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Real Time Face Mask Detection and Thermal Screening with Audio Response for COVID-19

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Abstract

The coronavirus COVID-19 pandemic is continuously spreading until now everywhere on the earth, and causing a severe health crisis. So the helpful and safe-keeping method is wearing a face mask in all areas where people are gathered, according to the World Health Organization (WHO). Along with the face mask, body temperature and sanitization also plays a vital role in being safer. Thus, monitoring the individuals that are wearing the mask or not is more significant. In this paper, we propose a system that uses TensorFlow, Keras, MobileNetV2, and OpenCV to detect the face mask. A dataset contains images of persons with and without masks obtained from multiple sources and trained on a deep learning model. Then the automatic temperature checking and Sanitation are done. Finally, the proposed system gives an audio/voice output whether the face mask is present or not, the person's body temperature. Our approach would be beneficial in reducing the spread of this infectious disease and will encourage people to use face masks, getting regularly sanitized and monitoring the temperature can keep the workplace safe.

Key-words: TensorFlow, Keras, MobileNetV2, OpenCV.

1. Introduction

The first case of the COVID-19 pandemic has been confirmed in China in December 2019. From then, the virus spread throughout the world, affecting nearly every country. Living at home, Working from home, self-driving, avoiding public transportation, and avoiding travel to affected cities are all possibilities for limiting the transmission of Covid 19. The two major causes of the

virus's propagation, according to WHO, are respiratory droplets and physical contact between people. The respiratory droplets from one person who is in contact with the infected one can be transferred to the other in different forms. The precautions given by the government are wearing masks and social distancing. The masks that are used by people are of different types, which stops the spreading of respiratory droplets from an infected person to any other. Social distancing is a basic phenomenon that typically involves keeping a minimum gap of 2 meters between objects and people. The other most important one is body temperature and Sanitation. A rise in body temperature is an early indicator of illness, keeping track of body temperature can help in the early recognition of diseases. Sanitation kills the germs and makes hands clean and hygienic. So, in our proposed methodology, we've created a mask recognition algorithm that can identify a wide variety of mask kinds and designs. With the help of computer vision, the deep learning algorithm is applied and the TensorFlow, Keras library of python is used for implementation. The Contactless Sanitization and Temperature Monitoring System are outfitted with a contactless Infrared Temperature Sensor MLX90614, an OLED show, Audio speaker module, Active IR sensor, TIP32C PNP Transistor, DC Water siphon, LED Indicators and Arduino UNO to detect determine whether a person's temperature is normal or abnormal.

2. Existing Methodology

As per the, [1][2] object detection can be achieved by the Single Shot Detector model. This system is integrated into places like malls, ATMs, bank etc to avoid the virus spread. The approach they followed using Goggle Colab, which didn't enable the webcam for testing images o video stream and it takes a large time for data loading. The Deep Learning model proposed in our approach using MobileNet makes it more efficient and easier to load the images from datasets. This system uses the CNN architecture [3][4][5] it can determine whether the person is warning face mask or not. This model is deployed into the CCTV cameras which ensure for working in a safe environment. The dataset collected contains a lot of errors and repetitions [6]. Here, in our approach, we used Mobilenetv2 in place of CNN for fast result processing. And, The process makes sure that all the images are preprocessed and cleaning is done for being error-free. Raspberry pi is used for facemask detection and it loads the images for the detection process. This approach involves the architectural characteristics of VGG-16 that are used as the base system for face recognition in this system[7]. Here, in our approach, we are also using deep learning features, for the recognition of face mask using TensorFlow, Keras and Open CV. Our approach provides accuracy or percentage of prediction.

And this gives the audio output at all stages that is according to the mask, temperature and sanitisation.

