#### **CAPSTONE PROJECT**

### LabGo

**Presented By:** 

1. Namita D A-BMS College of Engineering-Computer Science



#### **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

#### **Problem Statement 11: Al Lab Manual and Experiment Generator**

Educators and students often face significant challenges in preparing, accessing, and standardizing laboratory manuals and experiments across various educational institutions. The manual creation of lab guides is time-consuming, error-prone, and frequently lacks alignment with updated curriculum standards, safety protocols, and available infrastructure. Additionally, the absence of customizable experiment plans and automated evaluation rubrics makes it difficult to adapt lab experiences to different classroom environments and learning needs.

There is a pressing need for a system that can dynamically generate accurate, curriculum-aligned, and equipment-sensitive lab manuals, complete with procedural instructions, safety guidelines, and grading rubrics. The solution must be scalable, adaptable to multiple subjects and education boards, and capable of retrieving and synthesizing relevant data from trusted academic sources.



# PROPOSED SOLUTION

- Created an Agentic AI which generates lab manual and experiments.
- Data Collection:
  - Gathered multiple experiments with all details for grade 12 for chemistry, physics and biology.
- Data Preprocessing:
  - Cleaned and standardized the extracted data for consistency.
  - Removed duplicates, filled in missing values, and aligned formatting across subjects.
  - Organized data into sections with a uniform template for all experiments.
- Agentic Al logic:
  - Used LangGraph framework and ReAct architecture.
  - Natural Language is processed through a vector database called lab\_experiments
- Deployment:
  - Develop a user-friendly interface or application that provides real-time solutions for lab-experiments and its alternatives.
  - Deploy the solution on a scalable and reliable platform, considering factors like server infrastructure, response time, and user accessibility.
- Evaluation:
  - Accuracy of experiment data
  - Adhered to NCERT Guidelines



# SYSTEM APPROACH

#### **System requirements**

Processor:Dual core(i3 or above)

RAM:4GB minimum

Storage:SSD with minimum 128GB free space

Network adapter: Wi-fi or Ethernet with stable connectivity

Operating System: Windows/macOS/Linux

Web Browsers:Google Chrome/Microsoft Edge/Mozilla Firefox

#### Library required to build the model

IBM Cloud: watsonx service

Agentic Al lab(beta version)

Framework: LangGraph

Architecture: reAct

Added tools: Google search, DuckDuckGo search, Wikipedia, Webcrawler

Document Search: labexperiments Word Document (consists of defined experiments by Namita)



# **ALGORITHM & DEPLOYMENT**

#### Algorithm Selection:

The core architecture utilizes an **Agentic Workflow Model** implemented via the **LangGraph framework**, a powerful system for building dynamic, branching workflows with memory and tool usage capabilities. LangGraph enables stateful interactions between language models and tools like retrievers, databases, and formatters. This architecture suits the task well because the generation of lab manuals involves multiple stages: query interpretation, curriculum data retrieval, formatting, safety and rubric generation, and final compilation—all of which benefit from modular, traceable steps and memory.

#### Data Input:

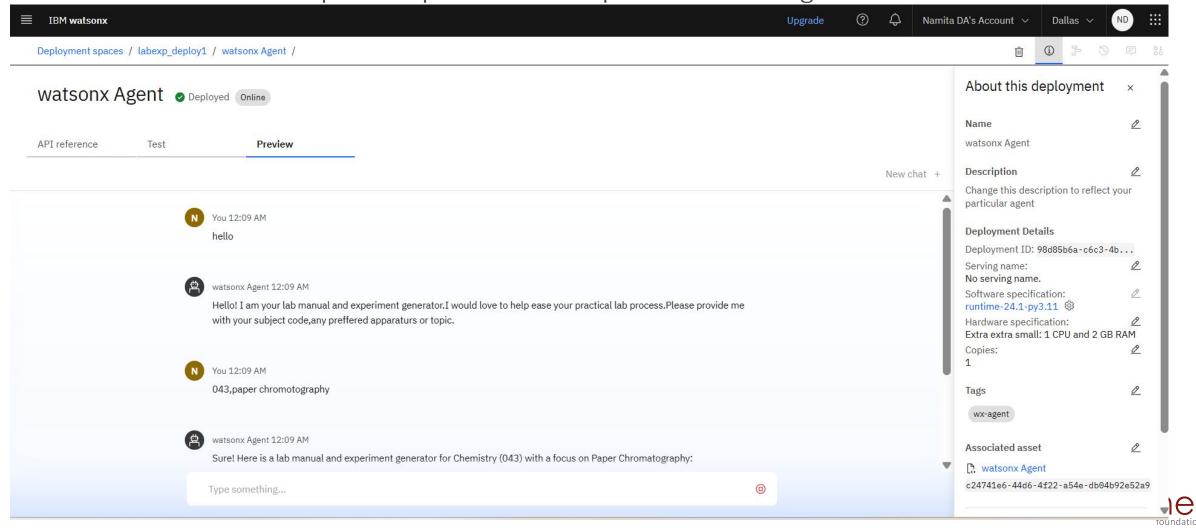
- Vector data: labExperiments Word document
- Course code or Subject
- Preferred topic
- Preferred format (PDF/Markdown)
- Equipment availability (optional constraint)

