CAPSTONE PROJECT

AI-POWERED LATEX DIAGRAM GENERATOR FOR ACADEMIC RESEARCH

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PROBLEM STATEMENT

Academic researchers and writers often struggle when creating diagrams in LaTeX, particularly using the TikZ package. Manually writing TikZ code is not only time-consuming but demands a high level of technical proficiency and is vulnerable to coding errors. This complexity leads to delays in documentation, poses a steep learning curve for newcomers, and detracts from overall productivity. There is a pressing need for a smart and accessible solution that simplifies and streamlines this process.

Proposed Solution:
To address this challenge, I propose an AI-powered intelligent assistant designed to automatically generate TikZ diagrams from natural language descriptions and rough sketches. This system offers real-time feedback, allows users to make refinements using plain English commands, and produces publication-ready LaTeX graphics. By eliminating manual coding, it significantly enhances the efficiency and accessibility of academic documentation—empowering researchers with fast, intuitive, and high-quality diagram creation.

TECHNOLOGY USED

IBM cloud lite services

Natural Language Processing (NLP)

Retrieval Augmented Generation (RAG)

IBM Granite model

IBM CLOUD SERVICES USED

- IBM Cloud Watsonx AI Studio
- IBM Cloud Watsonx AI runtime
- IBM Cloud Service
- IBM Granite(via watsonx.ai studio)
- IBM Cloud Object Storage IBM AI Tools

WOW FACTORS

Natural Language to Code Effortlessly convert plain English descriptions into precise TikZ diagrams for LaTeX documents.

Sketch-to-TikZ Conversion Transform hand-drawn sketches into clean, structured code for accurate diagram representation.

Dynamic Refinement Modify and fine-tune diagrams using real-time, conversational English—no need to touch the code.

Academic-Grade Output Generate high-resolution, publication-ready diagrams suitable for journals, theses, and reports.

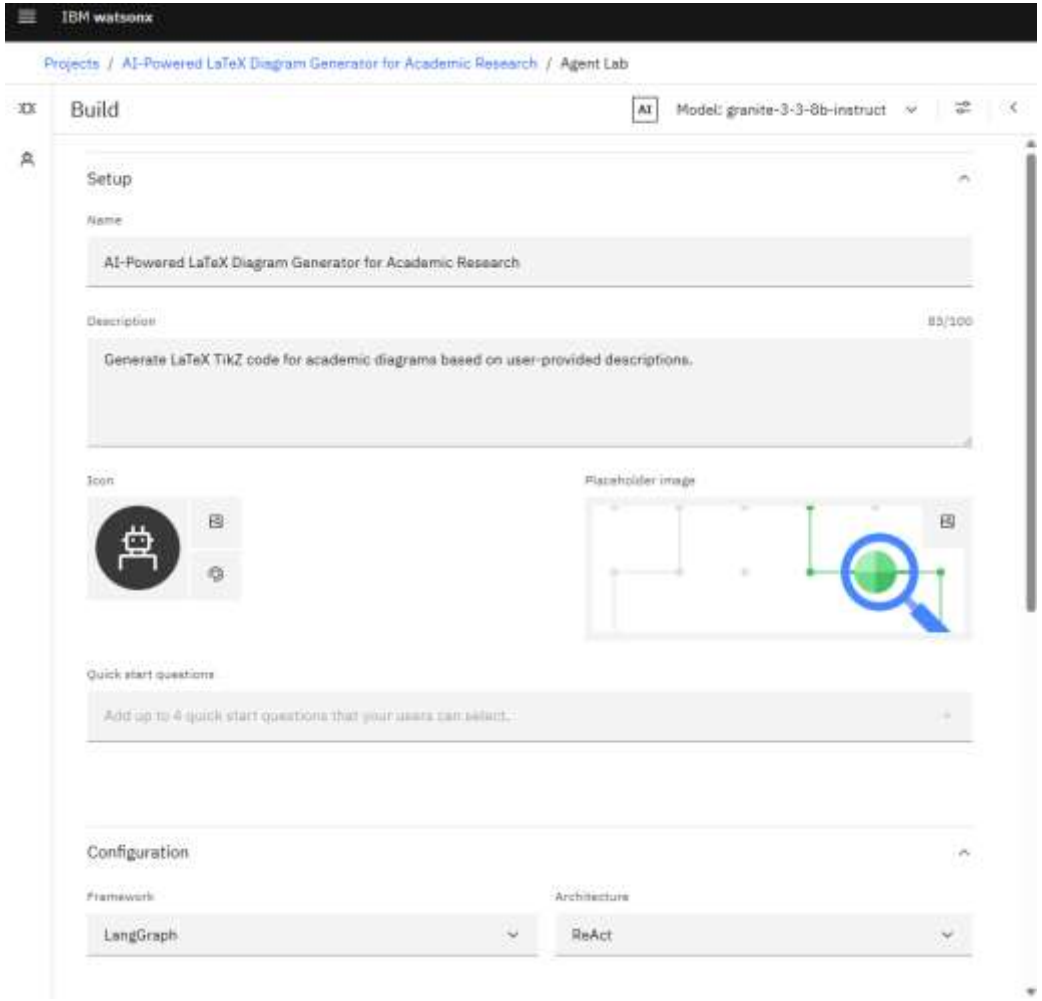
No Prior Experience Required Designed for all users—no LaTeX or TikZ expertise necessary to create professional visuals.

