# ARDUINO AND IOT BASED TEMPERATURE BASED SPEED CONTROL OF FAN

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**ABSTRACT**
The autonomous automated fan speed controller in this project regulates an electric fan's speed in accordance with our specifications. This closed loop feedback control system is dependable and efficient since it uses embedded technology. A microcontroller such as the ATMega8/168/328 enables quicker and more dynamic control. The system's LCD (liquid crystal display) makes it easy to operate. On the LCD screen, the measured temperature and fan speed level information are shown concurrently. Air conditioners, water heaters, snow melters, ovens, heat exchangers, mixers, furnaces, incubators, thermal baths, and veterinary operating tables are just a few of the many uses for this very small, multipurpose device. The circuit's core is the Arduino micro controller, which manages every operation. The microcontroller receives an electrical (analogue) signal from the temperature sensor DHT11, which measures the temperature. The 16x2-line LCD shows the temperature values that have been measured and set. To regulate the fan speed, the micro controller powers a transistor. A controlled 12V, 2A power source is used in this project. The initiative will help process businesses maintain and regulate the temperature of their boilers. Here, we have both automatic control via a sensor and human control using a mobile app that uses WiFi. Operating mode will be focused on the setup switch.

## I. INTRODUCTION

Every day, new intelligent systems are launched as a result of technological advancements. Everything is becoming more complex and understandable.The need for cutting edge technologies and intelligent electronic systems is rising. Since they provide the system with a brain, microcontrollers are crucial to the development of smart systems. The core of the new technologies that are being unveiled every day is now a microcontroller. A microcontroller is primarily a single-chip microprocessor designed for process and machine automation and control. Microcontrollers are utilised nowadays in a wide range of fields to perform automated operations more precisely. Microcontrollers are used in almost all contemporary devices, such as air conditioners, power tools, toys, and office equipment. A microcontroller is a single chip that has a Central Processing Unit (CPU), memory, input/output ports, timers, counters, interrupts, and analogue to digital converters (ADC). The control board's size and power consumption are decreased by the microcontroller's single chip integrated circuit architecture. The design and simulation of a fan speed control system using the PWM technology and room temperature are shown in this project. The room's temperature has been measured using a temperature sensor, and the PWM approach is utilised to adjust the fan's speed in response to the measured temperature. The fan speed is controlled by varying the duty cycle between 0 and 100, taking into account the ambient temperature as shown on the liquid crystal display.

Everyone is going towards new technology these days, preferring automated controlled equipment over manual activities. A cooling fan is one of the necessities for people in the heat. However, the fan's speed may be manually adjusted via a manual switch, such as a dimmer or fan regulator. You may adjust the fan speed by adjusting the dimmer. It is evident that the temperature typically increases during the day and decreases at night. The users are unaware of the temperature differences. Therefore, this is a way to adjust the fan speed based on temperature. This idea is especially useful in places where there are significant daytime and nighttime temperature variations. The manual fan will become an automated fan with this procedure. The automated fan will adjust its speed based on the room's temperature.

Automated systems with less manual labour are precise, dependable, and versatile. Owing to these requirements, automated control systems are preferred in many fields, but they are particularly useful in the electronics industry. One of the key components in the world of electronics is the microcontroller.

## II.LITERATURE REVIEW

The circuit uses the sensor's characteristic to turn on the DC fan. One kind of transducer is a sensor. Broadly speaking, any apparatus that transforms energy into a different form is sometimes referred to as a transducer. Aside from that, the thermistor is the part that made up the temperature sensor. A kind of temperature-dependent resistor, a thermocouple's resistance changes in response to ambient temperature. Positive temperature coefficient (PTC) and negative temperature coefficient (NTC) thermoistors are the two kinds of thermoistors.

PTC thermoswitches rise in resistance in response to temperature increases, while NTC thermoswitches decrease in response to temperature increases. Thermistors are resistors that resemble beads and range in value from 100 ohms to 10K or more. An NTC thermostat set to 1K (25°C) is used in this circuit. A tiny DC fan adjusts its speed in response to temperature changes. The fan automatically shuts off when the temperature drops below a certain threshold.

