International Journal of Pure and Applied Mathematics
Volume 116 No. 9 2017, 345-351
ISSN: 1311-8080 (printed version); ISSN: 1314-3395 (on-line version)
url: http://www.ijpam.eu
Special Issue

INPATIENT MONITORING FOR HEALTHCARE DATA USING WIRELESS SENSOR NETWORK

R.kavitha[1],G.kavitha[2],B.ramya[3]
[1,2]assistant.professor, [3]student
[1,2,3],department of computer science and engineering,
Bist,biher, bharath university, chennai-73, tamilnadu, india
[1]kavithar.cse@bharathuniv.ac.in, [2]kavithag.cse@bharathuniv.ac.in

Abstract: Recent technological advances in sensors, low-strength included circuits, and wi-ficomications have enabled the layout of low-cost, miniature, light-weight, and intelligent physiological sensor nodes. These nodes, capable of sensing, processing, and speaking one or greater critical symptoms, may be seamlessly included into wi-fi personal or frame networks (WPANs or WBANs) for fitness tracking. These networks promise to revolutionize health care by means of permitting inexpensive, non-invasive, continuous, ambulatory fitness tracking with nearly real-time updates of scientific facts through the Internet. Though a number of ongoing studies efforts are that specialize in diverse technical, monetary, and social problems, many technical hurdles nevertheless want to be resolved with the intention to have bendy, dependable, at ease, and energy-green WBANs appropriate for medical packages. The paper presents device architecture and hardware and software employer, as well as the authors' answers for time synchronization, electricity management, and on-chip signal processing.

Keywords: Sensors, Wi-Fi, Intensity Power, Time synchronization.

1. Introduction

Current health care systems structured and optimized for reacting to disaster and coping with contamination are facing new challenges: a rapidly growing populace of elderly and growing fitness care spending. According to the U.S. Bureau of the Census[1-2], the range of adults age 65 to eighty four is anticipated to double from 35 million to almost 70 million with the aid of 2025 when the youngest Baby Boomers retire. Also, average health care costs inside the United States reached $1.8 trillion in 2004 with nearly 45 million Americans uninsured. In addition[3-4], a latest observe located that nearly one 0.33 of U.S. Adults, most of whom held full-time jobs, have been serving as casual caregivers – ordinarily to an elderly discern. It is projected that fitness care costs will attain nearly 20% of the Gross Domestic Product (GDP) in much less than 10 years, threatening the wellbeing of the whole financial system. During the previous couple of years there has been a sizable growth inside the wide variety of various wearable fitness monitoring devices, starting from simple pulse video display units pastime monitors and portable Holter video display units, to sophisticated and steeply-priced implantable sensors.

However, wider recognition of the present structures is still limited by means of the following essential regulations. Traditionally[7-8], non-public medical monitoring systems, inclusive of Holter video display units, have been used simplest to collect information. Systems with more than one sensor for bodily rehabilitation frequently function unwieldy wires among the sensors and the monitoring system. These wires can also limit the patient's pastime and stage of comfort and for that reason negatively have an effect on the measured consequences. In addition, man or woman sensors frequently function as stand-alone systems and typically do now not provide flexibility and integration with 0.33-birthday party gadgets. Finally, the prevailing structures are not often made lower priced. For example[11-12], they may be used for habitat monitoring, gadget health monitoring and steerage, site visitors sample tracking and navigation, plant tracking in agriculture[13-14], and infrastructure monitoring. Such a machine can be used for computer-supervised rehabilitation for various conditions, or even early detection of scientific conditions. For instance, smart coronary heart monitors can warn users approximately impeding scientific conditions or provide information for a specialized provider inside the case of catastrophic occasions. Accelerometer-based monitoring of physical pastime with feedback can improve the manner of bodily rehabilitation, various conditions and patterns. Researchers will be able to quantify the contribution of every parameter to a given condition and discover synergy among extraordinary parameters, if an adequate variety of patients is studied in this manner.

