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AUTOMATIC CONTROL OF DOMESTIC FAN USING INFRARED THERMOMETER AND A MICROCONTROLLER

C.Vivekanandan
Professor-EEE, SNS College of Engineering, Coimbatore-641107
Affiliated to Anna University,Chennai.

B.Prabakaran
Assistant Professor-EEE, Sri Shakthi Institute of Engineering and Technology,
Sri Shakthi Nagar, L&T By pass, Chinniyampalayam Post, Coimbatore-641062
Affiliated to Anna University,Chennai

ABSTRACT

The domestic fans are now controlled by a manual switch or by using remote control. Using an infrared thermometer attached to the fan, temperature of the human being who is under the domestic fan can be measured and given to the microcontroller. The microcontroller will compare the temperature of the human being who is under or near the domestic fan with the standard body temperature of the human being stored in it. If the temperature matches, the domestic fan will be ON. If the temperature doesn't match, the domestic fan will be OFF. This way, automatic ON/OFF control of the domestic fans can be achieved. This saves the electrical energy when the person forgets to switch off the domestic fan when he is not under or near the fan. The domestic fans use single phase induction motors. In this paper, automatic speed control and ON/OFF control is explained for Capacitor start Capacitor run Single Phase Induction Motor.

Keywords- Infrared Thermometer, Fans.

I. INTRODUCTION

The domestic fans are ceiling fans and table fans. These fans are controlled by a manual switch or by a remote control. Automatic control of these fans is possible by using infrared thermometer and a microcontroller attached to the fans.

The automatic control of fans is necessary. The person working under the fan whenever leaves from that place, sometimes forget to switch off the fans. Whenever the person comes to his/her place, it is needed to switch on the fan before he/she occupies his/her seat. So In this paper, a method is described to automatically switch on/off the fans whenever the person moves in/out of that place. Automatic speed control is also described whenever the person is inside the coverage area of the fan.
The advantages of this method are

1. Automatic conservation of electrical power whenever the person is not in the coverage area of the fan.
2. The human beings need not switch on/off the fan manually or using remote control.

II. ANALYSIS ON HUMAN BODY TEMPERATURE AND ATMOSPHERIC TEMPERATURE

The standard normal body temperature of human beings is 37ºC (98.6ºF). The standard normal body temperature range is between 36.5ºC and 37.2ºC (97.7ºF and 99ºF).A fever in adults is a temperature of 38ºC (100.4ºF) or above. The standard atmospheric temperature in a place in Coimbatore, India is around 27^0C (81^0F). This may vary for different places in the earth. So there is a difference of 9.5^0C to 10.2^0C of temperature between the atmospheric temperature and human body temperature. By using an infrared thermometer attached to the domestic fan, the temperature of the human being who is under or near the fan can be measured. The infrared thermometer measures the temperature of the human being if that person is under or near the fan. If the human being is not under or near the fan, the infrared thermometer reads the atmospheric temperature. The infrared thermometer's output can be given to the microcontroller. The microcontroller compares with the normal range of the human body temperature with the output of the infrared thermometer. If the infrared thermometer's output is within the normal range of the human body temperature, the fan can be switched ON by the microcontroller using a relay. If the infrared thermometer's output is not within that range, the fan can be switched OFF by the microcontroller using a relay. This means that the infrared thermometer reads the atmospheric temperature which means that the human being is not there under or near that fan. If the atmospheric air temperature is near to human temperature, the fan can be switched ON based on the tolerance. When the fan is switched ON, the speed of the fan can be controlled by measuring and manipulating the body temperature of the human under/near the fan.

III. INFRARED THERMOMETER

Infrared thermometer is a thermometer which infers temperature from a portion of black body radiation emitted by the object being measured. They are sometimes called non-contact thermometers. By knowing the amount of infrared energy emitted by the object and its emissivity, the object's temperature can be determined. There are medical infrared thermometers available in the market as shown in the Fig.2.1[1].

These thermometers can be used for the automatic control of fans for measuring the human body temperature who is working under/near the fan.

