

DESIGN OF SELF-SANITIZING MASK

Submitted in partial fulfillment of the requirements for the award of a
Bachelor of Technology in biomedical engineering.

By,

AKSHARA D (39240005)

PRERANA S (39240030)



**DEPARTMENT OF BIOMEDICAL ENGINEERING
SCHOOL OF BIO AND CHEMICAL ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade “A” by NAAC | 12B Status by UGC | Approved by AICTE
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119**

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DEPARTMENT OF BIOMEDICAL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Interdisciplinary Project Report is the bonafide work of **AKSHARA D (39240005), PRERANA S (39240030)** who have done the Interdisciplinary project work as a team who carried out the project entitled **"DESIGN OF SELF SANITIZING MASK"** under our supervision from **January 2022 to May 2022.**

Internal Guide

(SINDU DIVAKARAN)

Head of the Department

(Dr. T. SUDHAKAR)

Submitted for Viva-voce Examination held on 30.04.2022

Internal Examiner

External Examiner

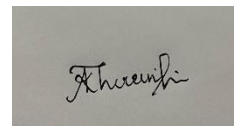
DECLARATION

We, **Akshara D (39240005)** and **Prerana S (39240030)** hereby declare that the Interdisciplinary Project Report entitled “**Design of self-sanitizing mask**” was done by us under the guidance of **Sindu Divakaran**, Department of Biomedical Engineering at Sathyabama Institute of Science and Technology is submitted in partial fulfillment of the requirements of the award of Bachelor of Technology degree in Biomedical Engineering.

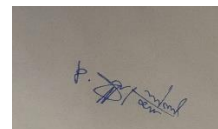
DATE: 25/04/2022

PLACE: Chennai

1. Akshara D

A rectangular box containing a handwritten signature in black ink, which appears to be 'Akshara D'.

2. Prerana S

A rectangular box containing a handwritten signature in blue ink, which appears to be 'Prerana S'.

SIGNATURE OF THE CANDIDATES

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We wish to express our thanks to all **Teaching and Non-teaching** staff members of the **Department of Biomedical Engineering** who were helpful in many ways for the completion of the Interdisciplinary

project.

ABSTRACT

The outbreak of COVID 19 unveiled the need for protective equipment worldwide. COVID 19 is a highly contagious disease caused by severe acute respiratory syndrome. While talking and breathing the resultant aerosol dispersion and droplets become the prime route of transmission. To prevent the transmission of disease we use masks. While using the mask, it gets infected with germs in the air. Every time changing a new mask is tedious and henceforth we are here to develop a mask that can sanitize on its own. This self-sanitizing mask is made of 3 layers of conductive fabrics, a rechargeable battery, and a potentiometer. This self-sanitizing mask is a smart mask that - works by generating Reactive Oxygen Species (ROS) and it provides three levels of protection for the wearer. This smart mask can be used by a wide range of people because of its simple mechanism and provides a high level of protection. It is expected to be potentially beneficial and slow down the spread of COVID-19

KEYWORDS: conductive fabrics, COVID 19, smart mask, Reactive Oxygen Species.

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CHAPTER – 1

INTRODUCTION

In December of 2019, a COVID-19 epidemic was discovered in mainland China, as most people around the globe are now aware. The disease can spread from person to person through small droplets from the nose or mouth which are spread when a person with COVID-19 coughs or exhales. The COVID-19 pandemic has resulted in a significant loss of human life around the world, and it poses an unprecedented threat to public health, food systems, and the workplace. To prevent the spread of this disease frequent hand washing and usage of face masks are highly recommended. Mask technology now only allows for two types of face coverings: disposable and reusable. Both varieties offer distinct benefits and drawbacks, leaving plenty of space for growth. Disposable masks are beneficial in clinical settings since they are designed for single use and can easily be thrown away and replaced when contaminated. However, the United Nations stated in July 2020 that over 75% of disposable mask trash will end up in landfills or the oceans⁶. Reusable masks significantly reduce the amount of plastic waste produced; however, the repeated use of a single face covering can lead to the accumulation of harmful viruses and bacteria on the protective material¹¹. In order to maintain the function of reusable face coverings, they must be constantly washed, resulting in the expenditure of large amounts of water and electricity, while also taking extended periods of time for the sanitization process to be completed, making them expensive and impractical in clinical settings. Given the importance of facial coverings in preventing COVID-19 transfer between people, there isn't enough focus on improving the function and durability of present mask designs. A mask that is easier to clean while still being easy to put on and remove is needed, as well as one that promotes healthy mask use. As a result, we have developed the self-sanitizing mask, to further combat the spread of COVID-19 and other infectious diseases and reduce unnecessary waste.

