FAKULTI TEKNOLOGI MAKLUMAT DAN KOMUNIKASI

SEMESTER 1 2022/2023

BITI 3533

ARTIFICIAL INTELLIGENCE PROJECT MANAGEMENT

PROJECT TITLE:

Face Mask Detection System

PREPARED BY:

Group E S1G2

Group Member	Matric No
GIRIDHEV A/L MAHESAN	B032010451
LOW PEI ZUO	B032010013
FOO HAW CHENG	B032120044

PREPARED FOR:

PROFESSOR TS. DR. BURHANUDDIN BIN MOHD ABOOBAIDER

1.0 Forum on GitHub

1. **What you understand about GitHub? Why do you think it is useful to manage the project?**

   GitHub is a code hosting platform for version control and collaboration. It lets you and others work together on projects from anywhere. GitHub is completed with essentials like repositories, branches, commits, and pull requests to help management become easier.

2. **How GitHub can be used to manage project related to artificial intelligence and software development?**

   The essentials of GitHub such as repositories, branches, commits, and pull requests enable developers to keep track of progress easily. They also make collaborative coding possible and make sure everyone in the team could access to the latest source code.

3. **List down other alternative tools can be used for AI project management like GitHub**

   a. GitLab
   b. BitBucket
   c. Asana

4. **Rank the alternative tools given in Question 3 and which is the best?**

   a. BitBucket
   b. GitLab
   c. Asana

   BitBucket is the best alternative tools

5. **Justify your answer given in Question 4**

   The core difference is GitLab has Continuous Integration/Continuous Delivery (CI/CD) and DevOps workflows built-in. GitHub lets you work with the CI/CD tools of your choice, but you'll need to integrate them yourself. GitHub users typically work with a third-party CI program such as Jenkins, CircleCI, or TravisCI.

2.0 Project Introduction

Project Name: **Face Mask Detection System**

There are no efficient face mask detection applications in the midst of the ongoing COVID-19 pandemic, which is now in high demand for transportation means, densely populated areas, residential districts, large-scale manufacturers, and other enterprises to ensure safety. The lack of large datasets of 'with mask' images has made this task time-consuming and difficult.

Our face mask detector makes no use of morphed masked images, and the model is accurate. It is computationally efficient due to the use of MobileNetV2 architecture, making it easier to deploy the model to embedded systems (Raspberry Pi, Google Coral, etc.). As a result of the Covid-19 outbreak, this system can be used in real-time applications that require face-mask detection for safety purposes. This project can be integrated with embedded systems and used to ensure that public safety guidelines are followed in airports, railway stations, offices, schools, and public places.

PMP (Project Management Plan) has five phases.

- Project Initiating
- Project Planning
- Project Executing
- Project Monitoring and Controlling
- Project Closing

Project Management Plan (PMP)

A. Project Initiating

Project initiating is the starting of a project. It is used to define the shape and direction of project. This process usually includes the project charter and stakeholders.

B. Project Planning

Project planning is the phase that is important to ensure efficiency of project management. It specified the scope of project and plan of the project. This process includes Work Breakdown Structure (WBS), Gantt Chart, and Scope Statement.

C. Project Executing

Project executing is the phase where the source code is developed and documented. This process defines and documents the source code, results, and technical implementation.

D. Project Monitoring and Controlling

Project monitoring and control is the phase to evaluate the project progress and performance such that the progress of project goes as planned and works as intended.

E. Project Closing

Project closing is the phase that all activities has been completed and closed formally. The process includes the closing documents, and report on lessons learned.

3.0 Project Overview

Project Summary

In year 2020, the global pandemic of COVID-19 has caused serious effect on worldwide. Hence, the government of Malaysia has decided to implement the Movement Control Order (MCO) and mandatory of face mask while outing to stop the spread of COVID-19.

Hence, with the help of our face mask detection system, cameras could be placed on various location around the campus of UTeM to detect whether the students had put on their face mask. The authority could then take action to warn the students to put on their face mask if they did not do so.

Customer

Universiti Teknikal Malaysia Melaka (UTeM)

Project Name

Face Mask Detection System

Team Members:

Giridhev A/L Mahesan	B032010451
Low Pei Zuo	B032010013
Foo Haw Cheng	B032120044

Objectives:

1. To develop an artificial intelligence system that are able to detect human face.
2. To develop a system that are able to detect the presence of face mask on human face.
3. To reduce the workload of authority such that they do not need to patrol frequently.

