CAPSTONE PROJECT

PROBLEM STATEMENT - 31

SMART HOME ENERGY ADVISOR AGENT

Presented By:
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OUTLINE

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- **System Development Approach** (Technology Used)
- **Algorithm & Deployment**
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PROBLEM STATEMENT

The Smart Home Energy Advisor Agent

Many households struggle to understand high electricity bills and how to manage their energy usage effectively. Without clear insights into when and how energy is being consumed, people often miss opportunities to save power and reduce costs. There is a need for a system that can make sense of this complex data and help users make smarter energy decisions.

PROPOSED SOLUTION

The Smart Home Energy Advisor Agent is an **agentic AI model** designed to actively assist users in managing home energy consumption. It leverages **IBM Granite AI** for intelligent decision-making and is deployed using **IBM Cloud Lite services** for scalability and accessibility.

- **Data Collection:**
  Collect real-time and historical data from smart meters and appliances, along with external factors like weather, occupancy, and dynamic pricing.
- **Data Preprocessing:**
  Clean and process the data to handle anomalies, and perform feature extraction to identify patterns affecting energy usage.
- **Agentic AI Modeling:**
  Use the IBM Granite AI model to power the agent's ability to analyze patterns, predict consumption, answer user queries, and generate energy-saving recommendations autonomously.
- **. Deployment:**
  Deploy the solution on IBM Cloud Lite with a user-friendly interface, enabling real-time interaction with the agent across web or mobile platforms.
- **Evaluation:**
  Assess performance using metrics like MAE or RMSE and continuously improve the system based on usage feedback and learning updates.

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SYSTEM APPROACH

The "System Approach" outlines the strategy and methodology for developing and deploying the Smart Home Energy Advisor Agent using an agentic AI model. It ensures seamless data processing, intelligent analysis, and user-friendly interaction. Here's a suggested structure for this section:

1) System Requirements

•Hardware: Smart meters, IoT appliances, internet-enabled device.
•Software: IBM Cloud Lite, IBM Granite AI model, basic web/mobile interface.

2) Libraries & Tools

•Python: pandas, numpy, scikit-learn.
•IBM Tools: Watsonx, IBM Granite, IBM Cloud services.

ALGORITHM & DEPLOYMENT

1. Algorithm Selection:

- The project uses an **agentic AI model** with the **LangGraph framework**, **ReAct architecture**, and **mistral-large model** in IBM Watsonx. This setup enables interactive, context-aware responses to energy-related queries.

2. Data Input:

- The agent takes inputs like:
- Total energy consumption (e.g., 250 kWh)
- Appliance-wise usage (e.g., AC – 100 kWh)
- User queries (e.g., "Why is my bill high?")

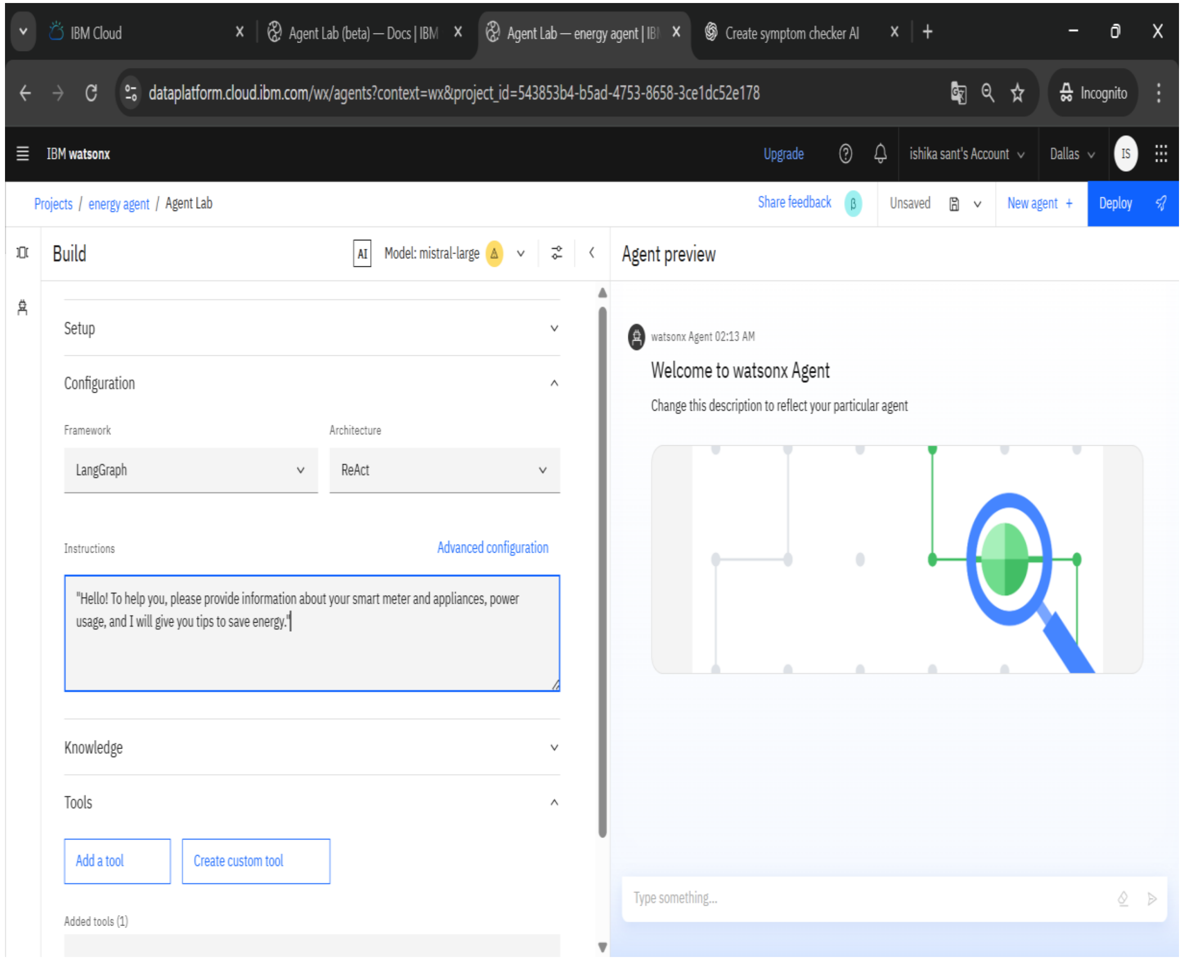
3. Training Process:

