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Temperature Based Fan Speed Controller With Human Detection

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ABSTRACT:
Primary objective of this project is to develop an intelligent fan system capable of autonomously adjusting its operational cycles in response to ambient temperature variations. The innovative system integrates specialized sensors designed to continually monitor the surrounding temperature conditions. These sensors serve as pivotal components, enabling the fan to dynamically adapt its functioning based on real-time environmental cues. At the core of this intelligent system lies a sophisticated micro controller unit, meticulously programmed to interpret data from the temperature sensors. Leveraging this data, the micro controller orchestrates precise adjustments to the fan's speed settings. This meticulous modulation ensures that the fan operates optimally, maintaining an environment within the desired temperature range.
The significance of this project extends beyond mere comfort enhancement it revolutionizes the domain of smart appliances. By infusing adaptability into the fan's operations, this system embodies a paradigm shift toward energy-efficient household appliances. Its ability to intuitively respond to temperature fluctuations not only optimizes energy consumption but also elevates the overall user experience.
Moreover, this project stands as a testament to the potential of integrating adaptive technologies into commonplace devices. It sets a precedent for the future of household appliances, showcasing the remarkable synergy between technology and sustainability. Through this endeavor, we aim to herald a new era where appliances intelligently harmonize with their surroundings, promoting both convenience and Eco- consciousness.

1-INTRODUCTION

A temperature-based fan speed controller by human detection is an advanced system designed to regulate the speed of a fan based on the ambient temperature and the presence of humans in a specific area. This system integrates temperature sensors to monitor environmental conditions and adjusts the fan speed accordingly to maintain optimal comfort and energy efficiency. Additionally, by incorporating human detection technology, such as counter sensors, the fan can operate only when people are present, further conserving energy.

This smart solution offers adaptive cooling by adjusting fan speed automatically, ensuring that energy is not wasted when cooling is unnecessary. It is ideal for homes, offices, and public spaces where climate control and energy conservation are key concerns. By combining real-time temperature monitoring with occupancy detection, this system enhances comfort, reduces energy consumption, and prolongs the lifespan of fan motors.

A temperature-based fan speed controller by human detection is an innovative solution that intelligently manages air circulation and cooling in various environments. The system utilizes temperature sensors to continuously monitor the ambient temperature and adjust the fan speed in real-time, ensuring optimal airflow based on current conditions. As the temperature rises, the fan speed increases to provide enhanced cooling, while cooler temperatures result in slower fan operation to conserve energy.

Such a system not only improves comfort by maintaining a consistent and suitable environment but also contributes significantly to energy conservation, making it an ideal choice for both residential and commercial applications. By optimizing fan operation based on real-time conditions, it reduces electrical costs and promotes sustainability, aligning with modern energy-saving trends.

Counter sensors provide a significant enhancement to the system by accurately counting the number of people entering or leaving a room. They are often installed at doorways or entry points and use infrared beams or other detection methods to count the number of individuals who enter and exit. This data is used to track occupancy levels in real- time.

2-LITERATURE SURVEY

A: **Dong Chunxi7854** The design of energy-saving intelligent fan speed IEEE Workshop on Electronics, Computer and Applications 2014 This introduces a C8051 F005 MCl) governor an energy-saving design clever use of pyroelectric infrared sensing technology, smart placeholder technology, wireless remote-control technology, SCM control technology, steeples speed technology, temperature and humidity sensing technology, the intelligent control of the technology used in the control of household appliances, sampling the ambient temperature around the body, for controlling the humidity and the presence and the number of people on the fan. And apply it in the ordinary fans, it has long-distance operation, automatically sense the temperature and humidity Diaodang timer switch function, so the fans more intelligent and humane, to gain a larger market space.

