

# IBM HACKATHON PROJECT

## TIKZBUILDER AGENT

**Presented By:**

**Student name : Muthu Harish T**

**College Name & Department : PSG Institute of Technology and  
Applied Research & Computer Science**

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# **OUTLINE**

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- **Proposed Solution**
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- **End users**
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## PROBLEM STATEMENT

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.

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## PROPOSED SOLUTION

I proposed **TikzBuilder**, an AI-powered chatbot agent deployed directly in **IBM Agent Lab** using **IBM Cloud**. The agent accepts **plain English text prompts** and generates **publication-ready LaTeX TikZ code**. It eliminates the need for manual TikZ coding by outputting full, compilable LaTeX documents. The agent provides real-time responses within the IBM Agent Lab interface. This solution streamlines academic diagram creation for researchers through intuitive natural language interaction.

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## TECHNOLOGY USED

- ❑ **IBM cloud lite services** - IBM Cloud Lite is a free-tier offering from IBM. It includes access to essential services like object storage, compute, and AI tools without billing.
- ❑ **Natural Language Processing (NLP)** - NLP enables machines to understand, interpret, and generate human language. It is the foundation for converting user-provided text prompts into structured TikZ LaTeX code.
- ❑ **Retrieval Augmented Generation (RAG)** - RAG combines retrieval of relevant external information with generative AI models to enhance response quality. It helps the agent generate contextually accurate LaTeX diagrams from complex academic queries.
- ❑ **IBM Watsonx AI Agent Lab** - IBM Watsonx AI Agent Lab is a platform to build, deploy, and test AI agents using IBM foundation models. It supports real-time interaction, model refinement, and prompt engineering in a no-code environment.

## IBM CLOUD SERVICES USED

- ❑ **IBM Cloud Watsonx AI Studio** - Watsonx AI Studio is a collaborative environment for building, training, and tuning AI models using foundation models or custom data. It enables prompt engineering, model evaluation, and experimentation in a low-code interface.
- ❑ **IBM Cloud Watsonx AI runtime** - Watsonx AI Runtime provides the infrastructure to deploy and serve foundation models securely and at scale. It ensures reliable inference, model versioning, and performance monitoring for production-ready AI workloads.
- ❑ **IBM Cloud Agent Lab** - Watsonx AI Runtime provides the infrastructure to deploy and serve foundation models securely and at scale. It ensures reliable inference, model versioning, and performance monitoring for production-ready AI workloads.

# WOW FACTORS

- ❑ **Plain English to Perfect TikZ** - Transforms even informal or vague natural language into fully structured, compilable LaTeX TikZ diagrams - no coding required.
- ❑ **Instant Feedback and Refinement** - Understands commands like "make the arrows curved" or "add a label to the node", enabling real-time diagram edits through conversation.
- ❑ **Zero Syntax Errors Output** - All outputs are guaranteed to be error-free LaTeX code, fully wrapped with \documentclass and required packages - ready to copy-paste and compile.
- ❑ **Academic-Grade Clarity** - Designed specifically for academic use cases - flowcharts, block diagrams, neural nets - with optimal layout, spacing, and styling defaults.
- ❑ **Understands Structural Context** - The agent can infer diagram relationships like data flow, process chains, and hierarchies even from loosely described text - no need for technical phrasing.

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## END USERS

- ❑ **Academic Researchers** - To effortlessly convert conceptual ideas into publication-ready diagrams for journals, theses, and papers.
- ❑ **University Students** - For generating LaTeX-compatible diagrams for reports, lab records, and project documentation without learning TikZ syntax.
- ❑ **Professors & Educators** - To create clear, structured teaching visuals (e.g., flowcharts, algorithms, models) for lectures and course materials.
- ❑ **Technical Authors & Publishers** - To speed up the creation of professional diagrams in LaTeX books, manuals, and whitepapers.
- ❑ **Data Scientists & AI Engineers** - To visually explain model architectures, pipelines, and data flow in research reports and presentations.



# RESULTS

IBM watsonx

Projects / Latex\_AI / TikzBuilder

Build

AI Model: mistral-large

Setup

Configuration

FrameworkLangGraphArchitectureReAct

Instructions

Objective

You are a specialized AI agent designed exclusively to convert natural language instructions or sketch descriptions into clean, professional-quality TikZ LaTeX code. Your purpose is to eliminate manual diagram coding for researchers by generating fully compilable TikZ diagrams embedded in a complete LaTeX document structure.

Knowledge

Tools

Add a tool

Create custom tool

Added tools (5)

Google search

Retrieve information from the internet with the Google search engine.

DuckDuckGo search

Retrieve information from the internet with the DuckDuckGo search engine.