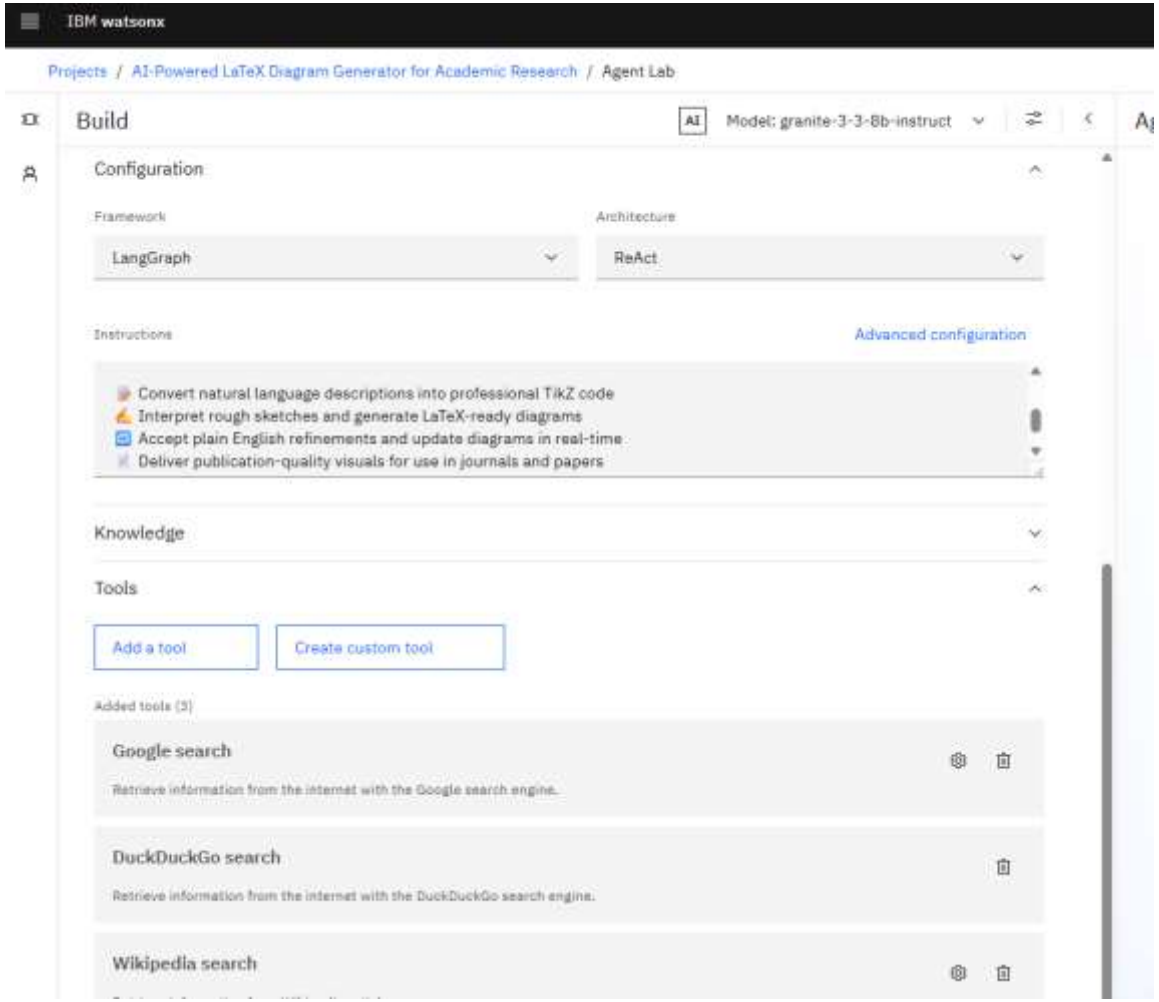
Flexible Deployment Accessible via web, desktop, and seamlessly integrated with platforms like Overleaf for smooth workflow.

