Smart Ceiling Temperature Controlled Fan

Aditi shree[2#], Sumit pandey[1#], Pankaj Gaur[12#], Sandeep sharma[12#]
#1Department of Applied Electronics and instrumentation Engineering
#2Department of Electronics and Communication Engineering
DIT university
Email: aditishree.lc@gmail.com , sumit.pandey.in@ieee.org

ABSTRACT: **Previous generation models requires more human efforts but in the age of modern era as every technology is being evolving into a more advanced an modified version by operating automatically so here in the same way this project work will reinvent the ceiling fan to make it smarter. Fans make people feel cooler but don't lower a room's actual temperature. So to save energy, it will run automatically according to the temperature of the surroundings and will get turn off below a particular temperature by itself. Considering already existing ceiling fans it is difficult to control the speed of each and every fan depending upon the weather conditions. The idea behind the paper smart ceiling temperature controlled fan is to control the speed of fan using microcontroller ATMEGA16, based on variations in temperature detected by temperature sensor. Besides house owners, this smart feature in a fan can also benefit schools, firms and other public buildings as they also have a certain regular routine. Therefore this project work is taken up to minimize human effort and save energy at the same time which is a need of an hour. The software used for this project is PROTEUS_V78i and WINAVR studio4.**

I.INTRODUCTION

In order to create a project about the control of the fan's speed based on temperature automatically or Simple fan's speed controller by temperature sensor. The concept of this circuit is introduced .Fans are useful when the weather is hot. But in cold weather, fans are not necessary to be used. If we turn the fan ON with full speed during night hours and then if the night gets cooler, we probably will need to get up and turn the fan OFF for the whole night and still feel unwell certainly. If we use a timer, may not be exact for every night .Sometimes the time been exhausted. But the weather is hot. Need to turn the fan again, Cumbersome and not really the point .So we can use the temperatures to control a fan better .In this project LM335 series analog temperature sensor is being used. This is a precision integrated-circuit, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. It is rated to operate over a -55° to +150°C temperature range. It has + 10.0 mV/°C linear scale factor. The output of this sensor will be connected to ATMEGA16 micro controller's PORT-A. The inbuilt ADC in ATMEGA is used for converting into Digital format. That will be used by ATMEGA16 to generate control logic. Then the PWM output from ATMEGA16 micro-controller is given to variable speed DC motor through a motor driver stage.

The circuit works on the feedback principle. The speed of the fan varies with the variation in the temperature. The speed of the fan increases if the temperature is increased and the speed of the fan decreases with the decrease in the temperature. LM335 produces its output voltage corresponding to the temperature. The temperature is given to ADC which converts the analog variation in the voltage into the digital form. When the Vref is properly selected then the temperature value appears on the output pins of the ADC in the binary form. This output is given as input to the ATMEGA16 microcontroller. The input is compared in the microcontroller and the required output is produce.

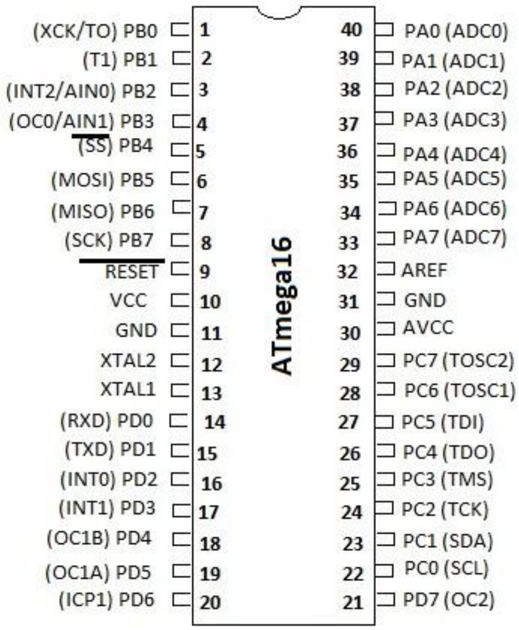
II. DESCRIPTION OF PARTS

ATMEGA16

ATmega16 is an 8-bit high performance microcontroller. It consumes less power. The Atmel's ATmega series of microcontrollers are very popular due to the large number of peripherals built-in them. They have features such as internal PWM channels, 10-bit A/D converters, UART/USART and much more, which makes them useful for a large number of applications and external hardware is reduced as these are built-in.

