

TWO IN ONE HOME APPLIANCE FOR LOW
POWER CONSUMING

SITI SARA BINTI RAZALI

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Signature :

Supervisor's Name : PUAN MAI MARIAM BINTI MOHAMED AMINUDDIN

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I dedicate this work to

*My father, Razali Bin Ismail and my mother, Noraini Binti Hamad
for their endless love, support and encouragement.*

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ABSTRACT

Demands for electricity in Malaysia are expected to rise between five to six per cent for the next two to three years in line with increasing urbanization and rapid industrialization in the country. In Malaysia, almost every day will use an electricity to generate the home appliance. As a tropical country, people will use a fan or air conditioning in order to get cool especially at the night. Currently, at night people use a fan and lamp in order to give a comfortable. So, if both home appliances are used in the same time, it means twice power consumption. This project innovates the controlling of home appliance by using only a one power source that can combine two home appliances. Besides that the system can produce a low power consuming compared with conventional home appliances. The most important part is that the system will not interfere other appliances and still work properly. At the same time this project cannot be harmful to the customer. Through this system, the project is capable to control the home appliance operation by using one power source that can be in dual functioning. Moreover, this project enhance the capability of the existing home appliance and help the users to lead a more comfortable and easy life especially to the middle people.

This report comprise of five chapters which will provide detailed explanation on the concepts applied.

ABSTRAK

Permintaan untuk tenaga elektrik di Malaysia dijangka meningkat antara lima hingga enam peratus untuk tempoh dua hingga tiga tahun akan datang sejajar dengan peningkatan pambandan dan perindustrian yang pesat di negara ini. Di Malaysia, hampir setiap hari akan menggunakan elektrik untuk menjana perkakas rumah. Sebagai sebuah negara tropika, ramai diantara kita akan menggunakan kipas atau penghawa dingin untuk mendapatkan keselesaan terutama pada waktu malam. Oleh yang demikian, jika kedua-dua peralatan rumah yang digunakan dalam masa yang sama, ia bermaknaakan mengakibatkan dua kali penggunaan kuasa. Projek ini adalah bertujuan untuk mengawal perkakas rumah dengan menggunakan hanya satu sumber kuasa yang boleh menggabungkan dua peralatan rumah. Selain itu, sistem ini boleh menghasilkan penggunaan kuasa yang rendah berbanding dengan peralatan rumah yang sedia ada. Bahagian yang paling penting adalah bahawa sistem ini tidak akan mengganggu peralatan lain dan masih berfungsi dengan baik. Pada masa yang sama, projek ini tidak boleh membahayakan kepada pelanggan. Melalui sistem ini, projek itu mampu untuk mengawal operasi perkakas rumah dengan menggunakan satu sumber kuasa yang boleh berfungsi pada masa yang sama. Selain itu, projek ini meningkatkan keupayaan perkakas rumah yang sedia ada dan membantu pengguna untuk menjalani kehidupan yang lebih selesa dan mudah terutamanya kepada golongan yang berpendapatan rendah.

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CHAPTER I

INTRODUCTION

1.1 Project Overview

Fan is home appliance is widely used in our daily life. Normally, this home appliance only can be operating each function at once time. However the fan system is rarely can be operates as multifunction. This project shows the use of the direct current motor that can be work as generator in order to lighting up the lamp.

Two in one home appliance for low power consuming product is product that can be operating in dual functions. The system function is capable to rotate a fan and also generate a lamp to light up and charging the device such as hand phone and media player device. A DC motor is the simplest motor that can be found.

Two in one home appliance for low power consuming product is a simple product to use and is easy to operate. It is very convenient to use and at the same time it also produce a low power consuming compared to the conventional home appliances. That means this product will also help the consumer that own a modest incomes that can afford to buy an air conditioning.

In this project the AC Motor used to apply torque or a twisting force to rotate the mechanical load which is a fan. Then, the use of DC motor will be function as a generator in order to generate a lamp to turn on. The most important part is that the system will not interference other home appliances and can be work properly. Besides that, this product can provide a low power consuming and can save an electricity consumption. In this project, a fan is used as a model of home appliance.

1.2 Objectives

In order for the project to be successfully implemented, the following objectives have to be achieved:

- To develop a two in one home appliance product that requires combining the table fan with the night lamp.
- To analyze the power consumption of the designed product.
- To design the circuit that using power electronic circuit to stabilize the mechanical loads.

