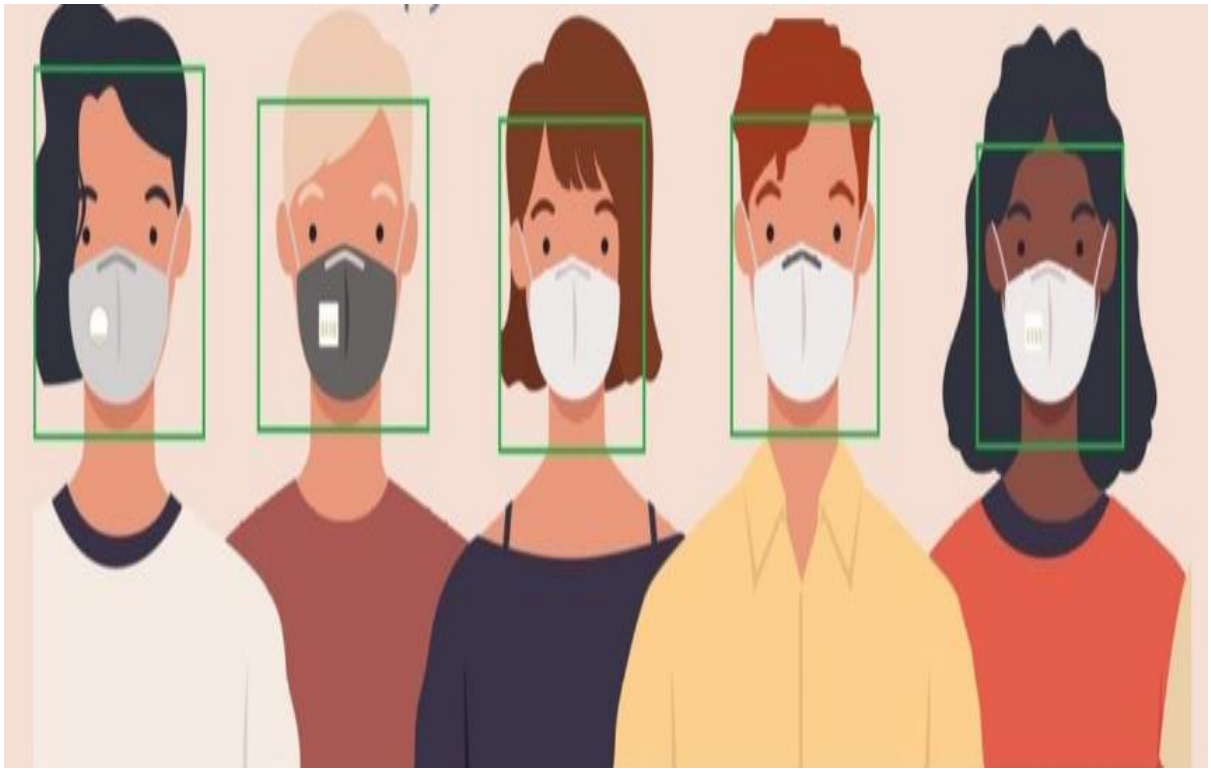
Softwarica College of IT & E-commerce | Coventry University

PROJECT PROPOSAL ON FACE MASK DETECTION SYSTEM USING IMAGE PROCESSING IN PYTHON



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ABSTRACT

The novel Coronavirus had brought a new normal life in which the social distance and wearing of face masks play a vital role in controlling the spread of the virus. But most people are not wearing face masks in public places which increases the spread of viruses. This may result in a serious problem of increased spreading. Hence to avoid such situations we have to scrutinize and make people aware of wearing face masks. Here comes the need for artificial intelligence (AI), which is the main theme of our project. Our project involves the identification of people wearing face masks and not wearing face masks in public places by means of using image processing and AI techniques.