2. Related works

2.1 Wireless Wearable Body Area Network Architecture

WWBANs are a pivotal a part of a multi-tier telemedicine gadget. It (tier 1) encompasses a number of wireless medical sensor nodes which are integrated into a WWBAN. Each sensor node can sense, pattern, and system one or extra physiological alerts. For instance, an electrocardiogram sensor (ECG) may be used for monitoring coronary heart interest, an electromyogram sensor (EMG) for tracking muscle pastime, an electroencephalogram sensor (EEG) for monitoring mind electric hobby, a blood strain sensor for monitoring blood strain, a tilt sensor for tracking trunk role, and a respiratory sensor for tracking respiratory; and movement sensors may be used to discriminate the person's repute and estimate her or his degree of pastime. Tier 2 encompasses the private server (PS) application going for walks on a Personal Digital Assistant (PDA)[15-16], a mobile cellphone, or a domestic non-public laptop. The PS is responsible for a number of responsibilities, supplying a transparent interface to the wi-fi clinical sensors, an interface to the consumer, and an interface to the scientific server. The interface to the WWBAN consists of the community configuration and control. The community configuration encompasses the subsequent responsibilities: sensor node Registration (kind and variety of sensors), initialization (e.G., specify sampling frequency and mode of operation), customization (e.G., run user-particular calibration or consumer-precise signal processing system add), and setup of a comfy conversation (key trade).

Once the WWBAN network is configured, the PS software manages the network, looking after channel sharing, time synchronization, facts retrieval and processing, and fusion of the facts. Based on synergy of facts from multiple clinical sensors the PS software have to determine the user's state and his or her fitness repute and provide feedback via a user-friendly and intuitive graphical or audio user interface. Finally[17-18], if a communique channel to the medical server is available, the PS establishes a relaxed link to the medical server and sends reports that may be integrated into the consumer's scientific record. However, if a link among the PS and the medical server is not to be had, the PS must be capable of keep the facts locally and initiate facts upload while a hyperlink turns into available. Tier three consists of a clinical server(s) accessed thru the Internet. In addition to the medical server, the closing tier may additionally embody other servers, along with casual caregivers, commercial health care providers, or even emergency servers. The scientific server typically runs a provider that units up a communique channel to the consumer's PS, collects the reviews from the user, and integrates the information into the user's clinical document. The carrier cans difficulty suggestions, or even trouble signals if reports appear to indicate an odd situation. More details about this structure and services may be determined.

2.2 Concern For Wi-Fi Curative Sensors

Wireless medical sensors have to fulfill the primary requirements including wear ability, reliability, safety, interoperability, Wear ability. To gain non-invasive and unobtrusive continuous fitness tracking, wireless scientific sensors should be lightweight and small. The length and weight of sensors is predominantly decided by the scale and weight of batteries. But then, a battery's capability is at once proportional to its length. We can count on that in addition era advances in miniaturization of incorporated circuits and batteries will help designers to enhance scientific sensor wear ability and the consumer's stage of consolation. Section 5 further discusses electricity performance in WWBAN[19-20]. Reliable verbal exchange in WWBANs is of extreme significance for clinical packages that rely upon WWBANs. The verbal exchange necessities of various medical sensors range with required sampling rates, from much less than 1 Hz to a thousand Hz. One approach to enhance reliability is to move past telemetry via acting on-sensor signal processing. For example[21], in place of shifting raw information from an ECG sensor, we can carry out characteristic extraction at the sensor, and switch most effective records about an occasion (e.G., QRS functions and the corresponding time stamp of R-height). In addition to reducing heavy demands for the conversation channel, the decreased conversation necessities keep on total electricity Costs, and consequently increase battery lifestyles. A cautious change-off among communication and computation is critical for most effective gadget layout Security. Though key established order, authentication, and information integrity are challenging tasks in resource restricted clinical sensors, a notably small range of nodes in a typical WWBAN and brief conversation levels make those responsibilities potential Interoperability. Wireless scientific sensors must permit users to without problems assemble a robust WWBAN depending on the person's country of health. Standards that explain interoperability of wireless scientific sensors will promote seller opposition and sooner or later bring about greater less costly structures.

