BITI 3553

AI PROJECT MANAGEMENT

PROJECT REPORT

LANE LINE DETECTION

Student name:

1. Siti Nabihah binti Abu Bakar (Project Manager)   B031810408

2. Siti Maimunah binti Abdul Rahman   B031810418

3. Siti Zulaikha binti Azman   B031820029

4. Khalid Tewfik Mohamed   B031810452

Lecturer: Prof. Ts. Dr. Goh Ong Sing

A. DEFINING THE PROJECT

Project Summary

Detecting lane lines is a task for autonomous vehicles while driving on the road. While it only seems like a simple project to do, this task is a fundamental component for the project. Lane line detection is a system that will be implemented in vehicles to aid and provide a self-driving car system. By using image processing to do recognition on the road lane, it will keep the car to stay on course and help the drivers with safe driving.

The developer will do the machine training by using Neural Network technique to build the line detector and then build a system that detect lane lines in real-time. The project will need computer vision to do the detection and the available computer vision at the moment is OpenCV library.

Customer: Proton Holding

Project name: Lane Line Detection System

Team Members:

- Siti Nabihah binti Abu Bakar (Project Manager)
- Siti Maimunah binti Abdul Rahman
- Siti Zulaikha binti Azman
- Khalid Tewfik Mohamed

Objectives:

- Image processing is being implemented to detect the desired lane of the vehicle in order to obtain the look-ahead distance and the lane angle.
- Extract information about the position of the vehicle with respect to the road from the video image.
- The system can provide high accuracy in lane deviation and headway distance estimation.
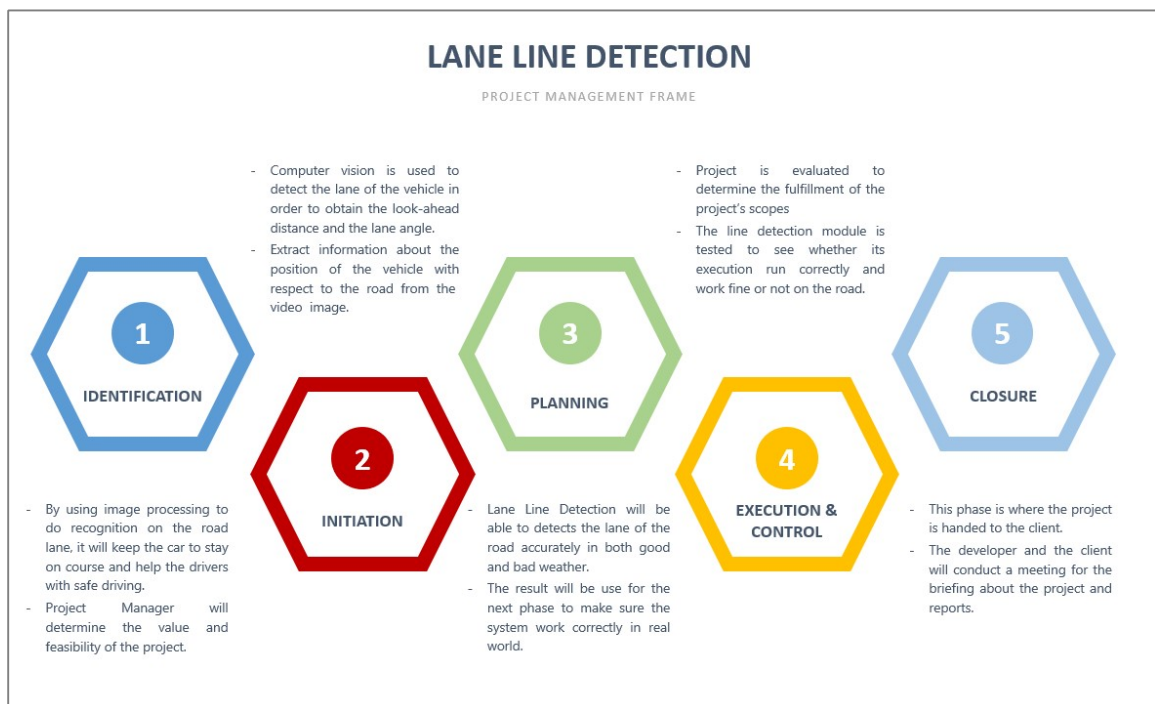
B.   PLANNING THE CYCLE

Before any project can be a success, planning is the first step. This phase is where the project is planned and structured before it proceeds to the next phase. In this part, each process that the team will need to go through will be discussed into details so that the project can be done within the milestone. The project management life cycle is used to illustrate the processes. For this project, Work Breakdown Structure (WBS) and Gantt Chart is used as the project management life cycle. There is also Responsibility Assignment Matrices (RAM) that assign the role to staffs and stakeholders.