## PROPOSED SYSTEM

A microcontroller is an essential component in the construction of smart systems in the suggested systems.Microcontrollers are now a crucial component of the modern technologies that are introduced on a regular basis. This article describes an Arduino-based temperature-based fan speed control and monitoring system.This technology uses the ambient temperature to automatically regulate the cooling system.An Arduino board is used by the system to construct a control system. Given that the cooling system is intended to be controlled by this system, it is crucial to understand Arduino-controlled systems.

## III.DESIGN OF HARDWARE

This chapter provides a quick explanation of the hardware. It goes into great depth about each module's circuit diagram.

## ARDUINO UNO

A microcontroller board based on the ATmega328 is called the Arduino Uno (datasheet). It has a 16 MHz ceramic resonator, 6 analogue inputs, 14 digital input/output pins (six of which may be used as PWM outputs), a USB port, a power connector, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; all you need to do is power it with a battery or an AC-to-DC converter or connect it to a computer via a USB connection to get going.The FTDI USB-to-serial driver chip is not used by the Uno, setting it apart from all previous boards. As an alternative, it has the Atmega16U2 (or Atmega8U2 up to version R2) configured as a serial-to-USB converter. The 8U2 HWB line on the Uno board is pulled to ground by a resistor, which facilitates DFU mode entry. The Arduino board now includes the following updates:

- 1.0 pin out: two further new pins, the IOREF, are positioned next to the RESET pin, the SDA and SCL pins that were introduced, and they enable the shields to adjust to the voltage supplied by the board. Shields will eventually work with both the Arduino Due, which runs on 3.3V, and the boards that utilise the AVR, which runs on 5V. The second pin is unconnected and set aside for future uses.
- A more robust RESET circuit.
- The 8U2 is replaced with an ATMega 16U2.

"Uno" is an Italian word for one, and it was chosen to commemorate the impending introduction of Arduino 1.0. Going future, the Arduino reference versions will be the Uno and version 1.0. The Uno is the most recent in a line of USB Arduino boards and the platform's standard model; see the index of Arduino boards for a comparison with earlier iterations.

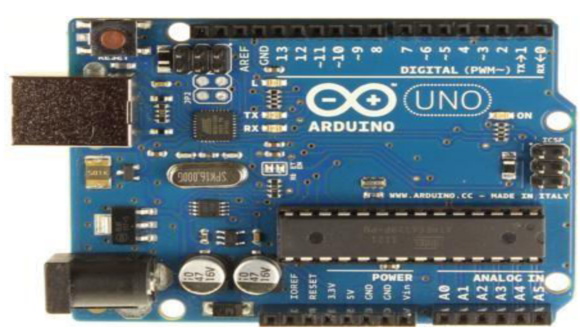



Fig: ARDUINO UNO

**POWER SUPPLY:**

The purpose of the power supplies is to convert the high voltage AC mains energy into a low voltage supply that is appropriate for use in electronic circuits and other devices. One may disassemble a power supply into a number of blocks, each of which carries out a specific task. "Regulated D.C. Power Supply" refers to a d.c. power supply that keeps the output voltage constant regardless of differences in the a.c. main or the load.

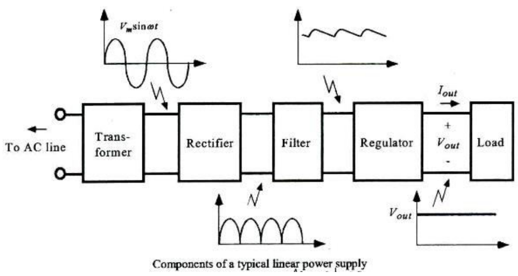



Fig: Block Diagram of Power Supply

**LCD DISPLAY**

The model shown here is the one that is most often utilised in practice due to its cheap cost and enormous potential. Its HD44780 microcontroller (Hitachi) platform allows it to display messages in two lines of sixteen characters each. All of the alphabets, Greek letters, punctuation, mathematical symbols, etc., are shown. Furthermore, it is possible to show custom symbols created by the user. Some important features are the automatic changing of the message on the display (shift left and right), the presence of the pointer, the lighting, etc.

