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Real-Time Face Mask Detection

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Abstract: *After the breakout of the worldwide pandemic COVID-19, there arises a severe need of protection mechanisms, face mask being the primary one. According to the World Health Organization, the corona virus COVID-19 pandemic is causing a global health epidemic, and the most successful safety measure is wearing a face mask in public places. Convolutional Neural Networks (CNNs) have developed themselves as a dominant class of image recognition models. The aim of this project is to use machine learning capabilities for detecting and recognize face masks worn by people in any given video or picture or in real time. This project develops a real-time, GUI-based automatic Face detection and recognition system. It can be used as an entry management device by registering an organization's employees or students with their faces, and then recognizing individuals when they approach or leave the premises by recording their photographs with faces. The proposed methodology makes uses of Principal Component Analysis (PCA), Face Net, LBPH Face detection Algorithm and HAAR Cascade Algorithm. Based on the performance and accuracy of our model, the result of the binary classifier will be indicated showing a green rectangle superimposed around the section of the face indicating that the person at the camera is wearing a mask, or a red rectangle indicating that the person on camera is not wearing a mask along with face identification of the person. Once the Algorithm Identified the face it will send a text message to the recognized person to wear a mask and save the record.*

Keywords: HAAR Cascade, Neural networks, LBPH Algorithm.

I. INTRODUCTION

Face Recognition is a technique that matches stored models of each human face in a group of people to identify a person based on certain features of that person's face. Face recognition is a natural method of recognizing and authenticating people. Face recognition is an integral part of people's everyday contact and lives. The security and authentication of an individual is critical in every industry or institution. As a result, there is a great deal of interest in automated face recognition using computers or devices for identity verification around the clock and even remotely in today's world. Face recognition has emerged as one of the most difficult and intriguing problems in pattern recognition and image processing. With the aid of such a technology, one can easily detect a person's face by using a dataset of identical matching appearance. The most effective approach for detecting a person's face is to use Python and a Convolutional Neural Network in deep learning. This method is useful in a variety of fields, including the military, defense, schools, colleges, and universities, airlines, banks, online web apps, gaming, and so on. Face masks are now widely used as part of standard virus- prevention measures, especially during the Covid-19 virus outbreak. Many individuals or organizations must be able to distinguish whether people are wearing face masks in a given location or time. This data's requirements should be very real-time and automated. The challenging issue which can be mentioned in face detection is inherent diversity in faces such as shape, texture, color, got a beard\moustache and/or glasses and even masks. From the experiments it is clear that proposed CNN and Python algorithm is very efficient and accurate in determining the facial recognition and detection of individuals.

II. LITERATURE SURVEY

The face mask detection model is very useful for public places like hospitals, airports, offices where a huge number of people travel from one place to another. In hospitals, we can embed this model in pre-installed CCTV cameras. If the workers of the hospitals are found without mask alarm will ring and the higher authorities of the hospital can take

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necessary actions against the worker. In airports, the entrance and exit gate of the airport should have this model. The System is prepared to recognize precisely whether an individual is wearing a mask or not. At the point when the calculation recognizes an individual without a mask, caution ought to be produced to alarm the individuals around or the concerned specialists close by, so fundamental activities can be taken against such violators. Not only for COVID-19 pandemic, any place and at whatever point facemask is commanded to relieve any air-borne illnesses, passage, what's more, leave access frameworks can be incorporated with such innovation to help in diminishing the spread of infection. The cameras are used to capture images from public places; then these images are feed into a system that identifies if any person without face mask appears in the image. If any person without a face mask is detected then this information is sent to the proper authority to take necessary actions. The trained architecture with multiple layers of convolution and max-pooling connected to dense neural network achieved 98.7% accuracy on distinguishing people with and without a facial mask for previously unseen test data. The trained model showed 98.7% accuracy and AUC of 0.985 on the unseen test data.

