

Microcontroller Based Fan Speed Control System

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ABSTRACT:- Design and implementation of Microcontroller based automatic Fan speed regulator using temperature sensor is represented here. Most of the available Fans today are controlled manually by voltage regulators which have different stages of speed. During summer nights, especially the room temperature is initially quite high, as time passes, the temperature starts dropping. Also, after a person falls asleep, the metabolic rate of one's body decreases, and one is expected to wake up from time to time to adjust the speed of the Fan. Many people who are disabled / physically challenged persons are affected the most because of the inconveniences associated in changing the Fan speed level manually when the room temperature changes. So, an efficient automatic Fan speed control system that automatically changes the speed level according to the change in environment / room temperature which is more comfortable than manual system. This project has been designed in such a way that the required components are available in local market. Therefore an indigenous low cost

control scheme has been developed which can be used in real life application.

Keywords:- Temperature Control Fan; Speed Regulator; Microcontroller.

I. INTRODUCTION

Today, Fan is always used in the daily purposes. It is used to control the room temperature. All the activities of Fan can be controlled by using centrifugal switch [1]. The user can select the interested speed by switching the appropriate level in switch centrifugal. Normally, a ceiling Fan has six speeds' switches. There are speed 0, speed 1, speed 2, speed 3, speed 4 and speed 5. The speed 0 is especially for switching off the ceiling Fan. The slowest is for speed 1 and the fastest is speed 5. During the night, the metabolic rate of one's body decreases, and one is expected to wake up from time to time to adjust / regulate the speed of the Fan (with respect to room temperature). Many people who are disabled / physically challenged persons are affected the most because of the inconveniences associated in changing the Fan speed level

manually [2]. Thus electricity usage by Fan about 100watts~80watts (depending on the make) is more than what is required for the desired low speed operation of Fan (approximately 10 watts to 30watts). So, an efficient and reliable system that automatically changes the Fan speed level according to the change in room temperature was built to solve the problems and shortcomings associated with manually method of Fan speed control [3].

Before fan is invented, bird feather had been used. As year goes by, human being very creative by the creative technology which make human's life easier. Nowadays, fan and air conditioner has been a must appliance to each home, offices and the industries. Mostly each invention will be the modified from years for a change. The same thing goes to fan. Basically, fan has been run manually. To change the speed one has to push the speed button at the control panel of the fan. There are so many machines or electrical appliances that can function automatically. With the invention of the fan automated system using temperature sensor, one does not have to change fan speed manually. It can change fan speed to lower or higher speed according to the temperature. Nowadays, the usage of fan is controlled manually by pressing on the switch button. This non-innovative feature makes it unable to turn on automatically according to temperature changes. So, an automatic temperature control system

technology is applied for the switching purpose in this circuit.

Due to its advantages, many researches focusing on automatic temperature control system application in different fields will gain the benefits. For examples, Room Temperature based Fan Speed Control System using Pulse Width Modulation Technique [4], Design an Automatic Temperature Control System for Smart Electric Fan Using PIC [5],an automatic temperature controller for multi element array hyperthermia systems [6],multi loop automatic temperature control system design for fluid dynamics [7],design of automatic temperature-control circuit module in tunnel microwave heating system [8], an automatic temperature controller for multi-element array hyperthermia systems [9], multi-loop automatic temperature control system design for fluid dynamics [10], automatic temperature control for transport airplanes [11], design of automatic temperature control system on laser diode of erbium-doped fiber source [12], design of automatic temperature-control circuit module in tunnel microwave heating system[13].

This paper proposes an invention of Smart Electric Fan for various applications. It has an automation operation by using a microcontroller. It uses a TRIAC instead of relay that reduce cost. It changes speed with one degree temperature variation. This is to enhance its functionality to become more efficient and

effective and also we can save more electricity. The circuit provides a comfort for human's life, especially for senior and physically handicapped citizens. It really helps to solve the problem of handicapped person when to switch on the fan.

II. BLOCK PRESENTATION OF PROJECT

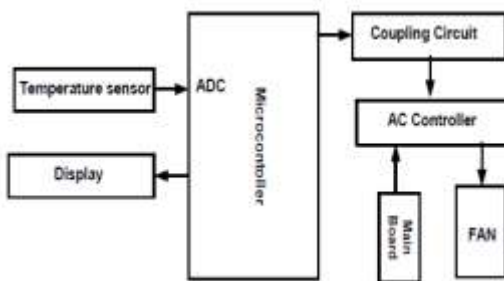


Fig.1: Block diagram representation of the project.

