A REPORT

ON

"FACE MASK DETECTION SYSTEM USING AI"

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BACHELOR OF ENGINEERING (COMPUTER ENGINEERING)

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CERTIFICATE

This is to certify that the project entitled

"FACE MASK DETECTION SYSTEM USING AI"

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ABSTRACT

In current pandemic, Covid-19 has made us realize the importance of Face Masks and we need to understand the crucial effects of not wearing one, now more than ever. Right now, there are no mask detectors installed at the crowded places. But we believe that it is of utmost importance that at transportation junctions, densely populated residential area, markets, educational institutions and healthcare areas, it is now very important to set up face mask detectors to ensure the safety of the public. In this paper we have tried to build a two phased face mask detector which will be easy to deploy at the mentioned outlets. With the help of Computer Vision, it is now possible to detect and implement this on large scale. We have used CNN for the implementation of our model. The implementation is done in Python, and the python script implementation will train our face mask detector on our selected dataset using TensorFlow and Keras. We have added more robust features and trained our model on various variations, we made sure to have large varied and augmented dataset so that the model is able to clearly, identify and detection the face masks in real time videos. The trained model was tested on both real-time videos and static pictures and in both the cases the accuracy was more than the other designed models.

Keywords : Face Mask detection system , computer vision , deep learning.

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CHAPTER 1

INTRODUCTION

1.1 Overview

In this project we are used two types of dataset that is with mask and without mask images and second type is information of organizational peoples then we are used tensorflow and keras machine learning libraries for training dataset. Then we are used convolutional neural network (CNN) for the classification of data and pre-processing of data. And we are used some python libraries like opencv2, Face recognition libraries for the identification of the organizational person's which is with mask or without mask. We are include email alert technique for the that organizational person who does not wear mask then email is automatically receive on that person's mail.

1.2 Motivation

In the last few years, we have seen Science and Technology advancing so much that now we are at a stage where, we know that with the right knowledge of the technology, the humans can achieve things that seemed nearly impossible just a few decades ago. Now, we have the advancing technologies and knowledge of Machine Learning and Artificial Intelligence, which has been proven to ease our lives from the micro levels to big impossible tasks. In the last few years, there has been a rise in the onset of algorithms that have been proven to be the solution to our complex, life threatening problems. One such field is the image and object detection, which has helped us find and spot people and things with just one click.

Computer Vision plays a crucial role in our lives now. Who would have thought that while sitting in one city you can easily spot the people in the other cities? It's almost unimaginative how Computer vision is now a very innovative aspect of the technology.

In 2019, the whole world witnessed the onset of the deadly Corona Virus, which now, still after almost a year has not left us and is still making the human race fight for its

existence. In between the survival fights, we have realized how technology is very much our only life saver. From extensive internet facilities to 24/7 services online, technology has been our true companion in these hard times.

But even when we have everything present at one click, there can't be no lives outside. In the past few months every country, every state has found its own new norms to fight the pandemic. And no matter what we do, we do need to step outside to survive. Schools, Offices, Colleges, Markets, Transportation, are the few crucial check points for any country. As much as we ask the public to be safe, the people miss their [without any restrictions lives. And so, it is now very important to closely watch the public and make them understand the importance of the tiny and small details of survival kit.

One such crucial factor is the extensive usage of face masks in our lives. Studies have proven that with the help of use of face masks, we can lower the chances of catching the Corona Virus by 80 to 85%, if it's used properly. But, even so, it is nearly impossible to enforce the face masks completely on the human race.

With the help of AI and Computer Vision, we have the best chance at enforcing the mask policy on the humans. With the help of our system, we aim on detecting the presence of face masks on static images and real time videos. Object detection, Classification, Regression, image and object tracking and analysis are our key aspects of the paper. We are aiming at a two phased CNN face mask detector. The first phase is the training phase wherein we have trained our model and the second phase the application, where the masks are detected with "with" or "without masks" tags. Other than the images we also aim to implement this on the real time videos, where the real time faces are detected, tracked and the data about the faces with or without masks is returned.

Our project can be of crucial help at the Stations, airports, Markets, Hospitals, Offices, Schools and many more, where the crowd can be monitored in real time.

1.3 Problem Definition

Wearing a mask in public places is an effective way to keep the communities safe as a response to the covid-19 pandemic. We open sourced a face mask detection system created by neutral that uses AI detect if people are wearing masks or not. Focused on making our face mask detector ready for real-world applications, such as CCTV cameras, where faces are small, blurry, and far from the camera.

To ensure that the mask rule is been followed there needs to be an automatic technique that can provide highly accurate intelligent system for face mask detection through image processing.

1.4 Project Scope and Limitations

Project Scope

The purpose of the face mask detection system is to detect a person are with face mask or without face mask and informing to authority and applying penalties on to the person then send message onto that persons mobile to reduce the spread of COVID-19 This system is based upon Convolutional Neural Network (CNN) which allows us to scan image by using CCTV and classify person wear mask or not.

Limitations

- Poor Image Quality Limits Facial Recognition's Effectiveness

Image quality affects how well face mask recognition algorithms work. The image quality of scanning video is quite low compared with that digital camera. Even high-definition video is 1080p usually, it can 720p. These values are equivalent to 2MP and 0.9MP respectively.

- Small Image Sizes Make Facial Recognition More Difficult

  When a face mask detection system finds out a face in an images from a video then the size of that face is compared with the enrolled images. size affects how perfect the face will be recognized. Already small size image, coupled with a target distance from the camera, means the detected faces is only 100 to 200 pixels.

- Different Face Angles Can Throw Off Facial Recognition's Reliability

  The relative angle of the targets face influences the recognition score perfectly. When a face is enrolled in the recognition tool, usually multiple angles are used. Anything less than a front view affects the algorithms capability to generate a template for the face.

- Data Processing and Storage Can Limit Facial Recognition Tech

  Even though high-definition video it is quite low in resolution compared with digital images, it still occupies significant amounts of disk space. Processing every frame of video is an enormous undertaking, so usually only a fraction (10 percent to 25 percent) is actually run through a face mask detection system.

1.5 Methodologies of Problem solving

- Training Model
- Object Detection
- Face Detection
- Mask Detection
- Email Alert

CHAPTER 2

LITERATURE SURVEY

2.1 Face mask Detection System using CNN:-(IEEE 2021):

Wang et al. has made executing face mask related models an obvious task by providing three samples of masked face datasets, which comprise of Masked Face Detection Dataset (MFDD), Real world Masked Face Recognition Dataset (RMFRD) and Simulated Masked Face Recognition Dataset (SMFRD). Matthias et al. has done a face mask recognition model that focusses on capturing real time images indicating whether a person has put on a face mask or not. It consists of two stages that is Stage 1 of the model is face detector, which can localize several faces in the pictures of different size and type, and it can detect faces even if there is overlapping. Convolutional Neural Network (CNN) is a structured deep learning process that plays a ground-breaking push for a variety of applications focusing on computer vision and image-based applications. So he has used CNN algorithm to detect the face masks on the faces detected in stage 1. The results of this stage are sent to the further stages and the final image that is our output is classified as masked or unmasked faces, for all the faces in the input image. Using 3 different image classification methods, our CNN based classifier was trained. For training a custom face mask detection system, he has a two staged architecture, and each stage with several other steps. By using keras/Tensorflow, he has trained our model on the selected dataset. The dataset is loaded from the disk and then after importing all the necessary packages, an argument parser is constructed to parse the arguments from command line. All the data and the labels are then converted into numpy arrays and then a training image generator is constructed for data augmentation. Later he constructed the head of our model that is placed on the top of the base model. After compilation and training, the mask detector model is saved. Stage 2 Deployment. After our detector is trained, he then loaded our face mask detector and applied the trained model on the dataset, then after detection, he has classified the faces "with mask" or "without mask". After the successful deployment he was able to

detect the faces in real time videos and images, with tags in green and red colour, named "with_mask" and "without mask.[1]

2.2 Face mask detection using MobileNet and Global Pooling Block:- (IEEE 2021)

Deep convolution neural networks (CNN) have become a predominant tool for computer vision tasks such as image classification. There are several successful deep CNN models available as follows. Kaiming et al. have proposed live variants of ResNet as ResNet-18, ResNet-34. ResNet-50.. ResNet-101 and ResNet-152. They attain a top-1 error rate of 24% and 22% with ResNet-18/34 anl ResNet-50/101/152. respectively. It shows that the performance and computational time of the model are directly proportional to the number of layers. The architecture of ResNet-50 is similar to ResNet 34 and causes less computation time than other variants of ResNet. Christian et al. have devised an inception network to achieve better accuracy for image classification and segmentation. In general, convolution with larger spatial filters tends to high computational cost. One prominent solution to reduce this cost is inception modules. Inception reduces the cost by finding out optimal local sparse structures. The idea of the inception block is to design a layer by layer construction with the analysis of layer correlation statistics. The clusters of highly correlated layers are used to form groups of units. Each unit from an earlier layer corresponds to some region of the input image is referred to as a filter bank. This process ends up with the concatenation of huge filter banks from a single region. Transfer learning of these models has become handy for image classification. Thus, he has proposed a MobileNet and Global Pooling (MNGP) model for face mask detection. The proposed model uses transfer learning with the global pooling block and details are as follows.[2]

2.3 A NOVEL APPROACH TO DETECT FACE MASK USING CNN :-(IEEE 2021)

This system works to detect masked face in this COVID-19 situation to occupy a significant part in order to transform coronavirus from one person to another person. To detect the mask face the CNN algorithm is used in our project which gives higher accuracy. This project able to detect the mask's faces very fast from every possible angle. While a person comes to the surveillance area without wearing a mask then the system provides a security alert to notify the authority. This paper presents a geminate mask face detector that can able to detect mask face and it regardless of arrangement and train it in a proper neural system to get precise outcomes. It takes an RGB input image from any orientation to obtaining output. The main work of this function is feature extraction and class prediction to the images. In the feature extraction system, the image is sketched and created into a new image where the generated image is more efficient than the previous image. In this part, a large number of images dimensionally reduce to an efficient representation in which an interesting part of the image is a capture. After doing features extraction in every convolutional layer it gives an output that works better for the image and represents those images a set of labelled images. In our proposed model mask face can be detected from the segmented image or using the webcam. Firstly the size of the input image resize 100*100 and perform feature extraction and prediction. Background noise also reduces and performs filtering to remove high frequency from the input image. After completing the training process it gives us some model data with their accuracy level. In this system three-parts work out to complete the process, the first part is connected with the dataset, the second is created some model with accuracy, and the third part is to detect the mask face.[3]

2.4 AN AUTOMATED SYSTEM TO LIMIT COVID-19 USING FACIAL MASK DETECTION IN SMART CITY NETWORK(IEEE-2020):-

He proposed an automated smart framework for screening persons who are not using a face mask in this paper. In the smart city, all public places are monitored by CCTV

cameras. 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. All the blocks of the developed system are described as follows. A. Image Pre-processing The images captured by the CCTV cameras required pre-processing before going to the next step. In the pre-processing step, the image is transformed into a grayscale image because the RGB colour image contains so much redundant information that is not necessary for face mask detection. RGB colour image stored 24 bit for each pixel of the image. On the other hand, the grayscale image stored 8 bit for each pixel and it contained sufficient information for classification. Then, he reshaped the images into (64×64) shape to maintain uniformity of the input images to the architecture. Then, the images are normalized and after normalization, the value of a pixel resides in the range from 0 to 1. Normalization helped the learning algorithm to learn faster and captured necessary features from the images. B. Deep Learning Architecture The deep learning architecture learns various important nonlinear features from the given samples. Then, this learned architecture is used to predict previously unseen samples. To train our deep learning architecture, they collected images from different sources. The architecture of the learning technique highly depends on CNN. All the aspects of deep learning architecture are described below. i) Dataset Collection: Data from two different sources [19], [20] are collected for training and testing the model. They collected a total of 858 images of people with masks and 681 images of people without a mask. For training purposes, 80% images of each class are used and the rest of the images are utilized for testing purposes. Some of the images of two different classes. ii) Architecture Development: The learning model is based on CNN which is very useful for pattern recognition from images. The network comprises an input layer, several hidden layers and an output layer. The hidden layers consist of multiple convolution layers that learn suitable filters for important feature extraction from the given samples. The features extracted by CNN are used by multiple dense neural networks for classification purposes.The architecture contains three pairs of convolution layers each followed by this information is sent to the proper authority. The GPS location of the CCTV camera captured the person

without a mask along with the image and the exact time is sent via SMS to the corresponding authority. They would come to the locality where the person without a face mask was detected and took necessary actions. If proper actions are taken, then people might not come in public places without a facial mask that would help greatly to limit the growth of COVID-19. [4]

