Smart Health Care System Using Internet of Things

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Abstract – The rapid development of Internet of things (IoT) technology makes it possible for connecting various smart objects together through the Internet and providing more data interoperability methods for application purpose. Recent research shows more potential applications of IoT in information intensive industrial sectors such as healthcare services. However, the diversity of the objects in IoT causes the heterogeneity problem of the data format in IoT platform. Meanwhile, the use of IoT technology in applications has spurred the increase of real-time data, which makes the information storage and accessing more difficult and challenging. Here in this paper a more efficient machine to machine communication is achieved for health care datas.

Index Terms – Internet of Things(IOT), Machine to Machine communication(M2M), Pulse Oximeter,EoR.

1. INTRODUCTION

In the last decade, a growing number of researches have been conducted toward using IoT technology to acquire data ubiquitously, process data timely, and distribute data wirelessly in the healthcare field [3], [4]. In [5], Ambient Assisted Living (AAL) is designed to support daily activities of elderly people independently as long as possible. In [6], IoT technology is used to support medical consultations among rural patients, health workers, and urban city specialists. With the use of IoT, M-health concept, which is defined as mobile computing, medical sensors, and communication technologies for healthcare, attracts more and more researchers applying fourth-generation (4G) mobile communication technology and IoT in healthcare service [7]. The above-mentioned uses of IoT technology bring both opportunity and challenges in ubiquitous data accessing medical services. More attentions have been paid in developing ubiquitous data accessing solutions to acquire and process data in decentralized data sources [8]–[10]. In [11], the software adaptation approaches are surveyed in ubiquitous computing for resource constrained devices to react to the changes of user requirements actively and transparently. In [12], control functionalities are designed to coordinate hybrid wireless networks in cloud computing. In [13], a metro system based on data-centric middleware is simulated to publish/subscribe message remotely. In [14], researchers use publish/subscribe-based middleware to disseminate sensor data in cyber-physical systems. A cloud platform is developed in [15] to handle heterogeneous physiological signal data to provide personalized healthcare services. In the related research, clinical data heterogeneity is still the main obstacle that hinders the clinic data integration and interoperation. Recently, RESTful (Representational State Transfer) resource oriented model has been extended from a kind of software architecture originated from Web service research mainly for Web service interoperation to Web resources management. In this research an efficient interoperability of medical data through Internet of things is explained and successfully shown how it is helpful to patients and doctors.

The rest parts of the paper are organized as follows. In Section II, interfacing of components of different parameters to be measured is discussed. In Section III the details of how to implement proposed system is shown. In Section IV protocols used for Machine to Machine Communication is shown. Finally, Section V concludes the paper.

2. RELATED WORK

All the related works that have been done by other researchers that are related to the current research problem are as follows

- A Health-IoT Platform Based on theIntegration of Intelligent Packaging, Unobtrusive Bio-Sensor, and Intelligent Medicine Box
- RFID Technology for IoT-Based Personal

  Healthcare in Smart Spaces

1.1 A Health-IoT Platform Based on theIntegration of Intelligent Packaging, Unobtrusive Bio-Sensor, and Intelligent Medicine Box

In-home healthcare services based on the Internet-of-Things (IoT) have great business potential; however, a comprehensive platform is still missing. In this paper, an intelligent home-based platform, the iHome Health-IoT, is proposed and implemented. In particular, the platform involves an open-platform-based intelligent medicine box (iMedBox) with enhanced connectivity and interchangeability for the integration of devices and services; intelligent pharmaceutical packaging (iMedPack) with communication capability enabled by passive radio-frequency identification (RFID) and actuation capability enabled by functional materials; and a flexible and wearable bio-medical sensor device (Bio-Patch) enabled by the state-of-the-art inkjet printing technology and system-on-chip. The proposed platform seamlessly fuses IoT devices (e.g., wearable sensors and intelligent medicine packages) with in-home healthcare services (e.g., telemedicine) for an improved user experience and service efficiency. The feasibility of the implemented iHome Health- IoT platform has been proven in field trials.

Disadvantage:

In this project only medical datas are collected and tells the information to the patient. It doesn't give the health care based information

1.2 RFID Technology for IoT-Based Personal Healthcare in Smart Spaces

Abstract—The current evolution of the traditional medical modeltoward the participatory medicine can be boosted by the Internet of Things (IoT) paradigm involving sensors (environmental, wearable,and implanted) spread inside domestic environments with the purpose to monitor the user's health and activate remote assistance.RF identification (RFID) technology is now mature to provide part of the IoT physical layer for the personal healthcare in smart environments through low-cost, energy-autonomous, and disposable sensors. It is here presented a survey on the state-ofthe-art of RFID for application to bodycentric systems and for gathering information (temperature, humidity, and other gases) about the user's living environment. Many available options are described up to the application level with some examples of RFID systems able to collect and process multichannel data about the human behavior in compliance with the power exposure and sanitary regulations. Open challenges and possible new research trends are finally discussed.