CHAPTER – 2

LITERATURE SURVEY

2.1 LITERATURE REVIEW

Prof. Chahan Yeretjian, Institute of Chemistry and Biotechnology, Department of Life Sciences and Facility Management, Zurich University of Applied Sciences ZHAW. Developed a mask that have these two functions – filtering and passive inactivation. But in addition, we have a third level of protection: active inactivation at the push of a button. This electrochemical sterilization can be used by the wearer in certain situations, for example, when the person is in an environment where there is a high risk of infection, such as on public transport or in a hospital. masks also have these two functions – filtering and passive inactivation. But in addition, we have a third level of protection: active inactivation at the push of a button. This electrochemical sterilization can be used by the wearer in certain situations, for example, when the person is in an environment where there is a high risk of infection, such as on public transport or in a hospital.

MAMATA S. KALAS, “REAL-TIME FACE DETECTION AND TRACKING USING OPENCV”, International Journal of Soft Computing and Artificial Intelligence, ISSN: 2321-404X, Volume-2, Issue-1, May2014Face detection is defined as the procedure that has many applications like face tracking, pose estimation or compression. Face detection is a two-class problem where we have to decide if there is a face or not in a picture. This approach can be seen as a simplified face recognition problem. Adaboost is an algorithm for constructing a “strong” classifier as a linear combination. Adaboost, short for Adaptive Boosting, is a machine learning algorithm. It is a meta-algorithm and can be used in conjunction with many other learning algorithms to improve their performance. Adaboost is adaptive in the sense that subsequent classifiers built are tweaked in favor of those instances misclassified by previous classifiers. Adaboost generates and calls a new weak classifier in each of a series of

rounds. For from a set of training images. This method can be used for both face detection and face locations. In this method, a standard face (such as frontal) can be used. The advantages of this method are that it is very simple to implement the algorithm, and it is easily to determine the face locations such as nose, eyes, mouth, etc. based on the correlation values.

C.Jagadeeswari, M. Uday Theja, "Performance Evaluation of Intelligent Face Mask Detection System with various Deep Learning Classifiers", International Journal of Advanced Science and Technology, Vol. 29, No. 11s, pp.3074-30780, (2020). Coronavirus disease (COVID-19) is an airborne infectious disease caused by a newly discovered coronavirus. The best way to prevent or slow down the transmissions is to have knowledge of the COVID-19 virus, the disease it can cause, and how it passes. There are many steps suggested by WHO (World Health Organization) to prevent the spread. One of which is wearing medical masks which is highly desirable even after the lockdown period until a vaccine /Medicine is invented. This system aims at classifying whether a person is wearing a mask or not by taking input from Images and Real-time Streaming Videos.

. Vinitha.V1, Velantina.V2, "COVID-19 FACEMASK DETECTION WITH DEEP LEARNING AND COMPUTER VISION", International Research Journal of Engineering and Technology (IRJET), Volume: 07, pp.1-6, Aug 2020. The mask face detection model is based on computer vision and deep learning. The model is an integration between deep learning and classical machine learning techniques with OpenCV, tensor flow, and Keras. We have used deep transfer learning for feature extractions and combined it with three classical machine learning algorithms. We introduced a comparison between them to find the most suitable algorithm that achieved the highest accuracy and consumed the least time in the process of training and detection. The images that were present were of different sizes and resolutions, probably extracted from different sources or from machines (cameras) of different resolutions. Face Mask Detection in webcam stream. The flow to identify the person in the webcam wearing the face mask or not. The process is two-fold. To identify the faces in the webcam. Classify the faces based on the mask. Identify the Face in the Webcam: To identify the faces a pre-trained model provided by the OpenCV framework was used. The model was trained using web images. OpenCV provides 2

models for this face detector: A floating-point 16 version of the original Caffe implementation. 8 bit quantized version using Tensor flow