B: **Damar Wicaksono Eka Firmansyah Hanung Adhi Nugroho**. A Microclimate Closed House Control Design for Broiler Strain 7th International Annual Engineering Seminar (InAES), Yogyakarta, Indonesia 2017 Through all stages of growing, chickens need a certain climate quality. The old climate quality is only the actual temperature based controlling. On modern climate, an organization called Cobb-Vandross detached three climate parameters need to be satisfied: 1) temperature, 2) humidity, and 3) wind speed. It is known that those three parameters are not independent, the area to be controlled are fast area while commonly, this available tool to control those three parameters is only the speed of the exhaust fans inside the broiler house. Therefore, controlling three parameters which were intertwined each other inside a fast area with only single actuator was the main problem of this paper. The main goal was to achieve ideal microclimate control to grow chicken inside a broiler house. Results shows that the climate control that can be implemented effectively to maintain the effective temperature of the broiler house at 32 to 22 degrees Celsius from the day-old chick to be matured in brooding stage. Temperature controller testing shows prototype device has linear set point response between two with maximum heating rate and maximum cooling rate.

C: **Surabhi, Upendra Prasad, Vivek Kumar Jain** Design and Fabrication of Temperature based DC Fan Speed Control System using Microcontroller and Pulse Width Modulation Technique International Journal of Innovative Research in Science, Engineering and Technology To get rid of the problem of Obscurity to control temperature in industries, a microcontroller-based controller has been proposed. 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 pulse width modulation technique. Controller is used to control the speed of

DC Fan and temperature is varied through the Temperature sensor and data is sent to AT89S52 microcontroller using analogue to digital converter. The duty cycle has been varied from 0 to 100% to control the fan speed depending upon the room temperature, which is displayed on liquid crystal display. Duty cycle values between 25% and 95% allow smooth control of the fan. It is easier, reliable and accurate.

D: **Jungsoo Kim, Mohamed M. Sabry, David Atienza, Kalyan Vaidyanathan**, Kenny Gross Global Fan Speed Control Considering Non-Ideal Temperature Measurements in Enterprise Servers 978-3-9815370-2-4/DATE14/ c 2014 EDAA Time lag and quantization in temperature sensors in enterprise servers lead to stability concerns on existing variable fan speed control schemes. Stability challenges become further

aggravated when multiple local controllers are running together with the fan control scheme. We validated the proposed control scheme using a presently shipping commercial enterprise server. Our experimental results show that the proposed fan control scheme is stable under the non-ideal temperature measurement system (10 sec in time lag and 1C in quantization figures). Furthermore, the global control scheme enables to run multiple local controllers in a stable manner while reducing the performance degradation up to 19.2% compared to conventional coordination schemes with 19.1% savings in power consumption.

E: **P.Siva Nagendra Reddy, K.Tharun Kumar Reddy, P.Ajay Kumar Reddy, Dr.G.N.Kodanda Ramaiah, S.Nanda Kishor**. An IoT based Home Automation Using Android Application International conference on Signal Processing, Communication, Power and Embedded System (SCOPES)- 2016 Now a day's technology becomes ever more invasive, the design challenges in home automation are increasingly apparent. Seamless controlling home, monitoring and programming by the end user have yet to enter the mainstream. This could be legitimate to the challenge of developing a fully independent and extensible home system that can support devices and technologies of differing functionalities and protocols. This project describes how to control and monitor home appliances using android application over internet. There are number of commercial home automation systems available in market. However, these are designed for limited use. Therefore, home appliances can individually be controlled both from within the home and remotely. This is very helpful to physically challenged people. The practical goal of this project has been to create a virtual, but practically usable, android home automation system. The android mobile is used to send the commands to the Arduino to control all the home appliances. The main feature of this system is to control the voltage levels of home appliance in home like speed of fan based on temperature, intensity of light based on light intensity etc. and another feature is we may get the status of our home appliances from our android mobile phone. In this system we use different sensors like temperature, rain sensor and LDR for different applications.

In this system we use different sensors like temperature, rain sensor and LDR for different applications.