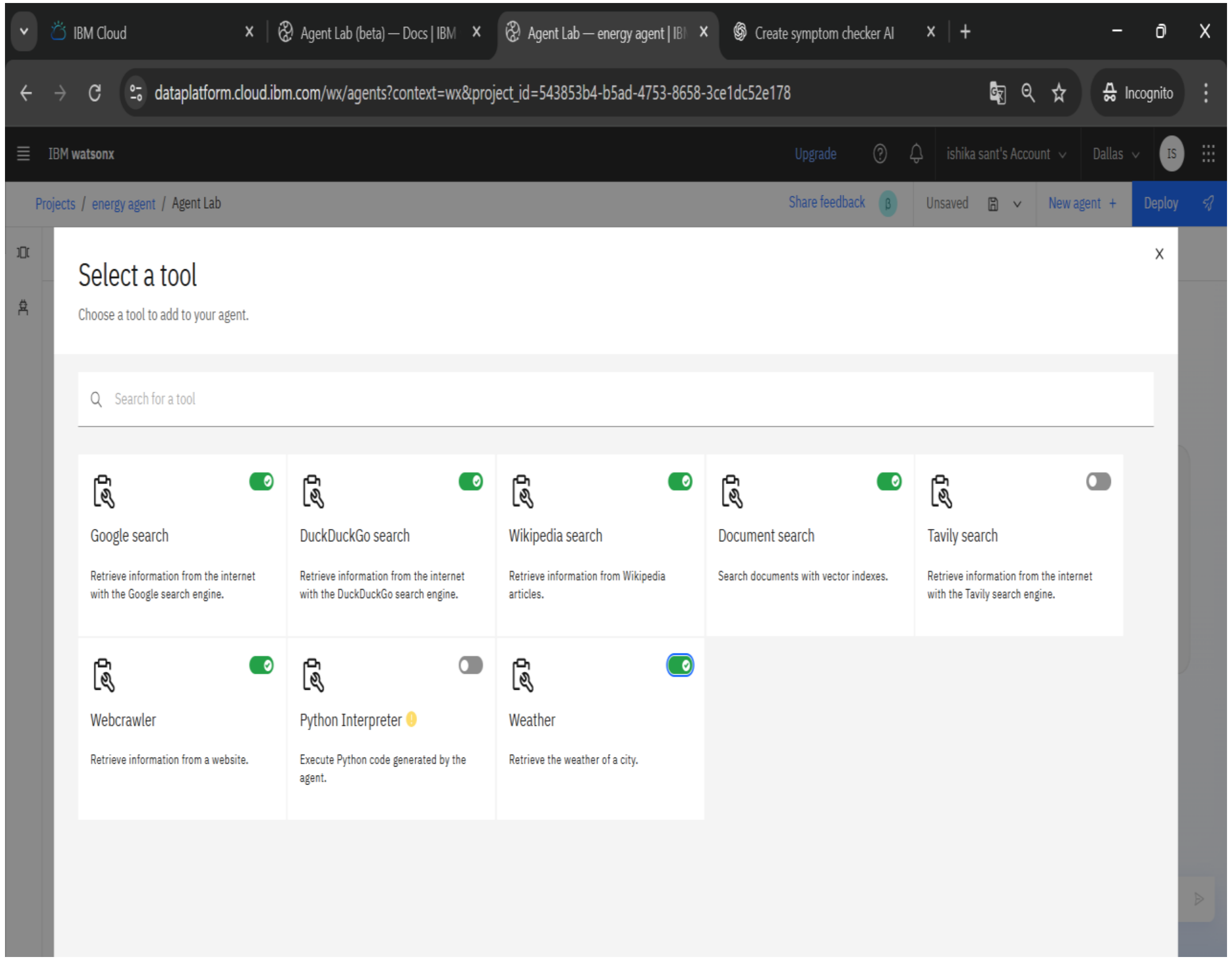
- The **mistral-large model** is pre-trained. No manual training is required—custom instructions and prompts guide its reasoning using the ReAct approach.

