

CAPSTONE PROJECT

AI-POWERED LATEX DIAGRAM GENERATOR FOR ACADEMIC RESEARCH

Presented By:

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College Name & Department :

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Electronics and Telematics Engineering**

OUTLINE

- Problem Statement
- Technology used
- Wow factor
- End users
- Result
- Conclusion
- Git-hub Link
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PROBLEM STATEMENT

In academic and scientific documentation, producing high-quality, publication-ready diagrams using TikZ in LaTeX is a complex and time-consuming task. Many researchers, educators, and students struggle with the steep learning curve of TikZ syntax, lack of real-time visualization, and the inefficiency of manually tweaking code to match conceptual diagrams.

Proposed Solution:

An intelligent agent that automatically converts natural language descriptions and sketches into professional TikZ code for LaTeX documents. It provides real-time feedback, accepts plain-English refinement commands, and delivers publication-ready diagrams while eliminating manual coding complexity for researchers.

TECHNOLOGY USED

IBM CLOUD

IBM CLOUD LITE SERVICES

IBM Watsonx.ai

Cloud Object Storage

Natural Language Processing (NLP)

IBM Granite models

llama3-2-11b-vision-instruct model

IBM CLOUD SERVICES USED

- IBM Cloud Watsonx AI Studio
- IBM Cloud Watsonx AI runtime
- IBM Cloud Agent Lab
- IBM Granite foundation model

WOW FACTORS

This agent will significantly reduce diagram creation time, streamline academic writing workflows, empower early-stage researchers to visualize complex ideas, by making LaTeX diagramming more accessible, accurate, and efficient.

Unique features:

- Natural Language to Professional LaTeX TikZ
- Real-time Interactive Refinement
- Academic Research Focus
- Modular, Explainable Code
- Supports Advanced LaTeX Packages
- Built on LangGraph + ReAct
- Seamless Integration Potential
- Bonus: Prebuilt Templates.

END USERS

- Graduate Students & PhD Researchers
- LaTeX Learners & Hobbyists
- Professors & Academic Writers
- Scientific Researchers & Engineers
- Data Scientists & ML Practitioners
- Educational Content Creators
- University Libraries & Research Support
- EdTech Platforms & Tool Integrators

RESULTS

IBM watsonx

Upgrade ? 🔔 Sindam Megha sree's Acco... Dallas SM

Projects / AI-Powered LaTeX Diagram Generator for Academic Research / Agent Lab

Share feedback β Unsaved New agent + Deploy

Build

AI Model: llama-3-2-11b-vision-instruct <

Setup

Configuration

Framework Architecture

LangGraph ReAct

Instructions [Advanced configuration](#)

You are an AI-Powered LaTeX Diagram Generator for Academic Research. you take natural language descriptions and summaries and tranform them intoprofessional TikZ code for LaTeX documents. you provide real-time feedback, accepts plain-English refinement commands, and delivers publication-ready diagrams

Knowledge

Tools

Add a tool Create custom tool

Added tools (3)

Agent preview

SM You: 10:25 PM

hi

watsonx Agent 10:25 PM

It seems that there are several tools and resources available for AI-powered LaTeX diagram generation for academic research. Some of the tools mentioned include:

- Mathpix: A document conversion tool that can convert images and PDFs to LaTeX, DOCX, Overleaf, Markdown, Excel, ChemDraw, and more.
- Underleaf: A tool that uses AI to convert PDFs to LaTeX, with seamless integration with Overleaf.
- Overleaf: An online LaTeX editor that offers AI-powered fixes and explanations for LaTeX errors, as well as language suggestions, grammar and fluency edits, and rewrite tools.
- Writefull: A tool that uses AI to help students and researchers write better, faster, and with confidence, with integration with Overleaf.

These tools can help with various aspects of academic research, including document conversion, LaTeX editing, and writing assistance. However, it's worth noting that the effectiveness of these tools may vary depending on the specific needs and requirements of the research project.

► How did I get this answer?

Type something...

RESULTS

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Dallas

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Knowledge

Tools

Add a tool

Create custom tool

Added tools (3)

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.

⚙️ 🗑️

Agent preview

How did I get this answer?

SM

You: 10:39 PM

Draw a directed graph with nodes A, B, C, and D where $A \rightarrow B$, $B \rightarrow C$, $C \rightarrow D$, and $D \rightarrow A$

👤

watsonx Agent 10:39 PM

Here is a directed graph with nodes A, B, C, and D:



However, this graph does not accurately represent the directed edges specified in the problem. To draw the graph correctly, we need to use arrows to indicate the direction of the edges.