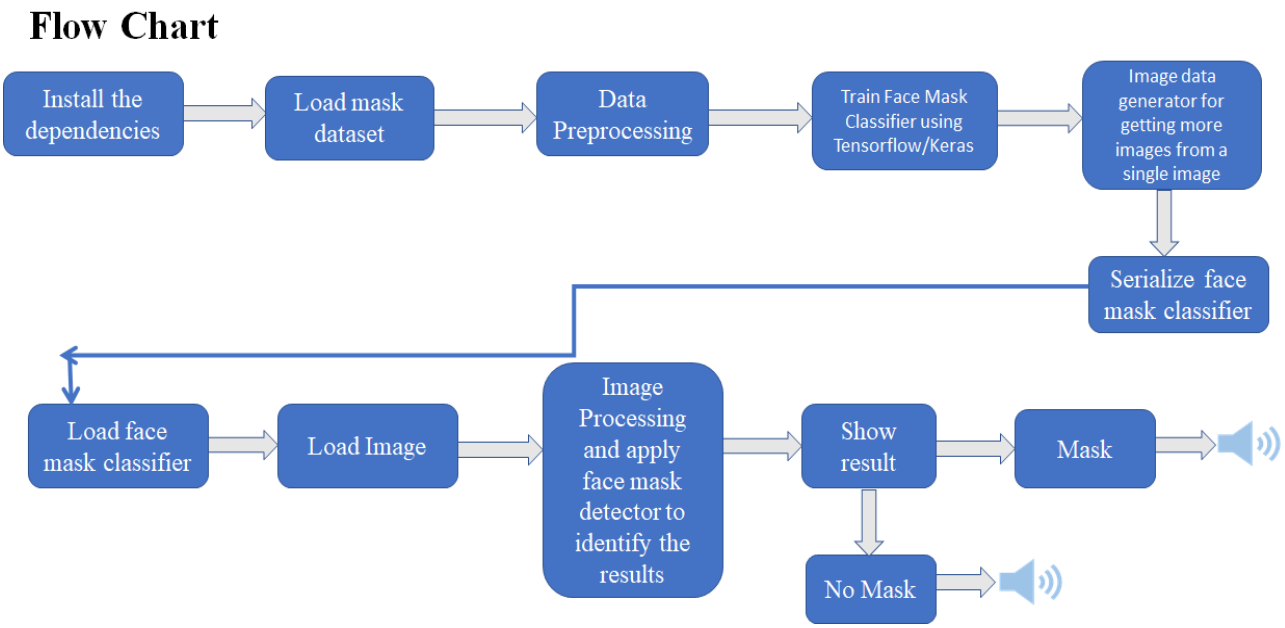
3. Proposed Methodology

The complete approach is categorized into two sections. They are as follows:

- Face mask detection.
- Contactless Sanitization and Temperature measurement System.

3.1. Face Mask Detection with the Audio Response

The proposed method for identifying, whether the person is wearing the face mask or not is given in the below flowchart. The suggested Deep Learning algorithm uses TensorFlow, Keras libraries and MobileNetV2 which aims to identify the person wearing a face mask on an image and shows the step by step approach for succeeding in it.



By following the above steps, the algorithm can provide the result, whether the person is wearing the mask or not furthermore gives the audio output of the state.