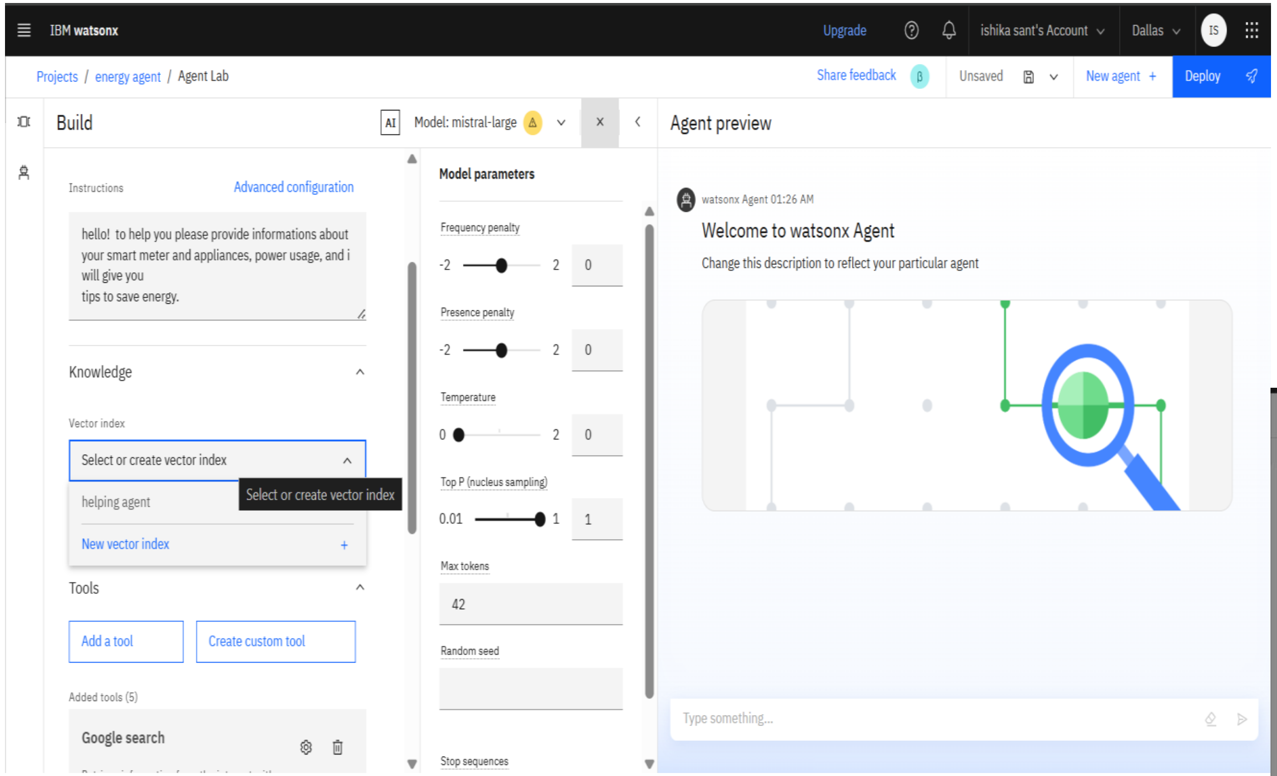
4. Prediction & Recommendation Process:

