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Face Mask Detection Using KNN Algorithm

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Abstract: *The COVID-19 pandemic has led to a sudden loss of human life worldwide and presents an uncommon challenge to public health, food systems and also the world of work. Declared by the World Health Organization(WHO), this coronavirus arises from Wuhan city, China in late December 2019. Upon thorough analysis, the virus has been ascertained as infectious and transferred by air or by coming in close contact with an infected person. To avoid the expansion of this virus, several measures are suggested, like maintaining a social distance, that is, maintaining a correct physical distance between people and reducing close contact with one another, and wearing a face mask to avoid the droplets from sending through the wind. Therefore, this research paper focuses its study regarding implementing a Face Mask Detection System. These systems can produce object detection and facial recognition within the video footage of a particular area. Relatable models like the OpenCV, Image preprocessing and KNN(K-Nearest neighbor) algorithms are used. A person whose face without face-masks was detected. The including results board is shown in the output holding the number of people violating or non-violating the respective actions. When implementing and establishing the models, this research project achieved a confidence score of 100 percent. Therefore, this research project concludes with the demonstration that wearing face masks helps to decrease the enlargement of the virus and so builds a model to assist detect these actions.*

Keywords: World Health Organization(WHO), KNN(K-Nearest neighbor), Opencv, Image Preprocessing, Face Recognition Etc

I. INTRODUCTION

According to the researchers, this virus will increase whereas coming in immediate contact with the one who is infected. Thus, like all the other infectious breathing diseases, researchers recommended close contact be withdrawn under any and all circumstances because the risk of the virus sending through air and droplets is quite likely to take place. Therefore, to overcome the spread of coronavirus, researchers have come up with a new social norm, Social Distancing and wearing a face mask. In this given COVID-19 condition wearing an antiseptic mask is very necessary. In order to avoid the growth of CORONA virus everyone must wear a mask throughout the pandemic. Possible points of interest of the use of masks lie reducing the risk from a harmful individual while the "pre-symptomatic" period and slander of discrete persons putting on masks to moderate the spread of virus. Therefore, face mask detection has become an important task for day to day life in society. COVID-19 could be disease that spreads from human to human which might be controlled by assuring proper use of a facial mask. The growth of COVID-19 can be restricted if people follow social distancing and use a facial mask. In many cases, people don't seem to be carrying out these protocols properly, which is increasing the spread of the COVID-19. Discovering the people not carrying out the rules and notifying the related authorities can be a solution in reducing the spread of coronavirus. In these tough times of COVID-19 it's needed to build a model that detects people with mask or without masks in real-time because it works as an easy precautionary measure to prevent the spread of virus. When colleges or schools reopen after pandemic coronavirus shouldn't be spread in students and people because of not wearing masks, we develop this system for detecting whether or not masks are present. Face mask detection involves detecting the location of the face in the real world and then determining whether it has a mask on that or not and informing to keep in touch. This system is based on Machine Learning (ML) packages like TensorFlow, Keras, OpenCV. This machine learning technique helps in simplifying the work of management and saving peoples lives.

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II. LITERATURE REVIEW

Topic: The Face Mask Detection Technology for Image Analysis in the Covid-19 Surveillance System
Author: G K Jakir Hussain , R Priya , S Rajarajeswari , P Prasanth , N Niyazuddeen
The proposed system to classify mask detection exploitation COVID-19 precaution both in pictures and footage using convolution neural network. thorough experimentation on the datasets and therefore the performance evaluation of the proposed methods are exhibited. The input face mask detection system is associated video obtained and also the final conclusion is an identification or detection of the mask of detected video database. From these problems, mitosis detection is an important feature in detecting the level of face progression. Face mask detection refers to identifying whether a person is wearing a mask or not. In fact, the problem is reverse engineering of face detection where the face is detected by exploiting different machine learning algorithms for the aim of security, authentication and management.

Topic: COVID-19 Face Mask Detection
Author: Parul Maurya , Sejal Nayak , Samarth Vijayvargiya , Megha Patidar
The proposed model is integrated with computers or laptop cameras permitting it to sort people that are wearing masks and not wearing masks. A system that restricts the expansion of COVID-19 by sorting out people who are not wearing any facial mask in a smart city network where all the public places are monitored with Closed Circuit Television (CCTV) cameras. Firstly, CCTV cameras capture real-time video footage of different public places in the city. From that video footage of various public places within the office, facial images are extracted and these pictures are used to determine the mask on the face. The Face Mask Detection System is often used at office premises to find if staff are maintaining safety standards at work. It monitors staff without masks and sends them a reminder to wear a mask.

Topic: Face Mask detection
Author: R Suganya , S. Arthi , S Kowshika , V Dhivya Lakshmi
The COVID-19 pandemic is causing a worldwide wellbeing emergency so the powerful assurance strategies are wearing a face cover in open territories as per the World Health Organization (WHO). The COVID-19 pandemic strained governments across the world to force lockdowns to forestall infection transmissions. Reports show that carrying face covers whereas at work remarkably decreases the danger of transmission. The planned methodology is least complex and it does not demand segmentation. Although other social distancing and sanitization issues have been discussed in the past, face mask identification has yet to be properly addressed. Wearing a mask during the whole pandemic is a crucial preventive measure, and it is particularly important in times when maintaining social distance is difficult. A mask is required for everyone who is at risk of severe illness from COVID-19 diseases, particularly those who are at higher risk. As a result, lowering the chance of transmission of this deadly virus from an infected person to a healthy individual can greatly reduce the spread of the virus and also the prevalence of the infection.