2.3 Appliances staging

The ActiS sensor node functions a hierarchical organization hired to provide a rich set of functions, enjoy the open software gadget assist, and perform computation and Communications responsibilities with minimum energy consumption. Each ActiS node makes use of a commercially to be had wi-fi sensor platform Telos and a custom wise signal processing daughter card attached to the Telos platform (Figure four). The pre-processed records are then transferred to the Telos board. The Telos platform can assist greater sophisticated real-time analysis and may perform additional filtering, characterization, function extraction, or pattern popularity. The Telos platform is likewise chargeable for time synchronization, conversation with the network coordinator, and cozy records transmission. Figure five suggests a block diagram of an ActiS with a Telos platform and a custom Intelligent Signal Processing Module (ISPM). Telos is powered by using two AA batteries and functions an ultra low power Texas Instruments MSP430 microcontroller; a Chipcon CC2420 radio interface in the 2.4 GHz band [21]; an included onboard antenna with 50m variety indoors/125m variety outside; a USB port for programming and verbal exchange; an external flash reminiscence; and incorporated humidity, temperature, and mild sensors. The MSP430 microcontroller is primarily based round a sixteen-bit RISC center incorporated with RAM and flash memories, analog and virtual peripherals, and a flexible clock subsystem. It helps numerous low-energy operating modes and consumes as low as 1 μA in a standby mode; it also has very speedy wake up time of no extra than 6 μs. Telos Revision A features a MS430F149 microcontroller with 2 KB RAM and 60 KB flash reminiscence; Telos Revision B (now TmoteSky) features a MSP430F1611 with 10 KB of RAM and forty eight KB of flash memory. The CC2240 wi-fi transceiver is IEEE 802.15.4 compliant and has programmable output power, most records fee of 250 Kbs, and hardware help for error correction and encryption. The CC2240 is managed by means of the MSP430 microcontroller through the Serial Peripheral Interface (SPI) port and a sequence of digital I/O traces with interrupt abilities. The Telos platform functions a ten- pin enlargement connector with one UART (Universal Asynchronous Receiver Transmitter) and one I 2 C interface, general-motive I/O strains, and 3 analog input strains. We developed two custom boards particularly for health tracking applications, an ISPM and an IAS (Intelligent Activity Sensor). The ISPM board extends the skills of Telos by means of including two perpendicular dual axis accelerometers (Analog Devices ADXL202), a bio amplifier with sign conditioning circuit, and a microcontroller MSP430F1232 (Figure five). The ISPM's two ADXL202 accelerometers cowl all three axes of movement. One ADXL202 is established directly on the ISPM board and collects facts for the X and Y axes. The second ADXL202 is installed on a Card that extends vertically from the ISPM and collects acceleration records at the Z axis. The user's physiological nation can be monitored using an on-board bio amplifier applied with an instrumentation amplifier and sign conditioning circuit. The bio amplifier could be used for electromyogram or electrocardiogram monitoring. The output of the signal conditioning circuit is linked to the local microcontroller as well as to the microcontroller at the Telos board via the enlargement connector. The ISPM has its very own MSP430F1232 processor for sampling and low-stage data processing, selected mostly for its compact size and high-quality MIPS/mW ratio. Other capabilities that have been desirable for this design had been the ten-bit ADC and the timer seize/evaluate registers which might be used for acquisition of records from accelerometers. The MSP430F1232 additionally has hardware UART this is used for communications with the Telos board. The IAS board is a stripped-down model of the ISPM with simplest accelerometer sensors and sign conditioning for a pressure-sensing resistor that can be used as a foot transfer.