Walid Hariri, "Efficient Masked Face Recognition Method during the COVID-19 Pandemic", pp.1-7, July 2020

The COVID-19 is an unparalleled crisis leading to a huge number of casualties and security problems. In order to reduce the spread of coronavirus, people often wear masks to protect themselves. This makes face recognition a very difficult task since certain parts of the face are hidden. A primary focus of researchers during the ongoing coronavirus pandemic is to come up with suggestions to handle this problem through rapid and efficient solutions.

Pre-processing and cropping filter: The images of the dataset are already cropped around the face, so there is no need for a face detection stage to localize the face from each image. To do so, we detect 68 facial landmarks using the Dlib-ml opensource library. According to the eye's location, we apply a 2D rotation to make them horizontal. The next step is to apply a cropping filter in order to extract only the non masked region. To do so, we firstly normalize all face images into 240 x 240 pixels. Next, we use the partition into blocks. The principle of this technique is to divide the image into 100 fixed-size square blocks (24 x 24 pixels in our case). Then we extract only the blocks including the non-masked region (blocks from numbers 1 to 50). Finally, we eliminate the rest of the numbers of the blocks.

CHAPTER – 3

AIM AND SCOPE

3.1 AIM

The main idea of this research work is to provide a mask that can sanitize on its own and is reusable so, that it can minimize the amount of waste eliminated every day by using a disposable mask. The fact that it can sanitize on its own slows down the spread of any viruses and bacteria.

3.2 PROPOSED SYSTEM

The mask consists of three layers: two conductive textile layers and an insulating fleece in between. A small battery of 0.6 volts applies an electrical voltage between the two conductive layers.

Together with some moisture, which is generated by breathing or by moistening at the beginning, and the oxygen in the air, this field then generates ROS, such as oxygen peroxide and other compounds, which then kill the viruses, but also bacteria, as a chemical weapon.

The masks known today only retain the viruses by filtering. there are already masks on the market that passively inactivate viruses with the help of certain coatings on the textiles. The disadvantage, however, is that inactivation is slow and incomplete.

Our masks also have these two functions – filtering and passive inactivation. we have a third level of protection: active inactivation at the push of a button.

This electrochemical sterilization can be used by the wearer in certain situations, for example, when the person is in an environment where there is a high risk of infection, such as on public transport or in a hospital. Using ESP-32 we have coded in a way that the mask sanitizes every 60 minutes once. The masks clean themselves. This is done with the integrated mini-battery, which should be recharged regularly.

3.4 SCOPE

Usage of a mask is mandatory during the pandemic and this self-sanitizing mask provides a high level of protection for the wearer. It's very easy to use and very efficient.

CHAPTER – 4

MATERIALS AND METHOD

4.1 ESP 32

ESP32 is a family of low-cost, low-power systems-on-chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The ESP32 series is powered by a Tensilica Xtensa LX6 dual-core or single-core CPU, a Tensilica Xtensa LX7 dual-core or single-core RISC-V microprocessor, and contains built-in antenna switches, RF balun, filters, power amplifier, power management modules and, low-noise receive amplifier. It can operate reliably in industrial conditions with operational temperatures ranging from -40°C to $+125^{\circ}\text{C}$. ESP32 can dynamically remove exterior circuit defects and respond to changes in external conditions thanks to improved calibration circuitries. ESP 32 can function as a stand-alone system or as a slave device to a host MCU, eliminating communication stack overhead on the primary application CPU.



