DESIGN AND DEVELOPMENT OF A MEDICAL TELEMETRY SYSTEM

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ABSTRACT

Medical telemetry is very important because every second is very crucial for a patient's life as the health condition of the patient is required to be sent to a health specialist as soon as possible. For example, if the heart stops, the person doesn't survive for more than a few minutes. Medical telemetry systems are very advanced with developing technologies such as wireless and Ethernet systems. Ethernet and wireless technology play important roles together in the medical telemetry systems because of their continuous high speed and high data transmission rates. Electrocardiogram signal (ECG) and blood oxygen saturation (SpO2) signals are two of the important indicators directly related to heart-pulmonary system. Monitoring and following of ECG and SpO2 offers us a good indication of heart functionality. Therefore, it is crucial to design and develop a homemade inexpensive device for measuring the Heart Rate and SpO2. In addition to this, data is required to be sent instantly so that it can be monitored and analysed remotely by the health specialist.

In the medical telemetry system designed and developed by the author, ECG and SPO2 signals are obtained using instrumentation amplifiers with filters, and are sent with serial Ethernet board to a remote place for analysis. Signals are transmitted in text format using suitable Ethernet boards. The developed system allows a health specialist to send data easily and cheaply to any required place.

Key words: Medical Telemetry, Biotelemetry, ECG, SPO2, Ethernet.

ÖZET

Medikal telemetri sistemlerinin kullanımı hayati bir öneme sahiptir. Çünkü hastanın hayatta kalabilmesi için hastanın durumunun sağlık uzmanına mümkün olabildiğince hızlı bir şekilde yollanması gerekmektedir. Örneğin, kalbin çalışması durursa kişi birkaç dakikadan fazla hayatını devam ettiremez. Medikal telemetri sistemleri gelişen kablosuz ve Ethernet sistemleri teknolojileri ile birlikte önemli bir ilerleme kaydetmiştir. Ethernet ve kablosuz teknolojileri sürekli yüksek hız ve veri iletim hız oranlarıyla medikal telemetri sistemlerinde önemli bir işleve sahiptir. Elektrokardiyogram (EKG) ve kandaki oksijen doyumu (SPO_2) sinyalleri kalbin dolaşım sistemleri hakkında iki önemli gösterge niteliğindedir. EKG ve SPO_2'nin görüntülenmesi ve izlenmesi kalbin çalışma fonksiyonu hakkında bize önemli bilgiler sunacaktır. Bu yüzden, SPO2 ve kalbin atış hızını ölçebilen ve uzak bir yerde bulunan sağlık personeline anlık olarak gönderebilen ev tipi cihazların tasarlanması hasta açısından hayati bir önem arz etmektedir.

Yazarın gerçekleştirmiş olduğu sistemde EKG ve SPO_2 sinyalleri enstrumantasyon yükselteçleri kullanılarak tasarlanmış olup analiz için uzak istasyona gönderilmiştir. Sinyaller text (metin) formatında Ethernet portu kullanılarak iletilmiştir. Sistem sağlık personeline gerekli herhangi bir yere verinin kolayca ve ucuz bir şekilde yollama imkânı sağlamaktadır.

Anahtar Sözcükler: Medikal telemetri, biyotelemetri, EKG, SPO2, Ethernet.

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ABBREVATIONS

LCD: Liquid Crystal Display

SPO_2: Saturation Peak of Oxygen in blood.

CMRR: Common Mode Rejection Ratio

GLCD: Graphical Liquid Crystal Display

AC: Alternative Current

DC: Direct Current

PC: Personality Computer

PCM: Pulse Code Modulation

FM: Frequency Modulation

FSK: Frequency Shift Key

GPRS: General Packet Radio Service

ARX: Mach like operating system for Acorn Computer

PDA: Personal Digital Assistant

AC: Access Point

AV: Atrioventricular

aVR: Augmented Vector Right

LED: Light Emitting Diode

RA: Right Arm

LA: Left Arm

RL: Right Leg

LL: Left Leg

aVL: Augmented Vector Left

IR: Infrared

LF: Low Frequency

HF: High Frequency

DSP: Digital Signal Processing

SL:Semilunar

aVF: Augmented Vector Foot

RAM: Read Access Memory

EMG: Electromyography

BPF: Band Pass Filter

HR: Heart Rate

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