Room Fans of the Future: A Sustainability Project

Abstract:

In an attempt to conserve energy, I altered the nightly duty cycle of a stand-up room fan through the use of the Arduino microcontroller/unit. Using a six hour per night sleep average, I programmed the microcontroller to turn the fan on for 1.5 hours, then off for 4 hours and, finally, to turn back on just as the sleep-cycle is almost over. By doing this, energy is saved at no expense to the comfort of the sleeping individual. The benefits of the fan— a sound and cool breeze to fall asleep and wake-up to—are preserved without wasting the excess energy. Currently, running a fan all night long in highly inefficient as, for the majority of the night, it is unneeded and simply runs without purpose. By allowing users to time the fan to turn on only as they fall asleep and wake, the maximum benefits of the fan are attained without any excess energy consumption.
Construction:

The four main hardware components of this project exist as the fan circuit, the electronic relay, the transistor and the Arduino unit. By constructing the fan’s circuit first, next incorporating the relay, then adding the transistor and, finally, programming and connecting the Arduino board, I greatly reduced the troubleshooting time of the project.

The fan has a power source independent of the Arduino and of the relay assembly. The positive wire from its battery plugs into the switching port on the relay; a wire is then connected from the normally off output pin of the relay to the fan’s motor. Next, another wire is connected to the negative side of the motor and ran to the ground of the battery. When the relay is flipped on, the switching port connects to the normally off output and the circuit is completed.
The relay uses its own 9 volt battery in order to power its coil. A wire from the battery is connected to one of the inductor’s pins and another wire is run from the other pin to the collector of the transistor. When the circuit is completed by the transistor, the inductor in the relay flips the internal switch from the normally on pin to the normally off pin. This then, in turn, completes the fan’s circuit.

The transistor is used in order to receive logic from the Arduino board in the form of 5V or 0V signals. When logic 1, or 5 volts, is given to the transistor from the Arduino via the center pin, the internal switch of the device allows a connection from its collector/top pin to its
ground/bottom pin. This completes the transistors circuit and, as a result, the other circuits in the system. The fan turns on for logic 1 and turns off for logic 0.

The Arduino unit is programmed to run the course of a six hour sleep cycle. For the first 1.5 hours, the fan is on. During this time a constant signal of 5 volts is provided to the transistor, which in turn completes all of the system’s circuits and turns the fan on. After the 1.5 hours, the Arduino board provides logic 0 to the transistor and, accordingly, the fan turns off for the entire 4 hours of this part of the code. Half an hour prior to the end of the sleep cycle, logic 0 is once again given to the transistor and the fan remains on until the user manually turns it off. The 5V or 0V signal is provided via port 13.

**Conclusion:**

Energy conservation is the top priority with this project. By reducing the nightly duty cycle of the fan, energy previously wasted is saved. In addition, the comfort of the individual using the fan is increased as they do not become overly cold during the night. This two-fold effect makes this product very marketable. In the future, the integration of a device, such as the one created for this project, into the average inexpensive room fan could both increase fan sales and consumer quality of life.

A link to a demonstration of this device can be found at:

http://www.youtube.com/watch?v=SUtQiBoVWWw