UNIVERSITI TEKNIKAL MALAYSIA MELAKA

NOVEL DESIGN AN INDICATOR OF THE EXCESSIVE DUST PARTICLES ACCUMULATION FOR THE 1.0 HP SPLIT UNIT AIR CONDITIONING

This report submitted in accordance with requirement of the UniversitiTeknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Engineering Technology (Type your Department's course here) (Hons.)

by

MOHAMED AZIM ISAM BIN ISA
B071210568
900804-01-6299

FACULTY OF ENGINEERING TECHNOLOGY
2015

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **novel design an indicator of the excessive dust particles accumulation for the 1.0 HP split unit air conditioning**

SESI PENGAJIAN: **2014/15 Semester 2**

Saya **MOHAMED AZIM ISAM BIN ISA**

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 TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

☐ TERHAD   (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972)

☐ TIDAK TERHAD

Disahkan oleh:

....

Alamat Tetap: Cop Rasmi:

No 93, jalan padi malinja 3

Bandar Baru Uda,81200

Johor Bahru,johor

** JikaLaporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisas iberkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

FAKULTI TEKNOLOGI KEJURUTERAAN
Tel : +606 234 6623 | Faks : +606 23406526

Rujukan Kami (Our Ref) :
Rujukan Tuan (Your Ref) :

28JAN 2015

Pustakawan
PerpustakaanUTeM
UniversitiTeknikal Malaysia Melaka
Hang Tuah Jaya,
76100 Durian Tunggal,
Melaka.

Tuan/Puan,

PENGKELASAN LAPORAN PSM SEBAGAI SULIT/TERHAD LAPORAN PROJEK SARJANA MUDA TEKNOLOGI KEJURUTERAAN PEMBUATAN (BETM): MOHAMED AZIM ISAM BIN ISA

Sukacita dimaklumkan bahawa Laporan PSM yang tersebut di atas bertajuk *"novel design an indicator of the excessive dust particles accumulation for the 1.0 HP split unit air conditioning"* mohon dikelaskansebagai *SULIT / TERHAD untuk tempoh LIMA(5) tahun dari tarikh surat ini.

2.   Hal ini adalah kerana IANYA MERUPAKAN PROJEK YANG DITAJA OLEH SYARIKAT LUAR DAN HASIL KAJIANNYA ADALAH SULIT.

Sekiandimaklumkan.Terimakasih.

Yang benar,

_____

* Potong yang tidakberkenaan

NOTA: BORANG INI HANYA DIISI JIKA DIKLASIFIKASIKAN SEBAGAI SULIT DAN TERHAD. JIKA LAPORAN DIKELASKAN SEBAGAI **TIDAK TERHAD**, MAKA BORANG INI **TIDAK PERLU DISERTAKAN** DALAM LAPORAN PSM.

DECLARATION

I hereby, declared this report entitled "novel design an indicator of the excessive dust particles accumulation for the 1.0 HP split unit air conditioning" is the results of my own research except as cited in references.

Signature   :………………………

Name   : MOHAMED AZIM ISAM BIN ISA

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 of Engineering Technology (Type your department's name here) (Hons.). The member of the supervisory is as follow:

……………………………….
(Project Supervisor)

ABSTRACT

An air conditioning mostly use in home, the factory is required air conditioning to improve the process and to keep a raw material in low temperature, furthermore the air conditioning is for the mankind to be comfortable, the air conditioning is use of cooling in one place or medium and it is to comfort the human being. All air conditioning has the filter to trap the dust and the particles to make an air output air flow velocity in normal condition. The cause of the low velocity of air output is cause by the excessive dust in the filter. The filter needs to maintenance regularly to make sure the efficiency of the air condition is high. Air resistance is a main consideration in the settlement of particles under gravitational power. The objective is to fabricate the indicator dust particles accumulation in the 1.0 HP split unit air conditioning. The scope of the project is using the wind sensor to connect with an Arduino to detect the decreasing velocity of air flow to indicate the filter condition. The indicator dust particles to detect the excessive dust keep the air conditioning efficiency is high and for easier maintenance. The Arduino Uno connected with the led and the wind sensor and 9 volt battery is used to power on the indicator. The analysis was conducted using a wind sensor on clean air filter and dirty air filter. The result is used to reprogramming the indicator led lamp. The red led lamp indicated the dirty air filter, the yellow Led lamp indicated a medium dirty air filter and green Led lamp is indicated clean air filter. The conclusion is the indicator dust particles accumulation is successfully developed for 1.0 HP split unit air conditioning by using the Arduino Uno and wind sensor with three led lamps.