Project Management Life-Cycle

Below is the figure of Work Breakdown Structure and the Gantt Chart that shows the task and the milestone of each task.

Work Breakdown Structure (WBS)

LANE LINE DETECTION
PROJECT MANAGEMENT FRAME

1 IDENTIFICATION
- By using image processing to do recognition on the road lane, it will keep the car to stay on course and help the drivers with safe driving.
- Project Manager will determine the value and feasibility of the project.

2 INITIATION
- Computer vision is used to detect the lane of the vehicle in order to obtain the look-ahead distance and the lane angle.
- Extract information about the position of the vehicle with respect to the road from the video image.

3 PLANNING
- Lane Line Detection will be able to detects the lane of the road accurately in both good and bad weather.
- The result will be use for the next phase to make sure the system work correctly in real world.

4 EXECUTION & CONTROL
- Project is evaluated to determine the fulfillment of the project's scopes
- The line detection module is tested to see whether its execution run correctly and work fine or not on the road.

5 CLOSURE
- This phase is where the project is handed to the client.
- The developer and the client will conduct a meeting for the briefing about the project and reports.

Gantt Chart

		Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1		📌	◢ **Project Initiation**	**16 days**	**Thu 10/15/20**	**Thu 11/05/20**		
2	✓	📌	Project Charter	3 days	Thu 10/15/20	Sun 10/18/20		Nabihah
3		📌	Research	5 days	Mon 10/19/20	Fri 10/23/20		Maimunah
4	✓	📌	Projections	6 days	Mon 10/19/20	Tue 11/03/20		Zulaikha
5	✓	📌	Stakeholders	4 days	Wed 10/21/20	Mon 10/26/20		Khalid
6	✓	📌	Guidelines	4 days	Wed 10/21/20	Mon 10/26/20		Khalid
7	✓	📌	Project Initiation	7 days	Thu 10/22/20	Fri 10/30/20		Nabihah
8		📌	Finish Project Initiation	0 days	Thu 11/05/20	Thu 11/05/20		
9		📌	◢ **Project Planning**	**11 days**	**Mon 11/02/20**	**Sat 11/14/20**		
10	✓	📌	Collect projects requirement	4 days	Mon 11/02/20	Thu 11/05/20		Nabihah
11	✓	📌	Set up goal & scope	4 days	Tue 11/03/20	Fri 11/06/20		Maimunah
12		📌	Create WBS	4 days	Mon 11/09/20	Thu 11/12/20		Khalid
13		📌	Verify & control scope	4 days	Tue 11/10/20	Fri 11/13/20		Zulaikha
14		📌	Finish Project Planning	0 days	Sat 11/14/20	Sat 11/14/20	13	