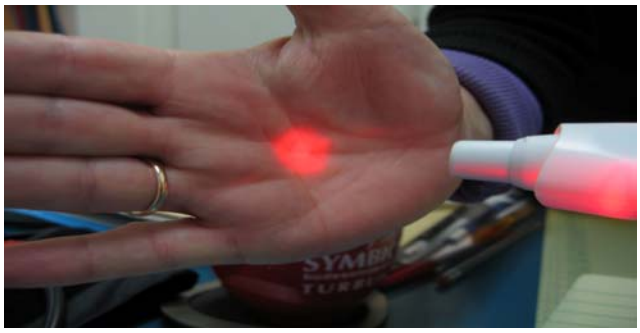

Fig.2.1.Medical Infrared Thermometer

IV. SINGLE PHASE INDUCTION MOTOR

There are two types of domestic fans. They are ceiling fan and table fan. These fans are made up of Single phase Induction Motors. There are several types of Single Phase Induction Motors based on the starting methods [2]. They are

1. Split Phase Motor
2. Capacitor Start Motor
3. Capacitor Start Capacitor Run Motor
4. Permanent Split Capacitor Motor
5. Shaded Pole Motor

Out of these types, Capacitor Start Capacitor Run Single Phase Induction Motor is the one widely used in domestic Fans.

V. BLOCK DIAGRAM

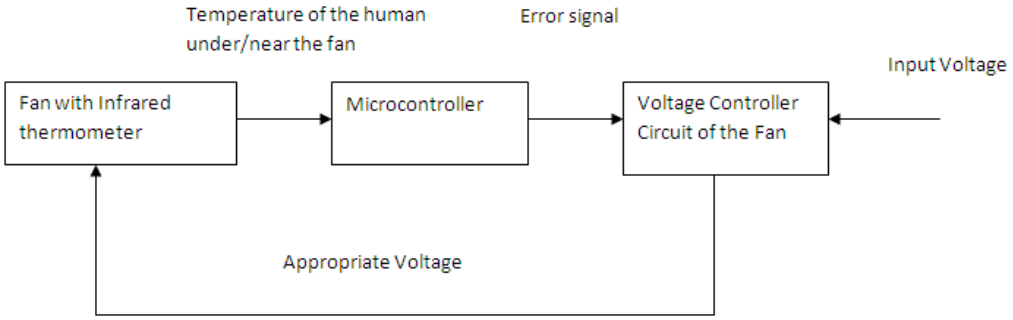

Fig.2.1. Block diagram of the automatic fan control

Fig.2.1 shows the block diagram of automatic fan control. The infrared thermometer attached to the fan measures the temperature of the human under/near the fan. This temperature in digital form is given to the microcontroller. The microcontroller calculates the difference between the set value and the measured value. The error signal which is derived from the difference in temperature is given to the voltage

controller circuit of the fan. The voltage controller circuit applies the appropriate voltage to the fan.

I. WORKING PRINCIPLE

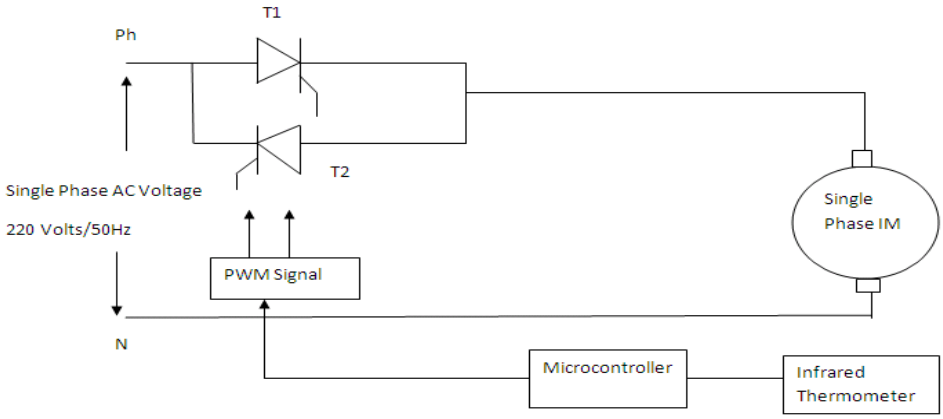

Fig.3.1.Circuit diagram of the automatic fan control

The single phase AC voltage applied to the single phase induction motor (Fan) can be controlled using a single phase AC regulator [2] as shown in Fig.3.1. In this method, two thyristors connected in anti-parallel are used. The firing angle α is controlled using the PWM signals generated from the Microcontroller. The Microcontroller generates the PWM signals by manipulating the difference between the set temperature and the temperature from the infrared thermometer.

Thyristor T1 is fired at an angle α. It conducts from α to π. At π, current through it falls to zero and is subjected to a reverse bias and turns off. Thyristor T2 is fired at π+ α.It conducts from π+ α to 2π.At 2π, it is turned off and this cycle is repeated. α is varied from zero to π.The rms value of the applied voltage changes from V to 0 accordingly.

VI. CONCLUSION

Thus automatic control of the domestic fan (Single phase Capacitor Start Capacitor run Induction Motor) can be achieved by using the AC Voltage regulator, Microcontroller and an Infrared Thermometer.

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