AN ANALYSIS OF MOBILE AD HOC NETWORK BACKBONE FOR E-HEALTHCARE

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ABSTRACT

In recent decades MANET has been a tremendous technology in the networking field. MANET is infrastructure-less and self-configuring between networks. Without using wires, the mobile devices are connected in the wireless network. MANET is also referred to as a wireless ad hoc network. In medical applications wireless ad hoc network plays a vital role. Healthcare is a developing area in medical applications, which monitor patient health by the wireless sensor network. The sensor is a small wearable device such as eWatch, HipGuard, Panic button, Shoe-based smart-sensing and T-shirt-based smart-sensing devices, etc. Wireless Body Area Sensor Network frequently monitors patient health and sends the bio-signals through Smart Phone Ad hoc Network. This paper presents a brief review of the 5G Smart Phones Ad hoc network in e-healthcare architecture and applications and challenges in e-Healthcare.

Keywords : MANET, 5G SPAN, e-Healthcare.

I INTRODUCTION

Today millions of people suffer from chronic diseases worldwide and spend 90% of their savings on healthcare plans. The growing population in developed countries force governments to increase their healthcare budgets. Health-monitoring is performed periodically to update the patient's symptoms constantly. Health-monitoring is done by wireless network architecture. E-health is deploying ICT in healthcare; m-health focuses on using mobile communications, medical sensors, and wearable technologies.

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Wearable monitoring is to reduce the burden and to help with expensive medical treatments. In mobile communication for health support is largely deployed with machine to machine communication. The WSN is used to monitor the patient's health condition continuously by using wireless ad hoc networks. A number of various wearable health monitoring devices are used to measure physiological signals (Fig 1). Various medical health applications can assist a patient in various activities such as smoking, weight-loss diets, and monthly hospital checkups.

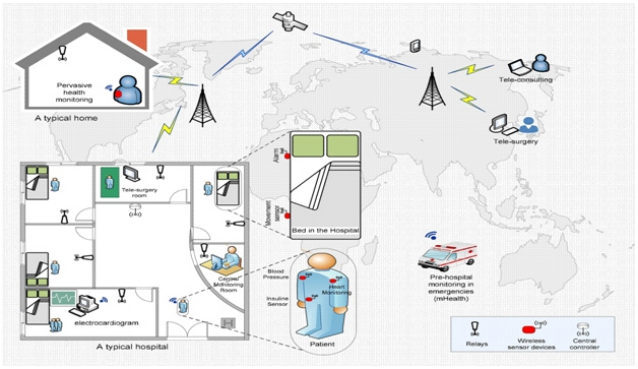

Figure 1. Wireless Health Monitoring System

Sensor data transmit to intelligent e-health gateways, which support different communication protocols. They receive data from different sub-networks. Biomedical and sensor signals are captured from the body/room used for treatment (Fig 1). Serial, SPI, Bluetooth, and Wi-Fi are used to transmit data to the gateway via wireless and wired communication protocols.

II RELATED WORK

This paper [1], presented a smart network architecture for e-health applications and focused on multiple complementary wireless communication access networks between the

patients and the system through UMTS, WiMax and the internet. The paper [2], presented wireless multihop ad hoc networks to implement a layered networking structure and software-defined networking principles. This was achieved through text-messaging, photo-sharing and multiplayer-game applications sharing data in a single hop of 5Mbps transmission bandwidth and 2-hop of 4Mbps transmission bandwidth. This paper focused [3], on the integrated network as a smart ad hoc network (SAN). The sensor nodes distributed storage facilities for some critical data. This paper [4], discussed a wireless patient-monitoring system which monitored patient health under various parameters like pulse rate, temperature, etc.

The basis of health monitoring was data acquisition, which involved patient sensor data, which was converted to digital form for processing and communication stages. Any change in the patient's health status was transmitted through vital signs. This paper [5], represented VANET-and-WSBN-based modern healthcare system. This paper [6], represented an evidence-based trust model by the theory of ARMA/GARCH which is used to predict future behavior derived from its past behavior. This paper [7], presented an intra-BAN communication, inter-BAN communication, and beyond-BAN communication.

This paper [8], presented a reliable wireless communication protocol and monitor the patient abnormal conditions were detected and save the patient's lives. This paper [9], focused on various healthcare monitoring features such as wireless body area sensor network applications, programming framework, security issues, and energy-efficient routing protocol. This paper [10], focused on collected patient movements and parameters by small wearable or implantable sensors using short-range. The m-health [11], combining with 5G wearable sensors, IoT and big health data enables flexible interaction between patients, doctors, clinics and hospital departments.

This paper [12], presented a complete smart home that was expressed to bring healthcare services with the aid of modern technologies. The smart home modern technologies are wireless communication platforms, high-performance processors and environmental and medical sensors. The purpose of IoT is to connect all the sensor devices and home systems which continuously monitor the patients' health and environment safety and security. This paper [13], focused on smart living-solution platform of medical and mobile devices and IoT ecosystem of smart wearables, which are intelligent non-invasive bio-signal recording systems.

