Project final Report

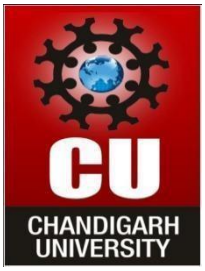
On

Face Mask Detection

Submitted for the requirement of

Project course

BACHELOR OF ENGINEERING
COMPUTER SCIENCE & ENGINEERING



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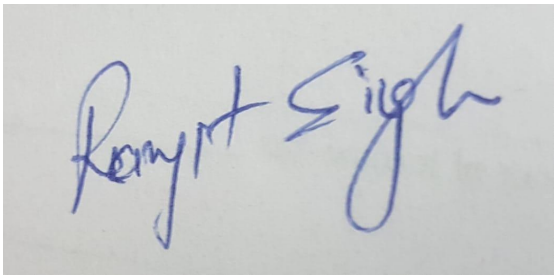

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

CHANDIGARH UNIVERSITY, GHARUAN

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ABSTRACT

The COVID-19 pandemic is causing a worldwide emergency in healthcare. This virus mainly spreads through droplets which emerge from a person infected with coronavirus and poses a risk to others. The risk of transmission is highest in public places. One of the best ways to stay safe from getting infected is wearing a face mask in open territories as indicated by the World Health Organization (WHO). In this project, we propose a method which employs TensorFlow and OpenCV to detect face masks on people. A bounding box drawn over the face of the person describes weather the person is wearing a mask or not. If a person's face is stored in the database, it detects the name of the person who is not wearing face mask and an email will be sent to that person warning them that they are not wearing a mask so that they can take precautions.
Keywords - COVID-19, Tensorflow, OpenCV, Face Mask, Image Processing, Computer Vision

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1. INTRODUCTION

COVID-19 had a massive impact on human lives. The pandemic lead to the loss of millions and affected the lives of billions of people. Its negative impact was felt by almost all commercial establishments, education, economy, religion, transport, tourism, employment, entertainment, food security and other industries. According to WHO(World Health Organization), 55.6 million people were infected with Coronavirus and 1.34 million people died because of it as of November 2020. This stands next to black death which almost took the lives of 60 percent of population in Europe in the 14th century. After the person gets infected, it takes almost fourteen days for the virus to grow in the body of its host and affect them and in the meantime, it spreads to almost everyone who is in contact with that person. So, it is extremely hard to keep the track of the spread of COVID-19. COVID-19 mainly spreads through droplets produced as a result of coughing or sneezing by an infected person. This transfers the virus to any person who is in direct close contact (within one-meter distance) with the person suffering from coronavirus. Because of this, the virus spreads rapidly among the masses. With the nationwide lockdowns being lifted, it has become even harder to track and control the virus. Face masks are an effective method to control the spread of virus. It had been found that wearing face masks is 96% effective to stop the spread of virus. The governments, all over the world, have imposed strict rules the everyone should wear masks while they go out. But still, some people may not wear masks and it is hard to check weather everyone is wearing mask or not. In such cases, computer vision will be of great help. There are no efficient face mask detection applications to detect weather the person is wearing face mask or not. This increases the demand for an efficient system for detecting face masks on people for transportation means, densely populated areas, residential districts, large-scale manufacturers and other enterprises to ensure safety. This project uses machine learning classification using OpenCV and Tensorflow to detect facemasks on people.

MACHINE LEARNING CLASSIFIERS:

These are used to predict the class/target/labels/categories of a given data points. Classification belongs to the category of supervised learning in which the targets are provided with input data. They are used in many applications like medical diagnosis, spam detection, target marketing etc. They use a mapping function (f) from input variables (X) to discrete output variables(Y).

OPENCV:

OpenCV is an open-source library which is primarily used for Computer Vision Applications. This contains many functions and algorithms for Motion tracking, Facial recognition, Object Detection, Segmentation and recognition and many other applications. Images and real time video streams can be manipulated to suit different needs using this library.

