

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOP AND DESIGN PORTABLE MINI TURBINE AND SOLAR BACKUP SOURCE FOR OUTDOOR USAGE

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Power) with Honours.

by

STUDENT NAME MOHAMMAD ZULFADHLI BIN RAMSAH MATRIX NUMBER B071410722 IC NUMBER 920807-12-5915

FACULTY OF ENGINEERING TECHNOLOGY 2017



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: DEVELOP AND DESIGN PORTABLE MINI TURBINE AND SOLAR BACKUP SOURCE FOR OUTDOOR USAGE

SESI PENGAJIAN: 2017/18 Semester 1

Saya MOHAMMAD ZULFADHLI BIN RAMSAH

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 TERHAI	Disahkan oleh:
Alamat Tetap: Blok 13 Lot14 Lorong 11	Cop Rasmi: SHAHRUDIN BIN ZAKARIA Pensyarah Jabatan Teknologi Kejuruteraan Elektrik Fakulti Teknologi Kejuruteraan Universiti Teknikal Malaysia Melaka
Rajawali 90500, Sandaka	n / / -
Sabah	Tarikh: 19/1/2018
Tarikh: 19-1-18	

^{**} 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 "DEVELOP AND DESIGN PORTABLE MINI TURBINE AND SOLAR BACKUP SOURCE FOR OUTDOOR USAGE" is the results of my own research except as cited in references.

Signature	:	Don't.
Author's Name	:	MOHAMMAD DULFAOHLI BIN RANGAH
Date	:	19-1-2018

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 of Electrical Engineering Technology (Industrial Power) with Honours. The member of the supervisory is as follow:

SHAHRUDIN JAKARIA (Project Supervisor)

ABSTRAK

Tujuan sebenar dalam untuk projek ini ialah membangunkan dan membuat reka bentuk mini turbin mudah alih untuk kegunaan aktitivi luar. Kepada penjalan kaki yang mendaki gunung mereka sukar untuk mendapatkan punca kuasa semasa pendakian. Oleh itu projek ini boleh mengatasi masalah tersebut dengan menggunakan sumber alam semula jadi iaitu punca air, angin dan sinaran matahari . pada masa kini generator mempunyai saiz yang agak besar dan berat untuk dibawa.projek ini mempunya reka bentuk yang kompak dimana ia berbeza dengan reka bentuk generator masa kini. Genarator juga memerlukan bahan api untuk menghasilkan kuasa elektrik dimana penjalan kaki perlu membawa bahan api tersebut ini juga menyebabkan kos untuk menghasilkan kuasa elektrik. Oleh itu projek ini hanya menggunakan sumber alam semula jadi sebagai contoh sungai, angin dan sinaran matahari yang boleh menjana kuasa elektrik. Objektif projek ini juga menggalakan teknologi hijau.

ABSTRACT

The main purpose of this project is to design and develop and (and also) design portable mini turbine for outdoor usage. The hikers cannot get enough energy resource to be use(used) on the electronic device for a long journey. Therefore, this project can overcome problem face (faced) by using nature resources such as hydro and wind. Nowadays, generators have a big size and heavy to carry it (to be carried). (That – to be cut) for this project has a compact design compare the generator design before. A generator also need a fuel to generate an electric source that a traveller must to bring it (must bring it) and make it more costing for (to) generate (an - to be cut) electricity. For this project just usefully a nature source like a river, wind and solar that can generate electricity. The objective of this project is to promote a usage green technology.

DEDICATION

To my beloved parents and friends

Appreciation for their support and understanding

ACKNOWLEDGEMENT



In the Name of Allah S.W.T, the most beneficent, the most merciful

Praise be to Allah S.W.T for giving me the strength to complete my Final Year project 2 (FYP2) and writing the report without any major obstacles. I would like to thank you to my supervisor Encik Shahrudin bin Zakaria who has contributed to this project by giving comments, ideas, suggestion and correction in completing this project. This project is dedicated to my beloved parents and friend who given the all moral support. My sincerest thanks again to all of yout because given me help when needed.

