

Wearable Device for Detection of COVID-19 and Tracking Symptoms

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Abstract

The purpose of this project is to create a wearable device that provides the user with valuable health diagnostic information related to common COVID-19 symptoms. COVID-19 is a respiratory disease that is fast-spreading and difficult to identify. The common symptoms currently include fever, dry cough, shortness of breath, low blood oxygen levels, and respiratory failure. In order to identify and monitor for these symptoms, the following project consists of an SPO2 sensor, temperature sensor, accelerometer, and a control unit. The data acquired from the device is sent to a mobile app which is able to indicate temperature, heart rate, SPO2 levels, and heart vibrations. This device provides a unique solution to allow for remote COVID-19 patient monitoring through the array of sensors included in the design.

Introduction

According to the CDC, there are over 30 million COVID-19 cases reported in the U.S., causing the world to be placed under a global pandemic. One solution to help reduce the spreading of COVID-19 is through telehealth. Telehealth is a contactless means for patients to interact with their practitioners through remote monitoring. The device components were selected to reduce virus transmission. The block diagram of the design is given in figure 1.

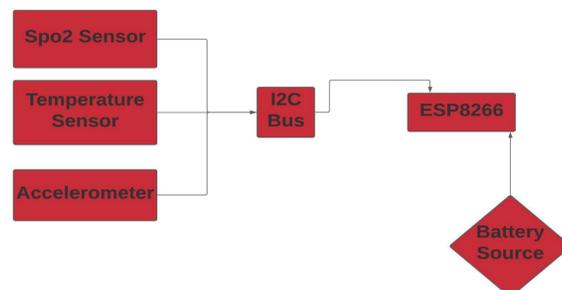


Figure 1. Design Block Diagram

Results and Discussion

The wearable COVID-19 device design features an accelerometer (ADXL345), temperature sensor (TMP117), SPO2 sensor (MAX30102), MCU (ESP8266), and a lithium-ion battery. An interchangeable rechargeable lithium-ion battery charger was also included into the design to allow users to continually wear the device. The device can transmit its data to a phone application via Wi-Fi:



Figure 2. Phone Application Screen

The data from a volunteer with a positive COVID-19 test result is given below. As indicated in the graph, the bloody oxygen level of the subject was decreasing as the disease was developing. The SPO2 levels begins to increase as the subject recovered from the disease.

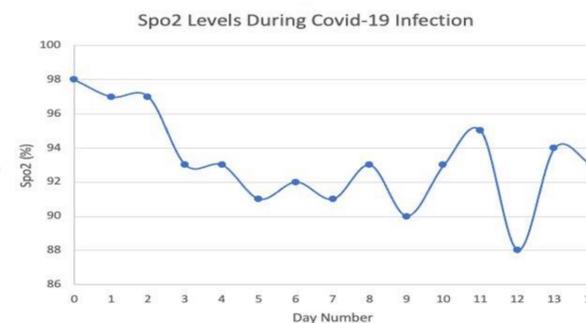


Figure 3. Volunteer COVID-19 SPO2 Results

Materials

The accelerometer and temperature sensor were placed into a PLA wearable chest encasement. The SPO2 sensor was implemented into an ear mold in order to generate accurate data.

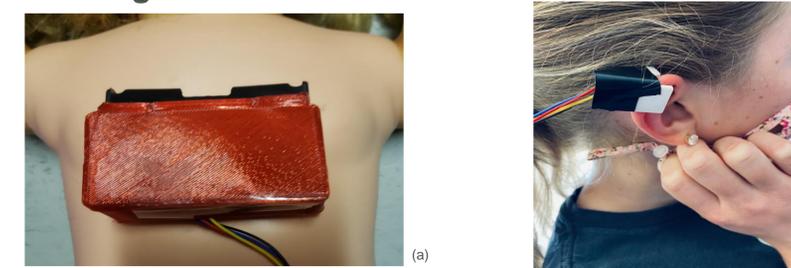


Figure 4.(a) Chest Encasement on Manikin Chest wall
(b) SPO2 Ear Mold

Conclusions

This wearable device for detecting and tracking COVID-19 related symptoms seeks to relieve the dependance on the healthcare system for monitoring patient health. By providing temperature, heart rate, SPO2 measurements, and cough sound data to the user via a mobile app, this device has the capability of reducing the spread of COVID-19. The hardware created for this project could also be integrated with an AI algorithm to detect asymptomatic individuals [1].

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[1] J. Laguarda, F. Hueto, and B. S. Subirana, "COVID-19 Artificial Intelligence Diagnosis Using Only Cough Recordings," *IEEE Xplore*. [Online]. Available: <https://ieeexplore.ieee.org/document/9208795>. [Accessed: 14-Apr-2021].