4.0 Project Initiating

The face recognition system for the project officially began at this phase. Defining projects widely is its main goal. A business case is typically the initial step. This section's goal is to determine whether the project is doable and ought to be fully implemented. The best moment for an organisation to conduct a feasibility test is right now. All significant stakeholders assess the business case during this phase and decide whether to approve the project or not. A project charter, also known as a project initiation document (PID), is created if all stakeholders agree to start the project. The project's goals, specifications, business requirements, business case, and all parties involved are discussed in this paragraph. Project guidelines will then be developed so that the precise course of the project's development may be decided.

A. Project Business Case

A business case is a project management document that outlines how and why a facial recognition system project will be more beneficial than it will be expensive. Business cases are developed during the project beginning phase to convince stakeholders of the project's value by outlining its goals, expenses, and benefits. A business case is an important project document that shows your client or other stakeholders that the suggested project is a wise financial decision.

B. Stakeholders Analysis

Stakeholder analysis is the procedure used to locate these people before a project is launched. Depending on each stakeholder group's level of involvement, interest, and impact on the project, decide how to engage and communicate with them successfully. When discussing the project with stakeholders, it will be simpler to pinpoint their key concerns, which will increase their readiness to contribute and spend.

Types	Name
a) Customer	Universiti Teknikal Malaysia Melaka
b) Project Leader	Giridhev A/L Mahesan
c) Resource Managers	Low Pei Zuo
	Foo Haw Cheng
d) Project Teams	Developers from TheMask

C. Project Charter

A project charter is a formal, frequently condensed document that describes your project in its totality. This covers the project's goals, the process for carrying them out, and the participants. It is crucial to project planning because it is used all through the course of the project.

TheMask Project Charter

Project Name: Face Mask Detection System

Project Description: A system that detects the presence of face mask on student by using artificial intelligence.

Business Case: Increasing sales by 40% for this quarter

Project Deliverables: An AI system that can be implement with camera or CCTV.

Project Benefits: Boosted reputation

Project Risks: This is the first project of our company that needed to be implemented into camera for real-time detection

Project Budget: Not to exceed RM 50,000

D. Projections

Projections are the process of predicting or estimating the future of a current activity. The cost, duration, and quality or performance of deliverables are just a few examples of the indications that project managers might examine to determine whether a project is on track. If the projections show that the project will be successful, it may be continued, a similar project may be approved, or the project may be made public. The appropriate changes can be made to fit the changed project trajectory if the projection reveals unexpected difficulties.

E. Project Guidelines Development

To ensure a seamless transition through all phases and stages of the project life-cycle, the formulation of project guidelines involved the planning and management of several project activities. It offers a thorough array of advice, ideas, and suggestions for controlling a project from conception and planning through its completion and closure.

F. Project Initiation

The project will be formally started and go on to the following phase once all of the aforementioned activities have been finished.

5.0 Project Planning

Developing a road map is the primary emphasis of the planning phase, which is crucial to the success of the project. This phase often begins with the establishment of project objectives. There are a range of strategies that project managers can use to develop objectives. Collect project requirements, set goals and scopes, develop WBS, check project scope, and manage project scope during the upcoming project kickoff meeting.

A. Project Kick-off Meeting

The objective of the kickoff meeting is to present the team with an in-depth understanding of the project and its function. this meeting will take place in person, as opposed to via email or shared papers, the possibility of misunderstandings is reduced. This prevents the scope from expanding. In addition, it makes it simple for the team to monitor the progress of each stage and to comprehend the project's needs, scope, etc.

B. Collect Project Requirements

The collecting project criteria encompass all needs for facial recognition system gathering collection initiatives. This phase can identify the required functionality for the project.

