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Bi-functional wireless stethoscope

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Abstract – *A stethoscope is a device used for listening to the vibrations generated during pumping or turbulence of the heart. It is a crucial device for observing various other sounds created by organs. There are many electronic stethoscopes available in the market, but they are beyond the reach of common people due to its price moreover they can't be carried everywhere. Their main disadvantage being skills of examining doctor to interpret the sound and the added noise in the examining room. The proposed product design is not only small but also provides a cost-effective solution, so every other person can purchase. The product here combines two different ideas into one. This stethoscope can be used as an esophageal stethoscope and also as a normal electronic stethoscope using diaphragm which is having an electret mic inside the tubing. Here an electret mic is used to sense the vibration (i.e. Sound made by heart). By using Atmega 328 the sound will be converted from analog to digital using built-in ADC and this sound will be transmitted and received using Bluetooth module HC-05 and will be heard using a headset.*

Key Words: Electret mic, diaphragm, Atmega328, Hc-05, oesophageal, wireless stethoscope, transmitter, receiver.

1. INTRODUCTION

The stethoscope is a device used for listening to the sounds made by heart, lungs, and bones. It has a chest piece (also called diaphragm), a hollow air-filled tube and earpiece to listen to the sounds made by various parts of the body. These types of stethoscope are known as the acoustic stethoscope. The sounds are captured by the diaphragm (bell-shaped for hearing low-frequency sound and chest piece or diaphragm for high frequency) which will pass through the air-filled hollow tube and then can be listened with the earpiece in the ear. The disadvantage being its low sound level and its use in the noisy area. However, being cheap acoustic stethoscope is still popular than the electronic stethoscope. A stethoscope is also used by anaesthetist for continuous monitoring of patients under anaesthesia and is a very crucial device for cardiac information, which reduces the chance of medical accidents. However problem with such kind stethoscope is, it is susceptible to noise. The main disadvantage being its length and skills of the examining doctor or physician. There are other heavy machines for examining the heart sounds and 3d monitoring like CT scan machine, MRI, ECG machine. These machines are heavy and expensive, is affordable to expensive hospitals only. In the study [1] the study of heart was done using oesophageal stethoscope by developing a portable digital electronic stethoscope. In a study [3] heart sound was observed using a piezoelectric and microphone. The oesophageal stethoscope is a device that measures the heart sound by inserting a catheter into the ooesophagus, near the mid-chest. There is another technique for observing the heart beats called phonocardiography [2]. It is a technique to record and display heart sounds. Both low-frequency sound and high-frequency sound can be observed graphically on the screen of personal computers or mobile phones.

This paper presents an idea to design and develop a mobile Bi-functional wireless stethoscope as a product that can be used anywhere any time. By bi-functional we mean, it can be used as both oesophageal stethoscope and normal electronic stethoscope.

2. Proposed design methodology

This product is divided into two parts, first is a transmitter and second being a receiver.

2.1 Transmitter design

The transmitter part is designed in such a way that it has two inputs giving two modes for stethoscope (i.e. one for operating in esophageal mode and second as a normal stethoscope mode. Both the modes are controlled using a toggle switch. In this design, we will be using an electret microphone of range 20 Hz to 20 kHz which is the audible range for human ears. For processing part, atmega328 IC is used. As the project requires short distance and secured communication, a Bluetooth module HC-05 is used. Bluetooth module is having range approximately up to 500 meter and provides a secure connection by using WAP protocol.

To begin with the transmitter's first part, that is the esophageal stethoscope, first of all, a tube was selected in such a way that it can be inserted inside the oesophagus of the human body of any age. We also considered its diameter so it won't chock up the oesophagus. The normal diameter of human oesophagus being 2 cm, a PVC tube was selected with diameter of 0.65 cm. This tube is named nasal-gastric tube or NG tube in the medical field. It is generally used for taking out gastric juices or feeding liquid food to the patients. An electret mic having approximate size 0.5cm was chosen which can easily be slipped inside the NG tube. The electret mic was inserted inside the tube in such a way that wirings may not come in contact with the human oesophagus. It isn't dangerous, but the risks are eliminated while developing the front end. Block diagram for transmitter section is shown in figure-1. The mic is attached to its preamplifier which amplifies and filter the signals. The controller then processes

the signal and using analog to digital conversion the signals are sampled, converted and then will be given to Bluetooth module HC-05 for transmission.

For the second part of the transmitter section a diaphragm is used, it provides better capturing of sound waves. An electret mic is set behind the diaphragm, into the tubing bore. The vibrations generated by the diaphragm are sensed by electret mic which inside the tubing of the stethoscope. A toggle switch is used to switch between the two modes and also used for switching off the device when not in use. The whole transmitter section is powered by six pencil cell battery. Here black lines represent power lines, and red arrows represent signal lines.