15		📌	◢ **Project Execution**	**16 days**	**Mon 11/16/20**	**Tue 12/08/20**		
16	✓	📌	Status & tracking	8 days	Mon 11/16/20	Wed 11/25/20		Maimunah
17	✓	📌	KPIs	4 days	Fri 11/20/20	Wed 11/25/20	16FF	Nabihah
18	✓	📌	Monitoring	1 day	Thu 11/26/20	Thu 11/26/20		Nabihah
19		📌	Forecast	8 days	Mon 11/23/20	Wed 12/02/20	18FF	Zulaikha
20	✓	📌	Project Updates	4 days	Fri 11/27/20	Wed 12/02/20		Khalid
21	✓	📌	Chart Updates	3 days	Thu 12/03/20	Mon 12/07/20	20	Khalid
22		📌	Finish Project Execution	0 days	Tue 12/08/20	Tue 12/08/20	21	
23		📌	◢ **Project Performance/Monitoring**	**11.5 days**	**Wed 12/09/20**	**Thu 12/24/20**		
24	✓	📌	Projects objectives	2 days	Wed 12/09/20	Thu 12/10/20		Zulaikha
25	✓	📌	Quality Deliverables	3 days	Thu 12/10/20	Mon 12/14/20		Maimunah
26		📌	Effort & Cost Tracking	6 days	Thu 12/10/20	Thu 12/17/20		Khalid
27	✓	📌	Project Testing	4 days	Fri 12/18/20	Wed 12/23/20	26	Nabihah
28		📌	Finish Project Monitoring	0 days	Thu 12/24/20	Thu 12/24/20	27	
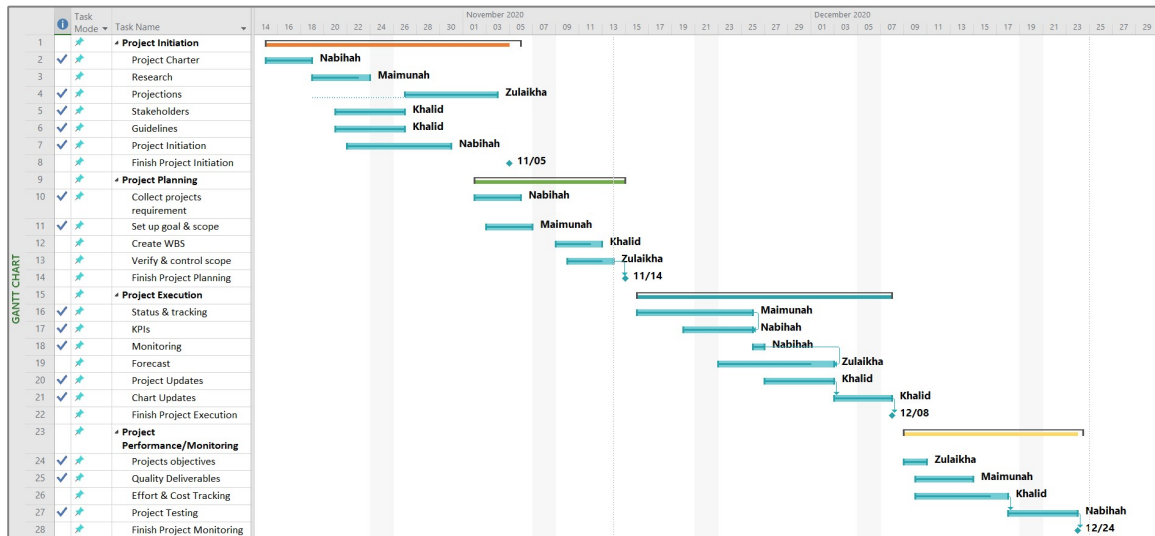
Risk Identification Chart (Quality, Cost, Time)

Control Element	What is likely to go wrong?	How and when will I know?	What will I do about it?
Quality	The Lane Line Detection unable to detect the line of the road which jeopardize the safety of the passengers.	During project monitoring and car drive testing.	Hire professional team of developers with high credibility of their past work to find new solution.
Cost	Lack of investment and sponsorship externally.	During project implementation process where cost required to run the project is estimated.	Do pitching to investors by highlighting the future impact of the project.
Time	The project's completion exceeds the dateline that has been scheduled which might be because of unexpected thing happened.	Can be seen by the end of every phase. If the work for each phase exceeds the timeline, most likely the project will not complete in time as scheduled.	Instead of make the duration for each phase short and tight, spare a few days or a week extra just in case the unexpected thing happened.

Responsibility Assignment Matrices (RAM)

There is also Responsibility Assignment Matrices (RAM) that assign the role to staffs and stakeholders involved in the project. This Matrices will visualize the importance of each roles for the respective task and how involved is the person for that particular task.