ABSTRAK

Penghawa dingin kebanyakannya digunakan didalam rumah, kilang menggunakan penyaman udara untuk menambah baik proses dan menyimpan bahan mentah dalam suhu yang rendah. Pendingin udara adalah untuk membuat manusia itu dalam keadaan selesa, penghawa dingin digunakan untuk menyejukan di satu ruang atau bilik untuk keselesaan manusia. Semua penyaman udara mempunyai penapis udara untuk memerangkap debu dan zarah. Punca halaju penghawa dingin menjadi rendah ialah kerana debu yang berlebihan didalam penapis udara. Penapis perlu diselenggara untuk memastikan kecekapan penghawa dingin dalam keadaan yang baik.. Objektifnya adalah untuk mereka cipta penunjuk keadaan penapis dalam 1.0 HP pecahan unit penyaman udara. Skop untuk projek ini ialah menggunakan sensor angin dan Arduino untuk mengesan penurunan halaju pada penghawa dingin untuk menunjukkan bahawa penapis udara kotor. Alat ini diggunakan untuk mengesan debu yang berlebihan dan menjaga kecekapan penyaman udara dan membuat penyelenggaraan lebih mudah. Arduino Uno disambungkan dengan led dan sensor angin dan 9 volt bateri digunakan untuk menghidupkan alat tersebut. Analisis ini dijalankan dengan menggunakan sensor angin pada penapis udara bersih dan penapis udara kotor. Hasilnya daripada kajian ini digunakan untuk memprogram semula alat tersebut. Lampu merah menunjukkan penapis udara kotor, lampu kuning Led menunjukkan penapis udara kotor dalam sederhana dan lampu hijau Led menunjukkan penapis udara bersih. Kesimpulannya adalah alat ini berjaya dicipta untuk 1.0 HP unit penyaman udara dengan menggunakan Arduino Uno, sensor angin dan tiga lampu.

DEDICATIONS

This thesis is dedicated to my parents for their love, endless support and encouragement.

ACKNOWLEDGMENTS

TABLE OF CONTENTS

© Universiti Teknikal Malaysia Melaka

© Universiti Teknikal Malaysia Melaka

© Universiti Teknikal Malaysia Melaka

LIST OF FIGURES

LIST OF TABLE

LIST OF SYMBOLS AND ABBREVIATIONS

SBM	=	Shape-Based Matching
Q	=	Heat transfer
K	=	instrument constant
B	=	Magnetic field strength
v	=	mean flow velocity
D	=	Electrode spacing
qv	=	Volumetric flow rate
λ	=	wavelength
f	=	frequency
V_p	=	velocity
$T_{A \to B}$	=	Time taken A to B
$T_{B \to A}$	=	Time taken B to A
D	=	Diameter of the tube
V	=	Velocity of the water
q	=	Flow rate of the water
A	=	Area surface of the pipe
W	=	Power generate by joules heating
Q	=	heat transfer surrounding
Qi	=	thermal energy store in wire
Rw	=	Resistance of the wire
Cw	=	Heat capacity of the wire
Tw	=	Temperature of the wire