KEYWORDS

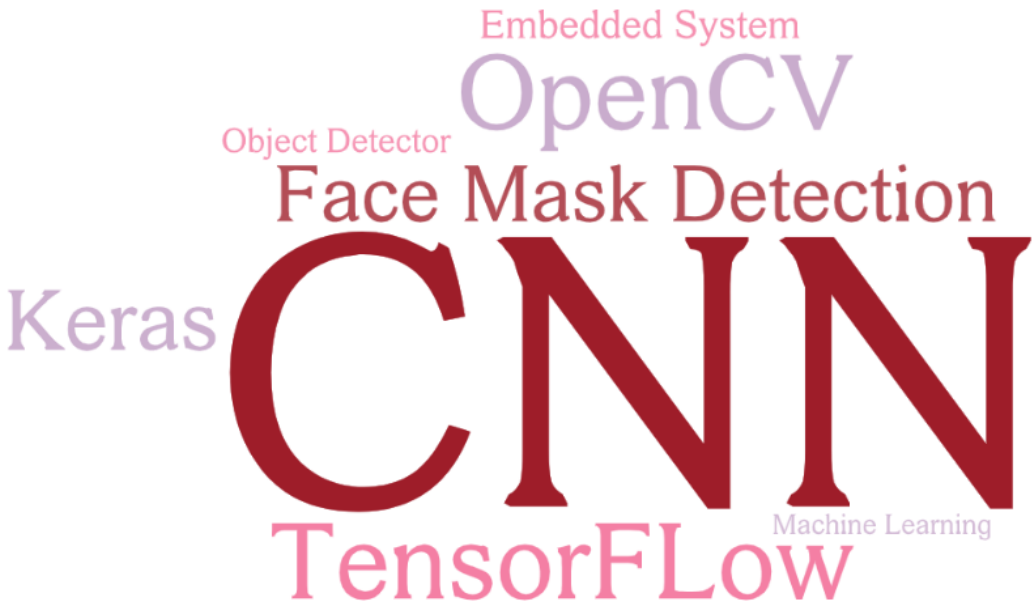

Figure 1: Keywords

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INTRODUCTION

The novel coronavirus covid-19 had brought a new normal life. Nepal was struggling to get out of this virus attack and the government implemented a lockdown for the long way. Lockdown placed pressure on the global economy. So the government gave relaxations in lockdown. Declared by the WHO that a potential speech by maintaining distance and wearing a mask is necessary (resting, 2019). The biggest support that the government needs after relaxation is social distancing and the wearing of masks by the people. But many people are getting out without a face mask which may increase the spread of covid-19.

Figure 2: Face Mask Detection

The face mask detector didn't use any morphed masked images dataset. The model is accurate, and since the architecture is also computationally efficient and thus making it easier to deploy the model to embedded systems (Raspberry Pi, Google Coral, etc.). This system can therefore be used in real-time applications which require face-mask detection for safety purposes due to the outbreak of Covid-19. This project can be integrated with embedded systems for application in airports, railway stations, offices, schools, and public places to ensure that public safety guidelines are followed.

AIM

The goal of the project “Face Mask Detection” is to create a tool that identifies the image of a human that can calculate the probability that he/she wearing a mask or not.

OBJECTIVES

- To search for different papers and documents which will add support to the project.
- To upload the custom-made pictures into the dataset.
- To train the detection system using Keras/TensorFlow.
- To load the mask detector and classify the face with or without a mask.

RESEARCH QUESTIONS

- How can a MobileNet-focused Convolutional Neural Network be used to sort pictures so that facial masks can be found?
- How well the suggested method does work in comparison to other similar methods?
- Does using the dataset lack transparency and informed consent?

MOTIVATION

In recent years, deep learning has gained popularity in machine vision, text analytics, object tracking, and other information processing domains. Most object detection studies employed convolutional neural network models. CNNs are used to detect images, synthesize speech, track objects, and discover an image's threshold. Deep learning does these tasks. CNN is adept at highlighting these picture qualities. In order to better collect picture information and increase classification performance, CNNs are replacing traditional classification techniques. Deep neural networks aren't ideal for mobile face picture categorization since their evaluation step is expensive and time-consuming. We present a MobileNet-based face image classification model that leverages "depth-wise separable convolution" DSC (Depth-wise separable convolution) is used for picture categorization. Depth-wise separable convolution is like regular convolution but utilizes numbers. Convolutions are usually depth-wise or 1x1 point-wise. The Depth-wise convolution layer applies one filter to one pulse and then uses 1x1 point-wise convolution to aggregate the results. Depth-wise separable convolution reduces learnable parameters and test-and-train costs.

PROBLEM STATEMENT

Many health organizations have told people to wear face masks to stop diseases from spreading. All governments are trying to make sure that people wear face masks in public, but it is hard to find people who aren't wearing masks by hand in crowded places. Scientists are working on automatic ways to find and stop people from wearing face masks in public places. Here's a brief summary of the problem: In a mask detection task, when the classification model is given a picture of a face, the picture of the face must be put into a category. Using Convolutions and MobileNet data, we give a fast and accurate way to classify face pictures based on mask detection. This is shown in this work. This project used Depth-wise separable convolution layers instead of traditional convolutional layers to build a model with fewer parameters that could be learned.

