A

SYNOPSIS

of

MINOR PROJECT

on

Automatic Room Appliances controller using Arduino and PIR Sensor

Submitted by

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Project Guide
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Problem Statement: In modern homes and offices, there is a growing emphasis on energy efficiency and convenience. Traditional methods of manually controlling appliances often lead to energy wastage when lights, fans, and other devices are left on in unoccupied rooms. This project addresses the need for an automated system that can intelligently manage room appliances, ensuring they are only in use when needed, thereby conserving energy and enhancing convenience.

Brief Description: This project involves the design and implementation of an automatic room appliance controller using an Arduino microcontroller and a PIR (Passive Infrared) sensor. The system detects the presence of individuals in a room using the PIR sensor, and based on this detection, the Arduino microcontroller will control the state of various appliances. The aim is to turn on lights, fans, and other devices when the room is occupied and turn them off when it is vacant, thus improving energy efficiency and user convenience. In the age of automation, the ability to operate household appliances with minimal effort is increasingly becoming a reality. This project aims to create a smart home automation system using Arduino and a PIR sensor to control room appliances such as lights and fans based on human presence. By integrating these technologies, we can develop an energy-efficient system that enhances convenience and comfort in modern living spaces.

Objective and Scope:

Objective:

- To design a system that automatically controls room appliances based on human presence detected by a PIR sensor.
- To enhance energy efficiency by reducing unnecessary usage of electrical appliances.
- To provide a cost-effective and easy-to-implement solution for home and office automation.

Scope:

- The system is designed for indoor environments such as homes, offices, and classrooms.
- It can be extended to control a variety of appliances including lights, fans, air conditioners, and heaters.
- Additional sensors and control modules can be integrated to expand the functionality, such as temperature sensors for climate control.

Methodology:

1. Research and Planning:

- Conduct research on PIR sensors and their application in detecting human presence.
- Study the Arduino microcontroller platform and its programming environment.
- Design the initial schematic for the circuit, identifying the connections between the PIR sensor, Arduino, and relay module.

2. Component Procurement:

- Purchase the required hardware components: Arduino Uno, PIR sensor, relay module, jumper wires, breadboard, power supply, and appliances for testing.
- Install the Arduino IDE software on a computer for programming the Arduino.

3. Circuit Design:

- Create a detailed circuit diagram showing the connections between the PIR sensor, Arduino, and relay module.

- Connect the PIR sensor's output pin to a digital input pin on the Arduino.

- Connect the relay module's control input to another digital output pin on the Arduino.

- Ensure proper power connections for the Arduino, PIR sensor, and relay module.

4. Programming:

- Write the Arduino sketch (program) to read input signals from the PIR sensor.

- Implement logic in the code to turn on the relay (and connected appliance) when motion is detected.

- Add a delay to prevent the relay from toggling too frequently due to brief sensor activations.

- Upload the code to the Arduino and test its functionality with the connected appliances.

5. Assembly and Testing:

- Assemble the hardware components on a breadboard or PCB according to the circuit diagram.

- Upload the program to the Arduino and conduct initial tests to ensure the sensor accurately detects motion and the relay controls the appliances correctly.

- Adjust the sensitivity and delay parameters in the code to optimize performance.

6. Deployment:

- Install the system in a test environment, such as a room in a house or office.
- Monitor its performance over a period of time, observing how well it responds to human presence and controls the appliances.
- Collect feedback and make necessary adjustments to improve reliability and user experience.

Hardware and Software Requirements:

Hardware:

- **Arduino Uno:** The microcontroller board that serves as the brain of the project, processing input from the PIR sensor and controlling the relays.

- **PIR Sensor:** Detects motion by measuring infrared radiation from human bodies.

- **Relay Module:** Acts as a switch to control high-voltage appliances based on the Arduino's low-voltage signals.

- **Jumper Wires:** Used for making connections between different components on the breadboard.

- **Breadboard:** A platform for assembling the prototype circuit.

- **Power Supply:** Provides power to the Arduino and other components.

- **Appliances:** Devices such as light bulbs, fans, or heaters to be controlled by the system.

Software:

- **Arduino IDE:** An integrated development environment used to write, compile, and upload code to the Arduino.

Technologies:

1. **Embedded Systems:** The Arduino microcontroller and its programming.

2. **IoT (Internet of Things):** Connecting and controlling appliances through sensors and actuators.

3. **Sensor Technology:** Using PIR sensors to detect human presence based on infrared radiation.

Testing Techniques:

1. Unit Testing:

- Test individual components separately, such as verifying the PIR sensor's motion detection capabilities.
- Ensure the relay module correctly responds to control signals from the Arduino.

2. Integration Testing:

- Connect all components and test them together to ensure seamless operation.
- Verify that the system correctly interprets sensor signals and controls appliances.

3. Functional Testing:

- Test the entire system in a real-world scenario, checking if appliances turn on and off based on human presence.

- Ensure the system responds accurately to motion and remains idle when the room is unoccupied.

4. Performance Testing:

- Measure the system's response time from detecting motion to activating the appliance.

- Evaluate the reliability and stability of the system over extended periods of use.

Project Contribution: This project significantly contributes to the field of smart home automation by providing a practical solution to energy wastage. By automating the control of room appliances based on human presence, it enhances energy efficiency, reduces electricity bills, and offers convenience to users. It also showcases the potential of IoT and embedded systems in creating intelligent environments, paving the way for more advanced and integrated home automation solutions in the future.