1.3 Problem Statement

Nowadays the characteristic of motor and generator for home appliance has been improved, day by day it increasingly to is widely used in our daily life. For example, the home appliance can be operating by only used the voice recognition. The appliances can be operated by using voice command. Meanwhile, this all technology or invention more to the appliance that only is operates a function at once time. There is no problem using the current system. But, the problem is faced by the consumers that want to save the power dissipation. At the same time the consumers also want a home appliance that has a dual functioning. In this project, the appliances will be operated in dual functioning. Through this system, it is possible for the consumers to save a lot of money and operate an appliance easily. In order to optimize energy usage towards „Going Green“, an efficient system is needed. Currently, at night people use a fan and lamp in order to give a comfortable. So, if both home appliances are used in the same time, it means twice power consumption.

1.4 Scope Of Project

To achieve the project objectives there are certain scope that must be done. The scope can be divided into several parts. The scopes are:

- 1) To design the prototype of a product that combines the available electrical appliance that is table fan and lamp.
- 2) Analysis the power consuming of the prototype.

CHAPTER II

LITERATURE REVIEW

This chapter consists of some information about literature studies which are relevant to this project are discussed. Carrying out the literature review is important in providing a broad view on the field of this project. As a result, the objective and scope of project had been identified. This chapter provides the summary of literature reviews on key topics related to the type of direct current motor, generator and also the low power consuming home appliances.

2.1 Introduction

Concerns related to energy and the environments are prevalent today. Such concerns sometimes become opportunities in that they lead to new inventions and innovations, often developed through engineering design. In this case study, the engineering design of a particular new product is described, which addresses both energy and environmental concerns by increasing the efficiency with which energy resources are utilized in buildings. Increased efficiency permits reduced use of energy resources and emissions of wastes [17]. In this chapter literature studies which are relevant to this project are discussed. Carrying out the literature review is important in providing a broad view on the field of this project. As a result, the objective and scope of project had been identified. This chapter provides the summary of literature reviews on key topics related to the alternating current motor characteristic, generator and also the low power consuming home appliances. Table fan is one of the commonly devices used by most of the people to blow air to a targeted area.

Masjuki et.al, Energy and electricity consumption analysis of Malaysian industrial sector, University of Malaya, Malaysia Proceeding Journal.

On average, the energy consumption in Malaysia is 34% more intensive than other country.

The highest use of electricity is at night.

- Lamp

- Fan/air conditioner

The hypothesis of this study is to reduce the uses of power by combing two electrical appliances that normally used, which are fan and night light.

2.2 Two in one home appliance for low power consuming product

A Case Study for Energy Efficient Home / Office Appliances

Concerns related to energy and the environments are prevalent today. Such concerns sometimes become opportunities in that they lead to new inventions and innovations, often developed through engineering design. In this case study, the engineering design of a particular new product is described, which addresses both energy and environmental concerns by increasing the efficiency with which energy resources are utilized in buildings. Increased efficiency permits reduced use of energy resources and emissions of wastes [8]. When buying an appliance, payment is for both the initial cost and the operating cost for as long as you own it. Over the life-span of an appliance the energy cost can be many times greater than the initial cost

There are many types of home appliance in our market. The home appliance here is can be operated in dual function and also can produce low power consuming. There are no some similar projects that had been done previously.

2.3 Appliance, Lighting, Electronic, and Miscellaneous Equipment Electricity Use in New Homes

The “Other” end-uses (appliances, lighting, electronics, and miscellaneous equipment) continue to grow. This is particularly true in new homes, where increasing floor area and amenities are leading to higher saturation of these types of devices. This paper combines the findings of several field studies to assess the current state of knowledge about the “Other” end uses in new homes. The field studies include sub-metered measurements of occupied houses in Arizona, Florida, and Colorado, as well as device-level surveys and power measurements in unoccupied new homes. We find that appliances, lighting, electronics, and miscellaneous equipment can consume from 46% to 88% of whole-house electricity use in current low-energy homes. Moreover, the

annual consumption for the “Other” end-uses is not significantly lower in new homes (even those designed for low energy use) compared to existing homes. The device level surveys show that builder-installed equipment is a significant contributor to annual electricity consumption, and certain devices that are becoming more common in new homes, such as structured wiring systems, contribute significantly to this power consumption. These findings suggest that energy consumption by these “Other” end uses is still too large to allow cost-effective zero-energy homes. [9]

2.4 Direct Current Motor

The DC motor of a fan motor is widely used as a control motor because of its excellent features. It has a simple structure, it is easy to operate, its revolution is easy to control, and it has an affordable price. However, the DC motor revolves at a high speed, so it can cause noise or vibration during operation of the system. In particular, the DC motor used in the actuators of automobiles and home appliances can give discomfort to users due to noise or vibration.