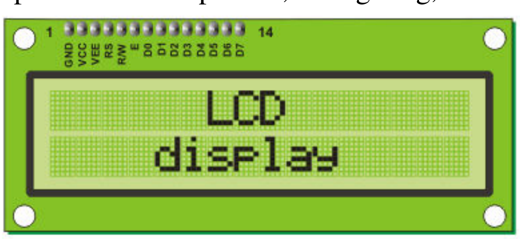
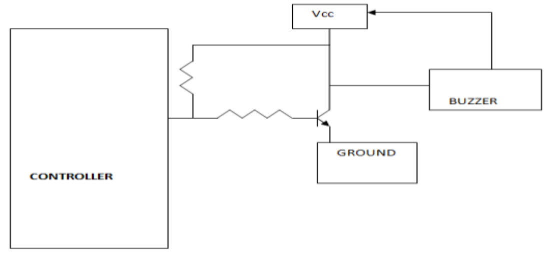



Fig: LCD

**BUZZER**

Relays, buzzer circuits, and other circuits cannot be driven by the current available on digital systems and microcontroller pins. The microcontroller pin can provide a maximum of 1-2 milliamps of current, even though these circuits need around 10 milliamps to work. Because of this, a driver—such as a power transistor—is positioned between the buzzer circuit and microcontroller.



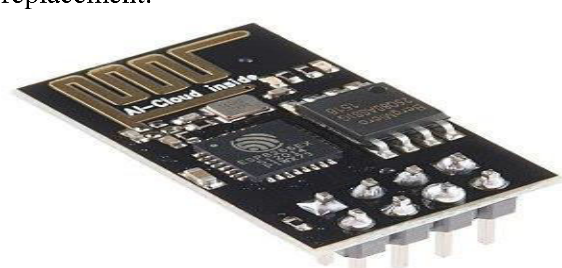

**WIFI MODULE:**

A low-cost Wi-Fi microprocessor with complete TCP/IP stack and microcontroller functionality, the ESP8266 is made by Chinese firm Espressif Systems, located in Shanghai.[1]

In August 2014, a third-party producer named Ai-Thinker's ESP-01 module brought the chip to the attention of western manufacturers for the first time. With the help of this little module, microcontrollers may establish basic TCP/IP connections and connect to Wi-Fi networks by utilising Hayes-style instructions. But at the time, there wasn't much documentation available in English on the chip or the commands it could execute.[2] Many hackers were drawn to investigate the module, chip, and software on it as well as translate the Chinese documentation because of its very cheap cost and the fact that it had very few external components, suggesting that it may someday be very affordable in production.[3]

With its 1 MiB of integrated memory, the ESP8285 is an ESP8266 that enables single-chip Wi-Fi capable devices.[4]

The ESP32 is these microcontroller chips' replacement.



**TEMPERATURE SENSOR (LM35):**

This temperature measurement must first be read and sent to the microcontroller in order for it to be continually monitored and compared to the preprogrammed fixed temperature. It is necessary to perceive this temperature. As a result, a sensor must be employed, and the LM35 sensor is the one used in this project. Temperature values are transformed into electrical impulses by it.

The output voltage of the precision integrated-circuit temperature sensors of the LM35 series is directly proportional to the temperature in Celsius. Since the LM35 is internally calibrated, no external calibration is necessary. The LM35 can achieve typical accuracy levels of ±1⁄4°C at ambient temperature and ±3⁄4°C across the whole temperature range of −55 to +150°C without the need for external calibration or trimming.

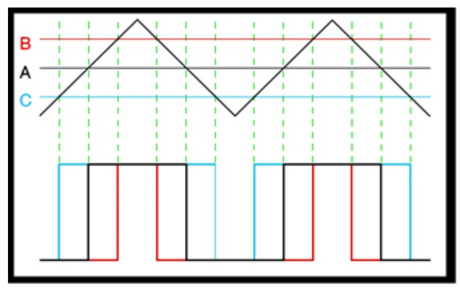
The LM35's ability to interface with readout or control circuitry is facilitated by its low output impedance, linear output, and perfect intrinsic calibration. It may be used with plus and minus supplies or a single power supply. It has extremely low self-heating, less than 0.1°C in still air, since it consumes just 60 µA from its supply.

