CAPSTONE PROJECT

SMART HOME ENERGY ADVISOR AGENT

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OUTLINE

- **Problem Statement** (Should not include solution)
- **Proposed System/Solution**
- **System Development Approach** (Technology Used)
- **Algorithm & Deployment**
- **Result (Output Image)**
- **Conclusion**
- **Future Scope**
- **References**

PROBLEM STATEMENT

In modern households, electricity consumption often goes unmonitored, leading to unexpectedly high utility bills and inefficient energy use. Despite the availability of smart meters and IoT-enabled appliances, most users lack the tools or expertise to interpret this data and take informed actions. There is a need for an AI-powered assistant that can analyze household energy consumption, explain causes for high usage, and suggest actionable energy-saving tips in a user-friendly manner.

PROPOSED SOLUTION

The proposed system aims to address the challenge of understanding and optimizing electricity consumption in smart homes by analyzing energy usage data and providing personalized, real-time recommendations. This involves leveraging data analytics and advanced AI models (IBM Granite) to respond to user queries such as *"Why is my electricity bill high?"* and *"How can I reduce usage during peak hours?"* The solution will consist of the following components:

1. Data Collection:

- Collect historical and real-time smart meter data, including timestamps, appliance usage, energy consumption (in kWh), and cost rates.
- Integrate additional context such as time of day, day of the week, and peak/off-peak hour information.

2. Data Preprocessing:

•Clean and preprocess the collected data to handle missing values, noise, and inconsistencies.

•Perform feature engineering to extract meaningful attributes such as:

- Appliance-wise usage percentage
- Daily/weekly consumption patterns
- Peak hour activity
- High-cost consumption trends

3. AI Model Integration:

•Use the Granite-3B or 13B-instruct foundation model via IBM Watsonx Prompt Lab.

•Design prompts that summarize energy insights and query context, allowing the agent to:

- Explain energy consumption behavior
- Identify high-usage appliances or times
- Provide energy-saving tips

4. Deployment:

•Build a simple front-end interface (e.g., using Streamlit) that allows users to:

- Upload energy usage data
- Ask queries in natural language
- View the agent's personalized advice

•Deploy the application on a cloud platform like IBM Cloud Lite for scalability and accessibility.

5. Evaluation:

•Evaluate the accuracy, relevance, and clarity of the agent's responses through:

- User feedback and satisfaction scoring
- Comparison with domain expert advice
- Testing across different usage scenarios and datasets

•Continuously improve prompt engineering and feature selection based on performance.

SYSTEM APPROACH

- **loud Platform:** IBM Cloud Lite
- **Foundation Model:** IBM Granite 3B/13B-instruct
- **Development Tools:** Watsonx.ai Studio, Prompt Lab, Python Notebooks
- **UI:** Streamlit (optional)
- **Data Format:** CSV logs from smart meters

System Requirements:

- **Hardware:**
  - Intel i5 or above
  - 8 GB RAM or higher
  - Internet connection for cloud access
- **Software:**
  - Python 3.8+
  - IBM Watsonx account
  - Jupyter or Streamlit environment
  - Optional: Git for version control

ALGORITHM & DEPLOYMENT

- **Algorithm Selection:**

  - No traditional ML model is used. Instead, the system uses IBM Granite's prompt-based reasoning to analyze preprocessed energy data and generate insights based on user input.

- **Data Input:**

  - Time-stamped appliance energy usage.