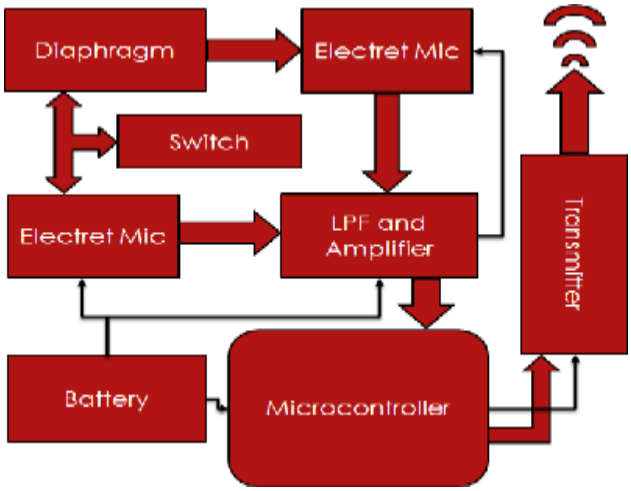

Figure -1: Block diagram of the transmitter section

2.1 Receiver design

The receiver is designed in such a way that it must take every signal, amplify the damp signal and process it so that doctors can hear the sounds captured by the mic clearly. So, following is the receiver block diagram in which a Bluetooth module is used for receiving the data. Further microcontroller Atmega328 IC is used for processing the signal.

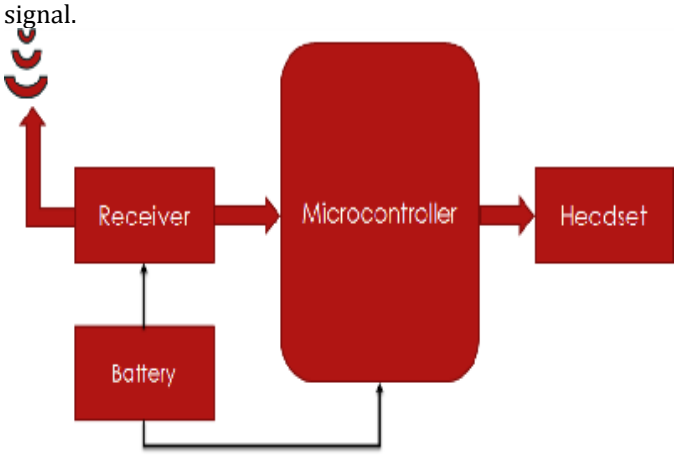

Figure -2: Block diagram of receiver section

In this section the wireless transmitted signal will be received by the receiver that will be processed using microcontroller. The signals will be processed and necessary conditioning will be done using controller. After the necessary conditioning is done, the sounds can be heard using earphones or headsets. The receiver section is powered by a four pencil cell battery. Here black lines represent power lines, and red arrows represent signal lines.

3. CONCLUSION

As the device is made compact, it can be used anywhere. Even a non-professional candidate can use it, without any special guidance. The product design is economical and can be purchased by anyone.

REFERENCES

[1] J.Y. Shin, S.W. Lim, Y.C. Kim, S.J. Kim, E.J. Cha, and T.S. Lee, "Design Technology in Portable Digital Esophageal Stethoscope", 32nd Annual International Conference of the IEEE EMBS Buenos Aires, Argentina, August 31 - September 4, 2010.

[2] E Rail, S Khoor, B Kaill, K Fiigedi, F BalAzs, "Internet Digital Phonocardiography in Clinical Settings and in Population Screening," Computers in Cardiology 2004;31:501-504, 02764547/04.

[3] Shaikh Anowarul Fattah*, Nael Mizanur Rahman, Ahmed Maksud, Shariful Islam Foysal, Rakibul Islam Chowdhury, Sayeed Shafayet Chowdhury and Celia Shahanaz," Stetho-phone: Low-cost Digital Stethoscope for Remote Personalized Healthcare ", 978-1-5090-6046-7/17 ©2017 IEEE.

[4] Sumarna, Juli Astono, Agus Purwanto, Dyah Kurniawati Agustika, The Improvement of Phonocardiograph Signal (PCG) Representation Through the Electronic Stethoscope, Proc. EECSI 2017, Yogyakarta, Indonesia, 19-21 September 2017.

[5] Priyanka Sandhu, Poonam Sheoran, Geeta Singh, "Electronic Stethoscope with Pulse Monitoring On Online Server," International Journal of Electronics, Electrical and Computational System, ISSN 2348-117X Volume 6, Issue 7 July 2017.