UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Control and Stabilize System for Temperature in Operation Theatre by Using Microcontroller

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electronics Engineering Technology (Industrial Electronics) with Honours

by

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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 ElectronicsEngineering Technology (Industrial Electronics) with Honours. The member of the supervisory is as follow:

……

(Project Supervisor)

ABSTRAK

Projek ini adalah untuk mengawal dan menstabilkan suhu di dalam bilik pembedahan. LM 35 akan diletakkan di dalam bilik pembedahan dan ia bertindak sebagai penderia suhu. Ia akan memberi isyarat kepada PIC16F876A untuk menghidupkankipas atau pemanas. Suhu yang diperlukan dikekalkan adalah sekitar 18 darjah Celsius hingga 22 darjah Celsius. Oleh itu, apabila LM 35 mengesan suhu minimum, pemanas akan bertukar ON sehingga suhu stabil dicapai. Kipas akan terus berfungsi. Walau bagaimanapun, apabila LM 35 mengesan suhu maksimum, ia akan menghantar isyarat kepada pengawal mikro. Oleh itu, pengawal mikro yang akan mengawal kelajuan kipas. Sistem ini juga akan melaksanakan teknologi baru bagi kaedah penyaman udara. Ais akan digunakan untuk bekalan udara yang sejuk di dalam bilik pembedahan. Oleh itu, kipas akan meniup ais untuk mengawal suhu. Sistem ini akan dikawal selia secara berterusan.

ABSTRACT

This project is to control and stabilize the temperature inside operation theatre. LM 35 will be placed inside the operation theatre that acts as a temperature sensor. It will give a signal to PIC16F876A to trigger the blower or heater. The temperature that is needed to be maintained is around 18 degrees Celsius to 22 degrees Celsius. Therefore, once the LM 35 detects the minimum temperature, the heater will turn ON until the stable temperature is reached. The blower will continuously activate. However, when the maximum temperature is detected by the LM 35, it will sent signals to the microcontroller. Thus, the microcontroller will control the speed of the blower. The system also will implement a new technology for air conditioning method. Block of ice will be used for supply the cold air inside the operation theatre. Thus, the blower will blow the block of ice to regulate the temperature. The system will be regulated continuously.

DEDICATION

To my beloved parents Mr. Lokmanulhakim Bin Basiron and Mrs. NorzainiBintiCheAmat thanks for your moral support. Besides that I would like to dedicate this project to my supervisor, Mr. IrNikAzran Bin Ab Hadi that assists me develops this project. I also want to thanks to my lecturers and friends that help me to develop this project.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

ACH	-Air Change per Hour
ASHRAE	-American Society of Heating, Refrigerating and Air-Conditioning Engineers
C	-Celsius
Cm	-Centimeter
IDE	-Integrated Development Environment
FED	-Federal
LAF	-Laminar Air flow
LCD	-Liquid Crystal Display
MOH	-Ministry of Health
MPLAB	-Microprocessor Laboratory
OT	-Operation Theatre
PCB	-Printed Circuit Board
PIC	-Peripheral Interface Controller
PLC	-Programmable Logical Controller
SD	-Standard
V	-Volt
°	-Degree
%	-Percentage

CHAPTER 1
INTRODUCTION

This chapter presents the overview for overall description for this project. Thus, it is including the background of project, objective and scope. The organization of the report also state in this chapter for the preview of the report ahead.

1.1 Background

Operation theatres require special attention in terms of air ventilation, temperature, and humidity. This is because, any negligence can come right side-effects. The temperature inside the operation theatre needs to be controlled because it can influence three main requirements which is avoided humidities that can contribute to the risk of infection to the patients, to conserve the patient resource, and last promote the comfort and working efficiency of the staff. For example, the humidity inside theatre should be maintained between 50 to 60%. One of the reasons this requirement needs to be met is that if the percents humidity in the room exceeds 60% chance of bacteria / fungi exist will be higher. If the percentage of humidity to be 78% of the bacteria already exist and fungus will occur. Other than that, when the temperature was uncontrolled it can contribute to the non-effective working environment which can affect the concentration of the team. Besides that, stable temperature should be emphasized because if the temperature dramatically decrease or increase it can affect the patient. The low temperature can cause bacteria breeding while the temperature is

too high can cause complication to post-operative patients. Therefore, one new system to be introduces.