Disadvantage:

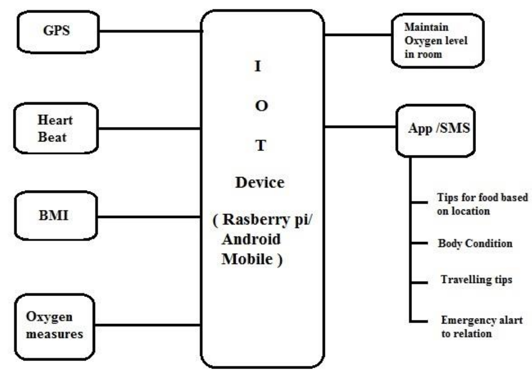
In this paper for the wireless communication is established in RFID technology that covers only short area

3. PROPOSED MODELLING

INTERFACING OF DEVICES TO IOT DEVICE:

IoT HEALTHCARE APPLICATIONS

In addition to IoT services, IoT applications deserve closer attention. It can be noted that services are used to develop applications, whereas applications are directly used by users and patients. Therefore, services are developer-centric, whereas applications, user-centric. In addition to applications covered in this section, various gadgets, wearables, and other healthcare devices currently available in the market are discussed.These products can be viewed as IoT innovations that can lead to various healthcare solutions. The next subsections address various IoT-based healthcare applications, including both single- and clustered-condition applications.



1) GLUCOSE LEVEL SENSING

Diabetes is a group of metabolic diseases in which there are high blood glucose (sugar) levels over a prolonged period. Blood glucose monitoring reveals individual patterns of blood glucose changes and helps in the planning of meals,activities, and medication times. An m-IoT configuration method for noninvasive glucose sensing on a real-time basis is proposed in [16]. In this method, sensors from patients are linked through IPv6 connectivity to relevant healthcare providers. The utility model in [17] unveils a transmission device for the transmission of collected somatic data on blood glucose based on IoT networks. This device includes a blood glucose collector, a mobile phone or a computer,and a background processor. A similar innovation is found in [18]. In addition, a generic IoT-based medical acquisition detector that can be used to monitor the glucose level is proposed in [19].

2) ELECTROCARDIOGRAM MONITORING

The monitoring of the electrocardiogram (ECG), that is, the electrical activity of the heart recorded by electrocardiography, includes the measurement of the simple heart rate and the determination of the basic rhythm as well as the diagnosis of multifaceted arrhythmias, myocardial ischemia, and prolonged QT intervals . The application of the IoT to ECG monitoring has the potential to give maximum information and can be used to its fullest extent . A number of studies have explicitly discussed IoT-based ECG monitoring. The innovation in [20] introduces an IoT-based ECG monitoring system composed of a portable wireless acquisition transmitter and a wireless receiving processor. The system integrates a search automation method to detect abnormal data such that cardiac function can be identified on a real-time basis. There exists a comprehensive detection algorithm of ECG signals at the application layer of the IoT network for ECG monitoring .

3) BLOOD PRESSURE MONITORING

The question of how the combination of a KIT blood pressure (BP) meter and an NFC-enabled KIT mobile phone becomes part of BP monitoring based on the IoT is addressed in [21]. A motivating scenario in which BP must be regularly controlled remotely is presented by showing the communications structure between a health post and the health center in [22]. The question of how the Withings BP device operates depends on the connection to an Apple mobile computing device is addressed in [23]. A device for BP data collection and transmission over an IoT network is proposed in [24]. This device is composed of a BP apparatus body with a communication module. A location-intelligent terminal for carry-on BP monitoring based on the IoT is proposed in [25].

4) Body Temperature Monitoring

Body temperature monitoring is an essential part of healthcare services because body temperature is a decisive vital sign in the maintenance of homeostasis . In [26], the m-IoT concept is verified using a body temperature sensor that is embedded in the TelosB mote, and a typical sample of attained body temperature variations showing the successful operation of the developed m-IoT system is presented. A temperature measurement system based on a home gateway over the IoT is proposed in [27]. The home gateway transmits the user's body temperature with the help of infrared detection. Another IoT-based temperature monitoring system is proposed in [28]. The main system components responsible for temperature recording and transmission are the RFID module and the module for monitoring body temperature.

