

Speed Control of Exhaust Fan Based on Temperature

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ABSTRACT

In this paper we represent the design of automatic speed control of exhaust fan based on temperature using microcontroller ATmega8, motor driver IC (L293D) and temperature sensor LM35. The main aim of this project is to save energy by controlling the speed of exhaust fan. This paper shows how speed of exhaust fan is controlled. The software used here is embedded C software which used to program the microcontroller. The speed regulation with temperature variation is shown on LCD display. A gas sensor is also used in this project to detect any gas leakage, if detected then buzzer will turn on.

Keywords : L293D, LM35, ADC, ATmega8

I. INTRODUCTION

Ventilation is one of most important aspect in our day to day life [1]. Ventilation is needed everywhere whether its a small scale industry, big industry, home, office etc. In the process of ventilation, exhaust fan is the main component used to control the room temperature. Exhaust fan is used everywhere but its speed regulation is rare. It kept on moving with the same speed whether the temperature is lower or higher. It consumes same amount of energy every time it is switched on.

When temperature inside a room is low, we don't necessarily need the high speed of exhaust fan as it consumes more electrical power which leads to wastage of power.

In this project our focus is on to automatically regulate the speed of exhaust fan based on temperature so that there is no wastage of electrical power and we can save power. With the invention of automated exhaust fan system using temperature sensor it can change the fan's speed lower or higher according to the temperature changes. Temperature sensor used here is LM35, it gives direct relationship between temperature and voltage. It ranges from -55 degree centigrade to +150 degree centigrade and its accuracy is $\pm 1/4^\circ\text{C}$.

Gas sensor is also used in this project to detect the gas leakage. Sometimes leakage of harmful gases leads to vast destruction like in Bhopal gas tragedy. To avoid such scenario gas detector is used in this project with a buzzer so that whenever there is any gas leakage buzzer is turned on so that people around there get to know about the gas leakage and necessary action can be taken to avoid any heavy destruction. LCD display is used to display the speed regulation with temperature.

II. PROPOSED SYSTEM

In this system our objectives are

- Automatic speed control
- Display the current temperature in LCD
- Vary the speed of exhaust fan accordingly
- Low power consumption

Block diagram

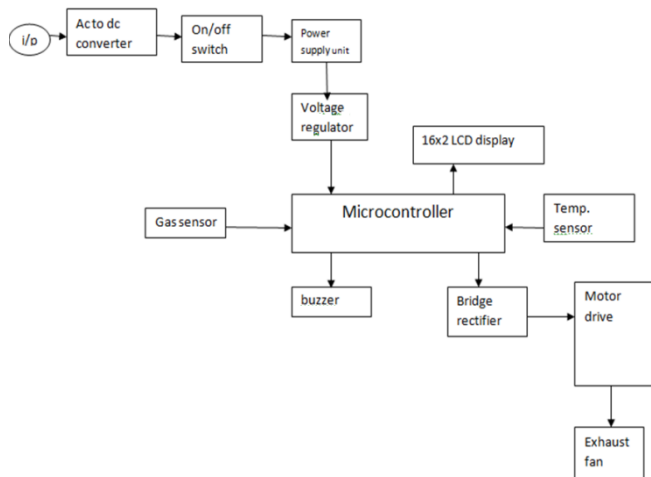


Fig-1

III. Hardware

1. DC motor

These fan runs at 12V dc supply and are very cheap. These are preferred over AC motor because DC motor has high control efficiency and it has better overload and peak voltage characteristics. DC motor can be controlled digitally in very simple way.

2. Motor Driver

L293D motor driver is used as it drives 2 dc motor simultaneously. Each motor can move in either anticlockwise direction or clockwise direction. These motor IC can be used for both large and small dc motor depending on the voltage level. Operation of L293D motor drive depends upon the voltage supply and the enable pin.

3. Microcontroller

The microcontroller we are using here is atMega8L8. It contains 32 general purpose register. It has all the features that a microprocessor has. It is the heart of our project. It has inbuilt analog to digital converter thus we don't required a external one and have various advantages.

