

Review on Arduino-Based Face Mask Detection System

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Abstract – In several nations around the world, the COVID-19 pandemic's emergence has had an ongoing effect since 2019. The Face-Mask Detection has Facemask detection has achieved great advancements in the field of deep learning and image processing. In this Technique we have to use a face mask as a preventive measure for any such viruses, The basic aim of the project is to detect the presence of a face mask on human faces on live streaming video as well as on image, The strategy outlined in this paper was created to prevent people without masks from entering certain locations.(i.e- Office, Mall, University...etc) by detecting the face the sensor sends the signal to the Arduino device that connects to the gate to be open. The System Detect the mask in the real time whether person wear a mask or not. The information provided in this paper, was collected from different sources.

Key Words: Face-Mask Detection, Arduino, Deep Learning, COVID-19.

1. INTRODUCTION

According to World Health Organization (WHO), since December 2019 more than 114 countries suffered from COVID-19 pandemic which has declared as a deadly virus that has globally infected over 120 million people causing more than 2.50 million deaths worldwide as on Feb 18, 2021, In Iraq since the rise of COVID-19 more than 654000 affected case and more than 13000 deaths has been registered, this is due to the insufficient vaccines to overcome this deadly disease to date [1]. Wearing a facemask during this pandemic is a critical defensive in times when social distancing is hard to maintain. Therefore, the many face mask detection and monitoring systems have been developed to provide effective supervision for public transportations, hospital, retail locations, airports and sports venues.

In the field of image processing, computer vision, and pattern recognition, face detection is first step for various applications that depends on facial analysis algorithms for identifying, and recognizing human faces, and also to capturing facial motions on faces in digital images, including the face recognition, face alignment, face verification, age recognition, face modelling, face authentication, access control, forensics, and human-computer interactions. Face relighting, facial tracking, head pose tracking, facial

expression recognition, gender recognition, and other face-detection based applications [2].

After the arise of Covid-19, Face-Mask detection has the widely considered a problem in the image processing field. This technology is currently more appropriate because it is applied to detect faces and identify people wearing masks in images, videos, and also in real-time vision. By using deep learning and convolution neural network (CNN) techniques, it becomes possible to achieve high accuracy results in image classification and object detection applications. The proposed system in this paper uses deep learning, TensorFlow, Keras, and OpenCV which are used as image classifier to detect face-mask and sends a signal to Arduino devices that control the open and close of the door.

2. FACE DETECTION OVERVIEW

Face detection may be a technique for recognizing or confirming somebody's identity by viewing their face. Face recognition software is identify people in pictures, videos, or in real-time. 40 Over the past 60 years as shown in Fig-1, face detection methods widely employed in various industries and have benefitted from the improvements during this technology and these include improve , border control, retail, mobile technology and banking and finance [3, 4, 5, 6].

- 1964: Bledsoe did a facial programming experiment. They imagine a semi-automatic input method, in which the operators enter twenty different measures, such as the scale of the mouth and eyes
- 1977: 21 new markers were added to the Bledsoe 1964 system to enhance it (i.e., the width of lips, eyes color, and hair color).
- 1988: computer science was accustomed improve previously used computational methods that exposed multiple flaws. Mathematics ("linear algebra") are used to view symbols uniquely and to search out the simplest way to simplify and modify them independently of human markers.
- 1991: EIGENFACES which was the primary successful techniques utilized in automatic face

recognition technology, that depends on the statistical Principal component analysis (PCA) method, Was developed by Pentland and Turk of the Massachusetts Institute of Technology (MIT)

- 1998: Face recognition technology “FERET the program” developed by the Defense Advanced Research Projects Agency (DARPA), created a database of 2500 images for 900 persons of deferent age and gender.
- 2005: The Face Recognition Grand Challenge (FRGC) was created to promote and improve face Generally, all face detection system uses dataset of images for testing, evaluating and comparing the system accuracy is verifying or identify individuals is shown in table 1 [4].
- 2011: using deep learning and machine learning techniques that depend on artificial neural networks, enables the system to select a point for a comparison in large databases. • 2014: The Facebook’s internal algorithm, Deep face, it allows to identify faces. According to the social network, the process comes close to matching the output of the human eye in approximately 98% of images.
- 2017: Apple launched a facial recognition technology in it's updates, and its use has expanded to retail and banking. • 2017: Selfie Pay is facial recognition system for online transactions developed by MasterCard.
- In 2018, Chinese police use a smart monitoring the system focused on live facial recognition to arrest a suspect of "economic crime" at a concert where his face was recognized in a crowd of 60,000 people after being identified in a national database.
- From 2019, People who want to purchase a new phone in China will now agree to have their faces scanned by theoperator

