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REMOTE HEALTH MONITORING USING MACHINE-TO-MACHINE SYSTEM WITH ANDROID MOBILE

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Abstract: In modern time the technology plays the role in different area. In which most important area is Healthcare and wellness management. In this paper we describe and provide a healthcare solution that combines android mobile and IPv6 techniques in a Wired Sensor Network (WSN) to monitor the health condition of patients and provide a wide range of effective as well as convenient healthcare services by using global network. In the new generation of mobile communication gives opportunities to open up for the development of healthcare systems that remotely monitor biomedical signals from patients. In these different types of sensors can be used to measure body parameters dynamically of patient from different location of body which provide valuable information like heart rate, blood pressure, temperature, humidity, oxygen level of patient's body. Visualization module of the Android program graphically displays the recorded biomedical signals on Android mobile devices used by patients and doctors at the end of the networks in real-time. Our system for a global M2M healthcare solution is managed to process the large amount of biomedical signals through the extended network combining IPv6 technique and mobile technology for daily lifestyle to users appropriately.

Keywords: Android mobile devices, global network, health condition, health care application, machine-to-machine.

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INTRODUCTION

This paper presents a discussion of the significant trends to technological developments that hold relevance to the evolution of Healthcare systems and analyzes the opportunities they may offer to enhance real-time healthcare services. The developments in digital revolution are identified such as location based services; wired body sensor networks, Mobile IPv6, smart phone devices, and also the evolution of wireless technologies. The use of Wired Medical Sensor Networks (WMSNs) in the medical and healthcare industry has been widespread and very effective. In hospitals, patients can also carry or even put on wearable sensors that can detect health-related parameters (*e.g.*, glucose level, heart rate, blood pressure *etc.*) and can monitor the patient continuously using wireless network. Sensors can be embedded or placed on human body (wearable), wirelessly connected and sharing information to monitor the real conditions of many patient bodies.

Information and communication technologies are transforming our social interactions, lifestyles, and workplaces. One of the most promising applications of information technology is healthcare and wellness management. The healthcare is moving from an approach based on the reactive responses to acute conditions to a proactive approach characterized by early detection, prevention, as well as long-term management of health conditions. The current trend places an emphasis on the watching of health conditions and the management of wellness as significant contributors to individual healthcare and well being. This is particularly very important in developed countries with a significant aging population, where information technology can continuously improve the management of chronic conditions and thereby improve quality of real life. In particular, the continuous or even occasional recording of biomedical signals is critical for the advancement of diagnosis as well as treatment of different cardiovascular diseases by using wired wearable sensors [6], [10], [15].

For example, continuous recording of an electrocardiogram (ECG) or Photoplethysmogram (PPG) by a wearable sensor can provide a realistic view of the heart condition of a patient during normal routines daily, and can help to determine such types of conditions like high blood pressure, stress [2], anxiety, diabetes, and depression [19], [14]. In addition, it is conceivable that further automated analysis of recorded biomedical signals could support doctors in their daily practices and allow the development of warning systems. This would bring several advantages: it would increase the health observe ability, collaboration among doctors, and also doctor-to-patient efficiency [8] and due to it decrease healthcare costs. Such type of continuous monitoring would increasing early detection of abnormal health conditions and various diseases, and therefore provides a high potential to improve the quality of life of patients [17].

The Machine-to-Machine (M2M) communications is a one of latest research areas which has achieved substantial endorsement. This technology aims at enabling machines to communicate with each other without human intervention [13]. The idea behind M2M communications is that the value of a machine increases when it is networked; whereas, a network attains more importance when it interconnects more machines [1], [3]. The availability of a new generation of mobile phones has had an important impact on the development of such healthcare systems, as they seamlessly integrated with a wide variety of networks (such as 3G, Bluetooth, wireless LAN, GSM and WCDMA), and thus it enable the transmission of recorded biomedical signals to doctors or patients from a central server located in a hospital, home, or office [11]. A smart phone presents a programmable monitoring platform for healthcare as people go about their daily lives [9].

This paper describes a wireless M2M healthcare solution that uses Android mobile devices in a global network to monitor different body parameters. The use of a global M2M network in healthcare applications promises to replace the use of traditional healthcare systems based on wireless sensor networks and it providing ease of measurement, accessibility, reliability and, also extension of network [16]. The proposed system also promises to help improve the expansion of healthcare service coverage by providing efficient support for IPv6 over low-power wireless personal area network (6LoWPAN) and mobile technology in wide areas. This paper not only provides healthcare solution but also provide authentication of data.

This paper is arranged as follows: Section 2 discusses some related technologies; Section 3 outlines the problem on previous system and the proposed system in Section 4 and conclusion in section 5.

