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Snooping And Securing Data For Medical Based Body Area Network

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Abstract: *A general framework for securing medical devices supported wireless channel observation and anomaly detection. Our proposal is predicated on a medical security monitor (Med Mon) that investigate on all the radio-frequency wireless communications to/from medical devices and uses multi-layered anomaly detection to spot probably malicious transactions.*
Upon detection of malicious dealings, Med Mon takes applicable response actions. A key good thing about Med Mon is that it's applicable to existing medical devices that area unit in use by patients, with no hardware or computer code modifications to them.
In our paper we need to indicate that the Slave is acting as Master furthermore as slave configuration to cause anomaly within the network. As slave it receives knowledge |the info |the information} from master and sends false reading to master which may cause problems since the master diagnosing are going to be inaccurate since false data is being fed to the Master via abnormal Node. Apart from password and time anomaly we include here distance anomaly, angle anomaly detection.
Keywords: *WSN, BAN, Anomaly, medical monitoring, zigbee protocol*

I. Introduction

As of late, therapeutic advances and developments in ultra-low-control figuring, systems administration, and detecting advances have prompted a blast in implantable and wearable restorative gadgets (IWMDs). IWMDs are right now used to perform cardiovascular pacing, defibrillation, breath action, insulin conveyance, profound cerebrum incitement, intrathecal sedate imbuement, and numerous other demonstrative, checking, capacities.

IWMDs usually incorporate remote correspondence interfaces through which they can be associated with outer demonstrative or programming gear, or to body zone systems (BANs) to frame individual social insurance frameworks (PHSs).

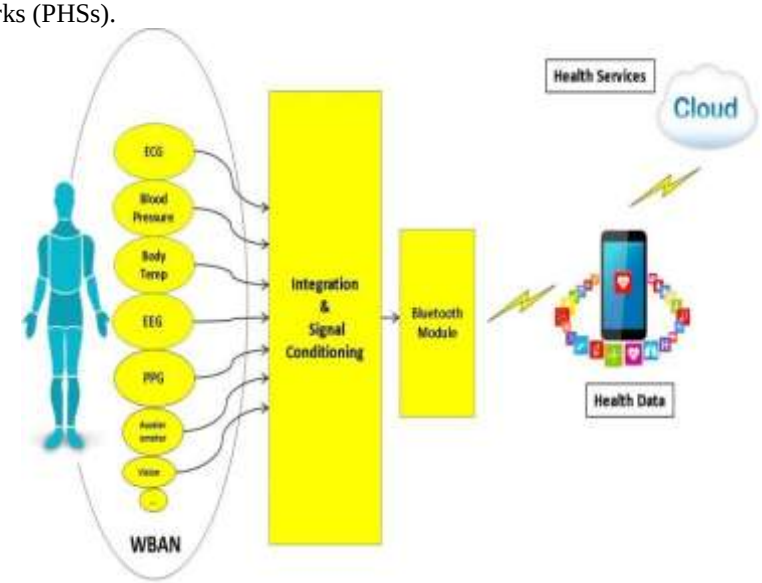


Fig. 1. Idea of advanced personal healthcare system.

Fig. 1 shows advanced architecture for how IWMDs can be connected to form a PHS. A PHS typically consists of sensors for physiological data collection, actuators for therapy delivery, remote controllers for reconfiguration, and a hub for logging, compressing, and analyzing the raw health data. Since the functions performed by IWMD and PHSs are frequently life-critical, any malfunction in the operation is of utmost

concern. An incessant trend in IWMDs has been towards increased functional complexity, software programmability, and network connectivity. The Federal Communications Commission (FCC) supervises the utilization of people in general Radio Frequency (RF) range inside which RF remote advances work. The FDA's approaches on remote restorative gadgets are composed with the FCC and furnish medicinal gadget producers with greater consistency and a superior comprehension of administrative necessities for therapeutic gadgets that use these advances. Fuse of remote innovation in restorative gadgets can have numerous advantages, including expanding tolerant portability by dispensing with wires that tie a patient to a medicinal bed, giving social insurance experts the capacity to remotely program gadgets, and giving the capacity of doctors to remotely access and screen understanding information paying little respect to the area of the patient or doctor (clinic, home, office, and so forth…). These advantages can extraordinarily affect quiet results by permitting doctors access to continuous information on patients without the doctor physically being in the healing facility and permitting ongoing alteration of patient treatment. Remote observing can likewise help extraordinary populaces, for example, seniors, through home checking of incessant ailments with the goal that progressions can be distinguished before more genuine outcomes happen.

