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An Efficient Energy Aware Secure Routing In Medical Data Transmission for Body Sensor Network

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Abstract— The Body Sensor Network (BSN) technology is one of the most imperative technologies used in IOT-based modern healthcare system. In this Process, at first we address the several security requirements in in BSN based modern healthcare system. Then, we propose a secure IOT based healthcare system using BSN, called BSN-Care, which can guarantee to efficiently accomplish those requirements. BSN architecture composed of wearable and implantable sensors. Each sensor node is integrated with bio-sensor such as Electrocardiogram (ECG), ElectroMyoGraphy (EMG), ElectroEncephaloGraphy EEG), Blood Pressure (BP), etc. These sensors collect the physiological parameters and forward them to a coordinator called Local Processing Unit (LPU). The LPU works as a router between the BSN nodes and the central server called BSN-Care server, using the wireless communication mediums such as mobile networks 3G/CDMA/GPRS. The Body Sensor Network (BSN) technology is one of the core technologies of IOT developments in healthcare system, where a patient can be monitored using a collection of tiny-powered and lightweight wireless sensor nodes.In this process, at first, we highlight the major security requirements in BSN-based modern healthcare system. Subsequently, we propose a secure IOT-based healthcare system using BSN, called BSN-Care, which can efficiently accomplish those requirements.

1. INTRODUCTION

A Body Area network (BAN), also referred to as a wireless body area network (WBAN) or a body sensor network (BSN), is a wireless network of wearable computing devices. BAN devices may be embedded inside the body, implants, may be surface-mounted on the body in a fixed position Wearable technology or may be accompanied devices which humans can carry in different positions, in clothes pockets, by hand or in various bags. Whilst, there is a trend towards the miniaturization of devices, in particular, networks consisting of several miniaturized.Body Sensor Unit (BSU) together with a single body central unit (BCU). larger decimeter sized smart devices, accompanied devices, still play an important role in terms of acting as a data hub, data gateway and providing a user interface to view and manage BAN applications. About six years later, the term "BAN" came to refer systems where communication is entirely within, on, and in the immediate proximity of a human body. The rapid growth in physiological sensors, low-power integrated circuits, and wireless communication has enabled a new generation of wireless sensor networks, now used for purposes such as monitoring traffic, crops, infrastructure, and health. The data traffic of different sensors dynamically dictated by the sensor functionalities, body movements and environment status[7]. In this process, at first, we highlight the major security The body area network field is an interdisciplinary area which could allow inexpensive and continuous health monitoring with real-time updates of medical records through the Internet. A number of intelligent physiological sensors can be integrated into a wearable wireless body area network, which can be used for computer-assisted rehabilitation or early detection of medical conditions. This area relies on the feasibility of implanting very small biosensors inside the human body that are comfortable and that don't impair normal activities. The implanted sensors in the human body will collect various physiological changes in order to monitor the patient's health status no matter their location. This device will instantly transmit all information in real time to the doctors throughout the world. The signaling cost can also be reduced due to the group management. Simulation results shown that it outperforms accuracy, high speed, low power.

2. RELATED WORK

Existing WBAN MAC protocols enhanced the energy efficiency primarily by TDMA multiplexing or reducing the communication frequency of beacons. However, synchronization of such super frame-based structures would consume extra energy than usual. Therefore, the need to study energy-efficient synchronization in sensors where synchronization is detected their own signal peaks driven by the heartbeat. Nonetheless, this does not guarantee the best of the result because the changes in heartbeat rhythm may not simultaneously be reflected on all the sensors, a perfect example is accelerometers, may not be used to extract the heartbeat. Our proposed work differs from early works in that we propose a new synchronization technique which could immensely reduce the overhead involved with the early

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schemes through dynamically adjusting synchronization frequency and maximizing the interval between two synchronization. More importantly, the energy issue is not considered independently but instead, we work towards satisfying the QOS constraints through optimal slot allocation and energy efficiency. Using static TDMA, a node will obtain consecutive slots and thus its frames are transmitted one by one. The deep fading which is troublesome for the static TDMA assignment of WBAN is long-lasting [8]. The deep fading is a major problem because if a frame happens to be dropped then the subsequent frames will most likely be dropped since deep fading problem last for along interval of time i.e. up to 400ms.CA-MAC protocol adapted a hybrid of contention Based superframe and TDMA to address the deep fading in WBAN but the contention period involved could negatively impact the channel utilization and energy. In this paper, we utilize collision-free TDMA and formulate optimized slot allocation to achieve the best required QOS among heterogeneous sensors.