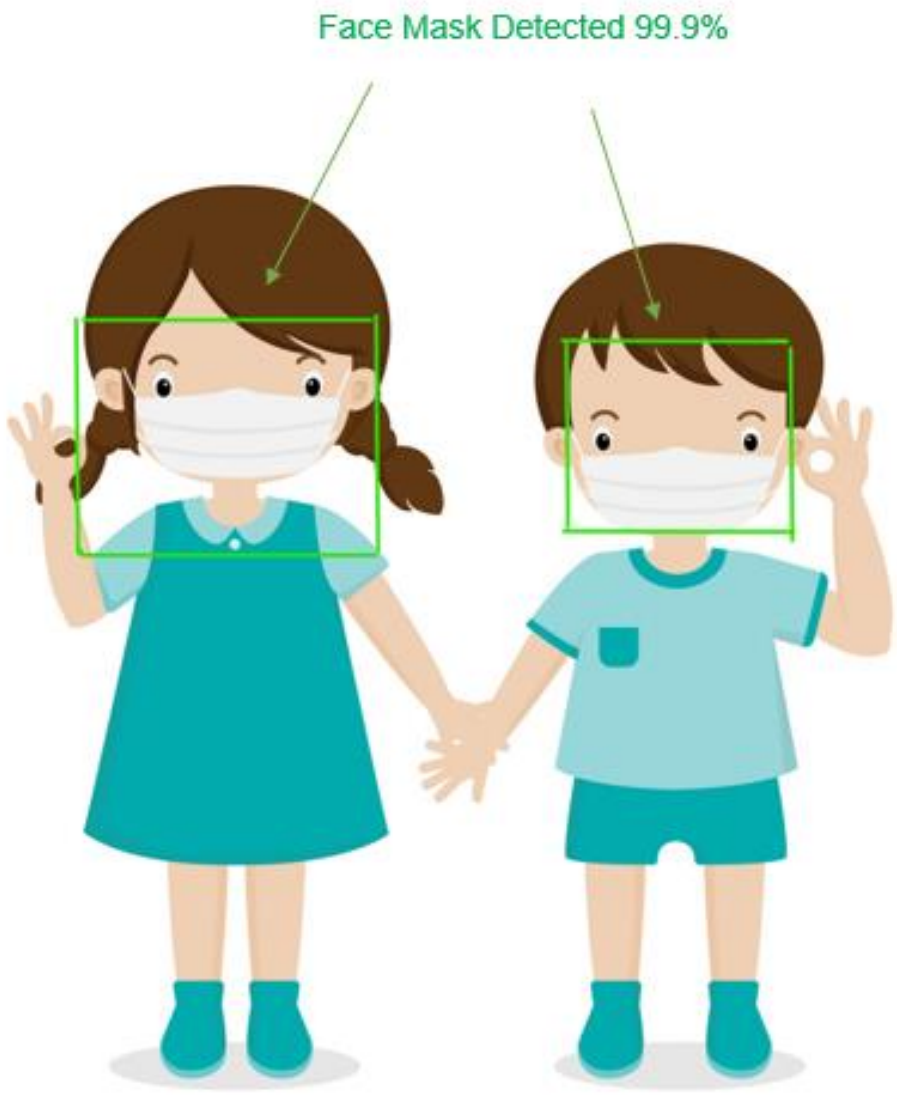


Figure 3: Mask Detection

TWO-PHASE MASK DETECTOR

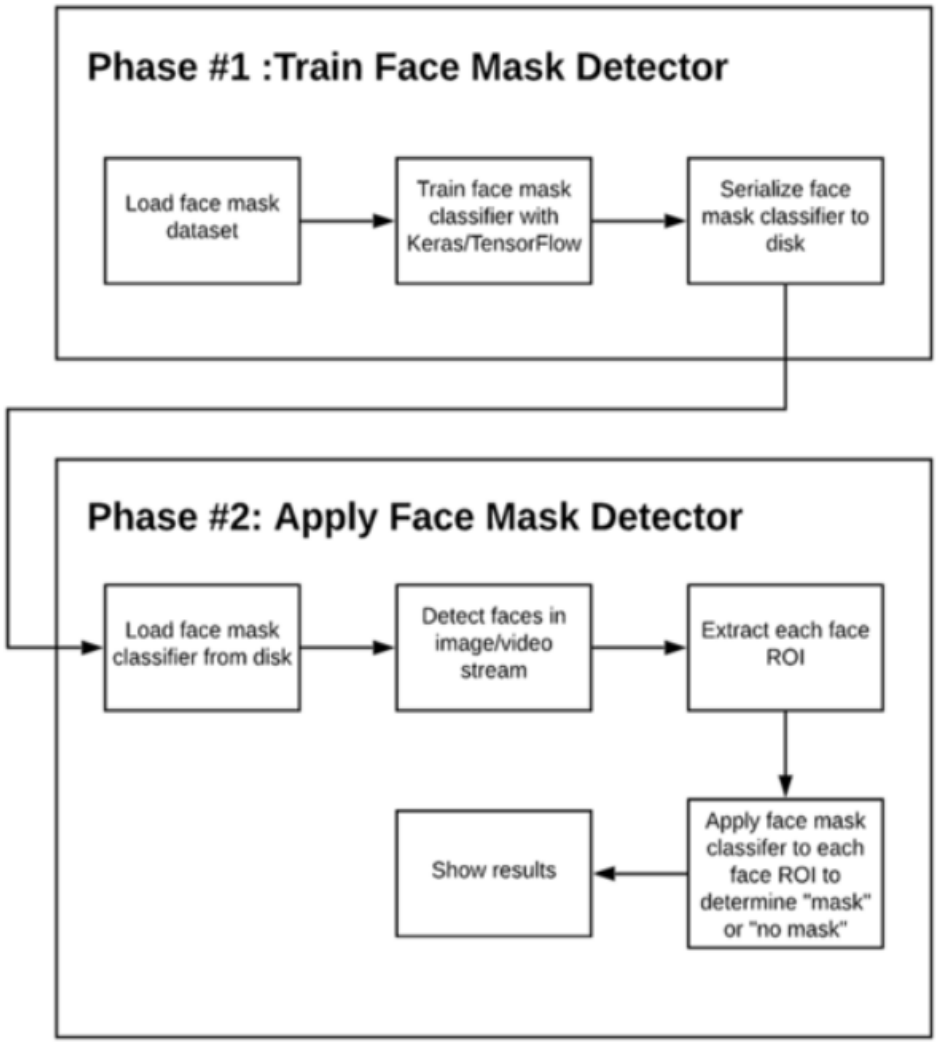


Figure 4: Purposed solution

In order to train a custom face mask detector, we need to break our project into two distinct phases, each with its own respective sub-steps (as shown in figure 3 above):

