Title: Smart Fan Controller with Temperature Sensing and LCD Display

Description: Design and build a smart fan controller using an AVR Atmega32 microcontroller that can automatically adjust the speed of a fan based on the ambient temperature. The project will also include an LCD display to show the current temperature and fan speed.

Circuit Design: The circuit will include an AVR Atmega32 microcontroller, a PWM module to control the speed of the fan, an ADC module to read the temperature from a sensor, a temperature sensor (such as an LM35 or a thermistor), and a 16x2 LCD display. The fan can be connected to the microcontroller using a transistor as a switch.

- We will use a **DC Motor** instead of the Fan and will be connected to the micro-controller using a Motor driver like L298N, the motor driver requires power (usually 12V) and a control signal (PWM signal).
- Adjust the motor direction to one direction using direction control pins of the L298N motor driver and control its speed.

Code Development: The code will continuously read the temperature from the sensor using the ADC module and adjust the speed of the Motor using PWM based on the following predefined temperature thresholds and corresponding PWM values:

If the temperature is below 25°C, the fan should be turned off (0% duty cycle)
If the temperature is between 25°C and 30°C, the fan should run at a low speed (30% duty cycle and 5 kHz frequency)
If the temperature is between 30°C and 35°C, the fan should run at a medium speed (50% duty cycle and 10 kHz frequency)
If the temperature is above 35°C, the fan should run at a high speed (80% duty cycle and 20 kHz frequency)
The code will also display the current temperature and fan speed on the LCD display. The LCD display will be connected to the microcontroller using the 4-bit mode.

Testing and Verification: The circuit and code will be tested and verified to ensure that the fan speed is adjusted correctly based on the ambient temperature and that the temperature and fan speed are displayed correctly on the LCD display.

Project Report: The project report will include a description of the project, a detailed explanation of the circuit design, the code, the testing results, and any challenges or issues encountered during the project.

Presentation: The project will be presented to the class or instructor, explaining the project's objectives, the approach used to build the project, and the results achieved.

Creativity and Innovation: Students can be creative by exploring different types of temperature sensors, experimenting with different PWM frequencies to achieve the desired fan speed, and adding additional features such as LED indicators or a display to show the current temperature and fan speed. They can also use other types of displays, such as OLED or graphical displays, to show more information about the temperature and fan speed. They can also implement a user interface, such as buttons or a rotary encoder, to allow the user to adjust the temperature range and fan speed settings.