UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF AUTOMOTIVE AIR SCOOP MICRO TURBINE

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Mechanical Engineering Technology (Automotive Technology) with Honours

By

MOHD SYAKIRIN BIN KHALID
B071310186
910305-11-5259

FACULTY OF ENGINEERING TECHNOLOGY
2016

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **DEVELOPMENT OF AUTOMOTIVE AIR SCOOP MICRO TURBINE**

SESI PENGAJIAN: **2016/17 Semester 1**

Saya **MOHD SYAKIRIN BIN KHALID**

mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (✓)

☐	SULIT	(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972)
☐	TERHAD	(Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☐	TIDAK TERHAD	

Disahkan oleh:

Alamat Tetap:

1596-N JALAN PANJI ALAM

21100 KUALA TERENGGANU,

TERENGGANU.

Tarikh:

Cop Rasmi:

** Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD

DECLARATION

I hereby, declared this report entitled "Development of Automotive Air Scoop Micro Turbine" is the results of my own research except as cited in references.

Signature : ……..

Name of Student : Mohd Syakirin Bin Khalid

Date :

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor Degree of Mechanical Engineering Technology (Automotive Technology) with Honours. The member of the supervisory is as follow:

……

(Project Supervisor)

ABSTRAK

Turbin angin adalah alat yang digunakan untuk menjana tenaga elektrik daripada tenaga angin. Tenaga elektrik boleh dihasilkan apabila daya angin memutarkan bilah turbin angin dan kemudian medan magnet terhasil. Daripada projek ini, ia akan dapat mengurangkan penggunaan bahan api dengan mengurangkan beban dari alternator. Apabila penggunaan bahan api dapat dikurangkan, ia juga akan membantu untuk melindungi alam sekitar. Turbin angin dikaji dalam pelbagai aspek seperti dimensi, seret aerodinamik, tekanan angin dan sebagainya. Pembolehubah-pembolehubah adalah sangat penting bagi menentukan tempat untuk memasang turbin angin pada kereta dan untuk menentukan voltan yang boleh dihasilkan. Untuk merealisasikan projek ini, satu kajian telah dilakukan melalui perisian dan eksperimen. Komputer perisian Dynamic Fluid digunakan untuk menentukan aliran angin dan tekanan angin di permukaan kenderaan. Berdasarkan keputusan ini, ia boleh digunakan untuk menentukan kedudukan tepat untuk memasang turbin angin. Seterusnya, kereta akan dijalankan dalam eksperimen pemanduan sebenar untuk mengukur voltan yang boleh dihasilkan. Voltan akan diukurkan dengan menggunakan multimeter digital.

ABSTRACT

Wind turbine is a device that used to generate electrical energy from the wind force. The electrical energy can be generated when the wind force rotates the blades of wind turbine and then the magnetic field will be produce. From this project, it will able to reduce the fuel consumption by reducing the load from the alternator. When the fuel consumption can be reduce, it will also help to protect the environment. The wind turbine is being study in many aspects such as dimension, aerodynamic drag, wind pressure and so on. Those variables are very important in order to determine the place to install the wind turbine on a car and to determine the voltage that can be generated. To realize this project, a research has been done through the software and experimental. Computer Fluid Dynamic software was used to determine the wind flow and wind pressure on vehicle surface. Based on this result, it can be determine the accurate position to install the wind turbine. Next, the car will be run in real driving experiment to measure the voltage that can be generated. The voltage will be measure by using digital multimeter.

DEDICATION

To my parents especially and friends, also for whom with their effort to support me in order for me to pursue study in higher education, and also in order to complete this project and project report to fulfil the requirement for Bachelor Degree in Mechanical Engineering Technology (Automotive Technology) award.

To my supervisor too, Mr. Ir. Mohamad Hafiz bin Harun and all the Mechanical Department Staff with their helpful suggestions, guidance and assistance in order for me complete this Final Year Project for degree course.

ACKNOWLEDGEMENTS

First of all, I present my gratitude to Allah the Almighty for His blessings on me that enable me to finish this project.

I would like to express my earnest gratitude and appreciation to my supervisor Mr. Ir. Mohamad Hafiz bin Harun for his patient, germinal ideas, priceless guidance, nonstop encouragement and constant support that encourage me to finish this project. I am grateful for his consistent support from the first day I applied to graduate program to these concluding moments. I am truly thankful for his progressive vision about my study, his tolerance of my naive mistakes, and his dedication to my future career.

Besides, thanks go to all my classmates and members of the staff of the Mechanical Engineering Technology Department, UTeM, who assisted me in many ways and made my stay at UTeM pleasant and unforgettable. I also want to acknowledge my appreciation to anybody for spending his or her time and energy to help me endure my hard times in finishing this project.

Then, I acknowledge my sincere indebtedness and gratitude to my parents for their love, dream and sacrifices throughout my life. I cannot find the appropriate words that could properly describe my appreciation for their devotion, support and faith in my ability to reach my goals.