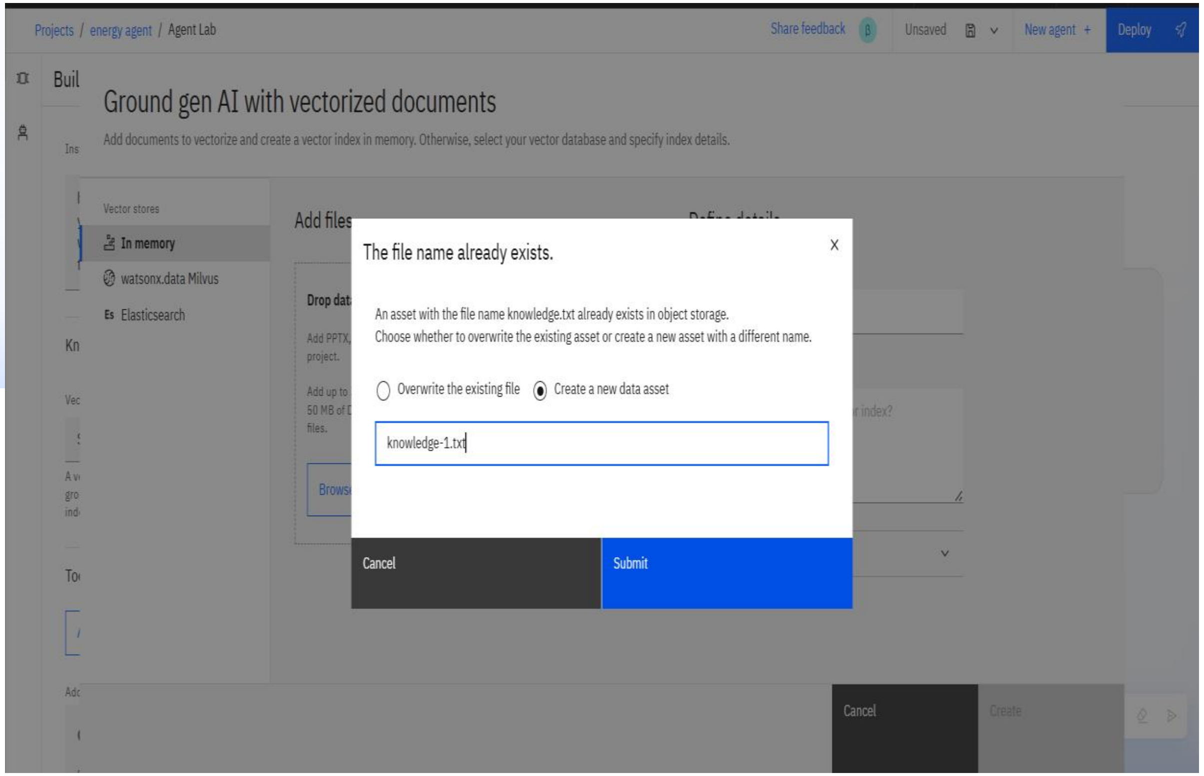
- The agent analyzes usage data, identifies high-consuming appliances, and provides smart suggestions (e.g., using appliances during off-peak hours) based on consumption trends and pricing logic.

RESULT


IBM Cloud
Agent Lab (beta) — Docs | IBM
Agent Lab — energy agent | IBM
Create symptom checker AI
dataplatform.cloud.ibm.com/wx/agents?context=wx&project_id=543853b4-b5ad-4753-8658-3ce1dc52e178
Incognito
IBM watsonx
Upgrade
ishika sant's Account
Dallas
Projects / energy agent / Agent Lab
Share feedback
Unsaved
New agent +
Deploy
Build
Model: mistral-large
Agent preview
Setup
Configuration
Framework
Architecture
LangGraph
ReAct
Instructions
Advanced configuration
"Hello! To help you, please provide information about your smart meter and appliances, power usage, and I will give you tips to save energy."
Knowledge
Tools
Add a tool
Create custom tool
Added tools (1)
watsonx Agent 02:13 AM
Welcome to watsonx Agent
Change this description to reflect your particular agent
Type something...


Select a tool
Choose a tool to add to your agent.
Search for a tool
Google search
Retrieve information from the internet with the Google search engine.
DuckDuckGo search
Retrieve information from the internet with the DuckDuckGo search engine.
Wikipedia search
Retrieve information from Wikipedia articles.
Document search
Search documents with vector indexes.
Tavily search
Retrieve information from the internet with the Tavily search engine.
Webcrawler
Retrieve information from a website.
Python Interpreter
Execute Python code generated by the agent.
Weather
Retrieve the weather of a city.