III. SYSTEM ARCHITECTURE

The overall real-time mask detection and face recognition framework consist of image input or captured, face detection, mask detection, face recognition and attendance record. Figure 1 shows the framework of the system. The system starts with an image captured from the video camera at the entrance. Face image of attendees captured and fed to the system for face detection. Once the face is detected, the system will perform mask detection. If the attendee is not wearing a mask, the system will perform face recognition. Else, the system will print 'No Mask' text on the screen and sends a SMS notification to the person to wear a mask. The face recognition module is conducted by comparing the face captured to the images saved in the face database. Finally, information of recognized person and time captured during detection was recorded and saved to the database. For the face detection task, the image was represented as a Haar-like feature representation. For mask detection, we adopted the custom Haarcascade. The cascade function was trained using positive and negative images. Positive images refer to the face images whereby a facemask occurs. Face without facemask images construct the negative images.

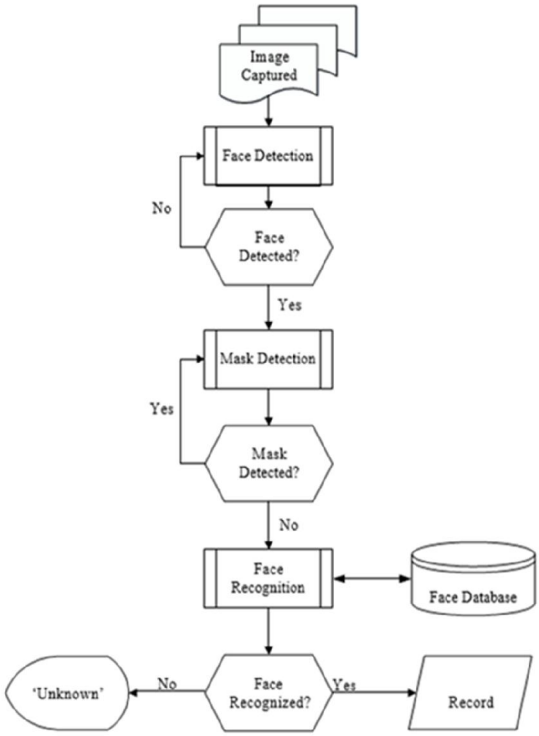

Fig: System Architecture

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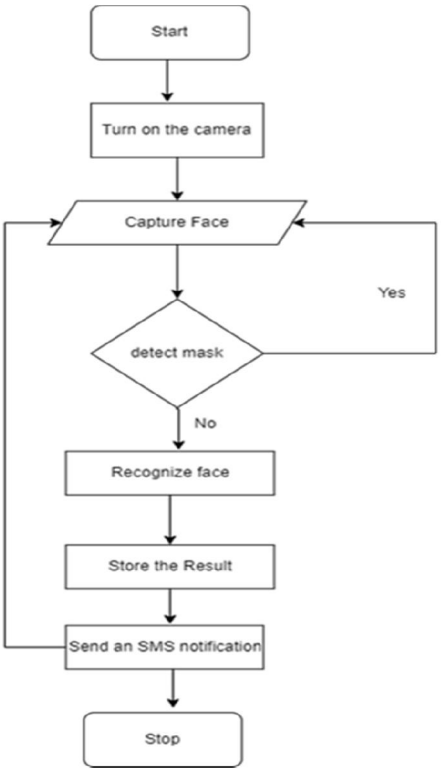
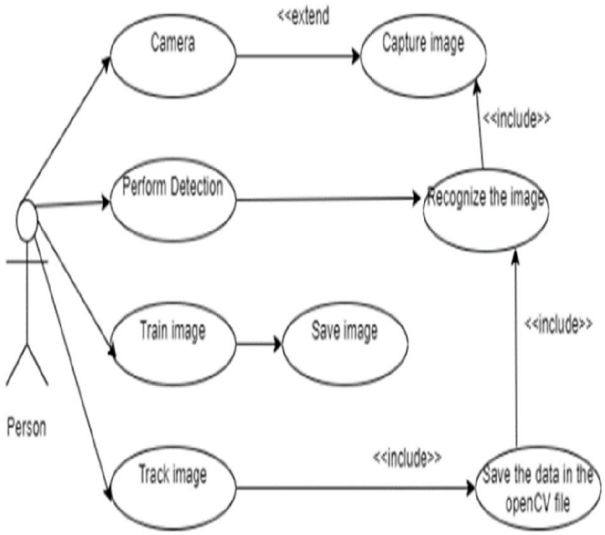
IV. METHODOLOGY

