DESIGN AND IMPLEMENTATION OF AN INTERNET OF THINGS-BASED SMART HOME SYSTEM USING ESP32 AND TELEGRAM

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ABSTRACT

The development of Internet of Things (IoT) technology is driving the implementation of smart home systems as a solution to improve the security, comfort, and efficiency of electrical devices in the home environment. This research aims to design and implement an IoT-based smart home system using a NodeMCU ESP32 integrated with the Telegram application for remote monitoring and control. The developed system uses a DHT22 sensor to measure temperature and humidity, an MQ-2 sensor to detect gas leaks, a flame sensor to detect fires, and an LDR sensor to detect light intensity. The actuators used include lights, fans, buzzers, and water pumps.

The research methodology encompasses system design, hardware and software implementation, and system testing on a mini-home prototype. The system implements threshold-based control with a delay (hysteresis) to maintain actuator stability and prevent frequent device status changes. Furthermore, the Telegram notification mechanism is designed to only send notifications when significant changes occur.

Test results show that the system is capable of monitoring environmental conditions and controlling devices automatically and manually via Telegram with a stable response. The application of the hysteresis method reduces repetitive actuator work and improves user convenience through minimal notifications. Based on these results, the developed smart home system functions well and has the potential to support efficient electrical energy use, although quantitative energy consumption measurements have not yet been conducted. This system is expected to serve as a reference in the development of more reliable and applicable IoT-based smart home systems.

Keywords: Internet of Things, Smart Home, ESP32, Telegram Bot, Hysteresis