END USERS

- **Academic Researchers** Automate complex diagrams for theses, journal articles, and research papers.
- **Professors & Educators** Create visually engaging lecture notes, slides, and classroom content with ease.
- **Students (Undergraduate, Postgraduate, PhD)** Simplify LaTeX-based assignments, project documentation, and academic submissions.
- **Research Institutions & Universities** Boost productivity and streamline publication workflows across departments.
- **Technical Writers & LaTeX Enthusiasts** Improve precision, speed, and aesthetics in diagram creation without manual coding.

RESULTS





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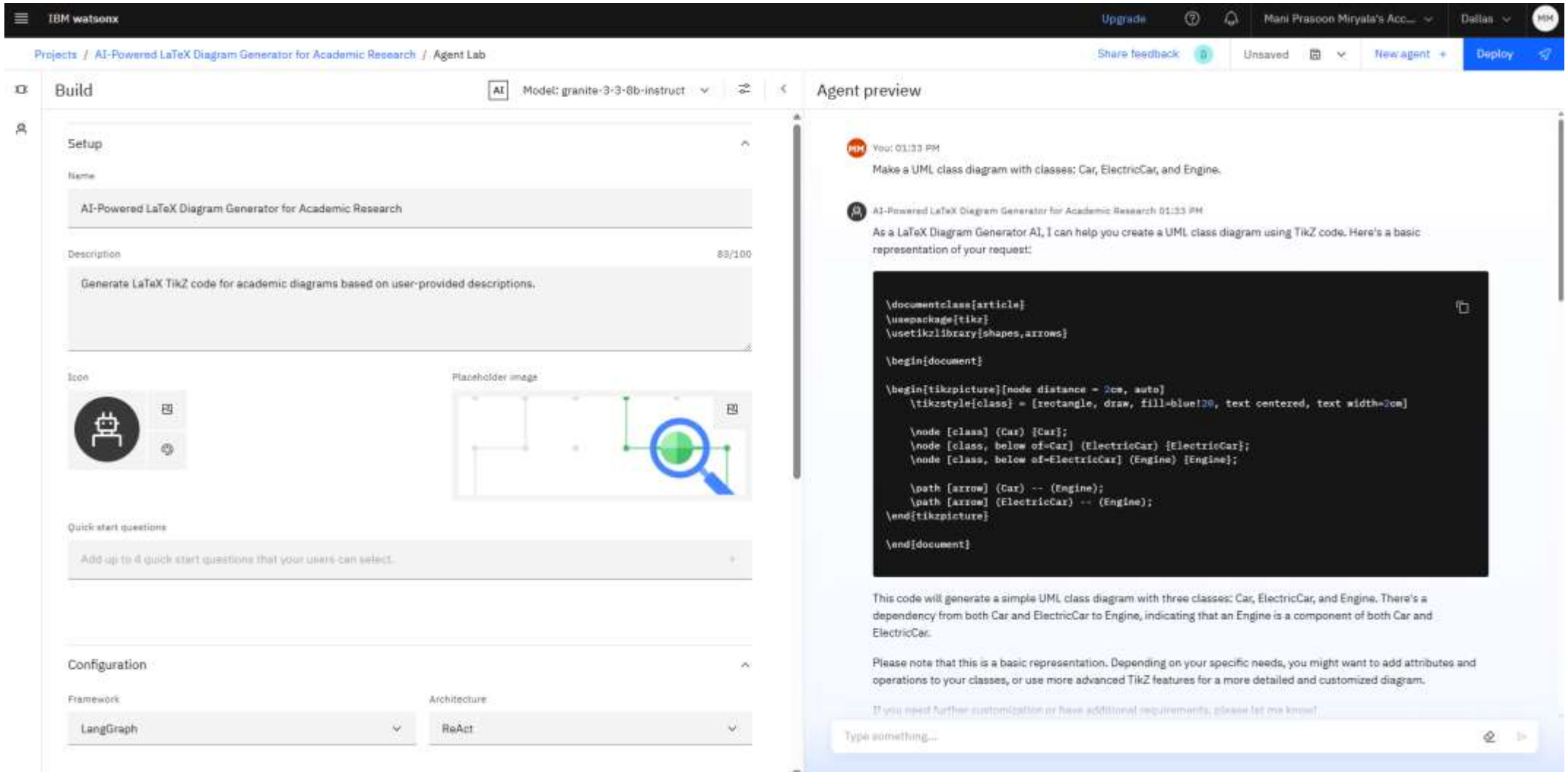
RESULTS