This system is able to control and stabilize the temperature in the operating room. Besides that, it is an interesting point where the system will use different method of air conditioning. Instead of using air conditioner, this system will used a block of ice for supply the cold air through the operation theatre. Therefore, the temperature in the operating theater is very important to ensure a smooth process surgery.

1.2 Problem Statement

Nowadays temperature system introduce in the hospital is good and follow the standard requirement given by the government. However, to maintain the temperature in this range is normally dealing with failure. Normally the hospital gives a negative feedback regarding the temperature. The temperature inside the operation room usually cannot be control. When the surgery take too long and it contribute with many people, the temperature inside the room will rise down. The temperature is not in range between 18℃ to 22℃ as standardize by Ministry of Health (MOH). This unfavorable temperature will give a side affect toward working environment of the surgery team. In addition, when the temperature is uncontrolled it can cause the infection toward the patient. The temperature that is too low can lead to wound breakdown. This complication can occur to patients, especially patients who have just finished the surgery process. Further than that, the room temperature will affect the stability of the patient especially for those just finish their surgery. So, if the room is too cold it will make the patient is in an uncomfortable situation thus will potentially other diseases such as hypothermia.

1.3 Objective

The objectives of this project are to:

- To implement a new method of technology.
- To stabilize the temperature inside operation theatre using blower and heater.

1.4 Scope of Project

This research will cover on designing one system that can control and stabilize temperature inside the operation theatre. Besides that, this system also will implement a new method system. Instate using air-condition, the system will apply a block of ice for supplying cool air toward operation theatre. Other than that, the research will cover on the operation of PIC16F876A microcontroller. This controller will trigger either heater or blower for stabilize the room. In addition the scope also is focus on the application of temperature sensor for detecting the surrounding temperature.

1.5 Project Significance

It is expected to build up one system that can control and stabilize the temperature inside operation room by using the PIC16F876A microcontroller. Other than that, this system will automatically run and it also will implement new method technology which is supply cold air using block of ice. This project can give benefic toward the operation theatre because it can overcome the problem regarding the temperature.

CHAPTER 2
LITERATURE REVIEW

A literature review is a body of text that aims to review the critical points of current knowledge for any related information so as to enhance the understanding of the concept and certain terminology which is used throughout this research.

2.1 Introduction of Operation Theatre

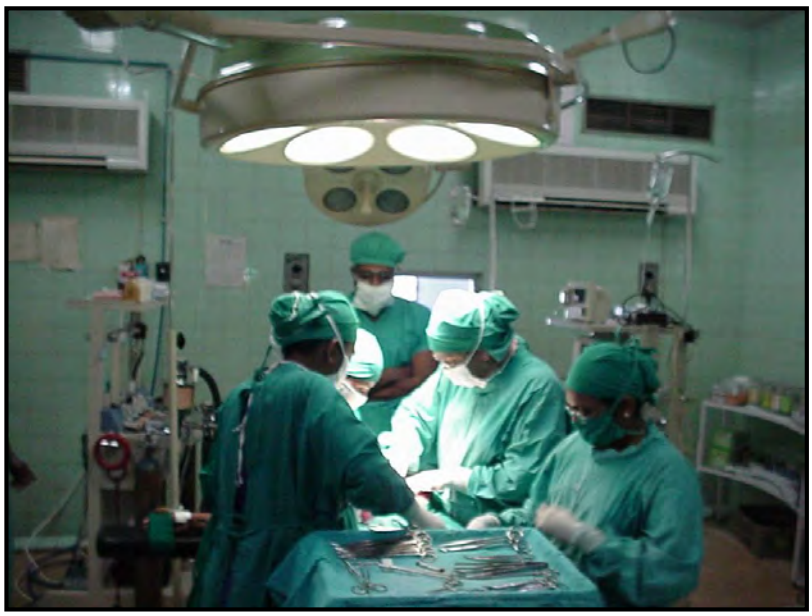

Figure 2.1: The Operation Theatre

Operation theatre was a room for performing a surgery. In the operation theatre there has table and chair at the centre of the room. The team involve with the operation theatre are surgeons and nurses.