TENSORFLOW:

It is an open-source machine learning framework to build and train neural networks. It has a collection of tools, libraries and community resources which helps in easy building of deployment of ML powered applications. This is developed and maintained by Google and was released in 2015

2. RELATED WORK

In [1] the authors used PCA (Principal Component Analysis) method to identify faces with masks, which is essential in the field of security. This is one of the few works which concentrated on detection of human faces where they are wearing masks. They found that the accuracy in human face detection decreases by 70% when a face mask is present.
In [2] the authors have developed a method to identify how a person is wearing the face mask. They were able to classify three categories of facemask-wearing condition namely correct facemask-wearing, incorrect facemask- wearing, and no facemask-wearing. This method achieved over 98% accuracy in detection.
In [3], the researchers proposed a method for the identification of faces using Generalized Intersection over Union (GIoU) based on Mask R-CNN. They proposed this method to reduce the background noise by correctly identifying the face instead of bounding box which adds noise to the face features and reduces the accuracy of detection.
Nicolae-Cătălin Ristea,Radu Tudor Ionescu [4] proposed a novel data augmentation approach for mask detection from speech.Original and translated utterances were changed over into spectrograms were given as inputs to a bunch of ResNet neural organizations with different depths.
In [5] the authors have employed a GAN-based network using two discriminators for the removal of face mask from a face and reconstruct the face without the face mask using the CelebA dataset.

3. METHODOLOGY

- **Dataset Collection:** The dataset was collected from Kaggle Repository and was split into training and testing data after its analysis.

- **Training a model to detect face masks:** A default OpenCV module was used to obtain faces followed by training a Keras model to identify face mask.

- **Detecting the person not wearing a mask:** A open CV model was trained to detect the names of the people who are not wearing masks by referring the database

4. WORKING

This project makes the use of OpenCV,Caffe-based face detector, Keras, TensorFlow and MobileNetV2 for the detection of face mask on humans. The dataset which is being used contains 3835 images out of which 1916 images have people with masks in them and 1919 people without masks in them. First a base model is generated. This is done my using Keras and MobileNetV2. First a base model is generated and a head model is generated on top of that. The head model consists of a network with 128 layers, an activation function of "Relu" and a dropout of 0.5 followed by another network with 2 layers and an activation function "softmax". All these three layers combined, will give out model which will be trained. The generated model is then trained with the labeled dataset by splitting it into two portions. One portion contains 75 percent images and it is used for training. The remaining portion contains the remaining 25 percent of images and is used

for testing the model accuracy. After the model is trained, it can be used for detection of facemask on human faces. The trained model is loaded and image which contains human faces with or without masks or a continuous video stream with humans is given as input. The image or a frame of the video, in case the input is a video stream, is first sent to the default face detector module for the detection of human faces. This is done by resizing the image or the video frame first, followed by detecting the blob in it. This detected blob is sent to the face detector model which outputs only the cropped face of a person without the background. This face is given as the input to the model which we trained earlier. This outputs weather there is a mask or not. Another model is trained with the faces of humans. The images used for the training of the model are provided with the name and email address of that person as the labels of those images. This is done by using Open CV. When an input image is given to the CV model, it detects the face of a person and asks the user to provide the name and email address of that person which will be stored in the database. The output of the first model is given as the input to this model. This face will be compared with the persons present in the database. And if his face matches, then a bounding box will be drawn over his face with his name on it ."Mask" will be present below the bounding box if the person is wearing a mask and "No Mask" if the person is not wearing one.

