A REAL TIME ECG AND EEG DATA TRANSMISSION FOR REMOTE PATIENT MONITORING SYSTEM

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Abstract

The recent year has witnessed a significant surge of interest in sensing and monitoring in healthcare. The monitoring and acquisition of patients' physiological information are quite crucial for the further treatment. The Electrocardiogram (ECG) aims to measure the cardiac rhythm and rate of a patient. It ensures that the QRS complex is intact for the diagnosis of cardiac arrhythmias.

The Electroencephalography (EEG) is used in the evaluation of brain disorders. Most commonly it is used to show the type and location of the activity in the brain during a seizure. Many patients can benefit from continuous monitoring as a part of a diagnostic procedure, optimal maintenance of a chronic condition or during supervised recovery from an acute event or surgical procedure.

These are challenges which include issues such as wireless networking protocols, power-efficient topologies, frequency, routing and security.

***Keywords**: ECG, EEG, Bluetooth communication.*

1. INTRODUCTION

The electrical impulses within the heart act as a source of voltage, which generates a current flow in the torso and corresponding potentials on the skin. The potential distribution can be modelled as if the heart were a time-varying electric dipole. If two leads are connected between two points on the body (forming a vector between them), electrical voltage observed between two electrodes is given by dot product of the two vectors [1].

An accurate indication of the frontal projection of the cardiac vector can be provided by three leads/electrodes, one connected at each of the three vertices of the Einthoven triangle [2]. Generally, as many as twelve leads are used to monitor cardiac signals. The most prevalent and significant among these is Lead II for diagnosing rhythm problems. Signals from Lead II measure the variations in potential between the right arm and the left leg, with the electrode of the left arm acting as the ground.

Looking for a choice between Bluetooth and IEEE 802.11 protocols, various indicators point the superiority of 802.11 over Bluetooth protocol. For e.g., experimental results have shown better performance for 802.11b as compared to Bluetooth. Also, the compatibility of 802.11b with existing LANs reduces the cost of extra hardware and the overhead of managing the Bluetooth network [4].

Smartphones with flexible software development environments have opened up the possibility of creating customized applications to facilitate emergency service. When designing a new systems, it is important to research and analyse any similar products that are already available. Application stores have created a market for both priced and free programs available for mobile download, and Apple's application store alone, there are nearly 12,000 applications related to health [5]. Among these are several applications dedicated to transmitting medical information. The application allows the user to take a picture of the ECG, sends it to the fast ECG website, and then generates a code that the sender can give to the intended recipient. The recipient enters the code on the fast ECG website to view the ECG. Cardiologists have approved the application for it is picture quality, reporting that it allows for normal interpretation of an ECG. The transmitted images are also only slightly compressed to 180kB, making transmission inefficient and slow. When the user presses send, fast ECG attempts to transmit the image only once rather than retrying for a specified amount of time. This decreases the probability of a successful transmission since it depends on having data service at one discrete moment. A vehicle may move in and out of strong service areas in a short amount of time, so a transmission is more likely to succeed if multiple attempts are made. A mobile application has potential to add value to the systems that are currently being used. All ECG devices available on the market produce 12-lead printouts; however some devices transmit ECG images to hospital servers, while others do not. Technology in camera phones has improved to take high resolutions images even in low quality lighting. Transmission using a smart phone is very different than using a proprietary system because applications on smart phones are developed to be flexible. Using a mobile application in the hospital workflow allows for customization with regards to probing for network activity and providing real-time feedback/results to users. Using the application could therefore provide more reliable feedback to users. In addition, the low cost of a mobile application would make ECG transmission accessible to rural EMS providers without funds for expensive systems.

2. MAIN TEXT

Wireless technology is ability to generate interactive healthcare utilizing modern technology and telecommunication. In telemedicine system is useful for absent of directly contact between the patient and doctor. The wireless device employ for the efficient remote monitoring system, using for real time, continuous and accurately information of patient heat condition.

The electrocardiogram is important role in the prevention, diagnose the abnormality of patients and rescue of heart disease. The development of a remote monitoring system for ECG signals, the deployment of packet data service over telecommunication network with new applications. Body area network where a certain number of sensors are acquire full range of biological signal and transmit them to remote base station for processing. Using wireless connection as medium, number of issue must be considered: ease of security, network generation, data throughput, data loss and power consumption.

3. ILLUSTRATIONS

The system divided in to the three parts. The first is the ECG and EEG acquisition part, the second part is the wireless transmission of the data to the patient's computer transmission, and the third part is data acquisition, viewing and restore.