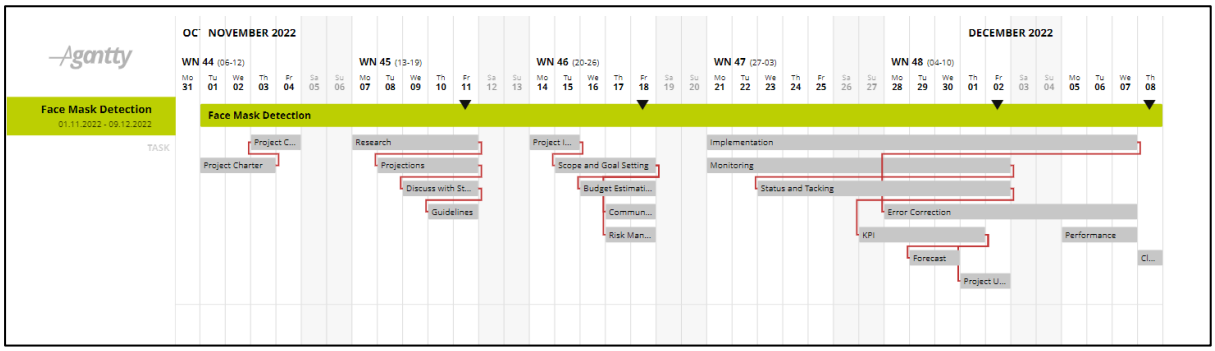
C. Setup Goals and Scopes

In this phase, the objective and scope of the project's face recognition system are determined. This will allow future development to have a clear scope and objectives, such as user scope.

D. Create WBS

Create a WBS may see the structure of a project comparable to a Gantt Chart, since it enables the user to deconstruct the project's scope and visualise all the tasks required to complete the project. Understanding the evolution of each structure facilitates monitoring and supervision by the project manager.

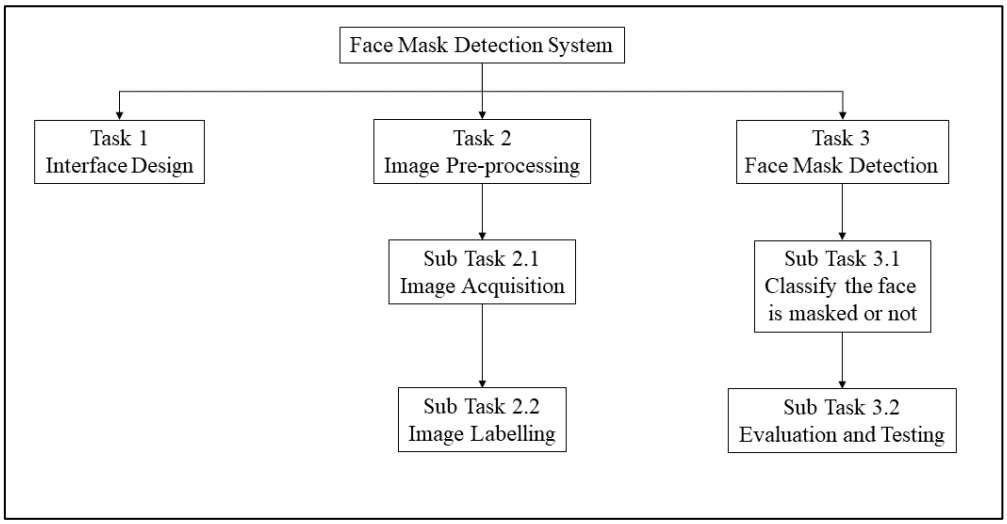
a. Gantt Chart of the Project



b. Work Breakdown Structure (WBS)

Task	Start Date	End Date	Duration (Days)
Initiating	**01-11**	**11-11**	**11**
Project Charter	01-11	03-11	3
Project Charter Revisions	03-11	04-11	2
Research	07-11	11-11	5
Projections	08-11	11-11	4
Discuss with Stakeholders	09-11	11-11	3
Guidelines	10-11	11-11	2
Planning	**14-11**	**18-11**	**5**
Project Initiation	14-11	15-11	2
Scope and Goal Setting	15-11	18-11	4
Budget Estimation	16-11	18-11	3
Communication Plan	17-11	18-11	2
Risk Management	17-11	18-11	2
Implement	**21-11**	**02-12**	**12**
Monitoring	21-11	02-12	12
Implementation	21-11	07-12	17
Status and Tracking	23-11	02-12	10
KPI	27-11	01-12	5
Error Correction	28-11	08-12	11
Forecast	29-11	30-11	2
Project Updates	01-12	02-12	2
Project Closing	**05-12**	**09-12**	**5**
Performance	05-12	07-12	3
Closing	08-12	09-12	2

c. Work Breakdown Structure (WBS): Technical Part



E. Verify Project Scope

The objective of verification is to establish each phase of the face recognition system development project is proceeding according to schedule. When a problem emerges, it can be discussed and revised promptly.