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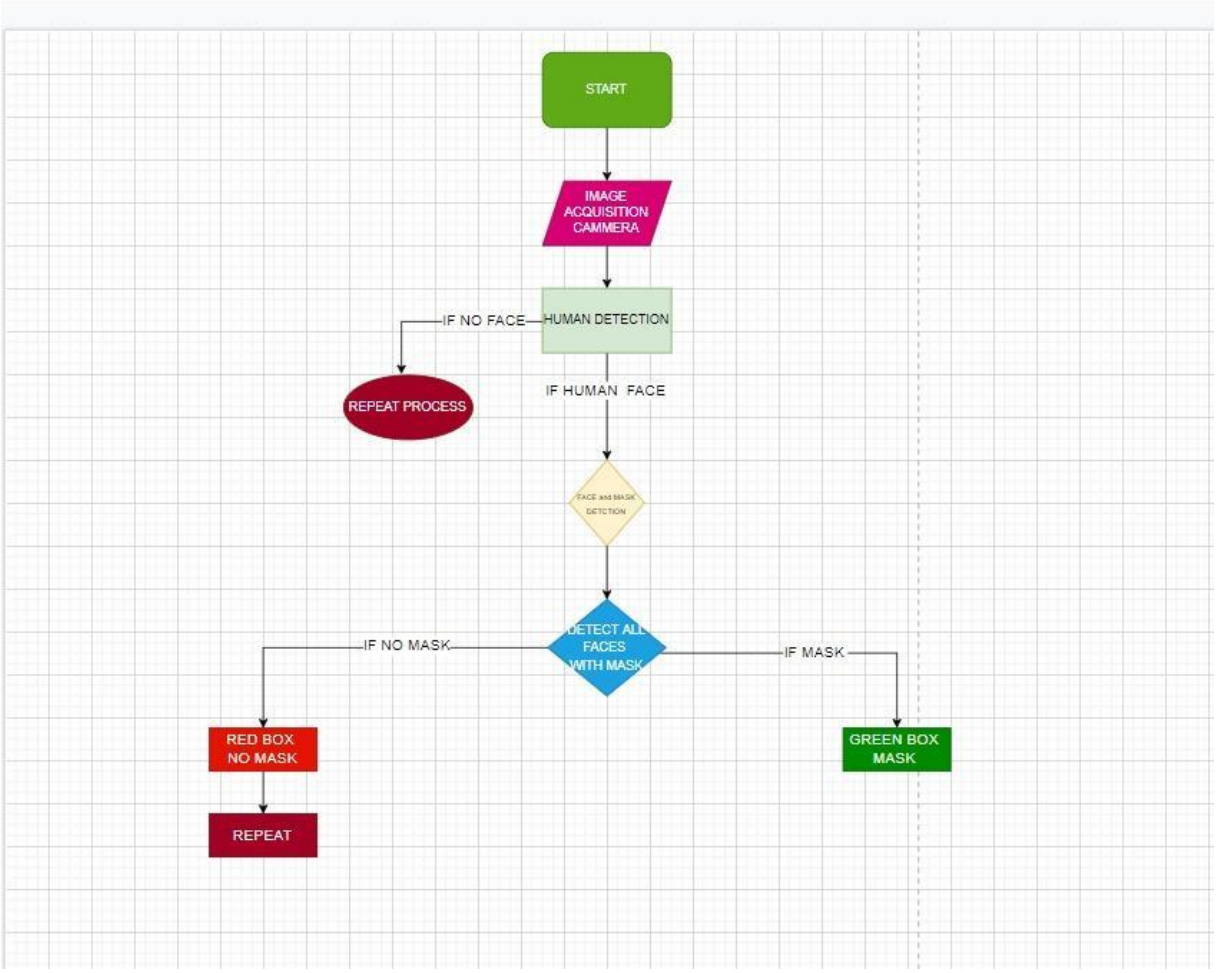

Fig4.1:Flowchart of the Project

5. RESULTS

Fig5.1: When The Person Not Wearing the Mask . A bounding box drawn over the face of the person describes weather the person is wearing a mask or not. If a person's face is stored in the database, it detects the name of the person who is not wearing face mask

Fig5.2:When Person Wearing Mask.A Bounding Box Drawn Over the Face of the Person Describes The Person Wearing Mask