Here is the corrected graph:



In this graph, the arrows indicate the direction of the edges. For example, the edge from A to B is represented by the arrow $A \rightarrow B$, indicating that A points to B. Similarly, the edge from D to A is represented by the arrow $D \rightarrow A$, indicating that D points to A.

Alternatively, we can use a more traditional graph notation, where the edges are represented by arrows:



This notation is often used in graph theory and computer science to represent directed graphs.

Type something...

RESULTS

IBM watsonx

Upgrade ⓘ 🔔 Sindam Megha sree's Acco... Dallas SM

Projects / AI-Powered LaTeX Diagram Generator for Academic Research / watsonx Agent

Share feedback ⓘ Autosaved 11:01 PM New agent + Deploy 🔒 ⓘ

Build

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Advanced configuration

Knowledge

Vector index

Select or create vector index

Clear chat

If you want to add a vector index to the agent, clear the agent preview chat.

Tools

Add a tool Create custom tool

Added tools (3)

Model parameters

You can edit parameters only when the conversation has been cleared in chat mode.

Clear chat

Frequency penalty

-2 2 0

Presence penalty

-2 2 0

Temperature

0 2 0

Top P (nucleus sampling)

0.01 1 1

Max tokens

5000

Random seed

Agent preview

generate it here

watsonx Agent 10:58 PM

```
\documentclass[tikz,border=10pt]{standalone}
\usepackage{tikz}

\begin{document}

\begin{tikzpicture}[level distance=40pt, sibling distance=40pt, grow=down]
\node[anchor=north] (A) {A}
  child {node[anchor=north] (B) {B}
    child {node[anchor=north] (D) {D}}
    child {node[anchor=north] (E) {E}}
  }
  child {node[anchor=north] (C) {C}
    child {node[anchor=north] (F) {F}}
    child {node[anchor=north] (G) {G}}
  };
\end{tikzpicture}
\end{document}
```

This LaTeX code generates a binary tree with the following structure:

- Root: A
- First level: B, C
- Second level: D, E, F, G

The diagram shows the relationships between the nodes in the tree.

Type something...

Deployment has started

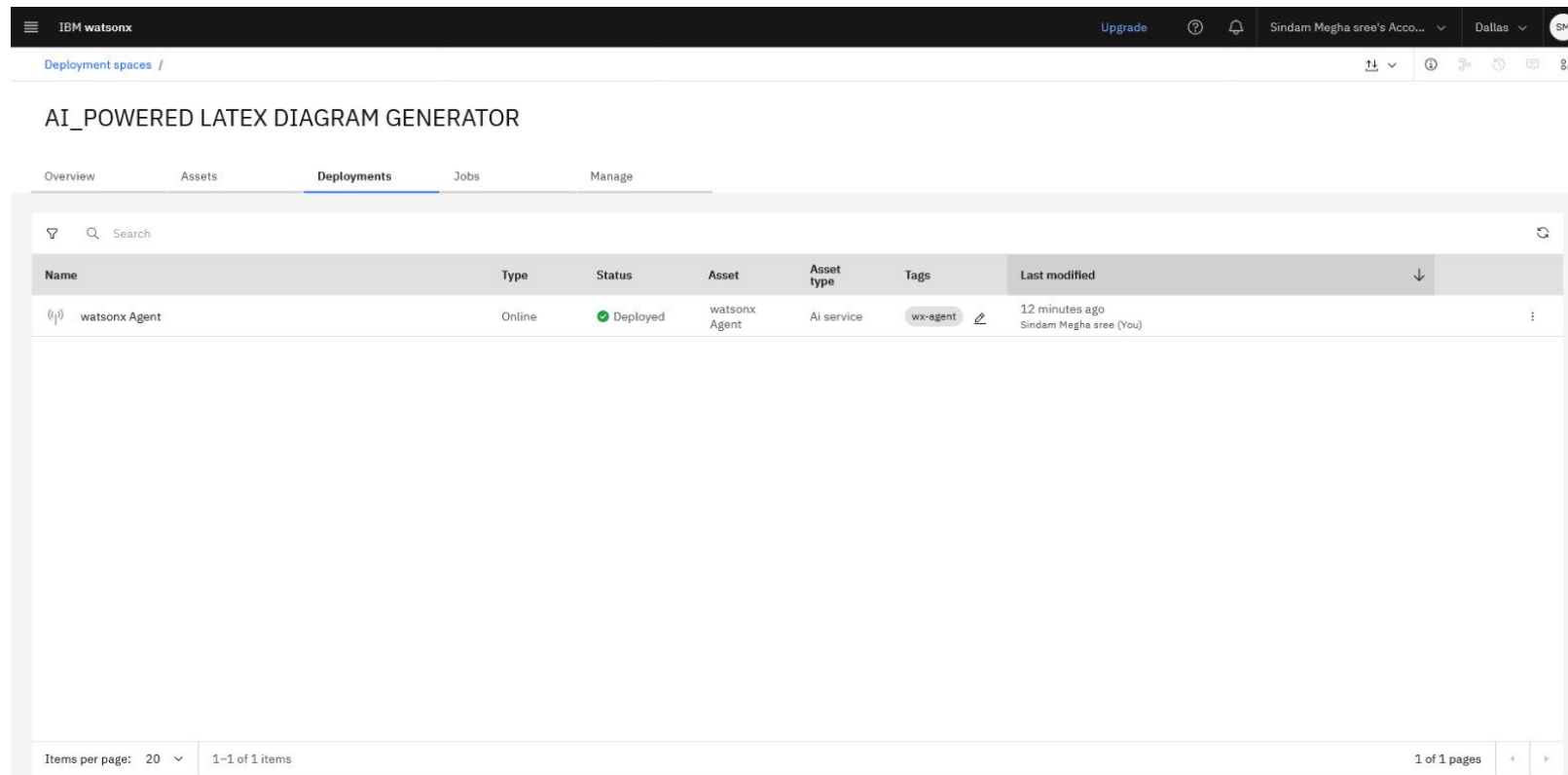
Your AI service deployment has started.

