UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF AN AUTOMATED HELMET DRYER USING ARDUINO

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation and Robotics) with Honours

by

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TAJUK: **Development of an Automated Helmet Dryer System Using Arduino**

SESI PENGAJIAN: **2016/2017 Semester 1**

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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 Automation and Robotics) with Honours. The member of the supervisory is as follow:

.....

(Dr. Aliza binti Che Amran)

ABSTRAK

Kebersihan topi keledar adalah satu isu atau masalah yang sering berlaku semasa perjalanan yang jauh bagi penunggang motosikal. Oleh itu, kami berhasrat untuk membantu masalah ini dengan mengeluarkan prototaip automatik pembersih topi keledar yang melibatkan beberapa proses untuk mengekalkan kebersihan di dalam topi keledar. Beberapa perbincangan dengan industri dan pengguna yang berpotensi telah dilakukan dalam usaha untuk memperoleh reka bentuk yang terbaik untuk projek ini. Sayap Niaga Sdn Bhd yang berpangkalan di Kuala Lumpur dan Melaka terlibat dalam projek ini untuk rundingan produk dan menyediakan sejumlah dana untuk pembangunan projek ini. Prototaip ini adalah seperti pembersih biasa yang mempunyai proses pembersihan dan pengeringan di dalam topi keledar, ia akan menggunakan medium kimia/buih untuk membersihkan topi keledar manakala penghembus untuk mengeringkan di dalam topi keledar. Dengan ini, kimia/buih akan diratakan di dalam topi keledar dengan menggunakan udara termampat melalui muncung. Pada masa yang sama, sebuah motor di bawah topi keledar yang dihubungkan dengan pemegang topi keledar akan berputar bagi memastikan kimia/buih diratakan di dalam topi keledar. Semasa topi keledar sedang berputar, muncung akan bergerak ke bawah menggunakan motor servo manakala plat keluli disambungkan dengan motor servo yang memegang muncung. Pergerakan ke bawah adalah untuk meratakan medium ke dalam topi keledar dengan lebih optimum. Pergerakan tersebut mempunyai beberapa langkah, selepas pergerakan terakhir, penghembus akan dihidupkan dalam tempoh tertentu mengikut yang ditetapkan. Projek ini dicadangkan sebagai pengering topi keledar automatic yang menggunakan Arduino sebagai pengawal dan penghembus sebagai bahagian utamanya.

ABSTRACT

The issues for hygienic of helmet are one of the problems that occur during the long ride for the motorcyclist. Therefore we intend to aid this problem by proposing the automated helmet cleaner prototype that involved several process to maintained the hygiene of inside the helmet. Several discussions with the industries and potential consumers have been done in order to derive the best design for this project. SayapNiaga Bikes based in Kuala Lumpur and Malacca are involved in this project for product consultation and provide an amount of fund for this project development. This prototype is like a normal cleaner which cleans and dries the inside of the helmet, it will use chemical/foam medium to clean the helmet while a blower to dry inside of the helmet. The machine will spread the chemical/foam inside the helmet by using the compressed air through the nozzle. At the same time, a motor below the helmet that connect with the helmet holder will rotate the helmet to make sure the chemical/foam able to spread inside of the helmet. After certain times of helmet rotation, the nozzle will move downward using a servo motor, a steel plate is connected to the servo motor which is hold the nozzle. This downward movement is to spread the medium deeper inside the helmet. The movements of downward nozzle have few steps when it reaches the last movement the blower will turn on. Lastly, the blower will be switched on for a certain period. This project is suggested as an automated helmet dryer which utilize Arduino as a controller and blower as its primary parts.

