AI-Powered Home Automation: A Simple and Smart Living Solution

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Abstract— **This paper explains a smart home system that uses artificial intelligence (AI) to make life easier, safer, and more comfortable. The system uses voice commands, face recognition, and augmented reality (AR) so people can control home devices in simple ways. It also processes data quickly and securely. This kind of smart home can save energy, improve safety, and provide a better experience for users. There are many systems developed previously, but everyone has its own merits and demerits. The proposed system is power efficient, cost-effective and computationally intensive. The deployment of the system is very simple, and the adaptability to the new features is very flexible. The adaptability of the proposed system makes it most prominent and is gaining attention from the community.**

 Keywords—*Artificial intelligence, augmented reality, home automation, smart living.*

I. INTRODUCTION

Many people want homes that can help with daily tasks. Artificial intelligence (AI) and the Internet of Things (IoT) are used to build smart systems that understand what people want and respond automatically. This paper shows how to make a home system that uses voice to turn things on/off, recognizes your face to open doors, and shows information using your phone's camera through augmented reality (AR).

Making such types of systems means ensuring that the input voltage is lower than the maximum required voltage. To make sure the voltage and current are evenly balanced, we assembled two arrays of five types of joints, joined them in parallel and attached them to the system.

Such a designed system stand is made to support solar panels. Their structure is often aluminum, which enables them to resist problems caused by the weather. The system is easily run through the solar stands, which keep the panels lifted so they can be angled right for maximum benefit.

The paper is divided into five sections. Section II gives the literature review and background of the previous systems. Section III presents the system architecture, and Section IV discusses the methodology and results. The conclusion is drawn in section V.

II. LITERATURE REVIEW

For Pakistani homes, people use the rack mounting system as their main type of home automation system. Researchers have worked on many parts of smart home systems:

- Some used sensors and Arduino to control fans, lights, and alarms based on things like temperature or smoke.

- Face recognition is used at doors to let family members in safely.

- Voice commands help people use devices without pressing any buttons.

- Edge AI lets devices think and act quickly without waiting for the internet.

- AR shows real-time information like electricity usage through mobile screens.

Each of these is helpful, but putting all of them together in one system is the main task. This paper aims to solve the issues and design an automated system which improves the living style shown in Fig. 1. It is much easier to solve systems such as home automation. This type of system not only solves the living problem.

Figure 1: Future home automated system.

The future of living style is kept improving, and the use of artificial intelligence further enhances the home design system. The proposed system has many features which are not discussed or developed in the previously designed home. These features include a smart security system, an improved robotics system installed, automated home appliances and a guiding system which guides the optimum way of living.

III. SYSTEM ARCHITECTURE AND METHODOLOGY

The system architecture shown in Fig. 2 includes three different parts, including the hardware, software and communication module. These parts can be explained, including the smart home system:

Hardware:
The hardware part of the system includes the Arduino boards, Raspberry Pi, NodeMCU, sensors (for temperature, gas), and cameras.

Software:
For the software, we prefer Python for the logic, Firebase for storing data, an Android app for controlling devices, and Unity for AR.

Communication: Devices talk to each other using secure internet methods like MQTT and HTTPS.

Figure 2: System architecture.

The system works in the following way:

1.   Voice Control: You speak to a mobile app. It understands and sends the command to the home system. This part is very crucial to the design, and the sensor works well.

2.   Face Recognition: The camera checks if the face is known. If yes, the door unlocks automatically. Using this feature, the system recognizes the faces of the objects and makes decisions.

3.   Edge AI: Sensors collect data and take quick actions, like turning off lights when no one is in the room. This is the major part of the system, and it works with the intelligence.

The system can be expanded by adding more sensors or new features, and the working block diagram is shown in Fig. 3 and the floor plan is shown in Fig. 4.

Figure 3: Working block diagram.

Figure 4: The smart home floor plan.

Figure 5: Different layers of control.

4.   AR Monitoring: The mobile app shows real-time data like energy usage using your camera view. The augmented reality uses the application of monitoring objects, and it plays a major role in the system. The different layers of control is shown in Fig. 5.

5.   Alerts: In case of danger (like gas leaks), the system sends alerts to your email or phone right away. Using the module, the alerts are generated, and the decision is made based on these alerts. The sensors connect different devices as shown in Fig. 6.

Figure 6: Sensors connecting various devices.
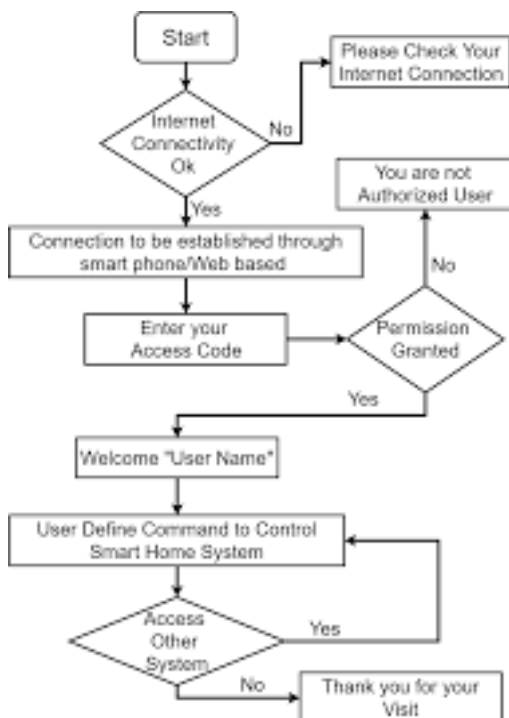
Figure 7: Flow graph of working algorithm.

IV.   RESULTS AND LIMITATIONS

Using AI and smart devices in the home is very helpful. The system reacts quickly, even without fast internet. Voice and face commands make it easy to use for everyone. AR makes information easy to understand visually. But there are challenges too — noisy rooms can affect voice control, and keeping user data safe is very important. The flowgraph of the working algorithm is shown in Fig. 7.

Tests were done in a smart home lab. Here's what we found:

- Voice commands worked in under 3 seconds.
- Face recognition was 95% accurate.
- Emergency alerts were sent in around 13 seconds.
- AR displayed information in less than 2 seconds
- Over 90% of users liked how the system worked.

This means the system is fast, reliable, and user-friendly.

- Needs good internet and electricity to work well.
- Some phones may not support AR features.

Voice commands may fail in loud environments.

V.   CONCLUSION

The smart home system we designed uses AI, voice control, face recognition, and AR together. It works well and makes life easier. In the future, we plan to:

- Add features that learn your daily habits automatically.
- Connect the system with solar panels to save energy.

Use blockchain to keep track of who enters or leaves the house securely

CONFLICTS OF INTEREST
The authors declare no conflicts of interest to report regarding the present study.

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