Patient's awareness towards advance medical system:

The utilization of RF remote innovation can mean advances in human services, and patients ought to be educated about the protected and successful utilization of these gadgets over the span of day by day life. Since the aviation routes are shared, the working of your remote restorative gadget might be influenced, (for example, information misfortune or disturbance) by different remote gadgets close you. Likewise with any therapeutic gadget. Because of the nonappearance of cryptographic assurance, the remote channel has been distinguished as the Achilles' foot sole area of restorative gadgets. Ongoing exhibits of fruitful RF remote assaults on cardiovascular pacemakers and insulin pumps, have put restorative gadget security under incredible investigation. To better see how remote channels can be utilized to trade off medicinal gadgets, we give a short outline of the assault portrayed in on a glucose observing and insulin conveyance framework. This assault misuses the remote channels between the gadget and controller, and between medicinal gadgets. The aggressor initially listens stealthily on the remote parcels sent from a remote control to an insulin pump. From the caught bundles, the assailant figures out the gadget PINs related with the remote control and glucose meter. By mirroring the remote control, the assailant can arrange the insulin pump to handicap or change the expected treatment, stop the insulin infusion, or infuse a significantly higher dosage than permitted. By imitating the glucose meter, the assailant can send fake information to the insulin pump, making the pump alter insulin conveyance in light of the false information. Moreover, the assailant can snoop on the parcels to induce delicate patient information.

The above attack is hard to defend against, especially because it is hard to differentiate the attacker's forged wireless transmissions from legitimate ones. In this paper, we propose a medical security monitoring system (called MedMon) that detects such wireless attacks and protects PHS integrity and patient safety. MedMon's is based on the observation that although the attacker's transmissions may conform to the communication protocol, they are likely to deviate from legitimate transmissions either in the physical signal characteristics or in the behavior or underlying content. MedMon is an external monitor that tracks all wireless communications to/from medical devices and identifies potentially malicious transactions using multi-layered anomaly detection. When anomalies are captured, the monitor can warn the patient and jam the suspicious transmission before it changes the state of the target device. MedMon can be implemented as a dedicated device or built into an existing personal device such as a smartphone. The summary of our contributions is as follows:
To design a body area network for patients in ICU.
To detect and intercept any anomalous data within the network.
To Design and develop an accurate and advance system for secured data .
The rest of the paper is organized as follows. Section II discusses concept of anomaly. Section III provides an overview of the available defence framework, Section IV evaluates proposed system finally, and Section V concludes the paper result.

Social insurance experts the capacity to remotely program gadgets, and giving the capacity of doctors to remotely access and screen understanding information paying little respect to the area of the patient or doctor (clinic, home, office, and so forth…). These advantages can extraordinarily affect quiet results by permitting doctors access to continuous information on patients without the doctor physically being in the healing facility and permitting ongoing alteration of patient treatment. Remote observing can likewise help extraordinary populaces, for example, seniors, through home checking of incessant ailments with the goal that progressions can be distinguished before more genuine outcomes happen.

II. Anomaly

Concept:

Anomalies are unusual measurements that may be obtained from sensors in a wireless sensor network for various reasons e.g. faulty sensors , actual events i.e. a change in some monitored property of the variable, obstructed or even faulty communication system among sensors , etc. They represent values, which appear to be different from others obtained from similar ambient conditions in such a way that one is fairly convinced they must be from a different distribution. Anomalies are also called outliers. are used. When Guardian is lost by the patient or it does not function properly, it can be easily rekeyed as nothing is required except ECG signal of patient. In case, if attacker could make physical contact with patient, he can extract the key.

Causes:

1. Faulty sensors or motes: Broken sensor, dead batteries, non-deliberate obstruction of wireless sensor communication, faulty motes, etc., all qualify as anomalies caused by faulty sensors or equipment. This is especially true if the anomalies disappear once the faults are fixed, if not, sabotage will be the more likely cause.
2. Sabotage: For this, an enemy that seeks to water down, or aggravate measurements with an aim to mislead decision makers causes the anomalies deliberately. This usually may take several forms. This has led to the research in the area of security in wireless sensor networks, with different already developed.
3. Errors: Errors may be due to changes in sensor intrinsic characteristics. An example is the changes in measurements by a sensor at different temperatures. Errors may also occur when the sensors communicate non-steady state measurements.
4. Events: Events are the actual anomalies that the wireless sensor network designer wishes to have to deal with. They represent the actual information. For whatever application, events are the changes that need to be monitored and should affect decision-making processes that take place based on measurements from wireless sensor networks.