Hardware requirements

The system typically integrates sensors, control algorithms, and actuators to automatically regulate airflow, optimizing energy efficiency and comfort. Here's a breakdown of the key components and how they work together

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3-HARDWARE AND SOFTWARE REQUIREMENTS

Block Diagram

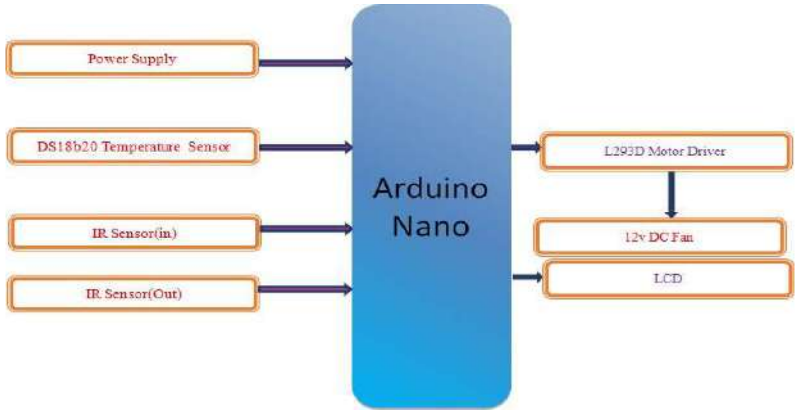
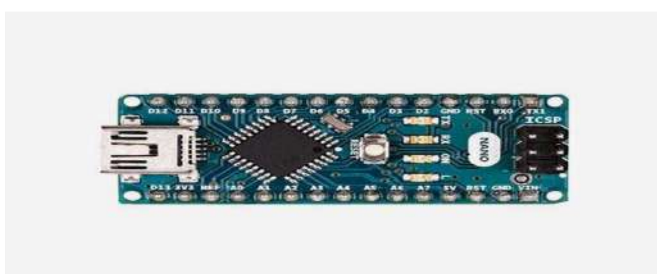


Fig 2.1 Block Diagram

Arduino Nano Overview

The Arduino nano is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The nano differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible both with the board that use the AVR, which and with the Arduino Due that operate with 3.3V. The second one is a not connected pin that is reserved for future purposes. Atmega16U2 replace the 8



Software Requirements

creating project in Arduino 1.7.11 version

Arduino IDE Installation: In this we will get know of the process of installation of Arduino IDE and connecting Arduino uno to Arduino IDE.

Step 1 --- First we must have our

Arduino board (we can choose our favourite board) and a USB cable. In case we use Adriana UNO, Arduino Due milanove, Nano, Arduino Mega 2560, or Diecimila, we will need a standard USB cable (A plug to B plug), t In case we use Arduino Nano, we will need an A to Mini-B cable.

Step 2 --- Download Arduino IDE Software. We can get different versions of Arduino IDE from the Download page on the Arduino Official website. We must select wer software, which is compatible with were operating system (Windows, IOS, or Linux).

After wear file download is complete, unzip the file.

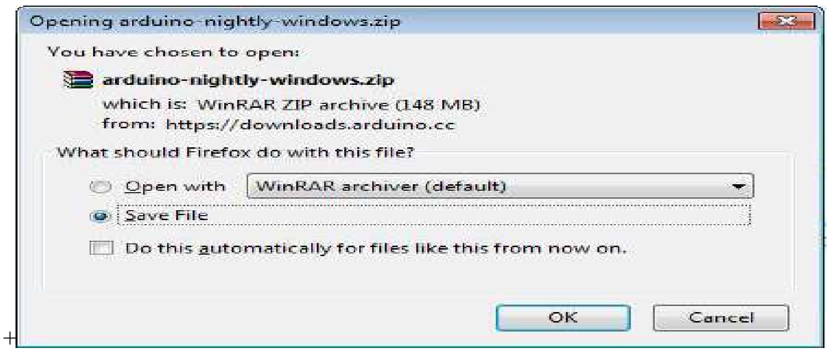


Fig 3.1 Download Arduino IDE software

Step 3 --- Power up our board.

The Arduino Uno, Mega, Duemilanove and Arduino Nano automatically draw power from either, the USB connection to the computer or an external power supply. If we are using an Arduino Diecimila, we have to make sure that the board is configured to draw power from the USB connection. The power source is selected with a jumper, a small piece of plastic that fits onto two of the three pins between the USB and power jacks. Check that it is on the two pins closest to the USB port.

Connect the Arduino board to wer computer using the USB cable. The green power LED(labeled PWR) should glow.

Step 4 --- Launch Arduino IDE. After our Arduino IDE software is downloaded, we need to unzip the folder. Inside the folder, we can find the application icon with an infinity label (application.exe).

