

## **First Review Document**

### **Intelligent Healthcare Monitoring System with Pulse Oximetry Analysis**

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## **Abstract**

In light of recent events that have exhausted the medical facilities of developed countries, the SARS-CoV-2 patients find difficulties in breathing after an increase in the concentration of carbon dioxide in the lungs and a decrease in blood oxygen level, which causes loss of patient's life. Various researchers have found that blood oxygen level and body temperature are significant factors used to monitor COVID or chronic obstructive diseases patients. The most standardized test for these kinds of conditions is the spirometry test. Similar to this, PCR and RT are also considered standardized tests for COVID suggested by WHO. Real-time monitoring of these chronic obstructive diseases to heal with proper medications and treatment.

The proposed architecture helps monitor the activity, body temperature, the oxygen saturation level (SpO<sub>2</sub>) parameters of disease caused by a coronavirus. Preliminary COVID symptoms can be detected using this proposed system. The developed architecture includes a hardware module to monitor the patient's body temperature and oxygen saturation level. As previously shown that measurements of body temperature, oxygen saturation can be performed with reliable accuracy under laboratory conditions. The observed data from the hardware are sent to the patient's doctor by WIFI module. The monitoring application and doctor examining the sensed values can take necessary action on the medication and treatment of the COVID patient. The developed architecture is a practical, authentic, and easy-to-use device to determine the symptoms of COVID or chronic obstructive diseases.

## **Keywords:**

PCR (Polymerase chain reaction)  
IoT based healthcare monitoring  
RT (rapid testing)  
SpO<sub>2</sub>  
microcontroller  
oxygen saturation  
Arduino

## Introduction

Communicable diseases through airborne is a transmission that delivers very minute water droplets. Those droplets are also known as microdroplets. The size is less than 5 micrometers. In comparison, water droplets are usually larger than 5 micrometers. Because it is minute and feathery, the aerosol carrying the SARS-CoV-2 coronavirus can survive levitating in the air for many hours. Besides, these particles can also drift quite far. Studies in the U.S. call the SARS-CoV-2 coronavirus can live on particles for up to four hours. While other reviews say, it can last 16 hours. The recent research shows coronaviruses that showered in the air can stay alive for at least three hours. However, the scientists stressed that the experiment conducted in a laboratory is different from real-life conditions where the results can vary. Cases of coronavirus, called 'super spreading,' have strengthened the suspicion that airborne contamination is possible. In the city of Mount Vernon in Washington, USA, one person is infecting at least 45 other people who have sung with him in the same choir. As people are getting so much infected, it would be straightforward if any device could simulate and find a relation between blood oxygen level and breathing also, with other health parameters. We could also detect the symptoms of disease caused by the coronavirus and save lives. There are devices like ventilators that aids patients while they are suffering from breathing problems.

Covid is a Chronic obstructive disease, which causes shortness of breathing, gasping, irritation in the respiratory tract, etc. The recurrence and grimness of the conditions vary from different age ground people, but it primarily affects old age people. Early morning cold effects, stress, common cold, pneumonia, etc., leads to aggravating of the disease. Apart from its allergies indulged, such as loss in taste and smell, a patient may rise from covid disease problems.

The World Health Organization suggests finding out and monitoring Chronic obstructive disease or covid at an earlier stage is the best way to deal with this virus. As per WHO instruction, doctors diagnose and monitor the seriousness of symptoms through PCR and spirometry tests.

This paper aims to analyze diseases and studies aiming to automated diagnosis or monitoring of infectious diseases whose symptoms are detected with body temperature, blood pressure, and

oxygen saturation level. In this work, we propose a system that monitors the patients' body parameters; if there is any unusual behavior, they will be symptoms. The monitoring system will help the area where the expert in respiratory diseases analysis may not be available. This project curbs human error while detecting these viruses or diseases by using intelligent monitoring and analysis systems. Evaluation of the percentage of detection and efficiency shows which monitoring, i.e., body temperature, blood pressure, and oxygen saturation level, has a higher predictive rate, a comparative study tested on the same input slide.

## **Objective**

There thousands of deaths that has happened because of corona virus and other chronic obstructive diseases still there are no proper system that monitor patients with these diseases. With the help of this system, we going to promote the concept of homecare is becoming increasingly vital role in medical technology and will play important role in future.

We plan to write a server application so that we can interface using our Arduino program with other clients in the network. Finally, we plan on making froward a frontend application in any language that will fetch data from sensors and log in server to display it in user friendly way. This will be an excellent way to setup a home health care monitoring system.

## **Problem Statement**

A regular blood oxygen reading would be between 95 and 100 percent, anything under 90 is considered unhealthy. While indicated coronavirus patients with measurements as low as 50 percent. When oxygen levels sink this far, patients have much more apparent trouble breathing. The data could be set, as well as the monitoring results are also directly connected and actually stored on IoT Gateway. From IoT gateway, the IoT system is used to send data of heart rate, oxygen level, carbon dioxide, and volatile organic compounds to the cloud for analytics in real-time.

There are lots of existing monitoring system but new concept of home isolation was brought in after coronavirus pandemic happened. This architecture basically help government, healthcare department and patients to promote home isolation and control the spread of virus.

## **Literature Review**

This article reviews about asthma disease and how can we monitor this disease with the help of Arduino [1]. As mentioned, this disease can be easily treated when medicine and treatment are given in time. The proposed architecture tests different activities and environmental parameters of asthma. The basic parameters that are going to be examined are temperature, humidity, air pressure, activity, and volatile gases are collected and then send to the patient's doctors via the GSM module. The doctor then examines the data and then gives suitable treatment and medicines for asthma.

