JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Temperature based Fan Speed Controller

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Abstract : This report aims to give an overview of a standalone automatic fan speed controller that controls the speed of an electric fan according to our requirement. With the help of the embedded technology makes more efficient and reliable with this closed loop feedback control system. This project is the Temperature Based Fan Speed Control & Monitoring with the help of the Arduino UNO and LM35 Temperature Sensor. In this the microcontroller controls the speed of an electric fan according to the requirement & allows faster control and the LCD display makes the system user-friendly. The LCD panel displays the Sensed temperature in Celsius Scale and fan speed in percentage simultaneously.

IndexTerms **- Arduino, UNO, LM35 Temperature Sensor, Fan etc**

1. Introduction

This report aims to explain the one-way automatic fan speed controller that controls the speed of the electric fan in line with our needs. With the use of technology, the closed-loop feedback control system has become efficient and reliable. This project is aimed at temperature measurement based on fan speed control and monitoring with the help of Arduino UNO and LM35 temperature sensor. Here, the microcontroller controls the speed of the electric fan as necessary, allowing faster control and the LCD screen puts the customer at ease. The LCD panel displays both the temperature in degrees Celsius and the fan speed in percentage.

1.1 Proposed System:

In this project, microcontroller is the most important and plays an important role in the design of smart machines. Nowadays, it has become an integral part of modern technology. This article describes temperature-based fan speed control in an Arduino system. This system is responsible for controlling the air conditioner according to the room temperature. The system requires an Arduino board to use the project's controls. It has since been proposed to use IoT technology to control fan speed by changing the temperature.

2. Descriptions:

This temperature based fan control project can be done using an Arduino board and some electronics. Since the Arduino UNO board is very popular in all electronic circuits, we used the Arduino UNO board for the fan speed control to work. The program itself says that it is designed to measure the temperature of the room and send the data to the Arduino UNO board. Then the Arduino UNO board compares the temperature with the current temperature according to the Arduino built-in program we provide. The output of the process is given to the LCD screen connected to the board via the O/P port of the Arduino UNO board. This generates PWM pulses from the circuit board which are fed into the driver circuit to achieve the desired output of the fan. [1-4]

3. Components used:

The components used are

1. Arduino UNO
2. Temperature Sensor
3. Fan
4. LCD Display
5. Potentiometer
6. Transistor
7. Resistor
8. Relay
9. Connecting wires

3.1 Arduino UNO:

Arduino UNO is a development board with a microcontroller on the board itself. It is an open source software. Among electronics, arduino has basic hardware and software. Arduino boards can read input, so light on the sensor, finger on the button, starting the motor, turning on the LED, manually printing the content online, etc. They can understand and give some results such as. These are given to us as output. It has many applications in daily life and ardunio is one of them. The reason is that Arduino is built according to the instructions we provide. How do we send instructions to the Arduino board? These instructions can enter the Arduino board through this tool, one is the Arduino programming language (as Wiring), the other is the Arduino software (IDE) as Operation. Arduino has long been the brainchild of thousands of projects, from everyday devices to complex research tools. This open software platform can be used by many types of people worldwide, such as students, hobbyists, artists, professionals, and professionals, hence it is beneficial for users. Developed by the Ivrea Interaction Design Institute, Arduino UNO is a simple tool for rapid design, aimed at students without an electronics and programming background. It soon engaged with the wider community, and the Arduino UNO board began to meet new needs and problems in the transition to the product. All Arduino boards are complete and open to all platforms; allowing users to freely create them and modify them precisely to suit their specific needs. The software is suitable for all types of users, including beginners and novices, and is flexible enough for advanced users. The software is suitable for all systems including Mac, Windows and Linux. In education, teachers and students can access the software independently. Other microcontrollers have similar functions. These all take into account the principles of microcontroller programming and package them into convenient-to-use functions. It facilitates the operation of Arduino UNO microcontroller: [5-7]

Cheap - The price of Arduino UNO board is lower than other microcontrollers in the market. Cross-platform - Arduino UNO software (IDE) is easily accessible for various platforms such as Windows, Macintosh OSX and Linux operating systems. Most microcontroller systems are limited to Windows. Lecturers are also required to teach students the following subjects. This provides access to C++ libraries in the IDE software itself.