CHAPTER 1

INTRODUCTION

1.1 Air conditioning

An air conditioning mostly used in home for cooling the room. According to (Langley et al., 2000) the factory is required air conditioning to improve the process of work. Furthermore, the air conditioning is use of cooling in one place or medium and it is to comfort the human being. The air conditioning was discovered early 1900s, it is used to cool the building and the first comfort air conditioning (McDowall, 2007). Split unit air conditioning is often used in hot climates country such as Malaysia, Singapore, and Vietnam. Split unit air conditioning consists a compressor part, filter, gas line, liquid line, condenser, evaporator, and fan to make the air conditioning is operated. The compressor, fan and condenser in the outdoor unit and the rest of the part is indoor unit. The warming control system is the key innovation for steady and dependable warming operation of variable refrigerant stream cooling system with multi-module open air units (Qiu Tu et al, 2010), The outdoor unit is to carry the heat to outside and stabilize the system. The indoor unit is used to cool the medium or the room.

The air conditioning not only use in the home, it also use in the industry, workplaces and in the manufacturing process. In the industrial it mostly used in the manufacturing process, the example is the food or some equipment required to keep under the low temperature. It is to make the equipment or food can last longer than on the normal temperature. The air conditioning is important to the industry or to the working place. It is used to comfort the mankind because of the hot climate. In the cold climate country, mostly they use the air conditioning to warm the house or the workplace. It is the reverse air conditioning process to keep the room warm. The air conditioning is also used in the market, which is same purposed as the other air conditioning.

1.2 Comfort conditioning

Comfort conditioning mostly use for the mankind, it is stated that (Jones, 2001) with the geographical on the world, some of the country will have a four season which is spring, hot, summer and cold weather. Thus, the air conditioning is used for comfort the mankind based on the weather condition. The air conditioning has a two functional types, the first is to give a low temperature or cold the room for the hot weather. The second is for warming the room for the cold weather. Thus, the air conditioning is needed for the human (Jones, 2001). The comfort air conditioning mostly used in the office and home.

The comfort conditioning mostly using split unit air conditioning. The split unit air conditioning consist the evaporator and the compressor or the indoor and outdoor unit. It is use because it small and easy to maintenance than the other HVAC system. The split unit air conditioning also less cost on the maintenance and cheap than other air conditioning type.

1.3 Operation of air conditioning

The split unit air conditioning has an indoor and outdoor unit to operate completely. The outdoor unit consists condenser and compressor and the indoor unit consist evaporator, fan, filter. The study showed the condenser is used to remove heat from the indoor unit (Sreelakshmi, 2014). The inverse side of the cycle is the condenser, which is situated outside of the cooled compartment.

The compressor unit is used to pump the refrigerant liquid or gas into the evaporator coil and pump the heat into the condenser (Sreelakshmi, 2014). The ventilation systems utilize a compressor to bring change of the pressure between the two compartments, and effectively gather and pump a refrigerant. The compressor split unit air conditioning is outdoor unit.

1.4 Air filter

Air filter is important in the split unit air conditioning to trap the dust or unwanted particles. It is for the clean air go through the output system of split unit air conditioning. The airflow and cooling capacity of the air conditioning will be decrease if the filter in excessive dust. It is state by (wang et al., 2005) filter fouling is reducing the fan efficiencies. Furthermore, it will reduce the warming or cooling limit of room ventilation systems. It is essential to opportune identify an Air-Conditioning (HVAC) system consider the ability of an over-fouled filter and clean filters. It is important to replace it if the filter in excessive dust or particles.

1.5 Problem Statement

Air conditioning has the filter to trap the dust and the particles to make an air flow in normal rate. The filter needs to be maintained regularly to make sure the efficiency of the air condition is high. Air resistance is a central point in the settlement of particles under gravitational power (Jones, 2001) and (Wang et al., 2005) the reducing of the efficiency of the HVAC system is because of the filter fouling and limit the cooling and warming room capacity HVAC.

