

A Study on Health Care in Internet of Things

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Abstract— Healthcare becomes one of major economic and social problems around the world, especially in aging people, where it costs tremendous health expenses and resources. The advancement of technology and consistent improvement in machine to machine technologies lead to the era of internet of things (IoT). The new trends in health care are gradually progressing with the help of IoT which may make us more health conscious. This paper reviews the concepts, applications and various existing technologies for health care. We have enumerated the difference between those techniques and brief explanation of scope of IoT in personalized health care.

Keywords- *Internet of Things ; healthcare ;M2M technologies; wireless sensor networks; security*

I. INTRODUCTION

“**Internet of Things (IoT)** is the network of physical objects or "things" embedded with electronic devices, software technologies, sensors, and network connectivity, which facilitates these objects to collect and exchange data for availing various services.” It is a concept demonstrating a connected set of anything, any one, any time, any place, any service and any network connection [1].

Simply we can say that IoT is a concept of basically connecting any device with an on and off switch to the Internet (and/or to each other). This includes every thing from smart phones, smart coffee and tea makers, washing machines, headphones, lamps, wearable devices and almost anything else you can think of (nano to macro devices). The analyst firm Gartner says that by 2020 there will be over 26 billion connected devices and that’s a lot of connections (may be over 1.5 trillion). The IoT is a huge network of connected “things” (which also includes common people). The relationship will be between people-people, people-things, and things-things [1], [3], [4].

Recently, wearable devices, such as smart wristwatch, ring, bracelet and hair lace, are widely applied to offer continuous healthcare, e.g., physiology parameter monitoring for remote healthcare, heart rate record for workout intensity or training, and calorie burn during fitness. These smart watches, health monitors, pedometers, activity trackers and virtual reality headsets are all part of the emerging landscape of wearable technology, which promises to not only change the way we exercise and communicate but also support the emerging healthcare. In the last few years, this field has attracted wide attention from researchers to address the potential of the IoT in the healthcare field by considering various practical challenges. As a part of this, there are now numerous applications, services, and prototypes in the area.

Consisting of these ubiquitous wearable devices, healthcare systems take the advantages of heterogeneous mobile networks[2] (e.g., cellular network, Wi-Fi and Device-to-Device (D2D) communications) and powerful computational servers (e.g., cloud server) to collect the health information sensed by wearable devices, analyze/process the information for health monitoring and diagnosis, and enable users’ social interactions.

For example, the patients can wear the dedicated wearable devices which continuously measure their physiology information, such as body temperature, heart rate, blood pressure and Oxygen saturation. Meanwhile, doctors or patients’ families can use desktops and smart phones to remotely access these health records.

The severe scenario, such as fainting and heart problem, the wearable devices can automatically report the health condition of the patient to his doctors and families. In addition to this feature, such systems can also act as promising wearable and social applications, e.g., sharing physical condition and activity information provided by wearable devices among social friends.

II. BACKGROUND

A. *Internet of Things*

The term internet of things was first proposed by Kevin Ashton in 1982 [1]. IoT is a combination of hardware and software technologies along with embedded devices which enables to provide services and facilities to any one, anytime, anywhere required using any network.

B. *Healthcare using wireless sensor networks*

The health care applications using IoT are increasing day by day and more because of sensor devices. The IoT has the potential to give rise to many medical applications such as remote health monitoring, physical fitness programs, Alzheimer’s diseases, and elderly care [2].

The IoT healthcare system mainly tries to work on the existing wireless sensor networks, embedded device technologies and ubiquitous computing. IoT systems need to provide the services to any one at anytime and anywhere. So we need architecture to implement the health care systems more efficiently and with less cost.

Here we briefly explain the wireless health care system which can be enabled to use along with IoT systems. It consists of health sensors, smart phone devices and server system to control and manage the information. The sensors will take input values and will send to the server using the smart phone. The server processes the data and informs patients. These health care systems help the patients to take to decisions suggested by the application.

