Smart Home

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Abstract

In today's fast-paced digital world, smart home automation has become an essential aspect of modern living, offering convenience, security, and energy efficiency. However, many existing solutions require expensive rewiring, proprietary ecosystems, or complex installations, making them inaccessible to a large segment of users.

This project aims to bridge this gap by providing an affordable, retrofit smart home solution that allows users to control their electrical appliances remotely over the internet and locally via WiFi. The system is built using an ESP8266 microcontroller, enabling WiFi connectivity and relay control for switching appliances on and off.

The mobile application, developed using Android Jetpack Compose, provides users with a seamless interface to monitor and control their devices in real time. Communication between the devices and the mobile app is handled via MQTT, hosted onan AWS EC2 server running a Mosquitto MQTT broker, ensuring secure, low-latency, and reliable data exchange. During the development and testing phases, the Arduino UNO and ESP32 were initially used to validate the communication between microcontrollers and relays. However, the final version integrates all functionalities within a compact, power-efficient, and scalable ESP8266-based PCB.

Key Features: Remote and local control: Supports cloud-based MQTT communication and offline WiFi-based operation.

Secure Authentication: Device binding via a unique serial number, preventing unauthorized access.

Seamless Onboarding: Bluetooth-based WiFi provisioning for quick and hassle-free setup.

Multi-Device Access: Users can control appliances from multiple smartphones by logging into their accounts.

Scalable Design: Modular PCB architecture supporting multiple relay configurations.

Unattended Automatic Plant Watering: Intelligent humidity monitoring and pump control allow automated water supply to plants without manual intervention.

This project delivers a cost-effective, scalable, and user-friendly smart home automation solution thatenables homeowners to modernize their living spaces without rewiring or investing in expensive smart appliances. With future enhancements such as voice control integration, AI-based automation, and energy monitoring, it holds strong potential to become a widely adopted standard for affordable smart living.

Keywords

Smart IoT Client, Remote Appliance Control, MQTT Protocol, Cloud-Based Control, PCB, Affordable Smart Home, Relay Control, Automatic Plant Watering.