2.5 REAL-TIME FACE MASK IDENTIFICATION USING FACEMASKNET DEEP LEARNING NETWORK:- (2020)

Face mask detection has been accomplished by adopting Deep Learning techniques. They have designed our project into two phases: training face mask detector and implementing face mask detector.The dataset is loaded for the model to be trained and the model is serialized in the training phase. Further, the trained model is loaded, the faces are detected in images and video streams and then the region of interest (ROI) is extracted. Finally, the face mask detector is applied and the images or faces in the video streams are classified as with a mask, improperly worn mask, without a mask. The green and yellow rectangular frame individually interpret the detected face and mask. The dataset consisted of 15 images of improperly worn masks, 10 masked images, and 10 images without a mask. They have used Mat lab programming to build our facemask detector model. To train the model, They have used Facemask net architecture. The initial learning rate is 1e-4 and the number of training epochs is 20. The data is then pre-processed. The images are resized to 227 x 227 x 3 pixels' intensities in the input image. After this, the model was compiled to be trained and then the model was evaluated on the test set. The accuracy and iteration curves were plotted. After the model was trained, an image was loaded as an input to distinguish whether a person is wearing a mask or not or wearing it improperly. The input image is then loaded and pre-processed. To localize wherein the image all faces are, face detection takes place and also the region of interest (ROI). The green and yellow rectangular frame respectively represent the detected face and mask. Next, they recognized face masks in real-time video streams. Face detection takes place the same way as

discussed earlier. A particular frame from the stream is grabbed and resized. After that detection of face mask takes place. The results are displayed on the screen after post-processing. [5]

2.6 FACE MASK DETECTION BY USING OPTIMISTIC CONVOLUTIONAL NEURAL NETWORK :-(IEEE 2021)

In this research work, they proposed an Optimistic Convolution Network that helps to ensure whether in public the people are wearing masks or not by monitoring automatically.He has described an architecture that shows how our system functions automatically to prevent the spread of COVID19. Our system uses the TensorFlow and Keras algorithm to detect whether an individual is wearing a face mask along with the Convolutional Neural network model. Here they first train the system with the Dataset from Kaggle and train it with Keras and TensorFlow, once the training is done then they will load face mask classifier from the disk, here faces are detected from a real time video stream. This process also involves use of MobileNet in order to train a huge collection of images and classification of high-quality images. Here image dataset is loaded from Keras and then the images are converted into an array, later MobileNet is used to pre-process input image and to append image to the data list. In the proposed system the main contribution includes person face identification and face mask detection. These both are done in Real Time with the help of MobileNet and OpenCV. A square box is been displayed on every person's face with the colour of red and green where red indicates the person is not wearing a mask and green indicates a person is wearing a mask. They have used a face cropped dataset from Kaggle of about 3918 images of persons with masks and without masks. These images are used in order to train the model that classifies into two categories: that is, faces with masks and faces without masks. These datasets are then converted into arrays in order to create a Deep Learning Model. The result of the person from the video displays a person with a square bound box. This system monitors continuously, and whenever a person is identified without a mask then the person's face is

been captured and then it is sent to the higher authorities, also to that person. Due to the outbreak of novel Corona Virus this proposed model can be implemented in public at real-time for monitoring the people wearing face masks. Our model can be used for monitoring automatically in public places that would help for those who monitor people physically/manually, that is the reason they picked this architecture. Our system can be used in airports, schools, railway stations, shopping malls, offices and other public areas to make sure that in-public people are wearing masks.[6]

CHAPTER 3

SOFTWARE REQUIREMENTS SPECIFICATION

3.1 Assumptions and Dependencies

- We have assumed that same person be try to enter in a campus everyday.
- If person wear mask then it's ok.
- If person put hand on mouth then siren goes on.
- If person not wear a mask then by using CNN algorithm we can detect face and sends pop-up message onto that persons mobile.

3.2 Functional Requirements

3.2.1 Maintainability

The system requires minimal maintenance which include updation of persons details, dataset and other dependencies.

3.2.2 Portability

The system is designed keeping portability is the prime motive in the mind and is available on any devices.

3.2.3 Availability

The system is available on all low end to high end pc's.

3.2.4 Accessibility

The interface of the system is designed for only admin and he can accessed with ease.

3.3 External Interface Requirements

3.3.1 Software Interfaces

It allow system to scan images and take the correct decision according to the condition.

3.4 Non Functional Requirements

3.4.1 Performance Requirements

Performance consideration: Scanning latency should be minimal and system not consume extensive processor. It makes use of multithreading to avoid system consuming main U.I thread memory.

3.4.2 Safety Requirements

Privacy: All the data is being stored in secured and encrypted way.

3.4.3 Security Requirements

The credentials of each person is being securely stored into the Firebase Authentication system using hashing.

3.4.4 Software Quality Attributes

1. Usability:

   The system is user friendly and easy to use.

   a) Learn-ability: The working of the system should be easily understood .
   b) Operability : The system should be efficiently operated .

2.Performance Efficiency:

The system should not consume extra CPU Usage and should not hamper overall system performance.

a) Time behaviour :It should behave appropriately and response in minimal time under stated conditions.
b) Resource Utilization : The system gets things done in the right manner with the minimal computing resources.

3.Compatibility:

The system works satisfactorily together on different devices with different hardware and software specifications considering all the basic requirements are satisfied.

a) Coexistence: The system would be visible to everyone as it is designed.
b) Inter-Operability: The system should effectively communicate with other services

4.Reliability:

The reliability of system is judged by providing specifies input and check whether it performance as expected under specified conditions.

a) Availability: the system would be available 24 x 7.

5.Portability:

The system is designed keeping portability as the prime motive in the mind it is available on any low-end pc.

a) Install-ability : The system requirement are minimal so it would be installed in any device.
b) Adaptability: The system will adapt itself with all the new versions by providing frequent updates.

3.5 System Requirements

3.5.1 Database Requirements

Image Database: It stored images which will be used to classify masked and without masked person and to detect the face.

3.5.2 Software Requirements (Platform Choice)

Operating System: It requires windows 7 operating system and above version.

Language: Python

IDE: VSCode / Pycharm

3.5.3 Hardware Requirements:

Processor: Minimum i3 and above

RAM: 4GB or More

HDD: 256 GB or more

3.6 Analysis Models

Stage 1: Planning and Requirement Analysis

Requirement Elicitation:

This step involved understanding the stakeholder and their expectations. It involved reading and watching the testimonials of teachers and students. It involved interactions with teachers and students. COVID-19 gave us the glimpse of the lack of infrastructure and technical expertise in teaching.

Stage 2: Defining Requirements

Our main objective was to design a cost effective solution hence this will helped as in eliminating the convolutional neural network as a technology.

We were left ANN , ANN required minimal software and hardware requirement and to much mi-ore time with low accuracy as compare to CNN. We chose visual studio code and pycharm as a platform due to its availability and cost effectiveness.

Stage 3: Designing Architecture

It described Dataflow, Architecture and Interface design. Based on the refined requirement, there are two levels of design architecture

1. High-Level Design Architecture.

   This diagram depicted the envisioned structure of the software system. It provides an abstract view of the system, which gives us an idea about the overall system but hides the technical details of the system. Activity Diagram, UI Wireframe and Design System were designed using this information. It is a conceptual view of the system and provide Logical or conceptual part, Process, Physical and Module overview.

2. Low-Level Design Architecture

   It showcases the technical details of the system and all the component level features of the system. Class Diagrams and other UML Diagrams are designed using this. Here, Modules are further explored and break down into its fundamental units. Usually Class diagrams and component diagrams are made using this design architecture.

Stage 4: Development

This phase is the actual implementation part of application. Technology stack is chosen as per team expertise and requirements. Modules are designed as per SRS and Design Documentation.

Stage 5: Testing and Integration

We are planning to carry out unit testing at every stage of development. After the completion of the core module and integration of all the modules, integrated testing will be carried out to check for possible compatibility issues and functionality. Test cases needed to be defined depends on the inter-module interaction, User- Device interaction, Network conditions and other scenarios being kept in mind.

Stage 6: Deployment and Maintenance

This system would be deployed on browser. Since our system is still in its earlier phase a lot of assets would be missing due to uncertainty demand by user. Our system would be continuously evolving with high accuracy and user can expect updates and schedule maintenance. Would be carried out accordingly.

CHAPTER 4

SYSTEM DESIGN

4.1 System Architecture

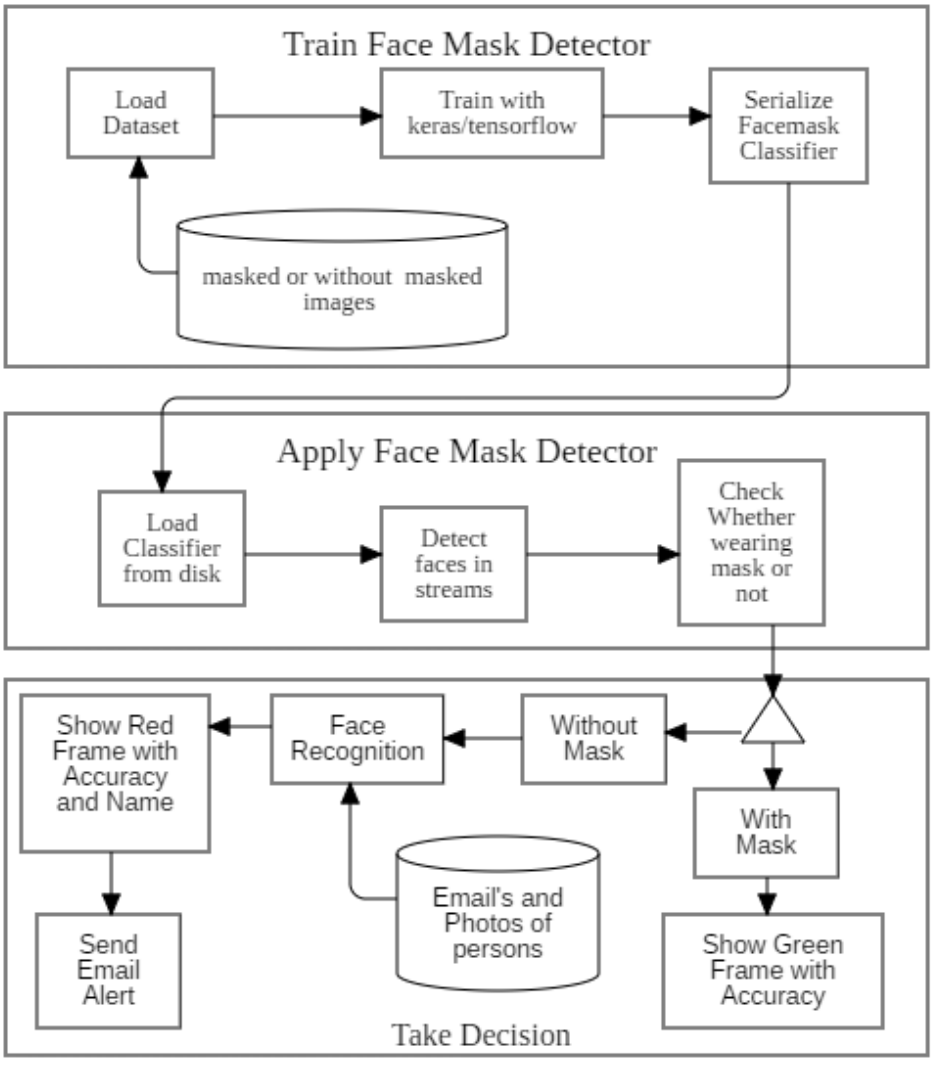


Fig. 4.1 System Architecture

- In this system we have loaded dataset into model the dataset is mask or without mask images .
- After that we are using tensorflow and keras libraries for training dataset.
- Serializing face mask classifier and pre-processing of data and validation of data .
- Then load the classifier from library. Detect faces in live streaming through camera.
- System will check using deep learning algorithm that is CNN (Convolutional Neural Network)
- Person Wearing mask or not ? If person worn mask then system will be automatically terminated .
- Using Python Face recognition library our system will recognize the face of that particular person who relates the organization using Face recognition dataset .
- If person not wearing mask then system recognize that face then show red frame with accuracy and name.
- E-mail Generation :- If person is not wearing mask system will find information about that person in the dataset and person will receive e-mail .