Consolidated RAM

Resource Responsibility P - Primary Responsibility A - Approval Authority S - Supporting Responsibility (Contributor or Reviewer) I - Information Only *(Select from drop down list)*	Project Manager	Procurement Manager	Risk Manager	Administrative Manager	Financial Analyst	Contract Manager	Project Scheduler	Quality Manager	Technical Manager	System Engineer	Implementation Manager	Test Manager	Configuration Manager	Project Sponsor
Project Funding														
Stakeholder	P	S	S	P	P	I	I	I	I	I	I	I	I	A
Acquisition Planning														
System application	P	P	S	S	P	I	P	S	S	S	S	S	S	A
Contracting														
Project Contract preparation	A	S	S	S	I	P	I	I	I	I	I	I	I	A
Requirements Analysis														
System Approach	P	P	S	S	I	I	S	P	S	P	S	S	S	A
System Design														
Data management	P	I	S	S	I	I	P	S	S	P	S	S	S	I
EDA	P	I	S	S	I	I	P	S	S	P	S	S	S	I
System Development														
Development	P	S	S	I	S	I	P	S	P	P	S	S	S	I
Testing	P	S	S	I	S	I	P	S	P	P	S	P	P	I
System Implementation														
Deploy system	P	P	P	S	P	I	I	A	S	P	P	P	P	A

Project Funding

Resource Responsibility P - Primary Responsibility A - Approval Authority S - Supporting Responsibility (Contributor or Reviewer) I - Information Only *(Select from drop down list)*	Project Manager	Procurement Manager	Risk Manager	Administrative Manager	Financial Analyst	Contract Manager	Project Scheduler	Quality Manager	Technical Manager	System Engineer	Implementation Manager	Test Manager	Configuration Manager	Project Sponsor
Project Funding														
Hold a meeting regarding fundings	P	S	S	P	S	I	P	I	I	I	I	I	I	A
Meet with stakeholders	P	I	S	S	P	I	S	I	I	I	I	I	I	A
Budget estimation	S	P	S	S	P	I	I	I	I	I	I	I	I	A

Acquisition Planning

Resource Responsibility P - Primary Responsibility A - Approval Authority S - Supporting Responsibility (Contributor or Reviewer) I - Information Only *(Select from drop down list)*	Project Manager	Procurement Manager	Risk Manager	Administrative Manager	Financial Analyst	Contract Manager	Project Scheduler	Quality Manager	Technical Manager	System Engineer	Implementation Manager	Test Manager	Configuration Manager	Project Sponsor
Acquisition Planning														
Develop Project Charter	P	I	S	S	S	I	S	S	S	I	I	I	I	A
Define system approach and measurement	P	I	S	S	S	I	S	S	S	I	S	S	S	A
Develop Business Case	P	I	I	P	I	I	S	I	S	S	S	S	S	A
Develop WBS	A	I	S	S	S	I	P	S	S	S	S	S	S	I
Identify Resources Needed	A	P	I	S	P	I	S	S	A	I	I	I	I	I

Contracting

Resource Responsibility	Project Manager	Procurement Manager	Risk Manager	Administrative Manager	Financial Analyst	Contract Manager	Project Scheduler	Quality Manager	Technical Manager	System Engineer	Implementation Manager	Test Manager	Configuration Manager	Project Sponsor
Contracting														
Prepare Team Contract	A	S	I	S	I	P	I	I	I	I	I	I	I	A
Prepare project contract	A	S	I	S	I	P	I	I	I	I	I	I	I	A

P - Primary Responsibility
A - Approval Authority
S - Supporting Responsibility
(Contributor or Reviewer)
I - Information Only
(Select from drop down list)

Requirements Analysis

Resource Responsibility	Project Manager	Procurement Manager	Risk Manager	Administrative Manager	Financial Analyst	Contract Manager	Project Scheduler	Quality Manager	Technical Manager	System Engineer	Implementation Manager	Test Manager	Configuration Manager	Project Sponsor
Requirements Analysis														
Identify Data Source	S	S	S	S	I	I	I	P	I	P	S	S	S	I
Define System approach and Measurement	S		S	S	I	I	P	P	S	P	S	S	S	I

P - Primary Responsibility
A - Approval Authority
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(Contributor or Reviewer)
I - Information Only
(Select from drop down list)

System Design

Resource Responsibility P - Primary Responsibility A - Approval Authority S - Supporting Responsibility (Contributor or Reviewer) I - Information Only *(Select from drop down list)*	Project Manager	Procurement Manager	Risk Manager	Administrative Manager	Financial Analyst	Contract Manager	Project Scheduler	Quality Manager	Technical Manager	System Engineer	Implementation Manager	Test Manager	Configuration Manager	Project Sponsor
System Design														
Data Management	S	P	S	I	I	I	I	S	S	P	S	S	S	I
Web Scraping	S	P	S	I	I	I	I	S	S	P	S	S	S	I
Data Wrangling	S	P	S	I	I	I	I	S	S	P	S	S	S	I
Data Preparation	S	P	S	I	I	I	I	S	S	P	S	S	S	I
Exploratory Data Analysis	S	S	S	I	I	I	I	S	S	P	S	S	S	I
Analyze Data Trend	S	S	I	I	I	I	I	S	S	P	S	I	S	I