1. **Training:** Here we'll focus on loading our face mask detection dataset from disk, training a model (using Keras/TensorFlow) on this dataset, and then serializing the face mask detector to disk.

2. **Deployment:** Once the face mask detector is trained, we can then move on to loading the mask detector, performing face detection, and then classifying each face as with mask or without mask.

RESEARCH PLAN

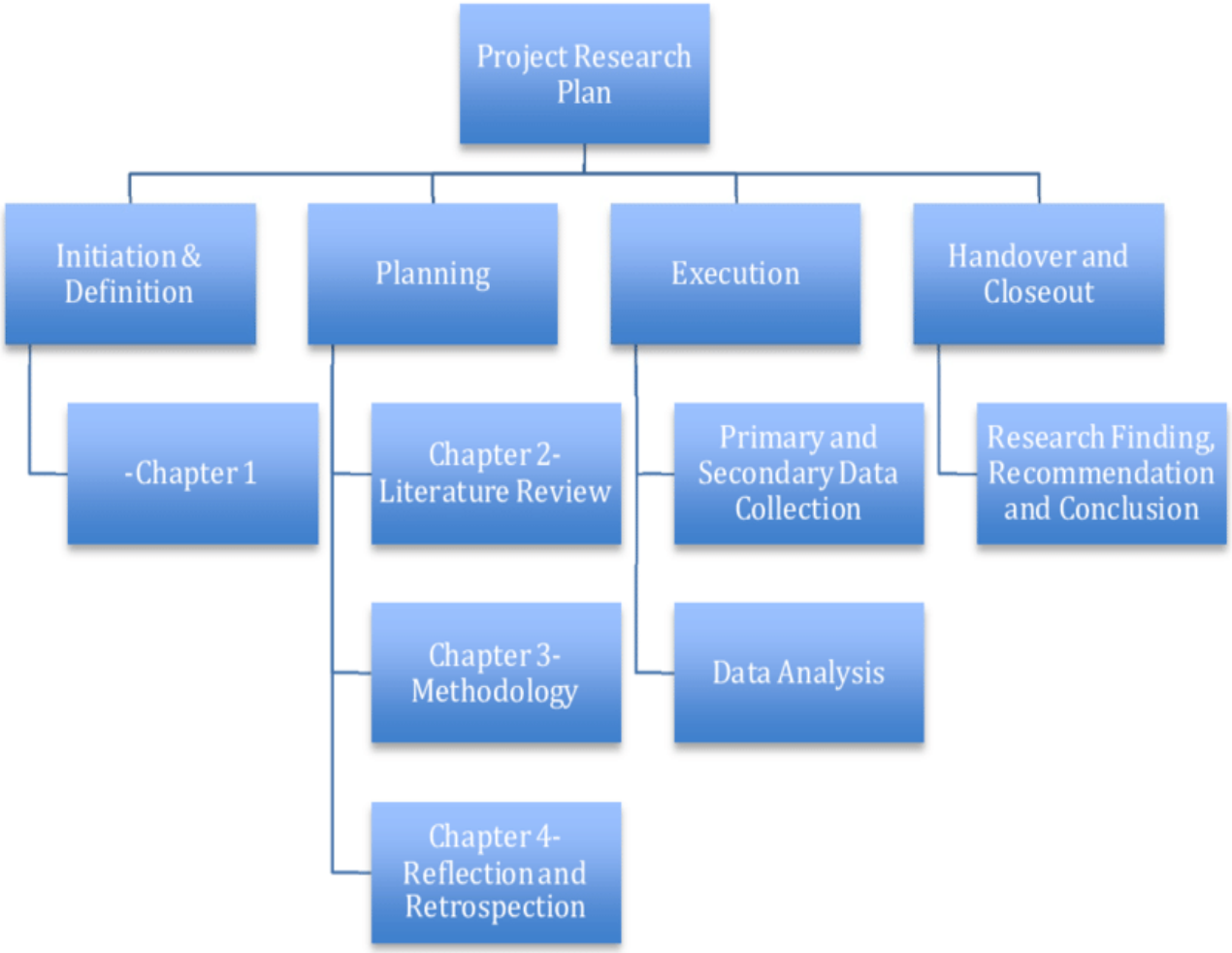


Figure 5: Project research plan

LITERATURE REVIEW

A literature review is a detailed look at everything that has been written about the topic up to this point. Before we can start our own research, we need to look at all of the related topics that have been studied by other researchers. The results of these studies will become our literature review. These give an idea of what the research has found and where it has hit a wall, as well as what steps need to be taken next to make something new.