I I. RELATED TECHANOLOGY

The overall architecture of a wireless M2M healthcare system for the monitoring of a patient's health state according to the flexible and scalable requirements of the 6LoWPAN and mobile communication is shown in Fig. 1.

A. M2M Devices

As the core hardware devices in the proposed system, the M2M devices which are designed to measure various body parameters and transmit the PPG signals in a wireless M2M healthcare system. The PPG sensor module is designed to obtain the PPG waveforms and oxygen saturation data from a patient's finger by calculating the ratio of red and infrared light on the hardware surface, which is depends on the absorption of both types of light. The PPG sensor contains a filters, analog signal process, amplifiers, and also analog-to-digital converters (ADCs). Since the raw signals are too weak and distorted, the signal processing is initially required. The raw signals requires a low-pass filter (24 Hz) for the reduction of high-frequency noise and a band-pass filter (0.5 Hz to 10 Hz) for the rejection of a DC component to enhance the AC component. The filtered signals are gathered into the microcontroller of an M2M node through an UART port containing the sampled PPG signals at 75 Hz [18]. The M2M nodes connected to the wearable sensors are placed on patient's body and are mainly responsible for collecting and transmitting the sampled signals at 75 Hz for the PPG signals to the M2M gateway. The M2M nodes are connected to the wearable body sensors which are placed on the patient's body in order to collect health parameters such as ECG signals, and an oxygen saturation value, PPG signals and transmit the collected parameters to the server for monitoring and analysis.

The M2M gateway is placed between an IPv6 over IEEE 802.15.4 network and an IP network. Moreover, the M2M gateway performs global address translation to either 16- bit short addresses or IEEE EUI64-bit extended addresses [12]. A Tiny OS-based M2M node is allocated its own IP address by the M2M gateway over IPv6 packets. The 6LoWPAN protocol stack is implemented on top of the IEEE 802.15.4 layer in M2M nodes for the transmission of packets according to a higher-level protocol and the 6LoWPAN ad hoc on-demand distance vector routing protocol developed by the IETF group [7].

B. 6LoWPAN

The 6LoWPAN is a new attempt at extending an IP based sensor network environment at different local coverage areas for healthcare applications with the IPv6 technique. Therefore, the external hosts directly communicate with the M2M nodes because each M2M node is assigned a global IPv6 address, thereby it supporting higher accessibility and epoch making network extension. The new system is made up of local gateways in different places with different IP addresses. Firstly, the IPv6 address and the M2M gateway address must be defined at the M2M gateway and server for the IPv6 communication. As the IP network can be normally accessed by IPv4 addresses. The IPv6-to-IPv4 tunneling processes, which change the address format in the M2M gateway, are required for it to be possible to approaches the server PC through the internet [20]. In this experiment, the IPv6 address 2002:527c:b890:527c:b890 is converted to the IPv4 address 82.124.184.144 by the IPv6-to-IPv4 tunneling process, and is then assigned to the server PC. The M2M gateway is assigned the IPv6 address 2001:2b8: ee: 1::1 (converted to the IPv4 address of 192.168.0.155) to allocate a lower prefix address to the connected M2M nodes as a 2001:2b8:ee:100:22:ff:fe00:5 in the 6LoWPAN by auto-configuration function.

C. Server and Android Mobile Device

The measured biomedical signals are sent to the server PC through the internet by using the M2M gateway for further processing. The monitoring and analysis program, which is written in the C# programming language, monitors, stores, and processes the received data in the server PC, as shown in Fig. 2. Once a data packet has been received through the M2M devices, the packet is processed, and useful data is extracted. When the data is received, an IPv6 address is identified first to ensure that the aggregated data has been sent from the correct M2M device source. Then, the received data is scanned to ensure the data packet is a complete packet. This program continuously monitors not only biomedical signals, such as the PPG signals and oxygen saturation data acquired by wearable sensors, but also information related to M2M devices, such as communication settings and IPv6 addresses, in real-time. Further, it sends the received data to the Android mobile device to support the mobile healthcare monitoring system wirelessly after emulator testing. The mobile monitoring program was implemented and tested on the Android mobile device (Samsung Galaxy S, Korea) running a 1 GHz ARM processor (Cortex A8, Hummingbird) and Android OS version 2.3.6. Through the wired or the wireless internet, the server is able to connect to different types of mobile devices and various development testing can be performed on it [4][5].