DEDICATION

To my beloved parents, I acknowledge my sincere indebtedness and gratitude to them for their love, dream and sacrifice throughout my life. I am thankful for their sacrifice, patience, and understanding that were inevitable to make this work possible. Their sacrifice had inspired me from the day I learned how to read and write until what I have become now. I cannot find the appropriate words that could properly describe my appreciation for their devotion, support and faith in my ability to achieve my dreams Lastly, I would like to send my gratitude to any person that contributes to my final year project whether it is directly or indirectly. I would like to acknowledge their comments and suggestions, which are crucial for the successful completion of this study

ACKNOWLEDGMENTS

First and foremost, all praise to Allah the Almighty for giving me the strength, health, knowledge and patience to successfully complete this Final Year Project report in the given time. I must thank to my parents for their love and support throughout my life. Thank you for giving me strength to climb the stairs and walking towards the paths of life. I would like to address my deepest appreciation to the supervisor, Dr Aliza binti Che Amran for his encouragement, comments, guidance and enthusiasm through the time developing the report. Special thanks to the friends that have been through thick and thin throughout the completion of this project. This project report might be impossible to complete without all your help. Last but not least, thank you to everyone that directly and indirectly involved in helping me finishing this Final Year Project report. Thank you.

TABLE OF CONTENT

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

BLDC	-	Brushless Direct Current
AC	-	Alternating Current
DC	-	Direct Current
PVC	-	Polyvinyl Chloride
PWM	-	Pulse Width Modulation
USB	-	Universal Serial Bus
ABS	-	Acrylonitrile-Butadiene-Styrene

CHAPTER 1

INTRODUCTION

1.0 Introduction

In this chapter, introduction is the most important topics that involve problem statement, objective, scope of the project. These topics are provided and the project organization of the overall chapters is provided as well within the same chapter.

1.1 Problem Statement

Motorcyclist frequently used a helmet, once the helmet in wet condition due to few causes such as rain and sweat, it should be washed. But the washed part is inside the helmet, it will take time to dry the helmet. Mostly, motorcyclist left the helmet under the sun for drying process, but it can produce bad smells if the helmet does not dry correctly. Furthermore, that method is not controllable and use longer time to dry up.

Nowadays, motorcyclist/super bikers frequently convoy or ride in large group to a long ride from one place to another. When the motorcyclist ride too long, the helmet can be wet because of sweat and make the motorcyclist feeling uncomfortable. Sayap Niaga Sdn Bhd had an experience in the bike week where most of the motorcyclist will clean their helmet after a long ride. There is one booth that provides cleaning services for helmet and the demand among the motorcyclist is very high. When the booth accepts too many customers, they dried the helmet using hair dryer manually.

One of the potential customers for helmet dryer is Formula 1 and Moto Grand Prix field. The product demand is high on this field.

1.2 Helmet Dryer System

Generally, the purpose of helmet dryer is to dry an inside of helmet which is in certain condition such as wet without excessive water. Maintaining an inside of helmet is very important for motorcyclist to prevent any bacteria that will affect the motorcyclist. The application of helmet dryer system could be used in daily life of the motorcyclist to maintain the hygienic of the helmet.

Helmet dryer system has direct systems which is the blower. The blower system basically involves with the blower and the time taken. But it will take a time to dry due to the process where does not had heating element. In the actual system, the liquid that would-be use is not water but it is a chemical that acts as detergent and easy to dry.

Helmet dryer system can be implemented at the workshops that provide maintenance for motorcycle. When the motorcyclist waiting for the motorcycle finished for the maintenance, the helmet can be cleaned using the system at the same time.

1.3 Objective

The main objectives of this report are:

i) To design an automated helmet dryer system prototype

ii) To develop the prototype using Arduino

iii) To test the drying performance using the developed prototype

1.4 Scope of Work

This part will consist of construction and operating system of the helmet dryer. The components of this project will include brushless DC motor as the blower that provide compressed air for the system and microcontroller that operated as the brain of the system where used to control input and output signal. The full face helmet will be used in this project because the helmet is commonly used by motorcyclist. The condition of the helmet is not too wet (has excessive water) before the drying process begins.