In SSDMNV2, Preeti Nagrath, Rachna Jain, Agam Madan, and their team came up with a way to find face masks in real time by using deep learning, Keras, TensorFlow, and OpenCV. This team was able to find the Kaggle's Medical Mask Dataset, which is an open-source dataset. Mikolaj Witkowski and Prajna Bhandary were the ones who made the dataset. In the proposed SSDMNV2 model, the team split the image dataset into two groups. In the first group, people with masks were included, while in the second group,

people without masks were included. Using the MobilenetV2 image classifier, they were able to sort their pictures into groups. The MobilenetV2 was chosen because it was easier to set up in real time, even on devices that were already built-in. (Era of Pandemic, 2022). After many tries, the team got results that were accurate 93% of the time and an F1 score of 93%. In general, the SSDMV2 model is very useful and can be used by the government to deploy real-time devices during a pandemic.

Mohamed Loey, Mohamed Hamed N. Taha, Gunasekaran Manogaran, and Nour Eldeen M. Khalifa came up with a way to label and find the objects in real-world images that are medical face masks. Their proposed model had two parts: a process for extracting features using the ResNet-50 deep transfer learning model and a method for detecting medical face masks using YOLO v2. By using the mean IoU, the authors were able to improve how well the detection worked. This helped figure out how many anchor boxes would be best. So, the authors were able to come to the conclusion that using Adam optimizer gave the best accuracy, which was 81% **("with LLE-CNNs", 2022)**.

Sammy V. Militante and Nanette V. Dionisio have proposed a study on how deep learning and Convolutional Neural Networks can be used to recognize face masks in real time (CNN). The study by the authors shows clear and quick ways to spot a face mask. The goal of the study was to tell the difference between people who wear face masks and those who don't. The CNN model was used to train the authors' model, which helped them get a performance accuracy of 96%. Also, the study was a useful tool for stopping the spread of the COVID-19 virus because it could tell who was wearing a face mask and who wasn't. The study can help set alarms to let other people know if someone isn't wearing a face mask.(MASK DETECTION, 2021).

METHODOLOGY

This project was built using the Waterfall Software Development Life Cycle (WF-SDLC). Since this system combines surveillance systems and facial expression systems to make a real-time surveillance system, we knew we had to add collaborative methods to the WF-SDLC because the WFSDLC can't work by itself in a collaborative system. So, the system will be made using the Collaborative Waterfall Software Development Life Cycle (C-WFSDLC). This system was made to be able to tell if someone is hiding their face with a mask. This will help the guards figure out whether or not someone is wearing a mask. The C-WF-SDLC method has six main steps: planning, analyzing, designing, putting the plan into action, testing, and maintaining.

