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Sensing And Monitoring The Human Heart Beat Rate Using Android Smart Phones

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***Abstract*—*Wireless Sensor Network is used in many communication applications. It achieves human heart beat rate detection that combines network, mobile and blue tooth technology. In existing, the PPG signals is used in a wireless sensor network to monitor the health condition of the patients and provide a wide range of effective, comfortable and sufficient healthcare services. In this paper, propose a monitoring module of the server program graphically displays the recorded bio-medical signals on Android mobile devices. It will be used by patients and doctors at the end of the networks in real time. The objective of this work is sensing the pulse using BEETS BLU sensor chip and monitors the pulse rate and ECG rate from the patient. As well as automatically transmit alert detection and lower or upper heart beat rate to the android mobile device via global network and blue tooth. Combine IPv6 technique in mobile technology for the user's daily life style.*

Keywords—Android mobile device, Wireless sensor network, Communicative application, Health condition, Wearable, Global network.

1. INTRODUCTION

Driven by knowledge advances in low-power networked systems and medical sensors, we have seen in recent years the appearance of wireless sensor networks (WSNs) in healthcare [1]. There are also a number of terrestrial settings in which such abilities are likely beneficial, including monitoring of patient with cardiovascular sickness to aid in diagnosis and to evaluate treatments, assessing gait stability, activity level, the quality/quantity of sleep, and monitoring of first responders and coincidence victims [2]–[3]. Wireless sensor networks (WSNs) is the most significant system widely used in many monitoring presentations such as environmental and health monitoring and enterprise supply cables. WSNs are mainly used for monitoring physical or ecological disorder, gathering environmental data such as temperature, sound. RFID is a technology that customs radio waves to transfer data between RFID tags and RFID readers [4]. Wearable schemes can be generally defined as mobile electronic devices that can be inconspicuously embedded in the user's outfit as part of the clothing or an accessory (shown in Fig. 1 below). In particular, unlike straight mobile systems, they can be operational and retrieved without or by very little hindrance to user movement [5], [6]. In this setting, devices pointing the sport and recreational market have been very effective. However, the majority of such recreational devices are not appropriate for medical monitoring of high-risk patients. Those devices that have been qualified for medical usage are usually fairly humble measuring just one or two parameters and provided that little or no online analysis.

Wireless communication is important to the growth of new wearable technologies that have broad and important insinuations for citizen and military applications [7]-[8]. For example, the emergent development of dense, low-power, small-size, light- weight, and inconspicuous wearable devices may simplify remote noninvasive monitoring of energetic signs from soldiers through training movements and combat. Telemetry of physical information via a short-range wirelessly-linked individual part network can also be useful for firefighters, risky material workers, mountain hikers, or extra first-responders working in harsh and dangerous environments.

The main goals of such a wireless mobile stage would be to retain track of an injured person's energetic signs, thus eagerly allowing the telemetry of physiological information to medical workers, and support extra responders in making dangerous and often lifesaving judgments in order to accelerate rescue operations. Having wearable physiological observing could proposal far-forward medics many advantages, including the skill to determine a casualty's disorder. Numerous technical tests must be overwhelmed to discourse the unmet request for long-term continuous physiological observing in the field.

Fig. 1. Wireless Sensor in Human Chest

The medical requests of WSNs are thoroughly related to vital-sign observing and real-time finding of life- hostile crises inside a few seconds, like heart attacks or sudden falls by elderly people, or to monitor persons for early discovery of chronic diseases and cognitive complaints (e.g., cardiovascular, Alzheimer illness, Parkinson disease, diabetes, epilepsy, asthma). For example, high blood weight is an important pointer for cardiovascular infections. WBANs are also secondhand in kinematic for rehabilitation valuation and to gather environmental limits (temperature, humidity, light, exposure to radiation, etc.) of the observed patient [9]. At present, many current medical wireless devices are obtainable in the and can be used to gather numerous vital signs [10], such as heart rate (HR), beat, oxygen volume (SpO2), breathing rate, body temperature (T°), electrocardiogram (ECG), electromyogram, blood heaviness, blood glucose levels, galvanic membrane answer, etc.