1.5 Organizations

Chapter 1 explains the introduction of the project, which includes the background, problem statements, objectives and the work scope of the study. In chapter 2, the chapter briefly explains the review of theories, experimental works and some findings that had been done during the past research that is related to the current project. In chapter 3, methodology and strategy to achieve the objectives are explained in detail. The working procedure, materials and apparatus are well explained. Chapter 4 presents the result and the findings of the study, the result from the experiments that are presented in tables, figures, drawings and graphs and are discussed elaboratively in the chapter. Several observations are also projected from the findings. Chapter 5 summarizes the outcomes of this experiment. The chapter also outlines several recommendations for further development and improvement on the design. Suggestions for future inventor are also provided within the chapter.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This project proposes a helmet dryer system which has a function to blow air through the nozzles. Most of the conventional helmet dryer system used a similar method for drying. This chapter will discuss on the drying system and the possibility for the system to be used in Malaysia. The theories and findings from the previous studies are reviewed and described to find the highlight knowledge associated with the current study.

2.1 Drying System

A process that removes a water or any solvent by evaporation from a solid or liquid. A source of heat or any agent to remove the vapour is recommended to reduce the time for drying process.

2.1.1 Helmet Dryer System (No Patent: US 65536877 B1)

Helmet dryer system is a system that is designed to maintain the dryness inside the helmet. Typically helmet dryer system is designed as All-Air system, which means the air is to be used to perform the drying process. The helmet is placed on the base of the dryer that mounted on the cylindrical body containing

an electric fan. The air is delivered by electric fan through perforations in the stanchion which circulates inside the helmet. There is a gap between the helmet from the stanchion by a spacer affixed to a dome. The function of the gap is for to ensure a proper and complete air flow along the inside of the helmet. This conventional system as a counter to the problem which is used a manual method for drying process such as paper towel, hand-held dryer and other items have been used to wipe and dry the inside of helmet. One of the objectives of this conventional helmet dryer system is to provide a “hands free” drying which is relatively inexpensive to develop and distribute.

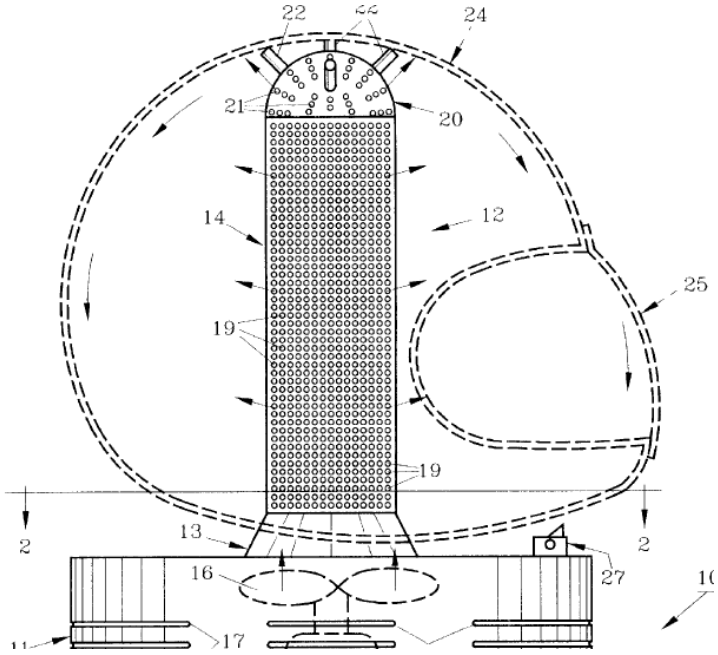

Figure 2.1: Helmet Dryer System (Leamon Jr, 2003)

2.1.2 Electromagnetic Dryer System

Electromagnetic induction heating dryer (electromagnetic dryer) is one of the energy conservation and environmental protection device, where the thermal efficiency is more than 90% and temperature control scope is about normal to 400 °C (Zhou et al, 2011). This system is the upgraded system from the traditional steam drying which is widely used in papermaking industry. By using the system, it can cater the current requirements of energy saving of the papermaking industry with the high degree of automation. The most important parameter to control for electromagnetic dryer is temperature control. Stability of dryer is one of the important components for the production because it will relate to the product quality and production efficiency. Resulting from the temperature control can significantly reduce dryer production time and energy consumption.