Fig: 4.1 - ESP 32 microcontroller

4.2 RECHARGEABLE LITHIUM BATTERY:

Renata CR2477N batteries are lithium coin cell batteries that meet the highest quality standards and offer excellent reliability. In addition to the wide spectrum of memory backup power sources, Renata CR2477N lithium batteries are used for different applications in the computer and automotive industries, telecommunications, medical industry, and in an increasing number of portable devices



Fig: 4.2 – LITHIUM BATTERY

4.3 POTENTIOMETER

The 10K Potentiometer Product Description: This adjustable or Variable resistor are PCB mountable and has 3 terminals. The voltage between the terminal varies as the preset is rotated. The Variable resistors are used for variation voltage as per the need in a circuit. The outer two pins are connected to Vcc and 0V, and center pin outputs a variable voltage between 0v and Vcc as the rotary is rotated. Potentiometer for PCB mounting.



Fig: 4.3 - POTENTIOMETER

4.4 INSULATING FLEECE:

Fleece is a decent insulator, it dries quickly and wicks well enough, which means it works pretty well worn under a windproof or waterproof.

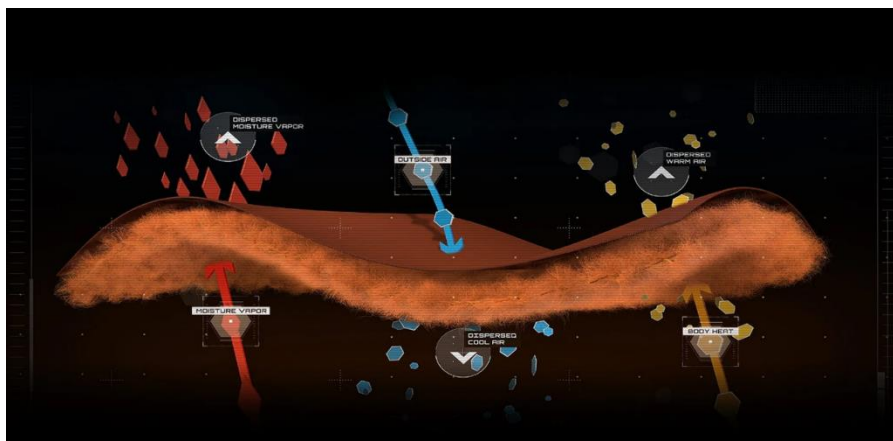


Fig: 4.4 – INSULATING FLEECE

4.5 CONDUCTIVE

Item - CDF-SF6

Base Fabric - 6%Silver + 94%Modal

Weight - 193 g/m²

Width (cm) - 145-150

Thickness (mm) - 0.55

Characteristics: Skin Friendly, Anti-Microbial, Anti Odor, Anti-Radiation, High Elasticity. High elasticity silver fiber weaving fabric has anti-microbial, anti-odor, and anti-radiation performance, it is a skin-friendly fabric.