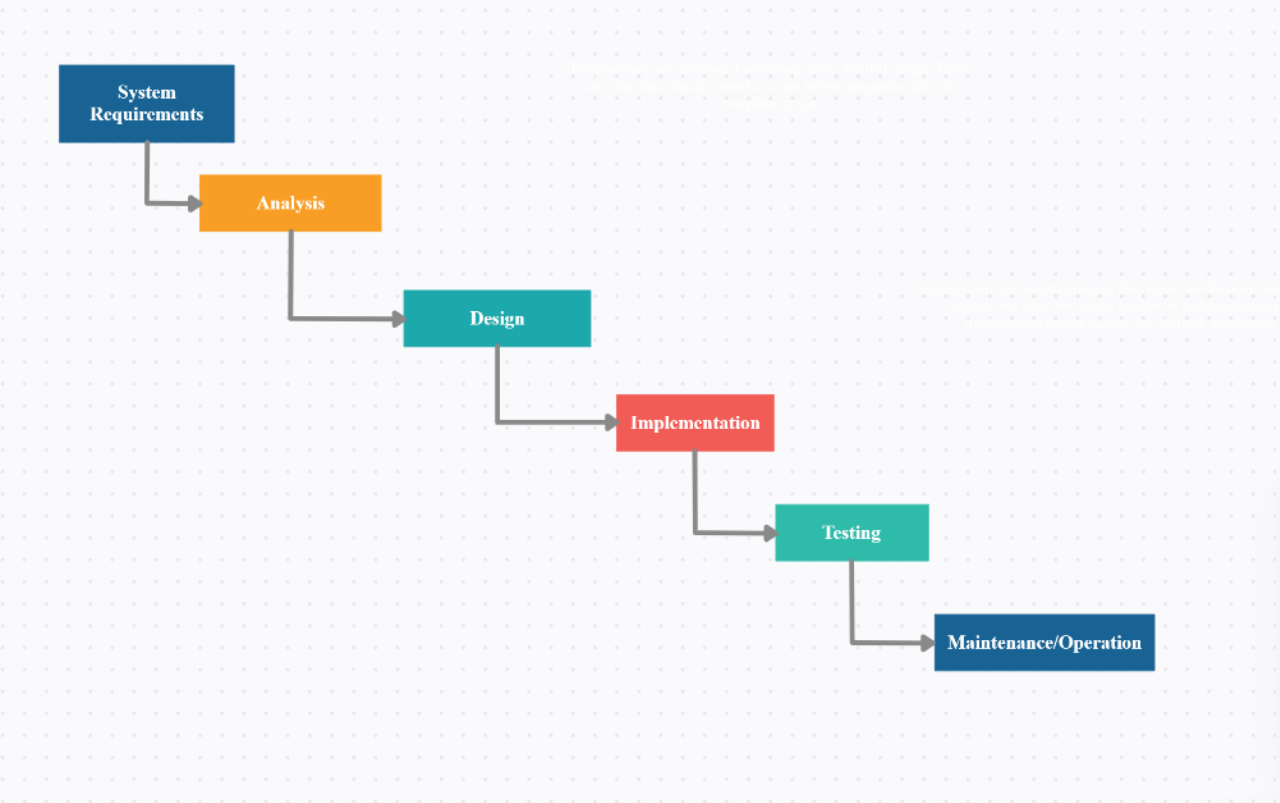


Figure 6: Waterfall Methodology

TOOLS AND TECHNOLOGIES

For the completion of this project, different tools and technologies were needed. Those tools and technologies are mentioned below.

Figure 7: Tools and Technologies

DELIVERABLES

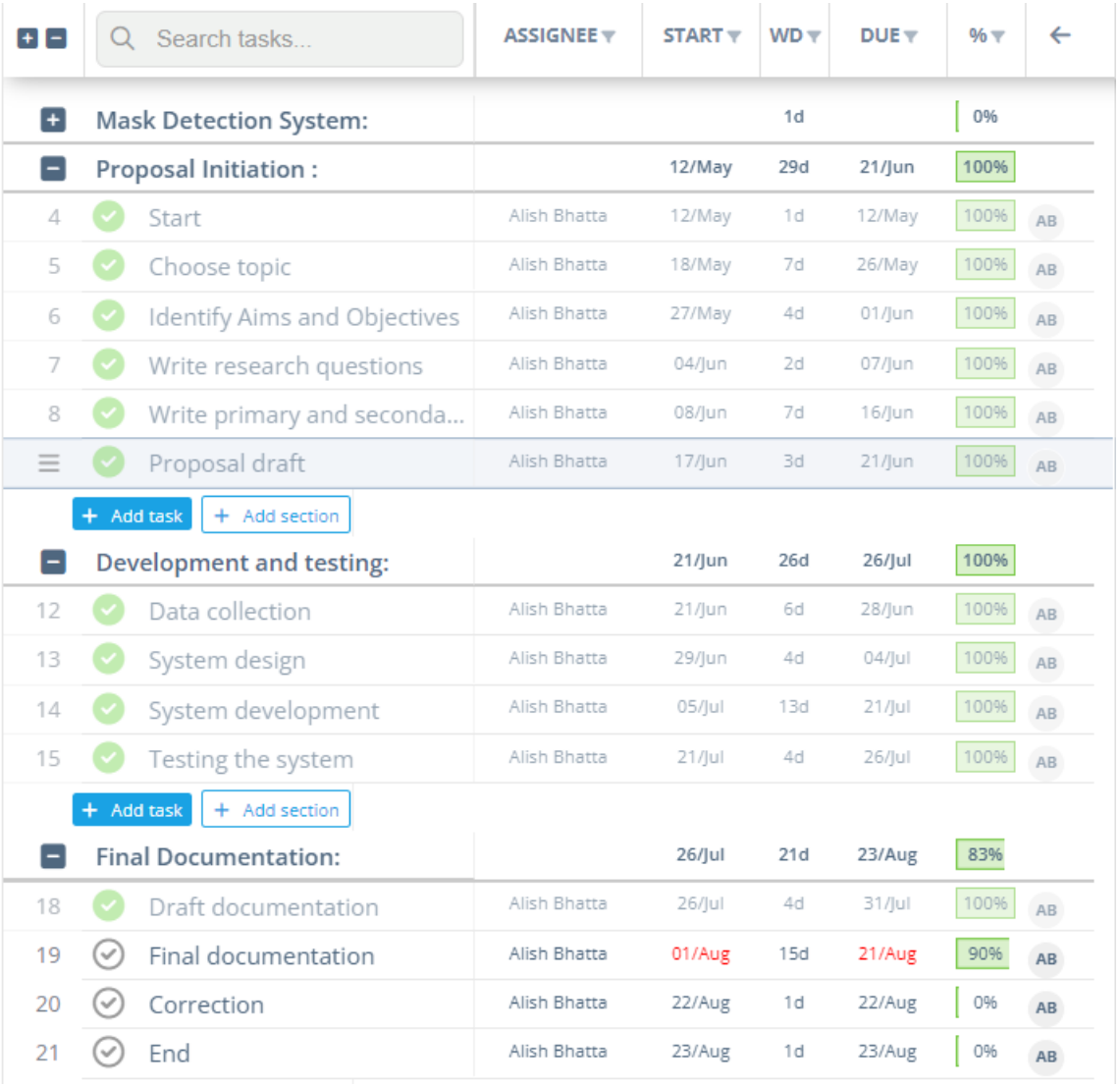
Deliverables are an important part of a project's outcome. There are many deliverables that can be found in a single project. It says what needs to be done by a certain date.