The controller for the electromagnetic dryer is programmable integrated circuit and combining the fuzzy control technology and PC Auto. By combining the components, it creates the intelligent control system for electromagnetic dryer which is to realize the distributed control for the intelligent controller of heating coil.

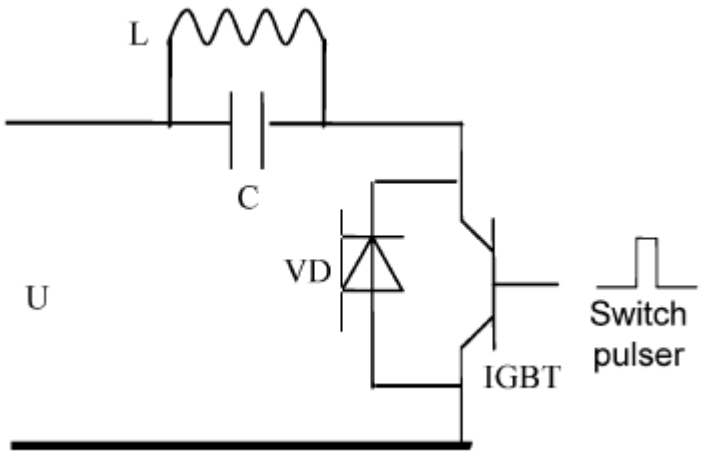

Figure 2.2: Electromagnetic Dryer Heating Circuit (Zhou et al, 2011).

As shown in Figure 2.2, the main heating circuit of electromagnetic dryer principally includes L-C oscillating circuit and insulated gate bipolar transistor (IGBT). The input voltage is 220 V DC with 50 Hz frequency. Input voltage is getting by rectification and filtered, and then is added to the both ends of the resonant circuit and power switch tube IGBT. A high frequency current is produced by the PWM pulse signal generated by the controller. Magnetic line of force produced by magnetic flux generator can cross dryer wall; under the action of high frequency changing magnetic field produced by magnetic flux generator, magnetic flux of each point unit time varies ceaselessly inside dryer wall thus eddy current is produced inside it. Meanwhile, because dryer wall itself has resistance, dryer wall becomes heat under the action of eddy current. By that, the heat dryer shell can use for drying the product.

2.1.3 Spray Dryer

Spray dryer operation consists of producing a dry powder of controlled particle size from a liquid or slurry by rapidly drying with hot air (Santre and Agashe, 2014). This system is mostly use in thermally-sensitive materials such as foods and pharmaceuticals. The spray dryers use some type of atomizer or spray nozzle to disperse the liquid or slurry into a controlled drop size spray. The commonly nozzle that been used are rotary disks and single fluid high pressure swirl nozzle. Spray dryers can be classified on the basic of stages:

i. Single Stage Spray Dryer
    - This stage is supplied by hot air to the chamber at one point only. The air is blown in co-current of the sprayed liquid where direction of hot air and feed is same.

ii. Multistage Spray Dryer

- In multiple effect spray dryers drying is done through two steps. In one step, hot air is supplied at the top (as per single effect) and in another an integrated static bed at the bottom of the chamber.