ATMEGA16'S SPECIFICATION

- FLASH -------- 16 kB
- EEPROM -------- 512 B
- SRAM -------- 1024 B
- SPEED -------- 0-16 Mhz
- VOLTS -------- 4.5 V - 5.5 V
- PINS -------- 40 (PDIP)

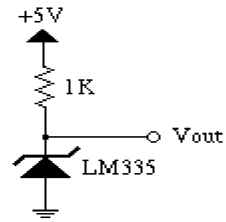


Pin description of ATmega16

Temperature Controller IC

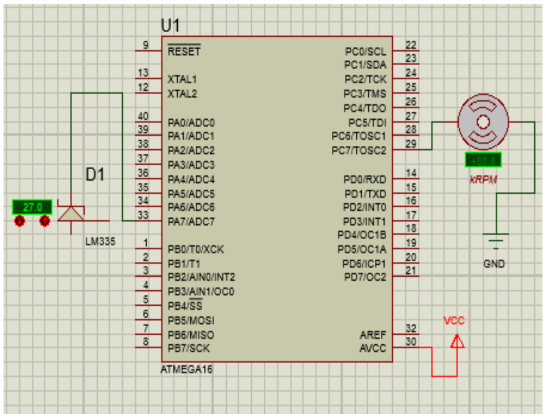
The LM335 temperature sensor is an easy to use, cost-effective sensor with decent accuracy (around +/- 3 degrees C calibrated). The sensor is essentially a zener diode whose reverse breakdown voltage is proportional to absolute temperature. Since the sensor is a zener diode, a bias current must be established in order to use the device. The spec sheet states that the diode should be biased between 400 uA and 5 mA; we'll bias it at 2 mA. It is important to note that self-heating can be a significant factor, which is why a higher bias current is not chosen.

The temperature sensor's voltage output is related to absolute temperature by the following equation: Vout = VoutT0 * T / T0, where T0 is the known reference temperature where VoutT0 was measured. The nominal VoutT0 is equal to T0 * 10 mV/K. So, at 25 C, VoutT0 is nominally 298 K * 10 mV/K = 2.98 V (to be really accurate, we'd need a reference temperature and a voltmeter, but nominal values are OK for our purposes). Thus, the voltage dropped between +5 and the diode is 5V - 2.98V = 2.02V. In order to get 2 mA bias current, a 1 K resistor is needed for R1. The bias circuit is as follows:



PROCEDURE

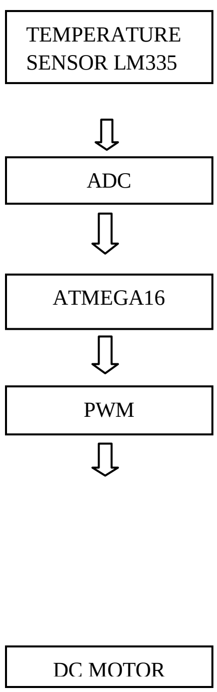
An ATmega16 AVR Microcontroller is used for carrying out all the required computations and control. It has an in-built Analog to Digital converter. Hence an external ADC is not required for converting the analog temperature input into digital value. Following discussion is about the temperature sensor used, the microcontroller and the methodology. An inexpensive temperature sensor LM335 is used for sensing the ambient temperature. Hardware Micro controller unit is used as the controller to maintain the DC motor speed at desired value, based on the input from the temperature sensor, in order to control the temperature. The duty cycle of the PWM (pulse width modulation) from microcontroller will determine the speed of the DC motor. To control the speed of the fan a PWM (pulse width modulation) is used. In pulse width modulation the power delivered to the load is varied by changing the duty cycle of the output voltage. To deliver high power duty cycle is kept high To deliver less power duty cycle is kept low . PWM output waveforms for different temperature ranges :For Duty cycle 20% (25 to 35 deg) For Duty cycle 40% (35 to 45 deg)For duty cycle 60% (45 to 55 deg) For Duty cycle 80% (55 to 65 deg)The LM335 does not require any external calibration or trimming to provide typical accuracies of ± 1/4°C at room temperature and ±3/4°C, over a full -55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM335's low output impedance ,linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM335 is rated to operate over a -55° to +150°C temperature range.Full range centigrade temperature sensor.



SCHEMATIC Fig.1

III. MATHEMATICAL MODELLING

Range of sensor output: -550 mV to 1500mV (for temperature range of -55 to 150 degree Celsius).Range of ADC input for ATMEGA: 0 to 5 VADC output: 0 To1023 (10 bit) For every 1 degree Celsius temperature rise, rise of sensor output is 10mVFor every 5 m.volt input rise to ADC, count increments by 1ADC_OUT = 1023 * (ADC_IN)/5000;So Temperature = ADC_OUT /2.046



BLOCK DIAGRAM Fig.2

CONCLUSION

Besides household use the temperature-controlled fan designed with microcontroller is also quite useful for conference halls, auditoriums, cinema halls, and other commercial organizations where many people gathered together, and lot of fans are required at these places. Depending up on the weather condition, organizers of the above places are supposed to control each and every fan , otherwise lot of energy will be wasted. Controlling each and every fan manually is highly impossible; there by this project work is taken up, which controls the fan automatically depending upon the temperature.

The basic concept is, depending upon the room temperature to control the fan speed automatically. Since our weather conditions are widely varied, temperature up and downs are common in our country. When the temperature is less then 15 0C fan is not required, there by a facility is provided in the system that the fan will be switched off automatically at less than 15 0C. The system is programmed to run the fan at its maximum speed at 40 0C. Therefore the fan speed varies linearly between 15 0C to 40 0C.

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