System Development

Resource Responsibility P - Primary Responsibility A - Approval Authority S - Supporting Responsibility (Contributor or Reviewer) I - Information Only *(Select from drop down list)*	Project Manager	Procurement Manager	Risk Manager	Administrative Manager	Financial Analyst	Contract Manager	Project Scheduler	Quality Manager	Technical Manager	System Engineer	Implementation Manager	Test Manager	Configuration Manager	Project Sponsor
System Development														
Modelling	S	I	I	I	I	I	P	S	S	P	S	S	S	I
Build Models	S	I	I	I	I	I	P	A	S	P	S	S	S	I
Train Data	S	I	I	I	I	I	P	S	S	P	S	S	S	I
Test Data	S	I	I	I	I	I	P	S	S	P	S	S	S	I
Test Accuracy of Data	S	I	I	I	I	I	P	S	S	P	S	P	S	I
Inferences and Interpretations of Results	S	I	I	I	I	I	P	A	S	P	S	P	S	I
Analyze results	A	I	I	I	I	I	P	A	S	P	S	P	S	I
Debug and Correction	S	I	I	I	S	I	P	S	S	P	S	S	P	I

System Implementation

Resource Responsibility P - Primary Responsibility A - Approval Authority S - Supporting Responsibility (Contributor or Reviewer) I - Information Only (Select from drop down list)	Project Manager	Procurement Manager	Risk Manager	Administrative Manager	Financial Analyst	Contract Manager	Project Scheduler	Quality Manager	Technical Manager	System Engineer	Implementation Manager	Test Manager	Configuration Manager	Project Sponsor
System Implementation														
Deploy System	P	P	P	S	P	I	I	A	S	P	P	P	P	A
Documentation	A	P	S	P	S	A	P	S	S	S	P	S	S	I

Project Planning Summary

Modules/Components	Budget	Schedule	Responsibility
Acquisition	RM 886,170	30/10/2020	Siti Nabihah
Design	RM 275,000	5/11/2020	Siti Maimunah
Restoration	RM 7,478,300	25/12/2020	Khalid & Zulaikha

C.   IMPLEMENT THE PROJECT PLAN

In this phase, the Lane Line Detection will be implemented to determine whether the system is able detects the lane of the road accurately or not in good and bad weather. The outcome will be anchor to gauge how successful the system is and how good it is to be applied in real world.

Deliverables

What the project has successfully achieved:

- The system is successfully able to detect line on the road.
- The detector is able to extract information about the position of the vehicle with respect to the road from the video image.
- The system is able to provide high accuracy in lane deviation and headway distance estimation.

Tasks and Estimated Costs

Some of the task need to spend money to get it done. Because money issue is not something that people can take lightly, budget planning is one of the ways to ensure the clarity of the money usage. Each of the things that require spending money will be listed into the table before the items are even purchased and the estimated cost of each things will be stated. Once every spending costs have been identified, the team will be able to see the overall cost the project spent to be complete.

	OVERALL PROJECT Cost	GRANT REQUEST Amount	PRISM MATCH Amount	MATCH NOT IN PRISM Amount
Sheet #1 Acquisition				
Property Costs	$ 640,000	$ 430,000	$ 210,000	$ -
Incidental Costs	$ 23,070	$ 22,450	$ 620	$ -
Administrative Costs	$ 215,600	$ 206,000	$ 9,600	$ -
Indirect Costs	$ 7,500	$ 7,500	$ -	$ -
STotal	$ 886,170	$ 665,950	$ 220,220	$ -
Sheet #2 Design				
Design Costs	$ 275,000	$ 195,000	$ 80,000	$ -
Indirect Costs	$ -	$ -	$ -	$ -
STotal	$ 275,000	$ 195,000	$ 80,000	$ -
Sheet #3 Restoration				
Construction Costs	$ 6,811,500	$ 6,707,000	$ 64,000	$ 40,500
AA&E	$ 666,000	$ 666,000	$ -	$ -
Indirect Costs	$ 800	$ 600	$ 200	$ -
STotal	$ 7,478,300	$ 7,373,600	$ 64,200	$ 40,500
GTOTAL	$ 8,639,470	$ 8,234,550	$ 364,420	$ 40,500

Total PRISM Project Budget	$ 8,598,970

Milestone Chart

Milestone chart is to see whether the project is able to follow the scheduled completion dateline or not for each of the phase.