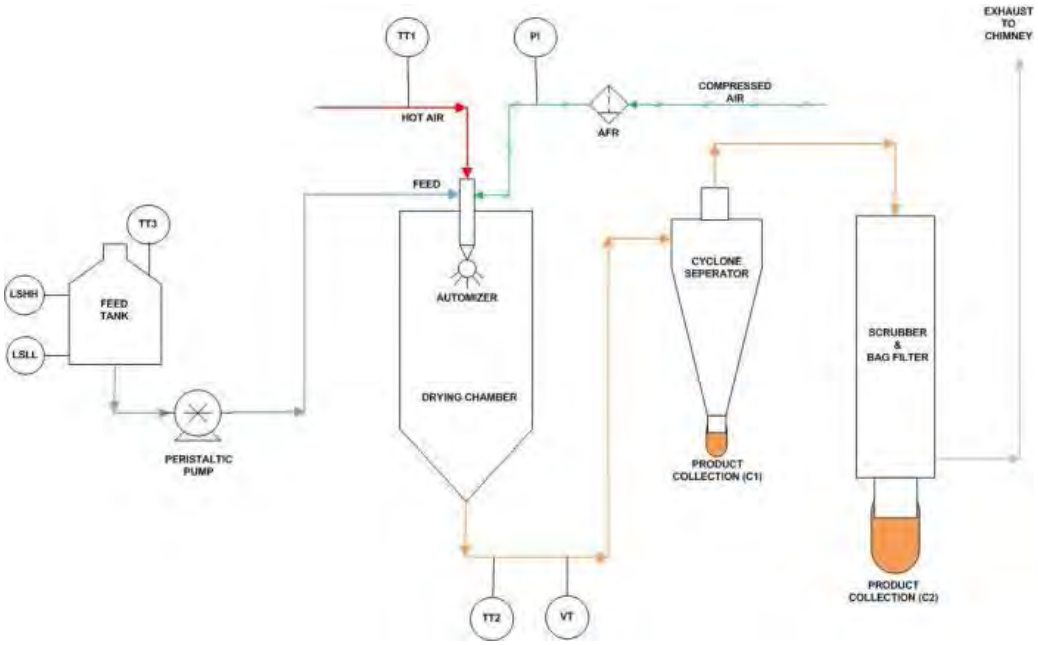

Figure 2.3: Process Flow Diagram of Spray Drying Process (Santre and Agashe, 2014)

Process is divided into two distinct sub-parts as spray drying process and product recovery. Spray dryer has been designed based on principle and engineering practices of chemical engineering and process control & instrumentation engineering.

2.2 Electric Fan

Typically, AC electric motor has two primary components, a rotor and a stator. The stator is a stationary component while the rotor is a moveable component which rotates with respect to the stator. In an AC motor, a magnetic field is induced into the

rotor. The interaction of magnetic field is induced into the rotor. Interaction of the magnetic field created by the stator and rotor cause the rotor to rotate with respect to the stator (M.Knapp, 2014). The drying system is fully utilizing the wind from the fan directly to inside of the helmet. The fan that been used is an electric fan that have five blades with 110V AC input voltage. The properties that make an AC motor the choice it is because unnecessarily needed for control system applications and do not required to convert the signals from AC to DC. Speed of the motor will constant because of the system does not have any load would be used.

While for DC motor well adapted for use in power tools and particularly hand-held, battery powered tools. The motor includes two sets of armature coils, with each set of coils being coupled to separate sets of commutator bars on the armature. Separate pairs of brushes are used to interface with the two sets of commutator bars. A switching subsystem is controlled either manually by a user engage able switch or automatically by a controller, to connect the two sets of coils in either series or parallel configuration. The series configuration provides a greater efficiency but with a lower power output than the parallel connection. The parallel connection provides a greater maximum power output from the motor (West and Despande, 2011).

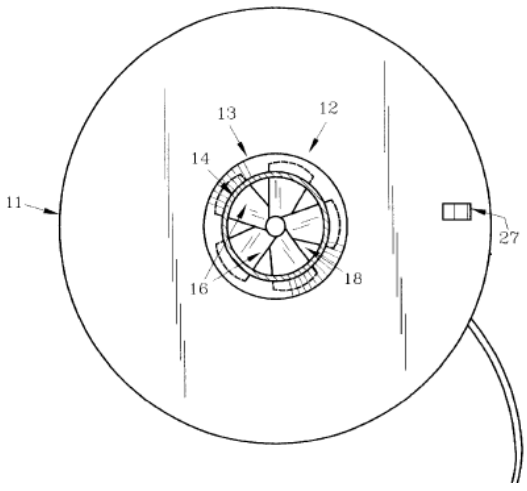

Figure 2.4: Electric Fan (Leamon Jr, 2003)