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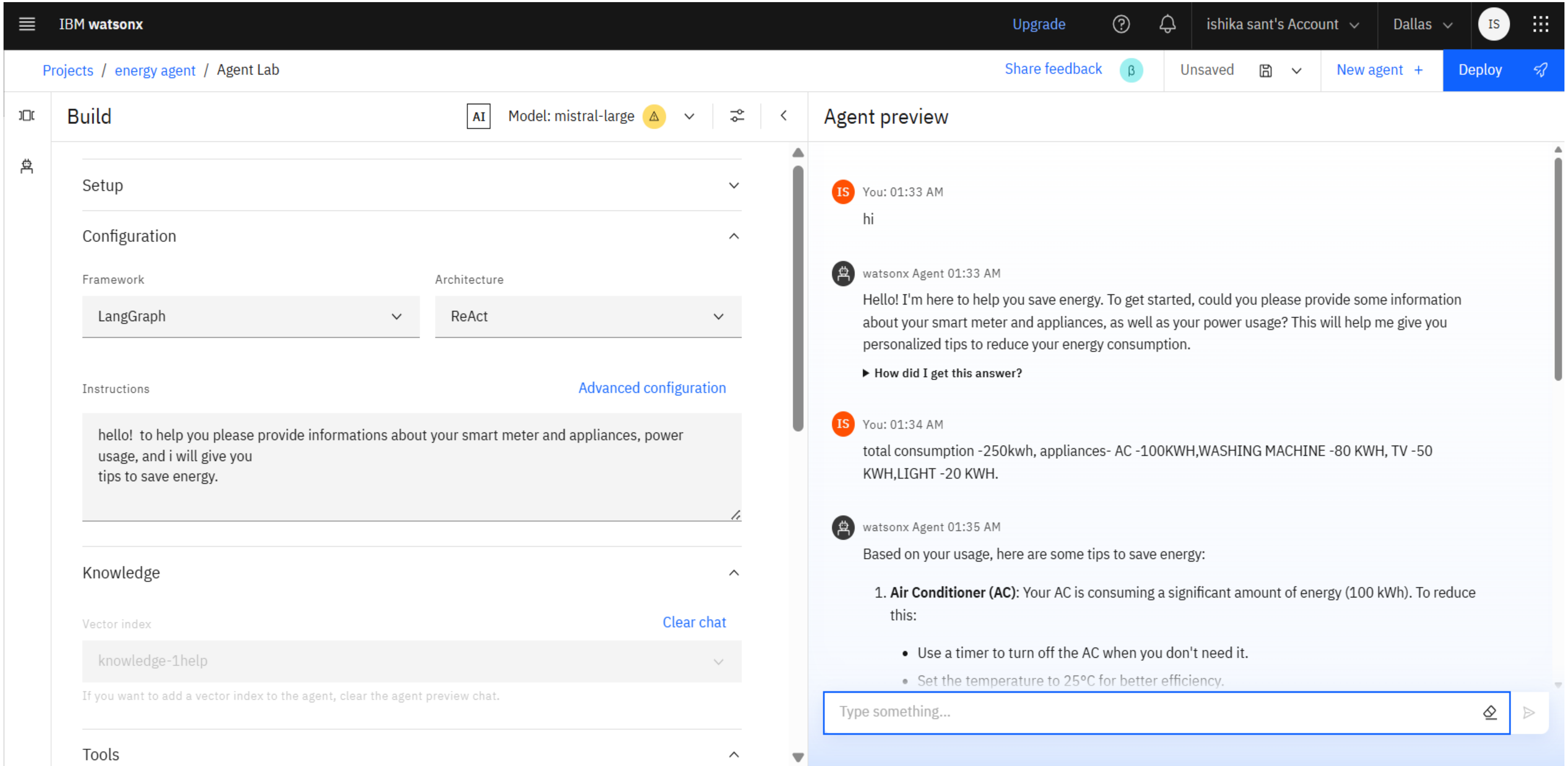
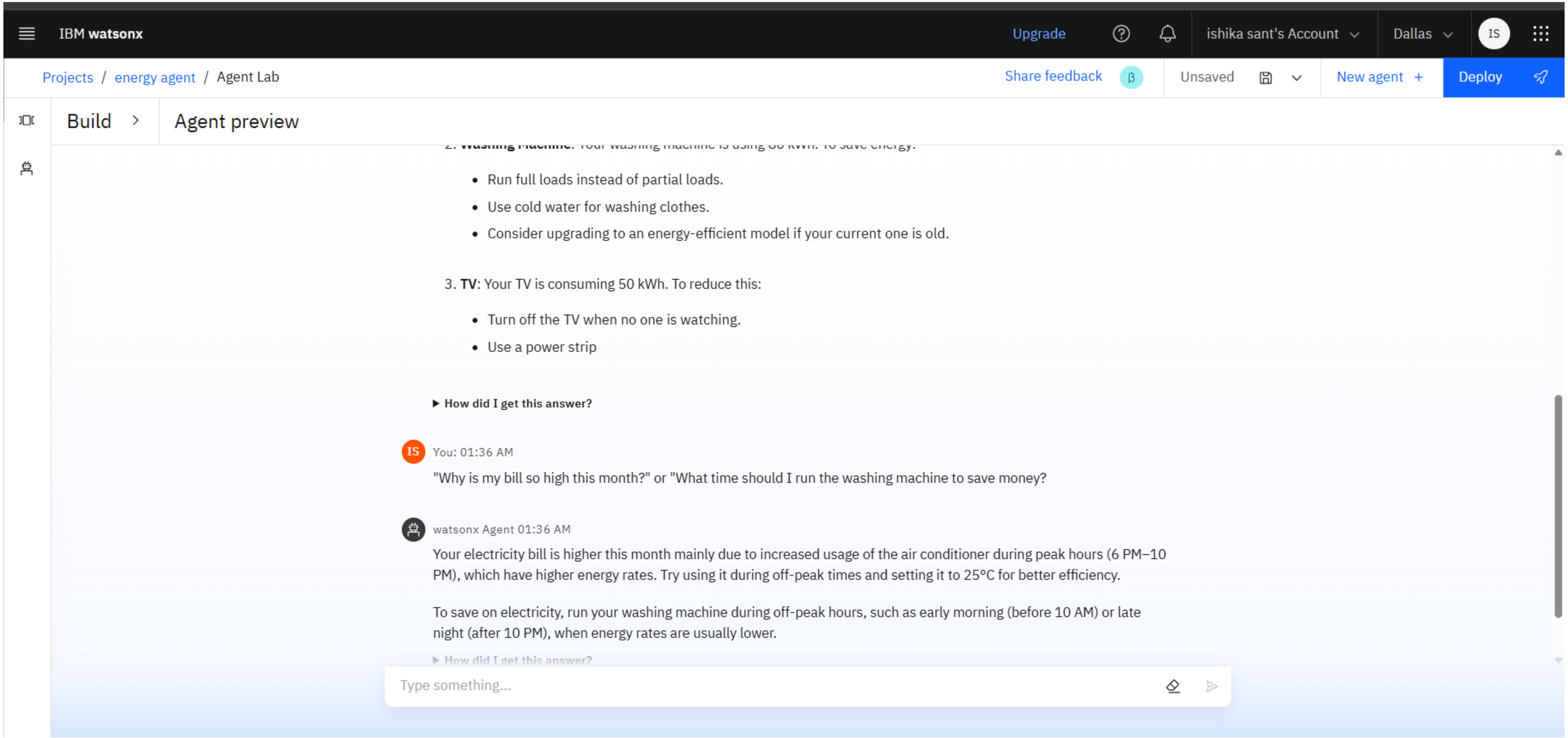

