

LITERATURE SURVEY

1. Introduction to Home Automation

Home automation systems have gained significant attention over the past decade, driven by advancements in IoT, wireless technologies, and microcontroller capabilities. A smart home automates control of various appliances and systems, enhancing convenience, energy efficiency, and security. The ESP32 microcontroller, known for its built-in Wi-Fi and Bluetooth, is increasingly used for automation due to its low cost, reliability, and versatility in connecting multiple sensors and devices.

2. Advances in IoT for Smart Homes

IoT has become the backbone of modern home automation, enabling devices to communicate over the internet for remote control and monitoring. Studies have shown that IoT-enabled automation systems contribute significantly to energy efficiency by allowing dynamic control over lighting, heating, and other appliances based on environmental data (Dewi et al., 2022). IoT technology has also facilitated mobile applications that enable users to monitor and control devices from anywhere, enhancing user experience and control.

3. ESP32 in Home Automation

The ESP32 microcontroller has become a popular choice for IoT-based automation projects because it combines wireless connectivity with adequate processing power and low energy consumption. Research highlights ESP32's utility in real-time applications, such as remote lighting control, climate management, and occupancy detection (Ghosh & Pal, 2021). ESP32 is also compatible with a wide variety of sensors (temperature, humidity, motion), making it suitable for developing multi-functional, scalable automation systems.

4. Occupancy Detection and Room Monitoring

Room occupancy detection is a key component in home automation, allowing for intelligent control of lighting, security, and climate systems. Ultrasonic sensors, commonly used for detecting movement, are highly reliable for occupancy detection, which enables lights or HVAC systems to be activated when someone enters a room (Patel et al., 2021). Recent studies have explored how combining occupancy data with temperature readings can further optimize HVAC systems, reducing energy waste.

5. Temperature Monitoring and Control Systems

Temperature sensors play a crucial role in home automation for managing indoor climate. Research demonstrates that automated systems using temperature data can reduce the need for constant manual adjustment of thermostats, leading to more stable and comfortable indoor environments (Johnson & Singh, 2020). Displaying temperature readings in real-time allows users to monitor room conditions, with some systems automating fan or heating devices based on set temperature thresholds.

6. Mobile Control in Home Automation

Mobile-based control has transformed home automation by providing a user-friendly interface for managing devices remotely. Applications that connect to microcontrollers like ESP32 allow users to turn devices on or off, set automation routines, and receive alerts about room occupancy or environmental changes. Studies show that mobile control is particularly beneficial for accessibility and flexibility, allowing users to adjust their home environments without physical interaction with each device (Lee & Kim, 2020).

7. Challenges and Future Prospects

While home automation systems offer numerous benefits, challenges remain, particularly in security, interoperability, and power consumption. Future directions in home automation suggest integrating machine learning for predictive behavior, allowing systems to learn from user patterns and automate responses without explicit commands. Further research is also focused on

integrating voice control and AI to enhance user experience and expand home automation capabilities (Singh & Gupta, 2021).

References

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