**BATCH-16**

**RESIDENTIAL ENERGY SAVING**

**Abstract:**

This project is about creating a smart platform to help people save electricity at home. It uses Python and machine learning to study how much energy is being used, predict future usage, and find where energy is being wasted. The platform gives real-time tips to reduce electricity use. It has a simple dashboard built with Streamlit, and it runs on Microsoft Azure cloud. This helps people save money and use energy more efficiently.

**Objective:**

To build a smart platform that helps monitor home energy usage, predict future consumption, and give useful tips to reduce energy waste using AI and real-time data.

**Introduction:**

This project aims to build an AI-powered platform that helps people track and manage their home energy usage. It uses machine learning to analyze energy data, forecast future consumption, and give real-time tips to save energy. The platform is built with Python, Scikit-learn, Streamlit for the interface, and Azure for cloud deployment.

**Problem Statement:**

Households often struggle to track and manage their energy usage, leading to high electricity bills and energy wastage. There is a need for a smart system that can analyze energy consumption patterns, predict future usage, and give simple tips to help save energy and reduce costs.

**Key Features:**

**📊Energy Usage Monitoring** – Tracks household energy consumption in real-time.

**📈Forecasting** – Predicts daily and weekly energy usage using ML models.

**⚠Inefficiency Detection** – Alerts users about abnormal or high consumption.

**💡Smart Recommendations** – Suggests ways to reduce energy wastage.

**🖥 User-Friendly Dashboard** – Interactive visuals built with Streamlit.

**Technologies used:**

* Python – for backend logic and ML models
* Scikit-learn – for building machine learning models
* Streamlit – for creating the user interface (web app)
* Azure – for cloud deployment and storage
* Pandas & NumPy – for data analysis and processing
* Matplotlib / Seaborn – for data visualization
* SQL / Azure Table Storage – for storing energy data

**Future Scope:**

In the future, the platform can be enhanced by integrating NLP and large language models (LLMs) to allow users to ask energy-related questions through voice or chat. It can also include real-time data from IoT-enabled smart devices for appliance-level monitoring.

**Architecture Diagram:**

Smart Meter Data

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Azure Storage

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Python + Scikit-learn (ML)

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Optimization Engine

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Streamlit Dashboard

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User

**UML Diagram Code:**

@startuml

actor "User" as U

actor "IoT Device" as D

actor "System Admin" as A

rectangle "Smart Energy Saver System" {

usecase "Register/Login" as UC1

usecase "Monitor Energy Usage" as UC2

usecase "Predict Consumption" as UC3

usecase "Control Appliances" as UC4

usecase "Get Energy Tips" as UC5

usecase "Manage Users" as UC6

}

U --> UC1

U --> UC2

U --> UC3

U --> UC4

U --> UC5

D --> UC2

A --> UC6

@enduml

**UML Diagram:**

