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SUBSTITUTION OF FRONTLINE WORKERS THROUGH AUTOMATION AND MONITORING SYSTEM BY ANDROID APPLICATION

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ABSTRACT

COVID 19 pandemic is causing a global health epidemic. The biggest and most powerful tool to avoid COVID 19 is wearing a face mask, whenever we go outside or we are at public places. Due to this COVID 19 many governments in the world are forced to implement lockdown to deter virus transmission. According to so many survey reports, we can clearly observe that by wearing a mask at public places will reduce the risk of transmission of COVID 19 significantly. In this project, an IoT-enabled android application based smart gate or barricade that uses a deep learning model for face mask detection is used. The android application consists of other features such as recording details of visitors, verifying identification, recording vaccinations certificate. With the model proposed in this project we can use it in any shopping mall, hotel, apartment entrance, etc. Evaluation of the proposed framework is done by the Face Mask Detection algorithm using the TensorFlow software library. Besides, the ability to record and store details and verify id's provides with security features that are foolproof. With the proposed system we can detect whether a person is wearing a mask or not by enabling the Internet of thing technology (IOT). In response to the ongoing COVID-19 pandemic, we present a robust deep learning pipeline that is capable of identifying correct and incorrect mask-wearing from real-time video streams. To accomplish this goal, we build a face mask detection model using transfer learning and embed the model with Arduino. CNN for detecting masks in the human face is constructed using sample datasets and MobileNetV2 which acts as an object detector in our case the object is mask. The technologies we use are OpenCV, TensorFlow, Neural Networks, IoT, Android Studio etc. So, with this face mask detection, as a part to stop the spread of the virus, we ensure that with this smart door we can prevent the virus from spreading and can regain our happy life.

Keywords: Deep Learning, Arduino, Opencv, Neural Networks, Android Studio.

I. INTRODUCTION

In 2020-2021, the largest pandemic in recent history spread through the world: COVID-19. As of September 16th, 2021, there have already been 226,236,577 cases and 4,654,548 deaths around the world. In many regions, those numbers are considerably under-counted. Beyond that, many parts of the world have slowed or stopped due to the human, economic, and social impacts of distancing and protection measures. A few nations around the globe have utilized face masks obligatory out in the open to help control the spread of COVID-19, the sickness brought about by the novel coronavirus. Physical separating is troublesome, for example, on open vehicle, in shops or other shut settings. So, we thought bringing an android application into availability, that can be used by various frontline workers such as watchmen, who can not only use the app to store, record details of visitors, but can also verify the vaccination certificate and detect face mask. Ultimately, when all the criteria is satisfied, the app lifts the barricade to let the person in. So, we are implementing this face mask detection using OpenCV – OpenCV is a library of programming functions mainly aimed at real-time computer vision, used to acquire images from web cam or other camera, in the case of app through mobile camera modules. MTCNN – Multi-task Cascade Convolutional Neural Network, used to detect a human face in an image and also used to localize the face in that image.

II. BLOCK DIAGRAM

The subsequent block diagram illustrates the internal working and components of the application. It describes application integration and process flow. The subsequent block diagram is used to represent the Deep Learning Model that is used for face mask detection.

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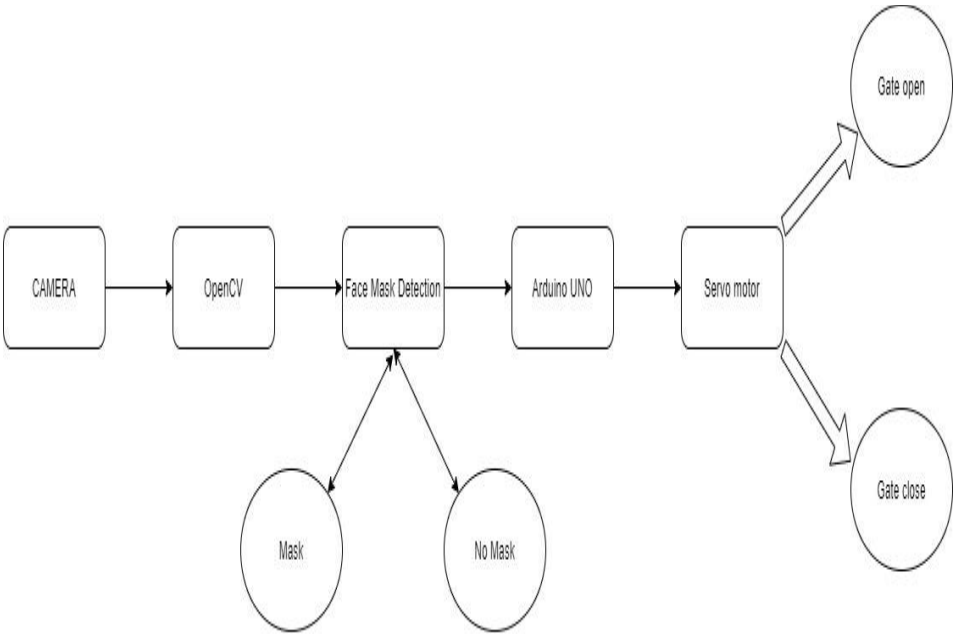