The surgeons will wear street clothes with an apron to protect them from blood stains. The operation will be handling with unsterilized instruments, hand-threaded needles. Operation theatre can be class into two categories. First categories is superspecialty operation theatre while second once is general operation theatre. Superspeciality operation theatre conducts operations of Neurosciences, Orthopedics (Joint Replacement), Cardiothoracic and Transplant Surgery (Renal, Liver). General operation theatre includes Ophthalmology and all other basic surgical disciplines. District hospital operation theatre and FRU operation theatre would fall under this category.

When handle with operation theatre, there are many things that need to take a serious look. This is because, in this room it will involve with the person life. So that, five mains things that need to be consider while built up the operation theatre.

The five main things are:

(a) ventilation of the room
(b) amount of particle contains
(c) temperature needed
(d) humidity
(e) pressure inside the room

However, there are too many standard guidelines in the world regarding the operation theatre. We in Malaysia use the British Medical Council as the references to organize our own standard that been provided by Ministry of Health (MOH).

2.1.1 Ventilation inside the Operation Theatre

Ventilation is important in all occupied hall. The requirements of ventilation are determined in some factors such as fresh air supply for human life, control of

airborne bacteria, thermal comfort, and humidity level. The ventilation system is considered as the main contributor to the efficiency and function of an operating theatre. Level of comfort and level of airborne contaminant need to be control because patients wound after surgery easily get infection.

Thus, the planning and designing of ventilation systems in operating theatres is crucial so that both infection rates and operating costs are lowered. Based on the journal written by Agne Nilsson (2002), there are many types of ventilation system has been practice for operation theatre. From the journal he had conclude some ventilation system regarding his study.

2.1.1.1 Conventional Ventilation Systems for Operating Theatres

There are various ventilation systems that have been designed and installed in the operating theatre. Normally, the designed and installed was classifies into two main categories which is mixing ventilation and parallel flow ventilation.

2.1.1.2 Mixing Ventilation

The operation of the mixing ventilation is based on the principle of air supply mixed with the existing air inside the room. The supply air normally located at the symmetrically on the ceiling. The results of this type of ventilation by Anderson, P.A (1983) prove that the airflow is fairly unstable. The air direction is uncontrolled. Based on the studies make by Anderson, P.A (1983), the area around the operation table received trace concentration twice higher compare to the other areas in the room. Therefore, it shows that the mixing ventilation is ineffective to ventilate away anesthetic gas and odors.