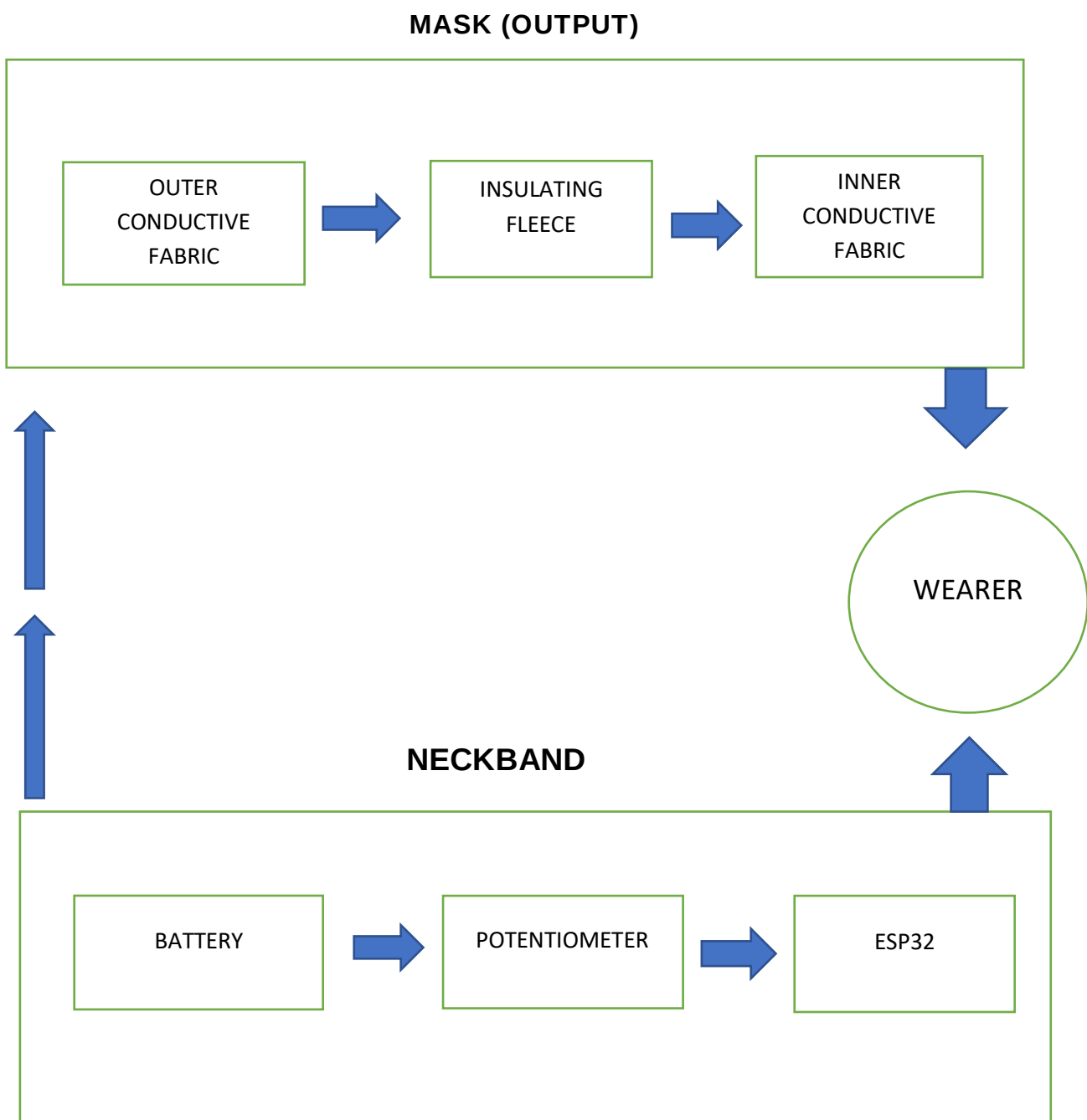


Fig: 4.5 – CONDUCTIVE FABRIC

4.6 ARDUINO IDE

The Arduino IDE is free and open-source software for writing and uploading code to Arduino boards. The IDE generates a Hex file when a user writes code and compiles it. The data is subsequently transferred to the board through a USB wire.

4.7 BLOCK DIAGRAM



CHAPTER – 5 RESULTS

Here the mask is made up of a conductive fabric that conducts an electric current that has been given out by a battery with the help of a microcontroller which helps to self-sanitize the mask every hour automatically or the user can themselves sanitize it whenever they want.



CHAPTER – 6

CONCLUSION

6.1 CONCLUSION

The main focus of this project is to prevent the spread of COVID-19 and any other contagious disease. Covid-19 has upended societies and dramatically altered everyday life across the globe and we want everybody to get socialized and be back to their routine without the fear of COVID. In future work will be focused on enhancing the better performance of the system.

6.2 SUMMARY

The current study leads to the following points:

- a). We are using conductive fabric coated with silver to provide electrical conductivity to kill any viruses and bacteria.
- b) We are connecting all the components in the neckband so that the wearer can easily wear it without any disturbances

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