UNIVERSITI TEKNIKAL MALAYSIA MELAKA

AUTOMOTIVE FRONT GRILLE ENERGY HARVESTING USING WIND 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) (Hons.)

By

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DECLARATION

I hereby, declared this report entitled“Automotive Front Grille Energy Harvesting Using Wind Turbine” is the results of my own research except as cited in references.

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Name of Student : Muhammad Asyraf Hakim Bin Muhammad Zaki

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 salah satu peranti yang dibuat untuk menjana tenaga elektrik darpada tenaga angin. Penggunaan bahan api boleh menjejaskan alam sekitar. Salah satu kaedah untuk mengurangkan penggunaan bahan api adalah melalui pengurusan kuasa yang cekap. teknologi menuai adalah penyelesaian untuk mengurangkan penggunaan bahan api. teknologi penuaian seretan aerodinamik adalah salah satu kaedah untuk mengurangkan penggunaan bahan api. Bagi merealisasikan keperluan ini, penyelidikan mengenai penuaian tenaga daripada seretan aerodinamik telah dijalankan. Sebelum memilih turbin, analisis CFD harus dilakukan untuk menentukan kedudukan turbin angin. Apabila turbin telah dipasang, eksperimen telah dijalankan untuk mengenal pasti voltan yang dihasilkan.

ABSTRACT

The wind turbine is one device that is made to generate electricity than about wind energy. Fuel consumption may affect the environment. One of the methods for reduces fuel consumption through efficient power management. Harvesting technology is the solution to reduce fuel consumption. Aerodynamic drag harvesting technology is one way to reduce fuel consumption. To realize this purpose, research on harvesting energy from aerodynamic drag has been carried out. Before choosing the turbine, the CFD analysis should be performed to determine the position of the wind turbine. When the turbine has been installed, the experiment was carried out to identify the voltage generated.

DEDICATION

Specially thanks is dedicated to my beloved father, En Muhammad Zaki Bin Shafii and my mother, Pn Rosnah Binti Ramli, who is very concerned, understanding, patient, and supporting. Special thanks to my supervisor En Ir. Mohamad Hafiz Bin Harun and my co-supervisor En Mohd Faruq Bin Abdul Latif for the constructive guidance, encouragement and patient in fulfilling my aspiration in completing this project. To my siblings and my fellow friend, the work and success will never be achieved without all of you.

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Bismillahirrahmaanirrahiim…

Alhamdulillah, grateful to Allah for giving me the strength to finish this final year project completely beside gaining valuable experiences and knowledge throughout completing this thesis, this experience and knowledge may assist me to develop my personal skill in the future.

Special thanks are addressed to my supervisor, En Ir.Mohamad Hafiz Bin Harun for his guidance, advices, idea, and his patience with me in accomplishing this project, a special debt of gratitude towards him. To my beloved family, thank you so much. Without their continuing support and encouragement, I could not have gone further than where I have. Not forgetting En Faruq Bin Abdul Latif as my co-supervisor and my friends for their help, cooperation, opinion and advice.

May Allah repay all your kindness.

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LIST OF ABBREVATIONS, SYMBOLS AND NOMENCLATURES

AutoCAD	-	Auto Computer Aided Design
CATIA	-	Computer Aided Three-Dimensional Intelligent Application
CFD	-	Computer Fluid Dynamic
CAM	-	Computer-Aided Producing
CAE	-	Computer-Aided Engineering
MBSE	-	Model Based Systems Engineering
AUTOSAR	-	Automotive Embedded Systems Development
Cd	-	Coefficient Drag
Cl	-	Coefficient Lift
VWT	-	Virtual Wind Tunnel
RANS	-	Reynolds-Averaged Navier-Stokes
DES	-	Detached-Eddy Simulation
LES	-	Large-eddy simulation
FSI	-	Fluid structure interaction

CHAPTER 1
INTRODUCTION

1.1 Introduction

In advanced vehicle technology, automobile becomes most necessity to the human being. It is also call an act as transportation that needed to travel for a short or long journey. Therefore, an automobile become more convenience. Vehicle comfort and safety aspect must be improved to meet the user's requirement. Other than that, the development of vehicles should be done to ensure new technology is implanted to enhance the driver and passenger.

Nowadays, the world fuel price is not consistency stable. So, development and improvement of the vehicle must also consist of the fuel consumption. This we can see when the users need to spend more money when used a car. This problem also includes when the load of all component is depending on the engine. So, that, the engine will be working with more power. Another thing that cause of more usage of fuel consumption is the driver's driving skill.

Vehicle manufacturer should product the vehicle that has less air resistance. Aerodynamic should be prior to the manufacturer and to fulfil customer requirement with suitable design that can produce a result of less load to the vehicle itself and the result of less fuel consumption.