4. Liquid Crystal Display

16*2 liquid crystal display is used here. It is a output device. It is flat, visual display electronic device which uses modulating properties of liquid crystal. LCD is

used in this project to display temperature and speed variation of motor with temperature .

5. Temperature Sensor

LM35 temperature sensor is used in this project. It acts as a transducer. The output of this temperature shows a linear relationship with temperature. It ranges from -55 degree celcius to +155 degree celcius.

6. Gas sensor

Gas sensor used here is to detect any gas leakage in the room. It also acts like a transducer. Whenever any leakage is detected it will give input signal to microcontroller and then output signal from microcontroller will be given to buzzer. Hence whenever a gas leakage is detected buzzer will buzz.

IV. Working

In circuit principle there are three electronics devices used which are temperature sensor, micro controller and motor driver. Basically the function of the temperature is to sense the temperature from the environment and to give an analog output to the ADC pin of the microcontroller.

Temperature sensor LM35 acts as a transducer. The function of the ADC pin of the microcontroller is to convert the analog signal into digital signal as the microcontroller can read only digital signals. ATmega8 microcontroller is used here. It has 6 multiplexed ADC channels which have 10 bit determination. This analog signal is compared to the threshold value programmed in the microcontroller. If the analog signal is greater than the threshold value or set value then the fan will be switched on. Motor driver runs the DC exhaust fan. It has two output signals and two enable pins. It is designed so that two DC motors will run at the same time.

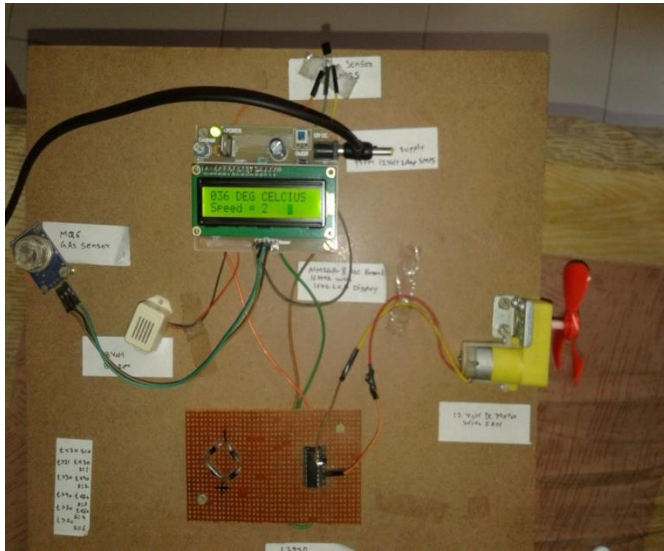


Fig-2

V. Fan Speed Control System

For controlling the speed of dc motor various methods are present. The method used in this project to control the speed is “applied voltage control”. This method has been employed to control the dc motor in this project. As we know speed in dc motor is given by

$$N = \frac{E - I_a R_a}{k\Phi}$$

Where

N= speed of motor

E= emf supplied

$I_a R_a$ = losses in armature winding

$$\Phi = \text{flux}$$

As we can see speed of motor is directly proportional to applied voltage so we can change the speed by varying the applied voltage. Also power is given as the product of applied voltage and current, so output power increases with the increase in speed.

In this project power width modulation technique is used to control the speed of fan by changing the duty cycle of input pulse signal between the control terminal and ground terminal. The duty cycle is varied according to the room temperature and thus speed of the exhaust fan is change according to the duty cycle.

VI. Result

Temperature sensor senses the room temperature and the value of temperature is read by microcontroller and

displayed on LCD. If the value of temperature is below the threshold value that is 20 degree Celsius fan remains off. When temperature is in between 20 degree Celsius to 40 degree Celsius the exhaust fan speed is slow, between 40-60 degree Celsius speed is medium and above 60 speed of exhaust fan is high.

VII. Conclusion

Automatic speed control of exhaust fan based on temperature is proposed in this paper. The use of temperature sensor, microcontroller, motor driver IC control the speed of exhaust fan according to the change in temperature. Also we have used gas sensor which detect any gas leakage, if any leakage detected buzzer is provided which starts buzzing, indicating gas leakage.

VIII. REFERENCES

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