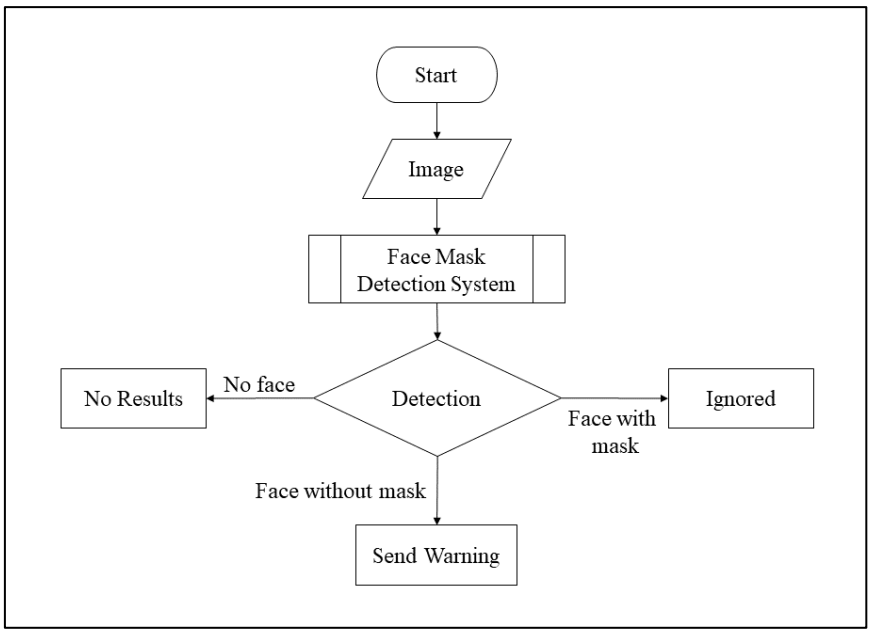
F. Control Project Scope

This phase pertains to verifying the project's scope. If any concerns are detected during scope verification, the project manager will make adjustments quickly so that the control scope may be implemented smoothly and the project can be developed efficiently.

6.0 Project Executing

Execution is the phase of a project in which every team's plans are implemented. The implementation plan for the project is as follows:

A. Flowchart Design



B. Software Requirement

- Python Language

C. Libraries Required

```
tensorflow
sklearn
imutils
maplotlib
numpy
argparse
cv2
os
```

D. System Interface Design

The face mask detection system is based on the design of the system interface. This entails developing the entire system to encompass the essential components, such as function, user profile, homepage, etc. This must also consider the user experience when the user has an excellent sense of usage. Before creating a comprehensive interface system, this phase must take a wide variety of variables into account.

E. API Design & Development

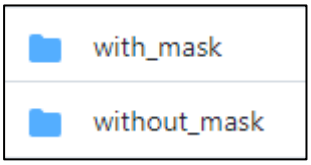
API design is the set of architectural and planning considerations made during API development. The architecture of an API impacts both the ability of developers to utilise it and their usage patterns. Therefore, this must take into account the user's API to prevent the user from having a poor experience when utilising the API. When the API design is finished, the API can be developed.

F. Data Acquisition

Essential to data collection and understanding is gathering the relevant data. As our project is a face mask recognition system, we must collect photographs of human faces with face mask in order to proceed to the next phase.

G. Data Preparation

Data preparation ensures that all necessary data has been collected and is well-prepared for AI model training. The acquired data will be tagged to indicate the location of human faces. The data can then be utilised in the subsequent phase.



H. Image Processing

Face mask recognition necessitates the application of image processing techniques to the gathered data. This step is necessary for the user to input photographs or capture their face in real-time.

```
        # dimensions
                image = cv2.imread(args["image"])
                orig = image.copy()
                (h, w) = image.shape[:2]

                # construct a blob from the image
                blob = cv2.dnn.blobFromImage(image, 1.0, (300, 300),
                        (104.0, 177.0, 123.0))

                # pass the blob through the network and obtain the face detections
                print("[INFO] computing face detections...")
                net.setInput(blob)
        detections = net.forward()
```