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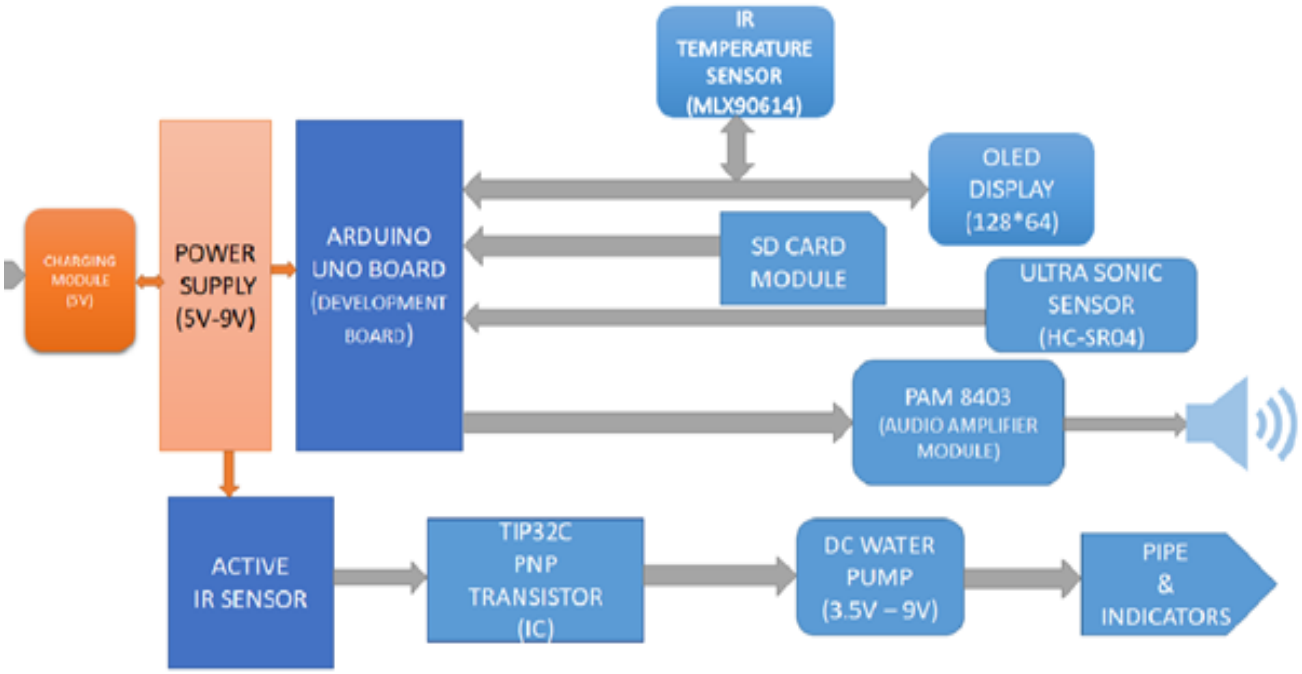
3.2. Contactless Sanitization and Temperature Measurement System

The design of Contactless Sanitization and Temperature measurement System with Audio Response and display temperature Scheme can be shown in Fig.



The Contactless Sanitization and Temperature Monitoring System is responsible for analyzing temperature and produces audio output. After completing the temperature test further we proceed with a sanitizer to hygienic our hands.

4. Implementation

4.1. Face Mask Detection with Audio Output

4.1.1. Data Source Collection

Here the collected images, with face mask and without face mask from different available open sources like the dataset available at PyImage Search and Kaggle. Choosing the right data set is very important for getting accurate output and reduces biased results. We can have a great accuracy based on the number of images collected.

4.1.2. Data Preprocessing

Data preprocessing is a very important step, for a good deep learning model. There can be a lot of errors, noises and repetitions in the images of the dataset which was taken from various sources. A clean and good dataset can produce a comprehensive model with great accuracy. So, to achieve that images were preprocessed, all repetitions and errors are removed manually. In the same way, the data cleaning was done manually. This makes images clean and noise-free. The images which are preprocessed are given as input for the model. All the images which are in the dataset have to be converted into arrays. Firstly, resize all the images into the same size (256 x 256). These images are converted into arrays, here we use NumPy for fast numerical computations. Primarily, Only with the arrays, the deep learning models work. After this process the train_test_split function can split, some of the dataset for training and some for testing.

Deep Learning Frameworks

The following choices for implementing this deep learning network:

1. Tensor Flow
2. Keras
3. PyTorch
4. Caffee
5. MxNet
6. Microsoft Cognitive Tool Kit

TensorFlow and Keras these give high performance and good accuracy and can be used for big datasets.

4.1.3. Data Augmentation

For the training of the model, to perform it productively, we require a large amount of data. Due to the lack of, data availability for the training, we use the method of data augmentation to overcome the issue. This approach includes functions like shifting the image, changing the image to directions, zooming the images, rotating the images. This makes several styles of images from a single image. These can be done by a function, image generator returns the training and testing batches of the data and makes more images by changing some of the properties of a single image.