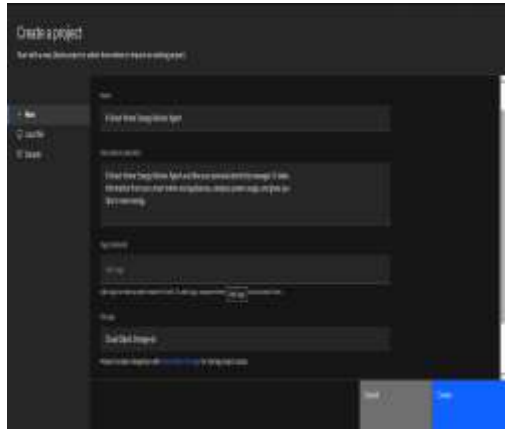
- **Prompt Example:**

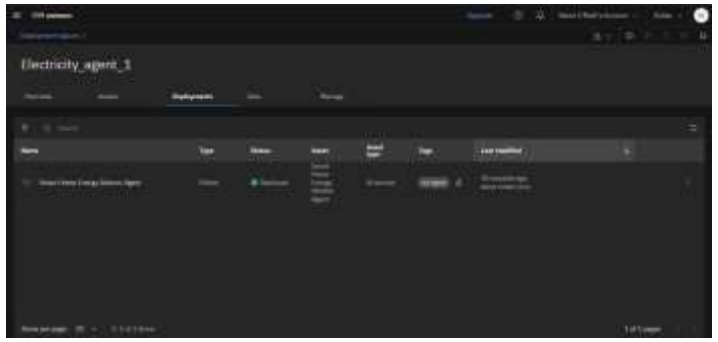
  - Based on this data: [summary], why is the electricity bill high this month?

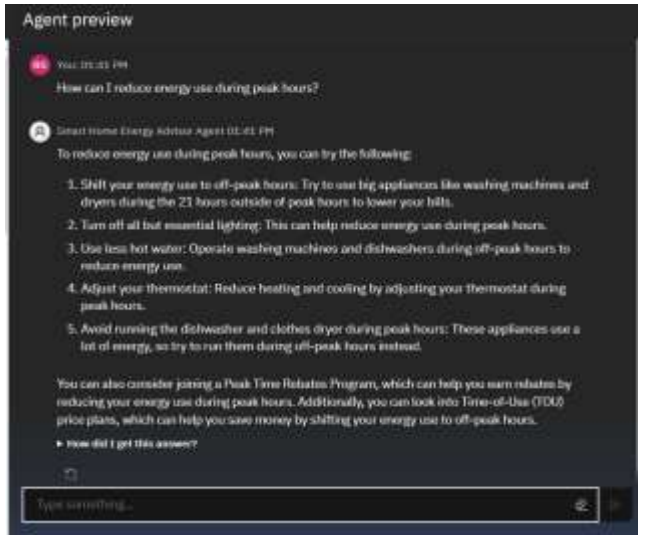
- **Deployment:**

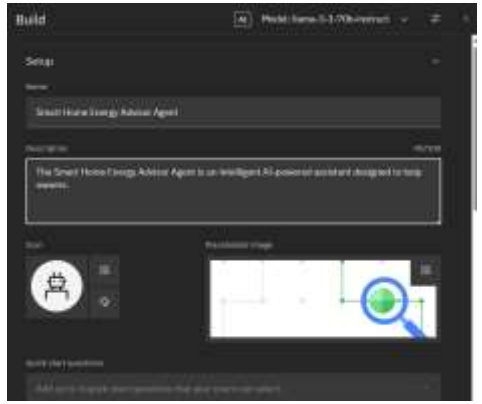
  - Deployed using IBM Watsonx Prompt Lab

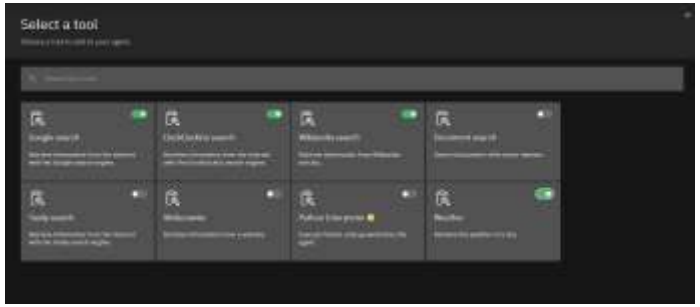
RESULT

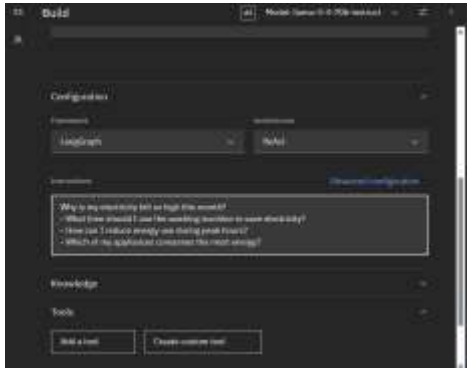












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CONCLUSION

The Smart Home Energy Advisor Agent successfully demonstrates the potential of AI to make household energy management accessible and actionable. It provides users with customized tips and helps reduce unnecessary energy costs using IBM’s Granite foundation model.

