INTRODUCTION

With the advancement in technology, intelligent systems are introduced every day. Everything is getting more sophisticated and intelligible. There is an increase in the demand of cutting edge technology and smart electronic systems. Microcontrollers play a very important role in the development of the smart systems as brain is given to the system. Microcontrollers have become the heart of the new technologies that are being introduced daily. A microcontroller is mainly a single chip microprocessor suited for control and automation of machines and processes. Today, microcontrollers are used in many disciplines of life for carrying out automated tasks in a more accurate manner. Almost every modern day device including air conditioners, power tools, toys, office machines employ microcontrollers for their operation. Microcontroller essentially consists of Central Processing Unit (CPU), timers and counters, interrupts, memory, input/output ports, analog to digital converters (ADC) on a single chip. With this single chip integrated circuit design of the microcontroller the size of control board is reduced and power consumption is low. This project presents the design and simulation of the fan speed control system using PWM technique based on the room temperature. A temperature sensor has been used to measure the temperature of the room and the speed of the fan is varied according to the room temperature using PWM technique. The duty cycle is varied from 0 to 100 to control the fan speed depending upon the room temperature.

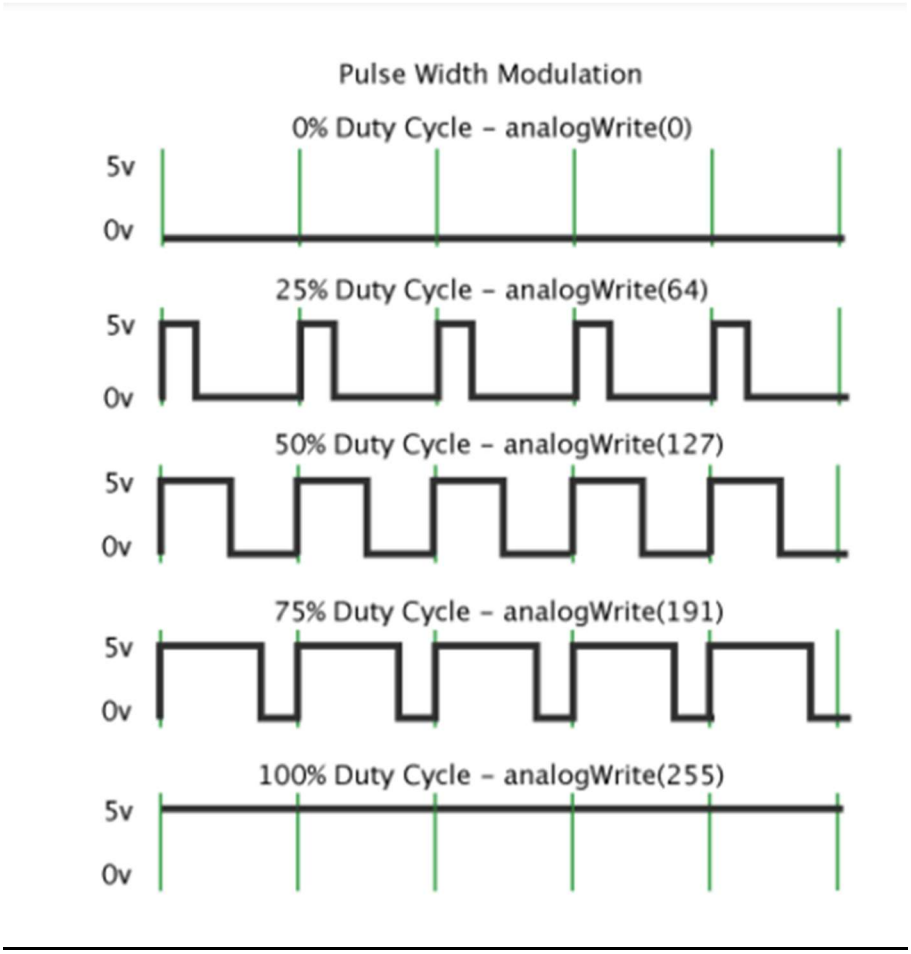
This project discusses temperature based fan speed control and monitoring system using an Arduino system. This system is used to control the cooling system automatically based on the room temperature. The system uses an Arduino board to implement a control system. This project is a standalone automatic fan speed controller that controls the speed of an electric fan according to our requirement. It is very compact using few components and can be implemented for several applications including air-conditioners, waterheaters, snow-melters, ovens, heat-exchangers, mixers, furnaces, incubators, thermal baths and veterinary operating tables. ARDUINO micro controller is the heart of the circuit as it controls all the functions. The temperature sensor senses the temperature and converts it into an electrical signal, which is applied to the microcontroller. The micro controller drives Transistor to control the fan speed. This project uses regulated 12V, 2A power supply. This project is useful in process industries for maintenance and controlling of Boilers temperature.