5)OXYGEN SATURATION MONITORING

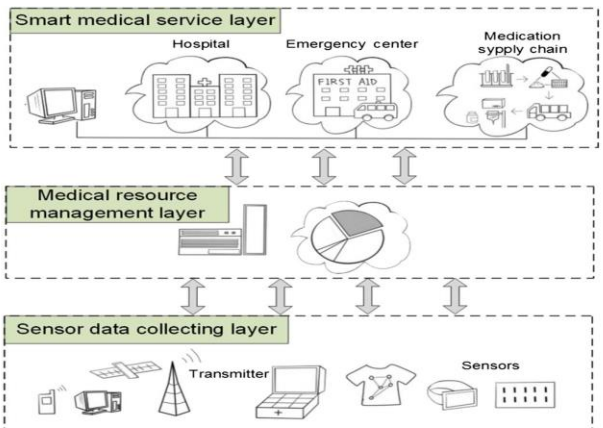
Pulse oximetry is suitable for the noninvasive nonstop monitoring of blood oxygen saturation. The integration of the IoT with pulse oximetry is useful for technology-driven medical healthcare applications. A survey of CoAP-based healthcare services discusses the potential of IoT-based pulse oximetry. The function of the wearable pulse oximeter Wrist OX2 by Nonin is illustrated in [29]. This device comes with connectivity based on a Bluetooth health device profile, and the sensor connects directly to the Monere platform. An IoT-optimized low-power/low-cost pulse oximeter for remote patient monitoring is proposed in [30]. This device can be used to continuously monitor the patient's health over an IoT network. An integrated pulse oximeter system for telemedicine applications is described in [31]. A wearable pulse oximeter for health monitoring using the WSN can be adapted to the IoT network.

6)Need of GPS:Nowadays, IoT technology is used widely in the healthcare service process For instance, medicines are bar-code labelled so that they can be delivered more correctly to patients and ambulances/equipments are global position system (GPS) and radio frequency identification (RFID) connected so that they can be located more quickly. Therefore, it becomes both an important and a challenging issue for doctors and managers in medical centers to share medical information during medical service processing, because it is such a process requiring close cooperation. Different objects are connected by IoT notes together to deliver healthcare activities to patients. These IoT notes must adapt to connect to IoT. Take a common Chinese hospital in Shanghai as an example, ambulances use GPS sensors to connect to IoT, patients and physicians use their ID cards to be identified, bar codes are used for medicines to be scanned to the hospital information systems, and valuable medical apparatus and instruments use RFID tags to be located. In order to assist doctors and managers accessing data resources efficiently, a data model that is semantic and flexible is needed to support heterogeneous data sharing, especially in the big data environment in IoT application. The semantic data model is expected to be self-explaining, supporting diverse and distributed data storage, as well as flexible and efficient data sharing. Furthermore, for healthcare service, it is important that data can be accessed anytime and anyplace conveniently.

NETWORK ARCHITECTURE:

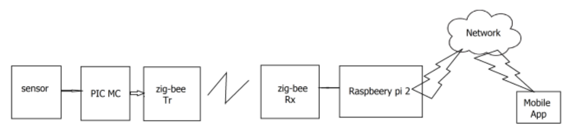
It consists of three network layers: 1) smart medical service layer; 2) medical resource management layer; and 3) sensor data collecting layer.

A smart medical service layer is directly linked to professional medical facilities such as hospitals, emergency centers, and medicine supply chain. For example, doctors can efficiently manage a large group of patients. They can inspect the medication history as well as the physiological status history of a specific patient, make further analysis of a suspicious portion of patient’s bio-signals (e.g., ECG), and based on that make a new e-prescription accordingly. Moreover, the doctors can perform an overall examination of a patient group by using dedicated software, which automatically analyzes the variation of an individual patient’s physical condition over a period of time, e.g., 1 week or 1 month. Subsequently, the doctors can easily identify the patient group whose health conditions have improved and make them aware of their progress. Both patients and their family may feel reassured, which helps build positive loops into rehabilitation and self-care. The medical resource management layer works as a transition auxiliary layer, which involves the administration and management of medical resources in an efficient manner and facilitates the smooth operation of the iHome system. In this layer, cloud computing and services are available to health and life science providers, providing an efficient way for data security and patient privacy protection.The sensor data collecting layer is the basis of the entire network. It consists of data sensing and acquisition devices, local computing and processing units, data storage devices, and wired/wireless transmitting modules. It is a multistandard wireless sensor platform, compatible with different wired/wireless protocols, such as Ethernet, RFID, Zigbee, Wi-Fi, Bluetooth, and 3G/4G network. With this three-layer iHome Health-IoT system, interaction between clinical professionals and home-stay patients can easily take place on demand or on a regular basis.