Figure 1: Arduino UNO

Technical data:1. Microcontroller - ATmega3282. Operating voltage - 5 V input voltage3. Input voltage - 6 - 20 V4. Digital I/O pins - 14 analog input pins: 6 \ no 5. DC 3.3V pin - 50 mA6. Flash memory - 32 KB SRAM : 2 KB7. EEPROM - 1 KB8. Clock frequency - 16 MHzGeneral pin functions:1. LED : LED is built in digital pin 13. So differences in values cause the LED to turn on/off. It is simple that the pin value is high when the LED is ON and the value is low when the LED is OFF.2. VIN: This input voltage pin is used to use an external power source instead of connecting to the USB port. So the additional feed is to access the board with this pin.3. 5V: This pin acts as a 5V output that passes through the board's regulator. We can power the board with direct current (7V-20V), also with the USB port (5V). If the supply voltage is 5V or 3.3V, the card is defective. 4. 3V3: 3.3 volt supply produced by the built-in regulator. The maximum current consumption is 50 mA.5. GND: This is the ground pin used for grounding. 6. IOREF: based on microcontroller operation, voltage reference given by the board itself.7. Reset: This reset pin is usually used to reset the program stored on the card.8. Special pin functions: all 14 digital and 6 analog pins of the Arduino UNO board can be used as input/output. Each pin operates at 5V. Depending on the operating situation, each pin can supply or accept 20mA and has an internal pull-up resistance (disconnected by default) of 20-50k ohms. Do not exceed 40mA on any I/O pin to avoid permanent damage to the microcontroller. The Arduino Uno has 6 analog inputs, called A0-A5, which provide 10-bit resolution (ie 1024 different values). Initially they measure from ground to 5V, although it is possible to change the upper end of their range using the AREF pin and the analogReference() function.9. Serial: This pin works especially for receiving and sending. Pins 0 (RX) and 1 (TX). It is used to receive (RX) and transmit (TX) TTL serial data. The serious ATmega8U2 USB-TTL pins are connected to these pins.10. External interrupts: Pins 2 and 3 are external interrupts. These pins can be configured to trigger low and high value interrupts.11. PWM (Pulse Width Modulation): Pins 3, 5, 6, 9, 10 and 11 can provide 8-bit PWM output with analog write function.12. SPI (Serial Peripheral Interface): Pins 10 (SS), 11 (MOSI), 12 (MISO),13. (SCK) support SPI communication using the SPI library.14. TWI (Two-Wire Interface): The A4 or SDA pin and the A5 or SCL pin support TWI communication using a wire library.15. AREF (Analog Reference): This is the reference voltage for analog inputs.3.2 Temperature sensor: The thermometer measures the room temperature. These electronic devices convert information from the environment into electronic data for storage. There is a wide selection of temperature sensors. The LM35 thermometer has a temperature range of -55°C to 150°C and a differential measurement of +10mv/°C to 150°C.

Figure.2: LM35 Temperature Sensor

Features:

Measurement directly in degrees Celsius (degrees Celsius)• Linear +10.0 mV per degree Celsius• 0.5 degree Celsius accuracy (+25 degrees Celsius)• Nominal range -55 to +150 degrees Celsius• Suitable for remote applications• Inexpensive due to multiple level clipping• Operates from 4 to 30 volts• Current consumption less than 60 microamps• Low self-heating of 0.08 degrees Celsius and only +/- 1 / 4 degree non-linearity.

3.3 Fan:

it is an electrical device used to move air around it. We all know that fans have blades that make air. The impeller, rotor or impeller is the rotating part of the blade.