4.2 Mathematical Model

we take a small matrix of numbers (called kernel or filter), pass it over our image, and transform it based on the values from the filter.

$$G[m,n]=(f\times h)[m,n]=\Sigma j\Sigma i\ h[j,k]\ f[m-j,n-k]$$

Since our image shrinks every time, we perform convolution, we can do it only a limited number of times before our image disappears completely.

$$P=(f-1)/2$$

Instead of shifting the kernel by one pixel, we can increase the number of steps. So, step length is also treated as one of the convolution layer hyper parameters.

$$nout=\text{floor}(1+(n+2p-f)/s)$$

The filter and the image you want to apply it to must have the same number of channels.

$$[\boldsymbol{n},\boldsymbol{n},\boldsymbol{nc}]\times[\boldsymbol{f},\boldsymbol{f},\boldsymbol{nc}]=\left[\boldsymbol{floor}\left(\mathbf{1}+\frac{\boldsymbol{n}+\mathbf{2}\boldsymbol{p}-\boldsymbol{f}}{\mathbf{8}}\right),\boldsymbol{floor}\left(\mathbf{1}+\frac{\boldsymbol{n}+\mathbf{2}\boldsymbol{p}-\boldsymbol{f}}{\mathbf{8}}\right),\boldsymbol{nf}\right]$$

