Energy Efficient And Environment Friendly Smart Home System

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Abstract

In the modern era of sophisticated hands-free home automation to ensure maximum level of comfort, we aim to design a system that focuses on optimizing energy consumption while ensuring proper environmental safety. The system integrates smart controls for lights, fans, and air conditioning (AC) units, leveraging sensor data and user preferences to dynamically adjust settings for optimal efficiency and comfort. The simplicity of using available MCUs, sensors, modules and ICs to carry out all the tasks meticulously is what makes our project unique and authentic.

Keywords—Automation, Control, Sensors, Sensor data, Relay Module, Energy efficiency, Environment friendly, Light, Fan, AC , Smart home etc.

Introduction

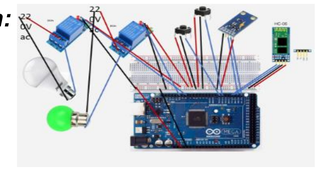
Amid growing environmental concerns and the continuous depletion of Earth's resources, the need for sustainable living has become increasingly urgent. Smart home technologies, with their ability to connect and automate household appliances, present a viable solution for improving energy efficiency and reducing the ecological footprint of homes. This paper delves into the application of eco-friendly and energy-saving systems in homes, focusing on essential appliances such as air conditioning, lighting, fans, and control systems. Leveraging cutting-edge sensors, the Internet of Things (IoT) technologies, and intelligent software, these smart home systems can intelligently adjust to user habits and environmental conditions, optimizing energy consumption and contributing to sustainability efforts. The paper outlines the current advancements in smart home technology, assesses the energy conservation potential, explores the environmental advantages, and examines the challenges and future prospects of this rapidly progressing field.

Methodology

Control of Light

For the light control, it is basically the **lux threshold** that determines whether the energy bulb/normal light will work or the dim light will work. Using state 1, user can activate the lights .Then by determining the threshold level while using state 2 the lights can be turned on/off. Also, manual switching is added for it.

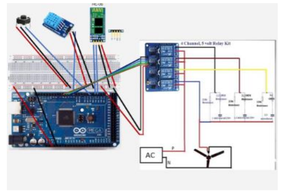
Circuit Diagram:



Control of Fan

For the fan control, relay is the main part of working principle. For the prototype the relay used is a 4 channels relay module. That means four levels for voltage variation is being used here. When the state is given via Bluetooth supported app it can turn the fan on/off and the speed can be controlled with respect to temperature and humidity which is done with the help of **DHT sensor data**. Again, it has manual switching option available.

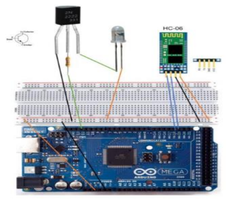
Circuit Diagram:



Control of AC

The AC control is done in two steps. The TSOP IC is used as the receiver of data array for reading and decoding that is going be sent via IR transmitter. The Bluetooth interface is used for user choice.

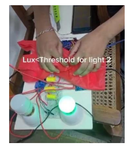
Step by Step circuit diagram:



Results and Findingss

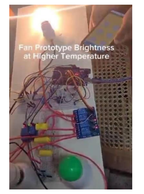
After the schematic circuit is realized in practical, we have demonstrated the output. The smart home automation has been demonstrated in three different segments. The first one, the segment with automatic enlightening of light bulbs depends on the luminous intensity of available light that is detected by a sensor hence the data is sent to the microcontroller unit. The following figure shows the activation of the first light bulbs.

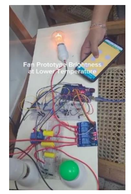
Schematic:



For realizing how a fan behaves by automatically adjusting its speed upon detecting the temperature around is demonstrated via a prototype, which consists of a light bulb that adjusts its intensity as per the speed. The information from the temperature sensor is sent to the microcontroller unit that selects the relay path, ultimately changing the brightness depending on the impedance encountered on the path. Shown below are the two extreme cases where the brightness is accurately changed at high and low temperature.

Schematic:





Conclusions & Future Prospect

In the era of rapid modernization, it is important to keep every project energy efficient while also keeping eye whether any of them is harming the environment. Our project is in strong alignment with all these requirements. We have successfully designed a smart home automation with low budget and zero risk of environmental harm.

Science has proven time and time again that there is no limit to development and every idea can be flourished more with curious minds and hard work. Although our project is self-sufficient and automatic, there are a few aspects that can be enhanced, or modified. The first and obvious one is to replace the prototype, since using the actual element will take it one step closer to the consumer level. Our system has to be turned on and off with commands. To make it automatic, presence of human in a room can be detected through an IR sensor and respective command can be sent to the Arduino board. The functioning of the AC can also be made automatic.

Acknowledgement

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References

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