S.N.	Deliverables	Week Number
1.	Project title and project description	1
2.	Research questions	2
3.	Primary, secondary research, and project proposal	3,4
4.	Research results	5,6,7,8
5.	Data collection and analysis	9,10
6.	Product prototype	11,12
7.	Final product	13,14
8.	Documentation	15,16

Figure 8: Deliverables

PROJECT PLAN

A project plan helps to explain how my project will be done and how it will be managed. The plan takes into account risk management and resource management, as well as baselines for the project's scope, and schedule.



		ASSIGNEE	START	WD	DUE	%
	Mask Detection System:			1d		0%
	Proposal Initiation :		12/May	29d	21/Jun	100%
4	Start	Alish Bhatta	12/May	1d	12/May	100% AB
5	Choose topic	Alish Bhatta	18/May	7d	26/May	100% AB
6	Identify Aims and Objectives	Alish Bhatta	27/May	4d	01/Jun	100% AB
7	Write research questions	Alish Bhatta	04/Jun	2d	07/Jun	100% AB
8	Write primary and seconda...	Alish Bhatta	08/Jun	7d	16/Jun	100% AB
	Proposal draft	Alish Bhatta	17/Jun	3d	21/Jun	100% AB
	Development and testing:		21/Jun	26d	26/Jul	100%
12	Data collection	Alish Bhatta	21/Jun	6d	28/Jun	100% AB
13	System design	Alish Bhatta	29/Jun	4d	04/Jul	100% AB
14	System development	Alish Bhatta	05/Jul	13d	21/Jul	100% AB
15	Testing the system	Alish Bhatta	21/Jul	4d	26/Jul	100% AB
	Final Documentation:		26/Jul	21d	23/Aug	83%
18	Draft documentation	Alish Bhatta	26/Jul	4d	31/Jul	100% AB
19	Final documentation	Alish Bhatta	01/Aug	15d	21/Aug	90% AB
20	Correction	Alish Bhatta	22/Aug	1d	22/Aug	0% AB
21	End	Alish Bhatta	23/Aug	1d	23/Aug	0% AB

Figure 9: Project plan with a timeline

GANTT CHART

Gantt charts help to plan my work around due dates and make sure that the right resources are being used. Gantt charts are also used by people who plan projects to keep track of the big picture.

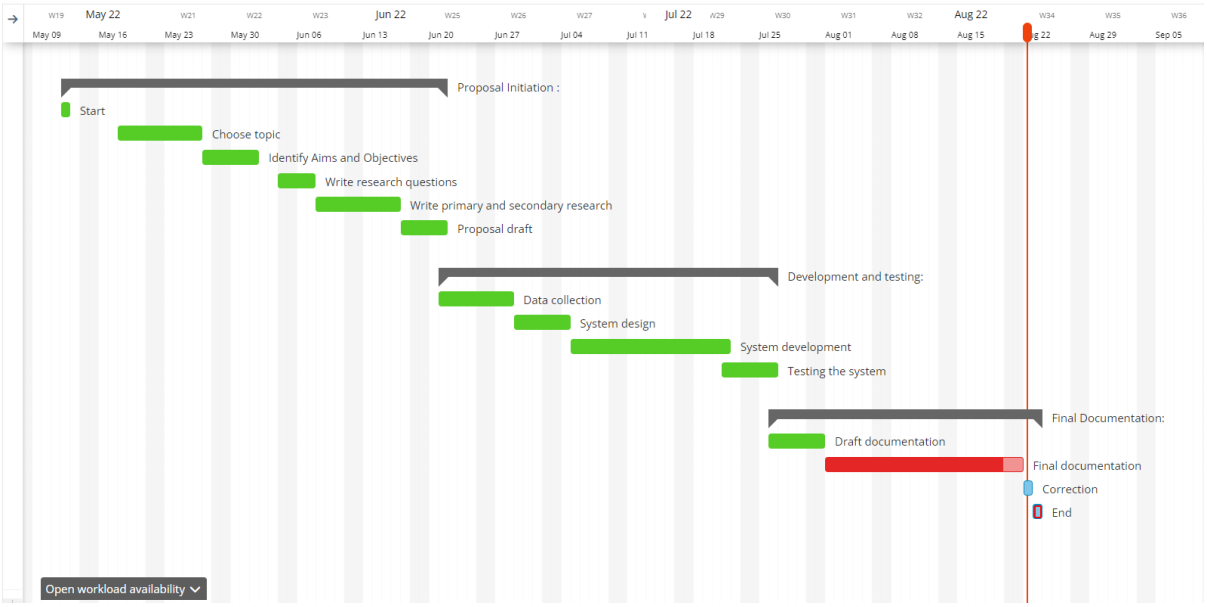


Figure 10: Gantt chart

SWOT ANALYSIS

SWOT analysis can be done by checking internal components i.e. strengths and weakness and external components i.e. opportunities and threats.