4.3 Data Flow Diagrams

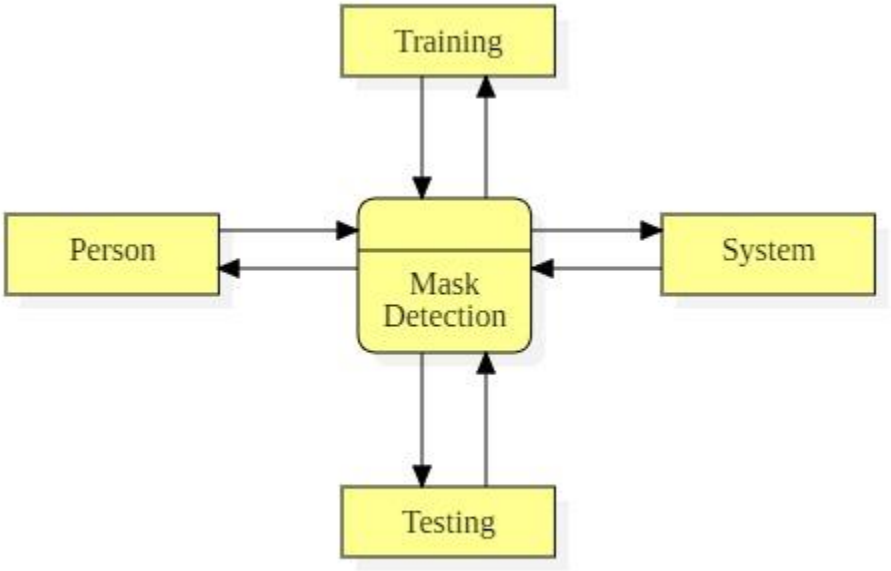


Fig 4.3.1 DFD Level 0

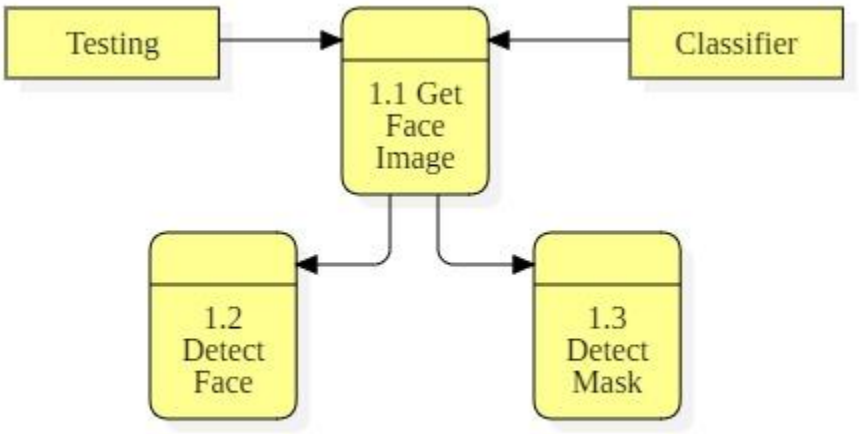


Fig. 4.3.1 DFD Level 1

4.4 UML Diagrams

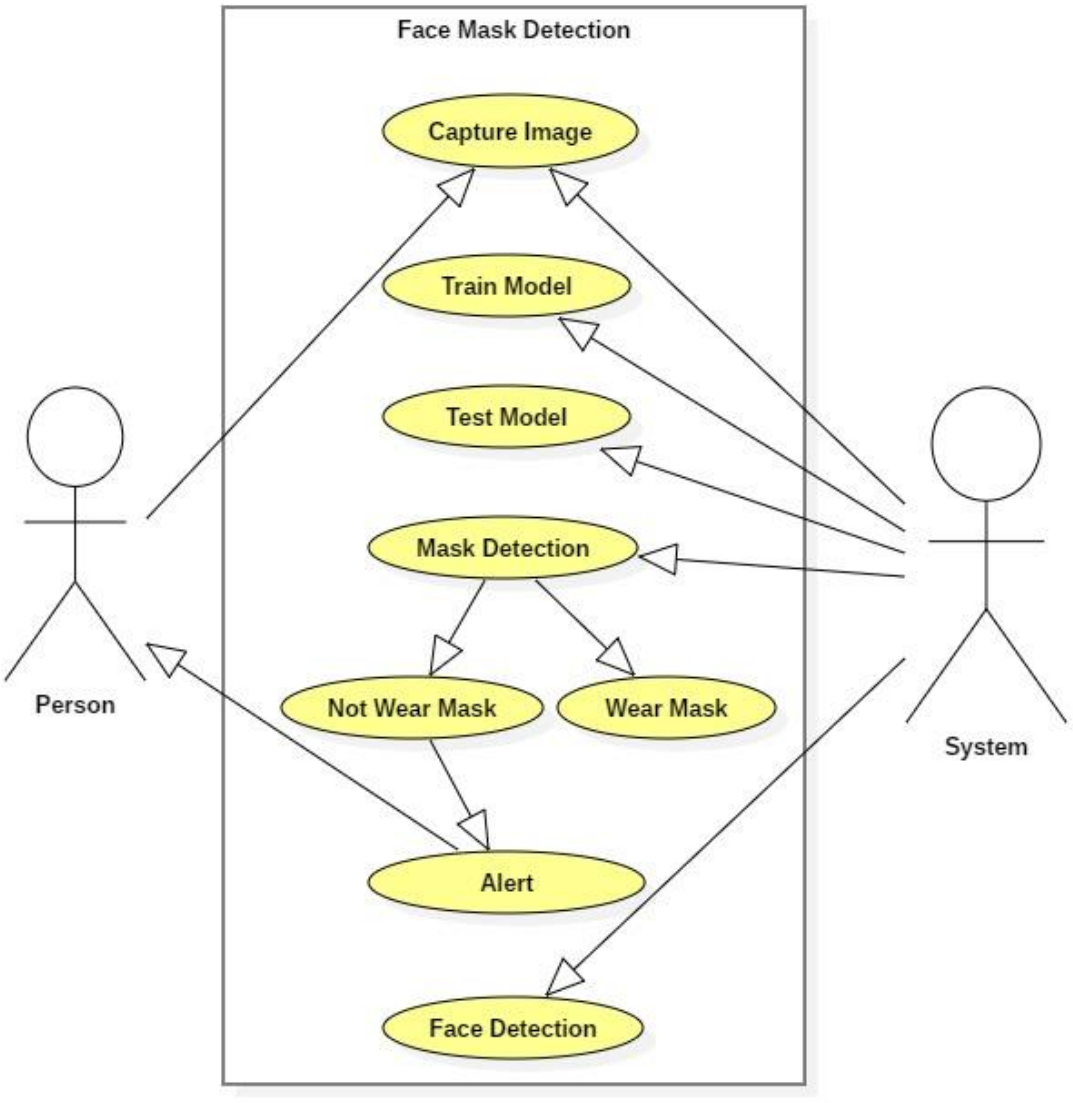


Fig. 4.4.1 Use Case Diagram

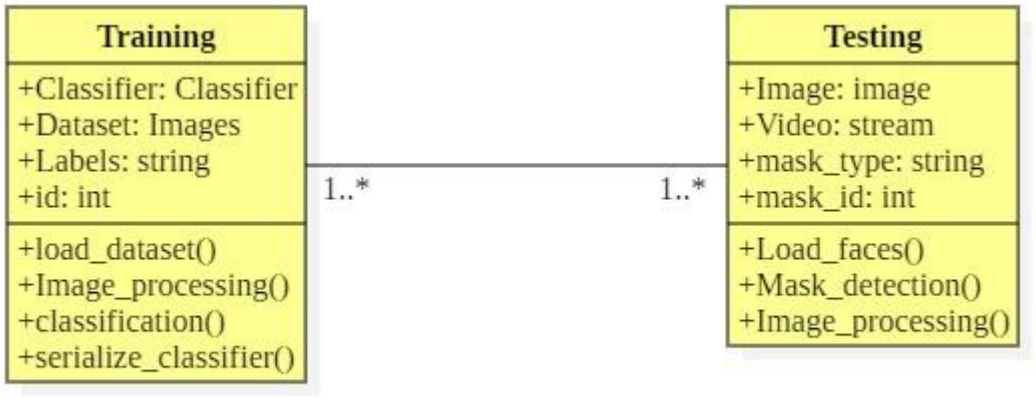


Fig 4.4.2 Class Diagram

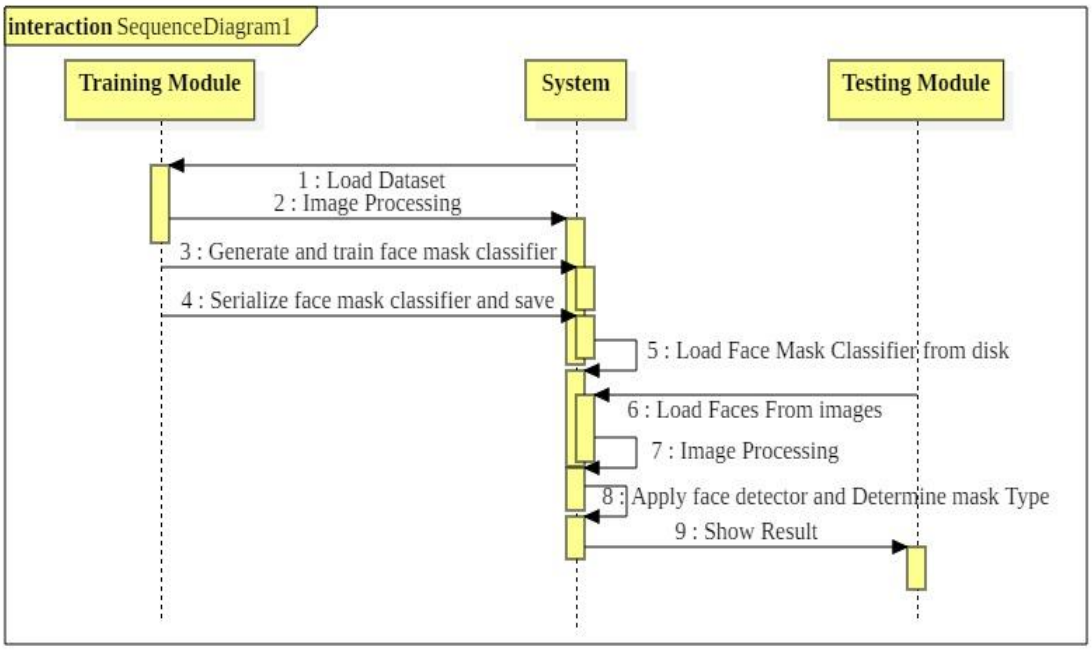


Fig 4.4.3 Sequence Diagram

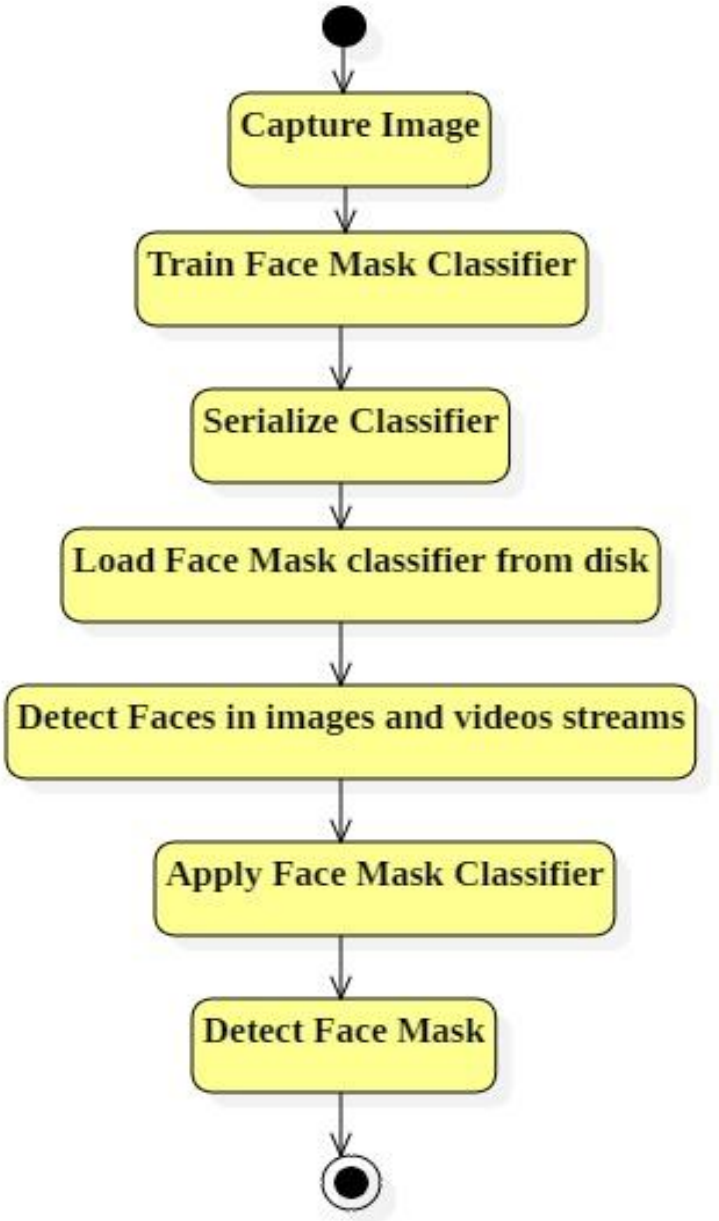


Fig.4.4.4 Activity Diagram

CHAPTER 5

Project Plan

5.1 Cost Estimate

It is the most frequently used technique for evaluating the effectiveness of the pro-posed system. More commonly known as cost/benefit analysis. It determines the benefits and savings that are expected from the proposed system and compares them with costs. The system is economically feasible since it would not entail additional hardware, thereby saving on the costs of the manpower involved. In economic feasibility study we do some calculations.

Table 5.1 Cost Estimate

Phases	Cost/Hour	Hours	Cost Estimation
Requirement gathering	30/-	20H	600
Design	30/-	50H	1500
Code development	30/-	40H	1200
Implementation	60/-	40H	2400
Testing	40/-	10H	400

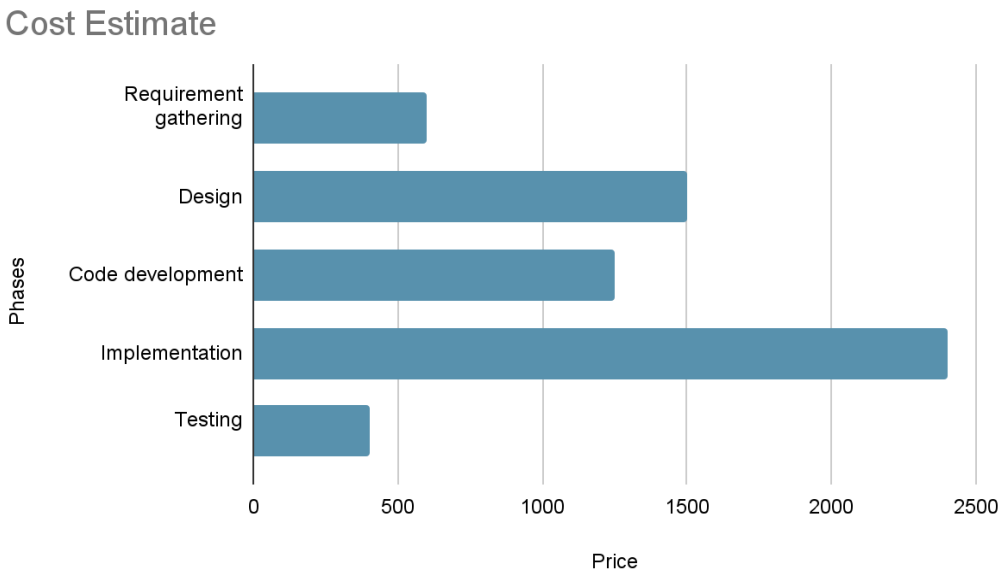


Fig 5.1 Cost Estimate Chart

5.2 Risk Management

If there is a possibility that the achievement of a goal is harmed, prevented from occurring or suffers negatively due to the occurrence of uncertain events, we call it the risk. These so-called uncertain events can be caused by different factors. An efficient risk management analysis should be able to attend to every one of them to be able to identify them promptly in each of the listed cases:

Personnel Risks:

Caused by a lack of Knowledge about technology and training to perform functions. There is a possibility that errors are intentional, this is the result of the dubious conduct. The main risks from personal issues are:

- Unintentional; resulting in omission or negligence.
- Cannot perform task because lack of ability.
- Lack of time management.

Process Risks:

The occurrence of internal process deficiencies like inadequate performance indicators, inefficient controls, modelling failures and an inability to abide by the current laws.

Systems risks:

Arising from inadequate, poorly structured or defective IT systems. Some examples:

- Intermittent networks
- Server crash
- Physical damage to data storage components
- System obsolescence
- Improper maintenance
- Power outage from internal causes
- System slowdown
- Security holes

Risk Management w.r.t NP Hard Analysis

- In rural area most of the time Internet will not be available so our system may not work.
- If reviews not available and false review are there then systems results will fail.
- If provide wrong input then system will show wrong output or it may fail.

5.2.1 RISK IDENFICATION:

- System may get fail during review database.
- Results may get fail.

5.2.2 Risk Analysis:

The risks for the Project can be analysed within the constraints of time and quality

Table 5.2.2.1

Risk Description	Probability	Impact		
		Schedule	Quality	Overall
Internet connection not available	Low	Low	High	High
Missing Admin	Low	Low	High	High
Incorrect input	Low	Low	High	High

Table 5.2.2.2

Probability	Value	Description
High	Probability of occurrence is	>75%
Medium	Medium Probability of occurrence is	26-75%
Low	Low Probability of occurrence is	<25%

5.2.3 Overview of Risk Mitigation, Monitoring, Management

Following are the details for each risk

Table:5.2.3.1

Risk Id	1
Risk Description	Change of requirements
Category	Software requirement risk
Probability	Low
Impact	High
Response	Mitigate
Risk Status	Occurred

Table: 5.2.3.2

Risk Id	2
Risk Description	Human Errors
Category	Software Scheduling Risk
Probability	Low
Response	Identified

5.3 Project Schedule

5.3.1 Project Planning Chart

Name	**Begin Date**	**End Date**
Group Formation	26/08/2021	28/08/2021
Abstract Idea Video Submission	05/09/2021	05/09/2021
Topic Finalization & Guide Allocation	10/09/2021	10/09/2021
Submission of Synopsis & Base Paper	20/09/2021	20/09/2021
Review 1(Sem 1)	23/10/2021	23/10/2021
Review 2(Sem 1)	27/11/2021	27/11/2021
Project Meeting with Coordinator	15/12/2021	15/12/2021
Review 3(Sem 1)	27/12/2021	27/12/2021
Preliminary Report Submission	29/12/2021	29/12/2021
Project Review 1	06/01/2022	06/01/2022
Project Review 2	13/01/2022	13/01/2022
Project Review 3	15/01/2022	15/01/2022
Project Review 4	03/02/2022	03/02/2022
Project Review 5	10/02/2022	10/02/2022
Project Review 6	07/04/2022	07/04/2022
Project Review 7	25/04/2022	25/04/2022
Project Submission	06/05/2022	06/05/2022

5.3.2 Timeline chart

Table 5.3.2 Time Estimate

Phases	Time in weeks
Analysis	06
Design	10
Coding	15
Testing	04
Documentation	05
Maintenance	06
Total Weeks	46

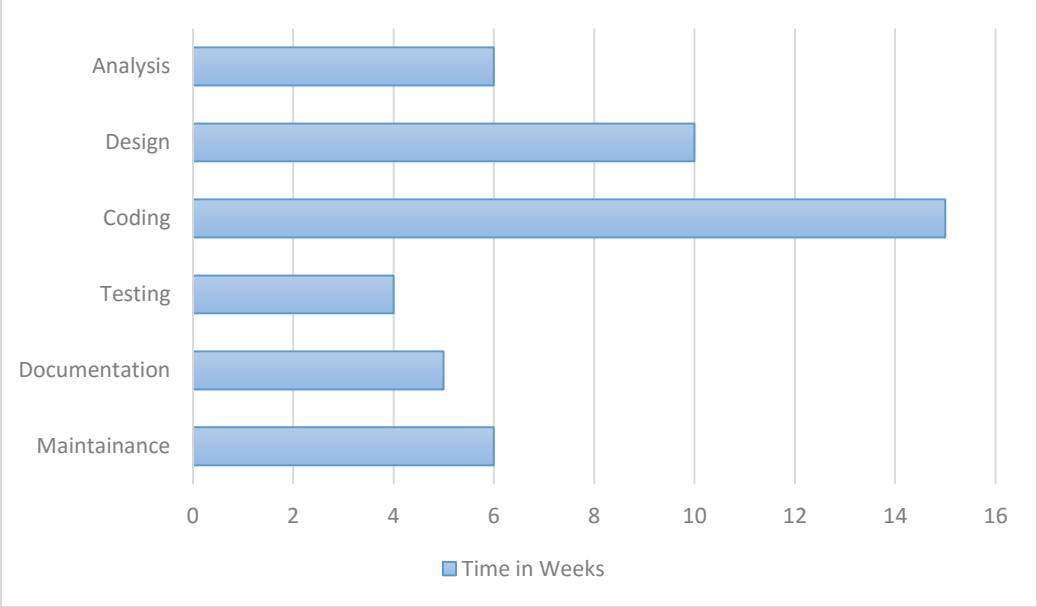


Fig 5.3.2 Timeline chart

5.4 Team Organization

5.4.1 Team Structure

Following are the team members

SR No	Name
1	Bansode Tejas Dnyaneshwar
2	Shermale Abhijit Ramesh
3	Shinde Darshan Daulat
4	Pawar Suraj Shankar

5.4.2 Management Reporting and Communication

5.4.2.1 Technical Feasibility

System require any technical feasibility constraints to implement. Only the Python , Jupyter Notebook will be require with proper Input format, with internet for sending image.

5.4.2.2 Cost Feasibility

System will be cost effective as it is fully software based system. No much or extra hardware is been require.

