NEW HORIZON
COLLEGE OF ENGINEERING
New Horizon Knowledge Park, Ring Road, Marathalli
Autonomous College Permanently Affiliated to VTU, Approved by AICTE & UGC
Accredited by NAAC with 'A' Grade, Accredited by NBA

TEMPERATURE CONTROLLED DC FAN USING MICROCONTROLLER

A MINI PROJECT

REPORT

Submitted by

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In partial fulfilment for the award of the degree of

BACHELOR OF ENGINEERING

IN

ELECTRICAL AND ELECTRONICS ENGINEERING

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Bonafide Certificate

This is to Bonafide that the mini project report entitled "**Temperature Controlled DC Fan Using Microcontroller**" submitted by **Vishal Suresh – 1NH18EE756, Vishal Gupta – 1NH18EE755, Vivek Ranjan – 1NH18EE069**, Department of Electrical and Electronics Engineering, New Horizon College of Engineering, Bangalore in partial fulfilment for the award of the degree of Bachelor of Engineering, is a record of bonafide work carried out by him/her under my supervision, as per the NHCE code of academic and research ethics.

The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university. The project report fulfils the requirements and regulations of the institution and in my opinion meets the necessary standards for submission.

Mr. Satishkumar. D	Dr. S. Ramkumar
Project Guide	HoD - EEE

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Place: Bangalore

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ABSTRACT OF THE PROJECT

This project will display the configuration, development, advancement, control and assessment of an automatic switching electric fan. This venture of a smart electric fan utilizes "clever innovation''. The microcontroller based programmed fan framework introduced in this project is obliged to satisfy the necessity of advances "tomorrow will be better than today". The electric fan naturally switches on according to the environmental temperature changes.

Generally, electronic gadgets create a lot of heat while functioning due to internal loss and several other factors. There is a necessity to decrease this heat generated so that the electronic device won't lose their characteristic or malfunction. The heat can be minimized in various methods. One of the method is by implementing a temperature dependent dc fan using microcontrollers. When environment temperature sensed by the sensor crosses the threshold value the fan is switched on and therefore the temperature is reduced. The fan will remain on until the temperature once again reduces below the threshold value. This is the general idea used in this project.

CONTENTS

INTRODUCTION

In this project we have used ATmega8 microcontroller, L293D driver IC, LM35 temperature sensor and DC motor. The function of each of the equipment’s depends on each other. The function of temperature sensor is to sense the temperature from the environment and give the analog input to the microcontroller at the Port C where ADC pin converts the analog signal into digital signals. The microcontroller has 28 pins. Some of the pins are known as VCC, GND, AVCC, etc. AVCC is used for ADC

There are three ports in the ATmega8 microcontroller which are Port B, Port C and Port D. each port can be used as input or output ports. In the project we used Port B as the output and output from the port is given to the motor driver. Pin PB1 is connected to the input 1 and pin PB2 is connected to the input 2 of the driver IC. The output of the motor driver IC is connected to the DC motor. DC motor runs when input 1 and input 2 is either 01(low high) or 10(high low).

The fundamental principle of the circuit is to turn on the fan associated with DC motor when the temperature is more noteworthy than a certain threshold value.

The microcontroller persistently reads the temperature value from its environmental surroundings. The temperature sensor goes about as a transducer and changes over the detected temperature to electrical worth. This is analog value which is applied to the ADC pin of the microcontroller.

The ATmega8 microcontroller has six multiplexed ADC channels with 10 bit resolution. The simple analog worth is applied to one of the input ADC pins. In this way transformation happens inside utilizing progressive approximation strategy.

For ADC change, inner registers ought to be predeclared. The ADC pin yields a digital value as output. This is contrasted and compared with the threshold or limit value by the controller which in turn switches the fan on if it is more noteworthy than the limit.

COMPONENTS

- Atmega8
- L293D
- Lm35
- DC motor

COMPONENTS DESCRIPTION

Atmega8:

Components of Atmega8:

Memory:

ATmega8 microcontroller contains 8 Kb Flash system memory around 10,000 times it can be write or erased.

It has 512 bytes of EEPROM and it can perform write or erase operation 100,000 times.

It also has 1 Kb internal Static RAM.

Input/output Ports:

There are 23 input lines which comes from three different ports. The three different ports are Port B, Port C and Port D.

Interrupts:

Port D has two external input source. Nineteen different types of interrupt vectors handling nineteen operations produced by the internal peripheral.

Timer and Counter:

Different types of timers are available in microcontroller ATmega8 which are used internally. 2 of them are of 8 bits and 1 of them is of 16 bits which works in different operations and also supports internal and external clock.