This paper [14], presented fast-developing IoT technology which is connected to several smart things with sensors. Healthcare is one of the most developing domains in IoT. This paper mainly focused on the transmission of medical data between the sensor devices and remote servers. This paper also considered security risks such as attacks, various threats, and vulnerabilities. This paper [15] focused on two types of biosensors which are ECG and EMG equipment by using wireless sensors of SHIMMERTM wearable biosensor technology. This paper gave a comparison of EMG and ECG equipment.

III NETWORK BACKBONE OF BIOSENSORS

Rapid growth of smart phones has made a solid personal computing device for e-health applications. A smartphone can create an ad-hoc network with sensors.

Low Latency – In M-Health applications healthcare systems monitor and help the patient with medical attention by achieving low latency 1ms.

Bandwidth – In biomonitoring sensors monitor patients' health and send information quickly by using 5G networks, which support very high frequencies.

Network Capacity - 5G networks increase the network capacity due to increasing biomedical sensor devices.

Long Battery Lifetime –M-Health system is to implement the self-sustainable batteries supplying power for the full duration medical treatment.

Security – 5G networks have new ideas of network architecture, new business models and new techniques of privacy protection.

IV ADVANTAGES & DISADVANTAGES OF MOBILE AD HOC NETWORKS FOR E-HEALTHCARE

MANET is an infrastructure-less network, where nodes are free to move randomly at any given time. MANET interconnection between the nodes can change rapidly. Nodes in MANET cooperate among multi-hop communications. In biosensor networks, devices form a self-creating, self-organizing and self-administering wireless network called a mobile ad hoc network (Fig 2). In MANET the future essential features are flexibility, freedom from infrastructure, ease of deployment, auto-configuration and low cost.

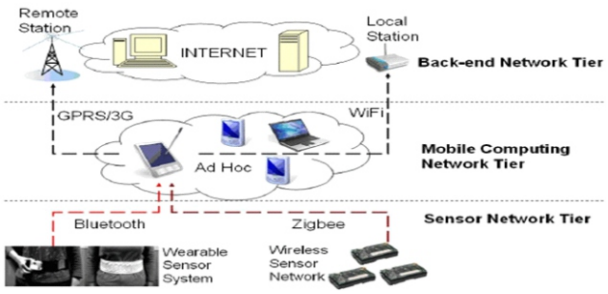

Figure 2. MANET Communication

V SMART PHONE AD HOC NETWORK

The multimedia sensors such as motion detector, microphone and camera are used in e-health monitoring. Shoe-based sensor system monitors the activities of the person like the pattern of heel acceleration and pressure activities including sit/stand motionless, climbing, cycling, walking, etc (Fig 3). WBASN system is equipped with sensors to monitor patients' movement and physiological conditions, WBSN monitors the heart rate and blood pressure of patients. A smart-shirt-based WBASN technology continuously monitors the health of people, with panic button in the wearable sensors, which a patient could use to generate alarm in an emergency.

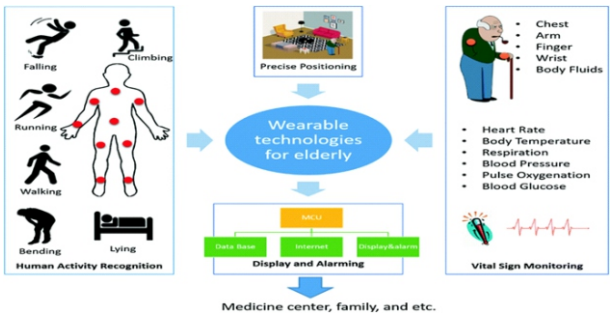

Figure 3. Overview of Wearable Technologies

VI BIO SENSOR DATA TRANSFER USING SPAN

WISAN – Wireless Intelligent Sensor and Actuator

- Network is structural health-monitoring in mind.
- Bio Radio Physiological Monitor – It receives signals by ECG, EMG, EEG, etc. It works on Bluetooth with a range of 10 meters.
- Qardiocore –Wearable sensor, which is used for continuous ECG monitoring.
- BTS – BTS FREEEMG is the smallest EMG device. It continuously records data up to 8 hours.
- SHIMMER – Sensing Health with Intelligence, Modularity, Mobility and Experimental Reusability.

VII CONCLUSION

Nowadays mobile monitoring systems provide medical assistance for long distances. These systems continuously receive signals through biomedical sensors and provide information on the health condition of the patient. The proposed paper focuses on the continuous health monitoring of patients using SPAN technology. This proposed system includes wearable sensors and smartphone and database system. It keeps data of all patients. Artificial Intelligence is used to predict the condition of the patient by Rule Based Healthcare Decision Support System. 5G SPAN technology

may provide continuous monitoring of patient health worldwide. 5G SPAN RBHDSS may handle a huge amount of data simultaneously, and create huge opportunities in the future.

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