CHAPTER 6

PROJECT IMPLEMENTATION

6.1 Overview of Project Modules

- Training Dataset
- Object Detection
- Face Detection(image/Video)
- Mask Detection(Image/Video)
- Face Recognition
- Email Generation

6.2 Tools and Technologies Used

Tools :

- tensorflow==2.5.0
- keras==2.4.3
- imutils==0.5.4
- numpy==1.19.5
- opencv-python== 4.3.0.38
- matplotlib==3.4.1
- argparse==1.4.0
- scipy==1.6.2
- scikit-learn==0.24.1
- pillow==8.3.2
- onnx==1.10.1
- tf2onnx==1.9.3
- face-recognition==1.3.0

- keyboard
- cmake
- dlib

Technologies :

- Artificial Intelligence

  Artificial intelligence is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert system, natural language processing, speech recognition and machine vision

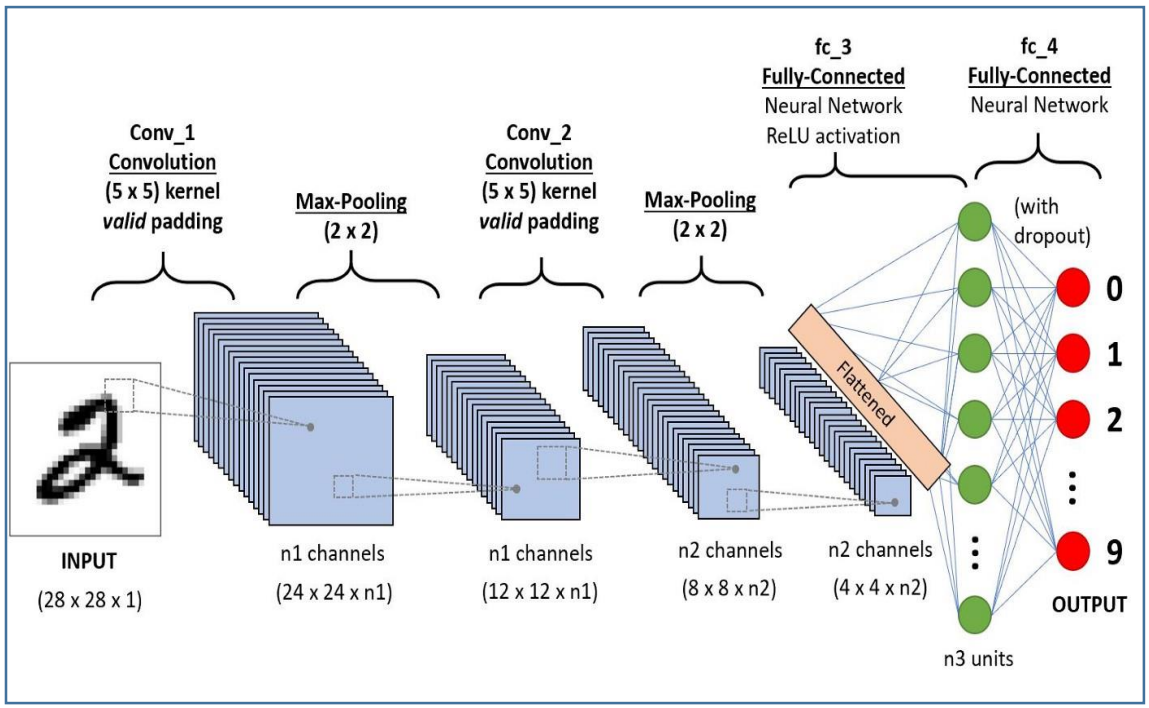
- Deep Learning

  The field of artificial intelligence is essentially when machines can do tasks that typically require human intelligence. It encompasses machine learning, where machines can learn by experience and acquire skills without human involvement.

6.3 Algorithm Details

Convolutional Neural Network (CNN)

A Convolutional Neural Network (CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics.



- Convolutional Operation
- RELU layer
- Pooling
- Flattening
- Full Connection

CHAPTER 7

SOFTWARE TESTING

Software testing is an investigation conducted to provide stakeholders with information about the quality of the product or service under test. Software testing can also provide an objective, independent view of the software to allow the business to appreciate and understand the risks of software implementation. Test techniques include, but are not limited to, the process of executing a program or application with the intent of finding software bugs.

Software testing can be stated as the process of validating and verifying that a computer program/application/product:

- Meets the requirements that guided its design and development
- Works as expected
- Can be implemented with the same characteristics
- Satisfies the needs of stakeholders.

Software testing, depending on the testing method employed, can be implemented at anytime in the development process. Traditionally most of the test effort occurs after the requirements have been defined and the coding process has been completed, but in the Agile approaches most of the test effort is on-going. As such, the methodology of the test is governed by the chosen software development methodology. Different software development models will focus the test effort at different points in the development process.

Newer development models, such as Agile, often employ test-driven development and place an increased portion of the testing in the hands of the developer, before it reaches a formal team of testers. In a more traditional model, most of the test execution occurs after the requirements have been defined and the coding process has been completed.

7.1 Types of Testing

- Unit Testing

Unit testing, also known as component testing refers to tests that verify the functionality of a specific section of code, usually at the function level. In an object-oriented environment, this is usually at the class level, and the minimal unit tests include the constructors and destructors. These types of tests are usually written by developers as they work on code (white-box style), to ensure that the specific function is working as expected. One function might have multiple tests, to catch corner cases or other branches in the code. Unit testing alone cannot verify the functionality of a piece of software, but rather is used to assure that the building blocks the software uses work independently of each other. In our project we will test following modules separately. Module for unit testing will be

- Integration Testing

Integration testing is any type of software testing that seeks to verify the interfaces between components against a software design. Software components may be integrated in an iterative way or altogether. Normally the former is considered a better practice since it allows interface issues to be localised more quickly and fixed. Integration testing works to expose defects in the interfaces and interaction between integrated components (modules). Progressively larger groups of tested software components corresponding to elements of the architectural design are integrated and tested until the software works as a system. To combine the modules below and combine test full system.

- GUI Testing

GUI testing is a process to test application's user interface and to detect if application is functionally correct. GUI testing involves carrying set of tasks and comparing the result of same with the expected output and ability to repeat same set of tasks multiple times with different data input and same level of accuracy. GUI Testing includes how the application handles keyboard and mouse events, how different GUI components like menu bars, toolbars, dialogs, buttons, edit fields, list controls, images etc. reacts to user input and whether or not it performs in the desired manner. Implementing GUI testing for your application early in the software development cycle speeds up development improves quality and reduces risks towards the end of the cycle. GUI Testing can be performed both manually with a human tester or could be performed automatically with use of a software program. TO test whether Project GUI is properly managed as per flow in use case diagram. To test all controls of In GUI testing check weather .Net module GUI is been Working properly as per blind user. To check all controls used in designing our project is been working properly

7.2 Test Cases and Test Results

Sr. No	Description	Expected Result	Actual Result	Test Result
1.	Face Detection	Green Fame for face detection.	Green Fame for face detection.	Pass
2.	Check if user is wearing mask or not.	Show accuracy in percentage that user is wearing mask.	Showing accuracy in percentage that user is wearing mask.	Pass
3.	Detecting of Multiple user who are wearing mask or not.	Detect multiple user and shows accuracy in %.	Detected multiple user and showing accuracy in %	Pass
4.	Check inputs to the System are working or not. Input such as Image, or Real-time through Camera.	Inputs should be working.	Inputs are working.	Pass
5.	When distance between user and camera is more, it should detect and show accuracy.	Should show the accuracy and detect the mask.	System is not detecting from long range.	Fail
6.	Check if mask is covering nose or not.	It should show variance in accuracy.	It is showing variance in accuracy.	Pass
7.	Check if user is not wearing mask.	It should show Red-Frame.	It is showing Red-Frame	Pass