III. Available Techniques For Monitoring And Anomaly Detection

1. Radiofrequency identification

Pacemaker systems were considered as implantable cardiac defibrillators. In this study, they assumed a channel between medical devices and controllers. This channel was based on radio frequency identification (RFID). But here the drawback was if antenna of the attacker is of high gain then there were chances that wireless channel can be easily attacked. And attacker can easily access the patient data, if it is within ten meters of distance from IMD.

2. Communication clocker

Patients have to wear these clockers externally. The interactions taking place between IMDs and the doctor are coordinated by clockers. When the patient wears the clocker, unauthorized programmers are not able to see the IMDs. So, patient's data cannot be accessed by an attacker. In emergency, medical staff can access the IMD by removing the clocker. But, if patient is not wearing the clocker, it is lost or damaged, external programmer can access the IMD.

3. Body coupled communication

A new concept of human-centric connectivity uses body coupled communication (BCC) technology where human body is used as a transmission medium. For BCC, a small electric field is induced in human body. The devices which are very near to the human body play important role in BCC. Signal propagates between these devices only. Thus, range of the communication is limited very close to the human body.

4. Ultrasonic distance bounding

This scheme used a message authentication protocol. The protocol used the concept of ultrasonic distance bounding. In this protocol, messages are encrypted beyond the distance measured by the IMD i.e., distance near to the IMD. By this concept, IMDs are accessible to the devices which are very closer to them. There are chances that an attacker can make the physical contact with patient by approaching him parameters. The key has to be printed into patient's skin with the help of ultraviolet- ink micro pigmentation. The key is placed near the point of IMD implantation. The ultraviolet-ink micro pigmentation were called invisible tattoos. The devices which are used for communication with IMDs consist of a reliable, inexpensive and a small ultraviolet light emitting diode (UV LED) and to enter the key, it has a device like a keypad or any other mechanism. Multiple devices may use a single key. No daily effort is required for UV micro pigmentation except the use of sunscreen.

5. IMD guard

IMDGuard is used for implantable cardiac devices like pacemaker, implantable cardioverter defibrillator etc. It uses a Guardian, a wearable device which plays a role of mediator between doctor and IMD. In this case, to

extract the key, electrocardiography (ECG) signals of the patient are used. When Guardian is lost by the patient or it does not function properly, it can be easily rekeyed as nothing is required except ECG signal of patient. In case, if attacker could make physical contact with patient, he can extract the key.

6. Shield

Shield is a personal base station. Patients have to wear this shield on the body near the IMD. Messages were coordinated between programmer and IMDs using shield. Shield provides secured communication of IMDs with programmer. Shield encrypts the messages sent by IMDs and sends them to the programmer. Considering the reverse case, the commands from the programmer to be send to IMDs by the shield are not encrypted. Therefore, commands do not remain confidential.

7. Secured and efficient data sensing for medical based body area network

It provides security by two ways. First is through wireless monitoring and second is through anomaly detection. Anomalies include physical and behavioral. Physical anomalies are of three types. These are time of arrival (TOA), differential time of arrival (DTOA) and received signal strength indicator (RSSI). Behavioral anomalies consist of the two, i.e., data anomaly and command anomaly. In secured monitoring system we only consider two types of anomaly i.e.time anomaly and password anomaly if it occurs only for that system reacts.

IV. Proposed System

Disadvantages of existing system:

1. Body area networks are susceptible to any attacks from within as well as outside the network.
2. The Body area network has no security against data which is being transmitted by other slaves form different network.
3. The existing body area networks are expensive to install and require regular maintenance
4. It covers only two types of anomaly time anomaly and distance anomaly

To avoid the above drawback we propose a system having

Objectives:

1. To design a body area network for patients in ICU.
2. To detect and intercept any anomalous data within the network.
3. To Design and develop system for ECG, blood pressure and heartbeat monitoring.
4. Apart from including only time anomaly and password anomaly detection we add RSSI (Received signal strength indicator) anomaly detection system.
5. To prepare data base of patient's different monitoring parameters for future reference purposes of medical expert.

