Smart Healthcare system using IOT and Secured wireless technology embedded with pace maker for remote monitoring

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Abstract

This paper describes the design and implementation of a wireless remote monitoring system for patients with temporary cardiac pacemakers using IOT where doctors can get notification about patients heart rate and doctor can send immediate message to concerned patient about his increasing heart rate which can be fatal if not controlled at that instant also patients can also control their heart rate immediately by taking specific precautions suggested by doctor. The system is built around a low power cardiac pacemaker with wireless data transmission capability, used for patient monitoring. Basically we are using IOT around this system for doctors and patients Doctors can remotely monitor the patient's heart rate when notifications are received .Also doctors will take remote follow-up about patients As pace maker is already implanted to control the heart rate and if the heart rate goes above the threshold value doctors will get alert message immediately with the help of IOT and WSN technology. Data will be received by WSN technology where the alarm will be signaled when value increased the threshold value.

Keywords: Pacemaker, Remote monitoring, Remote follow-up

INTRODUCTION

Recently, once the patient is admitted in hospital it takes long time for him to get discharged especially related to heart because the patient needs continuous medical care . Also doctors need continuous updating of the patients medical conditions. Hence efforts have been made so that patients do not stay long time in hospital. Wireless Sensors Network along with smart sensor node are having great importance now a days .In recent time integrated digital electronics embedded with physical sensors, microprocessor, and radio frequency devices into a single micro-chip has led to the emergence of very lightweight, ultra-low power, monitoring sensor devices .WSN can be used in Adhoc manner which make them flexible, fault tolerance, and adaptable in any condition. They can be greatly used to monitor and trace patients health in both cities and rural area using internet reducing the anxiety and time of doctors and also increase the efficiency of health providers of medicals , give comfort to the patients , workload is reduced to far extent .This new system is useful to patients as patients are going to get quick notices whenever the value of pacemaker reaches the beyond the threshold and doctor can monitor remotely the heart rate signal or physiological signals without the need of disturbing the patient's normal life thus improving the quality of life. Sensor node with the pace maker can be placed on human body to give entire coverage to the doctor about the increasing heart rate. Traditionally pace maker are temporary or permanent which stimulates the heart rate or pulse. The patients generally are not aware of their increasing or decreasing rate This device is in size of match box which automatically controls and even stimulates the heart rate It is worth saying that sensor nodes are operated by batteries, their power consumption during transmission must be minimal

for efficient and reliable data transmission . Using sensor nodes with communication technologies such as mobile phones such as 3G,4G with the internet, the sensor network can keep patient, caregivers, and doctor informed while also establishing trends and detecting variations in health. This paper, proposes a networking solution in which Medical Sensor collect multiple physiological signs sensed by each of the body sensors along with Pace maker is placed in human heart. Whenever there is alteration in heart pulse pace maker will try to stimulate it and sensors will simply give the indication to the doctor about the change in heart rate through internet. Doctors will get immediate notification through app and may give necessary instructions to the patients , also patients will get immediate messages and will understand the reason of their variations. Patients will become aware about the reason and next time they will take prevent their actions which are dangerous to their health. Such embedded devices will be very useful for doctors and can save many life's of patients suffering with heart problem .

LITERATURE SURVEY

This work describes the sensors to be embedded with pace maker to be placed inside human body. Here the patients can be very far from the health care center .The Doctor will get entire updation using IOT .To give the entire record we are using body sensors which is much in implantation now a days and helpful to mankind. The modern monitoring system in healthcare does not require the patient to be near the bedside. The patients can roam anywhere freely. During the early 1980's analog cellular telephone system was experiencing rapid growth in Europe, particularly in Scandinavia and United Kingdom, but also in France and Germany. Each country developed its own system, which was incompatible with everyone else's in equipment and operation. This situation was not desirable to patients crossing the boundary of their country. Also BSN is a collection of low-power and lightweight wireless sensor nodes that are used to monitor the human body parameters. The security and privacy issues that are commonly found in most healthcare applications are combated using body sensor networks [3].The collaboration of IoT and cloud offers an efficient healthcare monitoring systems in which medical information can be transferred safely with the consent of the patient. A network is built among all the entities participating in healthcare, which improves communication among the entities in turn delivering better care and services. Object hyper linking is a new age technology that aims at extending Internet to objects and locations around the world. The huge data generated from various sources resides in the cloud, which requires greater processing power to retrieve information in a secure and reliable manner [4]. A pervasive surveillance system comprises of sensors, actuators, and cameras. Due to its myriad advantages mesh topology is used in this surveillance system. The main challenge of anomaly detection is to minimize the risk of the disease going undetected which is accomplished through IoT[6].

Now a days simply integrating IoT devices into the healthcare system is the next step in advancing medicine and medical practices. In the healthcare industry, this technology is referred to as the Internet of Things for Medical Devices (IoT-MD). This category includes retail consumer products, such as fitness bands and digital scales, as well as connected medical devices such as insulin pumps and pacemakers. The process behind IoT-MD allows users mobile and medical devices to monitor and transmit personal data through the devices to secure clouds or medical-based platforms where findings can be analyzed to create actionable, data-driven measures and recommendations.

