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ijirset@gmail.com

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Detecting Pulserate and ECG Waveform by Using Bluetooth Stethoscope

S.Vijay Kumar, A.J. Grecia, N.Iswarya, S.Kokila, S.Mayuri

Department of Biomedical Engineering, Gnanamani College of Technology, Namakkal, Tamilnadu, India

ABSTRACT: Stethoscopes are used to listen to acoustic signals from the internal organs of the human body. Although stethoscopes play a very important role in the diagnosis process, the chest piece and the connecting cable are known to facilitate transmission of pathogens from patient to patient and from patient to the user. Replacing the connecting cable with a wireless system may help reduce the potential risk and further allow broadcasting of the signals to multi-users for examination. The system will serve the purpose of transmitting heart sounds wirelessly to a Bluetooth receiver module, which can either be a Bluetooth speaker or a headset. This wireless technique will allow real-time transmission of heart sounds to students for better understanding. Stethoscope is a special device to hear heartbeat sound and monitor pulmonary disease. The most type of stethoscope used these days is the acoustic stethoscope. However, the problem with this acoustic stethoscope is the sound level very low. It is hard to analyze the heart sound and difficult to be diagnosed by a medical doctor.

I. INTRODUCTION

The stethoscope comes from the Greek language for skope means chest and stethoscope means inspection. It is a very vital transducer for many medical practitioners. and used for end user like doctors, nurses and physicians detect the abnormalities of the heart and lung such as sounds of heart, lung rhythm, and vibration of the intestines and blood flow (Geddes 2005). Diaphragm of head stethoscope is the metal end that is placed on the chest to listen to the lungs and heart sound with the tubing to tapered inner bores. This structure is able to provide a better sound transmission while listening is known as a vacuum tube. The most type of stethoscope used these days is the acoustic stethoscope (Myint& Dillard 2001). However, the problem with this acoustic stethoscope is the sound level is very low make it hard to analyse and diagnose the heart sound by a medical doctor. This is why several forms of digital electronic stethoscope have been developed to replace the conventional acoustic stethoscope. Basically, the purpose of digital stethoscope is to improve the sound resolution, allow variable amplification, minimize interference noise and simplify the output signal.

Stethoscopes are used regularly by medical personnel to listen to acoustic signals picked from the internal parts of the human body during diagnosis and treatment of patients. Typically, signals that are picked from the body for diagnosis include that of the heart, lungs, and bowels. Although stethoscopes have become ubiquitous in healthcare delivery and are often used as a symbol of medicine in several media, their use may also serve as a threat to both patient and health personnel. For example, the diaphragm of the chest-piece and the connecting cable of the stethoscopes have been shown to harbor potentially pathogenic bacteria as these elements.

II. LITERATURE SURVEY

1. Design Of Wireless Electronic Stethoscope Based On Zigbee

Author - Ms.KadamPatil D. D. and Mr.Shastrri R. K.

Year – 2012

Heart sound stethoscope is primary stage to access diseases. In this paper design of an electronic stethoscope with the functions of wireless transmission is discussed. This electronic stethoscope based on embedded processor. The data can be transmitted through wireless transmission using Zigbee module. A microphone is used to pick up the sound of the heart beat. Acoustic stethoscope can be changed into a digital stethoscope by inserting an electric capacity microphone into its head. The signal is processed and amplified to play with or without earphone. Heart sounds are processed, sampled and sent wirelessly using Zigbee module so that multiple doctors can do auscultation. PC connectivity is provided through serial port where from audio and video can be made available through LAN and internet for telemedicine consultation.



2. Wireless Electronic Stethoscope

Author - G.Hemavathi ,S. Sherine

Year – 2018

Acoustic stethoscope is primary diagnostic tool used by doctors for effective analysis of various diseases. But, it suffers defects such as low level sounds and presence of murmurs. This paper aims at developing ‘Wireless electronic stethoscope using Butterworth filter’. Low level heart sounds are amplified with high gain preamplifier circuit. A review of basic filters like low pass RC filter, Butterworth filter, Chebyshev filter and Bessel filter are done for elimination of murmurs and best suited filter is suggested. Finally, amplified noise free heart sounds are simulated and results are shown in Proteus 7.4. The results prove that efficient filter for designing is ‘Butterworth filter’. This work can be further extended for a hardware prototype where amplified noise free heart sounds are wirelessly transmitted using RF module which could be heard by headphones or stored for further analysis.

3. Wireless Electronic Stethoscope

Author - Nishant Kumar BakshiMayur Gupta

Year – 2014

A stethoscope is a medical device for listening to the sound of heart and breathing in our body. The commonly used stethoscope is an acoustic stethoscope. The disadvantage of acoustic stethoscope is that the sound level is very low and this stethoscope is not very suitable to use in noisy environment as well as to detect internal sounds of babies as they are very low. However, acoustic stethoscope is commonly used because it is cheaper than electronic stethoscope. Electronic stethoscope electronically amplifies body sounds. As the sound signals are transmitted electronically, it can be wireless and can provide noise reduction. The primary aim of this paper is to develop and construct an electronic stethoscope using filters and based on wireless Bluetooth using Arduino Microcontroller that will make it easier to detect heart sound. In this paper we have discussed design and simulation of an electronic stethoscope.

