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Temperature Based Ac Fan Control for Home Appliances

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A B S T R A C T

This project turns a regular ceiling fan into a self-adjusting, energy-saving appliance. An Arduino with a DHT11/DHT22 sensor collects the information of the room conditions and, by using a servo motor, rotates the knob of a capacitive regulator to set the right speed automatically. The fan runs faster rpm when it is hot and slows down its rpm the room cools, providing steady comfort without user involvement .If we don't require, we can power off that automatic mode of the device and we can operate manually.Because the system uses a capacitive regulator instead of a resistive regulator, it also avoids heat loss and reduces electricity consumption. The result is an affordable, practical way for households without air conditioning to enjoy cooler nights and lower power bills.

Keywords: Arduino Uno, Capacitive regulator, Automatic speed control, Energy saving

1. Introduction

Most of homes in South India still depend on ceiling fans instead of air conditioners Because They are cheaper than the AC and they use less power, but unlike AC they don't adapt to the way the weather changes and they don't change it state . in southern parts of India,it's usually hot and stuffy at the start of the night and then cools as time passes and decreases most after midnight. Because of this, people either wake up to adjust the fan or sleep uncomfortably. The fan also keeps drawing more power than needed when the air cools down.

To solve this everyday issue, we built a simple controller for a normal fan. An Arduino board with a DHT sensor Measures the room conditions like Temperature and Humidity and changes the fan speed Based on those levels. When it's hot the fan speeds up as the temperature drops it slows down. The change is smooth, so the airflow always feels comfortable and less energy is wasted. For the energy saving we use Capacitive Regulator where the resistive regulator waste energy in the form of heat .Our aim was to create an affordable and practical solution for households that don't have air conditioning but still need better comfort.

2. Methodology

System Overview

An Arduino Uno is the main controller. It reads the room temperature from a sensor and automatically adjusts the fan speed by moving a servo motor that turns the existing regulator knob.In place of Arduino Uno we can use other Microcontrollers like Arduino Nano,esp32.

Sensor Setup

A temperature sensor DHT22 is connected to the Arduino's analog input. This lets the microcontroller constantly take the room conditions and convert them into temperature and Humidity values in real time.

Servo connection

A small servo motor is mechanically fixed to the fan regulator. Different servo angles set for different fan speeds, so rotating the servo changes speed of fan just like a person turning the knob and adjusting the speed.

Control Logic

The Arduino program continuously reads the temperature. Depending on the reading, it chooses a certain servo angle:

Cool- low fan speed

Warm- medium fan speed

Hot - high fan speed

This logic will update regular interval of time and detects changing temperature.

Software Implementation

The sketch was written in the Arduino IDE using the Servo library. The code maps temperature readings to servo angles, and the Serial Monitor was used during testing to find thresholds values and respective angles.

Testing

During testing, we observed the temperature readings and adjusted the servo positions so that each angle matched a comfortable fan speed on our regulator. This make smooth, automatic operation throughout the night.If we need constant speed, we can turn off the device and can operate manually.

Outcome

The fan slows down automatically as the room cools for below threshold level of temperature , saving energy and keeping the airflow comfortable without the user needing to wake up at night and to adjust it.

3. Modification

Original System

Fan speed changed electronically by the microcontroller, but limited to ON/OFF or two-step speeds.

Modified System

Replaced the simple electronic speed control with a servo motor coupled to a capacitive regulator. The servo rotates the knob of a capacitive regulator in real time according to the temperature readings. This physically adjusts the fan's capacitor-based speed control, just like a manual regulator but automated.

4.Capacitive Regulator

A capacitive regulator is a highly efficient method for controlling the speed of ceiling fans. Unlike resistive regulators, which reduce speed by wasting energy in the form of heat, a capacitive regulator uses the principle of phase shift which was created by a capacitor.

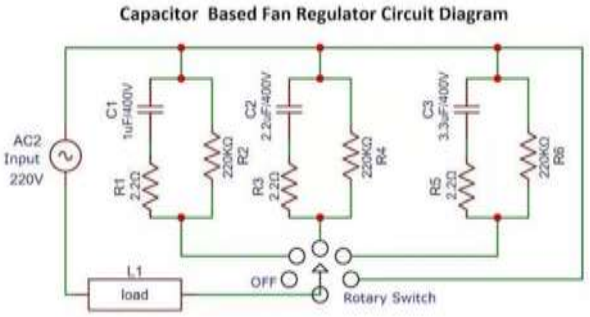

Fig 1

When a capacitor is connected in series with the fan motor, it changes the phase difference between voltage and current. This effective voltage and current supplied to the fan motor, which in turn controls its speed. By switch to different capacitor values they have different phase shifts, then the fan can operate at multiple speed levels low, medium, or high without wasting power because capacitor is an active element and stores energy and very less loss of power will be there.

Energy Efficient:

very low power lost as due to heat.

Smooth Operation:

Provides stable speed control without sudden voltage drops.

Durability:

Simple design with fewer losses it has long life and reliable performance.