Serial Peripheral interface:

In ATmega8 microcontroller three types of communication devices are inbuilt. Serial Peripheral interface, USART and two wire interface are used for communication purpose. For controlling Serial Peripheral interface four pins are used in ATmega8 microcontroller for the purpose of communication

USART:

USART is highly efficient in communication. 3 pins are declared for the USART communication. This communication is used in almost all projects. Asynchronous and synchronous data transfer is possible in ATmeg8.

Two Wire Interface:

ATmega8 microcontroller has a third communication devices known as two wire interface. This helps in communication between two devices. It is possible with the help of two wire and common ground connection. Pull up resistor are used to complete the circuit

Analog Comparator:

In ATmega8 microcontroller two external pins are embedded which are used for comparison of two voltages. A comparator is a device which compares between two signals. So these two voltages are used as an input to the comparator.

Analog to Digital Converter:

ADC are inbuilt in the microcontroller which converts the analog signal into digital signal internally. ADC converts the analog signal into digital signal of 10 bit resolution. This part is very essential part of the microcontroller.

The flash programmable memory can be many times read and write using the serial port interface (SPI). This memory is burn by AVR programmer. Port C can be selected as an input port and the input is given to anyone of the bits of Port C (PC0 to PC7).

From the below figure a general idea is given about ATmega8 microcontroller. Its interfacing between the ports, buses, CPUs and serial port communications, ALU units, interrupt signals, registers, internal oscillators, timer and counter, these all are shown in block diagram which can be understood easily. Port B used as an output port in ATmega8 microcontroller.

Use of ADC Registers:

ADC, ADCSRA and ADMUX registers are contained inside the ATmega8 microcontroller and these registers are declared for analog to digital conversion. 10 bit resolution is used in analog to digital conversion.

1) Reference voltage is selected by utilizing ADCMUX register to the ADC.

2) Reference voltage is set by selecting REFS1 and REFS0 values in ADMUX.

3) ADC channel is selected by the MUX0 to MUX3.

According to the set value of the MUX ADC values are shown in the below table:-

MUX 3-0	ADC CHANNEL
0	ADC0
1	ADC1
10	ADC2
11	ADC3
100	ADC4
101	ADC5

Table 1.1

4) To select any ADC channel from ADC0 to ADC7 ADCMUX is defined by ADMUX=0b00000111

5) To start the analog to digital conversion REFS0, ADEN, ADSP2, ADSP1 are set to 1 where ADSP1 and ADSP2 are used as dividing factor of the internal clock cycle.

6) ADSRA and ADSC are set to 1 for conversion

ADPS2	ADPS1	ADPS0	Division Factor
0	0	0	2
0	0	1	2
0	1	0	4
0	1	1	8
1	0	0	16
1	0	1	32
1	1	0	64
1	1	1	128

Table 1.2

7) An interrupt signal is introduced when the conversion is completed.

8) After a delay ADIF = 1 is set.

ATmega8 Overview:

The ATmega8 microcontroller contains 32 general purpose working registers. As shown in the below figure these registers are directly connected to ALU. Two registers can carry one single instruction consequently in one clock cycle.

The following feature are comprised in ATmega8:

1. 8 Kb of programmable flash memory which can read and write 10,000 times.
2. 512 bytes of EEPROM which can also read and write but 10 times more than the programmable flash memory.
3. 1 Kb of static RAM.
4. 23 general purpose input/output lines.
5. 32 general purpose working registers.

6. Counter and Timer with comparison mode.

7. Internal and external interrupts.

8. 3 types of communication interface which are SPI (serial port interface), a serial programmable USART and two wire interface.

9. A six channel ADC with 10 bit resolution with programmable watchdog timer with internal oscillators.

Pin Diagram of ATmega8:

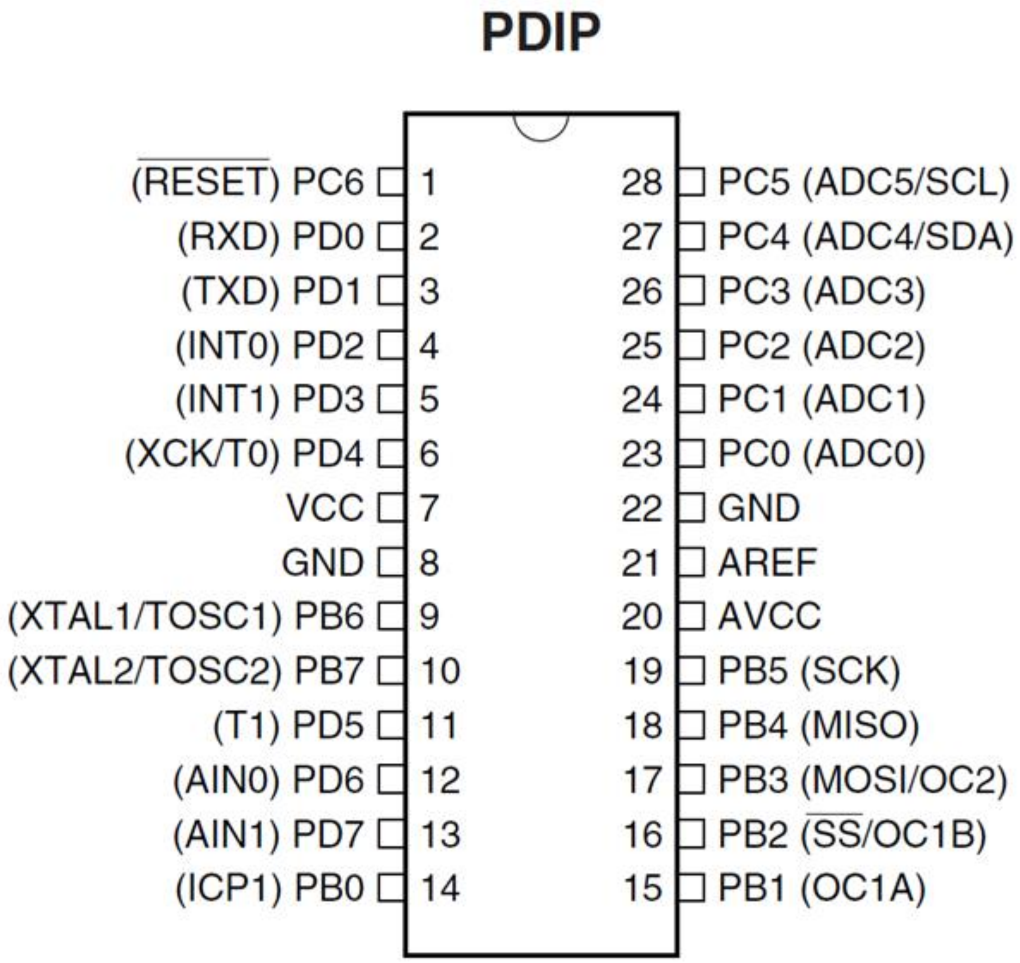

Fig 1.1

Block Diagram of Atmega8:

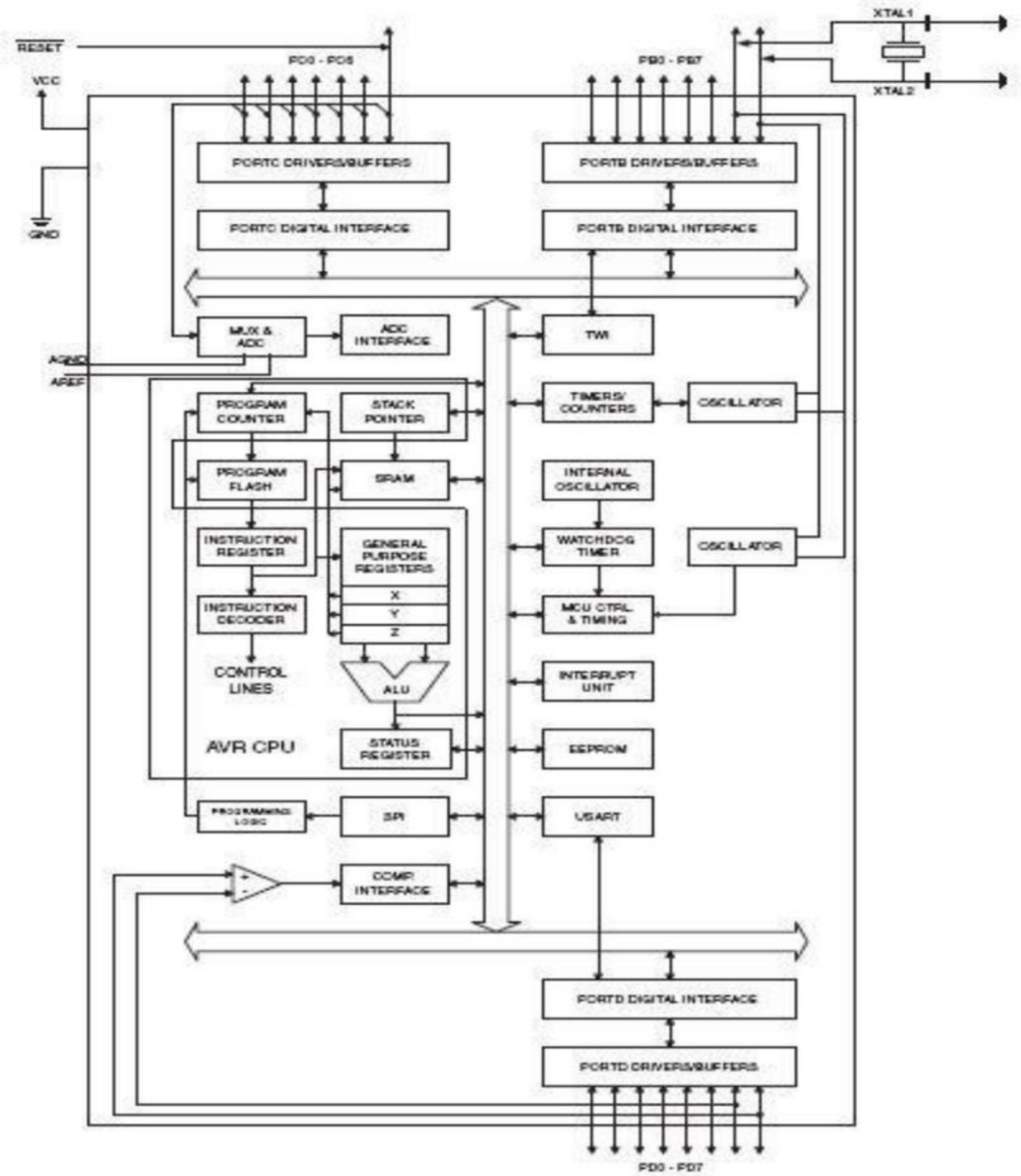

Fig 1.2

ATmega8 Specification:

EEPROM: 512 bytes

Flash memory: 8 kilobytes

Dc current per input/output pin: 40 milli ampere

Static ram: 1 kilobyte

Digital input/output pins: 14

Analog input pins: 6

Digital Pins:

Arduino board is used for program of microcontroller using the functions digital Write(), digital Read() and pinMode() commands. Pull up registers are used at each pin and it can be turn off or on using the digitalWrite() command. It means digitalWrite() pin can be made HIGH or LOW. The maximum current which can be allowed is of around 35 to 40 milli Ampere per pin.

Serial: 1 (TX) and 0 (RX):

When the serial data pin is 1 then TTL serial data is transmitted. When it is 0 then TTL serial data is received. FTDI USB to TTL serial chip pins are connected to the RX and TX pin of the Arduino Diecimila. When the Arduino BT is used at the place of Arduino BT Diecimila then RX and TX pin are connected to the pins of WT11 Bluetooth model. Another Arduino model i.e. Arduino LilyPad and Arduino Mini are used then RX and TX pins are connected to the external pin of TTL serial model.

External Interrupts (pin 2 and pin 3):

These pins are made low or high to execute another program, stopping the main program and after completing this program the value of the interrupts are made low and it returns to execute the main program.

PWM: 11, 10, 9, 6, 5 and 3:

8 bit PWM output is delivered by the function analog Write(). These output are available at the pins of 11, 10 and 9 of microcontroller ATmega8.

BT Reset:

This is used in only Arduino BT and connected to the pins of Bluetooth model.

Serial Port Interfacing – pin 13 (SCK), 11 (MOSI), 12 (MISO), 10 (SS):

Serial port interfacing communication uses the pins 10, 11, 12 and 13. These are not available in Arduino boards.

LED: pin 13:

Arduino Lilypad and Arduino Diecimila uses the pin 13. If pin 13 is low then LED is off. If pin 13 is high then LED is on.

Analog Pins:

Analog pins are used to convert analog to digital conversion obtained at 10 bit resolution. These analog pins sometimes used as a digital pins. Analog input 0 is given to the digital pin 14 as well as analog input pin 5 is given to the digital pin 19.

Power Pins:

When Arduino board is connected through the USB an input voltage will be 5 volts. The voltages coming through the USB may vary because of different boards. Arduino LilyPad does not contains VIN pin. Supply voltage is given through the power jack to the Arduino.

5V:- this is the regulated supply voltage which is used by the microcontroller and all other pins of the microcontroller uses 5 volts regulated voltage.

GND: - this pin is connected to the Ground. And its voltage is zero.

Other Pins:

AREF: this pin is used for comparison between the set value and analog inputs.

RESET: this pin is used to reset the microcontroller when the reset pin is LOW.

L293D:

L293D motor driver is used for driving two dc motors simultaneously. Each motor can run in either direction. The driving circuit of motors are knows as dual H-bridge. This types of motor drivers are very cheap and easily available at any shop. This motor driver IC can be used for small and little large motors depending on its voltage level. The cost of this driver is around Rs.40 to Rs.70. Pin diagram of the motor driver circuit is very easy and practical to understand. Operation of this motor driving IC depend on power supply and enable pin.