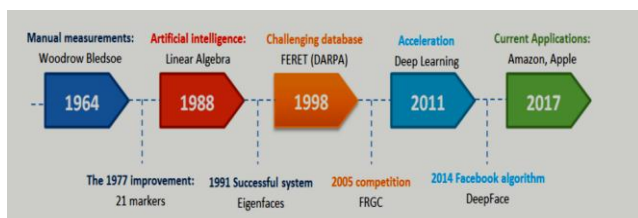
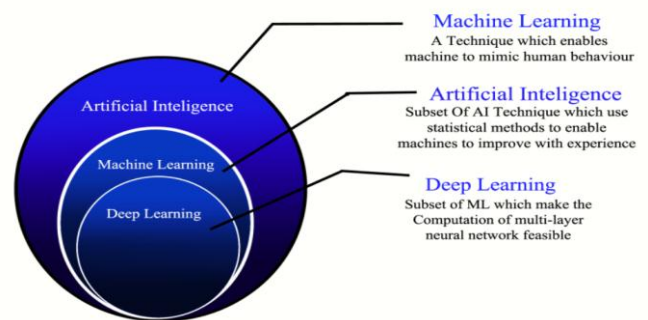


Figure 1. Primary stages in the history of face recognition

TABLE I. FACE DETECTION DATASETS

no	Dataset Name	Sample
1.	ORL Dataset	
2.	FERET Dataset	
3.	AR Dataset	
4.	XM2VTS Dataset	
5.	BANCA dataset	
6.	FRGC dataset	

The identification of face masks may well be a difficult task for the existing proposed face detector models. As all normal face detections systems, face-mask detection system depends on evaluating and comparing the Face detected with in datasets for finding the face so determining whether the person wear a mask or not. the data utilized in mask detection model consists of categories: (1) without a face masks (2) with face-Mask, as shown in table 2.



3. CONVENTIONAL NEURAL NETWORK

Convolutional Neural Network (CNN) is a Deep Learning algorithm that have the ability of assigning biases and weights to different objects in an Image and on basis of the same it can differentiate one image from another. It consists of processing different layers of Image Deep Learning (DL) is basically a subpart of Machine Learning (ML) model which involves algorithms that concerned with algorithms inspired by the structure and function of the brain and use multilayer neural networks called ANN.

4. ARDUINO

Arduino is a open-source platform used for making electronics project. Arduino consists of both a physical the programmable circuit card and a chunk of software or Integrated Development Environment that runs on your computer are accustomed write and upload code to the physical board.

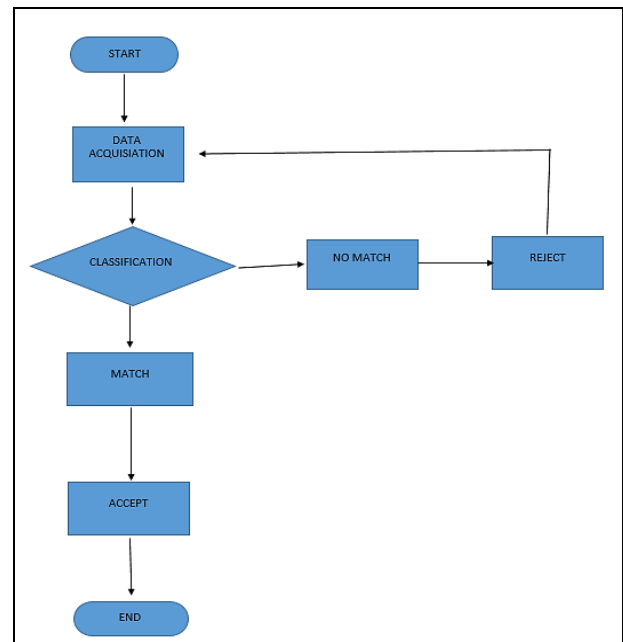
The Arduino platform has become quite popular people just starting out with electronics, and permanently reason. Unlike most previous programmable circuit boards, the Arduino doesn't need a separate piece of hardware so as to load new code on the board you'll be able to simply use a USB cable. The Arduino IDE uses a simplified version of C++ making it easier to be told to program. Finally Arduino provides a regular form factor that breaks out the functions of the microcontroller into a more accessible package.