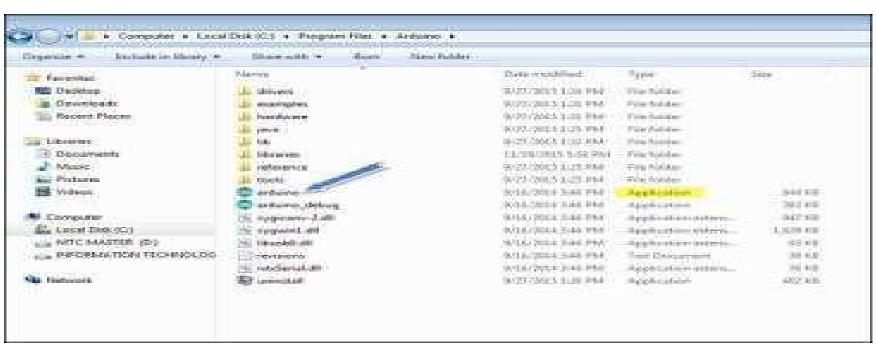


Fig 3.2 Launch Arduino IDE

4-Working Of Temperature Based Fan Speed Controller By Human Detection

A temperature-based fan speed controller with human detection using a counter sensor takes smart climate control a step further by integrating a counter sensor system that tracks the number of people in a room. This feature enables even more precise and efficient fan speed control, adjusting not only based on temperature but also the number of occupants, which can affect the cooling or ventilation requirements of the space.

Schematic Diagram

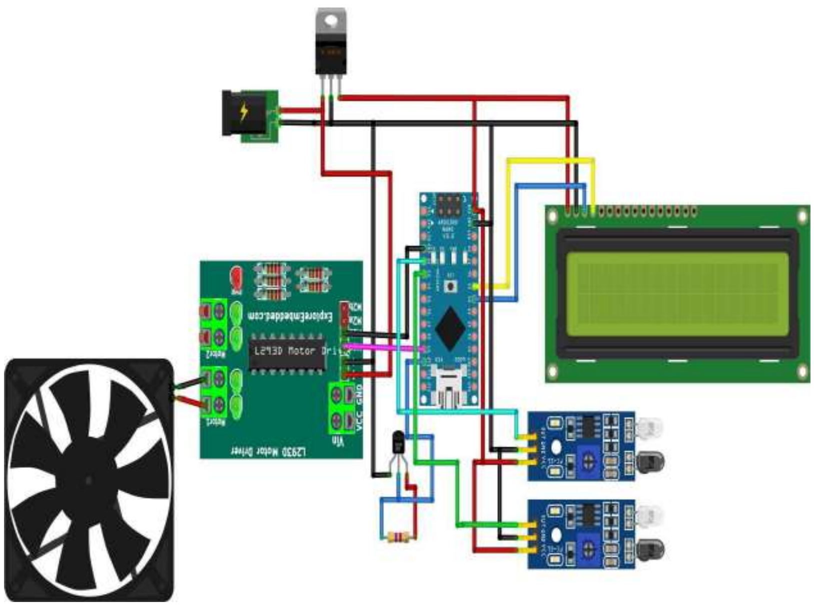


Fig 4.1 Shows the Circuit Diagram

To design a temperature-based fan speed controller that adjusts based on both room temperature and occupancy (tracked by IR entry and exit counters) . Here, the DS18B20 temperature sensor, a digital temperature sensor that communicates using the One-Wire protocol .Power supply used in our project is 12V 1A .The components used in this project need 5V of power supply. So, a voltage regulator is connected to power supply to convert 12V to 5V. VCC of all the components are connected to 5V and GND to 0V of power supply. Human detection is usually accomplished using IR sensors . These are typically placed at the room entrance. They consist of a pair of IR sensors or a laser- based system. When a person enters or exits the room, the sensors detect the crossing motion and keep track of the number of people inside the room. The microcontroller keeps an up-to-date count of the room occupancy based on the data from these sensors. Connect the counter outputs to the microcontroller digital input pins (e.g., pins D2 to D5 on an Arduino) for interpreting the occupancy count.