IBM watsonx
Upgrade
ishika sant's Account
Dallas
IS
Projects / energy agent / Agent Lab
Share feedback
Unsaved
New agent +
Deploy
Build
AI
Model: mistral-large
Setup
Configuration
Framework
LangGraph
Architecture
ReAct
Instructions
Advanced configuration
hello! to help you please provide informations about your smart meter and appliances, power usage, and i will give you
tips to save energy.
Knowledge
Vector index
Clear chat
knowledge-1help
If you want to add a vector index to the agent, clear the agent preview chat.
Tools
Agent preview
You: 01:33 AM
hi
watsonx Agent 01:33 AM
Hello! I'm here to help you save energy. To get started, could you please provide some information about your smart meter and appliances, as well as your power usage? This will help me give you personalized tips to reduce your energy consumption.
How did I get this answer?
You: 01:34 AM
total consumption -250kwh, appliances- AC -100KWH,WASHING MACHINE -80 KWH, TV -50 KWH,LIGHT -20 KWH.
watsonx Agent 01:35 AM
Based on your usage, here are some tips to save energy:
1. Air Conditioner (AC): Your AC is consuming a significant amount of energy (100 kWh). To reduce this:
Use a timer to turn off the AC when you don't need it.
Set the temperature to 25°C for better efficiency.
