

Artificial Intelligence Based Smart Home Energy Management System

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ABSTRACT- A home automation system controls temperature, multimedia systems, lighting, and appliances. Since these devices and sensors are connected to common infrastructure, they form the Internet of Things. A home automation system links multiple controllable devices to a centralized server. These devices have a user interface for controlling and monitoring, which can be accessed by using a tablet or a mobile application, which can be accessed remotely as well. Ideally, anything that can be connected to a network can be automated and controlled remotely. Smart homes must be artificially intelligent systems that need to adapt themselves based on user actions and surroundings. These systems need to carefully analyze the user needs and the conditions of the surroundings in order to predict future actions and also minimizes user interaction. Traditional home automation systems that provide only remote access and control are not that effective in terms of being 'smart', so in this paper we put forward the use of concepts of different machine learning algorithms along with computer vision to shape together a smart learning automated system that controls lighting, sound and other devices based on the user's emotion.

Keywords-Machine learning(ML), AI(Artificial intelligence), Smart home(SM), Internet of things (IoT), MQTT, Raspberry pi

INTRODUCTION OF PROPOSED SYSTEM

PROPOSED SYSTEM

The suggested method optimizes household energy use using IoT and machine learning, increasing financial savings and environmental advantages. The main part is a Raspberry Pi board, which is connected to lights, fans, and air conditioners with a 3-channel relay board. A Python-based machine learning model processes the real-time data on environmental variables and electricity use collected by the Raspberry Pi. The system can intelligently manage appliances thanks to this model, which was trained on historical data to forecast future patterns of electricity demand. The technology automatically turns appliances on or off based on these estimates, saving energy without sacrificing comfort.



Fig 1. Architecture of proposed system

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Users can also remotely operate appliances, monitor energy consumption, and receive notifications with an IoT-based messaging app. Customers who use this service can remotely regulate how much energy their home uses and get real-time analytics to help them make energy management decisions. The technology provides a more advanced method of managing household energy by combining AI for predictive analysis with IoT for data collecting and remote control. All things considered, this creative approach supports sustainable living objectives by lowering the home's carbon footprint and utility costs. In this project we are using raspberry pi 4 as a brain of our Project. Raspberry pi is a Microcomputer which has Linux as its Operating system.

MACHINE LEARNING

Machine learning is generally a training system to learn from past experiences and improve performance over time. Machine learning helps to predict massive amounts of data. It helps to deliver fast and accurate results to get profitable opportunities. In this project we are going to use regression method of ML.

Regression Method:

Regression algorithms are used to predict a continuous numerical output. In our project this technique predicts the energy consumption at that time from a remote place i.e. lower, medium or higher consumption of energy. Using this prediction we can control the energy devices in our house.

TOOLS AND TECHNOLOGY USED

Python Raspberry Pi OS - Linux Geany app in Raspberry pi Pycharm IDE compiler- Python 3.8

MQTT IOT server

EXPERIMENTAL SET UP



Fig 2 Experimental set up

RESULTS

The Raspberry Pi has proven to be a dependable central hub for the automation system. When the system is welldesigned, it runs smoothly and has little downtime. The Raspberry Pi can manage several tasks without freezing or crashing with the aid of a dependable power source and a top-notch SD card. To prevent any service interruptions, it is essential to confirm that every component is compatible and configured appropriately.

The Raspberry Pi-based home automation system has the potential to revolutionize the way we live. Its advantages in terms of security, energy efficiency, and simplicity make it an attractive option for modern households. Despite the challenges, the overall results suggest that a Raspberry Pi-based home automation system can greatly improve users' quality of life by purposefully simplifying and automating everyday work planning and execution.





Fig. MQTT Internet Protocol

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CONCLUSIONS

A Raspberry Pi-based home automation system is an efficient and cost-effective solution to remotely control household equipment. The system, which includes components such as the Raspberry pi, the ESP8266 for Wi-Fi connectivity, and relay boards, allows for seamless communication between users and appliances (such as fans, LEDs, and lamps) via an Internet of Things-compatible mobile app. Using Python-based machine learning methods to improve electricity usage projections increases energy efficiency. The system's real-time control, monitoring, and data analysis capabilities make it a valuable, scalable smart home solution that improves daily life while also encouraging environmentally friendly energy management behaviors. Machine learning algorithm used for prediction of energy used in smart homes is a very useful technique to control the use of energy. Also using MQTT mobile application helps to manage the energy control from remote places.

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