I. Feature Extraction

Extraction of features is a vital aspect of dimensionality reduction, which can facilitate image processing by making the image easier to handle. Its goal is to facilitate the processing of the desired characteristics of the data by splitting the data and extracting only its key points. In addition, it assists with data management.

```
# loop over the detections
for i in range(0, detections.shape[2]):
	# extract the confidence (i.e., probability) associated with
	# the detection
	confidence = detections[0, 0, i, 2]

	# filter out weak detections by ensuring the confidence is
	# greater than the minimum confidence
	if confidence > args["confidence"]:
		# compute the (x, y)-coordinates of the bounding box for
		# the object
		box = detections[0, 0, i, 3:7] * np.array([w, h, w, h])
		(startX, startY, endX, endY) = box.astype("int")

		# ensure the bounding boxes fall within the dimensions of
		# the frame
		(startX, startY) = (max(0, startX), max(0, startY))
		(endX, endY) = (min(w - 1, endX), min(h - 1, endY))

		# extract the face ROI, convert it from BGR to RGB channel
		# ordering, resize it to 224x224, and preprocess it
		face = image[startY:endY, startX:endX]
		face = cv2.cvtColor(face, cv2.COLOR_BGR2RGB)
		face = cv2.resize(face, (224, 224))
		face = img_to_array(face)
		face = preprocess_input(face)
		face = np.expand_dims(face, axis=0)

		# pass the face through the model to determine if the face
		# has a mask or not
		(mask, withoutMask) = model.predict(face)[0]

		# determine the class label and color we'll use to draw
		# the bounding box and text
		label = "Mask" if mask > withoutMask else "No Mask"
		color = (0, 255, 0) if label == "Mask" else (0, 0, 255)
		# include the probability in the label
		label = "{}: {:.2f}%".format(label, max(mask, withoutMask) *100)

		# display the label and bounding box rectangle on the output
		# frame
		cv2.putText(image, label, (startX, startY - 10),
			cv2.FONT_HERSHEY_SIMPLEX, 0.45, color, 2)
		cv2.rectangle(image, (startX, startY), (endX, endY), color, 2
```

J. Define AI Model

Define the required AI model for this project. In this step, the project's function and the AI Model required to move to the subsequent phase are analysed.

K. AI Model Training

The necessary AI model is subdivided, and then formal AI model training occurs. After Training, combine per project specifications.

L. Documentation Development

At this step, when all preceding phases have been completed, the development documentation will be developed, which will include all the written source code and act as the system document.

M. Project & Chart Update

This stage is one of continual rejuvenation from start to finish. This is for the ease of being able to see each step of the project's development.

7.0 Project Monitoring and Controlling

Monitoring and controlling a project entail keeping track of its progress, identifying any problems, and making the appropriate adjustments.

A. Performance Analysis

The practise of analysing a scenario's performance in relation to the goal that was intended to be attained is called performance analysis. Based on ROI, earnings, and other factors, performance analysis is possible in finance. Performance analysis in HR can be used to evaluate an employee's contribution to a project or task that was given to them.

B. Determine Variance Deviation Threshold

Variance is a quantifiable departure from a recognised baseline or standard. The cost, time, and scope are identified in project management to create the baseline for deviation. The work-breakdown structure (WBS), a hierarchical representation of all tasks to be completed, is created by the project management team. The work-breakdown structure is then used to determine the cost and schedule (WBS). When estimating the cost of each objective or task, an average daily, hourly, monthly, or annual rate may be used. For each objective or undertaking, the fixed expenses are identified. The project management team also determines how many days or hours are needed to complete a job or goal. Next, they develop a time-phased budget to calculate the cost of performance.

C. Tasks and Estimated Costs

Task	Cost (RM)
Project Team Members	20000.00
Devices	1000.00
Installation Software	500.00
Licensed Software	3000.00
Testing	5000.00
System Maintenance	10000.00
Total Project Cost	**39500.00**

8.0 Project Closing

The word "closing process" refers to a series of processes that have been carried out in order to formally end and close all tasks, activities, and component pieces of a certain project or phase of a project. The transmission, acceptance, and approval of the final deliverables to the assigning party or, in the event the activity did not really take place, starting and concluding the cancellation process will then often constitute the final steps of the closing process.

A. Customer Acceptance Form

CUSTOMER ACCEPTANCE/PROJECT COMPLETION FORM
12 DECEMBER 2022

Project Name: Face Mask Detection System
Project Manager: Giridhev A/L Mahesan

I (We), the undersigned, acknowledge and accept delivery of the work completed for this project on behalf of our organization. My (Our) signature(s) attest(s) to my (our) agreement that this project has been completed. No further work should be done on this project.