4.1.4. Algorithm for Implementation

Algorithm1: Pre-processing and Training on Dataset

Input: Images with their pixels values

Output: Trained Model

Steps:

1: Load Images in the dataset along with their pixel values.

2: Preprocess the images, i.e., making noise-free, resizing, including normalization, and conversion to a 1D array.

3: Load the Filenames and their respective labels to the arrays.

4: Now, Data augmentation and then divide data into training and testing batches, within the different ratios from the dataset.

5: From the training batches, the trained model is formed. To train it on training batches, load the Mobilenet V2 model from Keras.

6: Keep the model for further use.

Algorithm 2: Apply the model to the camera

Input: Choice of deployment and Files.

Output: Classification of Images into the mask or no mask in Real-time.

Steps:

1: Load the serialized face detector model for face detection

2: Load the face mask detector model

3: Load the Camera

4: Read the frame, every frame is an image. Show the frame within a certain width. (It is for the video loading from the camera).

5: Now, mask detection and prediction take place with the help of a face detector, mask detector and frame. This results in the percentage of prediction of wearing the mask and location, which the x,y coordinates of a rectangle surrounding the face.

6: Determine the label (Mask or No Mask) and colour(Green or Red) to draw around the face.

7: Show the predictions

8. The audio output is received.

- "Please Wear the mask" if the mask was not detected.

- “You are on the mask, so you can get it” if the mask was detected.

9: Give the keyboard interrupt to stop the video stream.

4.2. Contactless Sanitization and Temperature Measurement System

System Implementation

We have the following Libraries for Implementing the Temperature measurement with Audio response and display results on OLED. TMRpcm.h, Adafruit_MLX90614.h,SD.h, SSD1306Ascii.h

A person places his hands or forehead in Infront of the temperature sensor [8]. The temperature sensor will detect and transfer a signal to Arduino and it generates the temperature on OLED display and based on that temperature it produces audio from PAM8403 audio amplifier with a stereo speaker. Once Temperature detection is completed, the IR sensor will sense the hand and sends a signal to PNP Transistor to produce output and the DC motor will enable until the hands are placed in Infront of the IR sensor. A when we insert our hands for sanitisation then the led indicator enables and starts sanitization [9] until removing the hands with the help of, active IR sensor and DC Water Pump as shown in fig 4. B) The MLX90614 IR Temperature sensors analyze the temperature of a person contactless. Based on temperature results, the stereo speaker will generate an audio response is made and the temperature is shown in the OLED display as shown in fig 5.1 and fig 5.2. C) The view of the Contactless Sanitization and Temperature Monitoring System product as shown in fig 6. D) When the system is chargeable with the Li-molecule Battery. When we insert the charger, Red LED will enable and initiate charging as shown in fig7.

5. Benefits

- This system can be used in Hospitals, Colleges, Airport’s, Shopping Malls, ATMs, Banks, etc to Detect Mask and Contactless Thermal Screening.
- Gives the audio output at all stages Mask, Temperature, Sanitization.
- This can keep peoples safe from virus transmission.
- Contactless Sanitization and Temperature measurement System can be rechargeable, portable, cost - effective.

6. Result and Discussions

The Result section discusses face mask detection with the audio response and thermal screening with the audio response. This can be used in many public places, first, the face mask checked, and then we can get the voice output either to allow in or wear the mask. And then moved into the further section that is, Sanitization and temperature checking which displays the temperature and produces the voice output of the temperature level. These are done automatically without any manpower which reduces the virus transmission.

Below are few of the executed examples of the face mask detection on the images in real-time.