3. PROPOSED SYSTEM

Body Sensor Network (BSN) allows the integration of intelligent, miniaturized low-power sensor nodes in, on or around human body to monitor body functions and the surrounding environment. It has great potential to revolutionize the future of healthcare technology and attained a number of researchers both from the academia and industry in the past few years. Besides, when the LPU detects any abnormalities then it provides immediate alert to the person that wearing the bio-sensors. For example, in general BP less than or equal to 120 is normal, when the BP of the person reaches say 125, the LPU will provide a gentle alert to the person through the LPU devices . When the BSN-Care server receives data of a person from LPU, then it feeds the BSN data into its database and analyzes those data. Subsequently, based on the degree of abnormalities', it may interact with the family members of the person, local physician, or even emergency unit of a nearby healthcare center. Precisely, considering a person wearing several bio sensors on his body and the BSN-Server receives a periodical updates from these sensors through LPU. Now, our BSN-Care server maintains an action table for each category of BSN data that it receives from LPU. Table III denotes the action table based on the data received from BP sensor, where we can see that if the BP rate is less than or equal to 120 then the server does not perform any action. Now, when the BP rate becomes greater than 130, then it informs family members of the person. If the BP rate becomes greater than 145 and there is no one attending the call in family, then the server will contact the local physician. Furthermore, if the BP rate of the person cross 160 and still there is no response from the family member or the local physician then the BSN-Care server will inform an emergency unit of a healthcare center and securely provides the location of the person. Here, the response parameters "FR" (Family Response), "PR" (Physician Response), and "ER" (Emergency Response) are the Boolean variables, which can be either true (T) or false (F). If the value of any response parameter is false, then the server repeats its action. For example, when the family response parameter "FR: F", then the server repeatedly call his family members. Once, the family members of the concern person pick-up the call, then the value of the family response parameter (FR) will become true i.e. "FR: T". Now, if "FR:F" and BP > 130 then the BSN-Care server will call the local physician. In case, when the physician also does not respond to the server's call, then the value of the physician response parameter "PR" will stay in false. In this regard, the server will repeatedly call both the family members and the the physician. Unless any of the response parameter (FR, PR) value becomes true. Meanwhile, if "FR: F", "PR: F" and BP > 160, then the BSN-Care server immediately inform to the emergency unit of a healthcare center nearest to the concern person. Once the emergency unit responds, then the value of the emergency response parameter "ER" will become true i.e. "ER: T". It should be noted that, our BSN-Care system is not only designed for the patient, instead of that it can be useful for providing a decent quality of life for the aged people.

Merits of Proposed System:

- Improves the overall network lifetime and Achieving maximum throughput.
- Delay is reduced.
- QOS is improved.
- Latency is reduced and efficient performance in energy.
- Security is high when compare with an existing system.

4. PERFORMANCE ANALYSIS

Various aspects of data transmission in the body sensors are analyzed. A different network parameter analysis is being done for the proposed protocols. Parameters like Throughput, Packet Delivery Ratio and delay.

4.1. Throughput

Throughput is the number of useful bits per unit of time forwarded by the network from a certain source address to a certain destination, excluding protocol overhead, and excluding transmitted data packets.