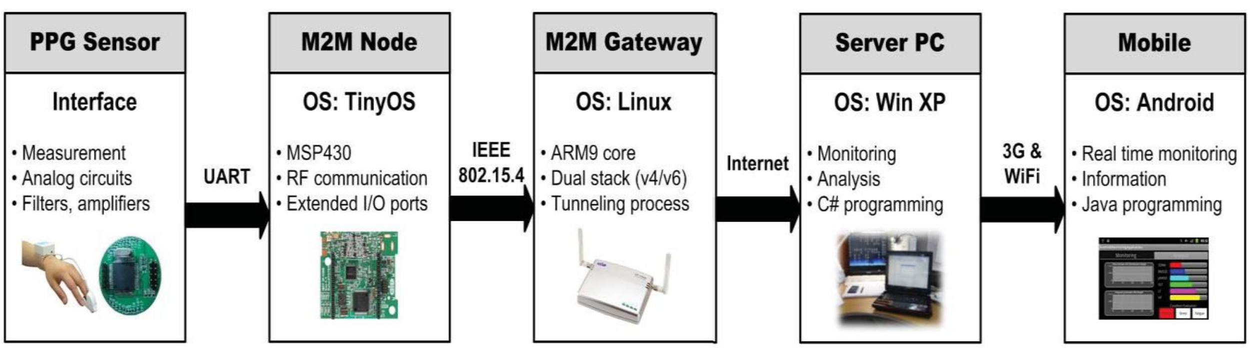

Fig.1 Block diagram of the overall system architecture

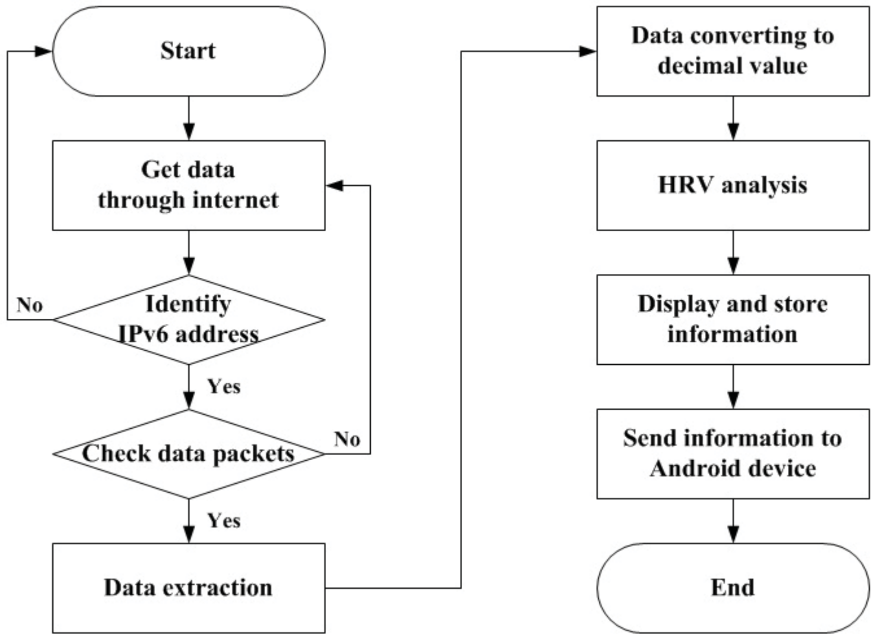

Fig. 2 Flowchart for data processing in the server

III. ANALYSIS OF PROBEM

In this paper it gives the good concept to monitor the health status of the patient as well as normal people. But this project having some problem like cost of this device is so much due to this all people cannot use this system. The second problem is that the size of sensor is very big and not comfortable with user.

Another problem is that it take time to monitor health status of patient hence it contains time delay to broadcast the current health status.

IV. PROPOSED SYSTEM

We have completely study the related technology which provides Healthcare solution. The system becomes more advance as well as cost effective in our proposed work. The previous system gives complex structure but proposed system having simple structure. We also add the authentication system in our proposed work. We will add the concept of data aggregation with compression to increase the speed of this system. We will reduce the size of sensor and make comfortable for user. We will available this project to all user in low cost through this all user can easy monitor our health status.

This paper deals with the some proposed work and objectives of the project which is given as below.