The excessive dust air filter or dirty air filter can affects the performance of the air conditioning. It may because of the surrounding place which the air is polluted or the time period to clean the dirty filter is long. The excessive dust filter because the cooling coil pressure increase and increasing the temperature (yang et al., 2006), thus it decrease the air flow of the evaporator. The dirty air filter can damage the cooling coil if the filter is not clean or change in the appropriate time.

It is important to timely detect an Air-Conditioning (HVAC) system study the capability of over-fouled filter and clean or replace it which is the low flow rate of air has a relationship with particles on the filter air conditioning and it is important to change the filter or clean it if the filter in dirty condition to increase or maintain the efficiency of the air conditioner.

The common way to detect the filter with excessive dust particle is to check the flow rate of the air on the air conditioner. The filter is important for all air conditioning (Yu et al., 2008). The Ac filter has a benefit which is the ozone is essentially can be removed by the AC filter, thus it is important to the Ac system.

This study focused on fabricated an indication due to excessive dust particles and reducing the air flow rate on the air conditioner by using air speed sensor and the Arduino. The wind sensor will be located in the air conditioning near the filter and Arduino will detect the reducing of the air flow rate. Thus, by using the sensing component with the Arduino, the reducing of the air flow rate on air conditioner can be detected.

1.6   Objective

Based on the problem statement, the following objective were drawn

1. To fabricate the indicator dust particles accumulation in the split unit air conditioning using a microcontroller and sensor

1.7   Scope

Based on the objective, the following scopes are formed

1. Fabricating the indicator dust particles accumulation for 1.0 HP split unit air conditioning
2. Fabricating the indicator using the Arduino and wind sensor
3. Testing the indicator on the 1.0 HP split unit air conditioning.

© Universiti Teknikal Malaysia Melaka

CHAPTER 2

LITERATURE REVIEW

2.1 Split unit air conditioning

Split unit air conditioning is a small air conditioning mostly using at home and office. The outdoor unit contain the condenser and compressor and the indoor unit contain evaporator, fan, and filter. The function of air conditioning for cooling one medium or reverse it to increase the temperature. The basic principle of air conditioning is shown on the figure 2.1. The split unit air conditioning is used refrigerant r22 or R-410A. The refrigerant r22 is not longer used in new model split unit air conditioning because the refrigerant r22 is ozone depletion that stated by (Bolaji, 2012). The refrigerant R22 that has been utilized transcendently as a part of cooling and in medium and low-temperature applications contains ozone exhausting chlorine particle and consequently will be eliminated at the end and the depletion of ozone will make the global warming (Bolaji, 2012). Researchers found that CFC substances is not harm to the ozone layer, additionally make the nursery impact, and seriously influence to the environment and human beings. New model split unit air conditioning is used refrigerant R-410. It is because the refrigerant R-410 is more ozone friendly (Paharia et al, 2013). Considering the comparison of performance coefficients (COP) and ratios of pressure of the tried refrigerants furthermore the primary Environmental effects of ozone layer exhaustion and a worldwide temperature rise, refrigerant R410A and R407Care discovered to be the most suitable choices refrigerants is refrigerant R22.
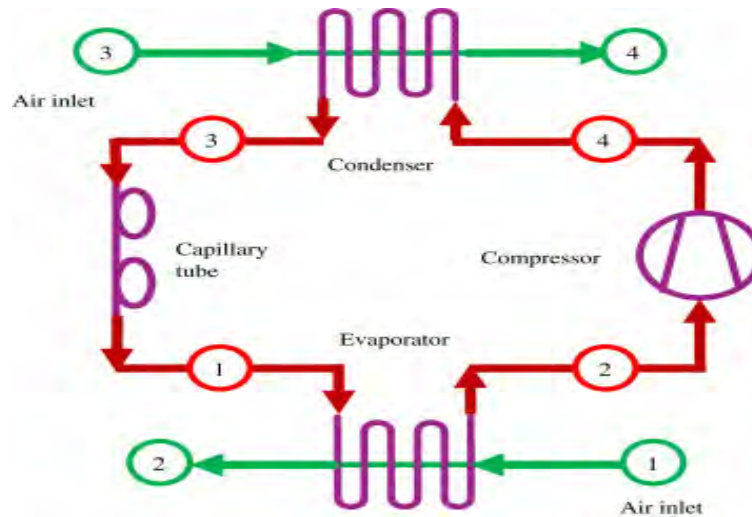
Figure 2.1: The Operation Of Air Conditioning (Wenhua et al., 2012)