A special appreciation to UTeM, especially the Faculty of the Engineering Technology for giving me chance to participate in this project paper. This project has really helped me understand the mini turbine and solar. I really hope this knowledge will help me for my future work. Finally, I would also like acknowledge the assistance of my colleagues and the other person involved ibt the completion of this research and preparation of this report writing

TABLE OF CONTENT

Abs	strak	i
Abs	tract	ii
Ded	lication	iii
Ack	nowledgement	iv
Tabl	le of Content	v
List	of Tables	vi
List	of Figures	vii
List	Abbreviations, Symbols and Nome	enclatures viii
CHA	APTER 1: INTRODUCTION	1
1.1	Introduction	1
	1.1 project briefing	
1.2	Problem statement and project o	bjective 2
	1.2.1 Problem statement	2
	1.2.2 Project Objective	2
1.3	Work scope	2
1.4	Project methodology	3
1.5	Result expectation	4
CHA	APTER 2: LITERATURE REVI	EW 5
2.0	introduction	5
2.2	Wind energy	5
	2.2.1 Type of wind turbine design	gn 6
	2.2.2 Type of blade design	6
	2.2.2.1 Stall to pitch control	7
	2.2.3 Synthetic jets	9
	2.2.4 Fatigue loads	9
	2.2.5 Cheap and effective	10
	2.2.6 Blade count	12

	2.2.6 Blade count	12
	2.2.7 Environmental impact	13
2.3	Hydro energy	14
	2.3.1 Impulse turbine	15
	2.3.1.1 Pelton turbine	16
	2.3.1.2 Turgo turbine	17
	2.3.2 Drive system	17
	2.3.2.1 Direct drive	17
	2.3.2.2 Flat belt and pulleys	18
	2.3.2.3 V or wedge belt and pulleys	18
	2.3.2.4 Chain and sprocket	18
	2.3.2.5Gearbox	18
2.4	Solar energy	19
	2.4.1 Type of solar cells	19
	2.4.1.1 Semiconductor materials	20
	2.4.1.2 Polycrystalline silicon cells	21
	2.4.1.3 Mono-crystalline silicon solar cells	21
	2.4.1.4 Thin film	22
	2.4.2 Solar radiation	24
	2.4.3 Environmental impact	24
	2.4.4 Improving solar cells efficiency	25
2.5	Dc motor	27
	2.5.1 Principle of DC motor	27
	2.5.2 Working of DC motor	27
	2.5.3 DC motor voltage equation and power equation	28
	2.5.3.1 Voltage equation	28
	2.5.3.2 Power equation	29
	2.5.4 Back EMF or counter EMF in DC motor	29
	2.5.4.1 Electro motive force and potential difference	30
2.6	Battery as the power storage	30
2.7	Electrical and mechanical part	31
	2.7.1 Converter and regulator	31
CHA	APTER 3: METHODOLOGY	32

3.0	Introduction	32
3.1	Data collection	32
3.2	Method to determine the type of hybrid system and the prototype	33
3.3	Software and Hardware	34
	3.3.1 Solidwork for Designing Modelling Part	34
3.4	List of Hardware and Components	39
	3.4.1 The voltage regulator LM7805	40
	3.4.2 Rechargeable Lead Acid Battery	40
	3.4.3 Boost converter DC-DC	40
	3.4.4 3-phase AC-DC Converter	41
	3.4.5 3-phase AC generator	41
	3.4.6 USB (universal series bus) port	42
	3.4.7 Perspex glass enclosed	42
	3.4.8 Flexible solar panel	43
	3.4.9 Multi-meter	44
	3.4.10 Charger Controller	44
3.5	Overall Methodology	45
3.6	Data Analysis and Result	46
3.7	Data Verification	46
3.8	Preparation Report	46
CHA	PTER 4: RESULT & DISCUSSION	47
4.0	Introduction	47
4.1	Water mini Turbine Measured	47
4.2	Wind Turbine Measured	49
4.3	Solar panel Measured	50
CHA	PTER 5: CONCLUSION	52
5.0	Introduction	52
5.1	Summary of The Project	52
5.2	Achievement of Project Objectives	53
5.3	Problem and Limitation Faced During Project Development	53
5.4	Suggestion for Future Work	54
5.5	Conclusion	54

