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# Automated Sanitation Station with Face Mask Detection and Temperature Scanning

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**Abstract -** *As pointed out by the World Health Organization, the preventive measures for COVID-19 are social distancing, face mask and regularly sanitizing one's hands. It is difficult to effectively check all these factors in crowded places. The pandemic has made wearing a face mask as the new normal and several governments have made it requisite to wear mask and enforce a fine on violators. With things returning to normalcy, there are situations where it probably won't be feasible to physically monitor who is wearing a face mask and who isn't, who is having a high temperature or who is sanitizing their hands. The application discussed and proposed in this paper can come handy in such situations, as in shopping centers, air terminals, eateries, shops and so on where one needs to detect everybody's body temperature, check for face mask, and sanitize their hands. Consequently, one will probably plan one machine which will actually want to do all of this.*

***Key Words***: **Arduino, CNN, COVID-19, Machine learning, TensorFlow**

## 1.INTRODUCTION

The COVID-19 pandemic has hugely influenced our day-to-day life disrupting nearly everything around us. Wearing a face mask has now become the the new normal and gradually, as public places open up, numerous of them will require that the clients/employees/guests wear face masks effectively and follow all the other precautions prescribed. Accordingly, face mask recognition has become a pivotal software to ensure safety. Our paper intends to accomplish this utilizing some fundamental Machine Learning bundles like TensorFlow, Keras, OpenCV and Scikit-Learn. The proposed technique distinguishes the face effectively and afterward recognizes if the individual is wearing a mask or not, and assuming an individual isn't wearing one, the concerned authority will be quickly notified. The device will also sense the individual's thermal temperature and distinguish a face even if it is moving. It is crucial to utilize Convoluted Neural Network model to recognize the presence of mask accurately without causing over-fitting. Additionally, it is intended to coordinate a computerized hand disinfection framework and temperature scanner with the face mask monitor.

The paper [1] entails the procedure and the cycle engaged with building and executing the face mask detection application. They have utilized TensorFlow, Keras and OpenCV. Two datasets were utilized, one with mask and one without. The proposed strategy comprised of a course classifier and a pre-prepared CNN which contains two 2D convolution layers associated with layers of thick neurons. [2] shows crossover model utilizing profound and old-style AI for face mask location was introduced. The proposed model comprised of two sections. The initial segment was for the element extraction utilizing Resnet50. Resnet50 is one of the well-known models in profound exchange learning. While the subsequent part was for the discovery cycle of face veils utilizing traditional AI calculations. The Support Vector Machine (SVM), choice trees, and gathering calculations were chosen as customary AI for examination.

Reference has been taken from these papers and we have added a few more aspects in addition to checking for face mask. The project is intended not only check if a person is wearing a face mask or not, but also to check if they have a fever/high temperature which is one of the most common symptoms of the virus. The system would then notify the concerned authority if no face mask was detected or if the temperature is higher than the set limit. Then the machine would sanitize the persons hand, when the person keeps his/her hands in front of the ultrasonic sensor deployed over there. Thus, to summarize, we want to build a machine which is capable of doing all the tasks that are currently undertaken by three or four different machines along with a human being present right now, which is automatic face mask detection, with temperature scanning and automatic sanitizing station.

The paper is organized in the following manner: Section II explores related work associated with face mask detection. Section III discusses the datasets used in the project, Section IV presents in brief, the details of the packages incorporated to build the model. Section V gives an overview of the block diagram. Section VI is the hardware description. Experimental results and analysis are reported in Section VII. Section IX concludes and draws the line towards future works.

## 2. RELATED WORK

In face recognition technique, a face is identified from a picture that has a few ascribes in it. As per [3], examination into face detection requires body detection, face following, and posture assessment. Given a single picture, the test is to distinguish the face from the image. Locating the face in an image is a challenging task because the faces change in size, shape, shading, and so on and they are not permanent. It turns into an even difficult task in murky pictures where face is blocked and not facing the camera, etc. Authors of [4] think accurate face mask identification has two significant difficulties: 1) inaccessibility of sizably voluminous datasets containing both covered and exposed appearances, also, 2) partially covered faces or dim images. As per the work in [5], convolutional neural network (CNNs) in PC vision accompanies a severe limitation with respect to the size of the information picture. The image is reconfigured prior to fitting them into the network to overcome the issue. Here the principal challenge is to distinguish the face from the picture effectively and afterward recognize on the off chance that it has a mask on it or not.

## 3. DATASET

Two datasets have been used for experimenting the current method. Dataset 1 [6] consists of 1376 images in which 690 images with people wearing face masks and the rest 686 images with people who do not wear face masks. Dataset 2 from Kaggle consists of 853 images and its countenances are clarified either with a mask or without a mask. Sample images are shown in fig.1 and fig.2.