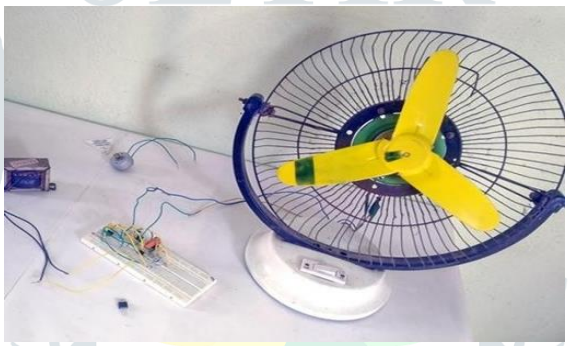

Figure.3: Fan

3.4 LCD Display:

Liquid crystal displays (LCDs) have made significant progress in the last few decades. They are everywhere in our daily lives. Some examples include cell phones, e-books, GPS devices, computer monitors, car monitors, projectors, and televisions. They play an important role in the information age and are an important part of our daily lives. LCD does not emit light. Their job is to change the state of light produced by the lamp to display the image. Light is produced either by direct light placed directly on the LCD panel or by edge light placed at the edge of the waveguide. . The backlight is suitable for large size LCDs as it can provide high brightness but is larger. The edge light is suitable for small handheld LCD monitor as it is compact but has low light output. Common lighting sources for LCD lighting include cold cathode fluorescent lamps (CCFL), light-emitting diodes (LED), external electrode fluorescent lamps (EEFL), and flat fluorescent lamps (FFL). CCFL consists of a glass tube with a cathode and an anode at each end. The tube is filled with mercury gas. The inside of the tube is coated with fluorescent material (phosphorus). When an electric current is applied between two electrodes, some (primary) electrons are released at the cathode by thermal action and quickly at the anode. There are also dichroic reflective polarizers that have the advantage of reflecting light. They transmit incoming light by polarizing it in one direction and reflect incoming light by polarizing it in a perpendicular direction. Light can be refracted by changing its polarization towards the direction of the polarizer. Spin polarization can be achieved by half- wave plates or scattering media.

Figure.4: LCD

Pin Description:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V - 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

Figure.5: Pin description

Figure.6: Potentiometer

3.5 Potentiometer:

A potentiometer is an electronic device used to measure battery voltage, which is the internal power of the battery. It is also used to compare the EMF of different batteries. It can also be used as a variable resistor in many cases. It is also used to compare the EMF of different batteries. It can also be used as a variable resistor in many applications.

3.6 Transistor:

A transistor is a semiconductor device used to amplify or convert electricity and current. It is made of semiconductor material and usually has at least three terminals for connecting to external circuits.

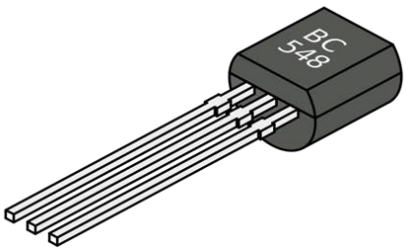

Figure.7: Transistor

3.7 Resistor:

Physical devices block the flow of electrical current to some extent. Some materials, such as copper, have very low electrical resistance and are therefore called conductors. Other materials, such as ceramics, have high resistance to electric current and are called insulators. In electrical and electronic equipment, the equipment must have a certain resistance between the conductor and the insulator. These materials are called resistors and their values are expressed in ohms.

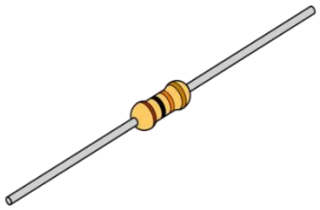

Figure.8: Resistor

3.8 Relay:

It is a switch that controls (opens and closes) circuits electromechanically. The main function of this device is to make or break contact using a signal without human intervention to turn the device on or off. It is mainly used to drive a high-power circuit with a low-power signal.

Figure.9: Relay

3.9. Connecting wires:

Connecting wires provides a means of moving electrical current from one point in a circuit to another. In the case of computers, wires are built into circuit boards to transmit electrical impulses.

Figure.10: Connecting Wires

4. Working:

The working of this project is the temperature sensor LM35 senses the temperature and converts it into an electrical (analog) signal, which is applied to the ATmega328 microcontroller of the Arduino UNO Board. In this the Arduino UNO board converts the recorded signal from analog to digital signal. So that the recorded values of the temperature and speed of the fan are displayed on the LCD. When the temperature crosses 30°C the fan starts rotating.
A low-frequency pulse-width modulation (PWM) signal, whose duty cycle is varied to adjust the fan's speed is used. An inexpensive, single, small pass transistor-like 2N222 or BD139 can be used here. It is efficient because the pass transistor is used as a switch.