2. RELATED WORK

A. Mobile to Mobile Communication

The general architecture of a wireless M2M healthcare scheme for the observing of a patient's health national according to the flexible and scalable necessities of the mobile communication (shown in below Fig.2)

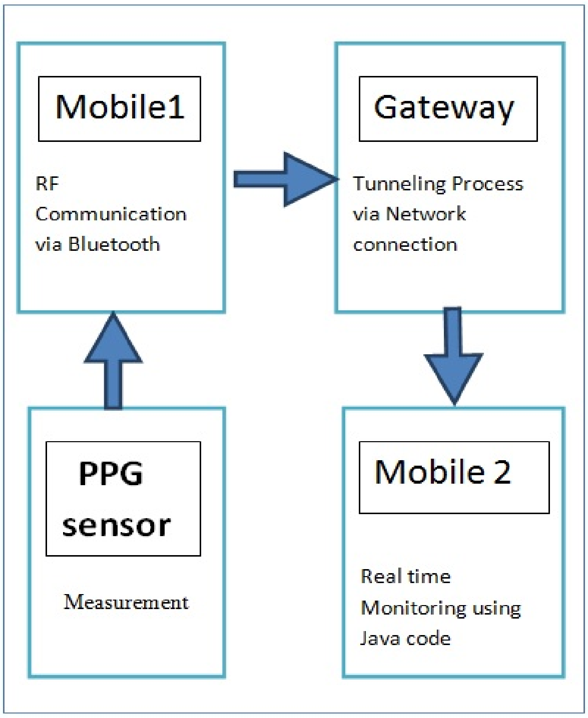

Fig. 2. Mobile to Mobile Communication

As the essential hardware devices in the future system, the M2M devices are intended to measure and convey the BEETS BLU signals in a wireless M2M healthcare procedure, as exposed in Table 1. The BEETS BLU sensor is intended to obtain the BEETS BLU waveforms and oxygen capacity data from a patient's chest by calculating the fraction, which is depending on the absorption of signal. The BEETS BLU sensor covers an analog signal procedure, amplifiers, filters, and analog-to-digital converters (ADCs). Since the rare indications are too weak and partial, signal dispensation is initially essential. The raw signals need a low-pass filter (24 Hz) for the discount of high-frequency sound and a band-pass filter (0.5 Hz to 10 Hz) for the elimination of a DC constituent to improve the AC constituent [11]. The M2M nodes related to the wearable sensors are located on the patient's body in order to gather health limits such as ECG signals, beets blue signals, and an oxygen capacity value and convey the composed parameters to the server for observing and investigation.

B. Specifications For Mobile to Mobile Devices

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](specifies in below Table 1).

Table 1. Specifications For Mobile to Mobile Devices

MODULES	ITEMS	SPECIFICATIONS
PPG Sensor	LED Power	940 nm Infrared 3.3v
Mobile to Mobile	RF Interface RF Controller	IEEE 802.15.4 Chip con CC2420
Gateway	Network Interface Power	802.3 10mb/s, WLAN DC 5 V
Android Mobile	OS Connectivity Battery	Android 4.2.2 Wi-Fi, Bluetooth. Li-ion 2100 mAh

C. Monitoring Disasters

While triage procedures for extra medical services already are present [13], [14], their efficiency can rapidly degrade with growing number of losses. Moreover, there is a essential to recover the valuation of the first responders' health position during such mass-casualty mischances. The increased movability, scalability, and quickly deployable nature of wireless sensing schemes can be used to routinely report the triage levels of frequent victims and continuously monitor the health station of first responders at the disaster act more successfully.

D. Physiological Monitoring

In physical monitoring presentations, short power sensors measure and report a person's vital signs (e.g., beat oximetry, breathing rate, and temperature). These requests can be developed and organized in dissimilar contexts ranging from disaster reply, to in-hospital patient monitoring, and longtime remote monitoring for the senior.