Figure 1: Flow of the process

III. HARDWARE COMPONENTS

The project uses an Arduino UNO connected with a servo motor that acts as an actuator for gate. The camera used for face mask detection is the inbuilt smartphone camera.

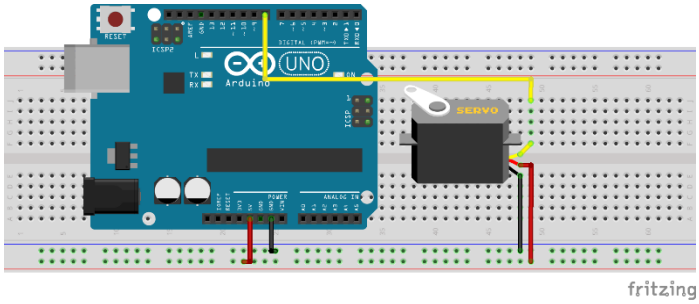

Figure 2: Arduino and Servo motor

IV. WORKING AND GRAPHICAL REPRESENTATION

Initially, upon the starting of application, the following home screen is displayed.

Figure 3: Opening Screen

The user can record the name, ID and other details of the visitor. The recorded details are sent to a secure database.

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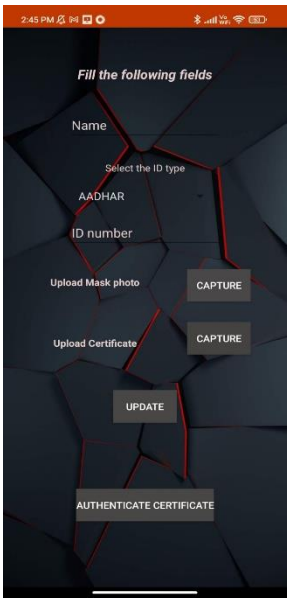

Figure 4: Information Screen

The verify certificate button takes the user to a government API that is specifically used to verify the authenticity of a vaccine certificate. The QR code on the vaccination certificate is scanned and the API checks the government database to determine it's correctness.

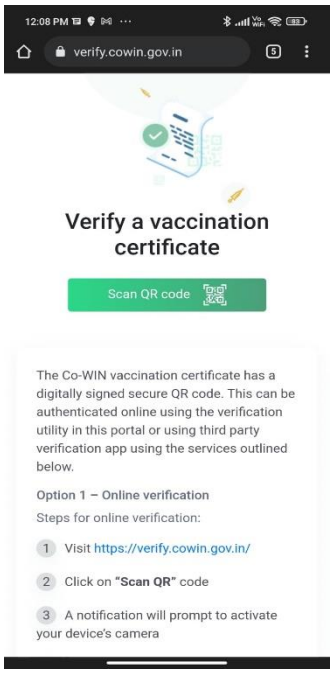

Figure 5: Information Screen

Upon fulfillment of required criteria and details, a success message is displayed and the user can proceed to scan the face of the visitor in order to detect the face mask and let him through the gate.

The process for mask detection-

1) Image dataset collection: Data collection is the systematic process of obtaining and measuring information on variables of interest in order to answer research questions, test hypotheses, and evaluate outcomes. Here we collected the data from Kaggle.inc. Our dataset consists of 12,000 images. The dataset is unsorted & all the images of persons with masks and persons without masks are mixed together.