TABLE OF CONTENTS

LIST OF TABLE

LIST OF FIGURES

LIST ABBREVIATIONS, SYMBOLS AND NOMENCLATURES

2D	=	Two Dimension
3D	=	Three Dimension
AC	=	Alternate Current
CAD	=	Computer Aided Design
CAE	=	Computer Aided Engineering
CATI	=	Computer Assistee Tridimensionelle Interactive
CATIA	=	Computer Aided Three Dimensional Interactive Application
CFD	=	Computer Fluid Dynamics
DC	=	Direct Current
DES	=	Detached – Eddy Simulation
DWG	=	Drawing
GMAW	=	Gas Metal Arc Welding
GTAW	=	Gas Tungsten Arc Welding
HVAC	=	Heating, Ventilation, Air Conditioning
HW	=	HyperWorks
IGES	=	Initial Graphics Exchange Specifications
Km/h	=	Kilometre Per Hour
m	=	Metre
m/s	=	Meter Per Second
MicroCAD	=	Micro Computer Aided Design
mm	=	Multimetre
PC	=	Computer
PD	=	Product Design

RANS	=	Reynolds – Averaged Navier - Strokes
STEP	=	Standard for the Exchange of Product Data
V	=	Volts
Vs.	=	Versus
W	=	Watt

CHAPTER 1
INTRODUCTION

1.0 Background

Nowadays, low fuel consumption requirement on a vehicle have risen because of the fuel price. A lot of study has been done to achieve this requirement. Due to the requirement, a study of wind energy technology has been developed because wind energy can be converts into electricity by using the correct tools. Wind energy is being study in many dimensions such as aerodynamics, structural mechanics and mechanical engineering.

Each car has its own design to fulfill the customer requirement. In winning exterior design, it is not just for the best look, but the maker also study about the aerodynamic drag when designing the shape of the car. The aerodynamic drag is depending on the car's shape, height and surface. Those parameter are being study very deep so that when the car is finished in design, it will produce less aerodynamic drag and it will help in lowering fuel consumption. The design of a car then will simulate in the wind tunnel by using CFD software. The CFD software used in this study is to obtain the data of wind velocity, wind vector, and flow of the wind. Each of these data will be different based on the car speed. If the aerodynamic is improved, it can reduce the engine load and fuel consumption too.

The first point concerning in this research is to identify the shape of Proton Perdana V6 model so that it can be draw by using any software. Secondly, the drawing model will be simulated in CFD software to determine the wind flow on the front hood of this vehicle. Next, after the car has been simulate, the results will be used to study the

area to attach or mount the wind turbine on the front hood so that it is able to get the air flowing around the front hood to turn the blades, therefore gain the energy. When the turbine has been mounted, the vehicle will be test to determine the maximum current can be generated based on different speed.

1.1 Problem Statement

Based on the observation, the electric current that being delivered to the battery is come from the alternator based on its motion when the engine is started because the alternator's pulley is connected to the crankshaft's pulley by using a belting. The main issue in this study is, an alternator has to work over limit to restore the current when a vehicle use too much electricity. When this is happen, the load in the alternator will become higher, and so it will affect the engine load too. The higher engine load will affect the fuel consumption. A turbine will be mount to the vehicle to solve the problem. The usage of the turbine is to generate electric current from the wind flow when the vehicle is in a motion. Then, the generated electric current will be deliver to the alternator to reduce its load and in the same time it will help to reduce engine load and fuel consumption.

1.2 Objective

i. To identify shape vehicle model of Proton Perdana V6.

ii. To determine the fastest wind speed on the front hood.

iii. To determine the maximum voltage that can be generated.

1.3 Scope of Project

The study will discuss about:

i. Potential of wind energy to generate electric current on a front hood of Proton Perdana V6.
ii. Utilization of CATIA software in designing the 3D model of Proton Perdana V6.
iii. Carry out wind tunnel test to validate the CFD simulation.
iv. After the simulation, turbine will be mounted at the high potential of the wind to flow on a hood.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This part examined about the work of past analysis. This part would discuss about the streamlined drag, feign body, wind turbine, wind turbine profile, cutting edge plan and the past work of research. In the past research, a few sub-subjects will be examined, for example, the approach, results and examination lastly the finish of past research.

Liquid streamed conduct could be examined all through the examination and exact reviews. To concentrate the attributes of the liquid streams, a software called Computational Fluid Dynamics (CFD) was created. All through the improvement of CFD, quantities of liquid issue were tackled, despite the fact that it was an entangled issue. (Abdul Halim, 2015)

2.1 Design Software

Design software is a software that being use to draw a model by an engineer. In this era, a lot of software has been published to be used by any user according to their skills and comfortness. Each of the software has their own advantages and disadvantages. So, when a designer wants to draw something, they will choose which software is suitable for them.

