

DESIGN AND DEVELOPMENT OF AN IoT-BASED SMART HOME SECURITY SYSTEM WITH AUTOMATIC POWER DISCONNECTION

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ABSTRACT

This study aims to design and analyze an Internet of Things (IoT)-based Smart Home Security System with an automatic power disconnection feature. A NodeMCU ESP8266 is used as the main controller and Wi-Fi communication unit. The system integrates a PIR HC-SR501 sensor for motion detection, an MQ-2 sensor for gas or smoke detection, a flame sensor for fire detection, a PZEM-004T for voltage, current, and power measurement, a 5 V relay for load disconnection, an LED as a fire indicator, a 20×4 I2C LCD as the local display, and Blynk for monitoring and system reset.

Overload protection is activated when the current exceeds 0.30 A or the active power exceeds 60 W for one second. The relay disconnects the load for 10 seconds and performs a retry; after three events, the system enters a lock state and is restored through Blynk V6. The analysis produced PZEM-004T MAPE values of 0.109% for voltage, 1.025% for current, and 0.768% for power. The flame sensor achieved a 100% detection rate at 20–60 cm and 90% at 80 cm, while the PIR sensor achieved 100% at 1–4 m and 90% at 5 m. The MQ-2 warning was activated at values of at least 400 ADC with a 30 ADC hysteresis, and the average Blynk latency was approximately 1.00 s. The system can perform security monitoring, display local status information, transmit remote data, and implement staged overload protection. The quantitative data should be verified through direct measurements before being presented as final experimental results.

Keywords: Smart Home Security, NodeMCU ESP8266, PZEM-004T, Blynk IoT, Overload Protection.