FUTURE SCOPE

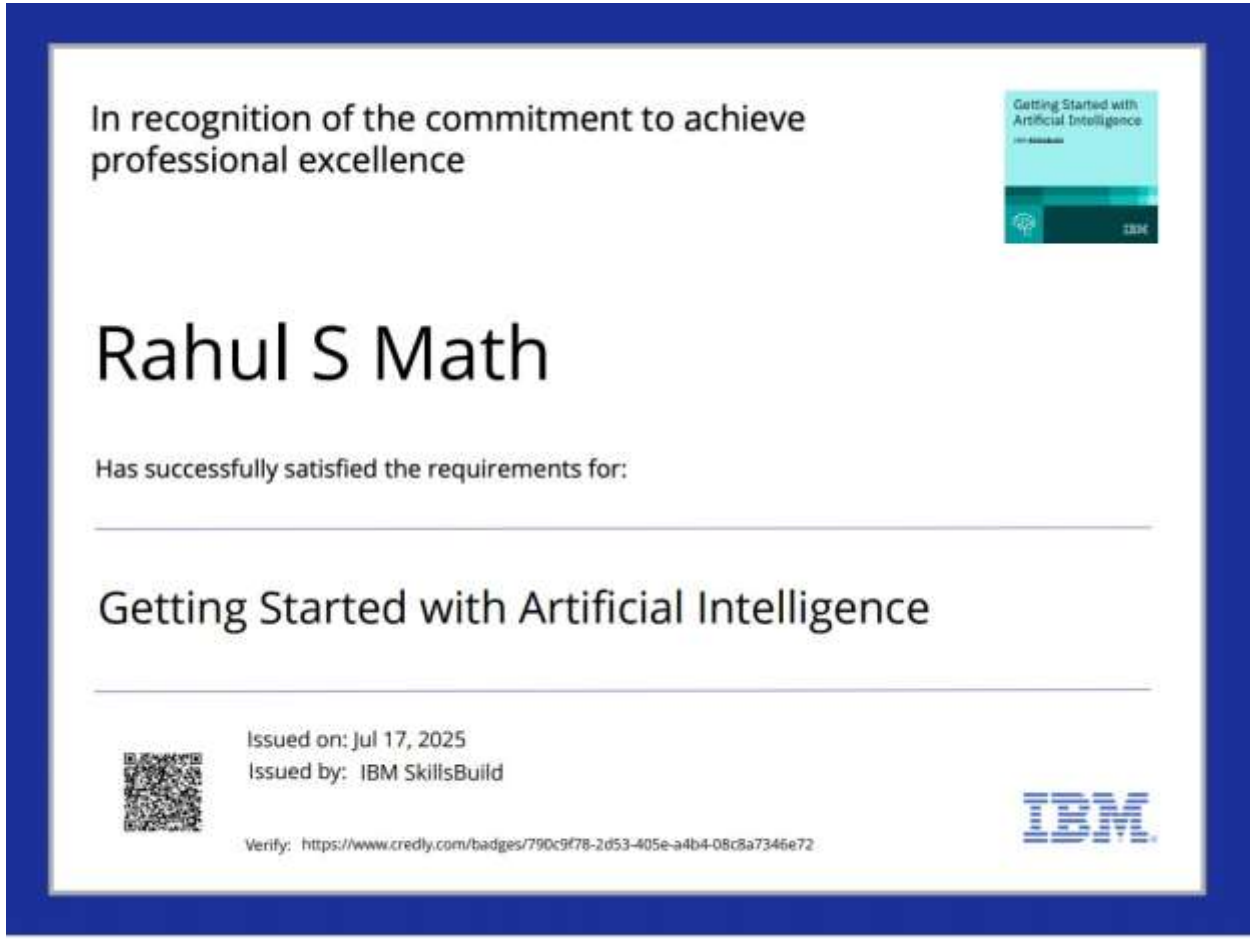
- Integration with real-time IoT data from smart devices
- Predictive alerts before bill spikes occur
- Voice assistant support (Alexa, Google Home)
- Adding solar energy and battery optimization modules
- Use of geolocation and weather forecasts for smarter insights

