Design of an Automated Stethoscope Using AI, IoT and Signal Processing

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Abstract A traditional stethoscope can be used to listen to the sounds made by heart, lungs or intestines as well as blood flow in arteries and veins. Nowadays people are facing more issues regarding their health and sometimes there will be a lack of availability of efficient doctors and also proper attention. In order to overcome these difficulties, an automatic diagnosis using a stethoscope can be made. So, the sounds are converted from analog to digital and compared with the digital data. The system consists of a microcontroller in which different outputs of the stethoscope (sound pattern) are stored and then run an algorithm using these patterns. This system can also be used to transmit the data from one place to another, irrespective of the location where the doctor or the patient is.

Keywords Stethoscope · Analog to digital · Microcontroller

1 Introduction

Many people face health-related issues and sometimes they can't reach the doctors in times of need. Also, there would be a lack of availability of doctors during emergencies. In order to overcome this, an automatic diagnosis system by using a traditional stethoscope can be made, i.e., a smart stethoscope. It can be used by doctors or health professionals through which consultation can be done irrespective of their location. The technology used here includes AI, IoT, and Signal processing.

A stethoscope can predict abnormalities inside the human body just by sensing the sound without the help of a doctor. A smart stethoscope can be used by nurses or health workers or the patient himself and it remotely connects with doctors (In

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case of any problem). All signals can be transferred to doctors in real time. Based on the instructions given by the doctor, nurses are able to capture the sound signals and amplify them. Noise-free signals are sent to the doctors automatically and they can do the check-up.

2 Existing System

A. Normal Stethoscope

- Used in listening to sounds produced within the body, chiefly in the heart or lungs.
- Price is very high (starts from 15,000/-).
- Recording of sounds are not possible.

B. Electronic Stethoscope

- An electronic stethoscope overcomes the low sound levels by electronically amplifying body sounds.
- Price is very high (starts from 20,000/-).

C. Electronic Stethoscope

- An electronic stethoscope overcomes the low sound levels by electronically amplifying body sounds.

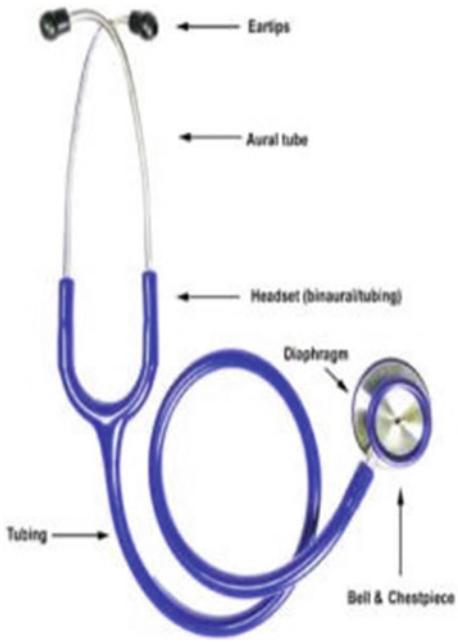


Fig. 1 Normal stethoscope

Fig. 2 Electronic stethoscope

- Price is very high (starts from 20,000/-).
- Recordings of sounds are possible here.

3 Proposed System

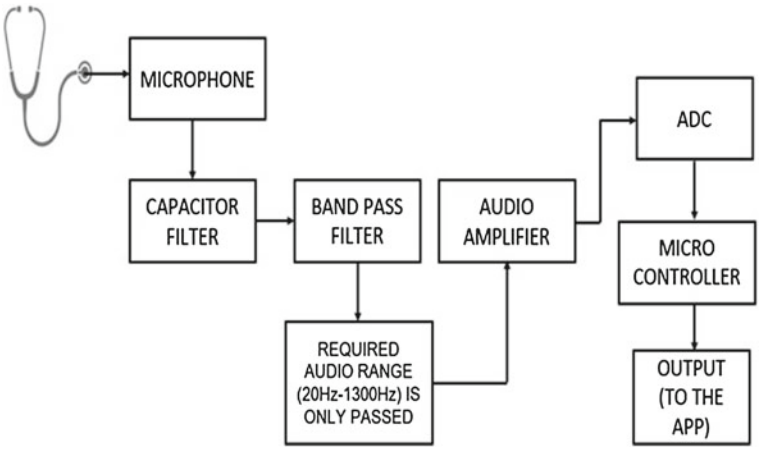
This is a stethoscope that can be used by any health professionals or doctors, working remotely. The doctors provide instructions to the nurses, and based on that, the sound signals are captured from the patients. These signals are amplified and the noise-free signals are sent to doctor automatically in real time. Hence, the diagnosis can be done.

AI is used to predict the condition of the patients for easier diagnosis. This device can also be connected to the Internet via IoT. Data can be stored in the cloud for later references. Apart from real-time monitoring, the doctors can log into their profiles and data access can be done anytime. AI is provided in the system to give alerts, in cases of emergency, to the health professionals so that the doctors can reach the patients quickly. Hence, the patients can be quickly shifted to emergency care. Doctors can listen to the signals by using their normal headphones by connecting to the admin interface either through smartphones or PC. Audio signals also show a graphical representation for detailed analysis. All the existing systems of stethoscopes are not affordable for ordinary people. So this will be a cost-effective product compared to the existing one. An automatic diagnosis by using a stethoscope is done in which the

body of the stethoscope is made up of silicon tubes. The diaphragm is made up of light-weighted plastic.

4 Design and Implementation

A. Block Diagram



The block diagram shows the working of the smart stethoscope. A microphone is connected to the diaphragm of the stethoscope in order to record the body sounds that we hear when we place a stethoscope in our body. The recorded sounds are then amplified by using an amplifier and then the wanted sounds are only taken out by the process of noise cancelling. The body sound that we want to analyse is then saved as an audio file. Through pattern recognition and a categorized database, we can obtain the output. From the output, we can analyse the abnormalities (if any) in the pulse rate, variations in blood level, etc. In case of emergencies, the audio file can be sent to the doctor immediately, and also, the doctor can view it from the app (provided) anytime from any place.

Steps

Step 1: It can be used by nurses or health workers and it remotely connects with doctors. All signals will be transferred to doctors in real time.

Step 2: Uses AI to predict the conditions of patients for easier diagnosis. The device can also be connected to the

Step 3: Apart from real-time monitoring, Doctors can log into their profiles and access the data anytime.

5 Result

A. Mobile App Development

We've created the app named "stethIot". At first, we have to log in/signup. After that, log in to the app and enter personal details like name, age, gender, e-mail id, etc.

And there will be tutorials about where to place the stethoscope. And after that, we are giving an audio input or will be taking a real input from the stethoscope itself.

And Based on the input we give, the result is shown normal/abnormal, i.e., shown in the figure below. If the condition is abnormal, they can further contact the doctor and take the advice.

6 Conclusion

This product can be used by nurses or health workers and it remotely connects with doctors. Moreover, it is a useful product for the people. All signals will be transferred to doctors in real time. With the help of AI, the condition of the patient can be understood.

The device is connected to the Internet by using IoT. Data can be stored in the cloud for later reference. Remotely diagnosing a patient with more observations and measurements increases the chance of more doctors and health officials reaching in for the product.

The never-ending demand for doctors especially during such times of peril puts this product in the prime spot for marketing.

Fig. 3 App logo

Fig. 4 Uploading a file

Fig. 5 Result showing normal condition

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