Topic: A facemask detector using machine learning and image processing techniques.
Author: Amrit Kumar Bhadani , Anurag Sinha
Generally, most of the projects specialize in face construction identity recognition when wearing masks. During these projects, the focus is on recognizing the people that wearing masks, or not help in decreasing the transmission and spreading of covid-19. The scientist has proven that wearing a mask helps in minimizing the spreading rate of Covid-19. The proposed system could also be vital to find travelers at airports. there's no mask. The traveler's data is often captured as a video within the system at the doorway. Any passenger who finds no mask will alert the airport authorities in order that they can act quickly. The rapid worldwide spread of Coronavirus Disease 2019 (COVID-19) has shown in a global pandemic. Correct facemask wearing is efficacious for infectious disease control, however the effectiveness of facemasks has been diminished, mostly due to improper wearing. However, there haven't been any published reports on the automated identification of facemask-wearing conditions.

III. METHODOLOGY

We proposed an automated system for screening persons who are not using a face mask on the particular area. In that area, all places are monitored by CCTV cameras. The cameras are used to capture images; then these images are fed into a system

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that identifies if any person without a face mask appears in the image. If any person without a face mask is detected then compare our database and send an alert message with the automatically generated fine and also send these records to the authorized person.

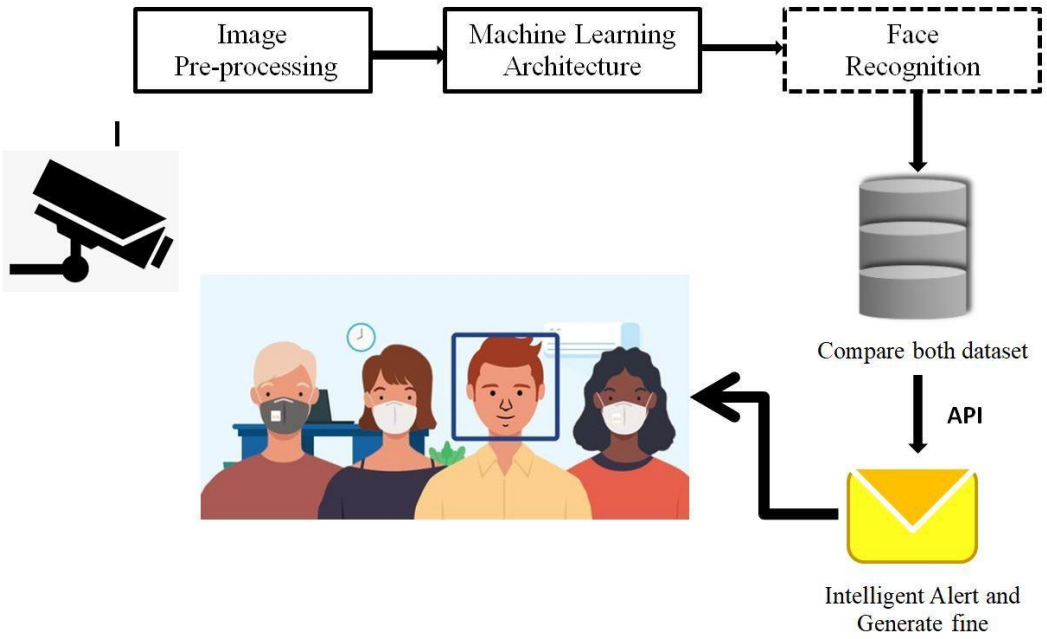

Fig 1 Methodology of Face Mask Detection

Image Preprocessing

Image preprocessing is required before going to the next step after grabbing images by the CCTV cameras. The aim of this preprocessing is to improve the quality of the image so that we can analyze it in a better way. By preprocessing we will be able to suppress undesired distortions and enhance some features which are required for the application we are working for. Within the preprocessing step, the image is converted into a grayscale image because the result of the RGB color image contains most unessential information that's not necessary for face mask detection. Normalization improves the learning algorithm to learn faster and understand required features from the images.

Machine Learning

The machine learning architecture determines different important nonlinear features from the identified samples. Working in machine learning architecture, we accumulate images from CCTV cameras which are captured from various areas where we can implement the system. It uses machine learning technology to detect, collect, store, and evaluate face characteristics so that they'll be matched to photos of people in a database. Then, this learned architecture is used to predict output. The architecture of this learning technique highly depends on KNN and CNN algorithms. All the outlooks of deep learning architecture are described below.

i) Dataset Collection:

Data from two different sources are collected for our model. We want to apply this system for our college campus so we collected images for dataset1 from students and staff and dataset2 is CCTV footage and the system captures images from it another dataset for training our system that is divided into two types one is with mask and another is without mask.

ii) Mask Detection:

When someone enters the CCTV coverage area then the system continuously scans faces of persons. For mask detection we apply KNN algorithm before image preprocessing is done. KNN algorithm uses neighborhood classification as the

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predictive value of a good instance value. The image preprocessing image pixels divided into the arrays then with mask or without mask dataset we have that images compare with that one by one till the all over data does not match.

ii) Face Recognition:

The System reads facial features. Key factors that play a role in the detection process can different from each other based on what mapping technique the database and algorithm use. Commonly, those are either vectors or points of interests, which map a face based on pointers (one – dimensional arrays) or based on a person's rare facial features respectively. 2D and 3D images are used for this process. The learning algorithm verifies faces by encoding it into a facial signature (a formula, strain of numbers, etc.) and correlating it with our two databases. To improve the accuracy of a match sequence of images rather than a single image are sent.