Each of vehicles that will produce must do computational fluid dynamic (CFD) simulation before going to mass production. This is to ensure which part of the vehicle has more air speed. From that, it needs to be minimizing the drag coefficient on the certain part of the vehicle body.

When the fuel consumption is more due to the higher amount of engine load, the vehicle will produce more pollution gases that can cause green house to the earth. To reduce the effects of green house, the vehicle that uses petrol must build a device that can reduce pollutant based on vehicle design and aerodynamics.

1.2 Problem Statement

In this era, all electronic devices in the vehicle system depend on the engine capacity of the existing system. By the reason, the fuel consumption will be more and it will burden the consumers who use them. The load imposed on the engine, the engine should be working with power levels or more to accommodate all the required by electronic devices or alternator.

To overcome all these problems, the use of wind turbine can reduce the load of the alternator which directly affects the engine load.

1.3 Objective

The aims of this research are stated below:

1. To identify the position of high speed wind at front grille.
2. To fabricate a wind turbine to harvest the wind at the front grille.
3. Identify the maximum current that can be generated by the wind turbine that has been installed at the front grille.

1.4 Scopes

This project will limited to this aspects:

1. The CATIA and CFD(Altair Hyper work) learning
2. Potential of wind to spin the turbine.
3. The turbine design that highly generate current.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

A literature review is a process to review the previous history research in order to obtain the information and methodology regarding research. Literature review is reference to obtain any information that relate to this research. Furthermore, it also gathered the information through books, journals, article, thesis, website or any other resources that it needs to run experiment, complete report and etc. For this project, the literature review will be focusing on topics that related to the project such as preceding research, fundamental of car Aerodynamic force, road automobile aerodynamic, wind tunnel method, model of vehicle body and computer fluid dynamic (CFD).

2.2 Design Process

2.2.1 AutoCAD

Figure 2.1: AutoCAD Architecture shortcut icon

AutoCAD was produced from a program called Interact, which was composed in a language called (SPL) by Michael Riddle. The first version kept running on the Marinchip Systems 9900 PC (Marinchip Systems was claimed via Autodesk prime supporters John Walker and Dan Drake). Walker paid Riddle US$10 million for this CAD innovation. At the point when Marinchip Software Partners (later known as Autodesk) established, the co-founder chose to re-code Interact in C and PL/1. They picked C since it was the greatest upcoming language. The C adaptation was the most complex programs in that language. Autodesk had to work with a compiler engineer, Lattice, to upgrade C, empowering AutoCAD to run. Early arrivals of AutoCAD utilized primitive substances, for example, lines, polylines, circles, circular segments, and content — to build more complex objects. Since the mid-1990s, AutoCAD upheld custom objects through its C++ Application Programming Interface (API). The present day AutoCAD incorporates a full arrangement of fundamental strong demonstrating and 3D instruments. The arrival of AutoCAD 2007 incorporated the enhanced 3D displaying that gave better navigation when working in 3D. Additionally, it got to be distinctly simpler to alter 3D models. The mental beam engine was incorporated into rendering and consequently it is conceivable to do quality renderings. AutoCAD 2010 presented parametric usefulness and mesh modelling. The most recent AutoCAD discharges are AutoCAD 2013 and AutoCAD 2013 for Mac. The discharge denoted the 27th major release for the AutoCAD for Windows and the third back to back year for AutoCAD for Mac.

In the mid 1980s, CAD systems gave via AutoCAD was open just to gathering of individuals connected with Specialize Graphics Terminals. However, the launch or release of the first version of AutoCAD allows the drafters or designing personnel to use a tool that could be utilized on standard computers.. The main rendition AutoCAD1.0 got launched back in the year 1982. The application was thought to be the first of its own kind and has exclusive features. From that point onwards, Autodesk Inc. had launched various updated versions of AutoCAD on frequent Intervals.