PROPOSED SYSTEM

In our system we introduce sensors embedded with pace maker .From the below figure 1 IoT enabled healthcare applications allow patients to schedule their appointments without the need to call a doctor's office and wait for a receptionist. Healthcare information technology allows doctors to carry information with them anywhere they go through apps on their smart phones.

Also during emergency doctor can get to know the whereabouts the patient. If the patient is unable to come doctor can send ambulance immediately to patients location .In propose we require body sensors, internet connection to provide data at good speed and Wireless connectivity .Here app is provided to doctor as well as patient where patient can directly contact through messages to doctors during emergency and doctors can give suggestion , notify patients about their level of heart rate also give preventive measures when patients are in critical situations. After the analysis is complete in case of an emergency situation the platform sends an alert to an emergency contact or it connects directly to the emergency control room[7]. The Internet of things is growing by the second and making life easier for patients and doctors. The devices such as smart meters and fitness bands and RFID based smart watches and smart video cameras assist in the process. Providers should be capable of handling large amounts of information and data, which is challenging. The potential of IoT for medical facilities are gathered by smart sensors, which are accurate and analyses a variety of health parameters. This includes the essential parameters such as pulse, heart rate, blood pressure and oxygen and glucose level in blood. Sensors can be incorporated in pill containers to generate alerts when the patient has taken the medication

CHALLENGES

Healthcare applications present several challenges: low power, limited computation, material constraints, continuous operation, robustness and fault tolerance, scalability, security and interference, and regulatory requirements

The power challenge The power challenge is present in almost every area of application of wireless sensor networks, but still there is restriction of a body smart sensor which is inplanted in human heart. Although researchers says that wirelessly they can provide the power but due to operational heat power it is not possible to cool down the sensor devices .Alkaline battery are useful in today's, it will be necessary to assure that a network can remain operational without any replacements [7].

Computation is directly limited due to the limited amount of power. Typically, biosensors are not expected to have the same computational power as conventional wireless sensor network nodes. Since communication is vital and footprint is small, little power remains for computation. A solution can be NEVES et al.: APPLICATION OF WIRELESS SENSOR NETWORKS TO HEALTHCARE PROMOTION 183 data fusion, which entails several nodes pooling their information together for increased computational power processing and accuracy. Moreover, it may be expected that for some applications, such as blood glucose monitoring, the ability to transmit data to an external device will be required for further data processing. Some sensors may have varying capabilities that communicate with each other and send out one collaborative data message [2].

Material constraints is another issue for wireless sensor networks application to healthcare. A biosensor must be in contact with human body, or even on it. If the biosensor is inside a pill, the choice of construction materials must be careful, especially on

batteries. Also chemical reactions with body tissue and the disposal of the sensor is of utmost importance. In many applications, it is possible to discard one or more smart sensors without the need for any operator intervention.

Continuous operation must be ensured along the lifecycle of a biosensor, which cannot benefit from duty-cycle variation techniques. This type of operation and data sensitivity clearly demand robustness and fault tolerance. The biosensor is expected to operate for days, sometimes weeks without operator intervention. Finally, the wireless sensor network must integrate mechanisms for security and interference free functionality. Carl Falcon stresses the requirements, topologies, selection of a transmission protocol, the environmental requirements, radio and multi-path interference problems, and data integrity check. He concludes that the understanding of protocols and requirements are crucial for the selection of the radio system [4].

Robustness. Rates of device failure will be high whenever the sensor devices are deployed in harsh or hostile environments. Protocol designs must therefore have built-in mechanisms. It is important to ensure that the global performance of the system is not sensitive to individual device failures. Furthermore, it is often desirable that the performance of the system degrade as gracefully as possible with respect to component failures [3]. Particularly, the failure of one node should not cause the entire network to cease operation.

Security and interference is one very important topic to consider, especially for medical systems. Physiological data collected by the sensor network involves personal information whose privacy must be protected, and data consistency maintained. These networks are often deployed in open areas, allowing attacks such as jamming or node capture and tampering [5]. To find the sweet spot between security and other challenges one must consider the attacker motivations and opportunities. The most often motivation for attacker is benefit from data. Attacker opportunities range from physical access, wireless communication, attacks on coordination and self-configuration, up to network visibility. Regulatory requirements must always be met, even more with medical applications. There must be some evidence that these devices will not harm; even prototype devices will have to meet the strict standards of patient safety before any human testing can be done. The wireless data transmission must not harm human body and the chronic functioning and power utilization of these devices must also be benign. Design for safety must be a fundamental feature of biomedical sensor development, even at the earliest stages. Reasonable evidence of design efficacy will be required even for prototype devices .

The sampling rate must be appropriate for the current application. In healthcare applications, this typically implies real-time data acquisition and analysis (if possible). This raises concerns like event ordering, time sampling, synchronization and emergency response.

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