Intelligent Alert

If not wearing faces is a match to data in the system, then the system generates a fine and sends the text message to the save data (mobile number and Email) of the particular person also this record sends to the admin mail through the gateway.

IV. MODELLING AND ANALYSIS

Model for when colleges reopen after pandemic coronavirus should not be spread in students because of not wearing masks for this so we develop this system for college campuses. We use this system in college campuses so we need to enter the data like images of a person, mobile number of particular people there are students, teachers and all members in a college campus.

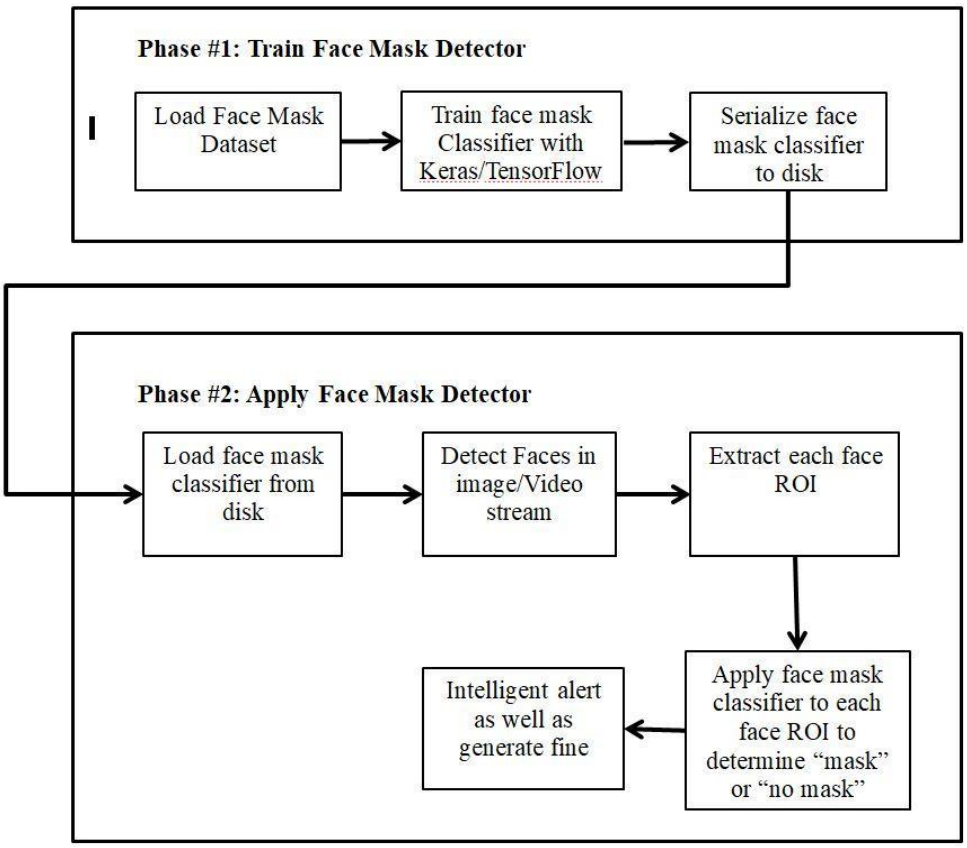

Fig 2. Model Structure of System

It needs to record a live video for detecting who is wearing a mask or who is not. So set CCTV in the campus area. CCTV cameras are used to capture real-time video footage of various campus areas in the college. From that video footage, facial

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images are captured and these images are used to identify the mask on the face using KNN algorithm. System deals with image and video data using OpenCV machine learning software library. When live CCTV video is turned on, a video system captures an image and performs different operations on it. Firstly, captured images go to the image preprocessing step then learning algorithm KNN is used for feature extraction from the images then these features are learned by multiple hidden layers. It transforms abstract data to meaningful representations using knowledge communication and insight discovery through encoding the captured image compared with the training dataset that is face with mask or without mask. When the system detects someone not wearing a mask then it matches the image with the save database using CNN algorithm and that person recognition records (name of the person and time) send via email to the admin(authority or management) and then generates a fine on that person then sends an alert in the form of a text message on number as well as send email to that person. The output record data can be centralized and used by authorized persons. Sometimes in the college campus some guest is visiting and they are not wearing a mask and it does not match with the system database then it shows an unknown person detected without a mask then the system informs the admin and admin conveys to the security guards to request him/her to wear a mask.