2.4 Intensity power

Energy consumption is a first class design constraint in wi-fi sensor networks when you consider that they're battery operated. To amplify each node's lifetime, it is essential to lessen electricity dissipation as a whole lot as viable; dissipation under one hundred microwatts will enable operation on power scavenged from the surroundings. Various layout trades-offs among communique and on-sensor computation, collaborative protocols, and hierarchical network organization can yield good sized electricity financial savings. Once the sensor community is deployed, dynamic strength management strategies can be hired in order to maximize battery existence. In WWBAN systems, lowering general energy intake is vital for several reasons. Size and weight of sensors are predominantly determined by way of the size and weight of the batteries. On the Other hand, a battery's capacity is directly proportional to its length. Consequently, WWBAN sensor nodes need to be extraordinarily strength efficient, due to the fact lowering power requirements will allow designers to apply smaller batteries. Smaller batteries will result in in addition miniaturization of physiological sensors and, in turn, an accelerated level of user's consolation. Second, an extended length of operation without battery modifications is proper, because frequent battery modifications on

multiple sensors are likely to hamper customers' attractiveness. In addition, longer battery existence will decrease WWBAN operational expenses. We have designed a custom, application-precise protocol in keeping with 802.15.Four pointers. In order to satisfy medical application necessities, the community protocol specifies a one-second outstanding frame cycle (TSFC = 1sec) and every slave node has its reserved timeslot of 50 ms to transmit the information. A great body cycle starts with a beacon message sent via the community coordinator; the beacon message incorporates time synchronization facts. Each sensor node wakes its radio interface up in a acquire mode right away earlier than the following anticipated beacon. We can absolutely discover 3 distinct states: Listen, Transmit, and Inactive modes. As defined in Section 3, the extremely-low power microcontroller on the daughter board samples three-axes of acceleration with frequency of 2 hundred Hz. The statistics is filtered and buffered. The processor at the Telos board wakes up every 40 ms (25 Hz) and raises an interrupt requiring the information from the daughter card. In the Inactive mode the wi-fi transceiver on the Telos platform is grew to become off, and the average cutting-edge drawn for the complete sensor is 1.Fifty three mA. The movement sensor can be configured to ship raw accelerometer facts or detected steps. If raw accelerometer information is needed, the amount facts to be despatched according to one exquisite frame (1 2d) is three axes * 40 Hz * 2 bytes = 240 bytes, which is equivalent to twelve TinyOS packets. If the step detection is achieved on the sensor most effective, statistics about that occasion and corresponding timestamp are sent (1 or 2 packets). The movement sensor attracts on common 20.1 mA inside the Transmit mode and 20.8 mA within the Listen mode. The essential contributor to this figure is the wireless radio that attracts 17.Four mA whilst it is transmitting and 19.7 mA whilst it is receiving. Based on these parameters, we will calculate the common modern as follows.

The common cutting-edge may be used to estimate battery lifestyles. If only messages are sent consistent with amazing frame cycle (TListen = 50 ms, TTransmit = 15 ms), the average current is two.77 mA. Two AA batteries at the Telos platform have 2900 mAh capability, so the predicted running time of the motion sensor is 1046 hours or over 6 weeks. However, with a tiny 120 mA rechargeable battery, the working time could be barely less than 2 days. Further optimizations are also feasible: depending at the WWBAN deployment state of affairs, we should lower the output energy at some stage in transmission, an amazing cycle may be prolonged (the node could spend less time inside the pay attention mode), or information may be saved domestically in a compressed layout and then later transmitted.

2.5 Advantages and disadvantages:

Why people love wi-fi sensor networks may be summarized as the following

1. Network setups can be carried out without constant infrastructure. 2. Suitable for the non-handy places such as over the sea, mountains, rural regions or deep forests

3.Flexible if there is random state of affairs whilst additional computer is wanted.

4. Implementation pricing is Cheap.

5. It avoids masses of wiring.

The negative aspects of wi-fi sensor networks can be summarized as follows

1. Less relaxed because hackers can input the access factor and gain all the data.

2. Lower pace as in comparison to a stressed network.

3. More complicated to configure as compared to a wired network.

4. Easily troubled by way of environment (partitions, microwave, large distances due to sign attenuation, and many others).