Data Flow Diagram for Face Recognition



Use Case Diagram for Training sets



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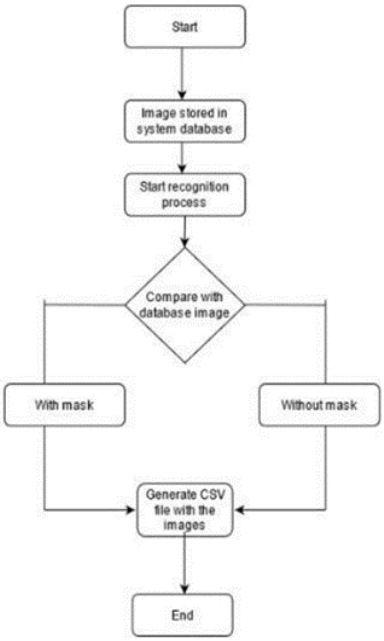
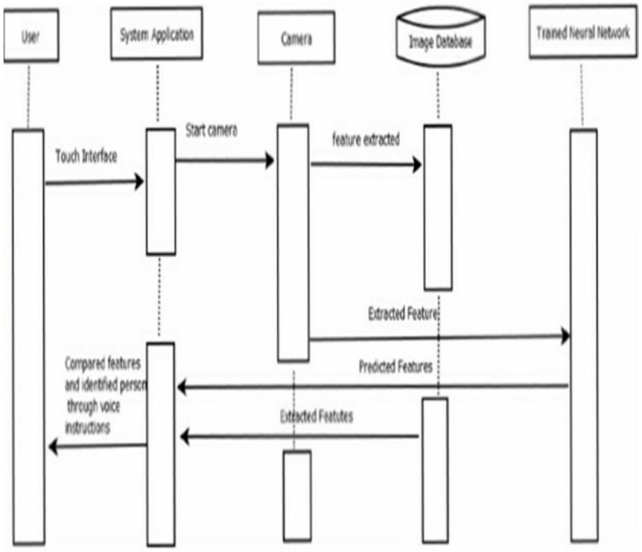
Data Flow Diagram for Face Detection



Sequence Diagram



V. PROPOSED SYSTEM

An Automated System to Limit COVID-19 Using Facial Mask Detection in Smart City Network

COVID-19 pandemic caused by novel coronavirus is continuously spreading until now all over the world. The impact of COVID-19 has been fallen on almost all sectors of development. The healthcare system is going through a crisis. Many precautionary measures have been taken to reduce the spread of this disease where wearing a mask is one of them. In this paper, we propose a system that restrict the growth of COVID-19 by finding 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. While a person without a mask is detected, the corresponding authority is informed through the city network. A deep

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learning architecture is trained on a dataset that consists of images of people with and without masks collected from various sources. The trained architecture achieved 98.7% accuracy on distinguishing people with and without a facial mask for previously unseen test data.

Masked Face Recognition Using Convolutional Neural Network

Recognition from faces is a popular and significant technology in recent years. Face alterations and the presence of different masks make it too much challenging. In the real-world, when a person is uncooperative with the systems such as in video surveillance then masking is further common scenarios. For these masks, current face recognition performance degrades. An abundant number of research work has been performed for recognizing faces under different conditions like changing pose or illumination, degraded images, etc. Still, difficulties created by masks are usually disregarded. The primary concern to this work is about facial masks, and especially to enhance the recognition accuracy of different masked faces.

Automated Face Mask Monitoring System

Automation simplifies Monitoring, and there is no need to have person to monitor whether people are wearing face mask or not. facial recognition technology can accurately detect the person who is not wearing a mask and store the details at what time the person was not wearing a mask.

Face mask detection system is fully automated that tracks the people who are not wearing a face mask and sends a warning message to wear a mask. This solution doesn't require much human intervention and this system can be easily used by non-technical person to check the details.