The temperature-based fan speed control system can be done by using an electronic circuit using an Arduino board. Now Arduino board is very progressive among all electronic circuits, thus we employed Arduino board for fan speed control. The proposed system is designed to detect the temperature of the room and send that information to the Arduino board. Then the Arduino board executes the contrast of current temperature and set temperature based on the inbuilt program of the Arduino. The generated pulses from the board which is further fed to the driver circuit to get the preferred output to the fan.

LITERATURE SURVEY

Pulse Width Modulation (PWM):

Pulse Width Modulation, or PWM, is a technique for getting analog results with digital means. Digital control is used to create a square wave, a signal switched between on and off. This on-off pattern can simulate voltages in between full on (5 Volts) and off (0 Volts) by changing the portion of the time the signal spends on versus the time that the signal spends off. The duration of "on time" is called the pulse width. To get varying analog values, we change, or modulate, that pulse width. If we repeat this on-off pattern fast enough with an LED for example, the result is as if the signal is a steady voltage between 0 and 5v controlling the brightness of the LED.In the graphic below, the green lines represent a regular time period. This duration or period is the inverse of the PWM frequency.



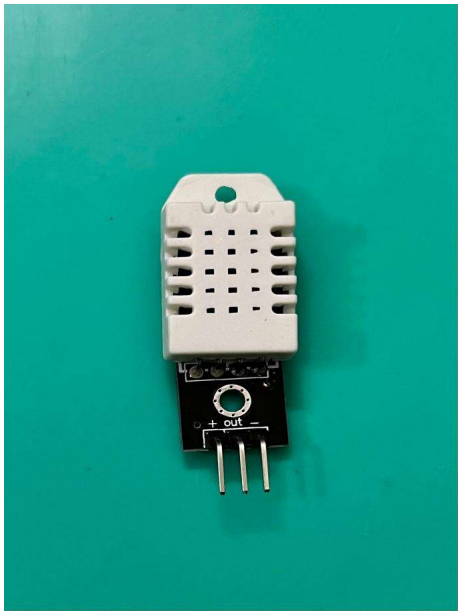
Temperature Sensor:

The DHT22 is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).

Connections are simple, the first pin on the left to 3-5V power, the second pin to your data input pin and the right most pin to ground.

Technical details:

- Operating Voltage: 3.5V to 5.5V
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data
- Temperature Range: -40°C to 80°C
- Humidity Range: 0% to 100%
- Resolution: Temperature and Humidity both are 16-bit
- Accuracy: ±0.5°C and ±1%



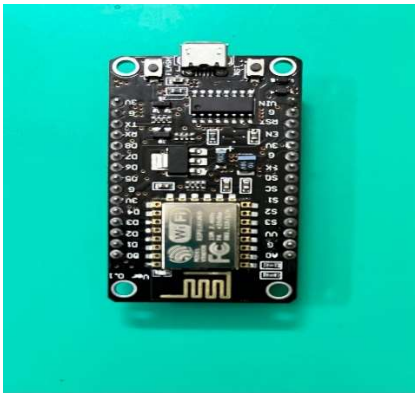
Arduino NodeMCU:

NodeMCU is predicated on the Esperessif ESP8266-12E Wi-Fi System-On-Chip. It is based on Lua-based firmware and is open-source. It's perfect for IoT projects, especially other Wireless connectivity projects as Arduino does not work wirelessly. We either need to connect it to a Bluetooth or nRF module. This chip has a great deal in common with the Arduino – they're both microcontroller-equipped prototyping boards that can be programmed using the Arduino IDE. The ESP8266 is more updated and younger than Arduino, and therefore the ESP has stronger specifications than Arduino.