The above diagram is the basic block diagram of the whole project. The temperature sensor is employed to sense the temperature from atmosphere. It produces voltage if rises temperature. The output of the Temperature sensor (analogue signal) is fed to the input of the ADC, which converts the analogue temperature value to digital equivalent required by the microcontroller. Thus, the output of the ADC is directly coupled to the microcontroller whose main task is to control / regulate the Fan speed via the actuators. The LCD made available in the system is used to display all the information of

the system like: - the Fan speed and the room temperature (at any point in time).

Flow Chart

Figure-2 shows the flowchart of the logic implemented in the modeled system. First set Temperature than The temperature is read from the temperature sensor and the condition is checked and the following processes are done:

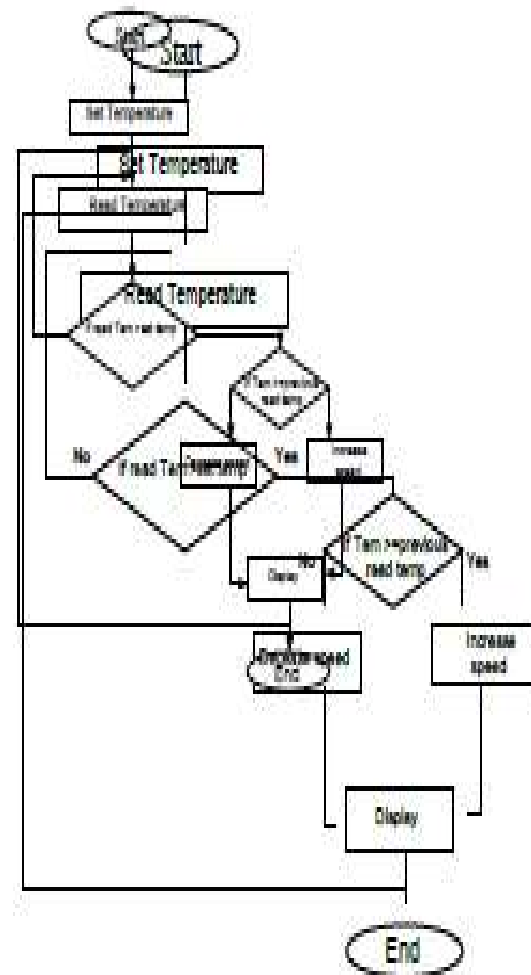


Fig.2: Flow Chart of the Project

- If read temperature is greater than set temperature, going next step.
- If read temperature is smaller than set temperature, than again read temperature.
- If temperature is greater than previous temperature, increase seed and display.
- If temperature is small than previous temperature, decrease seed and display.

III. FAN SPEED CONTROL SYSTEM CIRCUIT DESIGN

This section describes how the speed of fan is controlled by PWM output from microcontroller, with the change in room temperature. The schematic circuit diagram of fan speed control system shown in Fig. 8.