Connect the data pin to a digital input pin on the microcontroller (D10 on Arduino). Place a pull-up resistor between the data pin and 5V to enable communication. Connect VCC of the DS18B20 to 5V and GND to ground. A temperature sensor DS18B20 measures the ambient temperature in real-time. The sensor continuously monitors the room temperature and sends this data to the microcontroller (Arduino Nano).The microcontroller processes the inputs from the temperature sensor and human detection/counter sensors.

Connect the fan to a driver motor(L293D) in the circuit to control speed. If the room is occupied (i.e., there are people inside as indicated by the counter sensors), the system will adjust the fan speed according to the ambient temperature. Use PWM on the microcontroller's D9 pin to adjust the fan speed. The counter output or the microcontroller can select the fan speed based on both IR sensor count and temperature sensor data.

- If the temperature is high, the fan speed will increase.
- If the temperature is low, the fan speed will decrease.

If the room is unoccupied, the system will either turn off the fan or set it to a low, energy-saving mode. The microcontroller uses a method to control the speed of the fan, typically using PWM (Pulse Width Modulation) to adjust the motor's speed.

Based on the temperature readings and occupancy data, the PWM signal is adjusted to vary the power sent to the fan motor, thereby controlling the fan speed. PWM generates a pulsed signal where the duty cycle (the ratio of ON time to the total time) determines the average voltage supplied to the fan motor, thereby controlling its speed.

- 20% duty cycle = low fan speed.
- 50% duty cycle = medium fan speed.
- 100% duty cycle = maximum fan speed.

The number of people in the room affects the fan speed because more people generate more heat. The system uses the count from the human counter sensors to make finer adjustments. As more people enter the room, the fan speed might increase even if the temperature stays constant, since human bodies contribute to the overall heat. If the room becomes less occupied, the fan speed decreases accordingly.

If a person leaves and the room becomes empty, the system will wait a defined period before slowing or turning off the fan, to ensure that energy is conserved without compromising comfort if someone briefly leaves the room.

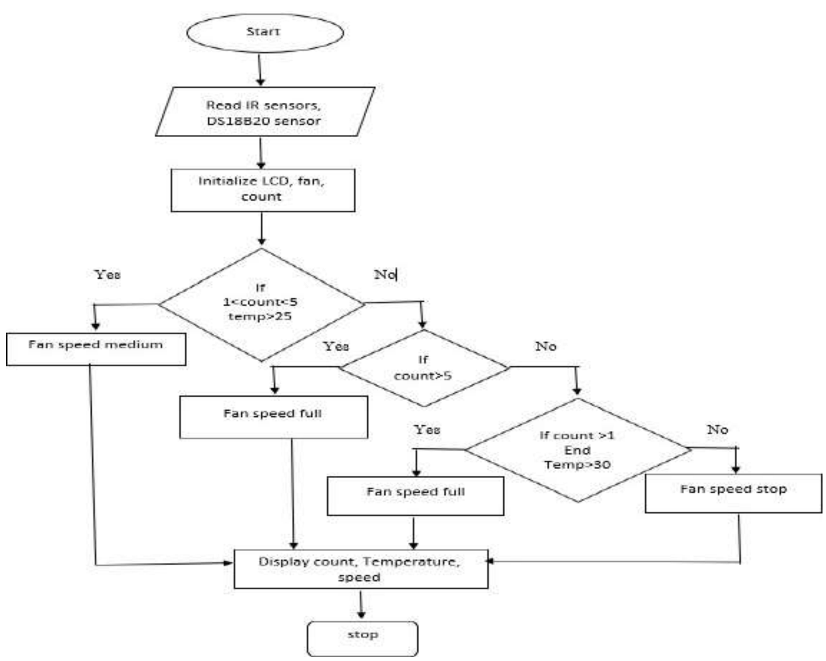


Fig 4.2 Flowchart represents working process

Advantage, Disadvantages & Applications

Advantages

The temperature-based fan speed controller with human detection project offers several distinct advantages that improve energy efficiency, user comfort, and system performance. Here are the key benefits:

Energy Efficiency: The system can intelligently adjust the fan speed based on real- time temperature readings and human presence. For instance, if a room is unoccupied and the temperature is stable, the fan can slow down or turn off entirely, leading to lower energy consumption.