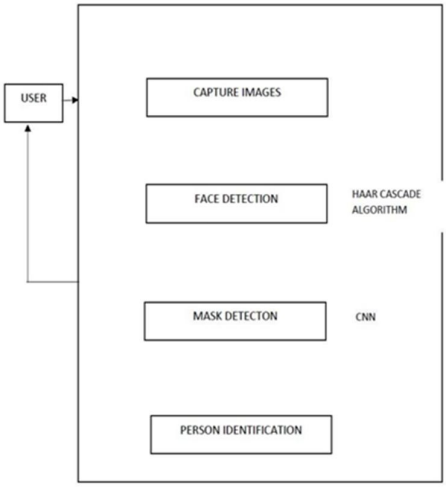

Fig: Proposed System

VI. IMPLEMENTATION

The application can take static images and frames from live video also as input.

- **Image input:** The user must provide the input in the form of image that contains face so that the application can detect face.
- **Live video input:** The user must provide the input in the form of video, i.e., user should perform face capture in front of camera so that application detects whether person is wearing a face mask or not.
- **Detected face from Image:** When the application successfully detects that the person is not wearing a mask then it recognizes the person and stores the details at what time the person was detected and send a warning text message to the person.
- **Detected face from Video:** When the application successfully detects person wearing a mask then it labels on screen that person is wearing a mask, if the person is not wearing a mask, then it recognizes the person and stores the details at what time the person was detected and send a warning text message to the person.

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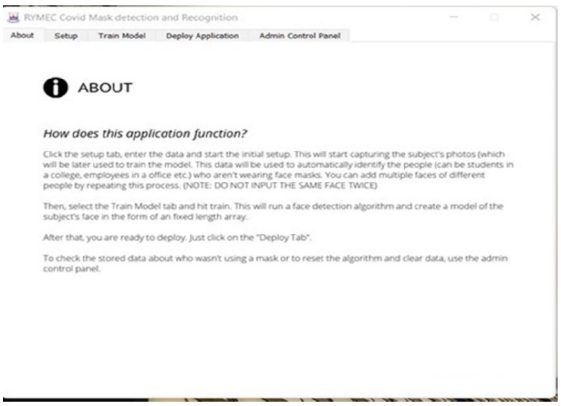
For the face detection task, the image was represented as a Haar-like feature representation. For mask detection, we adopted the custom Haarcascade. The cascade function was trained using positive and negative images. Positive images refer to the face images whereby a facemask occurs. Face without facemask images construct the negative images. For each of the images where the face is successfully detected, preprocessing that involves contrast adjustment, intensity and size normalization was performed. The preprocessed images were then sent to the face recognition module.

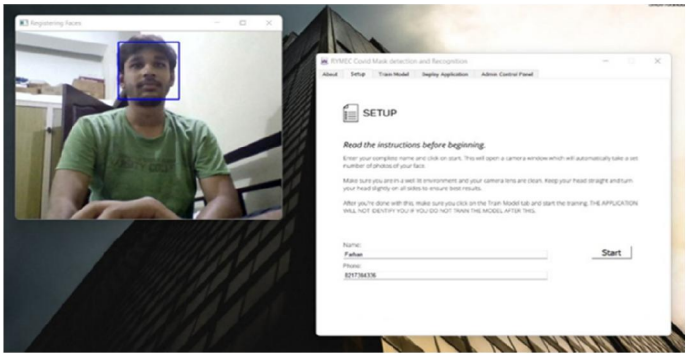
Eigenfaces and local binary pattern histogram (LBPH) were selected to perform face recognition. These algorithms were chosen as they require less processing time for implementation.