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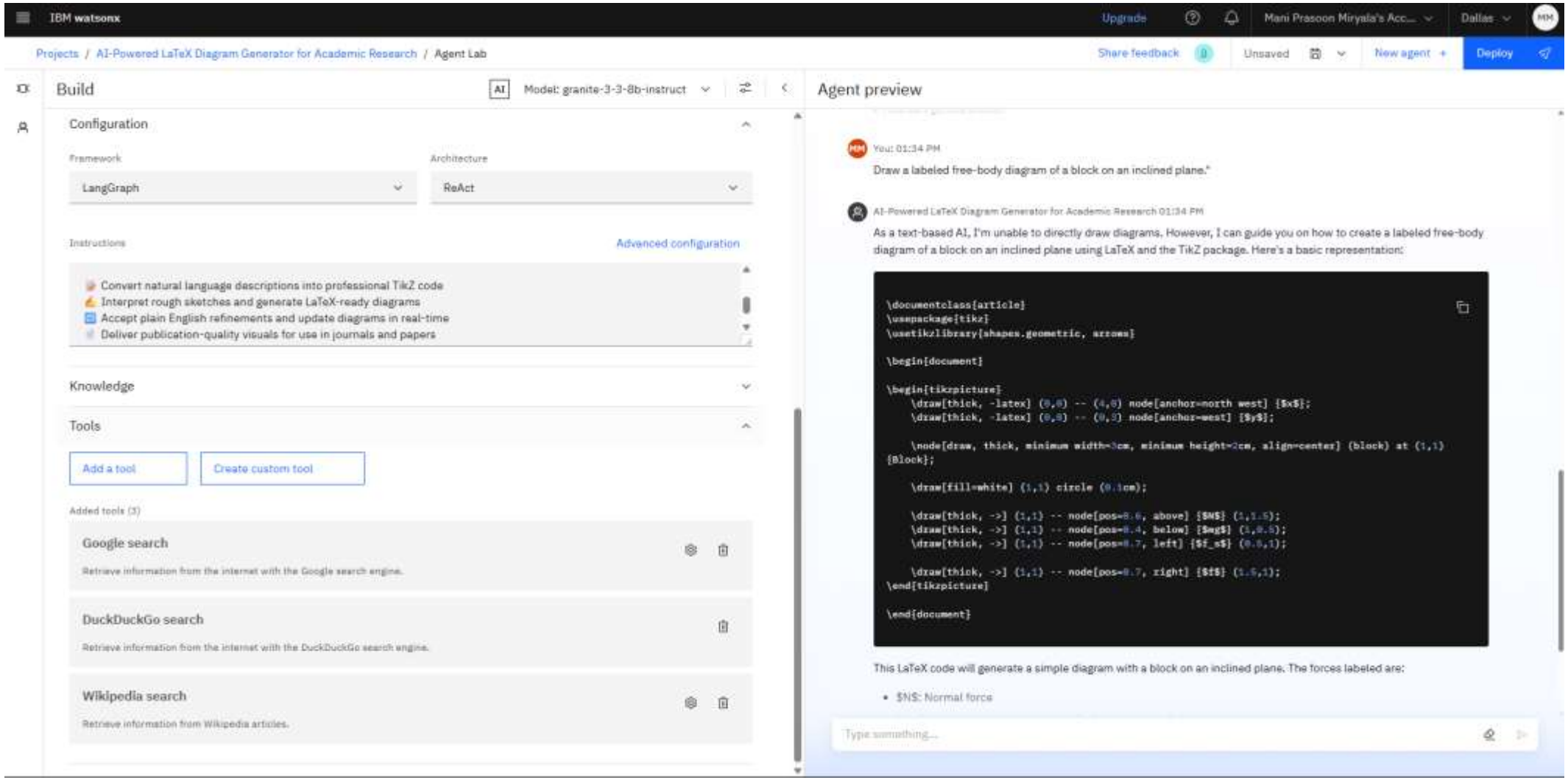
RESULTS



