PROJECT PROPOSAL

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Module Name: UNDERGRADUATE PROJECT

Project Title: AI-DRIVEN ENERGY OPTIMIZATION SYSTEM FOR SMART BUILDINGS

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Table Of Contents

List Of Figures

1. Background of the Study

Building energy consumption constitutes a large percentage of total energy consumption across the world, and its effects on the environment are very high. This consumption is one of the major determinants that should be reduced to ensure sustainability, and smart building technologies offer practical solutions to the problem by implementing the use of intelligent monitoring, data analytics, and energy optimization strategies.

This project is based on an AI-driven model that utilizes the historical data of energy consumption in CSV files as the main input. This data is analyzed by the system to determine patterns, forecast future energy consumption, and make implementable recommendations on how to maximize the efficiency of energy consumption. Through historical evidence, the project shows how AI can make informed decisions in order to minimize energy waste.

In practice, these data would be gathered by using IoT sensors and devices. Nevertheless, to have the scope of the academic research and the practical aspect of this project, some inputs of the IoT are simulated with the use of CSV files. The system is capable of integrating AI, predictive modeling, and data analytics to offer useful insights on how to increase energy efficiency without necessarily developing complex and expensive IoT systems.

2. Aim

The proposed theory aims to develop an AI-based system that predicts the energy consumption in smart buildings and provides fact-based recommendations to increase energy efficiency.

3. Study Objectives

A. Collect and refine past energy consumption data (CSV).
B. Forecast energy through the creation of a Random Forest regression model.
C. Build a Streamlit dashboard and visualize and derive insights.
D. Add a GPT-powered chat-based energy-saving recommendation chatbot
E. Performance of the system in comparison with MAE and RMSE measures and usability.

4. Research Gap

The existing research is concerned mostly with real-time energy monitoring with the use of IoT. There is a lack of research on the use of AI-assisted energy prediction by the use of offline data with an interactive recommendation system. The gap is filled in this project by incorporating:

A. Predictive modeling using Random Forest regression
B. A user-friendly **Streamlit dashboard** for data visualization
C. A GPT-powered chatbot to provide actionable energy-saving suggestions

This combination demonstrates how AI-driven insights can be provided even in the absence of live IoT inputs, using CSV data as a realistic substitute.

5. Research Problem / Questions

1. To what extent can AI models predict building energy consumption using past CSV data?
2. What are the possible practical recommendations to maximize energy efficiency?
3. How useful is the system availability of data in the absence of real-time IoT data, with the use of CSV data?

6. Research Strategy

A. Machine learning with historical data: supervised with data.

B. Streamlit dashboard based on the web, and visualization and interpretation.

C. Guidance with conversational AI based on the GPT API.

D. Predictive accuracy and usability testing, and refinement through iterative means.

7. Research Method

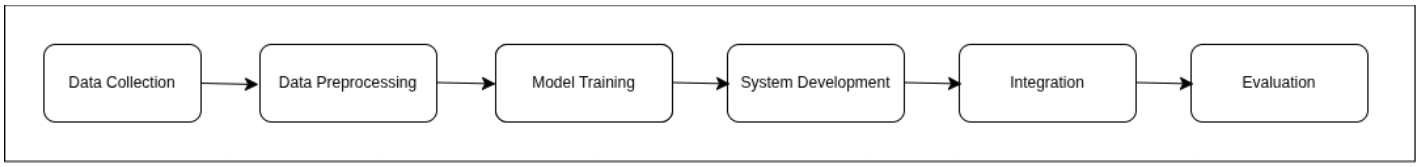

Figure 1:Research Method

Phase	Method
Data Collection	Gather historical CSV datasets on building energy usage
Data Preprocessing	Clean, normalize, and prepare features for modeling
Model Training	Train a Random Forest regression model in Python
System Development	Build a Streamlit dashboard with charts and predictions
Integration	Connect GPT API for energy-saving recommendations
Evaluation	Assess model performance using MAE, RMSE, and gather user feedback

8. Project Plan

Phase	Description	Duration	Timeline
Literature Review	Study past research, identify energy optimization methods & AI models	2 weeks	Week 1 – Week 2
Data Collection	Gather energy consumption datasets (CSV from Kaggle / simulated inputs)	3 weeks	Week 1 – Week 3
Data Analysis	Clean data, feature engineering, correlation analysis	3 weeks	Week 2 – Week 4
System Design	Design ML workflow, Streamlit UI, chatbot integration plan	3 weeks	Week 3 – Week 5
System Development	Build an AI model, create a Streamlit dashboard & chatbot integration	4 weeks	Week 4 – Week 7
Testing & Evaluation	Test model accuracy (MAE, RMSE), validate UI & chatbot output	3 weeks	Week 6 – Week 8
Report Writing	Prepare documentation, results analysis, screenshots, and future work	8 weeks	Week 1 – Week 8