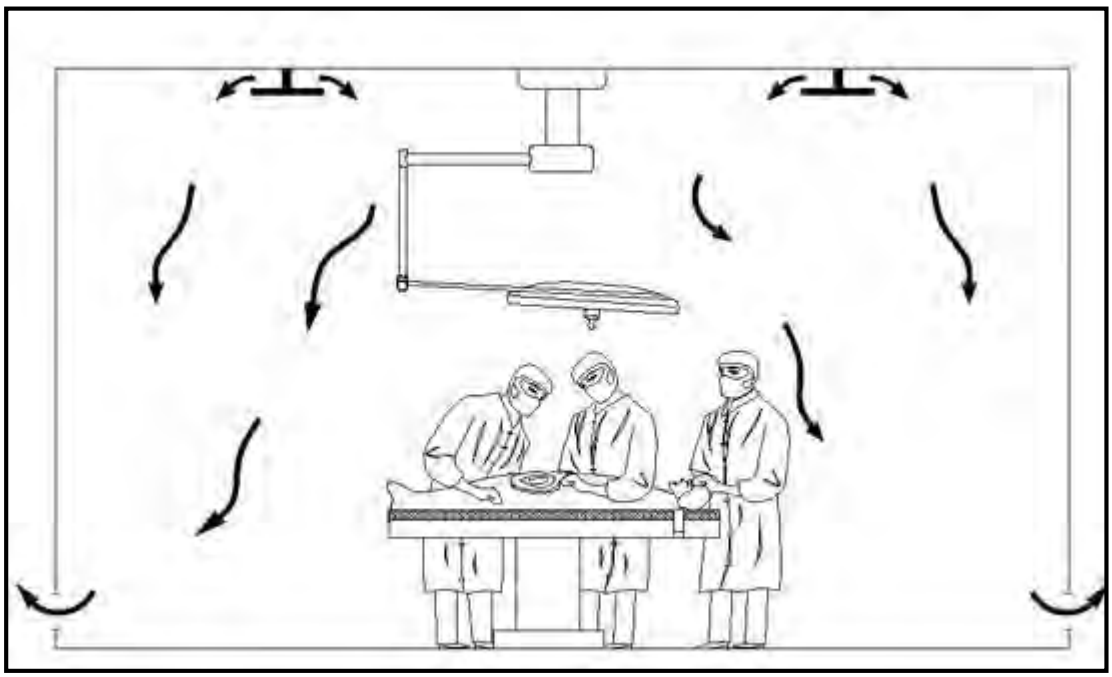

Figure 2.2: Mixing Ventilation

2.1.1.3 Parallel Flow Ventilation

The parallel flow ventilation operates based on the principle that supply air is conducted parallel through the room. The parallel flow ventilation systems can be horizontal or vertical flow. They have been used as conventional ventilation for operating theatres. Parallel flow ventilation is also commonly referred to as Laminar Air Flow system whereby the laminarity or uni-directionality of the air flow is said to exist in the operating theatre. H. Laufman from the Institute for Surgical Studies, Montefiore Hospital and Medical Centre, New York, once debated that laminar air flow cannot be achieved in an actively used operating theatre.

In 1982, it has been reported by E.A. Salvati, M.D., Journal of Joint and Bone Surgery, 1982, that horizontal parallel flow ventilation systems are proven to be susceptible to contamination of the upstream air flow by the medical staff and surgical team with consequential increase in wound infection. To reduce the risks, the only option is to build physical barriers, which would defeat the purpose for an ergonomic layout in the operating theatre.

To further worsen situation, the horizontal supposedly uni-directional air flow would be disturbed by convection up-currents, thus generating turbulence and entrainment of contaminants.