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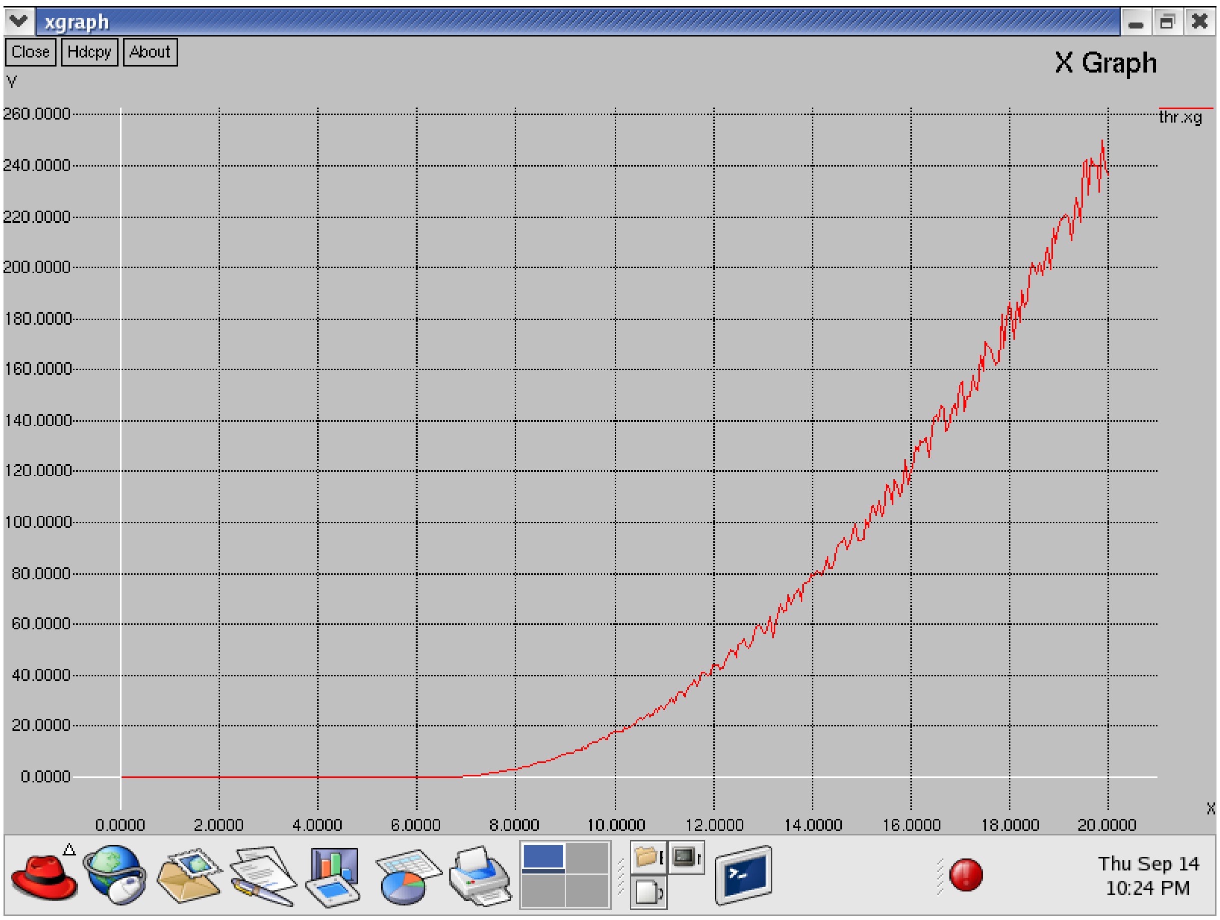
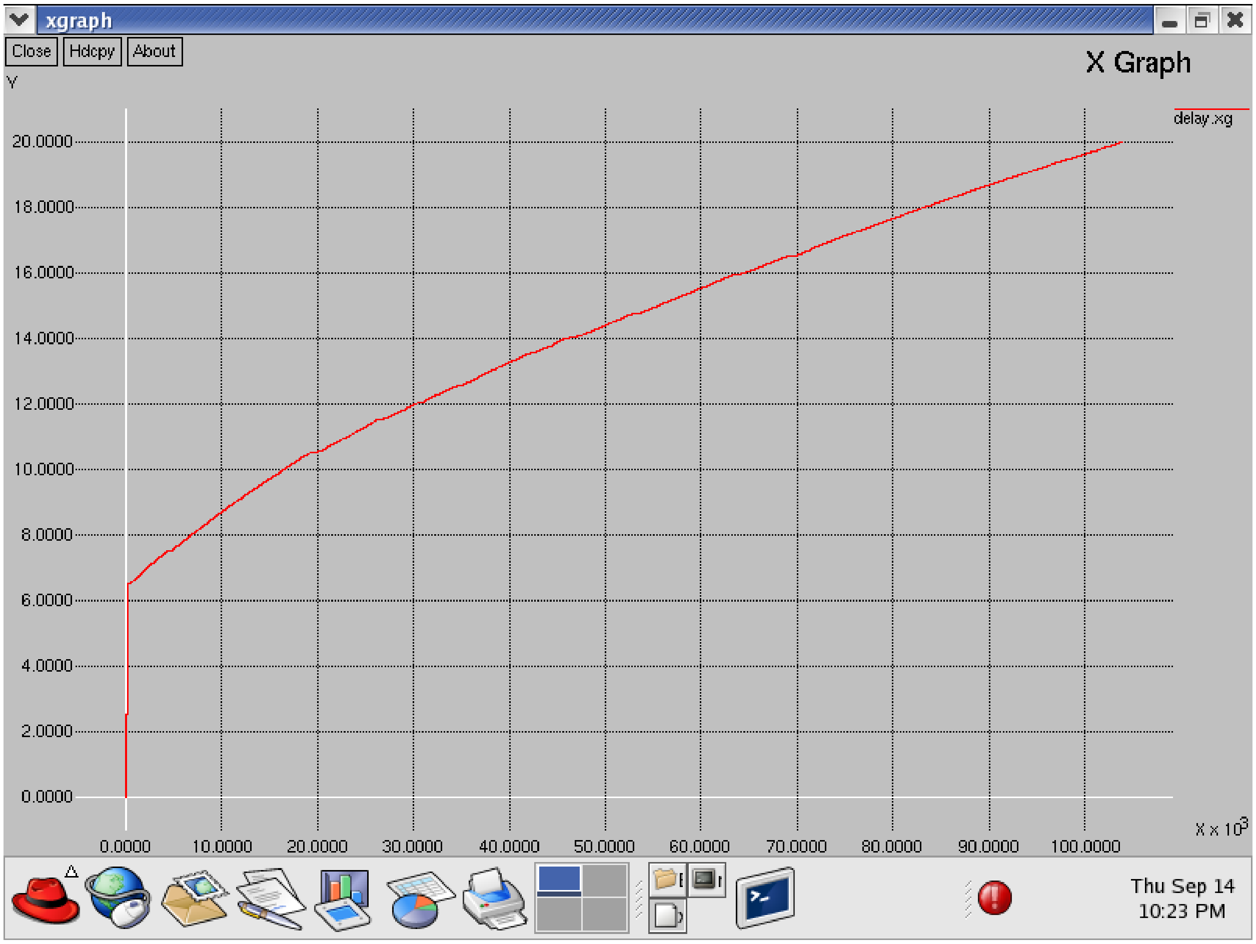
$$\text{Throughput} = \frac{\text{No of Packets Received}}{\text{Simulation time}}$$