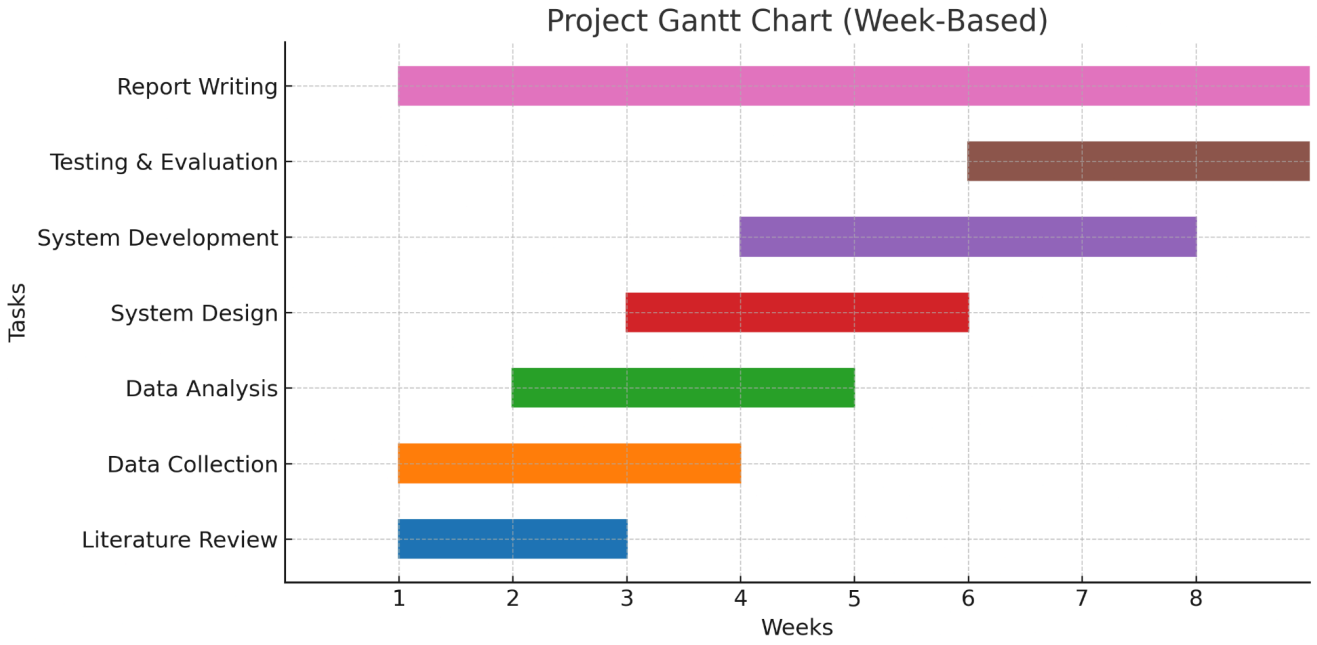

Figure 2:Gantt Chart

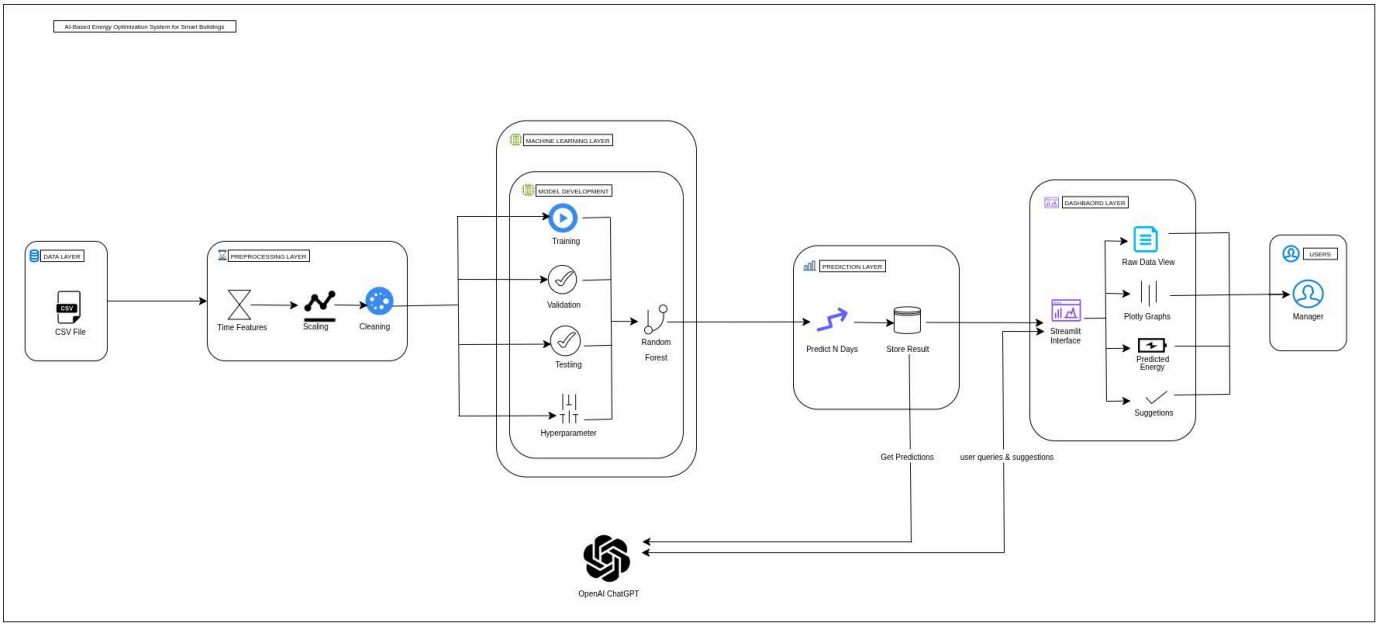

Figure 3:Software Architecture Diagram

9. Required Resources / Budget

Item	Description
Development Tools	Python (pandas, scikit-learn), Jupyter Notebook
Frontend	React, a charting library for visualization
AI API	GPT API subscription for chatbot functionality
Hardware	Laptop or PC for development and testing
Data	Open-source or simulated CSV energy consumption datasets
Budget	Minimal, mostly for software subscriptions or API usage

10. References

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