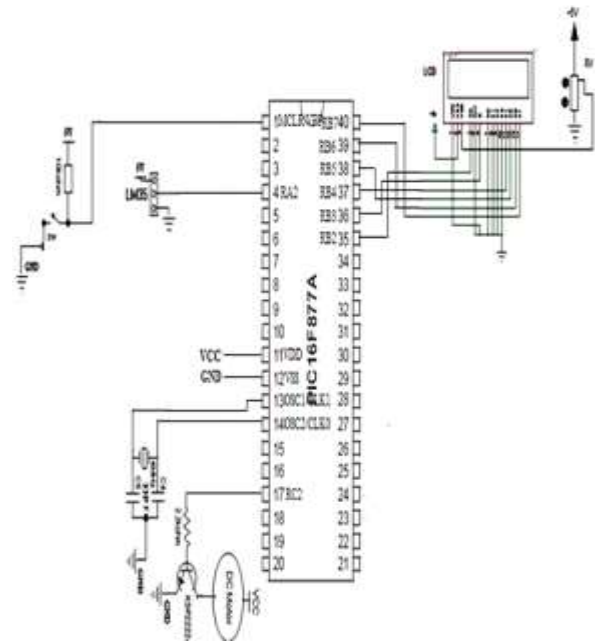


Fig. 8 Schematic circuit diagram of fan speed control system

In this circuit the microcontroller is used to control the fan according to the temperature variation. The voltage from the mains (220/240V AC) is stepped down by a transformer to 12V. Then the 12V DC passes through the voltage regulator to give a clean 5V DC. The LM35 functions to measure the changes of temperature surrounds the area. All the operations are controlled by the PIC16F877A to produce the output. The LCD, fans are the output where they are set with the pseudo code of PIC. The LCD is used to measure and show the changes of temperature value. As working principle, the temperature sensor senses the room temperature and displayed it on the LCD. The speed of the fan is controlled by using PWM technique according

to the room temperature change. For processing analog signals, microcontroller has analog to digital converter which converts analog signals to digital ones. The LM35 gives 10mv for each 1°c change in the temperature; this value is analog value and should be converted to digital. Any change in the temperature will be send to the microcontroller via PORTA pin 2, which have been specified by us in the program using TRISA. The microcontroller used in this system has inbuilt PWM module which is used to control speed of the fan by varying the duty cycle. According to the readings from the temperature sensor, duty cycle is varied automatically thus controlling fan speed. The microcontroller will send the PWM signal via pin RC2 in port C to the transistor which working as switch to the fan. Crystal oscillator is connected in between pin 13 (osc1) and pin 14 (osc2) of PIC16F877A, those are pins if we want to provide external clock to the microcontroller. 0.1 μ F bypass capacitor used on the output pin +5 V of the voltage regulator to smooth out the supply voltage to microcontroller and LCD. Vout pin of temperature sensor LM35 is connected on pin RA2 which is ADC0 of all ADC input pins. Pin 3 of LCD is connected to ground via 1Kohm resistor to set the contrast of the LCD to display temperature on LCD. Pins from RB2 to RB7 are connected to remaining LCD pins used for data and control signals between LCD and microcontroller PWM output

is given to gate terminal of Transistor NPN KSP2222A from microcontroller. Transistor NPN KSP2222A is high switching speed power switch. This switches on and off at PWM frequency and controls the voltage across motor. When KSP2222A is on, the motor starts to gain speed and off then motor looses speed. The hardware circuits that have been designed for the controlled fan speed system in this research, which consists of the LM35, PIC microcontroller, BLDC motor and LCD as shown in Fig. 9, which also include the crystal circuit.



Fig. 9 Hardware circuit of fan speed control system

IV. RESULT AND DISCUSSION

Since the calibration process should be done in any research. So that, two methods were used to measure the performance of the research. One

method was to use the voltmeter to measure the output of the LM35DZ temperature sensor. Since the output of this sensor is 10mv for each 1°C. Also another method to calibrate this work, was an external temperature sensor (thermometer) to gauge the room temperature. Fig. 10 describes the calibration process using the voltmeter and the thermometer.



Fig. 10 Calibration process using the voltmeter and the thermometer

The calibration process was done in different day times which can be summarized in Table I.

TABLE I
CALIBRATION PROCESS

Temperature (deg. C)	Speed (rpm)	Current (amp)	Voltage (volt)	Power Consumption (W)
20	1750	.12	118	14.16
21	2210	.14	136	19.04
22	2515	.15	152	22.8
23	2640	.15	170	25.5
24	2705	.16	185	29.6
25	2750	.16	202	32.32
26	2775	.17	215	36.55
27	2785	.17	224	38.08
28	2795	.17	225	38.25
29	2800	.18	229	41.22

V. CONCLUSION

In conclusion, the process in developing this innovative circuit is successfully done. The hardware implementation and its operation is functioning accordingly and smoothly following the procedure. High priority has been given to make the circuit simple but efficient with high reliability. Some slight of modifications have been made from the current and existing technology features to improve its performance such as using TRAIC instead of relay, speed change with one degree temperature change. The circuit has fulfilled the main objective, which to control the speed of fan using the temperature controller with microcontroller. Various graphs have been plotted to show the varying relationships between different parameters. This circuit is really practical to be applied, especially in real life applications.

Future Scope: In the future, there are several improvements can be made in order to upgrade the features such as

1. It can be extended for three phase induction load.
2. It can be extended by interfacing with android mobile to show temperature and RPM of fan in mobile.

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