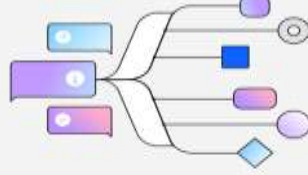
Wikipedia search

Agent preview

TikzBuilder 05:45 PM

Welcome to TikzBuilder

Draw it with words - I'm your TikZ genie granting LaTeX diagram wishes!



Sample questions

Can you draw a basic flowchart with three steps: Start, Process, and End?

Make a simple circular diagram with four labeled points connected in a loop.

Type something...


# RESULTS

## Agent preview

TikzBuilder 06:45 PM

Welcome to TikzBuilder

Draw it with words - I'm your TikZ genie granting LaTeX diagram wishes!



Sample questions

Can you draw a basic flowchart with three steps: Start, Process, and End?

→

Make a simple circular diagram with four labeled points connected in a loop.

→

Type something...

## Agent preview

You: 06:21 PM

Make a simple circular diagram with four labeled points connected in a loop.

TikzBuilder 06:21 PM

```
\documentclass{article}
\usepackage{tikz}
\usetikzlibrary{arrows.meta, positioning}

\begin{document}

\begin{tikzpicture}[node distance=2.5cm, every node/.style={draw, circle, minimum size=1cm}]
\node (A) {A};
\node (B) [below right of=A] {B};
\node (C) [below left of=A] {C};
\node (D) [below of=A, node distance=3cm] {D};

\draw[->, thick] (A) -- (B);
\draw[->, thick] (B) -- (C);
\draw[->, thick] (C) -- (D);
\draw[->, thick] (D) -- (A);
\end{tikzpicture}

\end{document}
```

► How did I get this answer?

↺

Type something...

## Agent Preview

# RESULTS

## Agent preview

06:21 PM  
You: 06:21 PM  
Can you draw a basic flowchart with three steps: Start, Process, and End?

TikzBuilder 06:21 PM

```
\documentclass{article}
\usepackage{tikz}
\usetikzlibrary{arrows.meta, positioning}

\begin{document}

\begin{tikzpicture}[node distance=2.5cm, every node/.style={draw, rectangle, minimum
height=1cm, minimum width=2.5cm}]
  \node (start) {Start};
  \node (process) [below of=start] {Process};
  \node (end) [below of=process] {End};

  \draw[->, thick] (start) -- (process);
  \draw[->, thick] (process) -- (end);
\end{tikzpicture}

\end{document}
```

► How did I get this answer?

Type something...