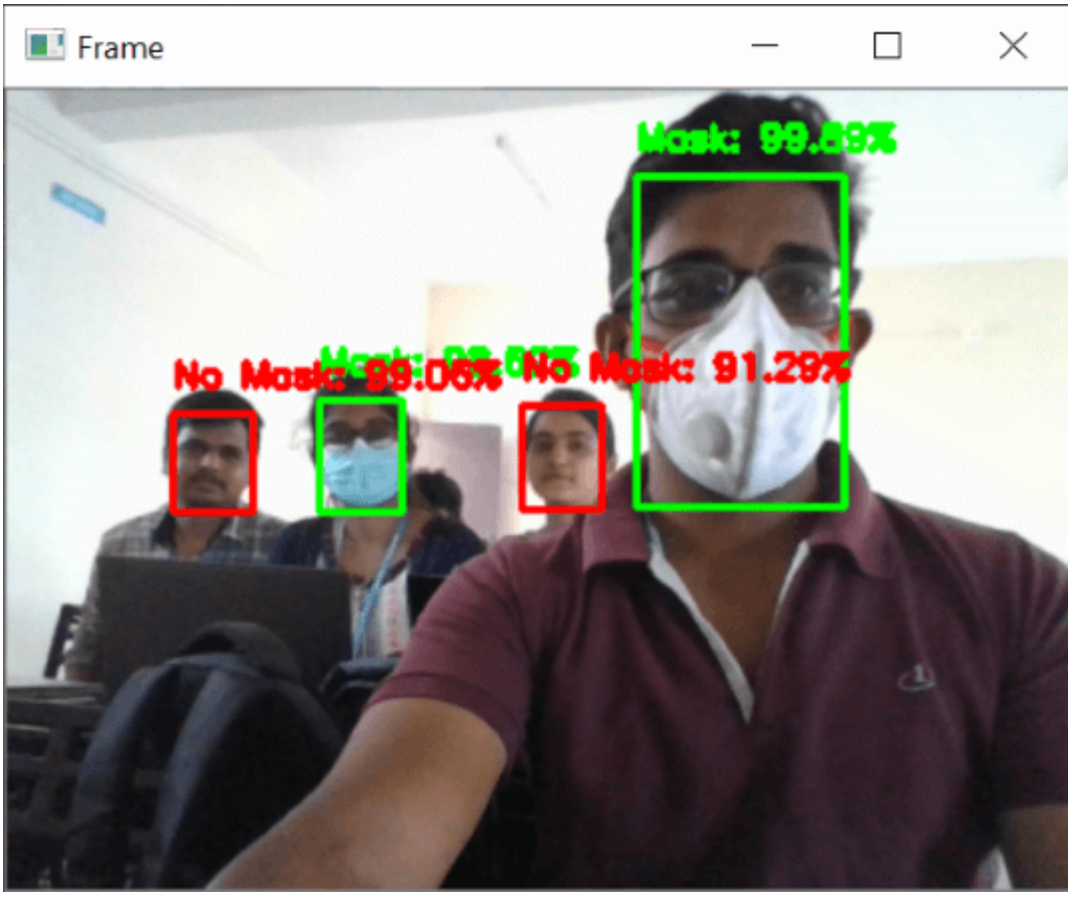

Fig5.3:When a person Identifies the not wearing Mask And those details not in the database it try's Match faces in the database. A bounding box drawn over the face of the person describes weather the person is wearing a mask.

Project management and Professional communication (Presentation):

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INTRODUCTION

- COVID-19 had a massive impact on human lives. The pandemic lead to the loss of millions and affected the lives of billions of people.
- Its negative impact was felt by almost all commercial establishments, education, economy, religion, transport, tourism, employment, entertainment, food security and other industries.
- COVID-19 mainly spreads through droplets produced as a result of coughing or sneezing by an infected person. This transfers the virus to any person who is in direct close contact (within one-meter distance) with the person suffering from coronavirus.
- It had been found that wearing face masks is 96% effective to stop the spread of virus.
- In such cases, computer vision will be of great help.

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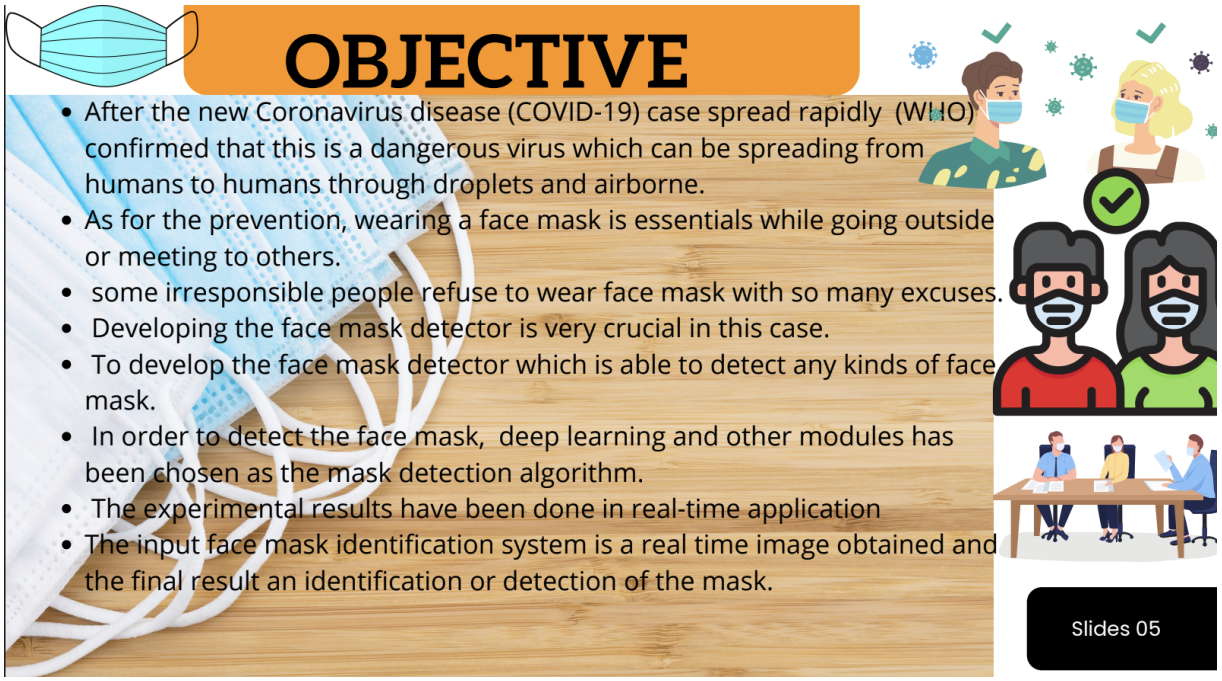