**Pulse width Modulation**

The best way to switch the power devices of the solar system controller and ensure consistent voltage battery charging is to use pulse width modulation, or PWM. When the solar array is under PWM control, the current tapers based on the state of the battery and how much it needs to be recharged. Examine a waveform like this one, which shows a voltage transition between 0 and 12 volts. It should be very evident that a "suitable device" attached to its output would observe the average voltage and believe it is being fed 6v, or precisely half of 12v, as the voltage is at 12v for exactly the same amount of time as it is at 0v. Consequently, we may change the 'average' voltage by changing the positive pulse's width.

**Pulse Width modulator**

So, how can a PWM waveform be created? Actually, it's pretty simple; the TEC website has circuits accessible. To begin, create a triangular waveform, as the picture below illustrates. This is contrasted with a d.c. voltage that you may modify to get the desired on/off time ratio. The output rises as the triangle crosses the "demand" voltage. When the demand voltage is lower than the triangle, the




**DC FAN:**

A fan is a motorised device that induces flow in a fluid, usually a gas like air. A fan is made up of a revolving set of blades or vanes that manipulate airflow. The terms impeller, rotor, and runner refer to the revolving combination of blades and hub. It is often housed in a case or other kind of housing.[1] This might improve safety by keeping things from coming into touch with the fan blades or it could guide the airflow. Although electric motors power the majority of fans, they may also be driven by hydraulic motors, hand cranks, internal combustion engines, and solar energy.

Mechanically speaking, a fan may be any rotating vane or vanes that generate air currents. Unlike compressors, which create high pressures at relatively low volumes, fans provide large volume, low pressure air flows that are nonetheless greater than ambient pressure. Anemometers and wind turbines are examples of devices that use the fact that a fan blade will often spin when exposed to an air fluid stream. These devices are designed similarly to fans.

Climate control and personal thermal comfort (think electric tables or floor fans), vehicle engine cooling systems (think radiators), machinery cooling systems (think computers and audio power amplifiers), ventilation, fume extraction, winnowing (think cereal grain chaff), dust removal (think hoover suction), drying (usually in conjunction with a heat source) and fire bristling are examples of typical applications.

## IV. PROJECT DESCRIPTION

The operation and circuitry of the "IOT BASED Speed control of Fan" are covered in this chapter. Its block diagram and circuit diagram make it easily understandable.