REFERENCES 55

LIST OF FIGURE

2.2.2.1.1	Attacking the angle between the relative wind and the chord line	7
2.2.2.1.2	Forces of lift and dragging at rotor blade vary with the angle of attack	7
2.2.5.1	wind turbine is rated	10
2.2.5.2	The blade design with angle and the calculation	10
2.3.1.1.1	Shape pelton turbine blade	14
2.3.1.2.1	Turgo turbine inject	16
2.4.1.2.1	Polycrystalline silicon cells	20
2.4.1.4.1	Thin film solar	21
2.4.2.1	Light Spectrum Based on Wavelength	23
2.4.4.1	Research cell efficiencies	25
2.5.1.1	Principle of DC Motor	26
2.5.3.1.1	Voltage equation	27
2.5.4.1	Back EMF or counter EMF in DC motor	28
2.6.1	Example battery	29
2.7.1.1	Bridge rectifier	30
2.7.1.3	Voltage Regulator circuit LM7805	31
3.3.1.1	Solidwork premium 2017 to design a modelling part	34
3.3.1.2	Blade holder	35
3.3.1.3	Generator shaft	35
3.3.1.4	Shaft holder	35
3.3.1.5	Water blade	36
3.3.1.6	Wind blade	36
3.3.1.5	Assembly 3 of modelling part	37
3.3.1.6	The connection for AC-DC 3 phase	38

3.4.1.1	LM/805 voltage regulator	39
3.4.2.1	Rechargeable Lead Acid Battery 12v, 1.2Ah	40
3.4.3.1	Actual boost converter DC-DC	4(
3.4.4.1	3-phase ac-dc converter	41
3.4.5.1	3-phase Ac generator	41
2.4.6.1	USB (universal series bus) port	42
3.4.7.1	Perspex glass enclosed	42
3.4.8.1	Back side solar panel	43
3.4.8.2	Front side solar panel	43
3.4.9.1	Multi-meter	44
3.4.10.1	Charger controller	44
4.1.1	Setup the multi-meter to the correct probe	47
4.1.3	Show the graph of generator speed and voltage	48
4.2.2	Show the graph of the wind speed against voltage generate	49
4.3.2	Show the graph time (24hour) against time voltage	5(
433	Show the graph time (24hour) against the current	5.1

LIST OF TABLE

2.4.1.4.2	Show the advantage and disadvantage for each type	22
4.1.2	Show the data recorded by generator speed against the voltage generate	48
4.2.1	The table data for wind speed in km/h and the voltage generate	49
4.3.1	Show the data are recorded a current and voltage against time (24hour)	50

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

Al - Aluminium

ANOVA - Analysis of Variance

ASEAN - Association of Southeast Asian Nations

AT - Annual Turnover

Cl - Chlorine

F - F Test (ANOVA)

FMM - Federation of Malaysian Manufacturers

HU - Highly Used

IT - Information Technology

LU - Least Used

M - Million

MITC - Melaka International Trade Centre

MNC - Multinational Company

MU - Moderately Used

NOYP - Number of Years in Operations

NOE - Number of Employees

NU - Not Used

PP - Polypropylene

PCL/TPS - Polycaprolactone/Thermoplastic Starch Blend

RM - Malaysian Ringgit

SD - Standard Deviations

SME - Small Medium Enterprise

U - U Test (Mann Whitney Test)

> - More than

σ - Stress

- Strain

τ - Torque

CHAPTER 1 INTRODUCTION

1.0 Introduction

The main purpose of this project is to design and develop and design portable mini turbine and storage the charge for outdoor usage. The hikers cannot get enough energy resource to be use on the electronic device for a long journey. Therefore, this project can overcome problem face by using nature resources such as hydro and wind. Nowadays, generators have a big size and heavy to carry it. That for this project has a compact design compare the generator design before. A generator also need a fuel to generate an electric source that a traveler must to bring it and make it more costing for generate an electricity. For this project just usefully a nature source like a river, wind and solar that can generate electricity. The objective of this project is to promote a usage green technology.

1.1 Project briefing

The main purpose of this project is to design and develop and design portable mini turbine for outdoor usage. The hikers cannot get enough energy resource to be use on the electronic device for a long journey. Therefore, this project can overcome problem face by using nature resources such as hydro and wind. Nowadays, generators have a big size and heavy to carry it. That for this project has a compact design compare the generator design before. A generator also need a fuel to generate an electric source that a traveller must to bring it and make it more costing for generate an electricity. For this project

just usefully a nature source like a river, wind and solar that can generate electricity. The objective of this project is to promote a usage green technology.

1.2 Problem statement and project objective

The hikers can't get any electricity source for there on gadget for example mobile phone, camera, gps (global position satellite), torchlight and etc. A generator is to heavy and difficult to bring and need a fuel (petrol or diesel) to generate it. Furthermore, in middle of journey hard to get fuel.