2.1.1 AutoCAD

AutoCAD is a business programming application for 2D and 3D PC supported plan (CAD) and drafting accessible since 1982 as a desktop application and since 2010 as a portable, web-and cloud-based application advertised as AutoCAD 360. Created and promoted via Autodesk, AutoCAD was initially discharged in December 1982, running on microcomputers with interior design controllers. Before the presentation of AutoCAD, most business CAD programs kept running on centralized computer PCs or minicomputers, with every CAD administrator (client) working at a different design terminal. AutoCAD is utilized over an extensive variety of businesses, by draftsmen, extend supervisors, engineers, visual creators, and different experts.
<https://en.wikipedia.org/wiki/AutoCAD>

It is upheld by 750 preparing focuses worldwide starting 1994. As Autodesk's leader item, by March 1986 AutoCAD had turned into the most omnipresent CAD program around the world. AutoCAD was gotten from a program started in 1977 and discharged in 1979 called Interact CAD, additionally alluded to in early Autodesk archives as MicroCAD, which was composed before Autodesk's (then Marinchip Software Partners) development via Autodesk fellow benefactor Mike Riddle. The primary form via Autodesk was shown at the 1982 Comdex and discharged that December. The 2016 discharge denoted the 30th real arrival of AutoCAD for Windows. The 2014 discharge denoted the fourth continuous year of AutoCAD for Mac. The icon of latest version is shown in figure 2.1.

Figure 2.1: AutoCAD icon

An AutoCAD software have many favorable position for the client. For instance, the first is AutoCAD programming contain standard mechanical segments which is If a working is going ahead with apparatus that requires hundreds or a huge number of parts, it may take weeks or even months to draw them without any preparation. The product underpins a few made parts, for example, nuts, screw, washers, bolts, pins, plugs, bushings, heading, auxiliary steel shapes, shaft segments, keyways and some more. The second preferred standpoint of AutoCAD programming is the product is effective and brisk measurement. With the utilization of improved instruments we can create measurements to effectively control and grow just imperative factors for assembling. With programmed dimensioning, we can produce a few with less info and constrain covering measurements to naturally put themselves separated legitimately and even drive and alter plan geometry to settle in certain size. Third preferred standpoint of AutoCAD is it can do a 'U over all drawings'. This implies AutoCAD consequently redraw geometry to show dashes and shrouded lines of parts that are obstructed by different parts in mechanical plan. The shrouded lines include consequently overhauls every single pertinent drawing when a change happen, for all intents and purposes expelling long manual redrawing of geometry because of rehash changes. This implies you spare time

and endeavors your 2D plan. Next, an AutoCAD programming make the client simple to swap information over various CAD frameworks which is AutoCAD Mechanical suite accompanies in-assembled industry-standard STEP (Standard for the Exchange of Product Data) and IGES (Initial Graphics Exchange Specification) designs for trading information between CAD frameworks.

AutoCAD software additionally has its own disadvantge. The first is the product is restricted record positions on the grounds that the AutoCAD is one of the main CAD programs, it restrains the quantity of document arrangement it can import and fare, in light of the fact that Autodesk anticipates that different projects will fare to AutoCAD configurations, for example, DWG and DXF. Sadly, this makes issues when utilizing different projects with all the more intense devices and trading the program to an AutoCAD design; geometry, shading and the impacts are lost regularly. Second burden of AutoCAD is it is non-parametric. AutoCAD gives apparatuses to make three - dimensional models, yet altering the models requires many strides, not at all like BIM parametric models, which consequently conform the greater part of the model segments while altering components. Next, the AutoCAD programming have issue with the line which is AutoCAD produces drawing utilizing line and shape instruments. Bends, circular segments and straight lines deliver the shapes, however AutoCAD can't alter the line and area as unreservedly as delineation program where altering and covering lines and line weights is restricted to a couple of choices. AutoCAD additionally have issue with shading, fill and surface where the application is limits the quantity of conceivable shading to 256 and the gives just a modest bunch of surfaces, which implies it can't make photograph sensible pictures like representation projects. Rather, you can import picture records and make material maps for AutoCAD renderings, however AutoCAD's rendering capacities can't contend with three – dimensional displaying projects or outline programs.
<https://en.wikipedia.org/wiki/AutoCAD>

2.1.2 CATIA

CATIA (Computer Aided Three-Dimensional Interactive Application) is a multi-stage Computer-Aided Design (CAD) or Computer-Aided Manufacturing (CAM) or Computer-Aided Engineering (CAE) programming suite created by the French organization Dassault Systèmes. It is composed in the C++ programming dialect. CATIA (Computer Aided Three-Dimensional Interactive Application) began as an in-house advancement in 1977 by French air ship producer Avions Marcel Dassault, around then client of the CAD/CAM CAD programming to build up Dassault's Mirage warrior stream. It was later embraced in the aviation, car, shipbuilding, and different ventures.
<https://en.wikipedia.org/wiki/CATIA>

Figure 2.2: Icon of CATIA software

CATIA first name was CATI (Conception Assistee Tridimensionnelle Interactive – French for Interactive Aided Three-dimensional Design), it was renamed CATIA in 1981 when Dassault made a backup to create and offer the product and marked a non-select dispersion concurrence with IBM. The software will start running by showing the icon as shown in Figure 2.2.