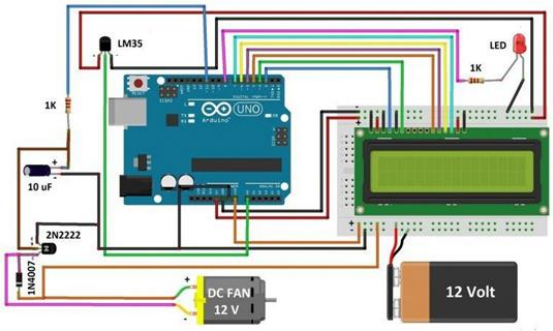

Figure.11: Circuit Diagram

Lm35 temperature sensor voltage to temperature conversion, now one of the most difficult thing is how to convert the voltage generated/output by the lm35 sensor at output in Celsius or Fahrenheit scales. Well this needs you to first go through the data sheet of temperature sensor and know about the characteristics of the sensor.

5. Program:

```
#include <LiquidCrystal.h> LiquidCrystal lcd(2,3,4,5,6,7);
int Pin = A1; // the output pin of LM35 int fn = 10; // the pin where fan is
int ld = 7; // led pin int tmp;
int tempMin = 24; // the temperature to start the fan 0%
int tempMax = 57; // the maximum temperature when fan is at 100%
int fnSpeed; int fnLCD; void setup() {
pinMode(fn, OUTPUT); pinMode(ld, OUTPUT); pinMode(Pin, INPUT); lcd.begin(16,2); Serial.begin(9600);
}

void loop()
{
tmp = readTemp(); // get the temperature Serial.print( tmp );
if(tmp < tempMin) // if temp is lower than minimum temp
{
fnSpeed = 0; // fan is not spinning analogWrite(fn, fnSpeed); fnLCD=0;
digitalWrite(fn, LOW);
}
if((tmp >= tempMin) && (tmp <= tempMax)) // if temperature is higher than minimum temp
{
fnSpeed = tmp;//map(temp, tempMin, tempMax, 0, 100); // the actual speed of fan//map(temp, tempMin, tempMax, 32, 255);
fnSpeed=2*fnSpeed;
fnLCD = map(tmp, tempMin, tempMax, 0, 100); // speed of fan to display on LCD100 analogWrite(fn, fnSpeed); // spin the fan at
the

fanSpeed speed
}

if(tmp > tmpMax) // if temp is higher than tempMax
{
digitalWrite(ld, HIGH); // turn on led
}
else // else turn of led
{
digitalWrite(ld, LOW);
}
lcd.print("TEMP: ");
lcd.print(tmp); // display the temperature lcd.print("C ");
lcd.setCursor(0,1); // move cursor to next line lcd.print("FANS: ");
lcd.print(fnLCD); // display the fan speed lcd.print("%");
delay(200); lcd.clear();
}
int readTemp() { // get the temperature and convert it to celsius
tmp = analogRead(Pin); return tmp * 0.48828125;
}
```

6. Application:

Usually we use a controller to change the fan speed. Here, the temperature of the room changes, the speed changes, so the fan rotates according to the temperature.The ventilators created by this project are widely used in Middle Eastern countries. This product is suitable for hot places.

7. Conclusions and Future Scope:

This project can be used both at home and in industry. It helps to save energy and electricity.• Monitor environments that are not convenient or impossible for humans to monitor, especially over long periods of time.• Avoids wasting energy when it's not hot enough to need a fan.• Helps disabled people automatically adjust the fan speed.• In the future, we will be able to monitor more parameters such as humidity, lighting and simultaneously monitor them and send this information to a remote location via a mobile phone or the internet.• This technique allows us to visualize the variable graphics of these parameters on the computer. And the temperature exceeds the limit; the automatic dialing system calls this number.

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