CHAPTER 8

RESULTS

8.1 Outcomes

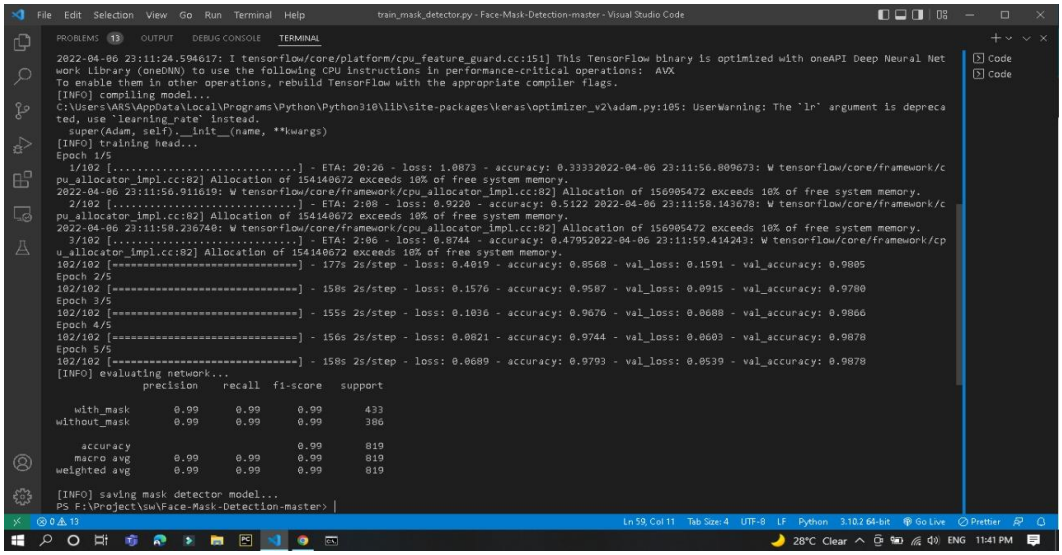


Fig. 8.1 Model Training

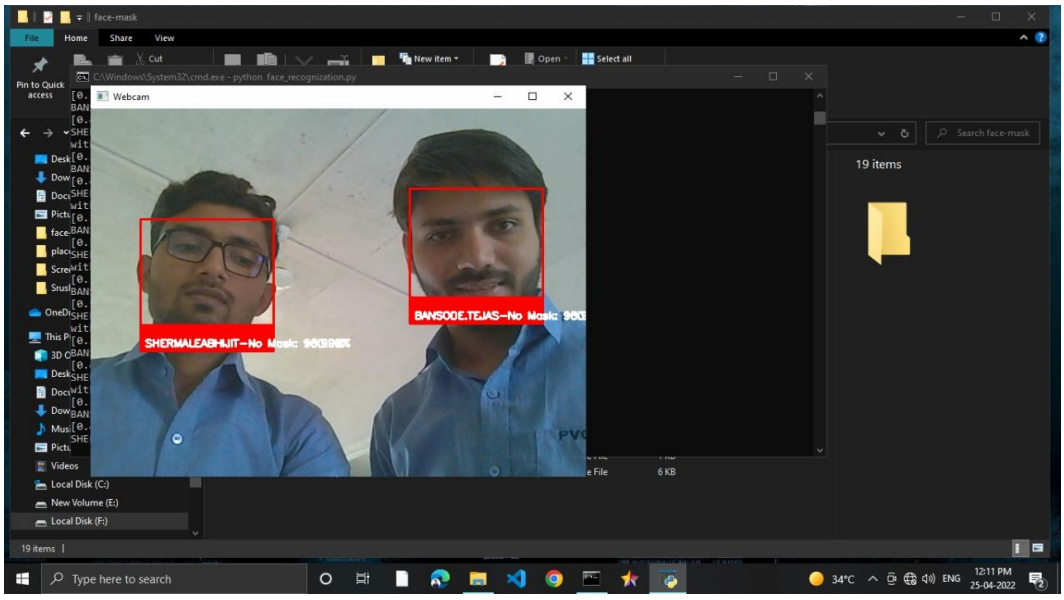


Fig 8.2. Not Wear Mask

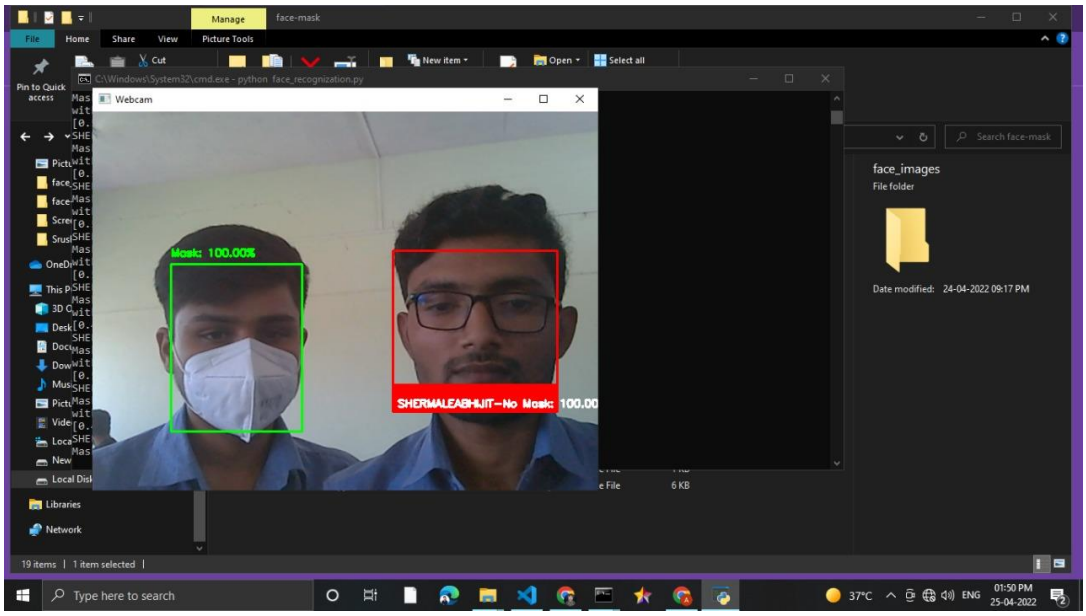


Fig. 8.3 Wear Mask

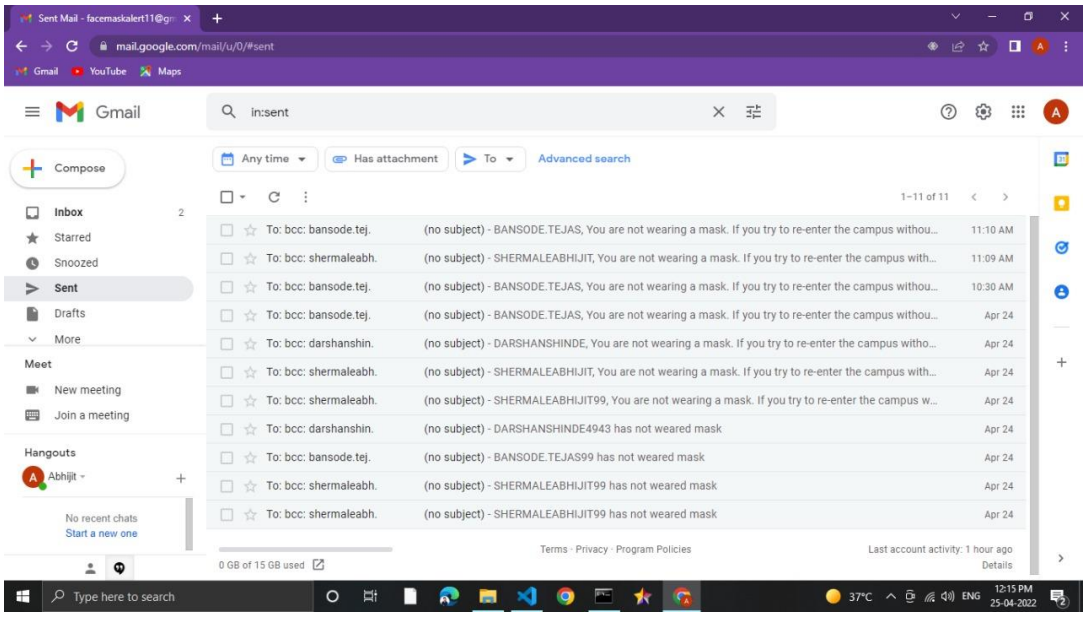


Fig. 8.4 Sender’s Mail

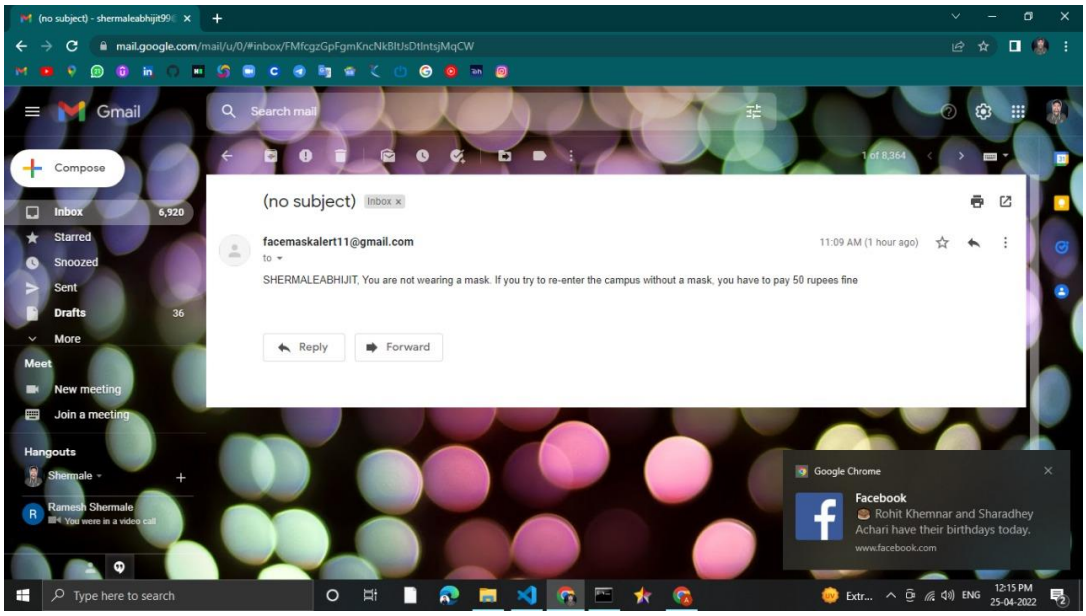


Fig. 8.5 Receiver’s Mail

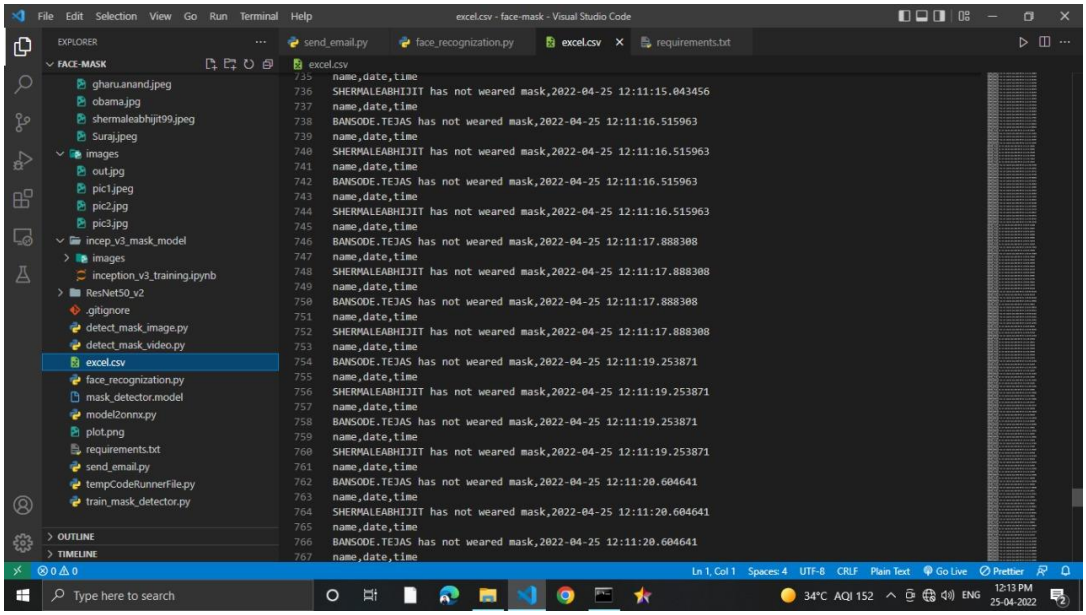


Fig. 8.6 Record Generation

CHAPTER 9

CONCLUSION

9.1 Conclusion

We have developed the system which can monitor the area through the real-time camera, without any additional devices. The proposed system is a simple real-time video analyser. It has the potential to check whether the people wear masks or not. It can be installed in any supermarkets and public places. This helps us to defeat the widespread of COVID-19 virus. Because wearing masks reduces the community spread of COVID-19 virus.

We can use this for many other options like checking and verifying all the customers have wearing facemask. The system thoroughly checks the persons who enter through the main gate. We can process the video recorded and find whether the person is wearing a facemask or not. If the person wears his/her facemask, the door will open; otherwise it may say some error command like "please wear your facemask".

9.2 Future Work

- We will try for sanitization tunnel .
- We will create database for each person.

9.3 Applications

- Airports

  The Face Mask Detection can be used at airports to detect travellers without masks. Face data of travellers can be captured in the system at the entrance. If a traveller is found to be without a mask, their picture is sent to the airport authorities so that they could take quick action. If the person's face is already stored, like the face of an airport worker, it can send the alert to the worker's phone directly.

- Hospitals

  Using Face Mask Detection System, Hospitals can monitor is their staff wearing masks in their shift or not. If any health worker is found without a mask, they will receive a notification with a reminder to wear a face mask. Also, if quarantine people who are required to wearing a mask, the system can keep an watch and detect if the mask is present or not and send notification automatically or report to the authorities.

- Offices

  Offices can be used the Face Mask Detection System to detect is people are maintaining safety standards at work or not. It monitors employee without masks and sends them a reminder to wear a face mask. The reports can be downloaded or sent an email at the end of the day to capture people who are not accepting with the regulations or the requirements.

9.4 Appendix A

NP Type

In computational complexity theory, NP (nondeterministic polynomial time) is a complexity class used to classify decision problems. NP is the set of decision problems for which the problem instances, where the answer is "yes", have proofs verifiable in polynomial time by a deterministic Turing machine.

There are two types of NP:

1. NP Hard

A problem is NP-Hard if an algorithm for solving it can be translated into one for solving any NP-problem (non deterministic polynomial time) problem. NP-hard therefore means "at least as hard as any NP-problem," although it might, in fact, be harder.

2. NP Complete

In computational complexity theory, a problem is NP-complete when it can be solved by a restricted class of brute force search algorithms and it can be used to simulate any other problem with a similar algorithm.

P Type

A problem is assigned to the P (polynomial time) class if there exists at least one algorithm to solve that problem, such that the number of steps of the algorithm is bounded by a polynomial in n, where n is the length of the input.

9.5 Appendix B: Details of paper Publication

Journal Publication of International Research for Engineering and Management (JOIREM)

Volume: 10 Issue: 04 | may-2022

FACE MASK DETECTION SYSTEM USING AI

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Abstract :- In current pandemic, Covid-19 has created United States understand the importance of Face Masks and that we ought to perceive the crucial effects of not carrying one, currently over ever. Right now, there aren't any mask detectors put in at the jammed places, however we tend to believe that it's of utmost importance that at transportation junctions, densely inhabited residential district, markets, academic establishments and care areas, it's currently vital to line up mask detectors to make sure the security of the general public. during this paper we've tried to make a 2 phased mask detector which can be simple to deploy at the mentioned shops. With the assistance of pc Vision, it's currently attainable to sight and implement this on massive scale. we've used CNN for the implementation of our model. The implementation is completed in Python, and also the python script implementation can train our mask detector on our selected dataset victimization TensorFlow and Keras. we've side additional sturdy options and trained our model on numerous variations, we tend to created bound to have massive varied and increased dataset so the model is in a position to obviously, determine and detection the face masks in real time videos. The trained model was tested on each time period videos and static footage and in each the cases the accuracy was over the opposite designed models.