Concepts:

According to the input signals received from the ATmega8 micro-controller H-bridge circuit gives output. The meaning is that output voltage direction changes as input to driver circuit changes. Motor can either run in clockwise or anticlockwise. Each motor is free to rotate in any direction or we can say that each motor is independent in case of rotation. Now we come to pin diagram description. There are 1 enable pin, 1 VCC pin, 2 input, two output and 2 ground pin on each side of driver IC. There are 2 Hbridge circuit inside the driver.

Pin one and nine is known as enable pin and always kept high. If enable pin is not kept high then motor will not run. Enable pin 1 is in left side of driver IC and enable 9 is in right of the driver IC. Left Hbridge work when enable pin 1 is kept high and right H-bridge work when pin 9 is kept high. The behavior of enable pin is just like a switch.

Pin Diagram of L293D:

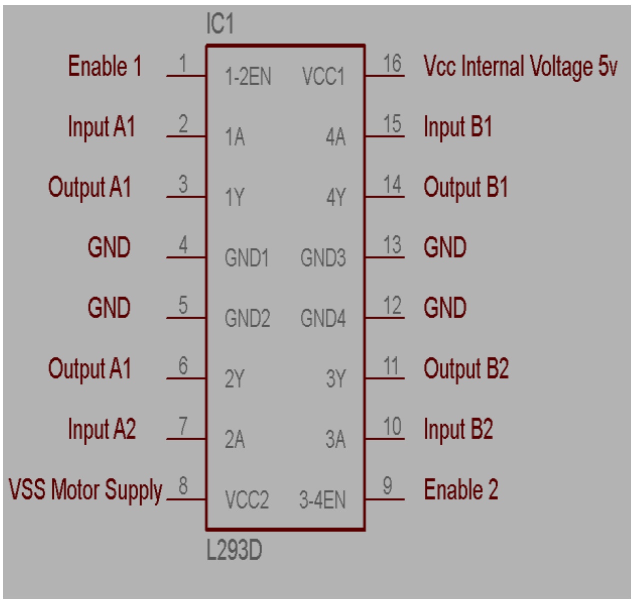

Fig 2.1

Function of L293D:

Four input pins come from microcontroller and enable pins are high. Now the rotation of motor depend on the input signal. If left side inputs 2, 7, both any one is low and other one is high motor will run. Same conditions are applicable for right side input pins 10, 15.

L293D Logic Table:

Left side motor is connected to output pin 3 and 6 and it rotation is tabulated below according to the input signal value of driver IC. High and low values are indicated by 1 or 0 respectively. This table is also applicable for right side.

Input A	Input B	Motor State
High	Low	Turns clockwise
Low	High	Turns anti-clockwise
High	High	Braking occurs
Low	Low	Braking occurs

Table 2.1

Voltage Specification:

Voltage value depends on motor specification. If motor is of 9v then VSS of motor driving IC should be 9v for operation of motor. VCC is used for internal operation and its value is 5v. VCC voltage is not utilized for driving purpose of motor by L293D. Voltage range under which motor driving IC pin VSS varies is about 5v to 36 volt. 36 volt is the threshold value of VSS. The motor of 36 volt rated is driven by driver easily. Relatively 36 volt motor are large compare to 5 volt motor. VCC is numbered 16 and VSS is numbered is 7 pin in driver. A maximum current of 600 milli Ampere can be supplied per channel. We can drive large motors with L293D.

Circuit diagram of L293D:

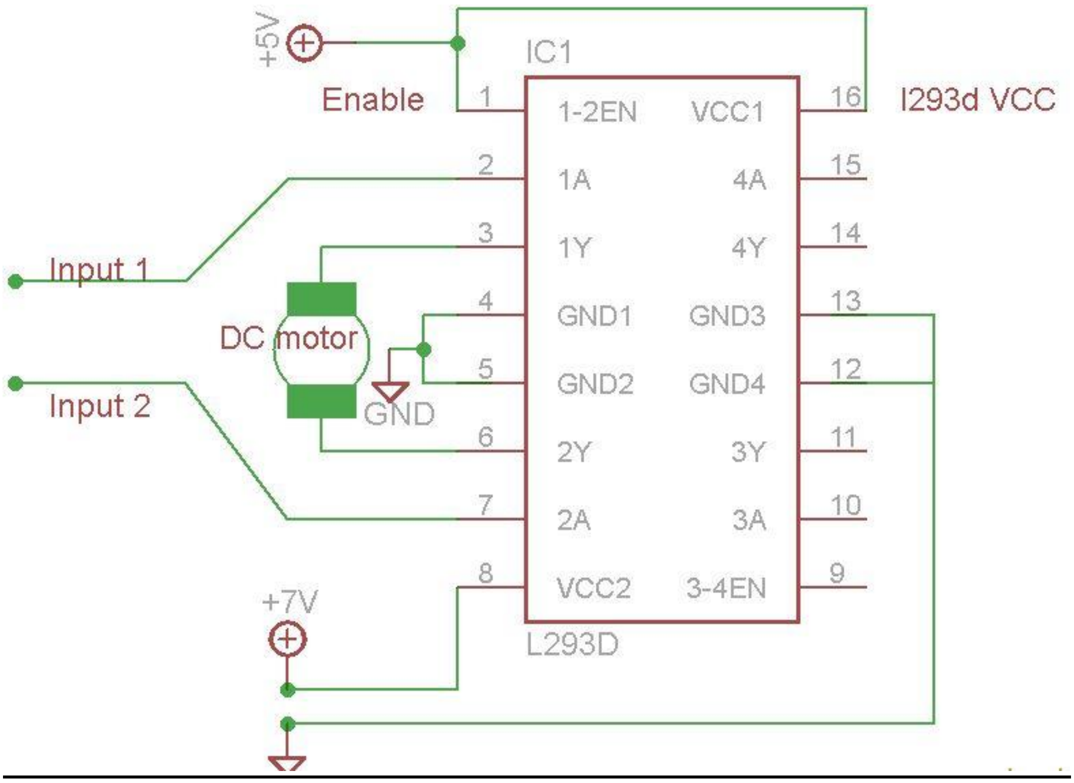

Fig 2.2

LM35:

LM35 is a device which converts the physical signal into electrical signal. That's why it is known as the transducer. It is calibrated with the environmental temperature and it linearly varies with the temperature and its output is in volt. There is no need of external calibration to provide the accuracy of the LM35 at room temperature which is about ±¼°C. Minimum temperature that can be measured by the LM35 device is -55°C. And maximum temperature that can be measured by LM35 is 150°C. Calibration of LM35 is done by trimming at the water level. To make the interfacing of control circuitry and readout circuitry very easy, low impedance at output side, output which is linear and precise inherent calibration of LM35 plays an important role. Temperature sensor takes a very low current of order 60 µA from the input supply. Heat loss in the LM35 is very less degree of around 0.1°C. LM35 can work in the range of -50°C to +150° which is the rated value. Another device which is also a temperature sensor of the family of LM35 known as LM35C which ranges from -40°C to +110°C. LM35 costs around 10 rupees in India and is easily available in the market which anyone can buy at any convenience store or electronics store.

Features of LM35:

- Low cost
- Accuracy is about ±¼°C
- Linearly varies with temperature (in centigrade)
- It can measure the temperature from -55°C to 150°C
- The current drawn from the supply is very less about 60 µA
- There is negligible heat in LM35
- Low impedance output i.e for a load of 1 mA about 0.1 ohm
- Calibrated linearly with Celsius
- Input voltage can vary from 4 volts to 30 volt.

Pin Diagram of LM35:

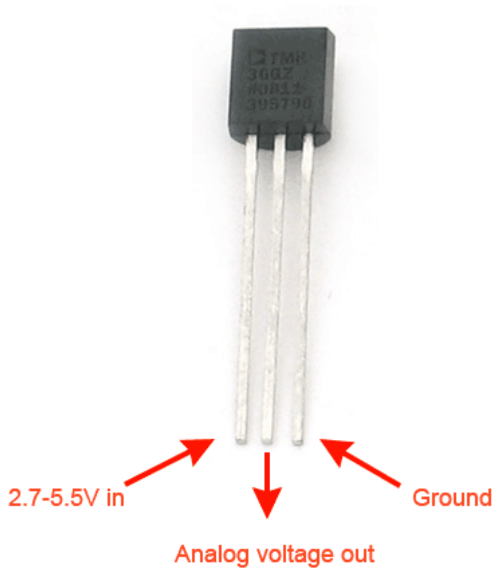

Fig 3.1

Circuit Diagram of LM35:

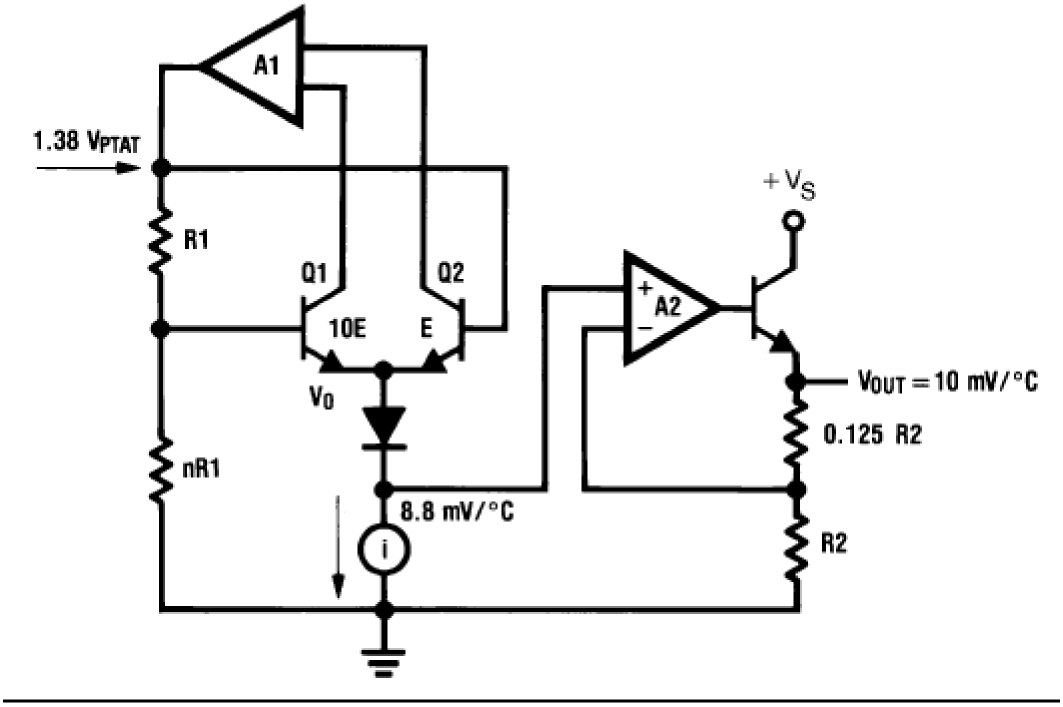

Fig 3.2

CIRCUIT DIAGRAM

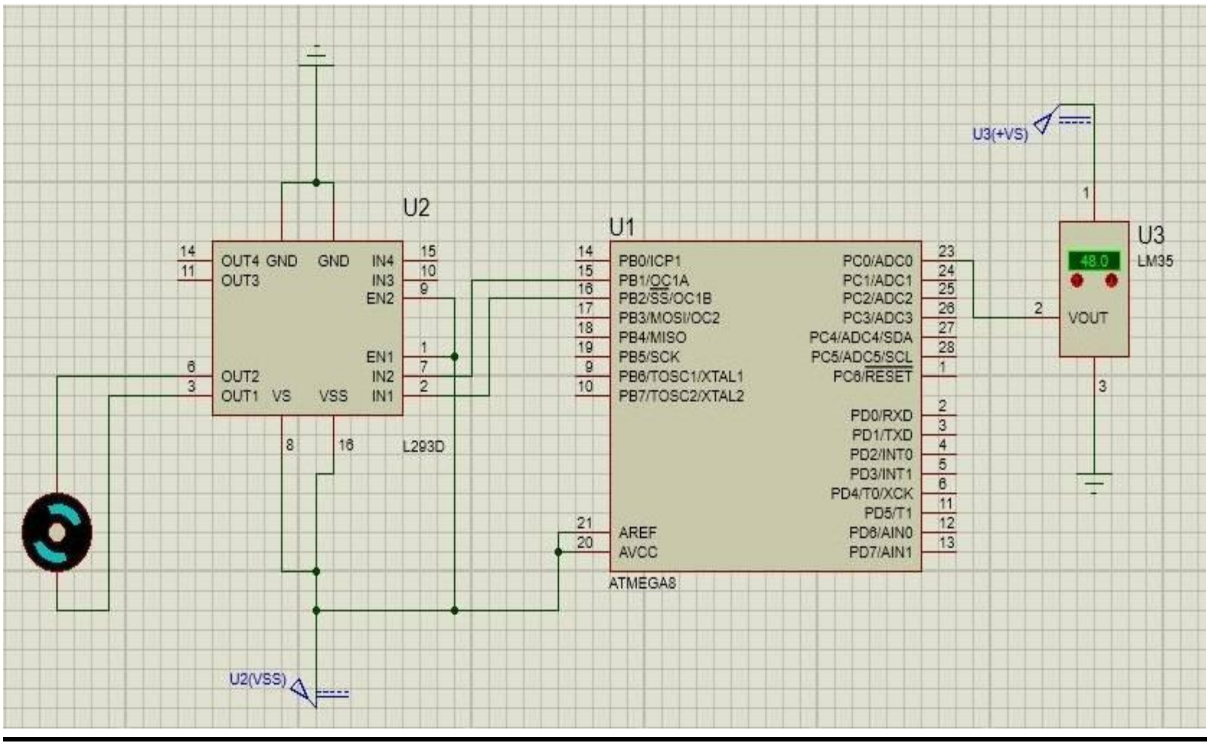

Fig 4.1

CIRCUIT DESIGN AND PRINCIPLE:

The circuit essentially comprises of ATmega8 microcontroller, temperature sensor, DC engine, driver IC. 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 is connected to the input of the ADC pin i.e. ADC0 pin of the microcontroller. Temperature sensor has three information pins, VCC, ground. Center one is yield and the other two pins are ground and VCC. Temperature sensor LM35 acts as a transducer.

VREF and AVCC for the ADC are applied externally to the microcontroller. Pin 20 and 21 are AREF and AVCC pins connected to the supply voltage of 5v. 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 has 10 bit determination. Port B of the microcontroller is connected to the motors through a motor driver IC i.e. L293D. Input pins of the motor driver are connected to the microcontroller. PB0 and PB1 are connected to the input 3 and input 4 of the motor driver IC. PB2 and PB3 pins are connected to the input1 and input2 of the motor driver IC. Output pins are connected to the motor. As the motor has two pins, these are connected to the output pins of the driver IC.

The analog signal received by the microcontroller 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 fan. It has two output signal and two enable pins. It is designed so that two DC motors will run at the same time.

WORKING

Working of the Circuit:

1. First power supply is given to the Arduino board.

2. Temperature sensor starts sensing the temperature from the environment.

3. The temperature sensor starts giving analog signal to the microcontroller.

4. ADC pins of the microcontroller starts converting analog signal into digital signal.

5. Using the internal successive approximation method the conversion of analog value to digital value is done by the microcontroller.

6. When the temperature is greater than the threshold or set value then the microcontroller gives output to the motor driver for starting the DC fan.

7. Now the motor starts running.

This is the explanation of the working of the temperature controlled dc fan implemented using atmega8 microcontroller.

CONCLUSION

The connections shown were made and the working of the project was successful.

The basic idea of this project was to run the DC motor fan when temperature sensed by the temperature sensor is greater than threshold value. In this project we have used Arduino board for the programming of microcontroller through the USB. The microcontroller uses the hex file to execute the program.

The temperature sensor output is connected to the microcontroller and it gives the output to the motor driver IC which runs the motor. In this way our main objective of the project is achieved.

The temperature controlled fan is one of the most unique and versatile piece of equipment as it has merits in various fields.

It is widely used as a sure proof method for detecting the surrounding temperature and taking the necessary action for the cooling down of the same.

Its error rate or chances of being inaccurate is also very low as it functions electronically.

The main aspect where this device thrives is in the electronic devices field. It can assure the secure functioning of an electronic device as it takes care of the overall wellbeing of the device.

It takes the necessary steps on its own in case of any danger to the system.

Thus there temperature controlled fans are used in pretty much all high end high performance electronic devices.

Therefore, we can say that the temperature controlled DC fan is truly an extremely efficient piece of design that can function and run in various scenarios for the smooth working and overall satisfaction of all involved.

APPLICATIONS

Temperature Controlled DC Fan can be used to control the rooms etc. by monitoring the temperature.

The circuit can be used in CPU to reduce the heating which may have occurred due to excessive use or high performance running.

This circuit can be used in car engines to reduce overheating which is a major issue prevailing in the automobile field.

Can be used in cooling pads of personal systems.

Can be used as a cooling component in several electrical devices which are supposed to run continuously without fail.

Can be extended to PWM based output, where the speed of the fan can be varied according to the duty cycle of the PWM signal.

Can be used a safety device in devices that are prone to overload.

With just minor modification, this device can be converted to an alerting system as well.

ADVANTAGES AND DISADVANTAGES:

ADVANTAGES:

- Extremely efficient.
- Very low error rate as the whole functioning is electronical.
- Highly safe even in terms of malfunctions.
- Functions without any need for human intervention.
- Cost to construct or implement this device is extremely low.
- Almost no maintenance required.
- Readily available parts in case of replacement.
- In an age of constant electrical needs, this device is of high importance as almost everyone uses some sort of electronic component.
- This device is of high demand as almost all day to day devices require a safety measure for heating.

DISADVANTAGES:

- Has most of its applications only in the electrical field.
- Has limitations in terms of capacity of functioning.
- Is not easily implementable on a large scale design.
- As it is the device that basically takes responsibility for the safety of certain appliances, it is also the most prone to damage for the betterment of the device.

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