Specifications & Construction

- Operating Voltage: 2.5 to 3.3V
- Operating current: 800 mA
- 3V 600mA on-board voltage regulation
- ESP8266 comes up with 2 switches one is reset and another one is flash button, Reset button is used to reset NodeMCU and flash button is used to download and is used while upgrading the firmware. The board has build in LED indicator which is connected to D0 pin.

- The NodeMCU board also contains a CP2102 USB to UART module to convert the data from USB to serial so that it can be controlled and programmed via computer.
- The esp8266 has 4 power pins: One VIN pin for input power supply and three 3.3V pins for output power supply. Even if 5V regulated supply is given through VIN, the voltage regulator will decrease it to 3.3v during output.
- The esp8266 has 3 GND pins which indicate ground supply. Generally, the negative terminals are connected to these pins.
- Esp8266 board also has I2C pins which can be used both as I2C master and I2C Slave. These pins are used to connect various I2C sensors and peripherals in your project. I2C interface functionality can be controlled via programming, and the clock frequency is 100 kHz at a maximum.
- Esp8266 NodeMCU has 17 GPIO pins which can be assigned to various functions such as UART, PWM, I2C,IR and Button via programming. When configured as an input pin, the GPIO pins can also be set to edge-trigger or level-trigger to generate CPU interrupts.
- ESP8266 NodeMCU has 2 UART interfaces, i.e. UART0 and UART1, which offer asynchronous communication, and may communicate at up to 4.5 Mbps. TXD0, RXD0, RST0 & CTS0 pins can be used for communication. It supports fluid control. However, TXD1 pin features only data transmit signal so, it's usually used for printing log.
- ESP8266 has two SPI in slave and master modes. These SPIs also support the following general features: 4 timing modes of the SPI format transfer. Up to 64-byte FIFO buffer.
- Esp8266 has a secure digital I/O interface which is used directly control the SD cards.
- Esp8266 has 4 channels of Pulse width modulation (PWM). The output can be controlled via programming and is frequently used for driving motors and LEDs. The frequency ranges from 100Hz to 1KHz.
- There are three control pins on the esp8266: The enable pin (EN), the reset pin (RST) and the wake pin.
- The esp8266 chip works when the enable pin is high. When the enable pin is low, the chip works on minimum power.
- The reset pin is used to reset the esp8266 chip.
- The wake pin is used to wake up the chip from deep sleep mode.

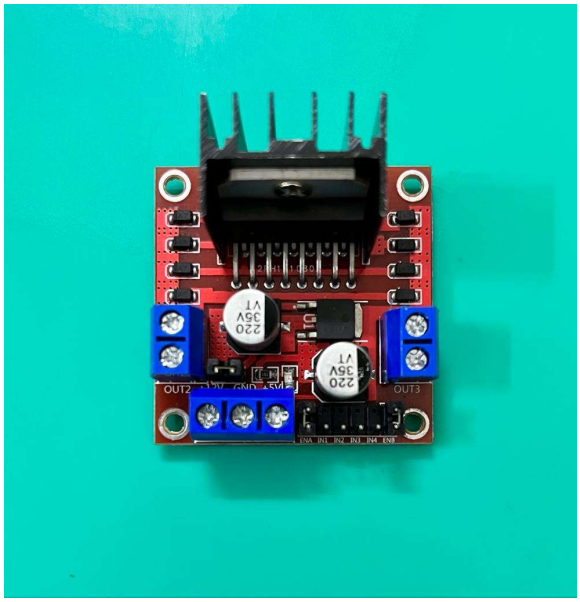


L298N Motor Driver Module:

This L298N Motor Driver Module is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control.