1) Introduction :-

In the last few years, we have seen Science and Technology advancing so much that now we are at a stage where, we know that with the right knowledge of the technology, the humans can achieve things that seemed nearly impossible just a few decades ago. Now, we have the advancing technologies and knowledge of Machine Learning and Artificial Intelligence, which has been proven to ease our lives from the micro levels to big impossible tasks. In the last few years, there has been a rise in the onset of algorithms that have been proven to be the solution to our complex, life threatening problems. One such field is the image and object detection, which has helped us find and spot people and things with just one click. Computer Vision plays a crucial role in our lives now. Who would have thought that while sitting in one city you can easily spot the people in the other cities? It's almost unimaginative how Computer vision is now a very innovative aspect of the technology. In 2019, the whole world witnessed the onset of the deadly Corona Virus, which now, still after almost a year has not left us and is still making the human race fight for its existence. In between the survival fights, we have realized how technology is very much our only life saver. From extensive internet facilities to 24/7 services online, technology has been our true companion in these hard times. But even when we have everything present at one click, there can't be no lives outside. In the past few months every country, every state has found its own new norms to fight the pandemic. And no matter what we do, we do need to step outside to survive. Schools, Offices, Colleges, Markets, Transportation, are the few crucial check points for any country. As much as we ask the public to be safe, the people miss their [without any restrictions lives. And so, it is now very important to closely watch the public and make them understand the importance of the tiny and small details of survival kit. "FACE MASK DETECTION SYSTEM USING AI" One such crucial factor is the extensive usage of face masks in our lives. Studies have proven that with the help of use of face masks, we can lower the chances of catching the Corona Virus by 80 to 85%, if it's used properly. But, even so, it is nearly impossible to enforce the face masks

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completely on the human race. With the help of AI and Computer Vision, we have the best chance at enforcing the mask policy on the humans. With the help of our system, we aim on detecting the presence of face masks on static images and real time videos. Object detection, Classification, Regression, image and object tracking and analysis are our key aspects of the paper. We are aiming at a two phased CNN face mask detector. The first phase is the training phase wherein we have trained our model and the second phase the application, where the masks are detected with "with" or "without masks" tags. Other than the images we also aim to implement this on the real time videos, where the real time faces are detected, tracked and the data about the faces with or without masks is returned. Our paper can be of crucial help at the Stations, airports, Markets, Hospitals, Offices, Schools and many more, where the crowd can be monitored in real time.

2) LITERATURE REVIEW:-

The existing models have used deep learning but they lack the variation in the dataset which means that their model is not that efficient when it comes to real time images and videos. Deep learning technique has been useful for big data analysis work focuses on some commonly implemented deep learning architectures and their applications. Deep learning can be used in unsupervised learning algorithms to process the unlabelled data. A CNN model for speedy face detection has been introduced by Li et al that evaluates low resolution an input image and discards non-face sections and accurately processes the regions that are at a greater resolution for precise detection. Our model is a trained custom deep learning and computer vision model which can detect if a person is wearing a mask or not. Our model has not used morphed or unreal masked pictures in the dataset. Our model is very accurate as we have used MobileNetV2 architecture, it has made the model computationally efficient too. This made it easier to deploy the model to embedded system. We can use this face mask detection system in places that require face mask detection in view of the current pandemic. The model can be deployed at Airports, Railway Stations, Offices, Schools and other public places.

3) PROPOSED WORK:-

The goal of the face mask detection system is to detect whether a person is wearing a face mask or not, warn authorities, and impose penalties on the person before sending a message to that person's mobile phone in order to reduce the spread of COVID-19. This system uses a Convolutional Neural Network (CNN) to analyse images captured by CCTV and classify whether or not people are wearing masks.

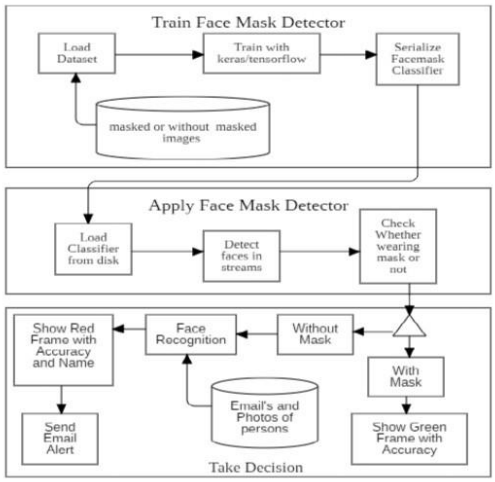

Fig 1. Architecture of Proposed System

CNN plays a vital part in computer vision related instances in pattern recognition. To remove top-level features, CNN uses convolution parts to blend with the primary pictures. The recommended starting network allows the network to become acquainted with the kernel mix. Planning to construct a good Convolutional Neural Network architecture is still a primary concern. K. He et al. suggested Residual Network (ResNet), which may use personality planning from the previous layer, to construct a much more advanced neural network. Because article locators are typically carried on portable or embedded devices with limited computational resources, Mobile Network (MobileNet) is proposed. This

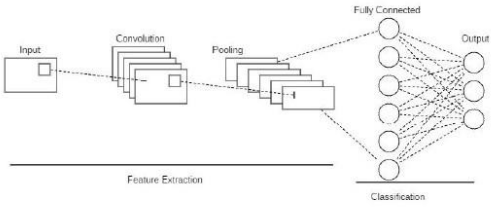

Fig 2-Convolutional Neural Network

Convolutional Layer:-

It is the fundamental block of CNN. Convolution is basically the fusion of two functions to receive another function. Here. the input data, which is a four-

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dimensional tensor (number of images. height. width and number of channels) is convolved with a convolutional filter called kernel to obtain the convolved feature. It has been utilized to remove features using back propagation with the removed feature can be used for pattern recognition. The result of the convolutional layer is turned to be a feature map. The attributes which are followed in CNN are convolution filter with width and height, sum of input and output channels. convolution filter depth and convolution operations.

Pooling Layer:-

The obtained feature map is influenced by the area of features in the input. This sensitivity can be overtaken in which the feature map requires down sampling of features. This makes the resulting feature map more speed to the variations in bearings of the aspect in the image. Pooling operations can be applied to make calculations faster, reducing the dimensions of the input matrix except any loss in aspect by summing up the existence of aspects in the feature map. This average presence of an aspect is summed up using two types of pooling methods. One is Average pooling and the other is maximum pooling also called Max pooling. In this paper, average pooling has been implemented. This pooling function sums up the average of all the values in the current kernel region and turns up a single value as the result. Average Pooling Layer is put in 2×2 patches of the feature map with a pace of (2, 2). This process includes summing the average for each patch of the feature map. Which is meant that every 2-2 square of the feature map is sampled down to an average value in the square.

Flatten Layer:

Flatten layer combines all available native aspects of the preceding convolutional layers without affecting the batch size. Every feature map channel in the outer of a CNN layer is a result of multiple 2-D kernels which are developed from each channel of the input layer and stacked to form a "flattened 2-D array. This layer converts a two-dimensional feature of a matrix into a one-dimensional array of vectors which is given into a fully connected neural network classifier. The tf.keras.layers. Flatten function reforms the tensor to a shape which will be equal to the sum of elements present in the tensor.

Fully-connected Layer:

The fully connected layers are added in the model and they have complete connections to activation layers. In this layer all the inputs are connected to the activation unit of the upcoming layer. The given images are classified as multi class and the activation function which is used in layers and they give out the result of estimated output classes in terms of probability.

Dataset:-

The collection is made up of 3918 photos separated into two categories: faces with masks and faces without masks. Faces without masks is a Kaggle dataset that comprises faces with diverse skin colours, angles, occlusion, and other features. Faces with masks comprises masks with hands, masks, and other items that cover the face, giving us an advantage when it comes to improving dataset variants.

The second collection contains photographs of persons associated with the organisation where our project is installed. This data is essential for facial recognition and sending emails to certain individuals.

4) MATHEMATICAL MODEL:-

we take a little matrix of numbers (called kernel or filter), pass it over our image, and rework it supported on the values from the filter.

$$\mathbf{G\,[m,n]=(f\times h)\,[m,n]=\Sigma j\Sigma i\ h\,[j,k]\ f\,[m-j,n-k]}$$

Since our image shrinks on every occasion, we tend to perform convolution, we are able to have it off solely a restricted range of times before our image disappears fully,

$$\mathbf{P=(f-1)/2}$$

Instead of shifting the kernel by one pel, we are able to increase the amount of steps. So, step length is additionally treated mutually of the convolution layer

hyper parameters. $nout = floor(1 + \frac{n+2p-f}{s})$

The filter and also the image you would like to it to should have a similar range of channels.

$$[n,n,nc] \times [f,f,nc] = \left[floor\left(1+\frac{n+2p-f}{s}\right), floor\left(1+\frac{n+2p-f}{s}\right), nf\right]$$

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Fig 3 -Dataset With and without face mask

5) MODEL TESTING:-

Our system helps to identify the organizational person if he or she is wearing or not wearing mask

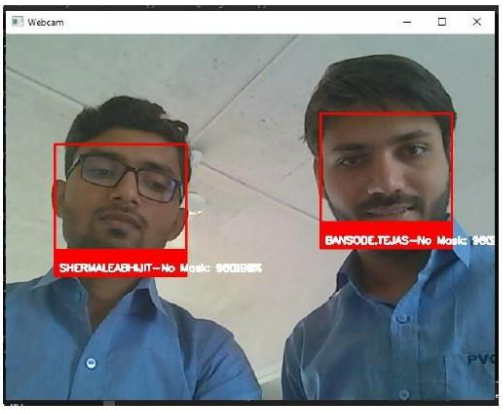

Fig 4 : Face recognition of organizational person

In the above fig System identify the person is not wearing mask and show the output by using red frame, Name of person, accuracy of wearing mask or not.

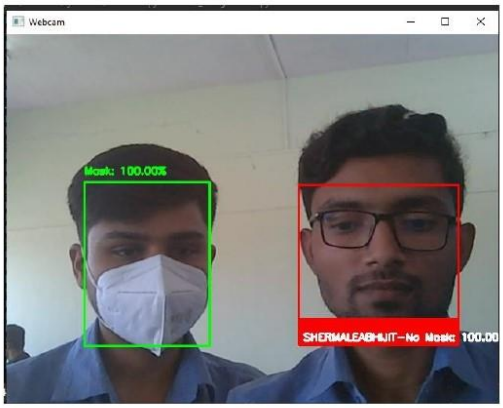

Fig 5 : Mask Detection

The figure above helps to identify whether the person is wearing a mask or not. And email alerts are sent to people who don't wear masks.

Fig 6 :Email alert

The above figure shows an e-mail alert that has been sent to a person who is not wearing a mask.

6) CONCLUSION:-

We have developed the system which might monitor the world through the period of time camera, with none extra devices. The planned system may be a easy period of time video analyzer. It's the potential to examine whether or not the individuals wear masks or not. It will be put in in any supermarkets and public places. This helps America to defeat the widespread of COVID-19 virus. as a result of carrying masks reduces the community unfold of COVID-19 virus. we will use this for several different choices like checking and collateral all the purchasers have carrying facemask. The system completely checks the persons enter through the most gate. we will method the video recorded and notice whether or not the person is carrying a facemask or not. If the person wears his/her facemask, then everything is ok; otherwise it should

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send some email alert message like " You are not wearing a mask. If you try to re-enter the campus without a mask, you have to pay 50 rupees fine"

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9.6 Appendix C : Plagiarism Report

9.6.1 Abstract

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In current pandemic, Covid-19 has made us realize the importance of Face Masks and that we got to understand the crucial effects of not wearing one, now quite ever. Right now, there are no face mask detectors system installed at the crowded places. But we believe that it's of utmost importance that at transportation junctions, densely populated residential district , markets, educational institutions and healthcare areas, it's now vital to set up mask detectors to make sure the security of the general public . In this paper we've tried to create a two phased mask detector which can be easy to deploy at the mentioned outlets. With the assistance of Computer Vision, it's now possible to detect and implement this on large scale. We have used CNN for the implementation of our model. The implementation is completed in Python, and therefore the python script implementation will train our mask detector on our selected dataset using TensorFlow and Keras. We have added more robust features and trained our model on various variations, we made bound to have large varied and augmented dataset in order that the model is in a position to obviously .The trained model was tested on both real-time videos and static pictures and in both the cases the accuracy was quite the opposite designed models.