5.Servo connections

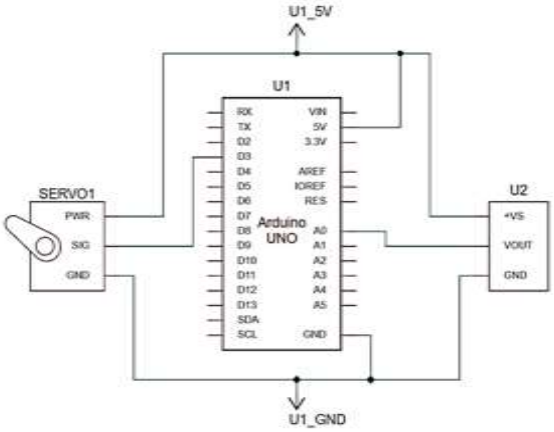

Fig 2

Fig 2 shows a simple control setup where an Arduino UNO (U1) drives a servo motor (SERVO1) using a separate power supply module . The Arduino receives 5 V from the main supply (U1_5V) and generates a control signal to control the servo motor angle. The servo's power pin is connected directly to regulated output of U2 to provide enough current without making the excess current for Arduino, while all grounds from the Arduino, the servo, and the power module are tied together (U1_GND) to make as common reference.

This arrangement allows the Arduino to send accurate PWM pulses to the servo for smooth and correct position control while maintaining stable power for both devices.

6.Temperature graph

Temperature in south India during summer

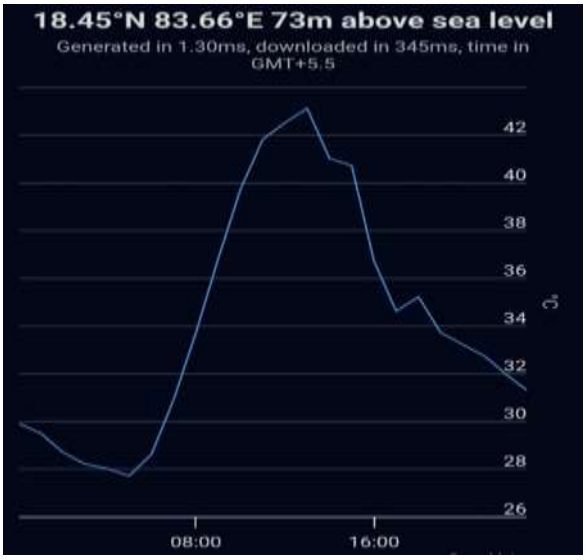

Fig 3

Fig. 3 represents a normal day's temperature variation in a South Indian location mainly in summer time . The graph shows how the climate here is often unpredictable and irregular. Early morning temperatures is around 29–30 °C, then steadily rise to a peak about 41–42 °C by midday. After this high point the temperature drops slowly in the late afternoon and continues to cool during the night. In many parts of South India, the temperature decreases even more rapidly after midnight, with noticeably cool conditions developing after 12 a.m., making the day–night temperature swing between hot and cool.

7.Results

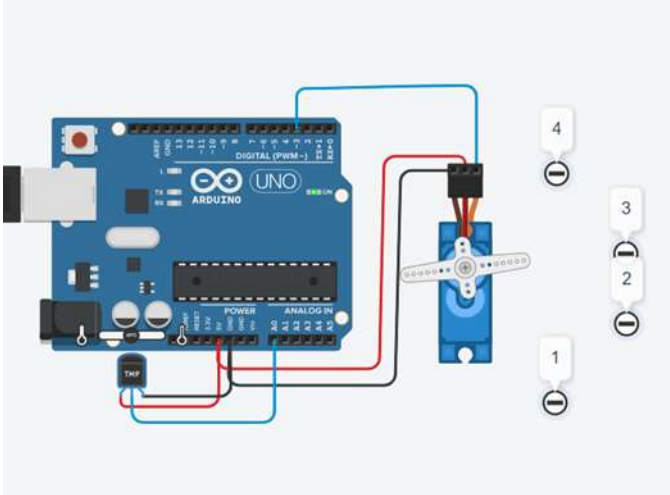

Fig 4

Table

Level	Temperature	Speed(rpm)
1	<25	200
2	25-35	280
3	35-45	370
4	>45	420+

Here the table represents 4 levels of the Capacitive Regulator . Based on the Temperature the level was changed by the servo motor and each level has specific rpm (Revolutions per minute).Lower rpm means the fan will run slow and low air with power saving .Higher rpm make higher breeze . Other two levels are for moderate wind .

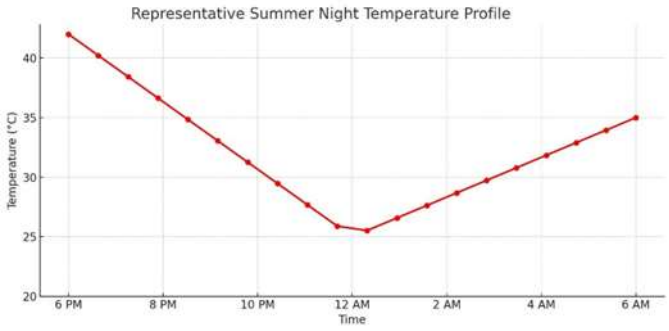

Fig 5

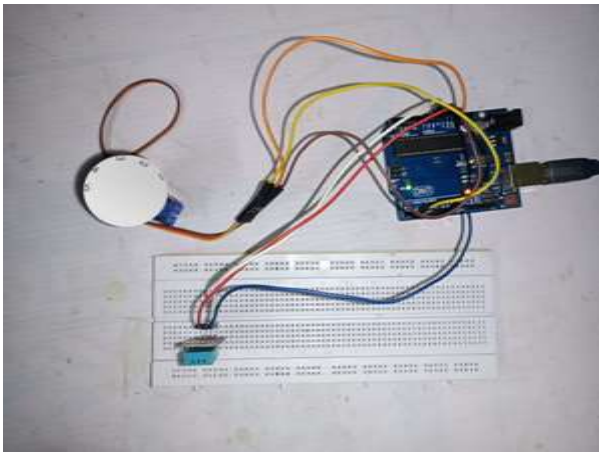

Fig 6

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