Milestone	Scheduled Completion	Actual Completion
Project Initiation	**5/11/2020**	**5/11/2020**
Project Charter	18/10/2020	16/10/2020
Research	23/10/2020	23/10/2020

Projections	3/10/2020	3/10/2020
Stakeholders	26/10/2020	25/10/2020
Guidelines	30/10/2020	30/10/2020
Finish Project Initiation	5/11/2020	5/11/2020
Project Planning	**14/11/2020**	**14/11/2020**
Collect projects requirement	5/11/2020	6/11/2020
Set up goal & scope	6/11/2020	8/11/2020
Create WBS	12/11/2020	12/11/2020
Verify & control scope	13/11/2020	13/11/2020
Finish Project Planning	14/11/2020	14/11/2020
Project Execution	**8/12/2020**	**8/12/2020**
Status & tracking	25/11/2020	21/11/2020
KPIs	25/11/2020	22/11/2020
Monitoring	26/11/2020	26/11/2020
Forecast	2/12/2020	1/12/2020
Project Updates	2/12/2020	4/12/2020
Chart Updates	7/12/2020	7/12/2020
Finish Project Execution	8/12/2020	8/12/2020

Project Performance/Monitoring	24/12/2020	24/12/2020
Projects objectives	10/12/2020	9/12/2020
Quality Deliverables	14/12/2020	13/12/2020
Effort & Cost Tracking	17/12/2020	15/12/2020
Project Testing	23/12/2020	23/12/2020
Finish Project Monitoring	24/12/2020	24/12/2020