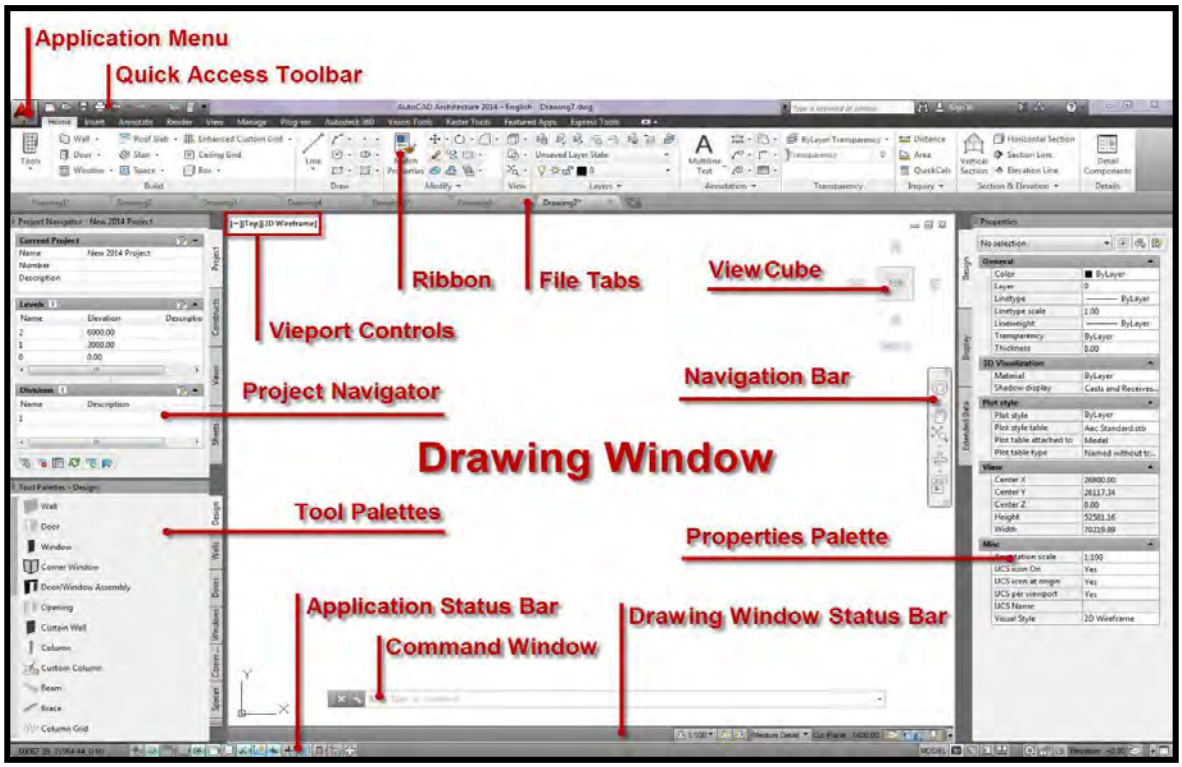

Figure 2.2: The interface of AutoCAD Architecture 2014

The advantages of using Autodesk AutoCAD software are:

i. Beginner-range software: This software can use for ages starting from secondary school until in industries.

ii. User friendly : AutoCAD is user friendly to the user to form a drawing with all shortcut icons are ready to click by the user without entering commands.

iii. Paperless Environment : This software just no need papers to draw. It can be saved in various type of format and can be opened in other computers.

iv. Easily edit : User can do minor or major changes of drawing with just edit on the drawing in this software.

v. Unlimited drawing size : User can draw for unlimited size of drawing. It can change the drawing scale in properties in this software.

The disadvantages of using Autodesk AutoCAD software are:

i. Requires high-spec of computer : A low-spec of computer is not supported to run AutoCAD

ii. Costing of AutoCAD installation : A software costs of thousand dollars for higher version for experts.

iii. Continuous updating equipment : Certain equipment and component needs an update in order to use the equipment.

iv. Requires special skill : It requires skill to draw using AutoCAD.

v. Data storage fragile : High probability of data corruption if it saved in storage for an example in a computer hard disk.

2.2.2 CATIA

Figure 2.3: Dassault Systems CATIA V5R21

Catia is made by its originator, Francis Bernard, and is encouraged by David Levin at isicad. The item was propelled by that name in 1977, yet it was gone before by decade of advancement work, incorporating a CAM interface in the late 1960s. Like other computer aided design programming of the time, it was made inside by an assembling organization, in this circumstance French plane maker Dassault Avionics. The business jump forward came in 1981 when IBM assented to pass on the item around the world.

CATIA (Computer Aided Three-Dimensional Intelligent Application) is a multi-arrange Computer-Aided Outline (computer aided design) or Computer-Aided Producing (CAM) or Computer-Aided Helped Building (CAE) programming suite made by the French association DassaultSystèmes. It is created in the C++programming dialect. CATIA (PC Helped Three-Dimensional Intelligent Application) started as an in-house advancement in 1977 by French flying machine producer Avions Marcel Dassault, around then customer of the computer aided design/CAMCAD programming to make Dassault'sMirage warrior jer. It was later grasped in the flying, car, shipbuilding, and different ventures.