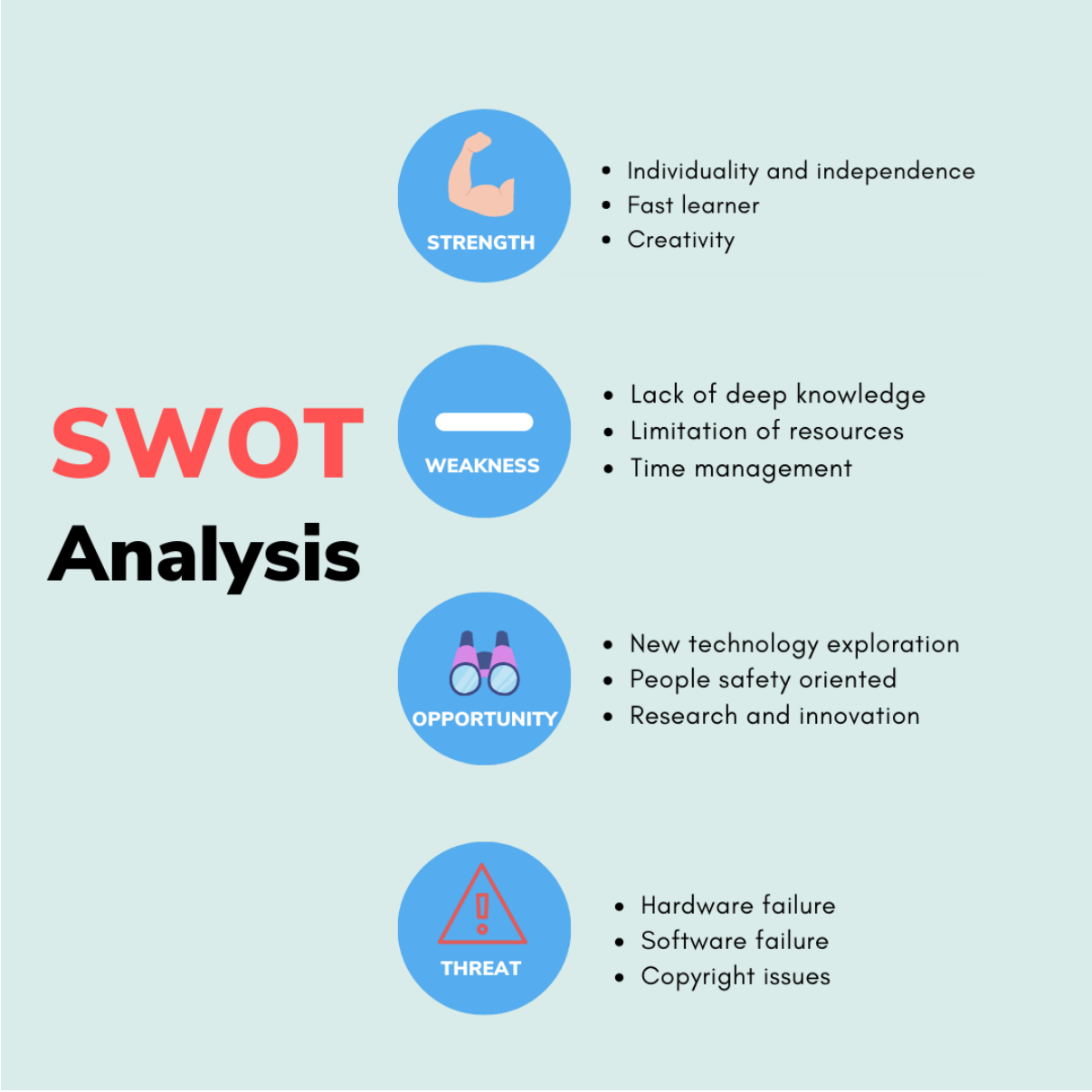


Figure 11: SWOT Analysis

RISK REGISTER

S.N.	Risk	Risk source	Impact	Occurrence probability	Mitigation
1.	Lack of knowledge	Limited understanding of the research subject	High	Low	Conduct proper research
2.	Time management	Research may need more time than planned	High	Medium	Make a project plan with dates
3.	Corrupted source	Sources may change time by time	Medium	High	Research and select a proper source
4.	Design failure	Failing to follow the researched methodology	High	Medium	Select appropriate methodology and start designing

Figure 12: Risk planning

CONCLUSION

The goal of this thesis was to make a detector for face masks. This goal was reached by putting the idea into action with tools like OpenCV, MobileNet, machine learning, and deep learning. More and more people are wearing masks these days. Masks are one of the few ways to avoid getting sick from the air, and they help keep people healthy and free of respiratory illnesses. This project can be used in airports, train stations, offices, schools, and public spaces, among other places, to keep people safe by combining it with embedded technology.

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