We propose a general framework for securing medical devices based on wireless channel monitoring and anomaly detection. Our proposal is based on a secured and efficient data sensing for medical based body area network that investigate on all the radio-frequency wireless communications to/from medical devices and uses multi-layered anomaly detection to identify potentially malicious transactions.

Upon detection of a malicious transaction, Monitor takes appropriate response actions, which could range from passive (notifying the user). A key benefit of this is that it is applicable to existing medical devices that are in use by patients, with no hardware or software modifications to them.

In our paper we are showing that the Slave is acting as Master as well as slave configuration to cause anomaly in the network. As slave it receives the data from master and sends false reading to master which can cause Issues since the master diagnosis will be inaccurate since false data is being fed to the Master via Anomalous Node.

Request and response protocol:

Master sends a request to slaves for data at particular interval of time

Following are all the anomalies monitored

Time anomaly: If a transmission is scheduled to occur at specific points in time, the occurrence of the transmission at a non-scheduled time reveals an anomaly.

Password anomaly: After receiving the frame the master /Slave will check for the security password. If the password is correct then only slave will respond to master request.

RSSI: If the distance between the monitor and each transmitting device is known and expected to remain relatively constant, the signal strength from the device can be expected to fall within a specific range. An anomaly is detected if the signal allegedly sent by the device has unusually high or low strength.

AOA: Assuming the monitor is carried at a fixed location on the patient, e.g., attached to the right side of the patient's belt, a transmitting device, e.g., a sensor on the patient's back, will have a fixed angle relative to Med

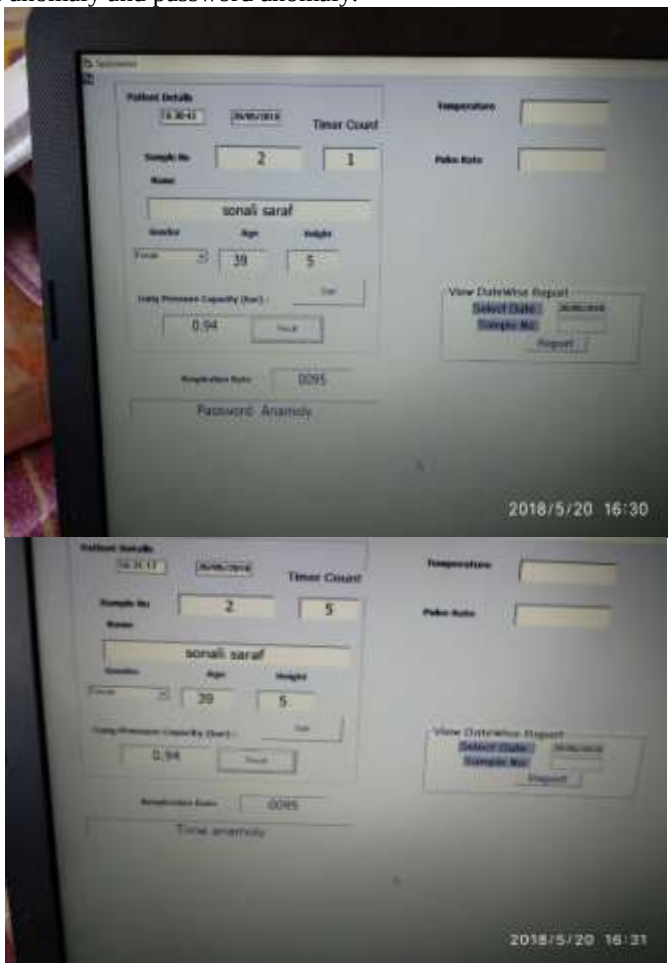
Mon. In such cases, AOA could be used to examine whether the signal is arriving from the correct direction. For example, the monitor will report an anomaly if it receives sensor signals from the front, when it expects them to come from the back.

Advantages of proposed system:

1. The proposed Body area network is equipped with a security mechanism which blocks any attacks or anomalous readings from other slaves.
2. The BAN designed is inexpensive and can very well cover today's hospital rooms.
3. Here we propose zigbee communication protocol which is better than the other protocols available for communication.
4. We propose the monitoring of ECG, BP,Heart rate parameters where we could design better pressure sensors as per the requirement.

V. Result

Fig shows results of time anomaly and password anomaly.



