# 1. Objective

To design a smart home automation system using digital logic and a microcontroller that controls appliances based on motion and light conditions, with added remote access and power-saving features.

# 2. Components Used

* ESP32 / NodeMCU / Arduino Uno - Main controller
* PIR Motion Sensor - Detects movement
* LDR (Light Dependent Resistor) - Measures ambient light
* Relay Module or LED - Switches light/fan
* Breadboard + Jumper Wires - Prototyping
* USB Cable - Programming + Power
* (Optional) HC-05 / Wi-Fi Module - Remote control

# 3. Working Principle

The system uses an AND logic: if motion is detected AND ambient light is low, the system turns ON the connected device.

It turns OFF automatically after a period of inactivity. Remote control can be added via Bluetooth or Wi-Fi. **4. Block Diagram**

[PIR Sensor] ----\

| --> [Relay Module] --> [Light/Fan]

[LDR Sensor] ----+--> [AND Logic] --> [Microcontroller] --> [Wi-Fi/Bluetooth Module (Optional)]

# 5. Arduino Code (Snippet)

const int pirPin = 2; const int ldrPin = A0; const int relayPin = 8; const int lightThreshold = 600; unsigned long lastMotionTime = 0; const unsigned long autoOffDelay = 2 \* 60 \* 1000;

void setup() { pinMode(pirPin, INPUT); pinMode(relayPin, OUTPUT); digitalWrite(relayPin, LOW);

Serial.begin(9600);

}

void loop() { int motion = digitalRead(pirPin); int lightLevel = analogRead(ldrPin);

if (motion == HIGH && lightLevel < lightThreshold) { digitalWrite(relayPin, HIGH); lastMotionTime = millis();

}

if (digitalRead(relayPin) == HIGH && millis() - lastMotionTime > autoOffDelay) { digitalWrite(relayPin, LOW);

}

delay(500);

}

# 6. Power Optimization Techniques

* Auto turn-off logic reduces power wastage.
* Sleep mode in ESP32 can be enabled when idle.
* Output is controlled only when required.

# 7. Applications

* Smart homes
* Automatic garden lighting
* Energy-efficient office spaces
* IoT-based home safety systems

# 8. Internship Details

Internship Title: 1-Month Digital Electronics & VLSI

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# 9. Submitted By

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