Project Report

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Subject Name: Internet of things **Subject Code: 24CAH-723**

Aim: IoT Based Smart Home System to control and monitor appliances from remote location.

Objectives:

1. To develop an automated system that controls electrical appliances such as lights and fans based on human presence detected by a PIR sensor.
2. To integrate IoT technology (using NodeMCU) for real-time monitoring and control of connected devices through a cloud platform like Blynk or ThingSpeak.
3. To minimize energy consumption by ensuring that electrical devices remain ON only when required, thereby promoting efficient power usage and reducing wastage.

Components Required:

Sno	Name of Component	Qty.
1.	NodeMCU (ESP8266) **(Times New Roman-12)**	1
2.	PIR motion Sensor	1
3.	Relay	1
4.	LED	2
5.	Resistor (230 Ohm)	2
6.	Breadboard	1

Details of Components:

1. **NodeMCU: (Times New Roman-14)**

   The NodeMCU board is a low-cost, open-source IoT platform widely recognized for its user-friendly approach to building Internet-connected projects. Based on the ESP8266 WiFi chip, it combines a microcontroller with WiFi capabilities, enabling developers to create connected devices with ease.

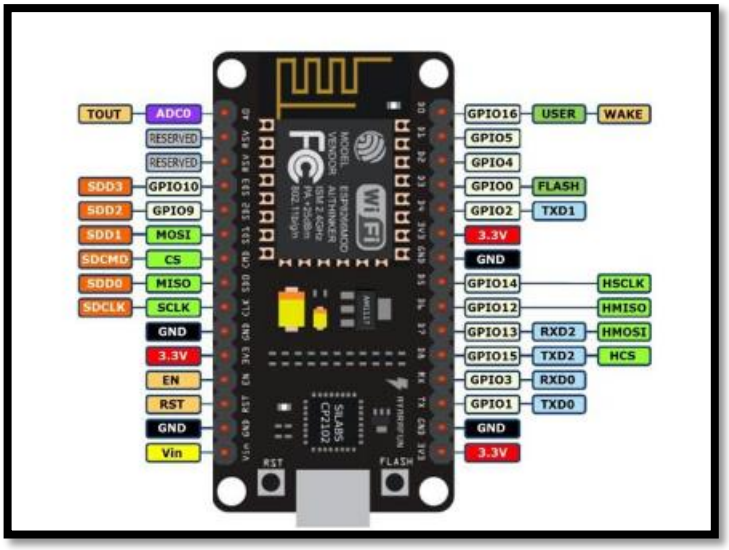


Figure 1 : NodeMCU Board

2. **PIR motion Sensor:**

   The Passive Infrared (PIR) sensor detects infrared radiation emitted by human bodies. It outputs a digital HIGH signal when motion is detected and LOW when no motion is present.
   This output is connected to NodeMCU's digital input pin (D2).

   Specifications:

   - Operating Voltage: 3.3 V – 5 V
   - Detection Range: 3 – 7 meters (adjustable)
   - Output Type: Digital (HIGH/LOW)
   - Delay and Sensitivity: Adjustable via onboard potentiometers

3. **2- channel Relay module:**
   A relay module acts as a bridge between low-voltage logic circuits (NodeMCU) and high-voltage AC loads. Each channel can control one electrical device (e.g., light or fan). It is optically isolated for protection.
   Specifications:
   - Channel: 2
   - Trigger Voltage: 3.3 V / 5 V (Active LOW)
   - Switching Voltage: up to 250 V AC or 30 V DC
   - Current Capacity: 10 A per channel
4. **LED and Resistor:** LEDs simulate the ON/OFF condition of light and fan for testing without AC loads.
   A 220 Ω resistor limits the current through the LED to prevent damage.

   Specifications:
   - Forward Voltage: 1.8–2.2 V
   - Current Rating: 20 mA
   - Series Resistor: 220 Ω
5. **Blynk:**
   These platforms are used for real-time data monitoring and control via internet.
   NodeMCU sends sensor data and appliance status to the cloud, where it is displayed on a mobile or web dashboard.
6. **Breadboard and Jumper Wires**
   Used to create the prototype circuit conveniently. No soldering is needed; components can be easily replaced or rearranged during testing.

Block Diagram of Designed Model:

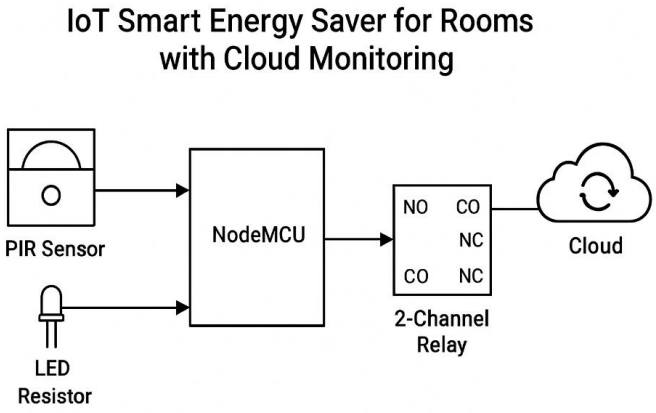


Figure 2 : Block Diagram of Model

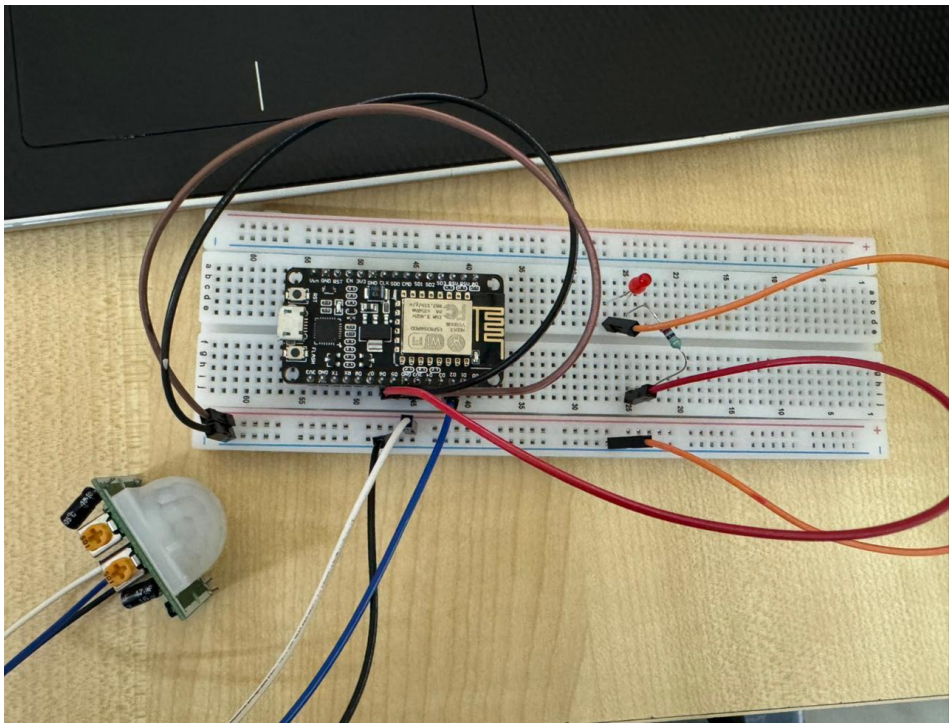
Working of Designed Model:

The working of the IoT Smart Energy Saver system is based on automatic detection of human presence using a PIR sensor, control of appliances through a relay module, and real-time monitoring via cloud connectivity using NodeMCU.

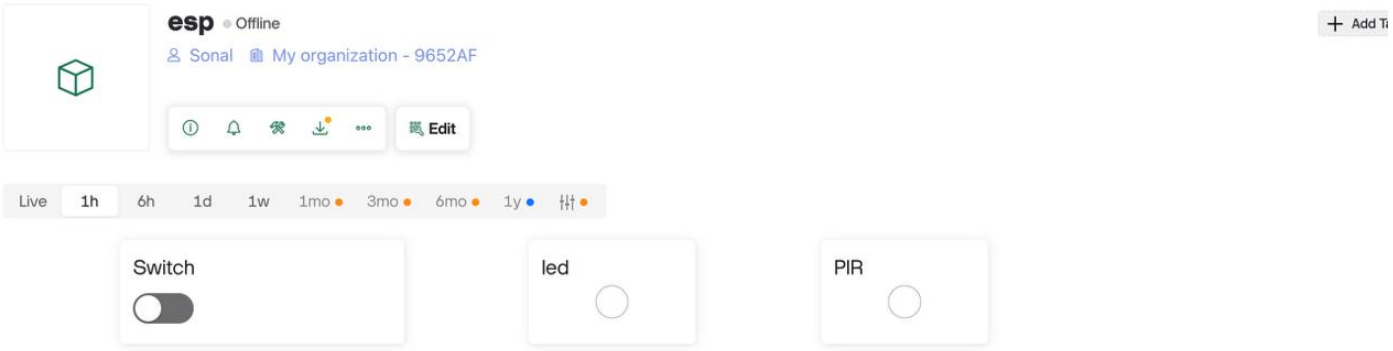
- Detection of Motion: The Passive Infrared (PIR) sensor continuously monitors the room for any motion. When a person enters the room, the sensor detects the infrared radiation emitted by the human body and sends a HIGH signal to the NodeMCU.
- Signal Processing by NodeMCU: The NodeMCU receives the signal from the PIR sensor through its digital input pin. Based on the received input, the microcontroller decides whether to turn ON or OFF the connected devices (LEDs, lights, or fans).
- Automatic Device Control: When motion is detected, the NodeMCU sends a HIGH signal to the corresponding relay channel, activating the connected devices (e.g., fan and light). If no motion is detected for a specific period (e.g., 2 minutes), the NodeMCU sends a LOW signal to the relay, turning OFF the devices automatically.

- Cloud Monitoring: The NodeMCU is connected to Wi-Fi and communicates with an IoT cloud platform (such as Blynk). The system uploads the current status of the devices (ON/OFF) and motion detection data to the cloud. Users can monitor and control the appliances in real time using a mobile or web dashboard.
- Energy Efficiency: By automatically switching OFF appliances when the room is unoccupied, the system significantly reduces unnecessary energy consumption and promotes sustainable power usage.

Pictures of Prototype:



Output of Deigned Model/Prototype (Paste Images of output)



Learning outcomes (What I have learnt):

1. Gained practical knowledge of integrating sensors and actuators with IoT devices.
2. Learned how to use NodeMCU for real-time data communication and cloud monitoring.
3. Understood the working principles of PIR sensors and relay modules for automation.
4. Developed skills in designing energy-efficient smart systems using IoT.
5. Acquired hands-on experience in circuit design, coding, and cloud-based control