1.2.1 Problem statement

- a) The hikers can't get any electricity source for there on gadget for example hand phone, camera, gps (global position satellite), torchlight and etc.
- b) A generator is to heavy and difficult to bring and need a fuel (petrol or diesel) to generate it. Furthermore, in middle of journey hard to get fuel.

1.2.2 Project objective

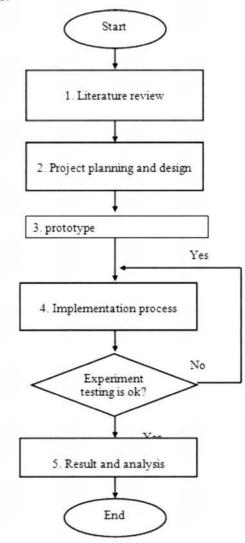
- User can to charge their gadget during the activity by using a renewable source.
- b) Design a changeable blade that using same generator.
- c) Switching a source to charge the battery by using a solar or generator.
- d) User can charge their gadget devices from the storage battery.

1.3 Work scope

The aim of this project is to design and develop a portable mini turbine

- a) Literature about structure of mini turbine
- b) Using a nature source to generate an electricity that using wind, river and solar. That so no need using fuel.

1.4 Project methodology



- 1. Find and collect information from any reliable source for this project.
- 2. To ensure this project run without any problem palnning and design must be organizing wisely to avoid any problem during implementation process.

- 3. Build a prototype by using a chosen hardware.
- Implementation process is the last process before testing. Software and hardware have to combine together to complete this project.
- 5. All the result will be recorded to make an analysis.

1.5 Result expectation

The expected result of this project is:

- a) A mini turbine can help the hikers or outdoor usage to get a enough electric source
- b) Have a good output power and efficiency by using nature sources
 - a. The solar panel can backup source in case for emergency condition

CHAPTER 2 LITERATURE REVIEW

2.0 Introduction

This chapter will discuss about of the project which is use a renewable energy and generate electricity by using a nature. Nowadays fuel or other source that we use in this century someday its will be depleted for accidentally to promote a green technology. This project also develops and design a mini turbine to usually for other future.

2.2 Wind energy

Wind control is developing rapidly on both European and overall levels. Over he span of late years, the overall presented utmost of wind control extended from around 2.5 GW in 1992 to somewhat more than 94 GW toward the complete of 2007, an ordinary yearly improvement of more than 25 for every penny. Owing to constant overhauls in turbine capability and higher fuel costs, wind control is winding up clearly fiscally forceful with standard power creation, and at areas with high contort speeds shore wards, wind control is believed to be totally business. The wander and cost structures of land-based and toward the ocean turbines are discussed. The cost of energy conveyed is moreover watched out for, which considers the lifetime of turbines and O&M costs, and the past and future progression of the costs of wind-made power s inspected. In subsequent parts, the centrality of store, reinforce plans and business ssues are discussed. Finally, the cost of wind delivered control is diverged from the cost of consistent non-sustainable power source let go control plants.

2.2.1Types of Wind Turbine Design

Wind turbines are classified into two general sorts: horizontal axis and vertical axis. A vertical axis machine has its blades rotating on an axis perpendicular to the ground. A horizontal axis machine has its blades rotating on an axis parallel to the ground. There are a number of available designs for both and each type has certain advantages and disadvantages. However, compared with the horizontal axis type, very few vertical axis machines are available commercially.

2.2.2 Types of Blades Design

The edge material takes an imperative thought in outline since it can influence the effectiveness of energy era. In view of the (Sharma, 2012) and (Widened and Ghatge, 2013), the perfect material for edges is wood since it is extremely solid, simple to cut, modest, and it is keep from weariness splitting. Another than that, the absolute best edges materials are Fiberglas in light of the fact that it is sufficiently solid and are normal in business windmills yet the form making procedure would take longer time contrasted with pine for an arrangement of sharp edges from wood. There have different materials are appropriate to use in little turbine. The PVC sharp edges are light in weight and simple to introduce however appropriate for little wind turbine. Ultimately, aluminum combination sharp edges are not by any means basic for little wind turbine. It is utilized for just 1kW to 5kW wind turbine. The outline of sharp edge that appropriate inherent roadway is the c-sort edge as expressed by (Ayyadurai, Palani, and Prem, 2013). This sort of plans ready to catch most extreme pneumatic force and can have greatest vitality change over from constrained twist vitality to rotational mechanical vitality.