4.2. Delay

It is defined as the average time taken by the packet to reach the server node from the client node.

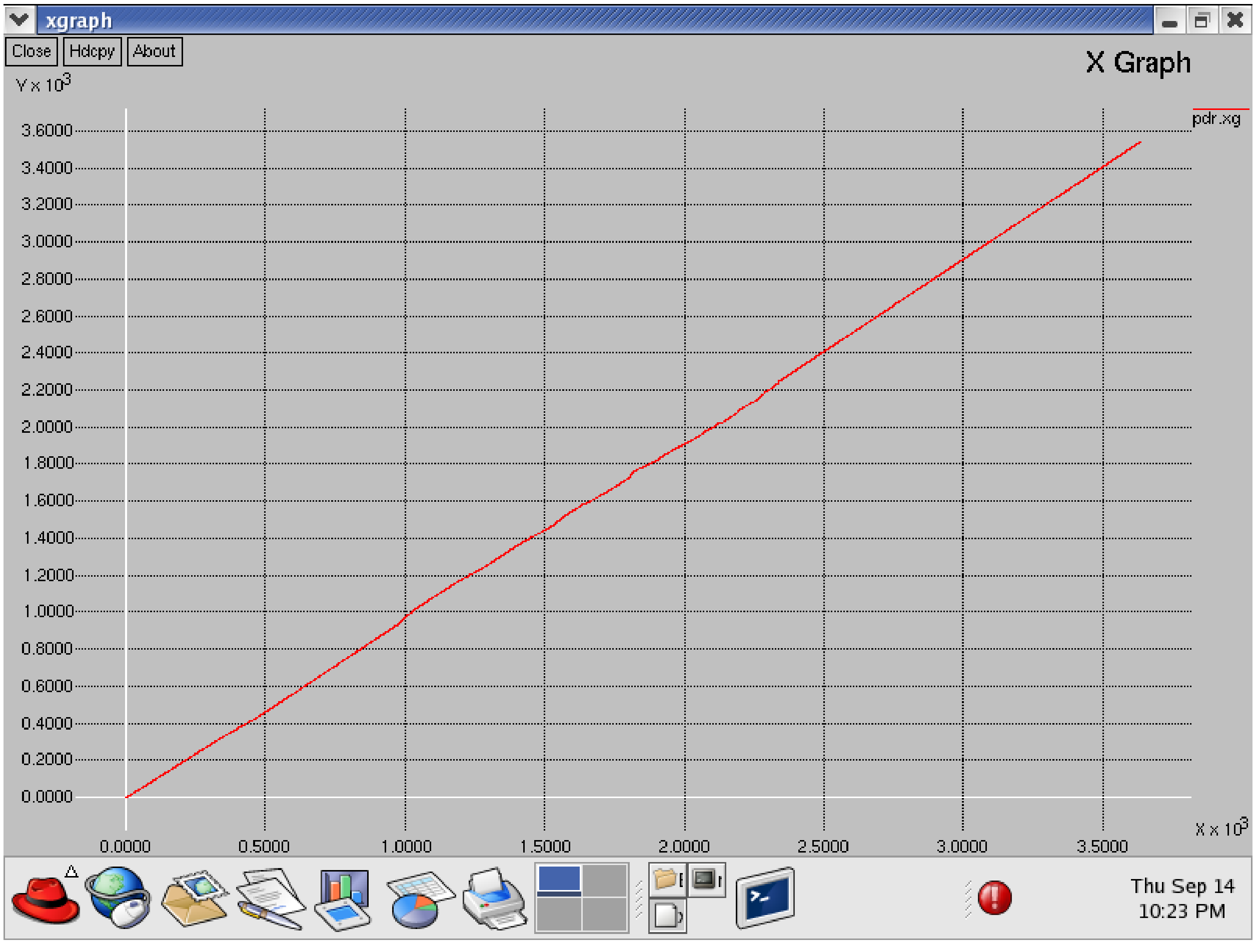
$$\text{Delay} = \frac{\text{No of Packets Sent}}{\text{Simulation time}}$$