5. It is smooth for hackers to hack it we couldn't manage propagation of waves.

3. Applications

There are lots of packages of WSN:

Process Management: Area tracking is a very commonplace the use of WSNs. In area tracking, the WSN is deployed spanning a location in which a few phenomenon is typically to be monitored. A army example may also be the use of sensors locate enemy intrusion; a civilian example might be the geo-fencing of gasoline or oil pipelines. Area monitoring is maximum vital element.

Healthcare tracking: The scientific applications may be of types: wearable and implanted. Wearable devices are applied to the body surface of the human or perhaps at near proximity from the person. The implantable medical gadgets are the ones that are inserted inner your body. There are numerous other programs too e.G. Body role measurement and of the character, overall tracking of sick patients in hospitals and also at houses.

Environmental/Earthsensing: There are severa packages in monitoring environmental parameters samples of which are given under. They share any additional demanding situations of harsh environments and decreased energy supply.

Polluting of the surroundings tracking: Wireless sensor networks have been deployed in plenty of towns (Stockholm, London and Brisbane) to display the energy of dangerous gases for citizens. These can leverage the random wi-fi links as a substitute of stressed out installations that also make them greater mobile for trying out readings in numerous regions.

Forest fireplace detection: A network of Sensor Nodes is normally placed in a forest to hit upon each time a hearth has all started. The nodes is normally with sensors to degree temperature, humidity and gases which are produced by fireplace within the trees or plants. The first detection is important to get a a hit motion of the hearth warring parties; As a result of Wireless as Sensor Networks, the fire brigade are able to recognize when a hearth starts you bet it can be spreading.

Landslide detection: A landslide detection machine makes use of a wireless sensor network to discover the slight actions of soil and adjustments to numerous parameters that will arise earlier than or during a landslide. With the facts accumulated it can also be feasible to recognize the look of landslides before it sincerely takes place.

4. Conclusion

This paper demonstrates the usage of Wearable Wireless Body Area Networks as a key infrastructure permitting unobtrusive, continual, ambulatory health tracking. This new technology has capability to provide an extensive variety of advantages to sufferers, clinical personnel, and society through continuous tracking in the ambulatory putting, early detection of extraordinary situations, supervised rehabilitation, and ability understanding discovery thru facts mining of all accumulated records. We have defined a popular WWBAN architecture, essential implementation issues, and our prototype WWBAN based totally on off-the-shelf wireless sensor platforms and custom-designed ECG and movement sensors. We have addressed several key technical issues along with sensor node hardware architecture, software program architecture, community time synchronization, and strength conservation. Further efforts are vital to improveQoS of wi-fi conversation, reliability of sensor nodes, security, and standardization of interfaces and interoperability. In addition, further researches of various scientific conditions in scientific and ambulatory settings are important to decide precise obstacles and feasible new programs of this technology.

References

[1] Stanford V (2002) Using pervasive computing to deliver elder care. IEEE Pervasive Computing 1: 10-13.

[2] Mcfadden T, Indulska J (2004) Context-aware environments for independent living, In Proceedings of the 3rd National Conference of Emerging Researchers in Ageing, Brisbane, Australia.

[3] Anliker U, Ward JA, Lukowicz P, Troster G, Dolveck F, et al. (2004) AMON: a wearable multi-parameter medical monitoring and alert system. IEEE Trans InfTechnol Biomed 8: 415–427.

[4] Cho G, Yoo1 SK (2009) Wearable ECG Monitoring System Using Conductive Fabrics and Active Electrodes, Proceedings of the 13th International Conference on Human-Computer Interaction, Berlin, Heidelberg.

[5] Darwish A, Hassanien AE (2012) Wearable and Implantable Wireless Sensor Network Solutions for Healthcare Monitoring. Sensors 12: 12375-12376.

[6] Udayakumar R., Kaliyamurthie K.P., Khanaa, Thooyamani K.P., Data mining a boon: Predictive system for university topper women in academia, World Applied Sciences Journal, v-29, i-14, pp-86-90, 2014.