MACHINE-TO-MACHINE (M2M) communications constitute the basic communication paradigm in the emerging Internet-of-Things (IoT) and involve the enabling of seamless exchange of information between autonomous devices without any human intervention. The services facilitated by M2M communications encompass personal, public, and professional spaces and scenarios of interest include smart power grids, intelligent spaces, smart cities, industry automation, and health care just to name a few. The increasing popularity of services and systems based on the use of M2M communications has been fueled in part by the utility of the applications they facilitate, as well as by the continued fall in the prices of autonomous devices capable of sensing and actuating.The number of devices based on M2M communication is poised for extensive growth in the near future with predicted compound annual growth rates of greater than 25% .The increasing M2M traffic and the associated revenue have created an interest among telecom operators as well as regulatory and standardization bodies to facilitate M2M communications. The unique characteristics of M2M communications introduce a number of networking challenges. Most applications and scenarios based on M2M communications usually involve a very large number of devices, and a fundamental issue is the efficient management of network resources. In addition to scalability, the network has also to consider the traffic characteristics and cater to the quality of service (QoS) requirements.

For example, in a home setting, M2M devices may randomly and infrequently send small bursts of data or transmit a fixed amount of data periodically. Also, the service requirements of applications using M2M communications may be different from existing applications and will also vary within the M2M-based applications. For example, in certain applications, it may be required to provide highly reliable communication with QoS guarantees thus requiring prioritized assignments.A significant fraction of the devices involved in M2M communications are expected to be battery operated. Consequently, lowering the communication related power consumption is an important design objective for the network. Finally, as M2M communication is primarily “hands off” (i.e., free from human intervention), the M2M communication network must be self capable in various aspects such as organization, configuration, and healing. These requirements and characteristics affect all the layers in the networks stack and make network support for M2M communications a challenging area of research at different levels.



In this paper, we consider the MAC layer issues related to M2M communications. The MAC layer is primarily responsible for channel access for nodes within a network that use a shared medium. The critical MAC layer challenge for M2M communications lies in facilitating channel access to extremely large number of devices while supporting the diverse service requirements and unique traffic characteristics of devices in

M2M networks. In addition, MAC protocols for M2M communications should be efficient, scalable, consume low power, have low latency, and be implementable using low-cost hardware. Channel access for scenarios with very large number of devices has the potential to become a bottleneck, as foreseen by the industry and standardization bodies.Consequently, development of MAC layer protocols and technologies for M2M communications is an area of considerable importance to both researchers and practitioners. This paper reviews the key MAC layer protocols that have been proposed for M2M networks. In addition, we also evaluate MAC protocols for general wireless networks in terms of their suitability forM2M communications. This paper classifies the protocols into three classes: 1) contention-based protocols; 2) contention-free protocols; and 3) hybrid protocols, which incorporate advantages of contention-free and contention based protocols while trying to alleviate their weaknesses.

In the application systems based on IoT, physical entities are connected to the information systems through sensors or tags, which become the representations of physical entities in information systems. The information systems cannot transfer physical entities directly; instead, the representations of the physical entities are transferred to realize the interactions of the physical entities. For example, in case someone wants to know if the medical ward of room #3203 in the hospital is occupied, he/she could access the status of the representation of the physical entity of “medical ward room #3203” in information systems. Formally, we define this kind of information representation as entity oriented resource (EoR).

The definition of EoR is as follows.

Definition 1: EoR:

EoR:= <Required person, Address, Authentication>

URI is the unique address for the application systems to access the physical entities, in which the EoR corresponding to the representation of the physical entity is actually stored.

4. RESULTS AND DISCUSSIONS

The expected result is Raspberry Pi collects and stores the medical data through the sensors attached. The collected data is transferred to the user through apps. The information provided through apps improves the health of the patients.

5. CONCLUSION

Innovative uses of IoT technology in healthcare not only bring benefits to doctors and managers to access wide ranges of datasources but also challenges in accessing heterogeneous IoT data, especially in mobile environment of real-time IoT application systems. The big data accumulated by IoT devices creates theproblem for the IoT data accessing.

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