4.3. Delivery Ratio

Packet Delivery Ratio is defined as the average of the ratio of the number of data packets received by each receiver over the number of data packets sent by the source.

$$\text{Delivery ratio} = \frac{\text{No of Packets Received}}{\text{No of packets Sent}}$$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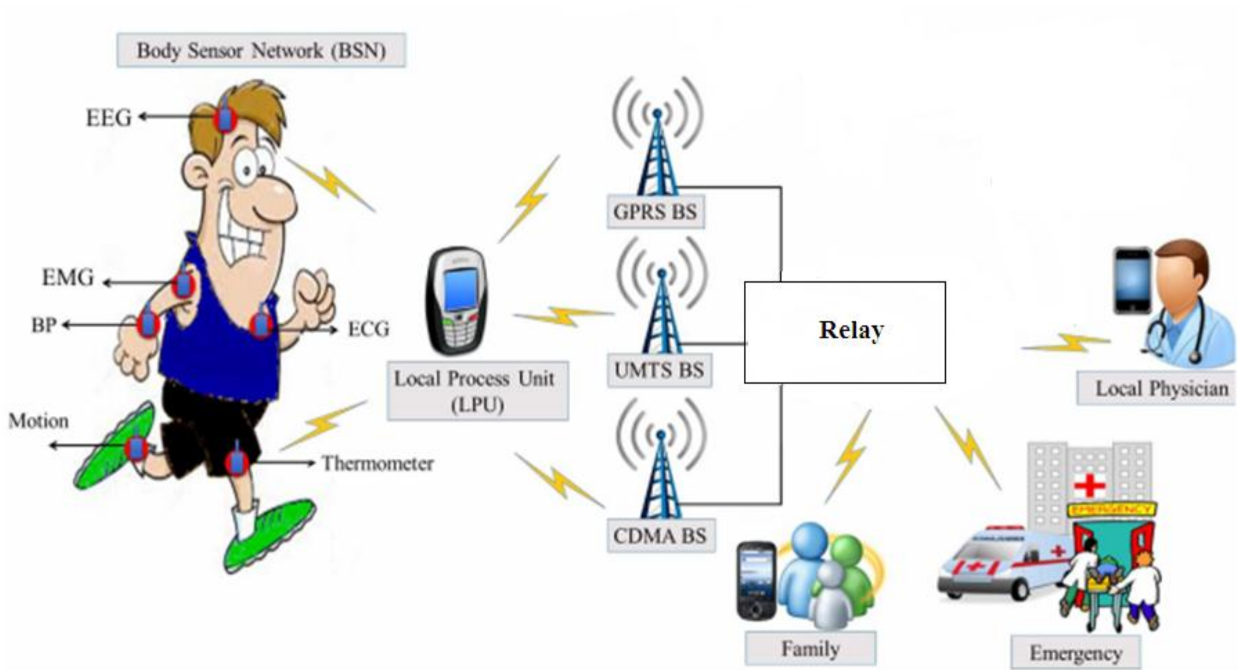

5. CONCLUSION

In this article, at first we have described the security and the privacy issues in healthcare applications using body sensor network (BSN). Subsequently, we found that even though most of the popular BSN based research projects acknowledge the issue of the security, but they fail to embed strong security services that could be preserve patient privacy. Finally, we proposed a secure IOT based healthcare system using BSN, called BSN-Care, which can efficiently accomplish various security requirements of the BSN based healthcare system.

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