[7] Kaliyamurthie K.P., Parameswari D., Udayakumar R., QOS aware privacy preserving location monitoring in wireless sensor network, Indian Journal of Science and Technology, v-6, i-SUPPL5, pp-4648-4652, 2013.

[8] BrinthaRajakumari S., Nalini C., An efficient cost model for data storage with horizontal layout in the cloud, Indian Journal of Science and Technology, v-7, i-, pp-45-46, 2014.

[9] BrinthaRajakumari S., Nalini C., An efficient data mining dataset preparation using aggregation in relational database, Indian Journal of Science and Technology, v-7, i-, pp-44-46, 2014.

[10] Khanna V., Mohanta K., Saravanan T., Recovery of link quality degradation in wireless mesh networks, Indian Journal of Science and Technology, v-6, i-SUPPL.6, pp-4837-4843, 2013.

[11] Khanaa V., Thooyamani K.P., Udayakumar R., A secure and efficient authentication system for distributed wireless sensor network, World Applied Sciences Journal, v-29, i-14, pp-304-308, 2014.

[12] Udayakumar R., Khanaa V., Saravanan T., Saritha G., Retinal image analysis using curvelet transform and multistructure elements morphology by reconstruction, Middle - East Journal of Scientific Research, v-16, i-12, pp-1781-1785, 2013.

[13] Khanaa V., Mohanta K., Saravanan. T., Performance analysis of FTTH using GEPON in direct and external modulation, Indian Journal of Science and Technology, v-6, i-SUPPL.6, pp-4848-4852, 2013.

[14] Kaliyamurthie K.P., Udayakumar R., Parameswari D., Mugunthan S.N., Highly secured online voting system over network, Indian Journal of Science and Technology, v-6, i-SUPPL.6, pp-4831-4836, 2013.
[15] Thooyamani K.P., Khanaa V., Udayakumar R., Efficiently measuring denial of service attacks using appropriate metrics, Middle - East Journal of Scientific Research, v-20, i-12, pp-2464-2470, 2014.
[16] R.Kalaiprasath,R.Elankavi, Dr.R.Udayakumar, Cloud Information Accountability (Cia) Framework Ensuring Accountability Of Data In Cloud And Security In End To End Process In Cloud Terminology, International Journal Of Civil Engineering And Technology (Ijciet)
[17] Volume 8, Issue 4, Pp. 376–385, April 2017.
[18] R.Elankavi, R.Kalaiprasath, Dr.R.Udayakumar, A fast clustering algorithm for high-dimensional data, International Journal Of Civil Engineering And Technology (Ijciet), Volume 8, Issue 5, Pp. 1220–1227, May 2017.
[19] R. Kalaiprasath, R. Elankavi and Dr. R. Udayakumar. Cloud. Security and Compliance - A Semantic Approach in End to End Security, International Journal Of Mechanical Engineering And Technology (Ijmet), Volume 8, Issue 5, pp-987-994, May 2017.
[20] Thooyamani K.P., Khanaa V., Udayakumar R., Virtual instrumentation based process of agriculture by automation, Middle - East Journal of Scientific Research, v-20, i-12, pp-2604-2612, 2014.
[21] Udayakumar R., Thooyamani K.P., Khanaa, Random projection based data perturbation using geometric transformation, World Applied Sciences Journal, v-29, i-14, pp-19-24, 2014.
[22] Udayakumar R., Thooyamani K.P., Khanaa, Deploying site-to-site VPN connectivity: MPLS Vs IPSec, World Applied Sciences Journal, v-29, i-14, pp-6-10, 2014.
[23] T. Padmapriya and V. Saminadan, “Improving Throughput for Downlink Multi user MIMO-LTE Advanced Networks using SINR approximation and Hierarchical CSI feedback”, International Journal of Mobile Design Network and Innovation- Inderscience Publisher, ISSN : 1744-2850 vol. 6, no.1, pp. 14-23, May 2015.