

Remote Stethoscope Project

Requirements Document

Prepared for: Dr. Robert Gatewood

Prepared by: Andrew Burneson, Yusuf Elazzazi, Avi Tombak, Quinn Tarbell

Goals

The goal of this project is to develop an electronic stethoscope for use in remote medicine as well as an application to accompany it. To accomplish this, we will design, prototype, and test the stethoscope and program. The project will be completed by the first of April, 2022 with further refinement afterwards as necessary.

Features

Stethoscope

- Form Factor
 - The stethoscope will have a head that attaches to a separate electronic component.
 - The electronics will be inside a case small enough to fit in one hand.
- The stethoscope will have a cord that connects the electronics to a usb C port.
- The stethoscope head will have a microphone within it.
 - The microphone will have a frequency range from 20 to 2k Hz.
 - The microphone will have a high enough quality to be able to hear heart sounds.
- The electronics will include an amplification circuit.
- The electronics will include an analog to digital converter.

Software

- The stethoscope will have one application designed to be used in conjunction with it.
- The application can create a host session.
 - The user must input a password to start a host session.
 - While hosting the user can accept requests to connect from other users.
 - Once connected the host will receive audio from the other user's application.
 - The host can listen to the received audio.
 - The host can adjust the volume of the received audio.
 - The host can record the received audio.
- The application can connect to a host application using a password.

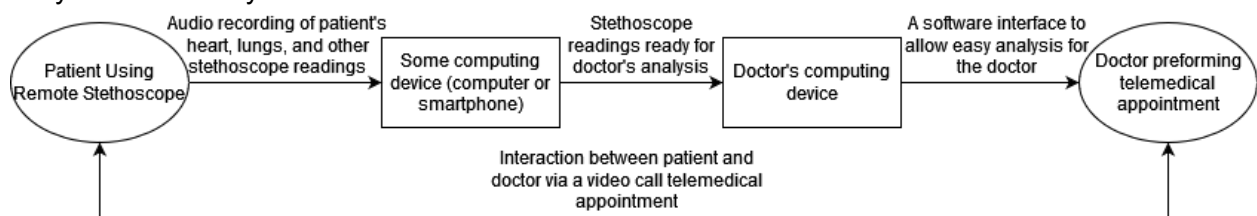
- While connected to a host, the application can receive audio from the electronic stethoscope.
 - While receiving audio the application will send the audio to the host application
- The application will function on Windows 10.

Users

The stethoscope and application will be used by doctors and patients conducting remote medicine. The doctors include cardiologists, general practitioners, and etc. The patients include people who are quarantined, people who have trouble moving, the elderly, and people who live too far away from the doctor.

The doctor only needs to use the application. First the doctor will start the application and create a host session. Second, the doctor will send the patient the password and accept their request to connect. Then, the doctor will direct the patient to use the stethoscope and listen to the audio from it. The doctor can adjust the volume or record the audio using the application.

The patient uses both the stethoscope and the application. First the patient will start the application and connect the stethoscope to the computer. Then they will input the password given by the doctor into the application. The patient will use the stethoscope to listen to their body as directed by the doctor.



Constraints and Dependencies

- The stethoscope must cost less than fifty dollars.
- The stethoscope and application must be HIPPA compliant.
- The user must have a computer.
 - The computer must run Windows 10.
 - The computer must have a usb C port.
 - The computer must have an internet connection.
- The user must have a connection to the internet.
 - The internet connection must be fast enough to transmit real time audio.
- The doctor and patient must have a method to communicate with each other.

Description:

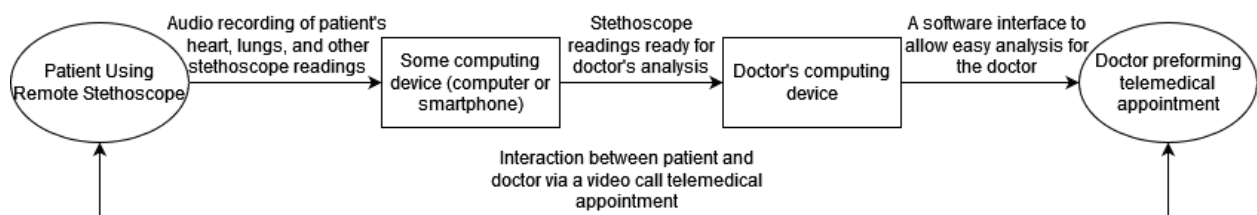
A remote stethoscope is to be designed for use in telemedicine appointments.