D. EXECUTING THE PROJECT

Project Design and coding

```
In [1]: #importing some useful packages
        import matplotlib.pyplot as plt
        import matplotlib.image as mpimg
        import numpy as np
        import cv2
        import math
        import sys
        %matplotlib inline
```

```
In [3]: def grayscale(img):
            """Applies the Grayscale transform
            This will return an image with only one color channel
            but NOTE: to see the returned image as grayscale
            you should call plt.imshow(gray, cmap='gray')"""
            return cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)

        image = mpimg.imread('0.jpeg')
        # grayscale the image
        grayscaled = grayscale(image)
        # plt.imshow(grayscaled, cmap='gray')
```

```
In [4]: def gaussian_blur(img, kernel_size):
            """Applies a Gaussian Noise kernel"""
            return cv2.GaussianBlur(img, (kernel_size, kernel_size), 0)

        # apply gaussian blur
        kernelSize = 5
        gaussianBlur = gaussian_blur(grayscaled, kernelSize)
```

```
In [5]: def canny(img, low_threshold, high_threshold):
            """Applies the Canny transform"""
            return cv2.Canny(img, low_threshold, high_threshold)

        # canny
        minThreshold = 100
        maxThreshold = 200
        edgeDetectedImage = canny(gaussianBlur, minThreshold, maxThreshold)
```

```
In [6]: def region_of_interest(img, vertices):
            """
            Applies an image mask.

            Only keeps the region of the image defined by the polygon
            formed from `vertices`. The rest of the image is set to black.
            """
            #defining a blank mask to start with
            mask = np.zeros_like(img)

            #defining a 3 channel or 1 channel color to fill the mask with
            #depending on the input image
            if len(img.shape) > 2:
                channel_count = img.shape[2]  # i.e. 3 or 4 depending on your image
                ignore_mask_color = (255,) * channel_count
            else:
                ignore_mask_color = 255

            #filling pixels inside the polygon defined by "vertices" with the fill color
            cv2.fillPoly(mask, vertices, ignore_mask_color)
```

```
                ignore_mask_color = 255

            #filling pixels inside the polygon defined by "vertices" with the fill color
            cv2.fillPoly(mask, vertices, ignore_mask_color)

            #returning the image only where mask pixels are nonzero
            masked_image = cv2.bitwise_and(img, mask)
            return masked_image

        #apply mask
        lowerLeftPoint = [130, 540]
        upperLeftPoint = [410, 350]
        upperRightPoint = [570, 350]
        lowerRightPoint = [915, 540]

        pts = np.array([[lowerLeftPoint, upperLeftPoint, upperRightPoint,
        lowerRightPoint]], dtype=np.int32)
        masked_image = region_of_interest(edgeDetectedImage, pts)
```

```
In [7]: def hough_lines(img, rho, theta, threshold, min_line_len, max_line_gap):
            """
            `img` should be the output of a Canny transform.

            Returns an image with hough lines drawn.
            """
            lines = cv2.HoughLinesP(img, rho, theta, threshold, np.array([]),
                    minLineLength=min_line_len, maxLineGap=max_line_gap)
            line_img = np.zeros((*img.shape, 3), dtype=np.uint8)

            draw_lines(line_img, lines)
            return line_img
```

```python
        all_left_grad = []
        all_left_y = []
        all_left_x = []

        # right lane line variables
        all_right_grad = []
        all_right_y = []
        all_right_x = []

        for line in lines:
            for x1,y1,x2,y2 in line:
                gradient, intercept = np.polyfit((x1,x2), (y1,y2), 1)
                ymin_global = min(min(y1, y2), ymin_global)

                if (gradient > 0):
                    all_left_grad += [gradient]
                    all_left_y += [y1, y2]
                    all_left_x += [x1, x2]
                else:
                    all_right_grad += [gradient]
                    all_right_y += [y1, y2]
                    all_right_x += [x1, x2]

        left_mean_grad = np.mean(all_left_grad)
        left_y_mean = np.mean(all_left_y)
        left_x_mean = np.mean(all_left_x)
        left_intercept = left_y_mean - (left_mean_grad * left_x_mean)

        right_mean_grad = np.mean(all_right_grad)
        right_y_mean = np.mean(all_right_y)
        right_x_mean = np.mean(all_right_x)
        right_intercept = right_y_mean - (right_mean_grad * right_x_mean)
```

```python
def draw_lines(img, lines, color=[255, 0, 0], thickness=2):
    """
    This function draws `lines` with `color` and `thickness`.
    """
    for line in lines:
        for x1,y1,x2,y2 in line:
            cv2.line(img, (x1, y1), (x2, y2), color, thickness)


#hough lines
rho = 1
theta = np.pi/180
threshold = 30
min_line_len = 20
max_line_gap = 20

houged = hough_lines(masked_image, rho, theta,
                threshold, min_line_len, max_line_gap)
```

```python
In [8]: def draw_lines(img, lines, color=[255, 0, 0], thickness=2):
    """
    This function draws `lines` with `color` and `thickness`.
    """
    imshape = img.shape

    # these variables represent the y-axis coordinates to which
    # the line will be extrapolated to
    ymin_global = img.shape[0]
    ymax_global = img.shape[0]
```

```python
        # Make sure we have some points in each lane line category
        if ((len(all_left_grad) > 0) and (len(all_right_grad) > 0)):
            upper_left_x = int((ymin_global - left_intercept) / left_mean_grad)
            lower_left_x = int((ymax_global - left_intercept) / left_mean_grad)
            upper_right_x = int((ymin_global - right_intercept) / right_mean_grad)
            lower_right_x = int((ymax_global - right_intercept) / right_mean_grad)

            cv2.line(img, (upper_left_x, ymin_global),
                          (lower_left_x, ymax_global), color, thickness)
            cv2.line(img, (upper_right_x, ymin_global),
                          (lower_right_x, ymax_global), color, thickness)
```

In [9]:
```python
def weighted_img(img, initial_img, α=0.8, β=1., λ=0.):
    """
    `img` is the output of the hough_lines(), An image with lines drawn on it.
    Should be a blank image (all black) with lines drawn on it.

    `initial_img` should be the image before any processing.

    The result image is computed as follows:

    initial_img * α + img * β + λ
    NOTE: initial_img and img must be the same shape!
    """
    return cv2.addWeighted(initial_img, α, img, β, λ)

# outline the input image
colored_image = weighted_img(houged, image)
```