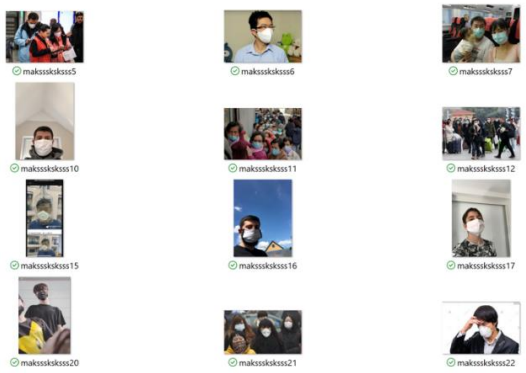

*Figure 1.Dataset of faces with mask*

*Figure 2.Dataset of faces without mask*

## 4. INCORPORATED PACKAGES

### 4.1 Tensor Flow

It's an interface for communicating AI calculations, used for executing ML frameworks into creation over a lot of spaces of software engineering, including notion investigation, voice acknowledgment, geographic data extraction, PC vision, text synopsis, data recovery. In the proposed model, the entire Sequential CNN engineering utilizes TensorFlow at backend. It is additionally used to reshape the information (picture) in the information handling.

### 4.2 Keras

It gives key reflections and building units for creation and transportation of ML plans with high cycle speed. It exploits the versatility and cross-stage capacities of TensorFlow. The center information constructions of Keras are layers and models. Every one of the layers utilized in the CNN model are executed utilizing Keras. Alongside the change of the class vector to the paired class lattice in information preparing, it assists with gathering the general model. Keras is the high-level API of TensorFlow 2: an approachable, highly productive interface for solving machine learning problems, with a focus on modern deep learning. It provides essential abstractions and building blocks for developing and shipping machine learning solutions with high iteration velocity.

### 4.3 OpenCV

OpenCV (Open-Source Computer Vision Library), an open-source vision and ML programming library, is used to separate and perceive faces, perceive objects, bunch developments in accounts, track camera activities, discover similar pictures from a picture information base, see scene and set up markers to overlay it with expanded reality, etc. The library has more than 2500 optimized algorithms, which includes a comprehensive set of both classic and state-of-

the-art computer vision and machine learning algorithms. The proposed technique utilizes these highlights of OpenCV in resizing and shading transformation of information pictures. The method proposed in this paper makes use of these features of OpenCV in resizing and colour conversion of data images.

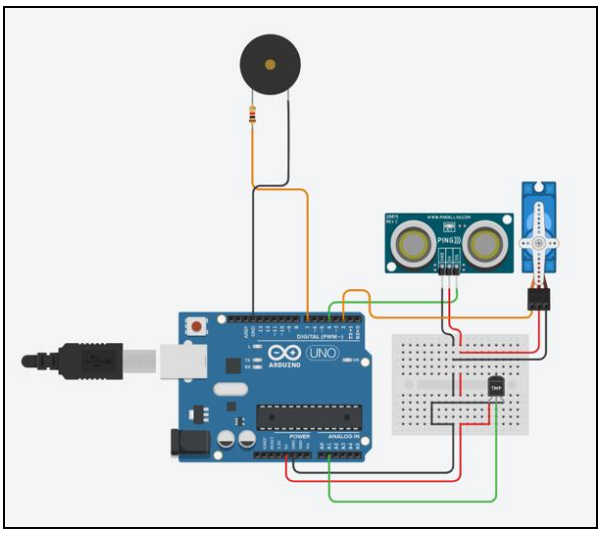

*Figure 3. Tinkercad simulation of the device*

## 5. HARDWARE DESCRIPTION

### 5.1 Arduino UNO

The Arduino Uno is an open-source microcontroller board dependent on the Microchip ATmega328P microcontroller and created by Arduino.cc. The board is outfitted with sets of advanced and simple (i/p)/(o/p) port that might be interfaced to different extension sheets and different circuits.

### 5.2 Ultrasonic sensor

An ultrasonic sensor is an electronic gadget that actions the distance of an objective item by transmitting ultrasonic sound waves and converts the reflected sound into an electrical sign. This is used to detect the person's hands, to dispense the sanitizer.

### 5.3 Servo Motor

The servo motor is used to pull down the sanitizer nozzle to dispense the sanitizer.

### 5.4 MLX90614

The MLX90614 is an infrared thermometer for non-contact temperature estimations. Coordinated into the MLX90614 are a low commotion speaker, 17-piece ADC and incredible DSP unit in this way accomplishing high precision and goal of the thermometer. It is used this temperature sensor to detect the persons temperature.

### 5.5 Buzzer

A buzzer is used to alarm if a person or anyone has high temperature. The buzzer is connected to the Arduino and whenever someone is detected to have a high body temperature, the buzzer goes off and alerts the authorities.

## 6. PROPOSED METHOD AND ALGORITHM

The general working of the proposed system is as given in table-1 below.