Type something...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Upgrade
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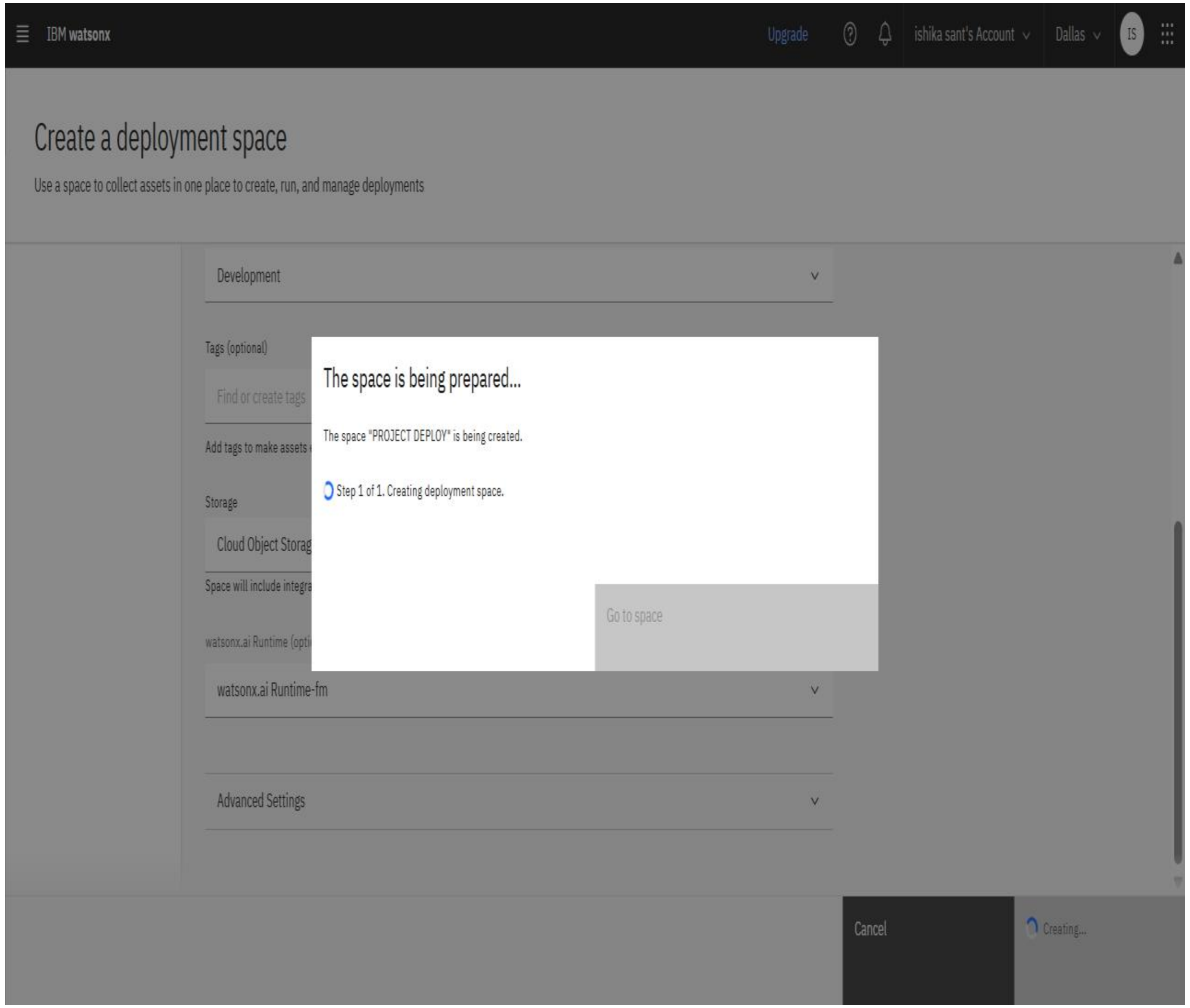
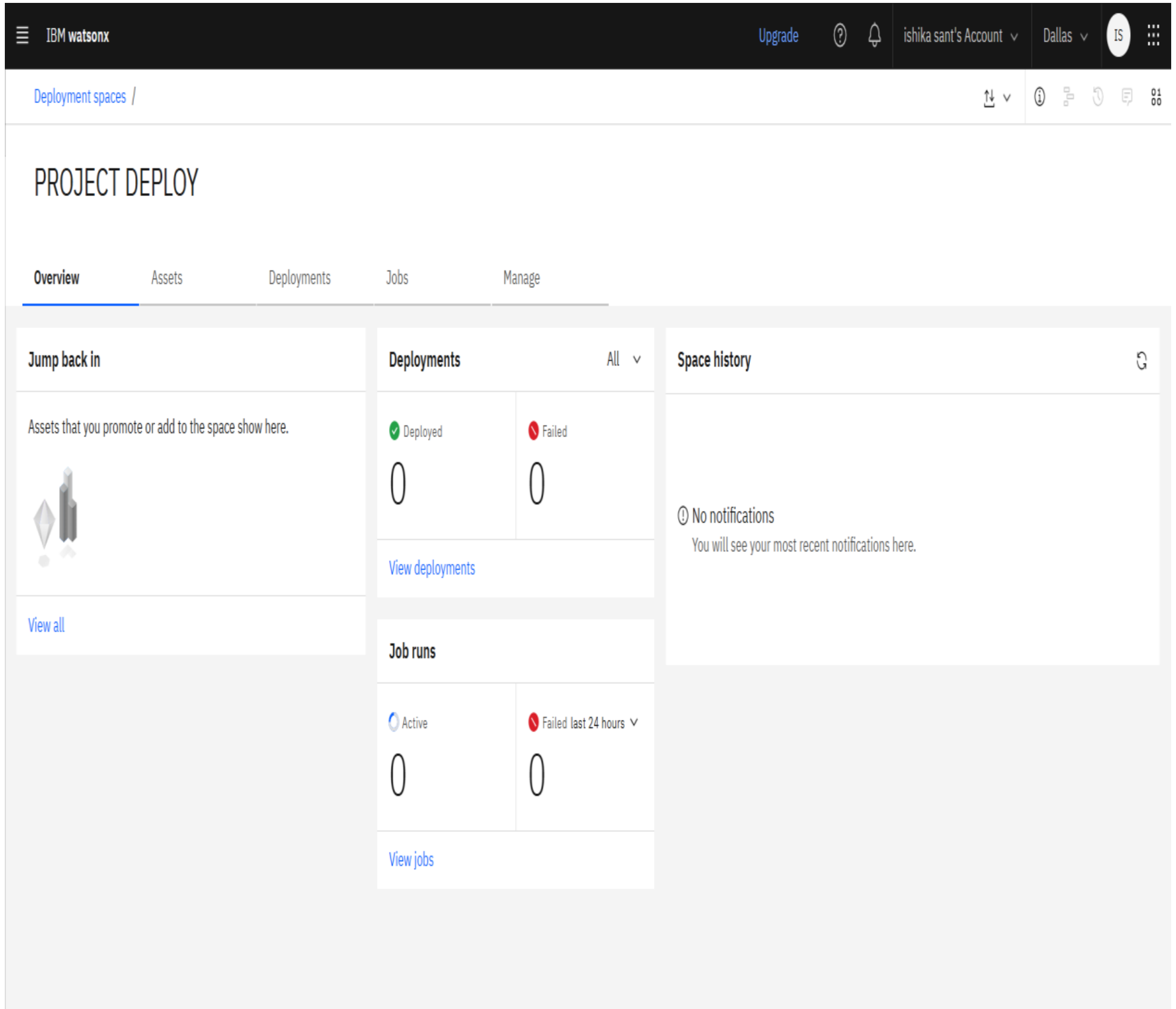
Dallas
IS
Projects / energy agent / Agent Lab
Share feedback
Unsaved
New agent +
Deploy
Build
Agent preview
• Run full loads instead of partial loads.
• Use cold water for washing clothes.
• Consider upgrading to an energy-efficient model if your current one is old.
3. TV: Your TV is consuming 50 kWh. To reduce this:
• Turn off the TV when no one is watching.
• Use a power strip
▶ How did I get this answer?
You: 01:36 AM
"Why is my bill so high this month?" or "What time should I run the washing machine to save money?
watsonx Agent 01:36 AM
Your electricity bill is higher this month mainly due to increased usage of the air conditioner during peak hours (6 PM–10 PM), which have higher energy rates. Try using it during off-peak times and setting it to 25°C for better efficiency.
To save on electricity, run your washing machine during off-peak hours, such as early morning (before 10 AM) or late night (after 10 PM), when energy rates are usually lower.
▶ How did I get this answer?
Type something...