V. RESULTS

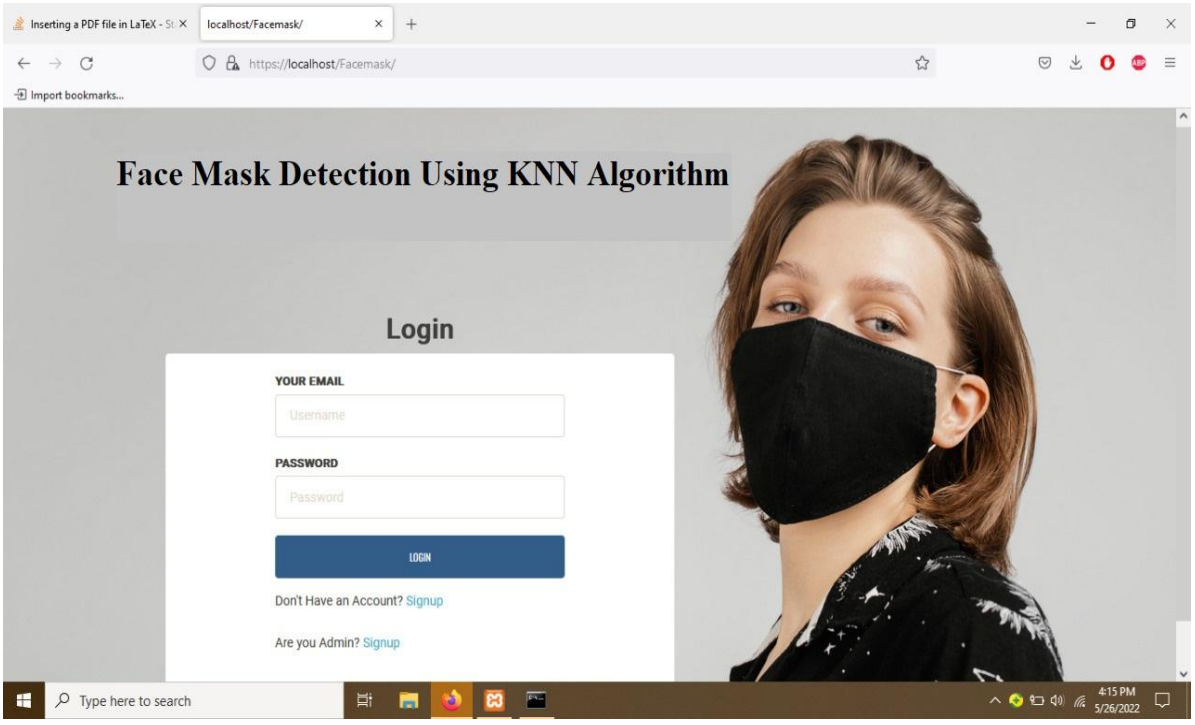

Fig 3. Login Page

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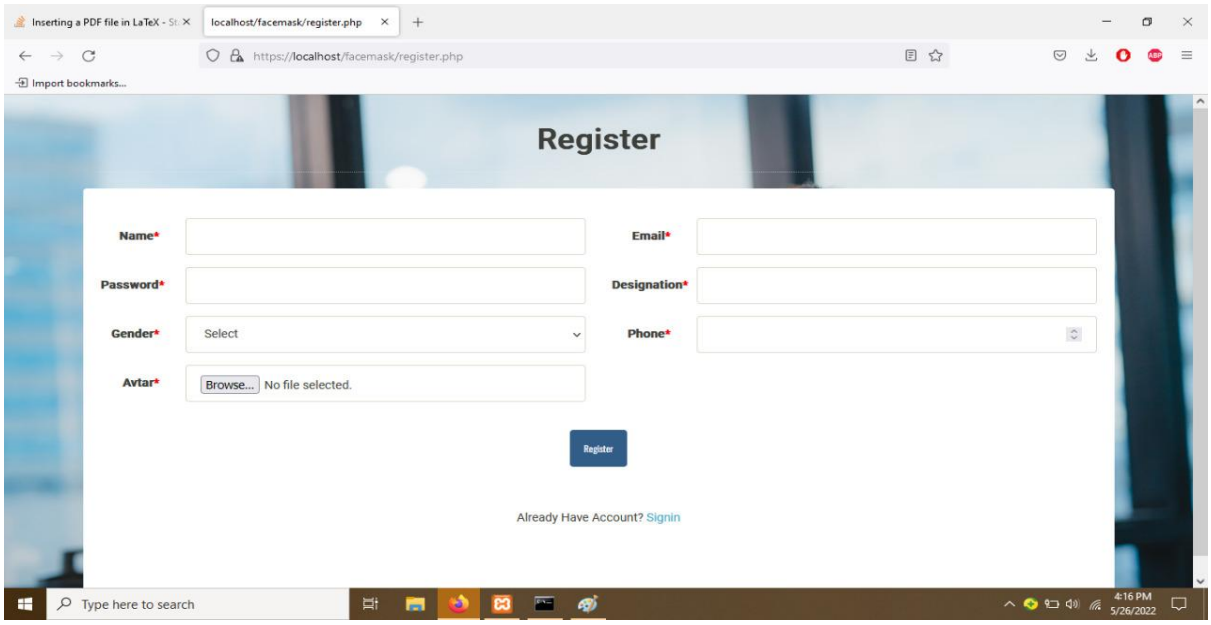