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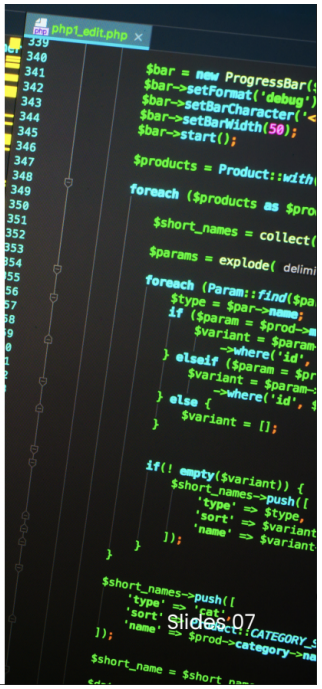
- Python is a high-level, interpreted, general-purpose programming language. Its design philosophy emphasizes code readability. Python is a must for students and working professionals to become a great Software Engineer specially when they are working in Web Development Domain.

- Python works on different platforms (Windows, Mac, Linux, Raspberry Pi, etc).
- Python has a simple syntax similar to the English language.
- Python has syntax that allows developers to write programs with fewer lines than some other programming languages.
- Python runs on an interpreter system, meaning that code can be executed as soon as it is written.



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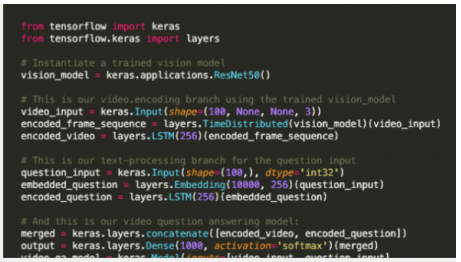
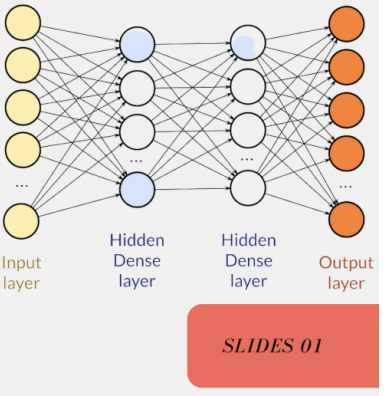


- Keras is an API designed for human beings, not machines.
- Keras follows best practices for reducing cognitive load:
- It offers consistent & simple APIs, it minimizes the number of user actions required for common use cases, and it provides clear & actionable error messages.
- It also has extensive documentation and developer guides
- Keras is a central part of the tightly-connected TensorFlow 2 ecosystem, covering every step of the machine learning workflow, from data management to hyperparameter training to deployment solutions.



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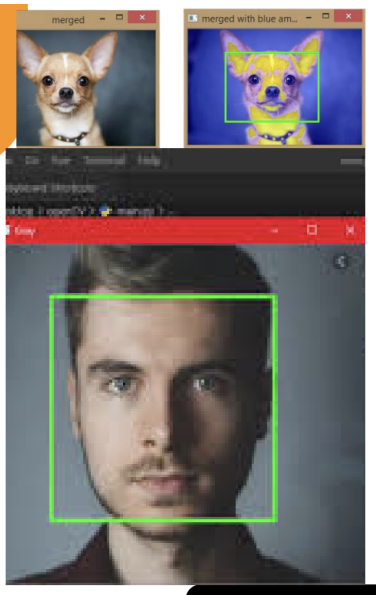
OpenCV