Another paper reviews about e-health monitoring system which the device designed monitors the difficulties experienced by the users in flight [2]. The main goal of this system comes after knowing of the condition inside cab travelers in cab conditions, such as low pressure, lack of oxygen, and low humidity risk factors in patients suffering from cardiovascular diseases etc. Monitoring the oxygen level of the patient during takeoff/landing and during flight hours provides valuable information on the health status of passengers. This information later could be used to travelers of similar alignment of health difficulties.

Basically, with the help of the architecture proposed, we will solve the major problem that we are facing in this pandemic. Firstly, the device helps to monitor the patient's primary health condition like spo2 level, which thresholds to be more than 92% of body temperature etc. from home itself, which reduces the risk of health workers and other frontline workers to get infected. Then after that, the doctor analyses the data received from the sensors and validates whether the patients are in safe conditions. If not, then changes in medication and treatment can be easily made through phone or necessary steps that can be taken.

## System Design

The following diagram gives an overview for the design we are going for:

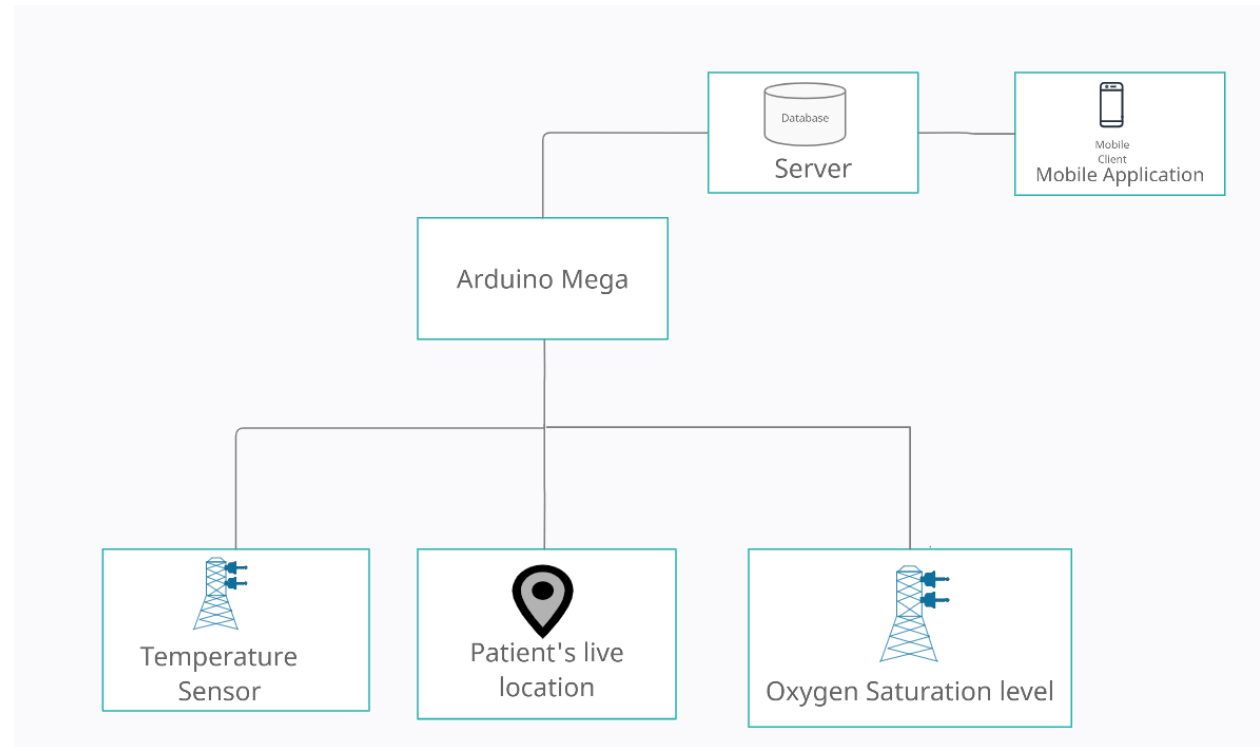


Fig 1. System Design Overview

The basic system architecture would consist of spo2 sensor module, body temperature sensor module, GPS sensor module. The main purpose of this project is to integrate these modules to gather data from the user. All the modules would be connected using Arduino board that contains wi-fi module which is going to send data onto the cloud. Now the data collected can be processed and analyzed using ML. This would be really helpful in predicting the how likely a person is going to affected by the virus or diseases and thus encouraging steps to create more health posts for the betterment.

## 1. Functional Requirements

### 1.1. Product Perspective:

The product is used for collecting data from the patient and uploading it onto the cloud for information and analysis.

### 1.2 Product Features:

The product implements sensors to collect data and then uses Wi-fi module to upload it to the cloud.

### 1.3 User Characteristics:

The user has to just give the input while the rest is assured by the proposed system.

### 1.4 Assumption and Dependencies:

The assumption is that the users have a good knowledge about using the input devices and a basic knowledge of keeping the device connected at all times.

### 1.5 Domain Requirements

The proposed project would require an established net connection on both the senders end as well as the receivers end for real-time data transfer.

The microcontroller we will be using Arduino mega which can run at default 490 Hz except pin 4 and 13 whose default frequency is 980 Hz and can give quick responses to temperature changes which makes it suitable for this purpose.



## **Conclusion**

We can get the position of patients easily and will stop other people from getting affected. We also can get his body's temperature & blood oxygen level which is basic criteria. In future this project could be further develop as product. The product in form of watch could help people to be monitored remotely than physically. We could use better sensors than we have used in this project to increase the accuracy of this project. The project could be further developed as product by developing it into watch by designing a PCB which could make it portable like a fitness band. The fitness band could easier for the patient to wear it.

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