Fig 4. User Registration Page

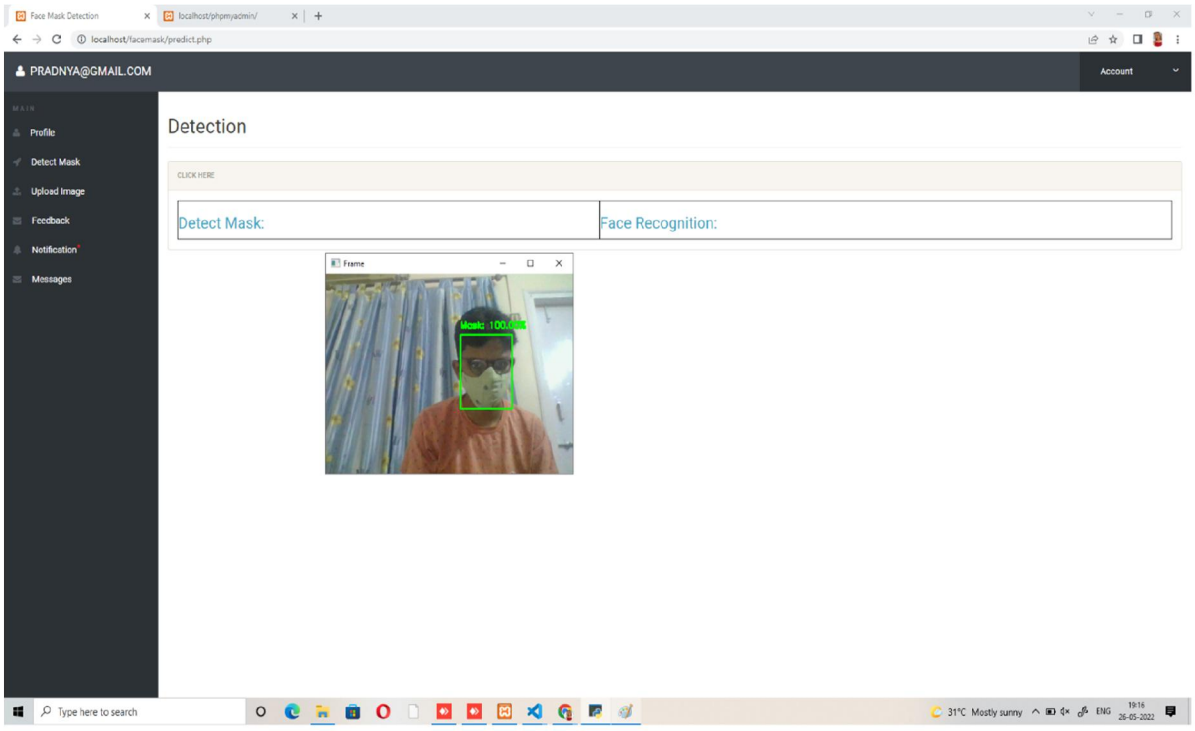

Fig 5. Face With Mask detected

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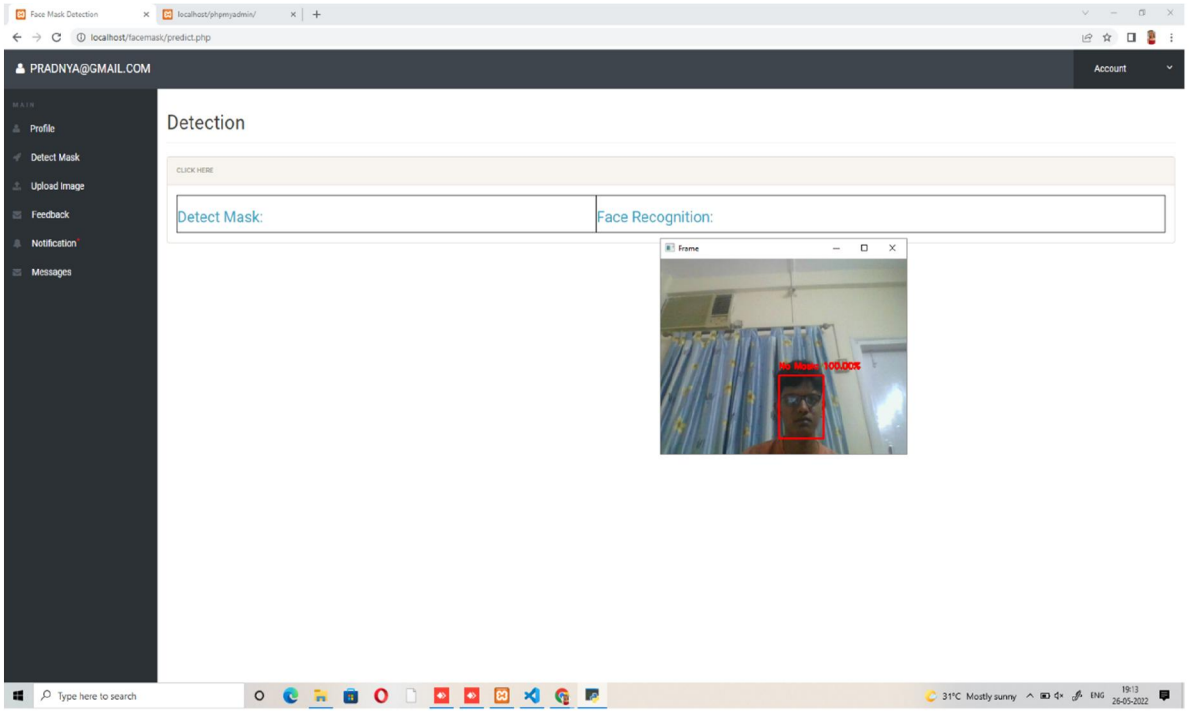