2.2.2.1 Stall to pitch control

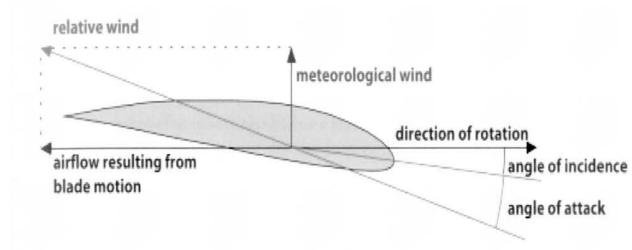


Figure 2.2.2.1.1 attacking the angle between the relative wind and the chord line with

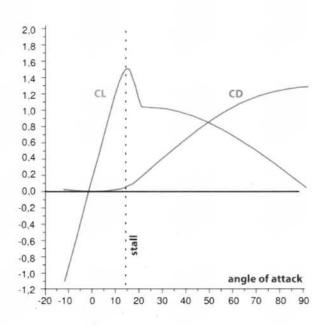


Figure 2.2.2.1.2 forces of lift and dragging at rotor blade vary with the angle of attack.

Wind turbines rely on upon the streamlined "slow down" of their rotor cutting edges to control. At the point when the wind stream hits the harmony line of a rotor cutting edge precisely from the front, the approach is zero and the edge does practically no work. In a perfect world, the relative wind approaches more from underneath, with an approach of around 8 degrees. This outcome in a lift compel substantially bigger than de air resistance (drag) of the sharp edge, with a segment in the rotor's bearing of revolution. At higher wind speed and generally consistent cycles every moment, both approach and lift constrain increment, bringing on a higher power yield. Past around 15 degrees the sharp edge will slow down. The drag keeps on expanding, however the lift compel drops, which restrains the ability to a sheltered esteem. Snell: A working point near the slowdown is not all that awful in a few regards. Varieties in the approach don't change the powers on the rotor in particular, in that locale. In any case, those strengths will as of now be expansive. Furthermore, the route in which the wind stream withdraws amid the slowdown is a fairly eccentric process, with varieties in time, bringing about cyclic burdens. So far, slow down power control has just been utilized for twist turbines up to around two megawatts. Bigger turbines are pitch controlled; the cutting edges are persistently changed in accordance with keep the power inside tight cutoff points, and the approach stays well outside the slowdown district.

2.2.3 Synthetic jets

What's required is a consistent change of the lift constrain, without changing the point of occurrence for the whole edge. Folds on the trailing edge (frequently called ailerons) could do it, however would be somewhat powerless and hard to keep up. Together with the University of Twente ECN is taking a shot at manufactured planes; each being a depression containing a swaying stomach and having little openings in the upper and lower skin of the cutting edge, close to the trailing edge. Amplifiers are utilized as a part of the model which is right now being tried in a wind burrow. They work at a full recurrence of the hole, making air be sucked in on one side while being removed at the opposite side, around 100 times each second. To diminish the lift compel, air is extinguished on the upper side of the sharp edge; coordinating the fly

downwards causes an expansion. The stream should obviously be precisely controlled, and that requires sensors.

2.2.4 Fatigue loads

This implies less turbulence diminishes the heap on the rotor sharp edges, at any rate all things considered. Be that as it may, there is likewise an impediment. The thin cutting edges of a huge wind turbine are to a great degree delicate to varieties in the wind stream, particularly at little approaches. A change of one degree may adjust the lift drive by a few tons, bringing about serious bowing weights on the edge roots. Snel: "Pitch control per singular cutting edge is sufficient to counter contrasts which happen once per upheaval, similar to the plunge in the twisting burden brought about by going before the tower. In any case, the speedier varieties additionally contain a lot of vitality. Furthermore, the present pitch control frameworks aren't sufficiently quick to deal with them."

2.2.5 Cheap and effective

There might be an exquisite arrangement: weight sensors in the main edge of the sharp edge, to gauge the weight contrast between the lower and upper sides," says Snel. "Changes in the approach could be precisely gotten from their information, permitting the product controlling the planes to repay very quickly." Engineered planes are mechanically basic and require next to no vitality. In this application their openings would be near the trailing edge of the rotor sharp edge, where ice is probably not going to bring about inconvenience; they ought to work dependably. The (little) openings for the weight sensors will probably experience the ill effects of ice and earth, however: "The product would see that a could without much of a stretch clean them utilizing air pressurized by the rotor itself - the empty sharp edges enable it to fill in as a colossal diffusive pump. The system accuracy and reliability can be further improved by