1. By having certain advancement in the software we can have RSSI and AOA anomaly indications also.
2. RSSI (received signal strength indicator) anomaly occurs if data signal strength gets varied from its expected value.
3. AOA (Angle of arrival) anomaly arrives if data signal angle varies from the expected value.

VI. Conclusion

Here we propose an advance medical monitoring system for intensive care unit which is based on secured wireless transmission of data. For communication of data we propose a zigbee wireless protocol which is having enormous advantages over other communication protocol. For anomaly detection apart from time and password anomaly we propose received signal strength indicator (RSSI) anomaly as well as location of sensors placed on patients' body anomaly.

References

[1]. S. Hartalkar and V. Bale, Secured and efficient data sensing for medical based body area network, *IOSR Journal of Electronics and Communication Engineering*, 13(4), 2018

[2]. Zhang, Meng, A Raghunathan, and N. Jha, MedMon: Securing medical devices through wireless monitoring and anomaly detection, *IEEE Transactions on Biomedical Circuits and Systems*, 7(6), 2013, 871-881.

[3]. Review on Security of Medical Devices International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 5, Issue 5, May 2016

[4]. Halperin, Daniel, et al. "Pacemakers and implantable cardiac defibril-lators: Software radio attacks and zero-power defenses", IEEE Symposium on Security and Privacy, 2008.

[5]. Insulin pumps - global pipeline analysis, opportunity assessment and market forecasts to 2016, globaldata. Global Data (2010).

[6]. K. Hanna, Innovation and invention in medical devices: workshop summary. National Academies Press (2001).

[7]. G. E. Park and T. J. Webster, "A review of nanotechnology for the development of better orthopedic implants", Journal of Biomedical Nanotechnology, Vol. 1, Issue 1, pp. 18-29, 2005.

[8]. E. Gultepe, D. Nagesha, S. Sridhar, M. Amiji, "Nanoporous inorganic membranes or coatings for sustained drug delivery in implantable devices", Adv. Drug Deliv. Rev. 62:305-315.

[9]. Fu, Kevin, "Inside risks: Reducing risks of implantable medical de-vices", Communications of the ACM, Vol. 52, Issue 6, pp. 25-27, 2009.

[10]. Maisel, William H., and Tadayoshi Kohno, "Improving the security and privacy of implantable medical devices," New England journal of medicine, Vol. 362, Issue 13, pp.1164-1166, 2010.

[11]. Li, A. Raghunathan, and N. K. Jha, "Hijacking an insulin pump: Security attacks and defenses for a diabetes therapy system," IEEE Int. Conf. on e-Health Networking Applications and Services, pp. 150–156, 2011.

[12]. Israel and S. Barold, "Pacemaker systems as implantable cardiac rhythm monitors", American Journal of Cardiology, Vol. 88, Issue 4, pp. 442-445, 2001.

[13]. K. Fotopoulou and B. Flynn, "Optimum antenna coil structure for inductive powering of passive RFID tags," in Proc. IEEE Int. Conf. Radio Frequency Identification, 2007, pp. 71–77.

[14]. G. P. Hancke and S. C. Centre, "Eavesdropping attacks on high-frequency RFID tokens," in Proc. Workshop Radio Frequency Identification Security, 2008, pp. 100–113.

[15]. T. Denning, K. Fu, and T. Kohno, "Absence makes the heart grow fonder: New directions for implantable medical device security," in Proc. Conf. Hot Topics in Security, 2008, pp. 1–7.

[16]. H. Baldus, S. Corroy, A. Fazzi, K. Klabunde, and T. Schenk, "Humancentric connectivity enabled by body-coupled communications," IEEE Commun. Magzine., Vol. 47, Issue 6, pp. 172–178, 2009.

[17]. K. B. Rasmussen, C. Castelluccia, T. S. Heydt-Benjamin, and S. Capkun, "Proximity-based access control for implantable medical devices," in Proc. ACM Conf. Computer and Communications Security, 2009, pp. 410–419.

[18]. S. Schechter, "Security That is Meant to be Skin Deep: Using Ultraviolet Micropigmentation to Store Emergency-Access Keys for Implantable Medical Devices", Microsoft Research, Tech. Rep. MSR-TR-2010-33, 2010.

[19]. F. Xu, Z. Qin, C. Tan, B. Wang, and Q. Li, "IMDGuard: Securing implantable medical devices with the external wearable guardian," in Proc. IEEE Int. Conf. Computer Communications, pp. 1862–1870, 2011.