**BLOCK DIAGRAM:**

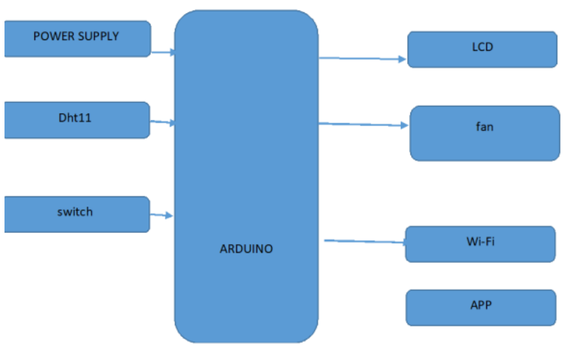



Fig block diagram

**SOFTWARE REQUIREMENTS:**

- Arduino
- Embedded c language

**HARDWARE REQUIREMENTS:**

LM 35
ARDUINO
DC FAN

**WORKING**

The current temperature and fan speed are shown on an LCD shield that I used, however you may use the circuit without the LCD display. Additionally, you must choose the transistor based on the kind of fan you use. In my instance, I powered the fan and transistor using a 9V battery and the well-known BD139 transistor. 5V from the Arduino board powers the red led and LM35 temperature sensor. The LiquidCrystal library (header), which has helpful functions to utilise when an LCD is attached to the Arduino board, is included in the program, as you can see on the first line. I then adjusted the pins on the fan, led, and sensor. Setting the variables temp Min and temp Max to the values you want is crucial. The temperature at which the fan turns on is called the "Temp Min," and the temperature at which the red LED lights alert you to the maximum temperature being achieved is called the "Temp Max." The fan will begin spinning at 30°C and reach its maximum speed at 35°C, for instance, if you set tempMin at 30 and tempMax at 35. The temperature is saved in the temp variable, and if it drops below tempMin, we utilise a few if() procedures to determine whether to turn the fan off (LOW). The following if() checks to see whether the temperature is greater than the minTemp and lower than the tempMax. If it is, it remaps the temperature value from one value to another using the map() method. FanSpeed in our scenario will be 32 at tempMin and 255 at tempMax. These numbers correspond to the temperature-based fan speed controller 28, which uses analogue Write() and PWM to regulate the fan's speed. You might claim that the fan's speed is directly correlated with the temperature of the LM35 since the fan LCD remaps the temperature to enable fanSpeed to be shown in a 0 to 100% range. Even though the temperature may rise over tempMax, the fan will be operating at its maximum spinning speed and the LCD will read FANS: 100% when the temperature hits the figure specified in tempMax. You may read the remainder of the explanation in the Arduino sketch's comments section. My next project will include building a temperature protection circuit that, once reaching a certain temperature, will cut off the power to any device.

We are creating a temperature-based, speed-controlled fan in this project. The LM35 sensor senses the ambient temperature. It transmits the detected signal, which is converted into an electrical signal that is transmitted to the microprocessor ATMEGA 328P, as voltage pulses. The motor driver is powered by the Arduino micro controller, which regulates the fan. It is feasible to control the fan using a laptop or mobile device by utilising the UBIDOTS free cloud storage service to link the ESP8266 Wi-Fi module with the Arduino. Initially, the ESP8266 Wi-Fi module is linked to the designated network when the power is delivered to the Arduino, and the fan may be switched using a mobile device. The fan turns on when a phone is used to switch it on. An LM35 sensor measures the temperature outside and uses that information to manage the fan's speed in accordance with the Arduino application.

**Application:**

1. A temperature-based fan speed controller helps "more efficiently" cool the CPU in laptops and desktop PCs. Typically, a laptop fan has just two or three speed settings. Thus, there is an increase in power usage. 2. The project's fan is developed with variable speed settings in response to temperature changes. Small-scale enterprises may also utilise this to cool their mechanical and electrical equipment. One PCB may be utilised to create the whole circuit, with the exception of the motor and fan, and it can be used for temperature-based control functions.

**Advantages:**

1. This project is suitable for use at home.
2. The industry may make advantage of this initiative.
3. This will contribute to power and energy conservation.
4. To keep an eye on places that are uncomfortable or impossible for people to keep an eye on, particularly for long periods of time.
5. Avoids wasting energy when the temperature isn't high enough to need a fan.
6. To help those with disabilities to automatically change the fan speed.

**Disadvantages:**

1. Only a technical expert can maintain it. It gets harder to maintain as a result.
2. Owing to temperature fluctuations, its effectiveness may sometimes decline.

**Future Scope:**

1. We have the ability to simultaneously monitor and manage many factors, such as light and humidity.
2. We may use the internet or a mobile device to convey this info to a distant place.
3. Using a computer, we can create graphs showing how these parameters change.
4. An automated dialler system will contact the specified number when the temperature above the threshold.

## V.CONCLUSION

This fan's design minimises the need for manual fan operation by automatically adjusting the speed. Thanks to Internet of Things technology, this fan may be switched from various locations using a cell phone.The project's objective is to improve coal miners' safety features. Most significant harmful incidents may be tracked by this method. This initiative makes it simple to keep an eye on the potentially hazardous situation and carry out rescue operations for the miners' safety. For this project, we deployed a fan to regulate the coal miners' body temperature. It is simple to install all of the sensors needed for continuous monitoring on coal mines.

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