VII. OUTPUT

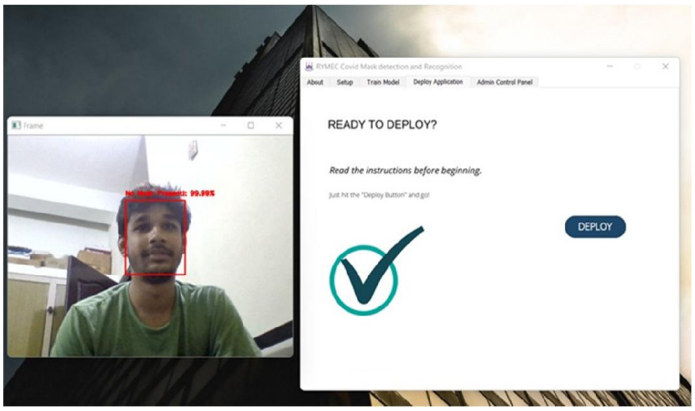
User Interface



Data Input



Output



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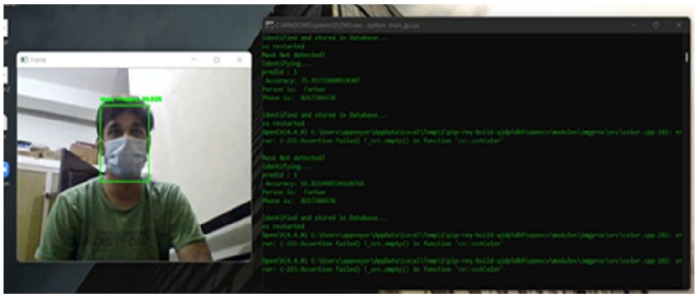
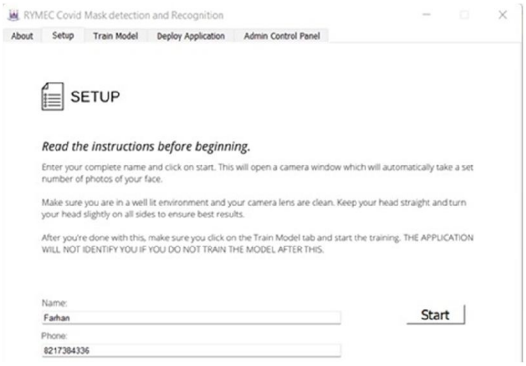
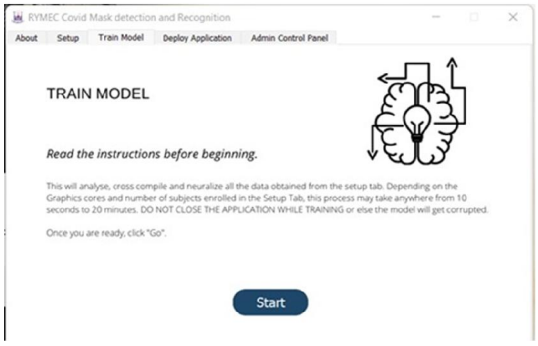
Output with Mask



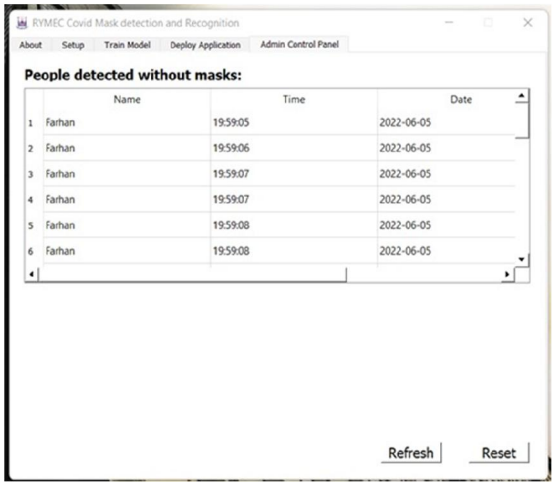
User Input Menu



Train Model



Admin Panel



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VIII. CONCLUSION

For the conclusion, in this project, a face mask detector with a recognition system is proposed, which can possibly contribute to public healthcare. Nevertheless, during this pandemic situation, it is advised that wearing a mask correctly can condense the spread of such viruses around the globe significantly. And present-day arrangements depend on a touch which needs to be excluded given the situation. This system proposes being safe with following COVID regulations.

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