E. Motion and Activity Monitoring

Another request domain for WSNs in healthcare is high-resolution observing of effort and activity levels. Wearable sensors can extent limb movements, carriage, and brawny activity, and can be applied to a range of clinical locations counting gait analysis [15], [16], [17], activity organization [18], [19], athletic performance [20],

[21], and neuromata disease reintegration [22], [23]. In a typical situation, a patient dresses up to eight sensors (one on each limb segment) armed with MEMS accelerometers and gyroscopes. A base position, such as a PC-class device in the patient's home, gathers data from the network. Data examination can be did to recover the patient's motor organization and activity level, which is in try used to measure the result of treatments. In such studies, the size and weight of the wearable sensors necessity be reduced to avoid burdening the patient's drive.

F. ECG Sensor

To get an ECG the patient necessity be physically connected to a front-end amplifier with singular bio electrodes that translate ionic current flow of the body to the electron flow of the metal wire. Silver-coated chest force electrodes or glue silver/silver-chloride conductors with chemical paste or gel can be used. The first prototype used silver/silver-chloride electrodes minus paste or gel. Through the first example testing the electrodes corroded afterward two to three months and the input confrontation design to a level wherever no ECG signal could be stately. To remove oxidation, second model used gold electrodes. The interaction resistance is somewhat higher, but a sensible signal quality can be gotten [24], [25].

3. Analysis

A. Human Chest type Sensor Device

The BEETS BLU sensor device original weighs 100 grams; the projected run time is two days and contains 5MByte of flash and 137 Kbyte on Chip SRAM for programme and data storage.

B. Power Consumption

The Battery life is one of the main design obliges in mobile healthcare schemes. The scheme must be continually operational without the need to often change or re-charge series. User expectation from extensive use of cell phones is that a device must run for at least a couple of days [26]. GSM, SPO and digital dispensation unit are the highest power clients. The digital dispensation unit was measured at 3.1V and 41MHz. Energy wise, communiqué via wireless is expensive. More run time can be gained if data transmission is approved out when the network quality is tall, there by needful less signal power. SPO2 is measured for 31 seconds each two minutes. Our test presented that the sensor wants about 20 seconds to give stable results, thus it has a duty series of about 50%. The analog part is used through temperature and ECG dimension and is turned off most of the time (duty cycle of 4.5%). The spare of the discrete analog board with an ASIC will decrease the power ingesting at least by a factor of 3. A duty cycle of 0.2% for inflating and 1.1% for deflating represents 11 dimensions per day [27] and [28].

4. Experimental Outcome

The stream of data conservative from the wearable unit is discrete to numerous places on the PDA's graphical display. The most projecting portion of the GUI display is

- ***Pulse Oximeter***: blood capacity in oxygen (SpO2) and pulse.
- ***Chest-type Human Heart Rate Monitoring***: systolic, diastolic, and pulse

C. Sensor Module

The Sensor Module covers analog signal processing electrical system, ADC, an entrenched microcontroller, and a RF transceiver. The part is small sufficient so the entire unit can be combined into a hairband or a helmet. The unit is motorized by a CR2032 kind coin cell battery with 220mAh dimensions, as long as at least 5 days of operation.

D. Receiver Module

The Receiver Module covers an embedded microcontroller, RF transceiver for interactive with the Sensor Unit, and a Universal Asynchronous Receive Transmit (UART) for joining to a PC. Signals learned by the Sensor Unit are established by the embedded microcontroller which synchronously translates the consistent PD production to R and IR BEETS BLU signals. Devoted software is used to screen the signals and compute SpO2 and HR based on the comparative amplitude and incidence content of the reproduced BEETS BLU signals. A tri-axis MEMS accelerometer notices changes in body action, and the information found through the slant sensing stuff of the accelerometer is used to regulate the orientation of the being wearing the expedient [29],[30].