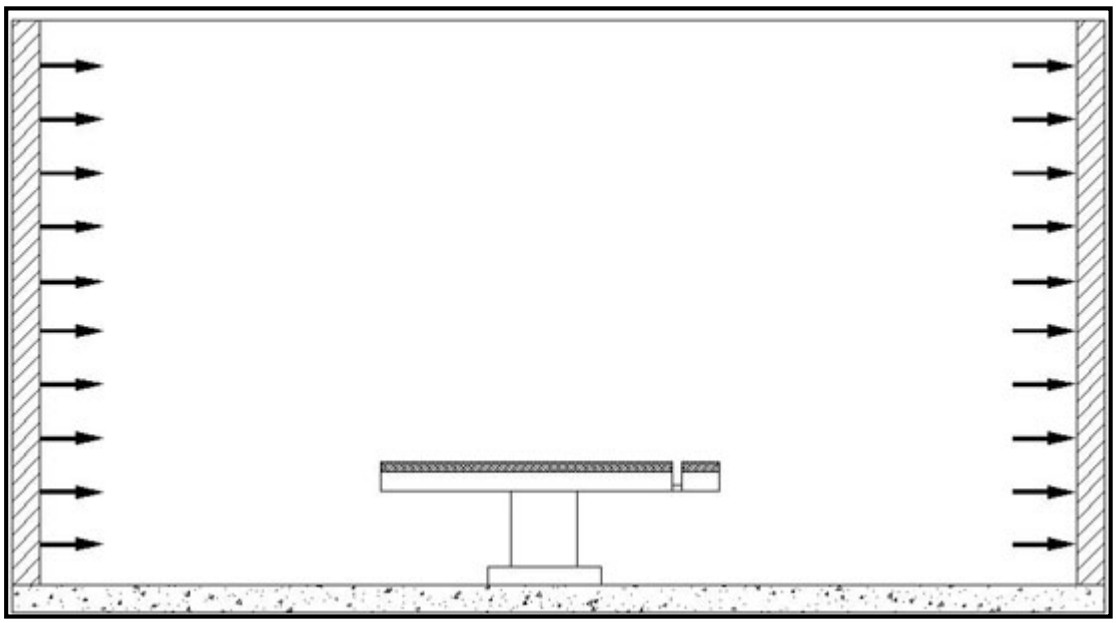

Figure 2.3: Horizontal Parallel Flow Ventilation

Vertical parallel flow ventilation or commonly known as laminar air flow (LAF) system is a widely acceptable ventilation system used in hospitals and other healthcare facilities. These systems were very common in the sixties and seventies particularly for joint replacement surgeries. There are major drawbacks for this particular type of ventilation system. Both the installation and operating costs for this system are high. In order to achieve a low bacterial count (cfu/m3), LAF systems have to produce as high as 400 air changes per hour (ACH). Some LAF systems even produce up to 800 ACH. If the sedimentation processes for the room balance were disregarded and the inverse proportionality relationship between bacterial count and ACH is assumed, then a low bacterial count can only be achieved with the expense of high operating costs. LAF systems also commonly have 8-12 filters to cover the entire ceiling mounted diffusion system to ensure all the supply air is filtered before it enters the operating theatre. This has added unnecessary first costs during installation.

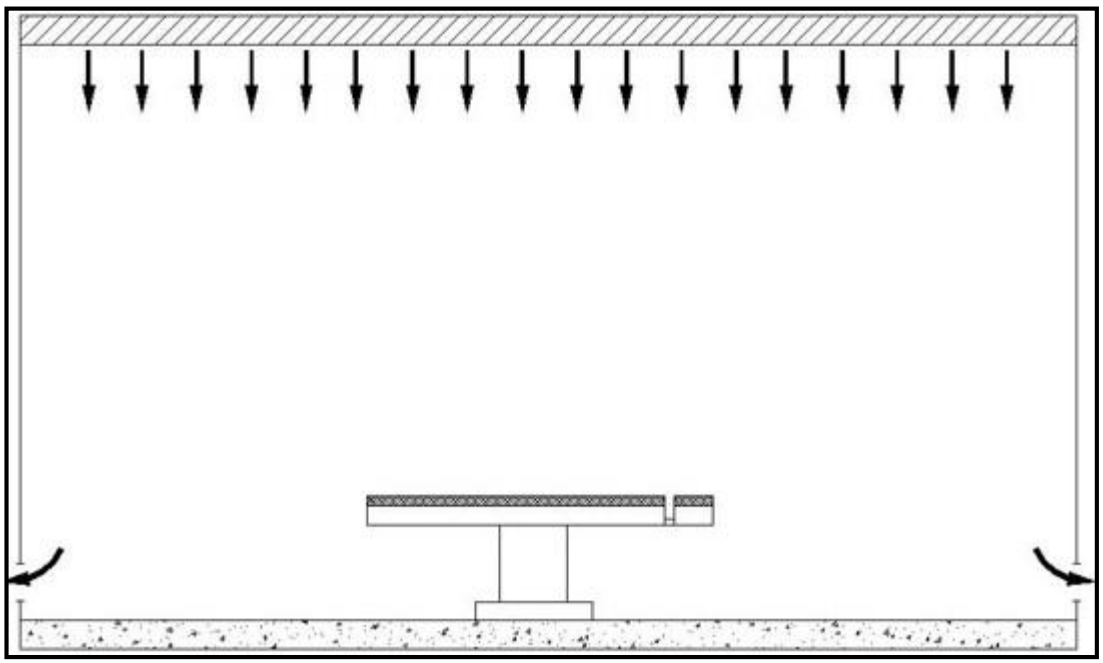

Figure 2.4: Vertical Parallel Flow Ventilation

2.1.1.4 Op-box Ventilation

In 1960s and 1970s, Professor J. Charnley, UK, state that the infection rate could be reduced from 7% to 0.5% by performing hip replacement surgery in an op-box ventilation system. However, all surgeons and medical staff had to wear tightly sealed surgical garments and masks with a special extraction system to achieve this result. Strict work discipline was also an influencing factor to prevent unnecessary vortex formation, which may convey bacteria to the sterile areas. These op-box systems have physical barriers such as curtains or wall systems built surrounding the surgical team. These systems therefore were popularly known as “op-boxes”. The major drawbacks for these systems are that surgeons suffered from poor mobility, poor visual contact because of misting on the hoods and poor communication through the hoods.