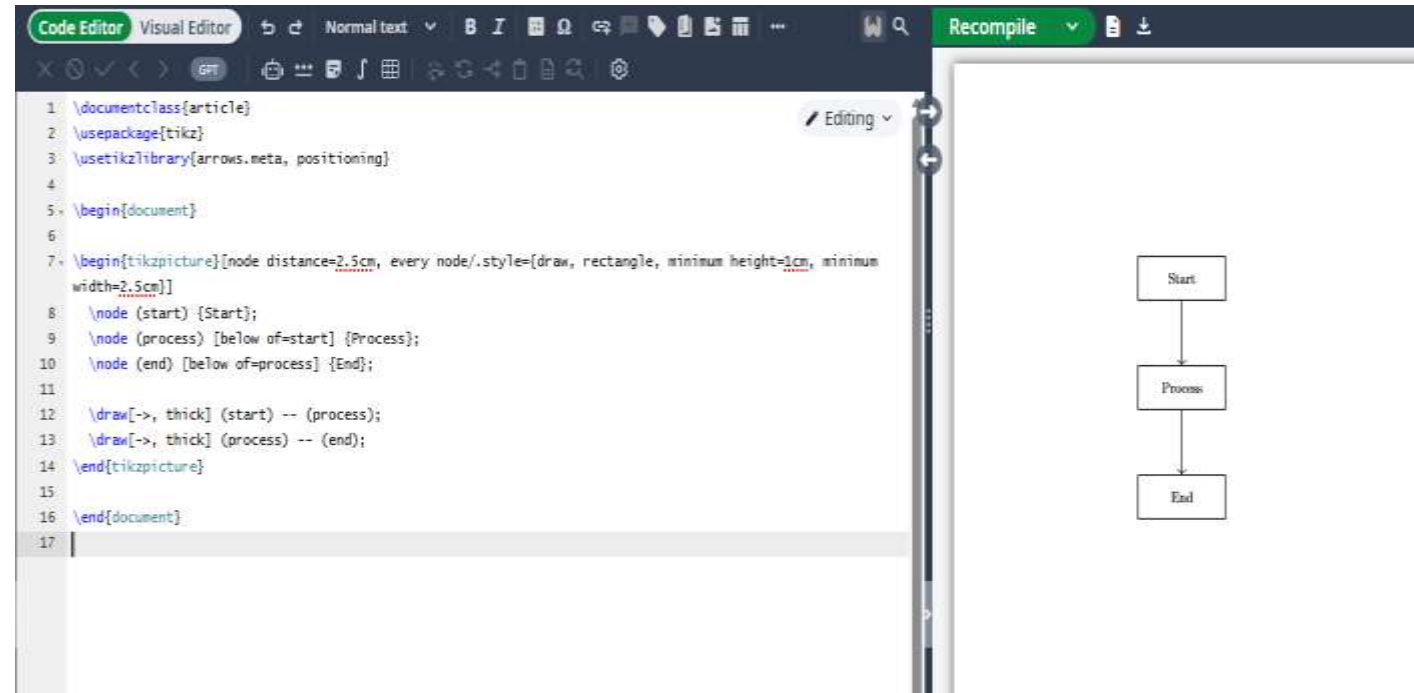




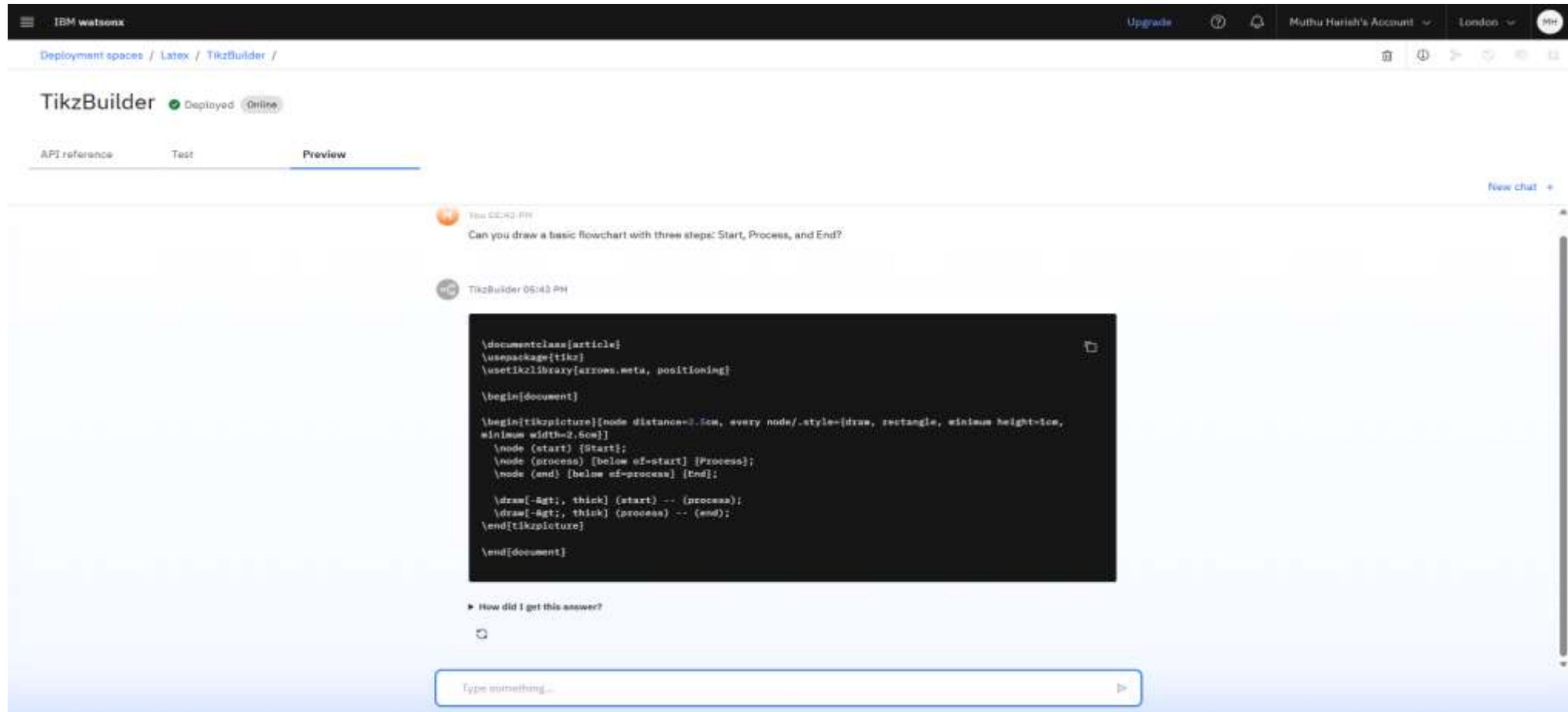


Diagram for the generated code

Agent Generated Code

# RESULTS

Name	Type	Status	Asset	Asset type	Tags	Last modified
 TikzBuilder	Online	 Deployed	TikzBuilder	Ai service	 	in 14,894 seconds Muthu Harish (You)