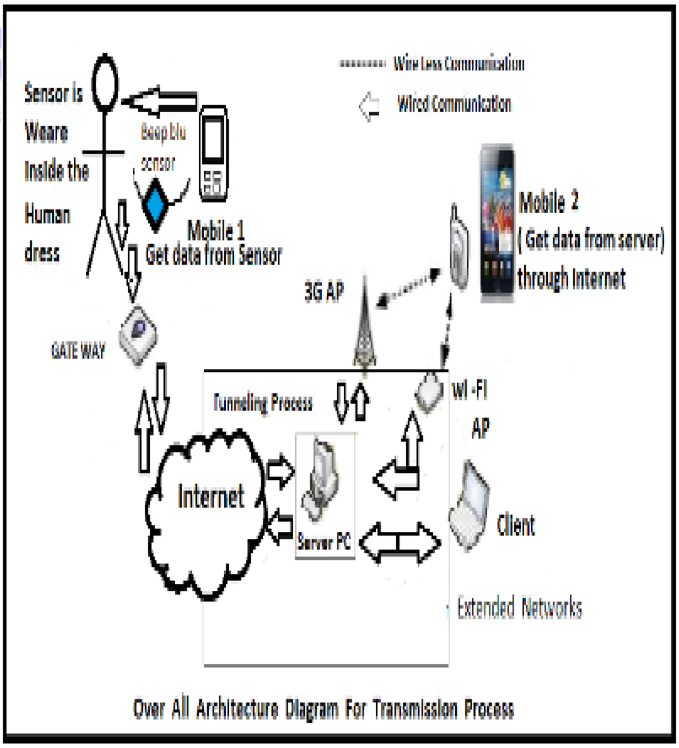

Fig. 3. Over all Architecture Diagram For Transmission

the scrolling BEETS BLU waveform, (shown in above Table 1) SpO2, ECG and HR values are presented separate pointer windows lastly laboratory assessments of the wearable pulse oximeter included simultaneous HR and SpO2 dimensions (shown below Fig. 4,5) To exemplify a clinical scenario of incessant patient monitoring under normal physiological events and Active healthcare requires access to patient data that are usually stored on varied database systems (shown in Table 2 below). Integration of patient data is a important challenge tackled by the healthcare public. In our experiment, we are able to attach two dissimilar systems, that is, the enduring record database and the web gateway, through the use of distinct web services. Patient material is transmitted, a protected and coded form of XML. The WSDL (Web Service Definition Language) for these web facilities is published to a public of official users. This web service-based method for intersystem communiqué gives our software the flexibility to interoperate with third-party software in the upcoming.

Table 2: Alert Detection Parameters

ALERT TYPE	DETECTION PARAMETER
Low SPO2	SPO2 < 90%
Bradycardia	HR < 40 bpm
Tachycardia	HR > 150 bpm
HR change	ΔHR / 5min > 19%
HR stability	max HR variability from past 4 readings > 10%

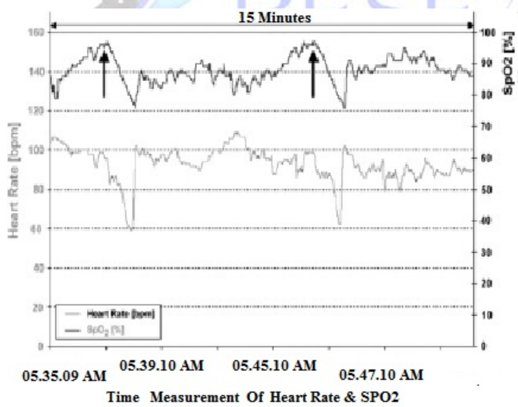

Fig. 4. Denotes the Human Heart Rate (spo2)

Fig. 5. Denote the Human (James P. Walton) Respiration Rate, Heart Rate, ECG and SPO2.

5. CONCLUSION

In summary, detecting and observing the human heart beat rate by human wearable sensor devices is effectively implemented in a global network with the help of the IPv6 method and multi stricture wearable physiologic monitor proficient of digital data storage as well as real-time wireless data flooding has been developed. The scheme has been established to operate effectively and will be assessed in clinical surroundings to obtain valued input for additional developments of the sensor device. The patient monitoring feature will not be useful in all conditions. In a mass loss disaster, when the doctors must triage many casualties quickly, they will not have period to respond to alerts until all patients have been triaged. Medics guess the monitoring system to be most valuable for patients who have been triaged and are to come for ambulances. They can then use our scheme to order the patients who essential to be elated by ambulance. Finally to regulate the scope of wireless sensor networks will be effectively integrated in healthcare exercise.

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