By minimizing operation when unnecessary, it reduces electricity bills and contributes to overall energy conservation.

Disadvantages

Cost: The setup cost for advanced fan systems that incorporate sensors and controllers can be higher than traditional fan systems. This may include expenses for both hardware and installation. If not implemented correctly, the cost savings on energy bills may not outweigh the initial investment, particularly in smaller applications.

Complexity: The installation of sensors and controllers can be more complex than traditional systems, requiring skilled labour or specialized knowledge. Setting up the system to respond accurately to various temperature thresholds and occupancy scenarios may require advanced programming skills and time.

Applications

The applications of a temperature-based fan speed controller with human detection are diverse and span various industries. By intelligently managing airflow based on real- time conditions, these systems enhance comfort, improve energy efficiency, and contribute to better air quality in residential, commercial, and industrial settings. As smart technology continues to evolve, the adoption of such systems is expected to grow, making environments more responsive and efficient.

Residential HVAC System: Integrates with home heating, ventilation, and air conditioning (HVAC) systems to automatically adjust fan speeds based on temperature and occupancy, enhancing comfort and energy efficiency. Optimizes fan operation in living spaces, kitchens, and bathrooms, responding to real-time conditions to maintain air quality and comfort.

Commercial Buildings: Adjusts air circulation in response to employee presence, ensuring comfort in work environments while reducing energy consumption during off- hours. Maintains optimal temperature and airflow in stores based on customer presence, enhancing shopper comfort and improving energy efficiency A temperature-based fan speed controller with human detection operates by dynamically adjusting the speed of a fan based on the ambient temperature and the presence of humans in a space. The system typically integrates sensors, control algorithms, and actuators to automatically regulate airflow, optimizing energy efficiency and comfort.

The temperature-based speed controller project successfully demonstrates adaptive control of a system based on temperature and occupancy. The system provides improved comfort, air quality, and energy efficiency, enhanced air quality through optimized airflow.

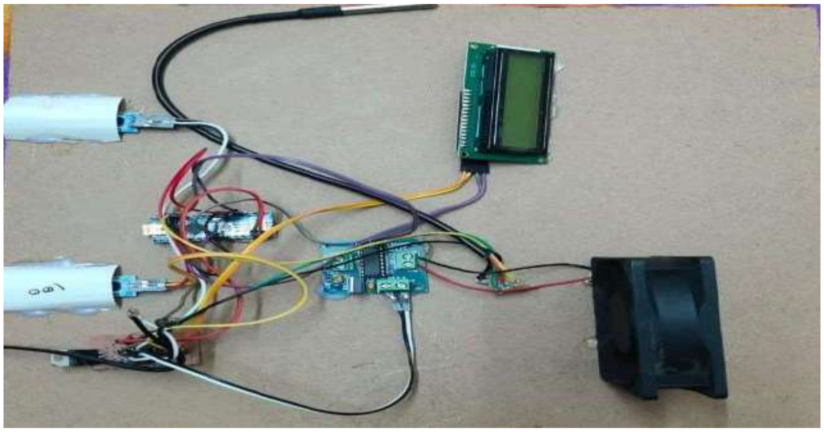


Fig 5.1 Shows the circuit in off state

The system is in standby mode, awaiting human detection. No human detection capability. The counter sensor monitors the area for human presence. When no human is detected, the system remains off.