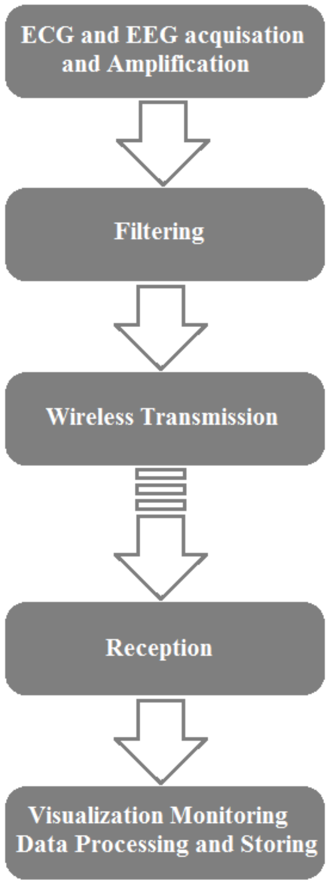

Figure 1. System work Flow

The analog signal portion has been simple, in order minimized space board. The raw signal- noisy ECG and EEG signals is acquire through disposable electrodes, attached to cables through a couple of standard clips. Filter circuit and then to wireless module for transmission. Wireless module based on IEEE 802.15.4 used for transmission and receiving the signal. ECG and EEG front end circuit connected with wireless module as remote base station.

The EEG test is non-invasive neurophysiology exploration usually needed in many neurological consultation to configure a final diagnose, together with the information from patient's clinic and neurological exploration. The EEG records the electrical activity of the brain to provide information used in the diagnosis of different clinical circumstances such as epilepsy or mental disorders. Moreover, it is used to analyse and control the treatment of patients with neurological damage. It is usually performed with an ambient video recording in order to clearly distinguish biological artefacts from neurological alterations and also to advice in advance epileptic seizures. Although the EEG test is a highly demanded medical technique, used in different medical fields like neurology, internal medicine and paediatrics, this service is not available in many primary or secondary hospitals. Thus, the introduction of a telemedicine system applied to acquire and transmit electroencephalographic signals in teal time is presented as an attractive solution to avoid patient's transfer to tertiary hospitals and to provide them better access. In telemedicine field using transmission media and compression techniques to deliver bio such as ECG, EEG for long distance medical services has become reality and challenge. For the urgent treatment or ordinary healthcare or patient monitoring system, it is necessary to compress and transmit these data for the efficient use of bandwidth. In telemedicine application, transmitting a large amount of data through limited bandwidth and compressed form become a challenge [7]. While transmitting an EEG data, of data is compressed by compression techniques then it will reduce the data volume but significant features are preserved at the time of decompression. EEG data, being the acquired output from biological and physical systems, may possess various properties and characteristics that contribute to their diagnostic value [8].

3.1. Overview of algorithms

To meet the requirements of the research, the survey is carried out for the well-functioning of the developed applications. The survey carried comprises of comparison and transmission between various methods to achieve EEG data compression and transmission. For data compression the basic communication methods could give a best result. Methods like sampling, transforming, filtering and amplifying and coding can give the compression result and by using wireless network the transmission can be achieved.

Sangjoon lee, Jungkuk Kim, myoungho Lee [4] deals with the different methodologies for compression of bio signal. This paper focused on rel-time algorithms for a periodic bio signal, which supports to e-health services. A mainly author introduces a real time compression and transmission algorithms. The proposed algorithms. Moreover, because the algorithm can compress and transmit data in real time, it can be served as an optimal bio signal data transmission method for limited bandwidth communication between e-health devices. The following evaluation factor of compression algorithm is

Table 1. *Evaluation factor of compression algorithm*

Sr No	Evaluation factor	Results
1.	Compression Ratio (CR)	21.30
2.	Percentage rms difference (PRD)	1.75
3.	Percentage rms difference normalize (PRDN)	24.93
4.	Signal to Noise Ratio (SNR)	13.10
5.	Quality of Service (QS)	12.18

In general, EEG data compression can be of two types

1. Lossless compression:

In the lossless processes the original data can be exactly reconstructed from their compressed form. Lossless compression is typically adopted for text compression. In the lossless compression all information is saved and the compression is reversible [9]. For typical biomedical signals lossless (reversible) compression methods can only achieve Compression Ratios in the order of 2 to 1 [10].

2. Lossy compression:

Other hand lossy (irreversible) techniques may produce CR results in the order of 10 to 1. In lossy methods, there is some kind of quantization of the input data which leads to CR which is defined as the ratio of the total number of bits used to represent the digital signal before and after Compression, higher CR results at the expense of reversibility. But this may be acceptable as long as no clinically significant degradation is introduced to the encoded signal. The CR levels of 2 to 1 are too low for most practical applications. Therefore, lossy coding methods which introduce small reconstruction errors are preferred in practice.

For the means of,

1. Effective and economic data storage.

2. Real time transmission of the signals.

The most efficient data compression technique from all the available lossless data compression techniques needs to be chosen.

4. CONCLUSION

There are several methods of recording and transmitting ECG and EEG signals. A classical recording in health centre, then ambulatory ECG and EEG recordings and telemetry monitoring the patient in and round medical centre. With the use of mobile phone in medical purposes, monitoring and recording of the ECG and EEG signals offer many advantages. It is possible to monitor a heart patient in a real time, immediately to give an advice and therapy, the covered area of movement of the patient is practically unlimited. The control monitor centre with trained medical staff enables 24 hour monitoring of few thousands patients. With pre-paid service we get more economical and efficient way of monitoring patients than with classical recording of the ECG and EEG signals.

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