Name	Title	Signature	Date
Zaahir bin Zufar	Executive Director	Zaahir	20 December 2022
Abdul Wadood bin Umar	Managing Director	Abdul	20 December 2022

1. Was this project completed to your satisfaction? **Yes**

2. Please provide the main reasons for your satisfaction or dissatisfaction with this project.

   The project is able to deliver to us in time. Now our campus could implement the system to monitor the student has put on their face mask with the help of AI. This reduces our workload a lot.

3. Please provide suggestions on how our organization could improve its project delivery capability in the future.

   We would like to suggest for a better performance of the system during the night. At low light level, the accuracy of system drops occasionally.

B. Lessons Learned Document

LESSONS-LEARNED REPORT
12 DECEMBER 2022

Project Name: Face Mask Detection System

Project Sponsor: Universiti Teknikal Malaysia Melaka
Project Manager: Giridhev A/L Mahesan
Project Dates: 01 November 2022 – 09 December 2022
Final Expenses: RM 39,500

a. Did the project meet scope, time and cost goals?

Yes, we did meet the main scope of our project within the time given and successfully complete the task within the time, with a lower price than the budget.

b. What was the success criteria listed in the project scope statement?

One of the success criteria that we achieved in this project is that we could detect the presence of facemask on the students with a good accuracy.

C. Reflect on whether or not you met the project success criteria.

Yes, our system works as intended as of what we have planned in the initial stage. The system can detect the presence of face mask correctly and push warnings to the server if student did not wear a face mask. The main successful point is that our system won the customer's satisfaction and accepted as we have fulfilled the requirement of customer within the time given. Moreover, the final costs of the project is lower that the budget of customer.

d. What were the main lessons your team learned from this project?

The main lesson that we have learned from the project is that a well-planned project is very important. In this project, our planning phase works as our guideline and we follows it closely, especially the Gantt chart. Hence, we managed to complete the project in time in the end.

C. Final Project Report

FACE MASK DETECTION SYSTEM

1.0 Project Objectives

The purpose of UTeM's Face Mask Detection System aims to detect the presence of face mask on student within the campus

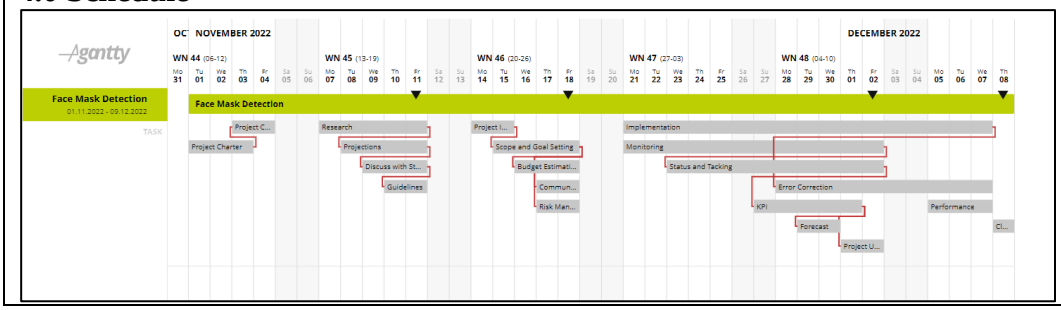
2.0 Project Scope

To detect the presence of face mask on students in campus accurately

3.0 Project Result Summary

Face Mask Detection System is able to detect the presence of face mask on student with an accuracy of 96.67%

4.0 Schedule



5.0 Budget Budget Given: RM 50,000.00 Expenses: RM 39,500.00
6.0 Transition Plan • System Maintenance • Error Handling

D. Close Contract

CLOSE CONTRACT
TheMask, Contract Closure Notice
30 December 2022

This letter provides formal notice that the work contracted with UTeM has been completed. TheMask has developed a mask detection system that can identify that a student has put on their face mask.

Giridhev, the project manager, has provided the following performance assessment for the cooperation provided:

"We were very pleased with the cooperation provided from UTeM. The staff from UTeM have given full cooperation are willing to have good communications with TheMask. So that the whole project can be done in a very smooth pace. We were extremely happy to work together with UTeM and we are looking forward for the next collaboration."

Giridhev

By: Giridhev A/L Mahesan
Project Manager, TheMask
Date: 30 December 2022

After all of the above is completed, the project is done and completed.