4. Design And Development Of Wireless Stethoscope With Data Logging Functions

Author -SitiNurHidayahBinti Ab. Malek

Year – 2013

Therefore, this project was developed to monitor and display heartbeat sound using wireless digital stethoscope. The condenser microphone is used as a sensor to capture the low sensitivity of heart sound signal and transmit the signal using Antenna Arduino ZigBee Pro Series 1. Microcontroller Arduino Nano and Arduino Mega were used as a platform to process the signal and sent the result to the computer. Graphical User Interface (GUI) was developed using MATLAB software to monitor real time electrocardiogram (ECG) waveform and for data logging purpose. The result shows that this device able to transmit and receive ECG waveform wirelessly. The ECG signal can be recorded through data logging application for further analysis by the medical personnel.

III. EXISTING SYSTEM

Acoustic stethoscope is primary diagnostic tool used by doctors for effective analysis of various diseases. But, it suffers defects such as low level sounds and presence of murmurs. This paper aims at developing ‘Wireless electronic stethoscope using Butterworth filter’. Low level heart sounds are amplified with high gain preamplifier circuit. A review of basic filters like low pass RC filter, Butterworth filter, Chebyshev filter and Bessel filter are done for elimination of murmurs and best suited filter is suggested. Finally, amplified noise free heart sounds are simulated and results are shown in Proteus 7.4. The results prove that efficient filter for designing is ‘Butterworth filter’. This work can be further extended for a hardware prototype where amplified noise free heart sounds are wirelessly transmitted using RF module which could be heard by headphones or stored for further analysis.

DISADVANTAGE

- A design of low cost wireless electronic stethoscope has been proposed and analysis based on simulations has been carried out in this paper.
- The proposed system have the functionality to store the data for further analysis and effective diagnosis hence improving the accuracy in diagnosis of cardio vascular diseases.
- The hardware design can be implemented in future with additional functionalities such as provision for viewing heard sounds in GLCD. This system will help doctors in accurate diagnosis and analysis of heart sounds.



EXISTING BLOCK DIAGRAM

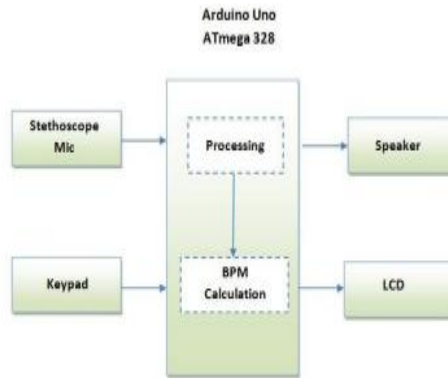


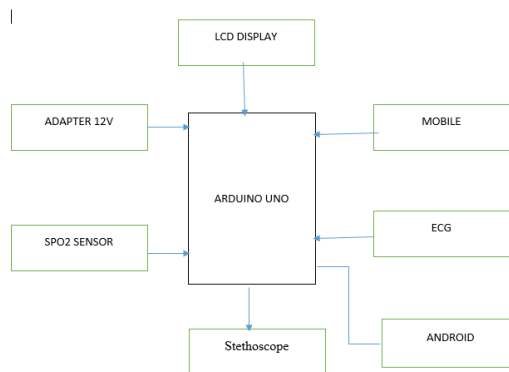
Fig.1 Block Diagram

IV. PROPOSED SYSTEM

A stethoscope is a medical device for listening to the sound of heart and breathing in our body. The commonly used stethoscope is an acoustic stethoscope. The disadvantage of acoustic stethoscope is that the sound level is very low and this stethoscope is not very suitable to use in noisy environment as well as to detect internal sounds of babies as they are very low. However, acoustic stethoscope is commonly used because it is cheaper than electronic stethoscope. Electronic stethoscope electronically amplifies body sounds. As the sound signals are transmitted electronically, it can be wireless and can provide noise reduction. The primary aim of this paper is to develop and construct an electronic stethoscope using filters and based on wireless Bluetooth using Arduino Microcontroller that will make it easier to detect heart sound.

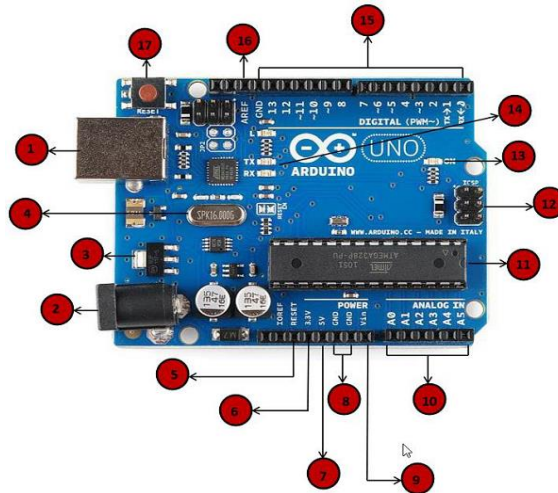
ADVANTAGE

- A stethoscope is a medical device for listening to the sound of heart and breathing in our body.
- By using the stethoscope the doctor can detect the problem of the heart and lung of the patient. There are two basic types of stethoscope.
- It is acoustic stethoscope and electronic stethoscope. Acoustic stethoscope is operating on the transmission of sound captured by the chest piece with two air tubing to the listener ears. The chest piece has two sides, a diaphragm and a bell.
- The diaphragm creates high frequency sounds and bell creates low frequency sounds.