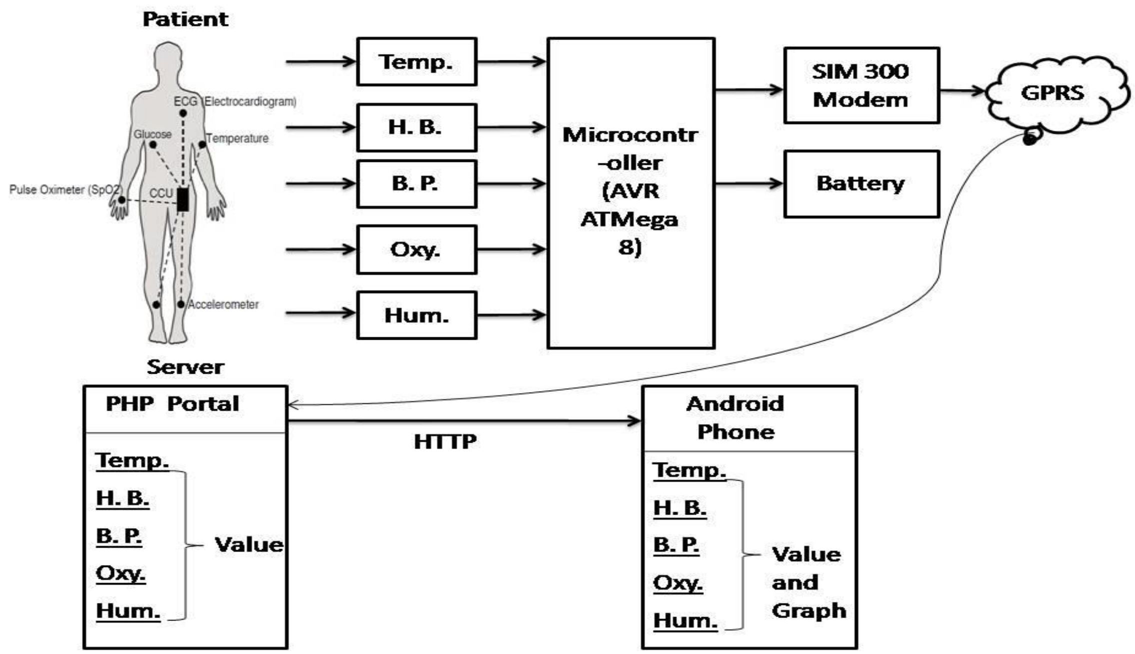

Fig.3. Block diagram of the proposed system architecture

A. Development of Schematic of the hardware

In proposed work we use the different types of hardware which are interconnected to each other. The most important things of proposed system are interfacing between hardware and software. We will also concentrate on developing of different types of hardware and software part which are comfortable with each other. We will develop the schematic of different hardware like body sensors, Microcontroller, SIM 300 module etc.

B. Online Portal

We will provide the facility of online portal in which all data of patient's body parameters is stored and continuously sending the data at end of android mobile phones. Online portal behave like server and it always connected to android mobile on which android application is running.

C. Android application

The development of Android application is essential part of proposed system. The Android application is used to monitor the body parameters on Android mobile phones. The Android application is install on any android phones and then connect to server for getting data from server.

The Fig. 3. describes the block diagram of proposed system in which body sensor (Temp., H. B., B. P. etc) are directly attached to patient body and collect the body related information. The body sensors generate the analog signals which are not understandable for human. The Microcontroller ATMega 8 is used to convert analog signal into digital form. All body sensors are connected to microcontroller (AVR ATMege 8) for performing Analog signal into Digital conversion (ADC). The Battery or AC power connector is connected to microcontroller for power supply and SIM 300 modem is used to sending the digital data to server through GPRS. In PHP portal all data is seen in the form of values and again this data is send to Android phones in the form of graph by using HTTP. We are adding the concept of authentication in which each and every user having user name and password and only valid user can access the body parameters.

V. RESULT

We conduct the practical test on this project to evaluate the real time performance and better result of wireless M2M system at the end of Android mobile phone. We successfully design and implement the hardware and get the result from hardware. We show the result on hardware, server and Android mobile phone as shown in fig. 4. In particular, an experiment was carried in which one of the authors wore sensor on his body to perform real-time monitoring for 8 minute. The sensor which is attached on a body is directly connected to microcontroller AVR ATmega 8 for converting the analog to digital (ADC) conversion. The microcontroller AVR ATmega 8 is connected to SIM 300 modem for sending the data to server. The Android mobile phone is connected to server through HTTP and result is shown in Androind mobile phone like fig. 4.

In fig. 4 all the parameter i.e. BP, Humidity, Temperature, SpO2 and HB shown in the form of value as well as graph. We conduct this experiment with different age Human for getting the different value on Android application. We successfully found the variation of result with respect to ages. The value and graph on Android phone is change in every 15 second and we get continuously result on Android mobile phone.

Hence we successfully perform the experiment and get the accurate value on Hardware monitor, server and Android mobile phone.

Fig.4. Android emulator test for monitoring program

VI. ADVANTAGE OF PROPOSED SYSTEM

i) This system can increase the health obeserability, collaboration among doctors and doctor-to-patient efficiency.

ii) This system can decrease the healthcare cost.

iii) Through this system Continuous monitoring of health would increase early detection of abnormal health.

iv) Providing ease of measurement, extension of network, accessibility, and reliability.

v) Only valid person can get patient body parameters.

vi) The Doctor can monitor the patient from any remote place.

vii) It can be adoptable for all type of user.

VII. CONCLUSION

In this paper firstly we have study related technology of Healthcare system. We have successfully found the problem of previous system and proposed new system for try to minimize the problem. Proposed system work planning reduces the complexity of system and provides healthcare service in low cost. Proposed system also provide authentication of user. This paper also gives the idea to make a system advance and effective.

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