- **OpenCV is a cross-platform library used to develop real time computer vision applications.**
- **OpenCV mainly focuses upon Image Porcessing, Video Capturing and analysis including Face detection and Object Detection**
- **There are a lot of features of OpenCV Library, as follows:**
- **Read and Write Images.**
- **Capture and Save Images.**
- **Processing of Images.**
- **Perform Feature Detection.**
- **Security Applications.**
- **Can be very useful in Surveillance program detecting suspicious activities. Bio metrics like Face detection, iris, eye and Finger print.**



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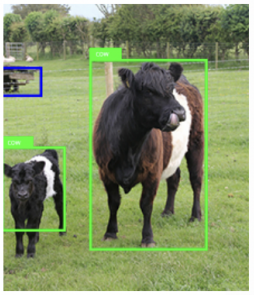
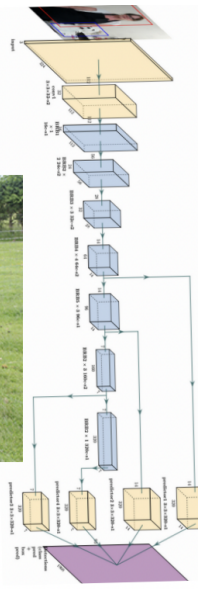
MOBILENET

- MobileNet is a type of convolutional neural network designed for mobile and embedded vision applications.
- They are based on a streamlined architecture that uses depthwise separable convolutions to build lightweight deep neural networks that can have low latency for mobile and embedded devices.
- MobileNets across a wide range of applications and use cases including object detection, finegrain classification, face attributes and large scale geo-localization





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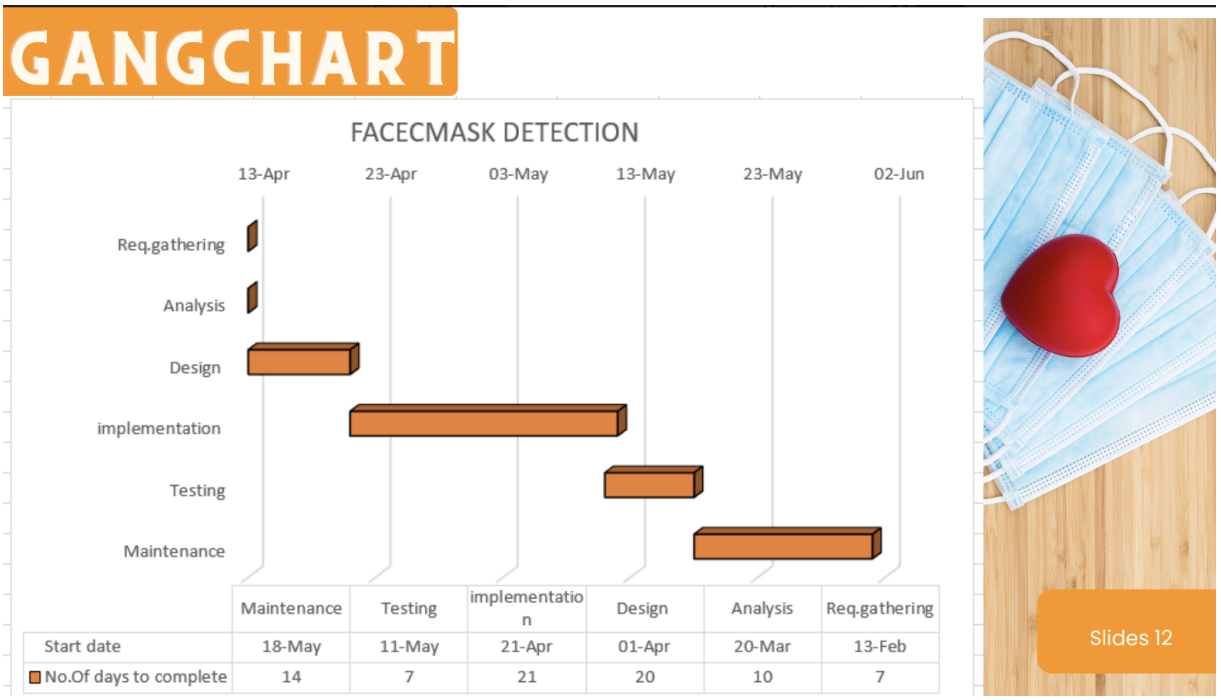

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