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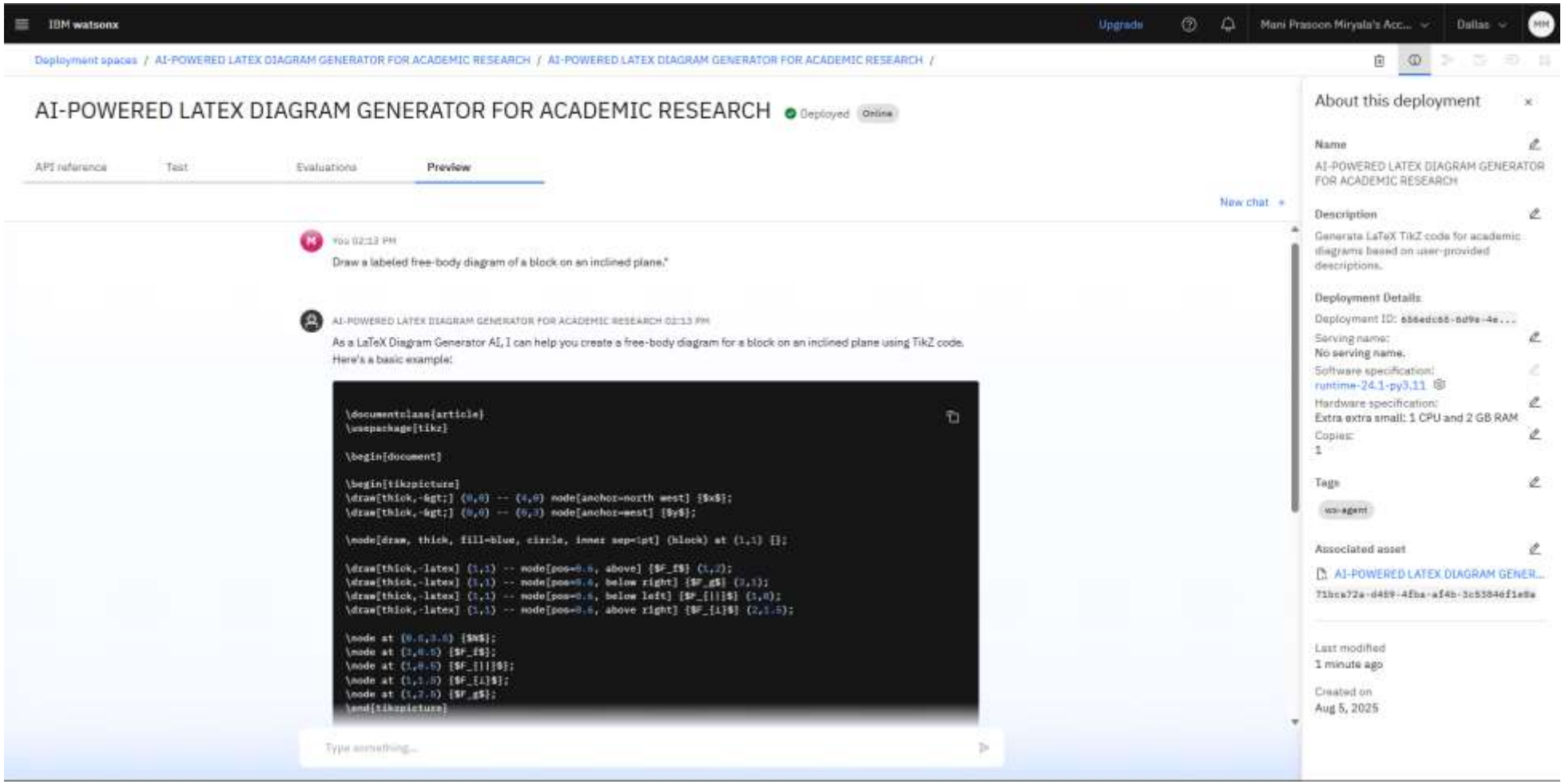
RESULTS