Fig 6. Face Without Mask Detected

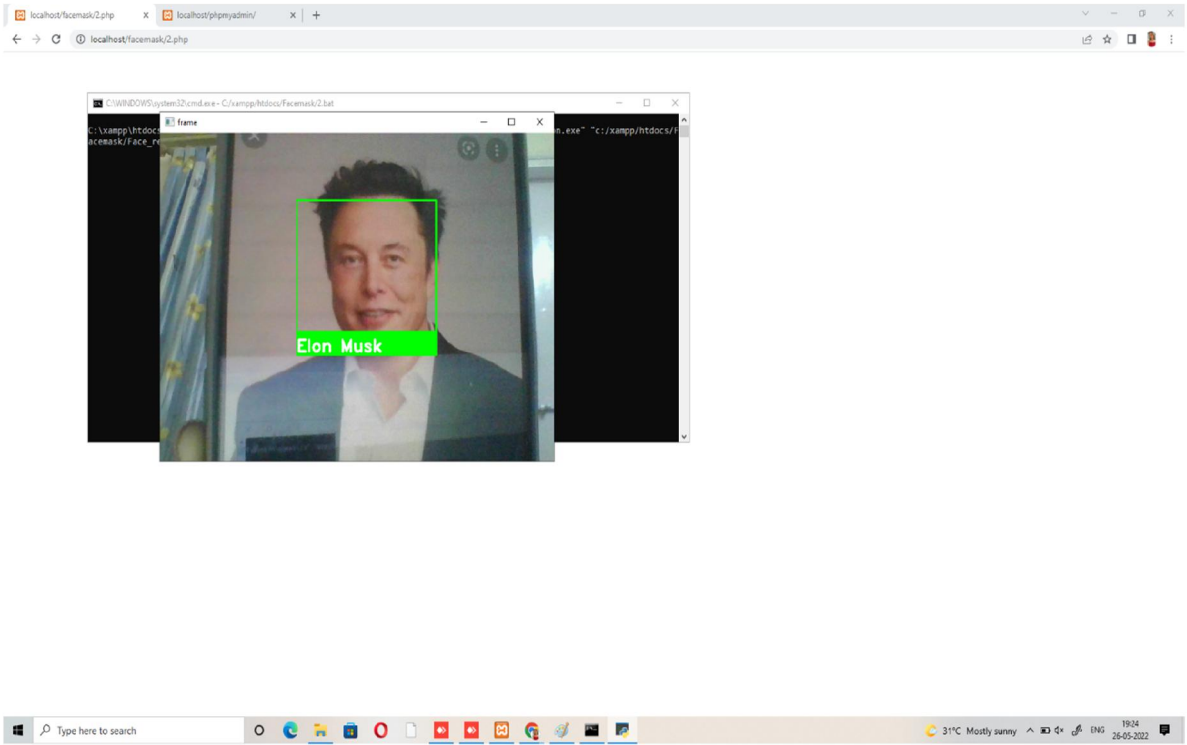

Fig 7. Face Recognize

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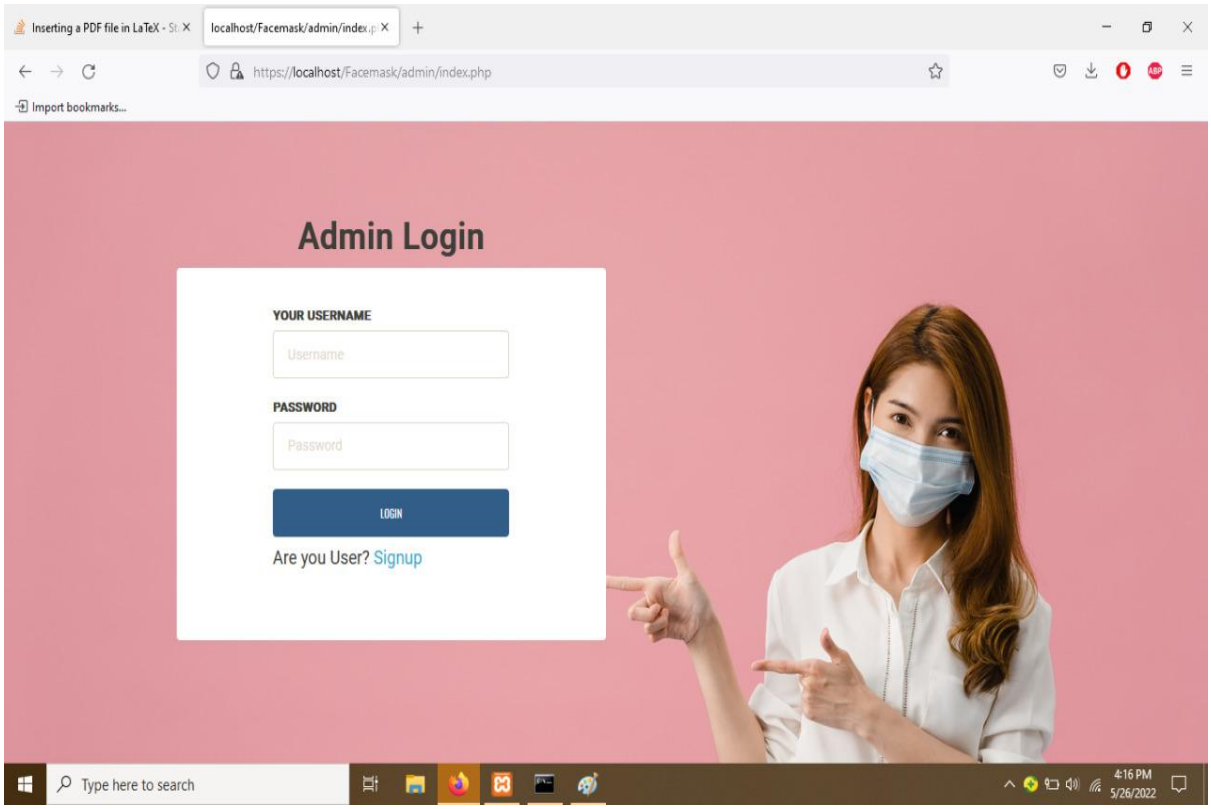