The patient will receive the stethoscope alongside a kit with a user guide and all necessary components.

The stethoscope will be used by the patient directly with doctor guidance via a video call.

There is also a software component that will allow the doctor to analyze the stethoscope readings remotely.

The following is a diagram of the process the remote stethoscope recording will undergo from patient to doctor.

**Remote Stethoscope Specifications:**

- A cost of less than \$50
- Sufficient audio quality and frequency range for hearing sounds of body systems (heart, lungs, gi)
- Record the audio and transmit it between the patient and doctor via other computing devices (i.e. a personal computer and/or a smartphone)
- Sufficient audio amplification and volume control
- Sufficient background noise filtration to isolate the body system sounds

Remote Stethoscope Patient/User Kit:

- Includes the remote stethoscope
- Includes any necessary cables and connectors for the stethoscope to interface with computers
- Includes a user guide document which has instructions on how to use the stethoscope

Remote Stethoscope Software Interface:

- Allow for easy analysis of the stethoscope readings by the doctor

Goals:

The aim of this project is to continue the work done by the previous group in charge of the remote stethoscope project. The goal is to create a cheap electronic stethoscope as well as a system to transmit audio over the internet for use in telemedicine. The stethoscope must be cheap in order for it to be accessible to patients.

Users:

The remote stethoscope would be used by patients and doctors conducting telemedicine. The patients will be within their homes. The patients will run the application and connect the stethoscope to their computer with a cable. The doctor will also run the application and connect it to the patient's application over the internet. The patient will then place the stethoscope on their body under the doctor's direction while the doctor listens to the audio using the application on their own computer.

Features:

The stethoscope will be able to detect sounds in the range of frequencies necessary for diagnosis. It will amplify the audio and have sufficient audio quality in order for the doctor to diagnose medical issues. The stethoscope will connect to a computer through a cable. The application will record the audio from the stethoscope and transmit it over the internet to the doctor's computer. The application on the doctor's computer will play the audio and allow them to control the volume.

Constraints:

The stethoscope must cost less than 50 dollars.

Requirements:

The patient and doctor must both have a computer and an internet connection.

Outline

- I. Goals
 - A. Develop Remote Stethoscope
 - 1. Design
 - 2. Prototype
 - 3. Test
 - B. Develop Software
 - 1. Design
 - 2. Prototype
 - 3. Test
 - C. Complete by Deadline (add deadline)
- II. Features
 - A. Remote Stethoscope
 - 1. Form Factor
 - a) Has a stethoscope head
 - b) Has an electronic circuit
 - c) Head connects to circuit
 - d) Circuit in case small enough to fit in hand
 - 2. Connector between circuit and computer (choose one connector)
 - 3. Microphone in stethoscope head
 - a) (add frequency range)
 - b) High sound quality (not specific)
 - 4. Amplification Circuit
 - a) Amplification factor (undecided)
 - b) Analog to Digital Converter (ADC)
 - (1) May be part of computer if using microphone jack
 - B. Software
 - 1. Can create a host
 - a) Generates password
 - b) Can accept requests to connect from guests
 - c) Receives audio from guest
 - (1) Plays received audio
 - (2) Can adjust volume
 - (3) Can record audio
 - 2. Guest
 - a) Can request to connect with a host using a password
 - b) Receives audio from stethoscope
 - c) Sends audio from stethoscope to host
 - 3. Functions on OS (choose one operating system)
- III. Users
 - A. Who uses it?
 - 1. Doctors
 - a) Cardiologists

- b) General Practitioners
 - c) (Ask Dr. Gatewood for more)
 - 2. Patients
 - a) Quarantined
 - b) Trouble moving
 - c) Elderly
 - d) Live to far away
- B. How is it used
 - 1. Doctors
 - a) Launch application
 - b) Start hosting
 - c) Give patient password
 - d) Accept patient's connection request
 - e) Instruct patient to use stethoscope
 - f) Listen to audio from stethoscope
 - g) Adjust volume
 - h) Record audio
 - 2. Patient
 - a) Launch application
 - b) Connect stethoscope to computer
 - c) Input password given by doctor
 - d) Use stethoscope as directed by doctor

IV. Constraints

- A. Must cost less than \$50
- B. Must be HIPPA compliant

V. Dependencies

- A. User must have a computer
 - 1. The computer must have the correct OS
 - 2. The computer must have the correct connection
 - 3. The computer must be able to connect to the internet
- B. The user must have an internet connection
 - 1. The connection must be fast enough to transmit real time audio
- C. The doctor and patient must be able to communicate