IBM watsonx
Upgrade
ishika sant's Account
Dallas
Create a deployment space
Use a space to collect assets in one place to create, run, and manage deployments
Development
Tags (optional)
Find or create tags
Storage
Cloud Object Storag
watsonx.ai Runtime-fm
Advanced Settings
The space is being prepared...
The space "PROJECT DEPLOY" is being created.
Step 1 of 1. Creating deployment space.
Go to space
Cancel
Creating...


IBM watsonx
Upgrade
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Dallas
Deployment spaces /
PROJECT DEPLOY
Overview
Assets
Deployments
Jobs
Manage
Jump back in
Assets that you promote or add to the space show here.
View all
Deployments
All
Deployed
0
Failed
0
View deployments
Job runs
Active
0
Failed last 24 hours
0
View jobs
Space history
No notifications
You will see your most recent notifications here.

CONCLUSION

- **Findings & Effectiveness**

The **agent** built using **mistral-large**, **LangGraph**, and the **ReAct architecture** successfully interprets structured user inputs and provides energy-saving recommendations. It handles multistep reasoning and offers context-aware responses in the Agent Lab preview.

Document ingestion via vector indexing (e.g. uploading knowledge files) enables grounded responses. Though file duplication alerts appeared, the agent was still configured correctly.

- **Challenges & Improvements**

Document version conflicts: Uploading knowledge files triggered overwrite warnings, requiring careful asset naming and management.

Expandable knowledge base: Adding more domain-specific documents will improve recommendation accuracy and adaptability.

Deployment setup: Though a deployment space was created, finalizing the agent deployment pipeline and connecting to real smart-meter data remains pending.

- **Significance**

Accurate energy usage analysis and recommendations are crucial for helping users understand their electricity consumption and adopt better habits. A responsive agent ensures households can optimize appliance scheduling (e.g. off-peak usage), which reduces bills and supports sustainable practices.

FUTURE SCOPE

- Add real-time energy, weather, and user behavior data for better personalization.
- Optimize algorithms for faster, more accurate recommendations.
- Expand coverage to multiple regions for localized advice.
- Use edge computing to improve response time and privacy.
- Apply advanced ML techniques like reinforcement and federated learning for adaptability and privacy.
- Develop mobile and voice assistant integrations for easier access. Enable smart device control for automated energy management.
- Incorporate user feedback to improve recommendations.

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This certificate is presented to

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for the completion of

Lab: Retrieval Augmented Generation with LangChain

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 24 Jul 2025 (GMT)

Learning hours: 20 mins

THANK YOU