2) Image dataset sorting: Since the images are mixed together, we need to sort the images into two separate folders 'with mask' and 'without mask'. The process of separating the images can be automated using OS library

in python. We need not manually do this. Based on image file name, the methods of OS library sort images into separate folder. The OS library manipulates the file path.

3) Model creation for mask detection:

i. Data preprocessing: Initially, we performed a one hot encoding on the labels of our dataset's photos. The representation of categorical variables as binary vectors is known as one-hot encoding. First, the categorical values are converted to integers. Each integer value is then represented as an all-zero binary vector. This basically entails learning one regressor or binary classifier per class throughout learning time. To do so, multi-class labels must be converted to binary labels (belong or does not belong to the class). The transform method in Label Binarizer makes this operation simple.

ii. Train test split: The train-test split procedure is used to estimate the performance of machine learning algorithms when they are used to make predictions on data not used to train the model. It's a quick and simple technique that allows you to compare the performance of different machine learning algorithms for your predictive modelling problem. Although the process is straightforward to use and interpret, there are occasions when it should not be utilised, such as when you have a tiny dataset or when further configuration is required, such as when it is used for classification and the dataset is not balanced. In our dataset, we divided the photos into twenty percent test sizes. This is the most important stage in calculating model correctness.

iii. Data Augmentation: Data Augmentation is a technique that we'll utilise to generate a variety of visuals from our data source. Data augmentation involves applying alternative changes to the data set's original images, resulting in many copies of the same image. However, depending on the augmentation techniques you use, such as shifting, rotating, and flipping, each copy is unique in some ways. Applying these minor changes to the original photograph does not modify its target class; rather, it provides a fresh viewpoint on capturing the object in real life. As a result, we frequently employ it in the development of deep learning models.

iv. Tensorflow Lite (TFLite): TFlite is a file format which can be used in Android processing of any machine learning model. The TFLite is converter is available in form of Python API. The .h5 format file is generated after model making. Then it is converted to tflite.

v. MLKit: ML kit is a platform provided by Tensorflow and Google. It can be used as replacement of OpenCV to work on mobile phones. Firstly, we inject the Tflite model to android assets folder. Then the transformation of data is done. In background, the inference will be run. Finally, the output will be interpreted based on tensors in labelled values.

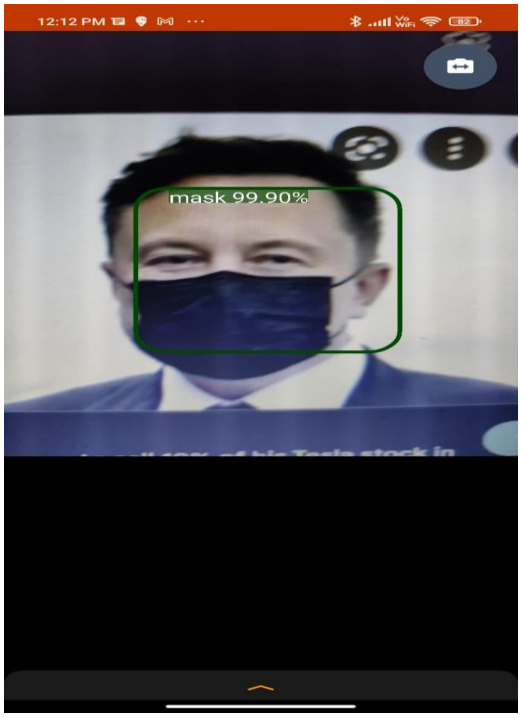

Figure 6: Mask detection screen

V. CONCLUSION

We, as a part of our country and through the responsibility we have, came up with the idea of smart android application with gate/face mask detection and have successfully implemented it to stop the spread of COVID19 and enhance security. We have successfully developed interactive mask detection model which is showing accurate results. Our mask detection model when tested against the samples that we have used for training has shown high accuracy. We can ensure that even when we use this model in real-time environment, we can get good accuracy. If most of the people use this application at their shops, homes, airports, malls and in different industries, people who are not wearing masks will automatically recognized and will not be allowed inside. So, the usage of masks will become mandatory which will help preventing the spread of the virus. The future scope of our project is embedding the contactless human body temperature sensor and automatic hand sanitizer. Addition of these two makes the Robot superior.

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