The proposed method has been designed in Python which is connected by a USB to an Arduino microcontroller. It requires to possess PySerial software, which may be a Python API module uses for reading and writing serial data from Arduino or the other Microcontroller. It encapsulates the access for the interface and provides backend for Python running on Windows, OSX, Linux, BSD and Iron Python. The module named "serial" automatically selects the acceptable backend [17, 18, 19]. PySerial has many features such as:

- Same class-based interface on all supported platforms
- It Access to the port settings through Python properties in a System
- Support for various byte sizes, stop bits, parity, and flow control with RTS/CTS and/or Xon/Xoff
- Working with or without receiving timeout
- File like API with "read" and "write"

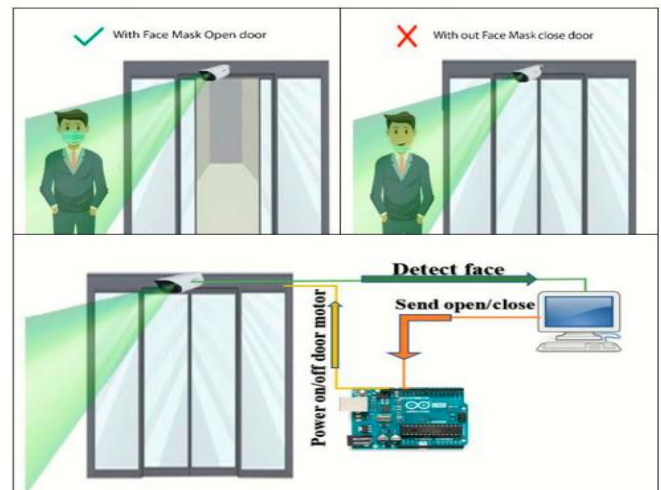
5. METHODOLOGY

Face detectors can guess where facial characteristics like the mouth, jawline, eyes, nose, and eyebrows are located. The detector aids in distinguishing the target region (TG) The TG is taken from facial pictures. The features are labeled. The model uses several phases that the following description:



Step 1. Face Acquisition

: - Face acquisition is the method that capturing impulses indicating gauge actual physical circumstances and transforming the resulting samples into digital numeric values that a system can manipulate. Data systems, also known as DAS, DAQ, or DAU, typically transform analogue waveforms into digital values for processing. The following are some of the elements of data acquisition systems:



Step 2. Classification

: - The Arduino board now accepts the signal from the sensor and checks to see if the given criteria are true or false. As a further step, this Arduino transmits a signal to a different sensor.

Step 3. Match OR Not Match

: -The Arduino will decide whether or not it is permissible once the classification has been completed.

Step 4. Accept OR Reject

: - In this phase, if the person is wearing a mask, access will be permitted; if not, protocol will prevent that person from entering.

Step 5. Future Scope

:- Recently, the wearing of face masks in public places has been made legal in more than fifty nations throughout the world, just as it is in supermarkets, public transportation, offices, and other places. Retailers frequently employ software to track customer traffic into their stores. They might also be interested in measuring the impact of advertisements and digital displays, thus we want to enhance our face mask recognition technology and make it available as an open source project.

The system requirement

These are the software's and hardware's requires to run the system.

1. Software Requirement

- a) Python: 3.4 and newer
- b) PySerial o tensorflow>=1.15.2
- c) keras==2.3.1
- d) imutils==0.5.3
- e) numpy==1.18.2
- f) Opencv-python==4.2.0.*
- g) matplotlib==3.2.1
- h) scipy==1.4.1

2. Hardware Requirement

- a) Camera: ESP 32 CAMERA
- b) Computer o Arduino
- c) Relay
- d) Slide Door
- e) Servo Motor
- f) IR Sensor

6. CONCLUSIONS

To mitigate the spread of pandemic measured must be taken. To train, validate. The performance of the designed method relies on efficiency of the exploited face and face- feature detectors. In the present study wearing glaces had no Negative effect. The use of rigid mask seems preferable because they reduced possibilities of wrong positioning on the face.

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