Fig. 1 - Detection for Mask, gives the Audio Output that, you are on the Mask so you can get in

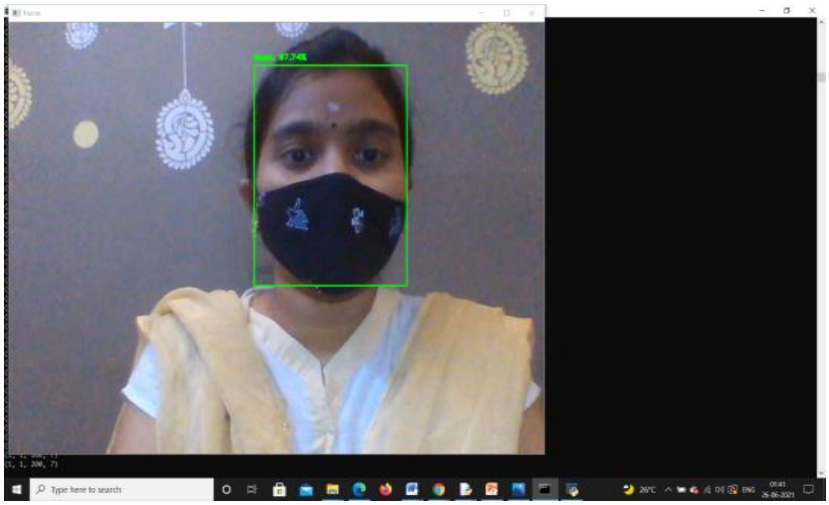


Fig. 2 - Detection for No Mask, gives the Audio Output that, please Wear the Mask

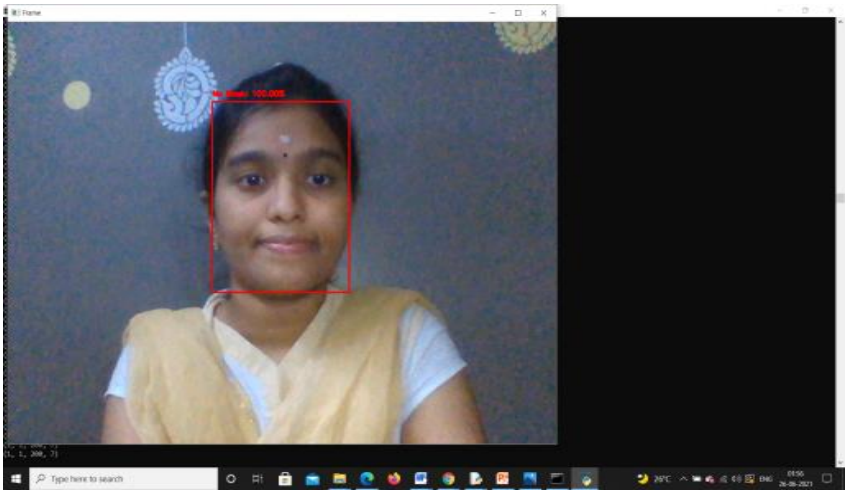


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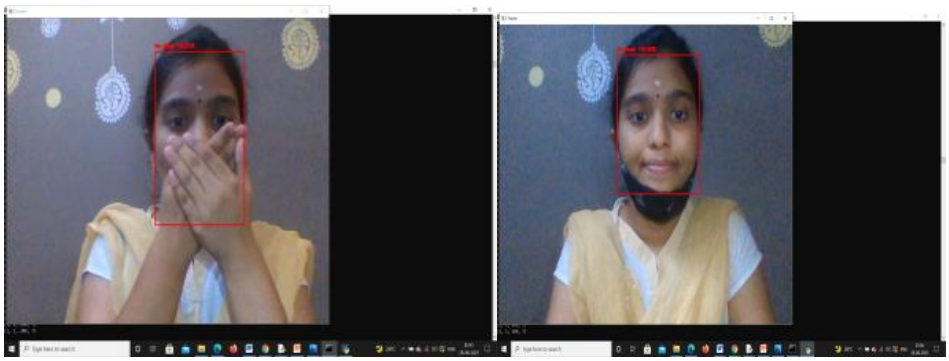
Fig. 3 - Detection for the Incorrect Wearing of the Mask



Below are the result and view of the Contactless Sanitization and Temperature measurement System

Fig. 4 - Contactless Sanitisation with LED Indicators

Fig. 5.1 - Before Temperature Measurement gives the audio output of "Welcome to Contactless Sanitization and Temperature measurement System".