Code Editor | Visual Editor | Normal text | WRITEFULL | Editing | Recompile | 1 / 1 | 92%

```
1  \documentclass{article}
2  \usepackage{tikz}
3  \usetikzlibrary{shapes,arrows}
4
5  \begin{document}
6
7  \begin{tikzpicture}[node distance = 2cm, auto]
8      \tikzstyle{class} = [rectangle, draw, fill=blue!20, text centered, text width=2cm]
9
10     \node [class] (Car) {Car};
11     \node [class, below of=Car] (ElectricCar) {ElectricCar};
12     \node [class, below of=ElectricCar] (Engine) {Engine};
13
14     \path [arrow] (Car) -- (Engine);
15     \path [arrow] (ElectricCar) -- (Engine);
16 \end{tikzpicture}
17
18 \end{document}
19
20
```

RESULTS

Deployed AI Agent



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CONCLUSION

- **Streamlines Diagram Creation** Automatically converts natural language and rough sketches into professional TikZ diagrams, removing the hassle of manual coding.

- **Accelerates Research Output** Speeds up academic workflow by enabling fast, high-quality diagram generation—saving valuable time for researchers, students, and educators.

- **Democratizes Access** Makes advanced LaTeX graphics available to all users, regardless of technical skill, through intuitive commands and real-time feedback.

FUTURE SCOPE

- **Voice-Controlled Diagram Generation** Enable hands-free interaction through speech-to-text input, enhancing accessibility and speeding up the design process.
- **Multilingual Command Support** Accept natural language inputs in multiple languages, empowering researchers worldwide to work in their preferred linguistic environment.
- **Seamless Overleaf Integration** Embed real-time TikZ diagram rendering and editing directly into Overleaf for streamlined LaTeX workflow management.
- **Context-Aware Diagram Suggestions** Automatically recommend suitable diagrams based on adjacent LaTeX content and semantic analysis of the document.
- **Real-Time Collaborative Editing** Facilitate simultaneous editing by multiple users, making it ideal for team-based research and co-authoring scenarios.
- **AI-Guided Layout Optimization** Provide intelligent layout suggestions to improve clarity, aesthetics, and readability of complex diagrams.
- **Multi-Format Export Capability** Support exports in TikZ, PNG, SVG, and PDF formats for flexible use across publications, presentations, and teaching materials.

IBM CERTIFICATIONS

In recognition of the commitment to achieve professional excellence

Getting Started with Artificial Intelligence

IBM

Mani prasoon Miryala

Has successfully satisfied the requirements for:

Getting Started with Artificial Intelligence

Issued on: Jul 18, 2025
Issued by: IBM SkillsBuild

Verify: https://www.credly.com/badges/c82d0d09-ccd0-4cc9-9c65-ebe43dcd1249

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IBM CERTIFICATIONS

IBM **SkillsBuild** Completion Certificate

This certificate is presented to

Mani prasoon Miryala

for the completion of

Journey to Cloud: Envisioning Your Solution

(PLAN-32CB1E21D8B4)

According to the Your Learning Builder - Plans system of record

Completion date: 19 Jul 2025 (GMT)

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IBM **SkillsBuild** Completion Certificate

This certificate is presented to

Mani prasoon Miryala

for the completion of

Lab: Retrieval Augmented Generation with LangChain

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 18 Jul 2025 (GMT)

