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REVIEW ON WIRELESS SENSOR NETWORK IN HEALTH CARE WITH EMPHASIS ON REAL TIME MONITORING OF BLOOD OXYGEN LEVELS IN ANESTHESIA

Computer Science

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ABSTRACT

Wireless Sensor Networks (WSNs) are being increasingly deployed in health monitoring,.Use of wireless sensor networks (WSN) with computational capabilities to monitor general anaesthesia vide use of anaesthesia machine in delivering mixture of anesthesia gases in critical surgeries with Real-time, continuous monitoring of saturation percentage of oxygen to control hypoxia can preventing medical emergencies. Medical sensors are attached to the patient's body to collect the patient's physiological data. Wireless transmission of the collected data to a medical staff's portable device. The current review gives insight into recent developments in WSN in Critical Medical applications focused on` how WSN and IOT can help maintain balanced Anesthesia.

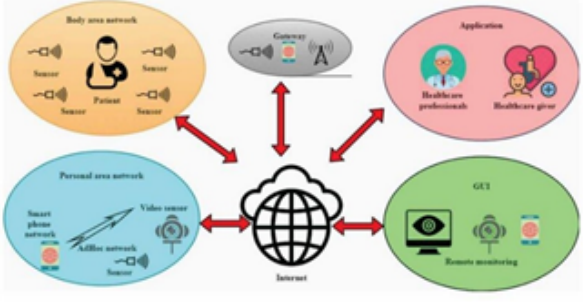
KEYWORDS

Wireless Sensor Network, Anaesthesia, Encryption, Monitoring, Internet of Things

INTRODUCTION

Wireless sensor networks (WSN) are important in patient health monitoring. Nodes have base stations, gateway to network with high-performance data processing or storage center with human interface access point and are used as a connection to deliver control information to networks or acquire data in network.. Security is increasing in challenge over time. Encryption requires complex operations. Detecting and verifying secure locations, establishing keys and establishing trust, attacking sensor nodes, managing security groups, and aggregating security data(1). In health care, there is an explosive growth of WSN because of technological developments in the networks in medical and low-power networked systems. Challenges and memory limitations, power limitations, processing limitations, size level constraints, and systems are requirements in healthcare. Nodes have base stations, gateway to network with high-performance data processing or storage center with human interface access point used as a connection to deliver control information to a network or to acquire data from the network. These types of nodes have an ability to collect some data and then return it to a sink.. This is a end user. Sink than communicates with a task Manager. Route is Internet or by satellite communications. Encryption requires complex operations. Detecting and verifying secure locations, establishing keys and establishing trust, attacking sensor nodes, managing security groups, and aggregating security data(1)

In health care, there has been a growth of wireless service networks because of technological developments in the networks in medical and low-power networked system that has led to expanding quality in several demographic segments in major field studies of human behavior and chronic illnesses. Challenges in memory limitations, power limitations, processing limitations, size level constraints, and systems where requirements are stringent networks are a cutting-edge component of the healthcare industry. This review is an update on , Medical sensors, sensors in anesthesia , encryption and futuristic-trends in development of sensors for oxygen monitoring in anesthesia**(1,23)**



Source ;https://techxplosre.com/news/2023-02-wireless-sensor-networks-potential-health

Literature Review

Historical Perspectives

Use of sensor nodes started in Cold War. The National Oceanic and Atmospheric Administration monitor marine developments like wildlife activity and earthquake and it protects its borders. In 1980, sensor network research began with Distributed Sensor Network programming extended the Arpanet communication technology (now the Internet) to sensor networks. It had spatially distributed low-cost sensor nodes. A sensor network consisted of numerous distributed autonomous sensor units which transmitted information to node made the most efficient use of accumulated data. WSNs in practice are related to the initiative Distributed Sensor Network that was initiated in 1980 by Defence Advanced Research Projects Agency. WSN applications are associated with military and industrial applications that are distant thought from marine life and volcanic activity. WSN technology which then found a place in the home for academic/ scientific research. . From then on, corporate units were the ones where WSNs were used in industriaapplications like the distribution of power, wastewater treatment, and automation in factories(4).