REFERENCES

- IBM Watsonx.ai Documentation
- IBM Granite Model Overview
- Python Pandas & Streamlit Docs
- Research on AI-powered home energy management systems
- IBM Cloud Lite project guides

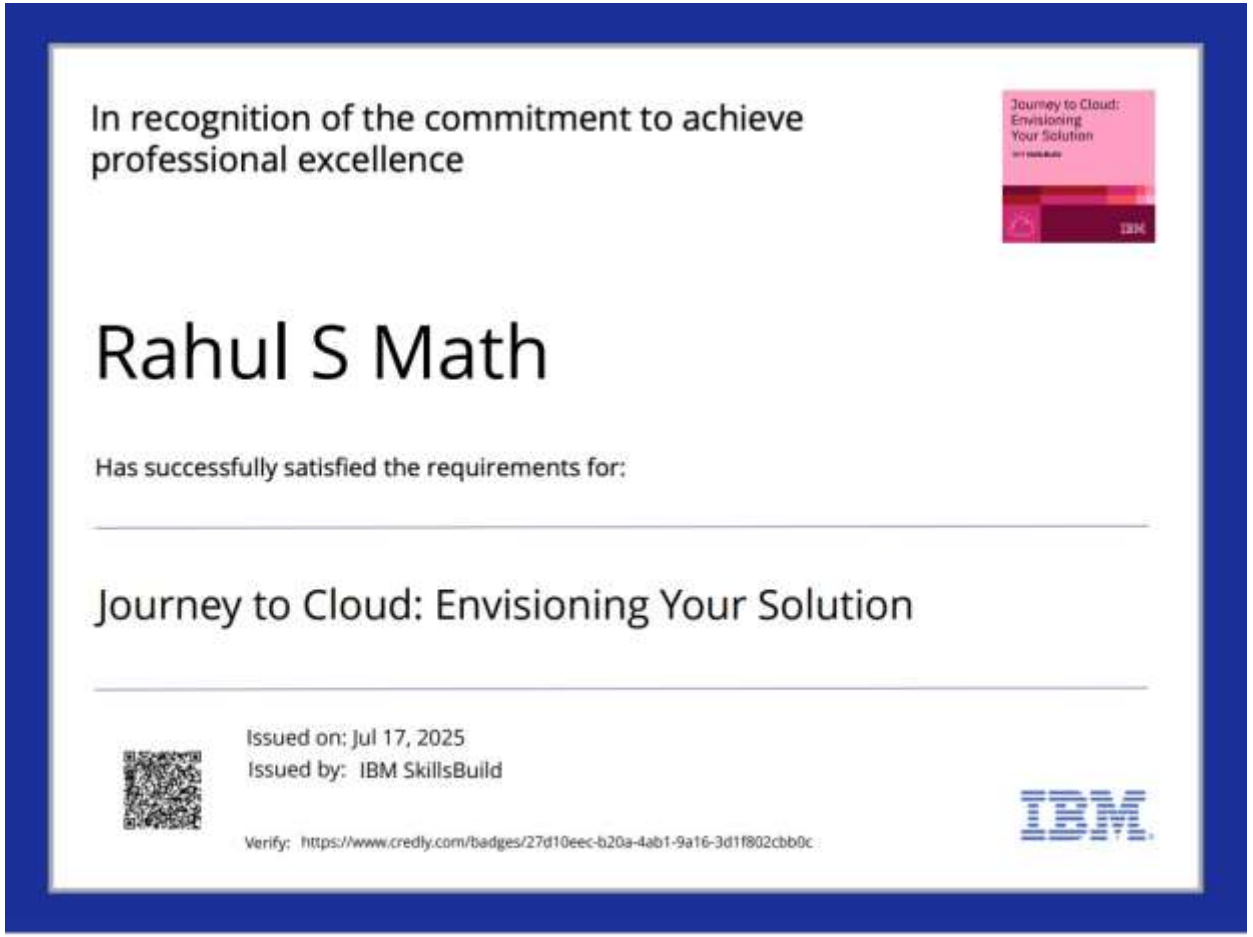
IBM CERTIFICATIONS

- Screenshot/ credly certificate(getting started with AI)



IBM CERTIFICATIONS

- Screenshot/ credly certificate(Journey to Cloud)



IBM CERTIFICATIONS

- Screenshot/ credly certificate(RAG Lab)

THANK YOU

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