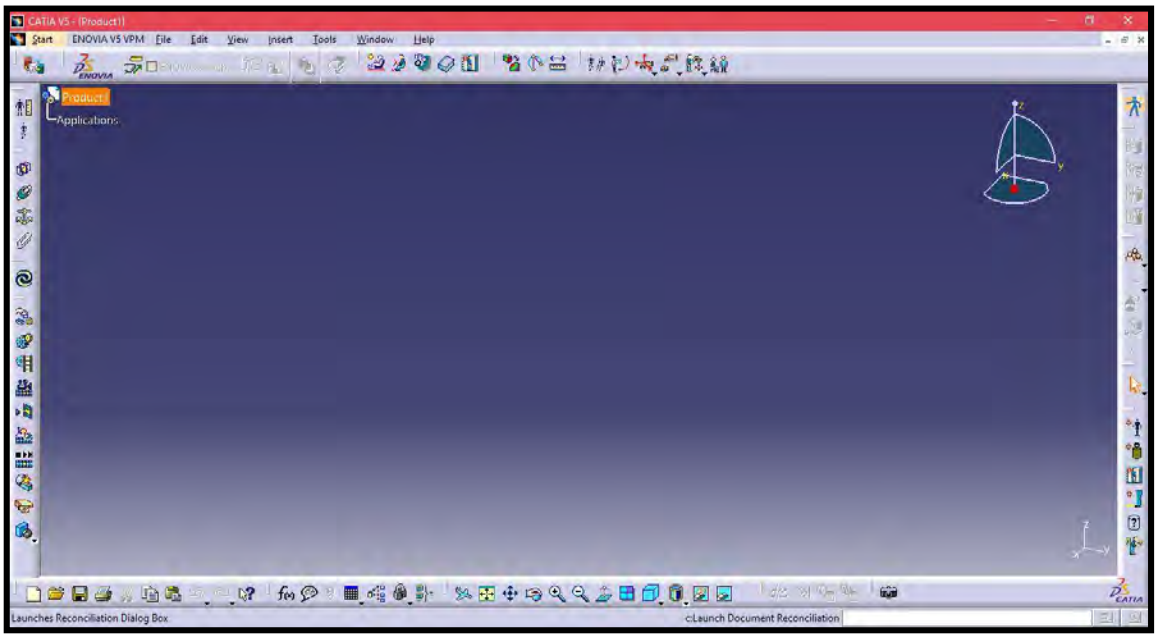

Figure 2.4: Interface of Dassault Systèmes CATIA V5R21

The chronicled setting of CATIA will be CATIA (Computer Aided Three-Dimensional Interactive Application) started as an in house progression in 1977 by French plane maker Avions Marcel Dassault, around then customer of the CAD/CAM CAD programming to develop Dassault's Mirage warrior fly. It was later grasped in the aeronautics, auto, shipbuilding, and distinctive endeavors.

At initially named CATI (Conception Assistée Tridimensionnelle Interactive– French for Interactive Aided Three-dimensional Design), it was renamed CATIA in 1981 when Dassault made a reinforcement to make and offer the item and assented to a nonexclusive flow course of action with IBM.

In 1984, the Boeing Company picked CATIA V3 as its major 3D CAD device, transforming into its greatest customer. In 1988, CATIA V3 was ported from unified server PCs to UNIX. In 1990, General Dynamics Electric Boat Corp picked

CATIA as its essential 3D CAD gadget to outline the U.S. Maritime drive's Virginia class submarine. Also, Lockheed was putting forth its CADAM CAD structure worldwide through the channel of IBM since 1978. In 1992, CADAM was purchased from IBM, and the next year CATIA CADAM V4 was conveyed.

In 1996, it was ported from one to four UNIX working structures, including IBM AIX, Silicon Graphics IRIX, Sun Microsystems SunOS, and Hewlett-Packard HPUX. In 1998, V5 was discharged and was a totally adjusted type of CATIA with support for UNIX, Windows NT and Windows XP (since 2001). In the years prior to 2000, issues brought on by oppositeness between adaptations of CATIA (Version 4 and Version 5) provoked to $6.1B in additional costs in light of years of wander deferrals in progress of the Airbus A380.

In 2008, Dassault Systèmes discharged CATIA V6. While the server can continue running on Microsoft Windows, Linux or AIX, client reinforce for any working structure other than Microsoft Windows was dropped. In November 2010, Dassault Systèmes propelled CATIA V6R2011x, the latest entry of its PLM2.0 organize, while continuing supporting and improve its CATIA V5 programming. In June 2011, Dassault Systèmes propelled V6 R2012. In 2012, Dassault Systèmes moved V6 2013x. In 2014, Dassault Systèmes propelled 3D EXPERIENCE Platform R2014x and CATIA on the Cloud, a Cloud variation of its item.

In this item moreover have degree of usage that ought to be use. By and large implied as 3D Product Lifecycle Management programming suite, CATIA supports different periods of thing headway (CAx), including conceptualization, arrange (CAD), planning (CAE) and amassing (CAM). CATIA energizes community oriented building crosswise over controls around its 3D EXPERIENCE arrange, including surfacing and shape plot, electrical liquid and electronic framework arrange,