HARDWARE COMPONENTS

1. ARDUINO UNO



Arduino is a prototype platform (open-source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. Arduino provides a standard form factor that breaks the functions of the micro-controller into a more accessible package.

2. Stethoscope

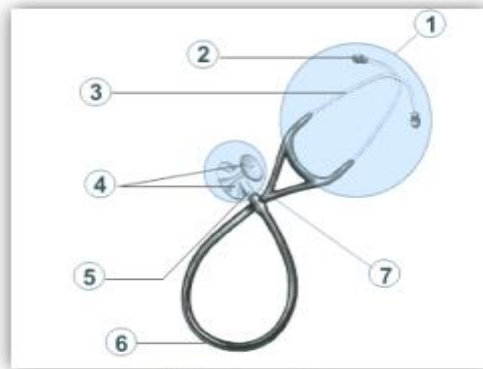


Fig.8 Stethoscope Parts

The stethoscope is an acoustic medical device for auscultation, or listening to the internal sounds of a human body. It is often used to listen to lung and heart sounds. It is also used to listen to intestines and blood flow in arteries and veins. In combination with sphygmomanometer, it is commonly used for measurements of blood pressure

Headset :

The headset is the metal part of the stethoscope onto which the tubing is fitted. The headset is made up of the two ear tubes, tension springs, and the ear tips. The wearer can adjust the tension to a comfortable level by pulling the ear tubes apart to loosen the headset or crossing them over to tighten

Ear tip :

Soft-sealing ear tips offer increased comfort, seal and durability, and feature a surface treatment that increases surface lubricity and reduces lint and dust adhesion

Ear tube :

The ear tube is the part to which the ear tips are attached.

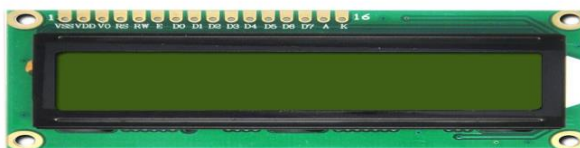
Tunable Diaphragm :

A traditional stethoscope consists of a bell and a diaphragm. The bell is used with light skin contact to hear low frequency sounds and the diaphragm is used with firm skin contact to hear high frequency sounds.



Stem:

The stem connects the stethoscope tubing to the chest piece.



3.LIQUID-CRYSTAL DISPLAY(LCD)

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in colour or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden, such as preset words, digits, and 7-segment displays, as in a digital clock.

4. PULSE HEART ECG MONITORING

A person’s heartbeat is the sound of the valves in his/her’s heart contracting or expanding as they force blood from one region to another. The number of times the heart beats per minute (BPM), is the heartbeat rate and the beat of the heart that can be felt in any artery that lies close to the skin is the pulse.

5. BLUETOOTH MODULE



It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard, and many more consumer applications. It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions. It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air. It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).

6. 12v POWER ADAPTER

The purpose of this new connector is to deliver more +12V current to the motherboard than is available from the standard ATX main power connector. The presence of the 4-pin +12V connector indicates that a power supply is ATX12V. The absence of that connector indicates that it is a standard ATX power supply.



7. ANDROID MOBILE



When a device goes from just working to actually making life easier, Android is behind it. It's the reason that your GPS avoids traffic, your watch can text and your Assistant can answer questions. It's the operating system inside 2.5 billion active devices. Android is open to everyone: developers, designers and device makers. That means more people can experiment, imagine and create things that the world has never seen. When you have Android, you have security that's there right out of the box and never stops working.

V. RESULT





VI. CONCLUSION

Electronic Stethoscope and Heart Rate Monitor project is able to achieve the intended aims; it is capable to: 1 Capture heart sounds signals using microphone and convert them into electrical signals. 2 Produce acoustic signals in real-time depending on captured signals. 3 Provide facilitated interface with user to make the using more comfortable. 4 Calculate and display heart rate during specific duration identified by the user. Protective precautions have taken to ensure user safety such as wires isolation and make sure for quality of soldered connections The project we have undertaken aims to design and simulate an electronic stethoscope which will not only provide us with a better signal but can also be interfaced with users, and it can be further analysed and stored for future uses. We have made this design comprising of very simple and well known components like microphone.

VII. FUTURE SCOPE

Acoustic stethoscopes are used to monitor signals from patients. Incidentally, the connecting tube between the chest-piece and the ear-piece of common stethoscopes is known to serve as a medium for transmitting pathogens from patients to physicians or from one patient to another patient. This work presents a wireless stethoscope design with mobile integration that transmits heart sounds to mobile devices for evaluation and analysis, thus, eliminates the connecting tube. This is an extension of the previous work that presented the proof of concept of a wireless stethoscope with Bluetooth transmission.

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