*Table 1. working Algorithm*

| **Algorithm 1:** General functioning of the System | | |
|---|---|---|
| Input | : | Face of person, temperature |
| Output | : | Sanitiser dispensing |
| Step 1 | : | Use webcam to scan a person's face |
| Step 2 | : | Check presence of mask |
| Step 3 | : | Check body temperature |
| ***if*** | : | Body temperature exceeds limit |
| | : | Trigger the buzzer |
| Step 4 | : | Dispense sanitising material |

However, Image Processing has its own subset of its functioning, which is used for detecting the presence of a face mask. It uses the CNN method of detection. This involves numerous steps as follows:

### 6.1 Conversion of Image from RGB to Greyscale

First, the image is processed so that better results can be obtained, hence yielding a higher accuracy. The image is first converted from RGB (Red Green Blue), which is a coloured image, to greyscale, which is in shades of black and white. This reduces the training data required to obtain the same amount of accuracy as that obtained without conversion.

### 6.2 Reduction of Image Size to 100 x 100 Pixels

CNN is usually trained along with fine-tuned images. Hence the image size is reduced from its original size to 100 x 100 pixels for better accuracy.

### 6.3 Normalization of Image

This changes the pixel intensity range of the image. This ensures that data is distributed in a more uniform manner.This helps in the detection of a partially or fully visible face in the dataset.

### 6.4 Training and Testing the Model

Various models can be used in training and testing the obtained set of images. First the data is split into two categories: training, and testing. First the training data is used to train the model, and finally the accuracy of the result is then checked using the testing data.

## 7. RESULTS AND ANALYSIS

The face mask detection was successful, so was the automatic hand sanitizer dispensing and temperature sensing mechanism. The basic flow of the project it that when a person reaches the desk, they are first checked for a face mask. Then, their body temperature is checked. If the temperature is above a certain limit, then the buzzer goes off. Finally, when the person comes close to the sanitizer dispenser, the ultrasonic sensor senses it and in turn the motor rotates, and sanitizer is dispensed from the nozzle.The accuracy achieved was 96% as seen in Figure 5 and Figure 6 in the face mask detection mechanism. The system can efficiently detect partially occluded faces either with a mask or hair or hand.

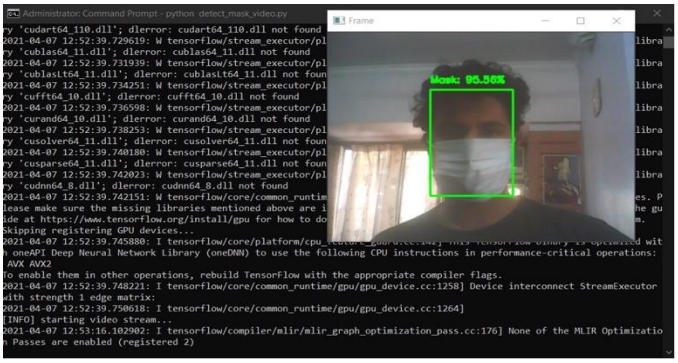


*Figure 4. program successfully detecting face with mask*

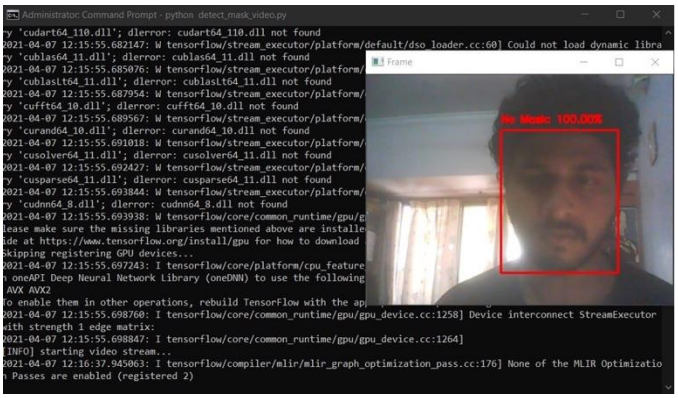


*Figure 5. program successfully detecting a face without a mask*

*Figure 6. the sanitizer dispensing mechanism*

## 8. FUTURE SCOPE

Businesses are constantly overhauling their existing infrastructure and processes to be more efficient, safe, and usable for employees, customers, and the community. With the ongoing pandemic, it's even more important to have advanced analytics apps and services in place to mitigate risk. For public safety and health, authorities are recommending the use of face masks and coverings to control the spread of COVID-19. Hence this project has high scope of practical implementation ranging from airports and offices to hospitals and local shops.

This project is mostly software based and the face mask detection part only requires a laptop with front camera. The proposed system might require addition hardware and equipment for sanitizer and thermal scanning but is manageable. There is a high demand for this kind of a product right now. We believe this can be developed and implemented; hence it is feasible.

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