Learning hours: 20 mins

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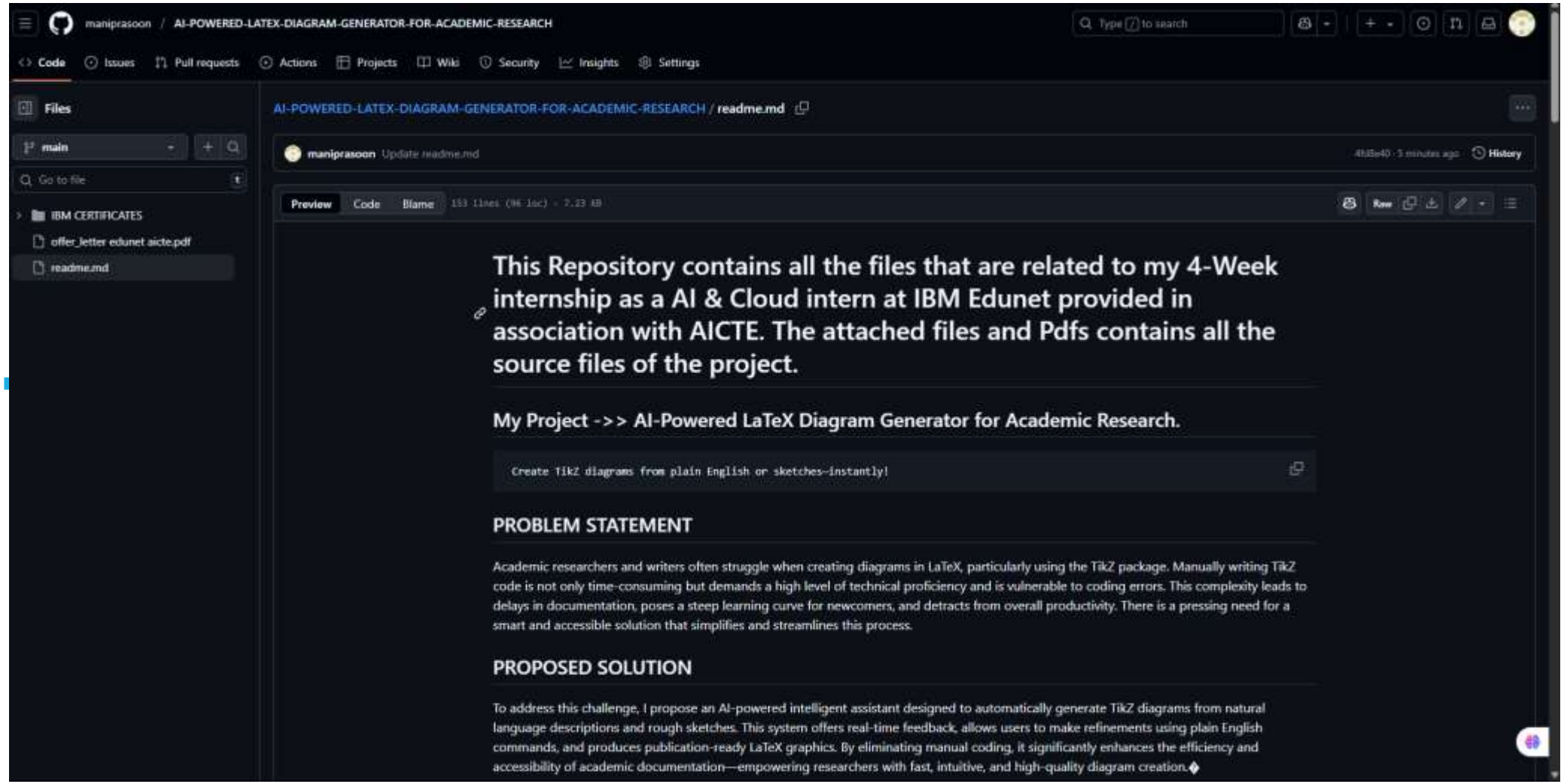
Github link : https://github.com/maniprasoon/AI-POWERED-LATEX-DIAGRAM-GENERATOR-FOR-ACADEMIC-RESEARCH

GITHUB (README)



Github link : https://github.com/maniprasoon/AI-POWERED-LATEX-DIAGRAM-GENERATOR-FOR-ACADEMIC-RESEARCH

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THANK YOU

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