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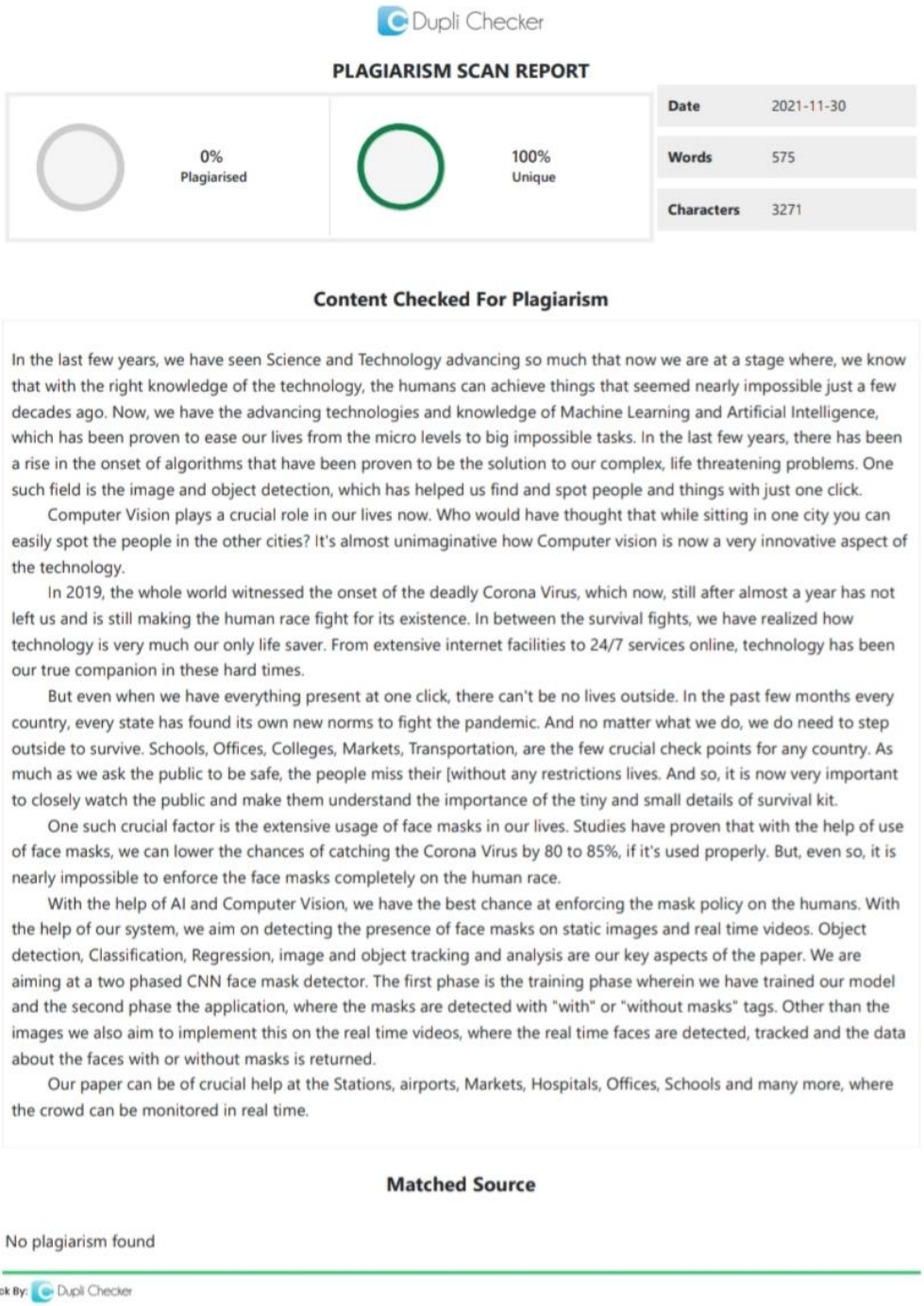
9.6.2 Introduction



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In the last few years, we have seen Science and Technology advancing so much that now we are at a stage where, we know that with the right knowledge of the technology, the humans can achieve things that seemed nearly impossible just a few decades ago. Now, we have the advancing technologies and knowledge of Machine Learning and Artificial Intelligence, which has been proven to ease our lives from the micro levels to big impossible tasks. In the last few years, there has been a rise in the onset of algorithms that have been proven to be the solution to our complex, life threatening problems. One such field is the image and object detection, which has helped us find and spot people and things with just one click.

Computer Vision plays a crucial role in our lives now. Who would have thought that while sitting in one city you can easily spot the people in the other cities? It's almost unimaginative how Computer vision is now a very innovative aspect of the technology.

In 2019, the whole world witnessed the onset of the deadly Corona Virus, which now, still after almost a year has not left us and is still making the human race fight for its existence. In between the survival fights, we have realized how technology is very much our only life saver. From extensive internet facilities to 24/7 services online, technology has been our true companion in these hard times.

But even when we have everything present at one click, there can't be no lives outside. In the past few months every country, every state has found its own new norms to fight the pandemic. And no matter what we do, we do need to step outside to survive. Schools, Offices, Colleges, Markets, Transportation, are the few crucial check points for any country. As much as we ask the public to be safe, the people miss their [without any restrictions lives. And so, it is now very important to closely watch the public and make them understand the importance of the tiny and small details of survival kit.

One such crucial factor is the extensive usage of face masks in our lives. Studies have proven that with the help of use of face masks, we can lower the chances of catching the Corona Virus by 80 to 85%, if it's used properly. But, even so, it is nearly impossible to enforce the face masks completely on the human race.

With the help of AI and Computer Vision, we have the best chance at enforcing the mask policy on the humans. With the help of our system, we aim on detecting the presence of face masks on static images and real time videos. Object detection, Classification, Regression, image and object tracking and analysis are our key aspects of the paper. We are aiming at a two phased CNN face mask detector. The first phase is the training phase wherein we have trained our model and the second phase the application, where the masks are detected with "with" or "without masks" tags. Other than the images we also aim to implement this on the real time videos, where the real time faces are detected, tracked and the data about the faces with or without masks is returned.

Our paper can be of crucial help at the Stations, airports, Markets, Hospitals, Offices, Schools and many more, where the crowd can be monitored in real time.

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9.6.4 SRS Specification

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3.2.1 Maintainability

The system requires minimal maintenance which include updation of persons details, dataset and other dependencies.

3.2.2 Portability

The system is designed keeping portability is the prime motive in the mind and is available on any devices.

3.2.3 Availability

The system is available on all low end to high end pc's.

3.2.4 Accessibility

The interface of the system is designed for only admin and he can accessed with ease.

3.3 External Interface Requirements

3.3.1 Software Interfaces

It allow system to scan images and take the correct decision according to the condition.

3.4 Non Functional Requirements

3.4.1 Performance Requirements

Performance consideration: Scanning latency should be minimal and system not consume extensive processor. It makes use of multithreading to avoid system consuming main U.I thread memory.

3.4.2 Safety Requirements

Privacy: All the data is being stored in secured and encrypted way.

3.4.3 Security Requirements

The credentials of each person is being securely stored into the Firebase Authentication system using hashing.

3.4.4 Software Quality Attributes

1. Usability:

The system is user friendly and easy to use.

a) Learn-ability: The working of the system should be easily understood .

b) Operability : The system should be efficiently operated .

2.Performance Efficiency:

The system should not consume extra CPU Usage and should not hamper overall system performance.

a) Time behaviour :It should behave appropriately and response in minimal time under stated conditions.

b) Resource Utilization : The system gets things done in the right manner with the minimal computing resources.

3.Compatibility:

The system works satisfactorily together on different devices with different hardware and software specifications considering all the basic requirements are satisfied.

a) Coexistence: The system would be visible to everyone as it is designed.

b) Inter-Operability: The system should effectively communicate with other services

4.Reliability:

The reliability of system is judged by providing specifies input and check whether it performance as expected under specified conditions.

a) Availability: the system would be available 24 x 7.

5.Portability: The system is designed keeping portability as the prime motive in the mind it is available on any low-end pc.

a) Install-ability : The system requirement are minimal so it would be installed in any device.

b) Adaptability: The system will adapt itself with all the new versions by providing frequent updates.

3.5 System Requirements

3.5.1 Database Requirements

Image Database: It stored images which will be used to classify masked and without masked person and to detect the face.

3.5.2 Software Requirements (Platform Choice)

Operating System: It requires windows 7 operating system and above version.

Language: Python

IDE: VSCode / Pycharm

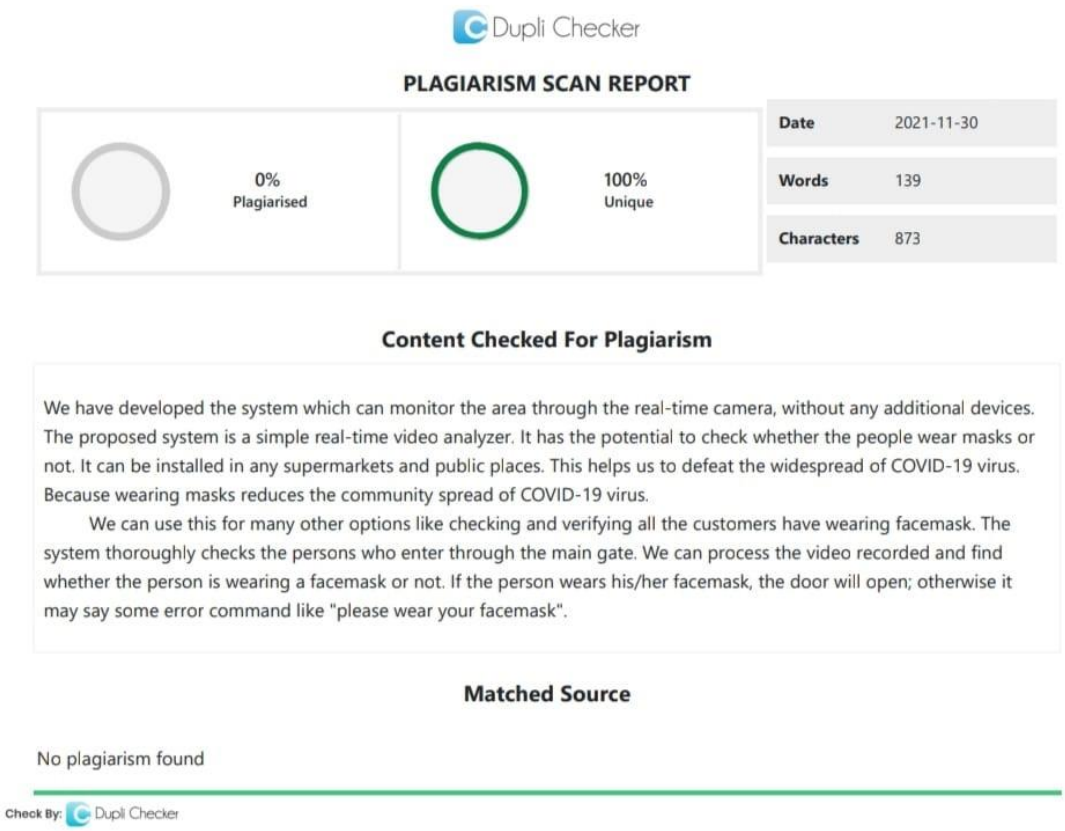
3.5.3 Hardware Requirements:

Processor: Minimum i3 and above

RAM: 1GB or More

HDD: 256 GB or more

9.6.5 Conclusion



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PLAGIARISM SCAN REPORT

Date	2021-11-30
Words	139
Characters	873

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We have developed the system which can monitor the area through the real-time camera, without any additional devices. The proposed system is a simple real-time video analyzer. It has the potential to check whether the people wear masks or not. It can be installed in any supermarkets and public places. This helps us to defeat the widespread of COVID-19 virus. Because wearing masks reduces the community spread of COVID-19 virus.

We can use this for many other options like checking and verifying all the customers have wearing facemask. The system thoroughly checks the persons who enter through the main gate. We can process the video recorded and find whether the person is wearing a facemask or not. If the person wears his/her facemask, the door will open; otherwise it may say some error command like "please wear your facemask".

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