2.5 DC “brush” motor

A Brush DC Motor provides precision control of speed, driven by a direct current. Noted for a particularly high ratio of torque to inertia, the Brush DC Motor has the potential to supply three to four times more torque than it is rated torque. If needed, it can even provide up to five times more, without stalling. The Brush DC Motor consists of six different components: the axle, armature/rotor, commutator, stator, magnets, and brushes. The Brush DC Motor offers stable and continuous current, using rings to power a magnetic drive that operates the motor’s armature. Perhaps one of the earliest used motors, the Brush DC Motor is commonly used because of the ability to vary the speed-torque ratio in almost any way

Table 2.1: The advantages and disadvantages of DC Brushed

DC Brush Motor Advantages	DC Brush Motor Disadvantages
A simple construction therefore may not require a controller. Typically a simple and inexpensive drive design.	Less reliable in control at lowest speeds.
Controlling the speed is simple. The higher the armature voltage, the faster the rotation.	A Brush DC Motor is physically larger than other motors producing equivalent torque.
Torque control is also easy to accomplish. Output torque is proportional to current. If the current is limited, limited the torque also limited which the brush motor can achieve.	A Brush DC Motor is considered high-maintenance.
Controlling the speed of a Brush DC Motor is simple. The higher the armature voltage, the faster the rotation.	A Brush DC Motor is vulnerable to dust which decreases performance.

2.6 DC brushless motor

A Brushless DC Motor (also known as a BLDC Motor), is a synchronous electric motor powered by a direct current. As the name implies, the Brushless DC Motor does not operate using brushes; rather it operates with a controller via electronic commutation.

Table 2.2: The advantages and disadvantages of DC Brushless Motor

DC Brushless Motor Advantages	DC Brushless Motor Disadvantages
Simple operation, requiring only a voltage source, power transistor, and analog control input for variable speed or servo operation.	Heat is generated in the rotor winding which is primarily conducted away through the rotor shaft. Harder to keep cool.
Dynamic braking capability without additional power input (short the leads)	The brushes wear, the wear producing small particles which can affect the cleanliness of surrounding operations.
No appreciable heat is generated in the rotor and hence the heat conducted to the shaft is minimized.	High current through the brushes can cause it to burn out rapidly.
Due to the lack of brushes, motors can be operated at high torque and zero rpm indefinitely as long as the winding temperature does not exceed the limit.	Motor operation requires the purchase of a complicated electronic motor driver.
No brushes to wear out or contaminate the Surroundings.	Most motor drivers brake DC brushless motors by applying reverse current, in which almost as much power is expended to stop the motor as was required to start it moving.

2.7 Stepper motor

A stepper motor is a brushless, synchronous electric motor that converts digital pulses into mechanical shaft rotation. The stepper motor can only take one step at a time and each step is the same size.

Table 2.3: The advantages and disadvantages of Stepper motor

Stepper motor Advantages	Stepper motor Disadvantages
The rotation angle of the motor is proportional to the input pulse.	They have low torque capacity (typically less than 2,000 oz)
The rotation angle of the motor is proportional to the input pulse.	They have limited speed (limited by torque capacity and by pulse)
The motor has full torque at standstill (if the windings are energized).	They have low torque capacity (typically less than 2,000 oz)
Torque capacity and power requirements can be optimized and the response can be controlled by electronic switching.	They have high vibration levels due to stepwise motion.
Excellent response to starting, stopping, or reversing	Large errors and oscillations can result when a pulse is missed under open-loop control.

2.8 Type Selection of DC Motor

DC motors are typically used when:

- ✓ Low-cost, variable speed is advantageous and unfortunately precise speed regulation not required.
- ✓ Starting torque required up to 5-10 times more than running torque and brief overloads OK, since motor has time to cool.
- ✓ Frequent start/stop cycles, reversing, or closed-loop positioning required