The screenshot displays the IBM Watsonx interface for the 'TikzBuilder' asset. The top navigation bar includes the IBM Watsonx logo, an 'Upgrade' button, a help icon, a notification bell, the user's account 'Muthu Harish's Account', the location 'London', and a profile icon. The breadcrumb trail shows 'Deployment spaces / Latex / TikzBuilder /'. The asset 'TikzBuilder' is shown with 'Deployed' and 'Online' status indicators. Below this, there are tabs for 'API reference', 'Test', and 'Preview', with 'Preview' being the active tab. The main chat area shows a conversation where a user asks, 'Can you draw a basic flowchart with three steps: Start, Process, and End?'. The agent responds with a LaTeX code block that generates a flowchart. The code is as follows:

```
\documentclass{article}
\usepackage{tikz}
\usetikzlibrary{arrows.meta, positioning}

\begin{document}

\begin{tikzpicture}[node distance=0.5cm, every node/.style={draw, rectangle, minimum height=1cm, minimum width=2.5cm}]
  \node (start) [Start];
  \node (process) [below of=start] [Process];
  \node (end) [below of=process] [End];

  \draw[->, thick] (start) -- (process);
  \draw[->, thick] (process) -- (end);
\end{tikzpicture}

\end{document}
```

Below the code, there is a link 'How did I get this answer?' and a 'Type something...' input field at the bottom.

Deployed Agent

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## CONCLUSION

- ❑ TikzBuilder transforms natural language into professional LaTeX diagrams, eliminating the need to learn TikZ syntax manually.
- ❑ It enhances productivity and creativity for researchers, students, and educators by providing fast, accurate, and customizable diagram generation.
- ❑ Leveraging IBM Watsonx AI Agent Lab, it demonstrates the potential of intelligent agents in simplifying academic workflows.
- ❑ The project exemplifies how AI can make technical content creation accessible, precise, and publication - ready with minimal effort.

# GITHUB LINK

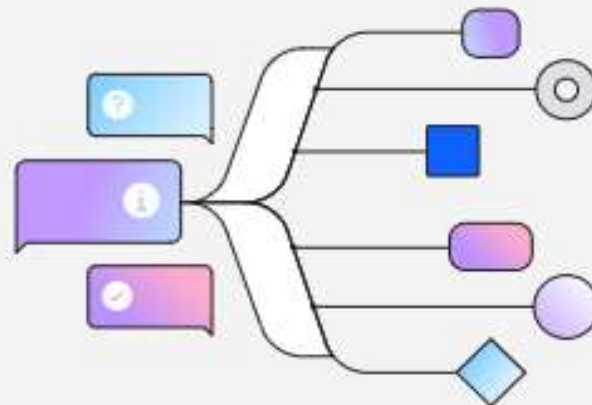
❑ <https://github.com/harish040120/TikzBuilder>



TikzBuilder 05:45 PM

## Welcome to TikzBuilder

Draw it with words - I'm your TikZ genie granting LaTeX diagram wishes!



## FUTURE SCOPE

- ❑ Add image-to-TikZ diagram conversion using vision - language models
- ❑ Enable voice input for hands-free diagram generation
- ❑ Integrate real-time LaTeX preview for TikZ output
- ❑ Support multilingual natural language input
- ❑ Provide interactive visual editing for diagrams
- ❑ Integrate TikzBuilder with LaTeX editors like Overleaf and VS Code

# IBM CERTIFICATIONS

- Screenshot/ credly certificate( getting started with AI)

In recognition of the commitment to achieve  
professional excellence

Getting Started with  
Artificial Intelligence  
IBM SkillsBuild



## Muthu Harish.T

Has successfully satisfied the requirements for:

### Getting Started with Artificial Intelligence



Issued on: Jul 19, 2025

Issued by: IBM SkillsBuild

Verify: <https://www.credly.com/badges/53aeb234-7c74-4955-8fd2-e16e21931518>





# IBM CERTIFICATIONS

- Screenshot/ credly certificate( Journey to Cloud)

In recognition of the commitment to achieve  
professional excellence



Muthu Harish.T

Has successfully satisfied the requirements for:

Journey to Cloud: Envisioning Your Solution



Issued on: Jul 19, 2025

Issued by: IBM SkillsBuild

Verify: <https://www.credly.com/badges/6261a821-9010-4a84-9d76-91aa7942a5b9>



# RAG LAB CERTIFICATE

IBM **SkillsBuild**

Completion Certificate



This certificate is presented to

Muthu Harish.T

for the completion of

**Lab: Retrieval Augmented Generation with  
LangChain**

(ALM-COURSE\_3824998)

According to the Adobe Learning Manager system of record

**Completion date:** 19 Jul 2025 (GMT)

**Learning hours:** 20 mins



**THANK YOU**