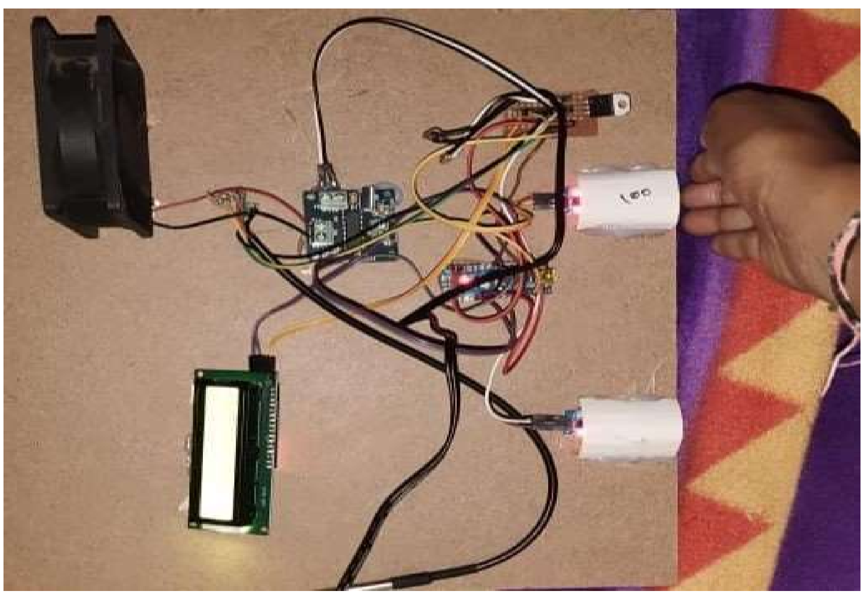


Fig 5.2 Shows the light in LED indicates power supply has been connected and pair of sensors detecting human presence

When Power supply is connected the system is active. Microcontroller initializes and sensors power up. System checks for human presence. Maintains system settings and data. Communicates with sensors. IR Sensors start monitoring for human presence and detects changes in infrared radiation patterns. Human detection triggers the counter sensor. DS18B20 senses the surrounding temperature readings. This sensors sends signal to microcontroller and processes sensor data and controls fan speed based on temperature .

Fig 5.3 Shows that the IR sensor count the number of persons

The counter sensor detects changes in the environment caused by human presence. When a person enters the room, the sensor sends a digital signal (HIGH or LOW) to the microcontroller. The microcontroller processes the signal and activates the temperature control system. Indicates presence (1) or absence (0) of a person. If more persons detected then count increases

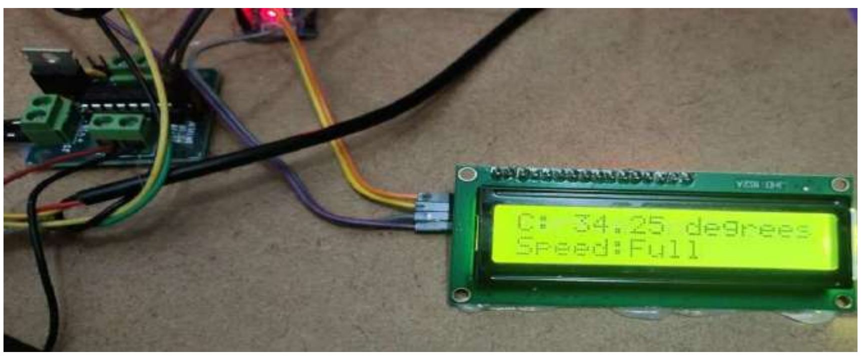


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Fig 5.4 Shows that speed can be controlled based on the temperature and persons

Use temperature and counter sensor readings to determine fan speed. Divide temperature range and person count range into zones. Assign speed levels to each zone (low, medium, high). Adjust fan speed accordingly

Fig 5.5 Shows the fan is operated according to temperature

Fan speed is adjusted based on temperature and occupancy. PWM signal from Arduino Nano controls fan speed. Fan is turned off when temperature is below setpoint or no occupancy.

7-CONCLUSION

A temperature-based fan speed controller with human detection is a highly efficient and practical solution for optimizing comfort, energy usage, and air quality in a variety of settings. By automatically adjusting fan speed based on real-time temperature data and occupancy, it reduces energy wastage, lowers operational costs, and extends the lifespan of equipment. The project has diverse applications in residential, commercial, industrial, and public spaces, enhancing user experience through automation while contributing to sustainability efforts.

This setup can be used to control the internal ambient temperature of an enclosed room. When the threshold temperature is reached the fan turns on. When the temperature goes below threshold temperature fan turns off. So it's basically an automated process. We connected a relay for controlling devices which runs on mains voltage such as table fan. When the room temperature reaches the threshold temperature the fan turns on and turns off when the room cools down. This may be the best way for saving power and this can be heaven for lazy people who wish others to switch the fan ON when they feel warm.

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