Medical Sensors

Sensors give patients and their Medics insight on physiological and physical mental status that is relevant for the detection, diagnosis, treatment, and management of diseased conditions. Medical devices employed in hospitals, clinics, and homes require to monitor a patient's status if thermometers, blood pressure monitors, Glucometer, electrocardiograms (ECG), photo seismographs (PPGs), electroencephalograms (EEG's), and modern imaging sensors that are cost- effective were not available. Cardiac intervention device pacemakers and enabled to measure physiological conditions continually. In aid of a particular signal-processing method, a medical sensor does combine transducers to detect signals of electrical, thermal, optical, chemical, genetic, and other physiological origins.It estimates characteristics indicative of human health.(5)

Wireless Networking Sensors in Critical Medicine and Surgery

Advancements in enduring healthcare monitoring could stop or rapidly reduce the incidence of illnesses and accidents. Simple sensors have limitations and locations; wired communication does not allow a patient to move freely from one place to another place. Number of medical errors is decreased. An SPO2 sensor and pressure sensor are suggested devices for cardiac patients to monitor blood pressure and oxygen saturation levels. Each patient's sensor data is relayed to smartphones, including the doctors'. Even while patients are unconscious, a cloud network efficiently uses monitoring .Intensive Care Unit (ICU) patient needs to be observed carefully. A monitoring system involving usage of huge cables impedes nursing methods and makes complications in patient transfer(4,5,6).

General anesthesia and Use of Sensors in General anesthesia

Anesthesia is a drug-induced, reversible condition in which the patient remains unconscious and is unresponsive to any painful surgical stimuli called sedation status that is achieved by intravenous administration of a cocktail of medications including a muscle

relaxant, hypnotic, and analgesic agent. A balance of gas and infra-venous drugs is crucial to ensure quick onset and an accurate Depth of Anesthesia during induction phase, to ensure pleasant and short recovery time after surgery. Anesthesia Drugs slow down body's metabolism.This reduces amount of oxygen delivered to heart. Thus administration of oxygen prior to induction in anesthesia, is essential in airway management. This prevents hypoxaemia (low oxygen in blood , Tissues) during Apnea or No-normal Breathing in Surgical or stage III anesthesia(7).

Classification of Sensors

Analog and Digital Physical properties of the body can be measured by using different sensors like body temperature, heart rate, pulse rate, respiratory, and heart rate. Common types of sensors include Ultra-Sonic Pressure Based, Infra-Red Radiation based, Thermocouple and /or Temperature based, Gyroscopes, Light-Based sensors, Color based touch-based, half effect-based Metal Detector based, and Proximity Sensors Infra-Red Sensor A Photodetector emits digital signal then calculate speed by a disc attached to a rotating shaft.

A sensor passes through each slot in the shaft. An output pulse as logic 1 or logic displayed on a LCD. Digital type of Accelerometer. An accelerometer may produce variable type of accelerom frequency with a square wave with a Width modulation. When an output produced in a PWM signal pulse width is in direct proportion for acceleration. Other sensors like digital temperature sensor(9,10,11).

The Modern Anesthesia Machine

This is an integrated anesthesia workstations designed to work as a complete anesthesia and respiratory gas delivery and monitoring system that combines advanced ventilation features, gas delivery and agent vaporizing with patient monitoring and information management to form an integrated anesthesia care-station. Modern Anesthesia monitors are open-source communication interface type that permits hard wired connection of the monitor to recording system. Depth of Anesthesia during induction phase, to ensure pleasant and short recovery time after surgery[4,5,6,7] Monitoring Health monitoring systems are important and research on health monitoring were developed for applications like military, home-care unit, hospital, sports training and activity emergency monitoring system. A wearable and real-time monitoring system for critical vital signs in patient's age over 60 years may help doctor or people in family monitor the emergency alarm from patient. It consists of blood pressure, heart rate, oxygen saturation, body temperature and respiratory rate. That vital sign can measure by using device namely; pulse oximeter. The pulse oximetry data are important for doctor to monitor patient's health condition. Implementation and design of wireless sensor network for real-time health monitoring system using ZigBee wireless standard, and demonstration of pulse oximetry data (heart rate and SpO2) monitoring on the patients designed for reducing the cost, size and comfortable in daily life usage. An automated syringe pump based on the Raspberry Pi has been successfully constructed and the test data examined in order to evaluate the system's functionality in studies earlier. A 50% reduction in functional residual as can result in pulmonary atelectasis..Correct use of anesthesia and analgesic techniques influence pulmonary outcomes in the Post Anesthesia Care Unit (PACU) (12, 13, 14, 15, 16).

Confidentiality of Data

Patient health care data is considered under legal and ethical obligations of confidentiality, and disclosed only to physicians or caretaker. Attackers may employ patient data for illegal purpose and it compromises patient privacy(17).

Sensors in General Anesthesia

Using a continuous flow anesthesia machine, a precisely controlled and constant supply of medical gas (air, nitrous oxide, oxygen,) mixed with an anesthetic vapor (isoflurane) at a fixed concentration to pump it at known pressure and flow rate for balanced anesthesia

Medical Sensor Safety

Medical sensors collect sensitive body data from a patient and transmit it through wireless channels, become more vulnerable than usually wired networks.Patient physiological variables are personal, they must be protected from security threat.