Features & Specifications

- Driver Model: L298N 2A
- Driver Chip: Double H Bridge L298N
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Logic Voltage: 5V
- Driver Voltage: 5-35V
- Driver Current:2A
- Logical Current:0-36mA
- Maximum Power (W): 25W
- Current Sense for each motor
- Heatsink for better performance
    - Power-On LED indicator

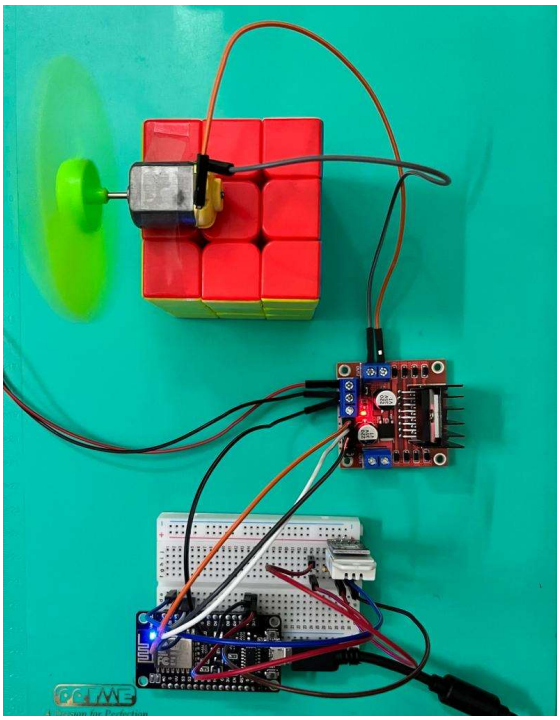


RESULT:

Working:

You need to select the transistor by the type of fan that you use. In our casewe used the well-known a 12V power supply to provide power to the fan and transistor. The DHT22 temperature sensor and red led are powered with 5V from the Arduino board. Then we set

the pins for the sensor, led and fan. The most important part is to set the variables temp Min and temp Max with your desired values. Temp Min is the temperature at which the fan starts to spin and temp Max is the temperature warning to you that the maximum temp was reached. For example if you set tempMin at 30 and tempMax at 35 then the fan will start spinning at 30°C and reach its maximum speed at 35°C. We store the temperature value in the temp variable and then use some if() functions to check if temp is lower than tempMin and if so let the fan OFF (LOW). The next if() is to check if temperature is higher than the minTemp and lower than the tempMax and if so then use the map() function to re-map the temp value from one value to another. In our case fanSpeed will have a value of 50% of its efficiency at tempMin and 100% of efficiency at tempMax. These values are Temperature based fan speed controller used to control the speed of the fan using PWM and the analog Write(). When the temperature reaches the value set in tempMax the fan will be at its maximum spinning velocity and the LCD will display FANS: 100% even though the temperature might increase above tempMax.



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Temperature: 28.80 °C           Fan speed: 73 %
Temperature: 28.80 °C           Fan speed: 73 %
Temperature: 28.90 °C           Fan speed: 73 %
Temperature: 28.90 °C           Fan speed: 73 %
Temperature: 28.90 °C           Fan speed: 73 %
Temperature: 28.90 °C           Fan speed: 73 %
Motor Started
Temperature: 28.80 °C           Fan speed: 73 %
Temperature: 28.80 °C           Fan speed: 73 %
Temperature: 28.80 °C           Fan speed: 73 %
Temperature: 28.80 °C           Fan speed: 73 %
Temperature: 28.80 °C           Fan speed: 73 %
Temperature: 28.80 °C           Fan speed: 73 %
Temperature: 28.90 °C           Fan speed: 73 %
^C
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Applications:

1. Temperature based fan speed controller is useful for cooling the processor in the laptops and personal computers “more efficiently”. Generally fan in laptop comes with only two or three possible speeds. So it results in more power consumption.

2. The fan designed in this project, has different values of speed according to temperature change. This can be also used in small scale industries for cooling the electrical/mechanical equipment. The whole circuit except motor and fan can be manufactured on a single PCB, and it can be used for temperature based control operations.

Advantages:

1. This project can be used in Home and Industry.

2. This will help in saving the energy / electricity.

3. To assist people who are disabled to adjust the fan speed automatically.