The figure 1 shows diagram wireless networks work for helping the patients. It consists of sensors attached to human body, wireless devices, server system and doctors and hospitals that provide the services to the patients for their well fare. The sensors try to collect the data continuously for keep tracking of patient details. They also try to locate the patients after the discharge by using their health records.

increase of interest in wearable devices may lead to reduce the cost of these devices.

In [12] Shiliang et.al proposes architecture of remote monitoring cloud platform of healthcare information. The system uses a PSOSAA algorithm for medical monitoring and managing application of the hospital information system. This simulated system can improve efficiency about 50%.

In [11] Alok et.al reviews healthcare applications of the internet of things. The IoT based health care systems are clinical care, which provides continuous automated flow of information about patients and remote monitoring which enables wirelessly monitoring patients.

In [13] Val et.al proposes a body sensor networks for mobile health monitoring. Two approaches: PHM and MobiHealth. The PHM system adopts the policy of local processing, with interpretation algorithms running locally on the mobile system worn by the patient. In contrast the MobiHealth BAN is designed to be inherently a telemedicine system so feature is transmission of data to a remote system or user.

In [14] Media et.al proposes health care monitor system using wireless sensor networks. The main advantage of this system in comparison with previous systems reduced energy consumption, extended communication coverage to increase freedom for enhanced patient's quality life.

In [17] Valerie et.al describes a personal heart monitoring application using a smart phone and wireless (wearable) sensors. It was able to detect life threatening arrhythmias locally on a smart phone. System generates alarms and warnings when it crosses thresh hold values to inform the patient.

In [16] Mir et.al proposes Internet of Things (IoT) provides an opportunity of discovering healthcare information about a tagged patient or medical object by browsing an Internet address or database entry that corresponds to a particular Radio-Frequency Identification (RFID) tag. The tags interact with healthcare information system for automating managerial everyday tasks like admission care, transfer and discharge details.

Finally, the table I briefly explains the services provided and sensors used in the each system for patient monitoring.

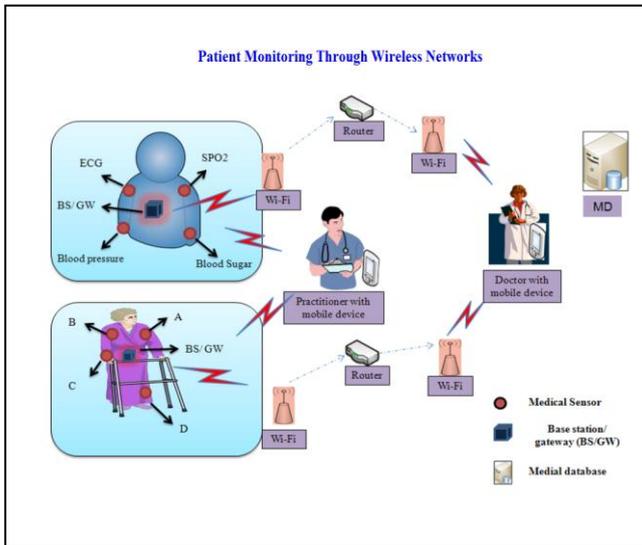


Figure 1. Wireless sensor networks for healthcare.

In case of any emergency, the wireless wearable devices can remotely report the health condition of the patient to his doctors and family members. In such situation the doctors and hospitals will try to immediate services such as ambulance or providing necessary actions to the families for aiding them to help the patients.

III. RELATED WORKS

In [6] Urs et.al proposes an advanced care and alert portable telemedical monitor (AMON), a wearable medical monitoring and alert system targeting high-risk cardiac or respiratory patients. It consists of a wrist-worn device which acts as a communication link and a comprehensive medical center software package.

In [7] Luca et.al proposes smart hospital system for automotive monitoring and tracking of patients, personal and biomedical devices within hospitals and nursing institutes. The system mainly deals with two cases: patient monitoring and management of emergency situation.

In [8] Rui et.al suggests a system for applying internet of things (IoT) for personalized healthcare in smart homes. Continuous monitoring of physical parameters and processing health data makes the system much smarter one. The core functionalities of system are exposed using RESTful web services to the consumers.