2.1.1 Fixed Speed Air Conditioning

Fixed speed variable for air conditioning is one speed of fan to produce a velocity of output cooling air. It is the first generation of the HVAC system use the fixed speed air conditioning. Using the fixed speed air conditioning makes the process of cooling is slower than variable speed. The variable speed will send a fixed amount of energy of power and make the impact slower. Furthermore, the fixed fix air conditioning is causing more slowly to cooling the room than the variable speed air conditioning.

2.1.2 Variable Speed Air Conditioning

Variable speed air conditioning is widely used in the most of air conditioning because it more save energy consumption and high efficiency. The variable speed also makes one medium faster to cooling (William, 2005). The operation of power to operate the motor will decrease if the motor speed is decreased. This showed that the energy consumption is less than the fixed speed air conditioning. It also has the ability to turn into a different speed which is more advantageous than a single or fixed speed of air conditioning (William, 2005). The speed combination can be

6

controlled with the fan and compressor motor based on the requirement. The variable speed can balance it speed with the structure load which the result can increase the efficiency is increase and the consumption of energy or electric will reduce (Smith et al, 2014).

2.2   Cup Anemometer

The Anemometer is a tool or equipment to measure a wind speed or air speed. Thus, it is a useful tool beside the sensor for measuring the air flow or wind speed. It is most convenient wind speed type measurement tool is cup rotating anemometer (Cavendish, 2003). the cup anemometer has three or four shapes of conical and hemispherical cups located at the end of level spokes that transmit from a vertical pivoting shaft (Cavendish, 2003). The cup anemometer operates by the cup is directly turn when the wind or air flow is directed to the cup, thus the measurement reading can be collected. Thus, according to (Tong, 2010) the average speed of wind is being produced by the counting speeds of the turn of the anemometer cup with a set time period for a broad range of speed. The constant sign of the rate of revolution can be accomplished by coupling a little dynamo to the shaft (Cavendish, 2003). This strategy produces a voltage yield relative to the rate of the rotating, wind velocity can then be take a reading specifically off a suitably balanced the voltmeter.

2.2.1   Propeller Anemometer

The Propeller anemometer function is identical to the all anemometer type which is to measure the wind or air flow speed. The propeller anemometer is used for measuring the low speed of wind or air flow which is in the range of 1 Km/h to 25 Km/h (Cavendish, 2003). The propeller anemometer consists a fan or blades, it attached the blade or fan to the horizontal rotating shaft. It is method measuring as a cup anemometer. The rotation speed of the blade or fan is directly proportional to the air or wind speed as it same method to the cup anemometer for measuring the speed

© Universiti Teknikal Malaysia Melaka

of wind (Cavendish, 2003). Thus, it is useful for measuring wind speed such as air conditioning air flow and it as the prone of the digital meter.

2.1.2 Thermal anemometer

Thermal anemometer is measuring a wind speed as it same as cup anemometer and the propeller anemometer. The thermal anemometer operates different method than the cup and propeller anemometer. The thermal anemometer operates by the amount of heat is removed by a heated temperature sensor which is related to the fluid velocity by flowing fluid(Wilson, 2005). The hot wire is accessible with the single point equipment for the purpose of the test, for the multi point array is for the fixed installation (Wilson, 2005). The thermal anemometer is suitable for measuring the low air flow or low wind speeds, it is can calculate the air velocity from 1Km/h to 220 Km/h (Wilson, 2005).