Fig. 5.2 - After Temperature Measurement gives the Audio of a Person Temperature

7. Conclusion

The COVID-19 pandemic has brought a lot of difficulties to the nation, and the virus's spread must be controlled since the virus has impacted over crores of people across the world. So, the development of a face mask detection system with audio response can determine, if someone is wearing the mask or not wearing the mask and gives the audio response according to it can benefit in many cases. So, we have provided a deep learning model by using frameworks TensorFlow and Keras including MobileNetV2 and OpenCV. The Contactless Sanitization and Temperature Monitoring System can monitor the temperature and display on OLED, allows for sanitisation and gives the audio response according to it. Therefore, through this system, we hope to protect people from virus transmission and the spread of infectious diseases. We plan to implement it further by, integrating the two sections that are Face mask detection and Contactless Sanitization and Temperature Monitoring System make it a single product with low cost.

References

Deep Learning Implementation of Facemask and Physical Distancing Detection with Alarm Systems, Sammy V. Militante; Nanette V. Dionisio, *2020 Third International Conference on Vocational Education and Electrical Engineering (ICVEE).* Doi:10.1109/ICVEE50212.2020.9243183

A. Waheed, M. Goyal, D. Gupta, A. Khanna, F. Al-Turjman, and P. R. Pinheiro. CovidGAN: Data Augmentation Using Auxiliary Classifier GAN for Improved Covid-19 Detection. *IEEE Access, 8,* 91916–91923, 2020. doi:10.1109/ACCESS.2020.2994762

SSDMNV2: A real time DNN-based face mask detection system using single shot multibox detector and MobileNetV2 Preeti Nagrath, Rachna Jain, Agam Madan, Rohan Arora, Piyush Kataria, Jude Hemanth.

V. Chamola, V. Hassija, V. Gupta and M. Guizani, "A Comprehensive Review of the COVID-19 Pandemic and the Role of IoT, Drones, AI, Blockchain, and 5G in Managing its Impact," *in IEEE Access, 8,* 90225-90265, 2020. Doi:10.1109/ACCESS.2020.2992341

Face mask detection for covid_19 pandemic using PyTorch in deep learning. Sneha Sen and Khushboo Sawant. *IOP Conf. Ser.: Mater. Sci. Eng.* 1070 012061

P.A. Rota, M.S. Oberste, S.S. Monroe, W.A. Nix, R. Campagnoli, J.P. Icenogle, S. Penaranda, B. Bankamp, K. Maher, M.H. Chen. Characterization of a novel coronavirus associated with severe acute respiratory syndrome. *Science,* 300(5624), 1394–1399, 2003.

Covid-19 Facemask Detection with Deep Learning and Computer Vision, R. Suganthalakshmi, A. Hafeeza, P. Abinaya, A. Ganga Devi.

Vinod BG, Teja's A, Implementation of Automatic Contactless Temperature Sensing and Door Access, *International Journal of Advanced Research in Computer and Communication Engineering,* Vol. 9, Issue 6, June 2020.

Abhinandan Sarkar, Faculty of Electronics Department of Computer Science and Technology Luthfaa Polytechnic Institute, Durgapur (W.B), Design of Automatic Hand Sanitizer with Temperature Sensing, *International Journal of Innovative Science and Research Technology*.

Akshay Sharma Student, Department of Electronics and Communication Engineering, Vidyavardhaka College of Engineering Mysore, India Review on Automatic Sanitizer Dispensing Machine. *International Journal of Engineering Research & Technology (IJERT)* http://www.ijert.org ISSN: 2278-0181 IJERTV9IS070307, Vol. 9 Issue 07, July-2020.

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