In [9] Arif et.al proposes a context aware intelligent wallet for individuals to store their bio-signals and wallet shares the finding with appropriate persons. Special hardware is needed to implement sensor nodes.

In [10] Subhas et.al reviews the existing wearable sensors for human activity monitoring. The system plays an important role for continuous monitoring of physiological parameters especially of the elderly or chronic patient. The survey shows

TABLE I. COMPARISON OF EXISTING HEALTHCARE SYSTEMS

Approach	Sensors	Services and technologies
An IoT-Aware Architecture for Smart healthcare Systems	Temperature sensor, barometric pressure, ambient light, 3-axis acceleration and ECG sensor.	Remote monitoring, management of emergency situation
Medical Monitoring And Managing Application Of The Information Service Cloud System Based On Internet Of Things	Body sensor, environment sensor and activity sensor	Medical monitoring and managing in hospital systems, PSOSAA algorithm for medical monitoring
Applying Internet Of Things For Personalized Healthcare In Smart Homes	Room temperature sensor, room temperature controller, body temperature sensor and light sensor	IoT system for smart homes, layered approach

Approach	Sensors	Services and technologies
Context Aware intelligent Wallet for Healthcare	Motion sensors, environment sensors	Intelligent wallet for supervised monitoring of individuals, layered approach
Healthcare Applications Of The Internet Of Things: A Review	Pill camera, wrist band, fitness tracker	Clinical care, remote monitoring
AMON : A Wearable Multi parameter Medical Monitoring And Alert System	SPO sensor, ECG sensor, blood pressure sensor, acceleration sensor and temperature sensor	Wrist worn medical device, monitoring and alert system for cardiac/repertory patients.
Around The Clock Personalized Heart Monitoring Using Smart Phones	ECG monitor, oximeter, blood pressure monitor and GPS	Alarms and warnings for patient, system high risk cardiac patients.
Body Sensor Networks For Mobile Health Monitoring	ECG, accelerometer, blood pressure monitor, pulse oximeter, weight scale and GPS	Cardiac rhythm monitoring, cardiac rehabilitation, copd problems, discharged patient monitoring
A Hospital Healthcare Monitoring System Using Wireless Sensor Networks	Blood pressure sensor, heart rate monitor.	Increases coverage of services, decreases end to end delay
The Appliance Pervasive of Internet of things in healthcare systems	RFID tags	Medical products with epc tags, tagged patients

IV. PROPOSED SYSTEM

The proposed system uses all the capabilities of Internet of Things by connecting the smart devices or things with human beings to provide them the best health care. It composes of all the correct elements from each method, so we can have a perfect recipe for yielding the best health services, which leads to the minimized error free version of the existing systems. The new system, IoT Health system which will be monitoring the conditions of a person using various sensors such as heart rate sensor, temperature sensor, blood pressure sensor, etc. Sensors can be converted to into any time wearable devices if the user wants to use it all the time. Now the system will send the collected data to the smart things; which transferred to the system server via IoT network using IoT gateway. Next system analyses these values and predict the chance of occurring the diseases. If the patient is indeed in critical care ,the system automatically alert the hospital and doctors so that the patient can receive immediate services (such as ambulance , help of doctors ,etc) as soon as possible. Thus patients with heart diseases, old age problems can use the system as a automatic hospital system. Even it might help in the detection of chance of having diseases in advance.

V. CONCLUSION

The internet of things, devices gather and share information with each other, making it possible to collect, analyze/process and store data more accurately. Thus IoT can also be use for patient monitoring and provides services to the patients. The IoT based health care system will provide services in a timely manner and may save the life of millions. In this paper, we try to compare the existing methods for ensuring the healthiness of patients. It ranges from wrist worn devices to IoT health care systems. With advancement of IoT enabled health care systems, we will have a revolution in health care that changes society as once did by industry revolution. Also these need to make sure the privacy and quality of life of every person.

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