In [10]:
```python
from moviepy.editor import VideoFileClip
from IPython.display import HTML

def process_image(image):
    # grayscale the image
    grayscaled = grayscale(image)

    # apply gaussian blur
    kernelSize = 5
    gaussianBlur = gaussian_blur(grayscaled, kernelSize)

    # canny
    minThreshold = 100
    maxThreshold = 200
    edgeDetectedImage = canny(gaussianBlur, minThreshold, maxThreshold)

    # apply mask
    lowerLeftPoint = [130, 540]
    upperLeftPoint = [410, 350]
    upperRightPoint = [570, 350]
    lowerRightPoint = [915, 540]

    pts = np.array([[lowerLeftPoint, upperLeftPoint, upperRightPoint,
                    lowerRightPoint]], dtype=np.int32)
    masked_image = region_of_interest(edgeDetectedImage, pts)

    # hough lines
    rho = 1
    theta = np.pi/180
    threshold = 30
    min_line_len = 20
    max_line_gap = 20
```

```
    # hough lines
    rho = 1
    theta = np.pi/180
    threshold = 30
    min_line_len = 20
    max_line_gap = 20

    houged = hough_lines(masked_image, rho, theta, threshold, min_line_len,
                         max_line_gap)

    # outline the input image
    colored_image = weighted_img(houged, image)
    return colored_image

output = 'output_8.mp4'
clip1 = VideoFileClip("8.mp4")
white_clip = clip1.fl_image(process_image)
%time white_clip.write_videofile(output, audio=False)
```

```
t:    1%|█                                          | 3/540 [00:00<00:2
Moviepy - Building video output_8.mp4.
Moviepy - Writing video output_8.mp4


Moviepy - Done !
Moviepy - video ready output_8.mp4
Wall time: 11.1 s
```

Project Result

E.   COMPLETING THE PROJECT

CUSTOMER ACCEPTANCE/PROJECT COMPLETION FORM
20 DECEMBER 2020

Project Name: LANE LINE DETECTION
Project Manager: SITI NABIHAH BINTI ABU BAKAR

I, the undersigned, acknowledge and accept delivery of the work completed for this project on behalf of our organization which is Lane Line Holding SDN BHD. My signature is the prove that our project has been completed. No further work should be done for this project.

Name	Title	Signature	Date
Siti Maimunah Binti Abdul Rahman	Training Director	*maimunah*	8/1/2021

1. Was this project meet all your requirements and satisfaction? **(YES)**

2. This is our first project and it is a new technology and we are trying our best to deliver to the fullest. A lot of idea and improvement can be done in the future hence every input and suggestion from you are appreciated.

3. Lane Line Detection is a project that will benefit a lot of people especially the automotive fields. As the moving forward, we will try our hardest to deliver a better technology and system for a modern and safe world. Every suggestions, idea and complaints are vital for us as this is a new project and a lot of things can be improved.

Thank you for your input.

LESSONS-LEARNED REPORT

20 DECEMBER 2020

Project Name: **LANE LINE DETECTION**

Project Sponsor: Muhammad Alif bin Mustafa

Project Manager: Siti Maimunah binti Abdul Rahman

Project Dates: 8/1/2021

Final Budget: RM 1200000

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

Yes, we meet the scope and cost goal. However, we have to request for extra time to finish up the project due to sudden halt in production. Since the cause of the halt happened because of the pandemic, the sponsor had approved the request.

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

The following statement is the outline for the project scope and success criteria – "Our sponsor has stated that the project is a success if the lane line detector that is being applied to the car is able to give a sense of security and proven functional to the users. Within two years, there should be a group of users who can claim the usefulness of the product just as written in the objective".

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

All the training to drive the automated car will be done within 6 months after the car is produced and about average 100-200 drivers will be evaluated after the training. We do not know if the project will be receiving the good end after two years, but with the current review and respond from the tester, we can gauge that the system will be going at least for another one year.

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

The main lesson we learned is:

1. Communication played a very important part in making the project works. The essential of reporting and responding to calls to each of the team members are equal to the success of achieving objectives. Dissatisfaction and misunderstanding also need to be solve by communication among the team and no staying quiet is allowed.

F. PROJECT PRESENTATION

The link below is the presentation video of this project.

URL: https://youtu.be/qLOPjP0gPWc