Fig 8. Admin Login Page

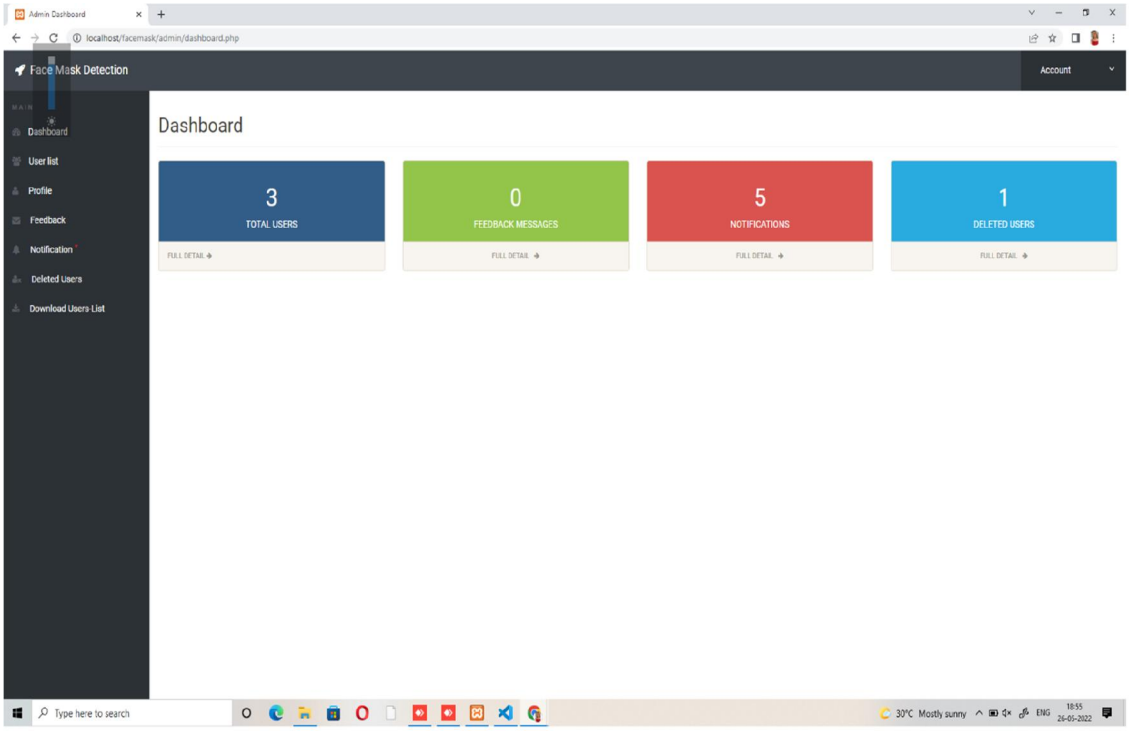

Fig 9. Admin Dashboard

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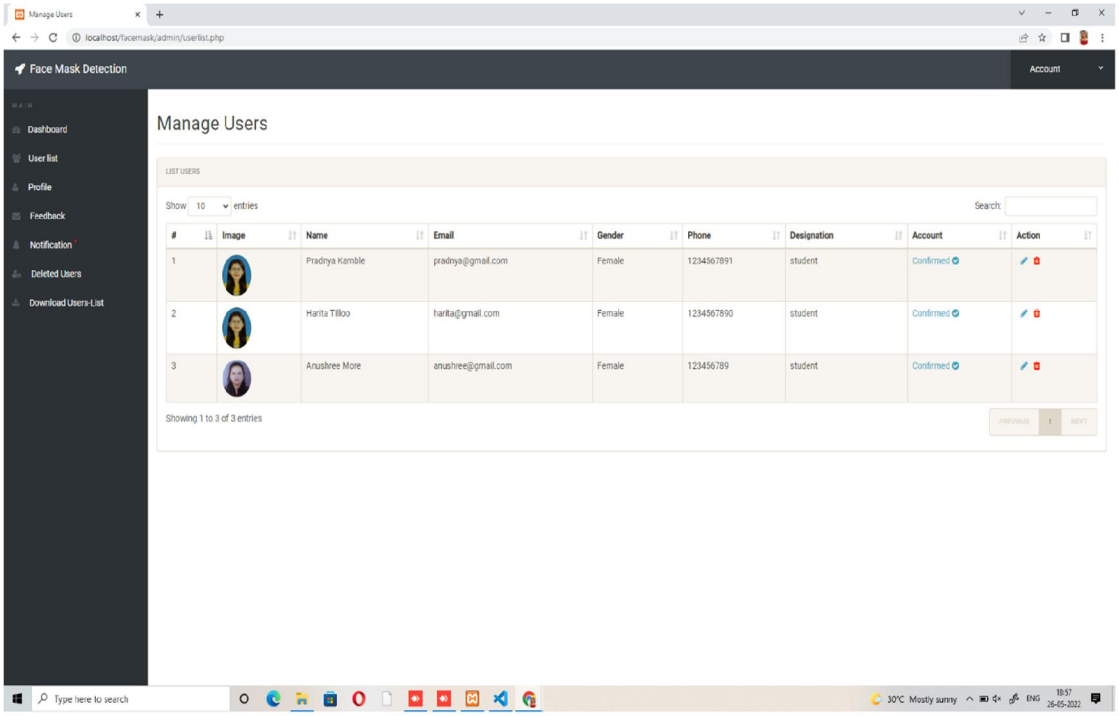

