embedded in a wide range of medical and healthcare instruments for use at hospitals, healthcare centers, and homes. Such sensors (thermometers, blood pressure monitors, glucose monitors, electrocardiography (EKG), photoplethysmogram (PPG), electroencephalography (EEG), and various forms of imaging sensors) provide patients and their healthcare providers insight into physiological and physical health states that are critical to the detection, diagnosis, treatment, and management of ailments.

The WSN in u-healthcare make patient monitoring and healthcare easy and more effective as shown in Figure 1. It conglomerate transducers for detecting electrical, thermal, optical, chemical, genetic, and other signals with physiological origin with signal processing algorithms to estimate features indicative of a person’s health status.

![Figure 2. A WSN Application in U-Healthcare](image-url)
4. Diagnosis Application

This system (shown in Figure 3) contains six different types of agents: the main agent (MA), the user agent (UA), the medical store agent (MSA), a database wrapper (DW) and some doctor agents (DA), media and govt. agent (MGA).

User Agent:
• User agent enters his/her symptoms and gets the list of available doctors in clinic, hospital, nursing homes in the city.
• The user agent can chat or mail to the doctors.
• The user agent can view his/her health profile.

Main Agent:
• The main agent searches the best available doctors in the city.
• The main agent fixes appointment to the doctors.
• The main agent searches the medicines available in the different medical stores in the city through medical store agent.
• The main agent send alert about possible epidemic situation to the media and government agent in the city.

Doctor Agent:
• The doctor agent prescribes the medicine.

Media and Government Agent:
• The media and government agent can view the alert about the possible epidemic situation in the city.

Database Wrapper:
Database wrapper stores the data and performs analysis on the data to generate the required result.
5. Conclusion

Many developing countries are facing the shortage of medical experts in medical field. Due to shortage of medical expert they are getting a huge queue of patients in hospitals. Especially in rural areas we have young medical expert or don’t have medical expert. This Architecture for U-Healthcare Diagnosis System can be substitute of the above problem. This is very useful to diagnose patient diseases and prescribe the good prescription to the patients as a human medical expert. From the above study, it is concluded that this Architecture for U-Healthcare Diagnosis System can be applied any hospitals any country for improving medical services. Also this system can be applied anytime, anyplace, any hospital to provides medical prescription for general diseases. The system adopts user-friendly control interface and the usage of easy words makes the user to operate the system without doubts and difficulties. The openness of the source codes and documentations will make future enhancements and improvements can be done easier. As the system was tested matching the desired input with the desired output thus the system has a certain level of reliable.
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