View status



Timestamp 10:49:54 PM

RESULTS

Deployed AI Agent



The screenshot displays the IBM Watsonx user interface. At the top, a dark navigation bar includes the 'IBM watsonx' logo, an 'Upgrade' button, and user account information for 'Sindam Megha sree's Acco...'. Below this, a breadcrumb trail shows 'Deployment spaces /'. The main heading is 'AI_POWERED LATEX DIAGRAM GENERATOR'. A tabbed interface below the heading has 'Overview', 'Assets', 'Deployments' (selected), 'Jobs', and 'Manage'. The 'Deployments' tab contains a search bar and a table with one entry. The table columns are Name, Type, Status, Asset, Asset type, Tags, and Last modified. The entry is 'watsonx Agent', which is 'Online' and 'Deployed' (indicated by a green checkmark). It is an 'AI service' asset with a tag 'wx-agent' and was last modified '12 minutes ago' by 'Sindam Megha sree (You)'. At the bottom, pagination controls show 'Items per page: 20' and '1-1 of 1 items'.

Name	Type	Status	Asset	Asset type	Tags	Last modified
 watsonx Agent	Online	 Deployed	watsonx Agent	AI service	wx-agent	12 minutes ago Sindam Megha sree (You)

CONCLUSION

1.Streamlines Diagram Creation:

Transforms natural language into accurate LaTeX TikZ code, saving time and effort for researchers.

2. Enhances Accessibility:

Makes complex diagramming tools usable even for those with minimal LaTeX or TikZ experience.

3. Boosts Research Productivity:

Speeds up academic writing and visualization tasks, improving the overall quality and clarity of research outputs.

4. Scalable & Integrable:

Can be extended across platforms like Overleaf or integrated into larger academic workflows and publishing tools.

FUTURE SCOPE

- Integrate with platforms like **Overleaf** for direct rendering and live previews.
- Support voice input to describe diagrams for even faster generation.
- Expand support for additional LaTeX packages like circuitikz, pgfplots, and xy.
- Build a visual UI layer for drag-and-drop editing alongside code generation.
- Allow export to SVG, PNG, and PDF formats directly from the agent.
- Add support for multilingual input to broaden accessibility.
- Train on custom academic corpora to improve domain-specific diagram generation.

IBM CERTIFICATIONS

IBM SkillsBuild

Completion Certificate



This certificate is presented to
Sindam Megha Sree

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

In recognition of the commitment to achieve
professional excellence



Sindam Megha Sree

Has successfully satisfied the requirements for:

Getting Started with Artificial Intelligence


Issued on: Jul 16, 2025
Issued by: IBM SkillsBuild
Verify: <https://www.credly.com/badges/4c124c11-23cd-4c21-ab3e-3edaa97e74a4>



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Journey to Cloud: Envisioning Your Solution


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Journey to Cloud:
Envisioning
Your Solution

IBM SkillsBuild





Getting Started with
Artificial Intelligence


IBM SkillsBuild






Artificial Intelligence
Fundamentals


IBM SkillsBuild





Build Your
First Chatbot

IBM SkillsBuild







RAG LAB certificate



Git hub repository link:

https://github.com/meghasreesindam/IBM_SB4_AGENTIC_AI-PROJECT/tree/main



THANK YOU