Fig 10. User List in Admin Login

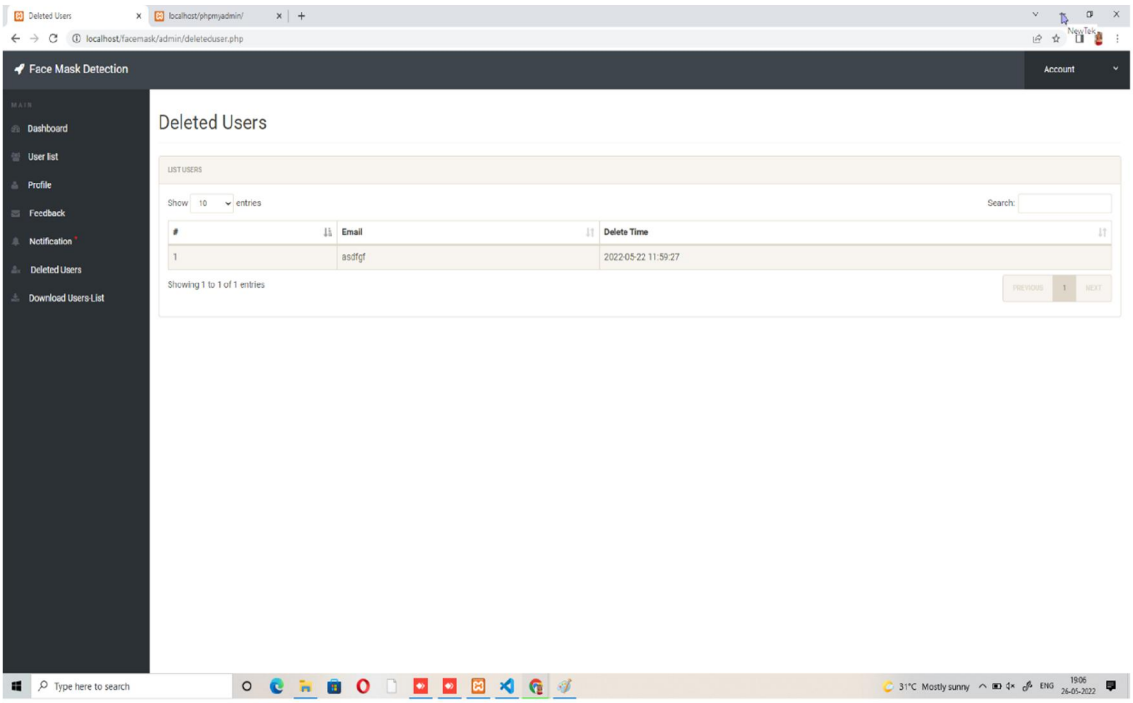

Fig 11. Delete user from Admin Login

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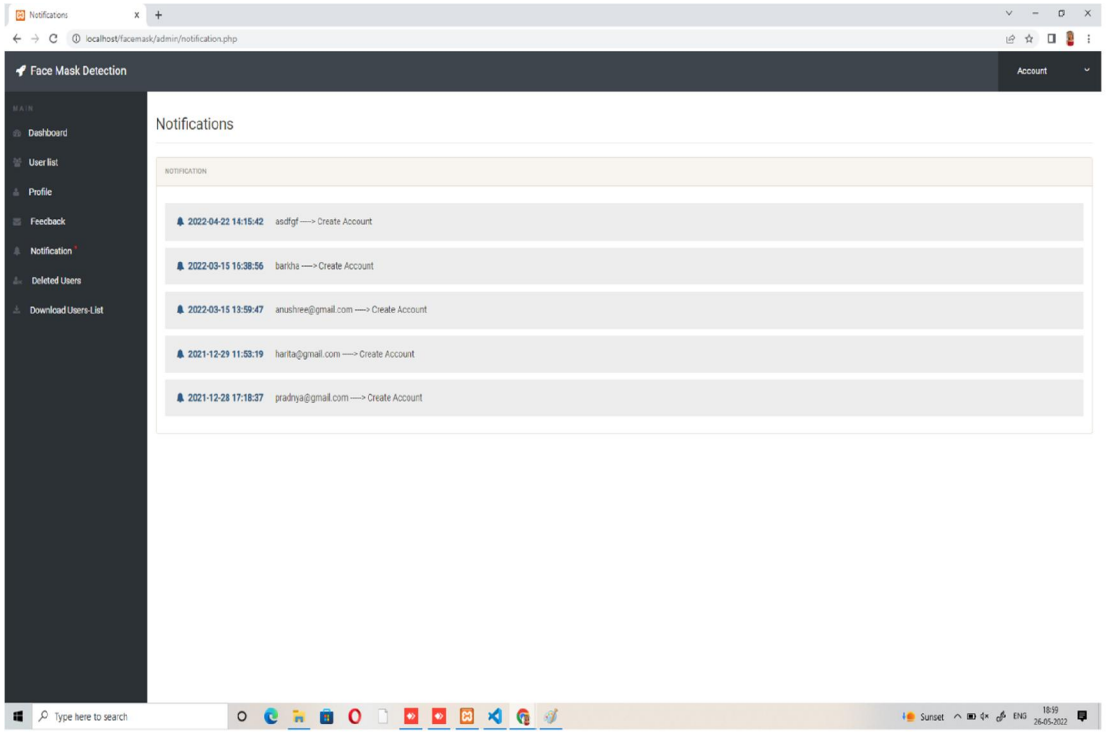

Fig 12. Notifications of Admin Login

VI. CONCLUSION

As the technology is growing with new trends, we've a novel face mask detector which might contribute to the general public health care department. People whose faces without face-masks were detected. Generally the results board is shown in the output containing the number of people violating or non-violating the respective protocols. Our face mask detection is trained on KNN models and we use machine learning software libraries like OpenCV, Tensor Flow, Keras and for business logic use python to detect whether or not a person is wearing a mask. After that which is found without a mask for their detection we use CNN Algorithm. The accuracy of the model may be accomplished and therefore the optimization of the model is a continuous process. This brings us to a conclusion that if this practice is followed accurately and with care efficiency. Therefore, this research project concludes with the proven fact that wearing face masks helps reduce the increase of the virus and thus raises a model to help detect these measures.

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