2.3 Microcontroller

Microcontroller is widely used in the modern era, such as automatic gate, washing machine, and welding machine (V. Udayashankara et al, 2009). Microcontroller has been broadly used in home machines, for example, fridge, clothes washers and microwave boiler. Microcontroller is a small PC that store memory and control the methodology of working devices.this is show Data stockpiling and preparing is an intergral piece of any programmed control system. The need is to have a gadget, purported "microcontroller", which permit controlling timing and sequencing of these machines and courses of action (Deshmukh, 2005). Microcontroller has more than five components to make the microcontroller to make it working (Deshmukh, 2005). Microcontrollers are single-chip microcomputers, more suited for control and automation of machines and processes, microcontrollers have a central processing unit (CPU), memory, input/output ports (I/O), timers and counters, analog-to-digital converter (ADC), digital-to-analog converter(DAC),serial

ports, interrupt logic, oscillator circuitry and have more functional block in chip. The figure 2.2 showed the block diagram of a microcontroller.
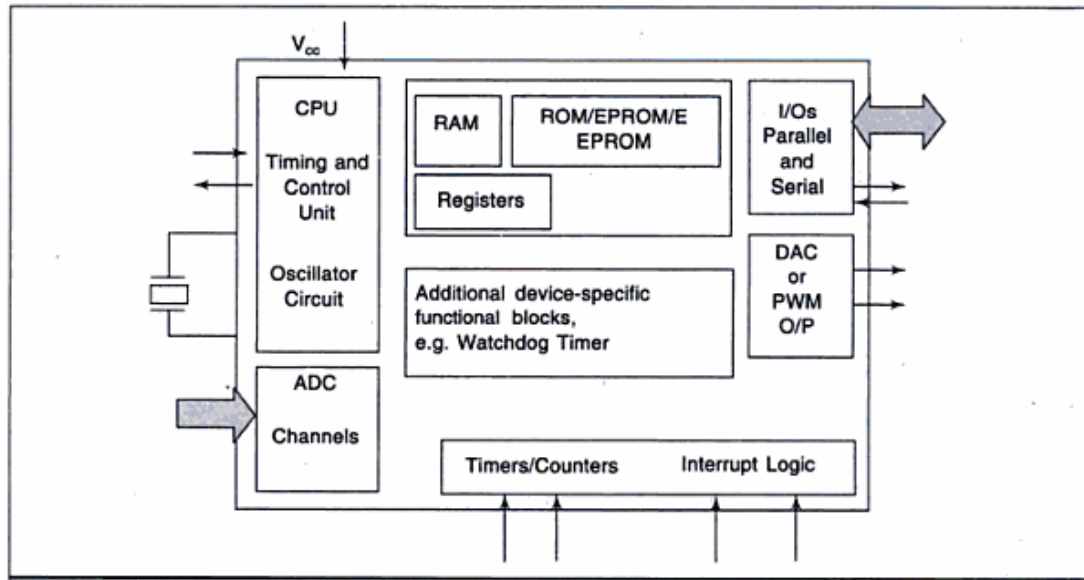

Figure 2.2: The Functional Block Diagram Of Microcontroller (Deshmukh, 2005)

2.3.1 Arduino

Arduino is a microcontroller which is a device that control work processing system and sequence control. The Arduino is combining with hardware and software to make a devices work (Koenkaa et al., 2014). The Arduino device sets provide all the bits and bytes to set up physical control of equipment segments. Nonetheless, it gives just a restricted approach to intuitively control them and there is much space to enhance regarding client interface. The main component of the Arduino is memory, processor, ram , port, and power supply port, The Arduino is connected to the PC and it will be programmed based on the sensor. Arduino is adaptable, offers an assortment of computerized and simple inputs, SPI and serial interface and advanced and PWM yields (Kumar et al, 2013). It is anything but difficult to utilize, join with PC through USB and conveys utilizing standard serial convention, runs in standalone mode and as interface associated with computers. It incorporates the most vital things which are key to backing the microcontroller essentially join it to a PC with a USB link or force it with an AC-to-DC connector or battery to begin.

9