Advances in medical sensor technology

Advanced technology new chemical, biological, and genomic sensors and analytics using microelectromagnetic systems, medical -imaging, micro-fluid, and Nano-fluid investigations are in place now. thus enabling their quicker detection and personalized type treatment.They have complexity used outside of their medical domains. Recent developments in micro-electronics and computers have created new forms of medical sensing more readily now available to individuals at home, in workplaces, and in living space that evaluate blood pressure and blood glucose. These medical devices have revolutionized the treatment of chronic organic ailments hypertension and diabetes, allowing frequent recording of readings on vitals even before a doctor's visit. Using sensors we continuously monitor physiological variables in dayto-day life. Holter monitors and wearable heart rate and activity monitors are engineered to be designed to record any sudden heart and/or brain event that may not even look as appearing apparent on a doctor's visit. Geriatric assistance devices and certain implants and prostheses with embedded medical sensors are also becoming available now. Research and development in implantable medical sensors to continuously monitor the patient's vitals in glaucoma, objectives must be to continually record health metrics which are not externally available. The aim is to use measures that act as triggers for physiological treatments. These steps can stop impending undesirable scenarios (epilepsy seizure) or status requiring immediate physical help (brain-controlled motor prostheses). Such a Sensing device should be capacitated be able to communicate and receive power wirelessly.

Recent innovation and advances in information technology is now readily connecting medical sensors to other devices but early sensors were by and large isolated using built-in user interfaces with displayed readings. It is possible to connect a sensor to an external device through wired interfaces like RS 232, USB, and Ethernet. Sensor-based devices are being integrated into patient is away from home and engaging in outline tasks. Now this is on real-time medical imaging. With Wearable devices and ambulatory sensors, wired or wireless connection may be connected to cloud computing. These sensors do record patient data in non-volatile memory. This can later be uploaded and further shared with doctors for further analysis. Also, sensor technology is more sophisticated using the development of cheap, small, high-quality sensors even in personal and also advanced machine learning algorithms which are capable of analyzing complex conditions such as stress. The caregivers should be informed about depression and addiction derived from sensory sensor information. Development of internet connectivity enables information and rapid response

In sensor networks communication from sensor node to the sink is an energy consuming task. Here , Clustering has been suggested as a strategy to provide communication in the sensor network. Gupta et al, (19) have recently proposed a clustering procedure to reduce energy consumption, reduce delay in communication and improve the connectivity of the network. This algorithm improves the performance and lifetime of the network by improving the above mentioned parameters.During the global pandemic of COVID-19 it was felt to have a myriad of social distancing practices, just as limiting travel, exercising control over borders, closing bars and clubs, and reminding people to make sure a safe distance of about 1.6 to 2 m amongst them. But determining the extent of virus dissemination and the effectiveness of the limited it is a problematic issue. People went out for food, medical supplies, and other vital items, activities.Recently a general model for automatically detecting objects (here a class of people) based on deep neural networks using existing CCTV cameras and for tracking and measuring distances between objects, while performing real-time dynamic threat assessment based on statistical analysis of data on human movement in the field was suggested allowing tracking people's movements and behaviors, assess the rate of social distancing violations for the entire population and identify areas of high risk in the short and long term(20).Threats in Information Transit **can** occur if sensor data is being sent (in transit). SHIMMER is an embedded micro-controller with very low-power radio with a consumption of about 60 mW, design allowing a small and rechargeable battery to last for hours or days together. Software is designed with resource limitations because of a lack of memory and computing power and wireless have limited bandwidth. Sensor nodes balance computing and communication overheads. Use of a Smartphone-based system has great computing power. A shorter charge cycle limits types of apps that a smart-phone can support.. The topology in a network may change over time, because of node mobility, environmental changes in RF medium and results in an unpredictable amount of power consumption

pattern [18].. WSN device mobility, each having its own SR responsible for configuring and managing all aggregated devices WSN movement in RFC3963, a research effort of the IETF working group NEMO (2005). The privacy issue for information gathered, transferred, and processed in a WSN has received less attention. Payload data gathered by sensors and to a centralized data processing server is one kind of private information of concern. Effective defenses against the exposure of both data and context oriented private information are essential requirements in realworld WSN systems.

CONCLUSIONS

WSNs have a wide range of potential applications and use of networks in with Big Data demonstrates their capacity too overcome limitations to fulfil specific objectives. We may anticipate heterogeneous datasets constantly generated by IoT to the point it cannot be collected, managed, or analyzed by conventional methods in Big Data. LS-WSNs can acquire and analyze it, Even if an anesthesiologist is not present physically, amount of anaesthesia that is needed is exactly predicted, preventing variations in anaesthetic levels and achieving correct depth of anesthesia. Research to ultimately make Anesthesia machines verbally interactive with notifications indicated automatically with software SMS, or a Bluetooth messenger.

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