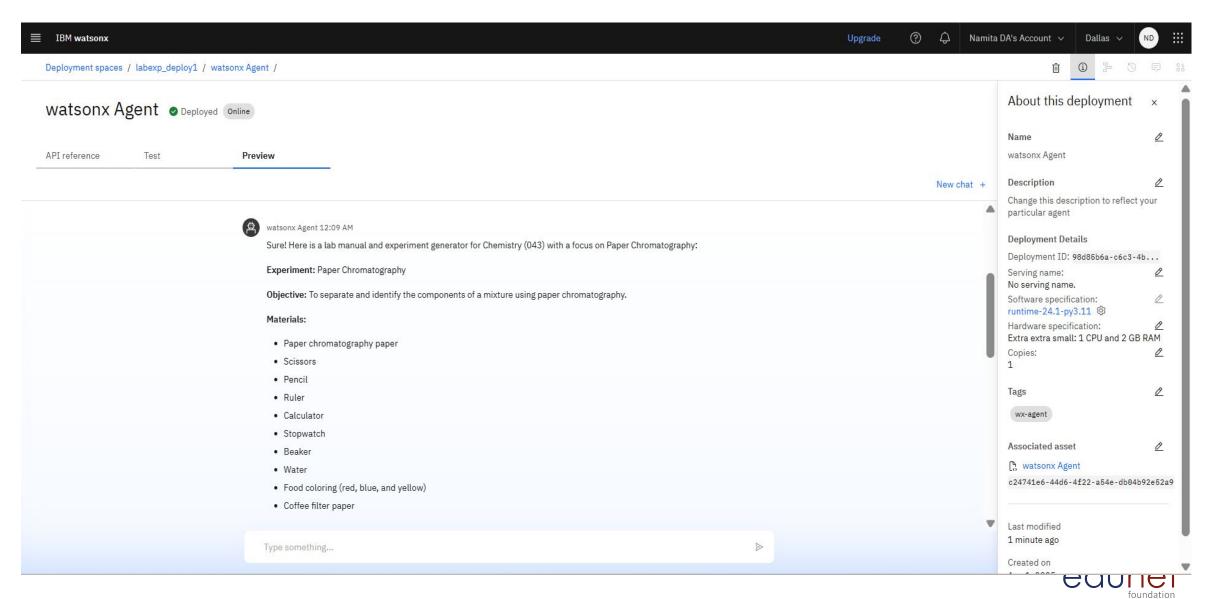
#### Prediction Process:

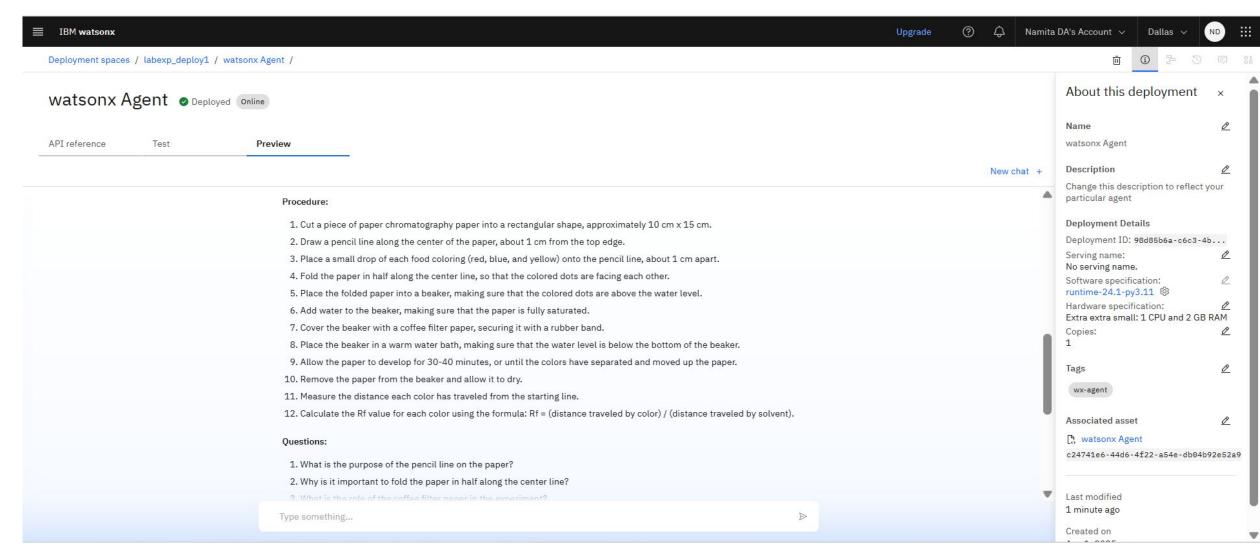
Uses RAG (Retrieval-Augmented Generation) to fetch relevant experiment procedures, safety guidelines, and rubrics from NCERT and other academic repositories



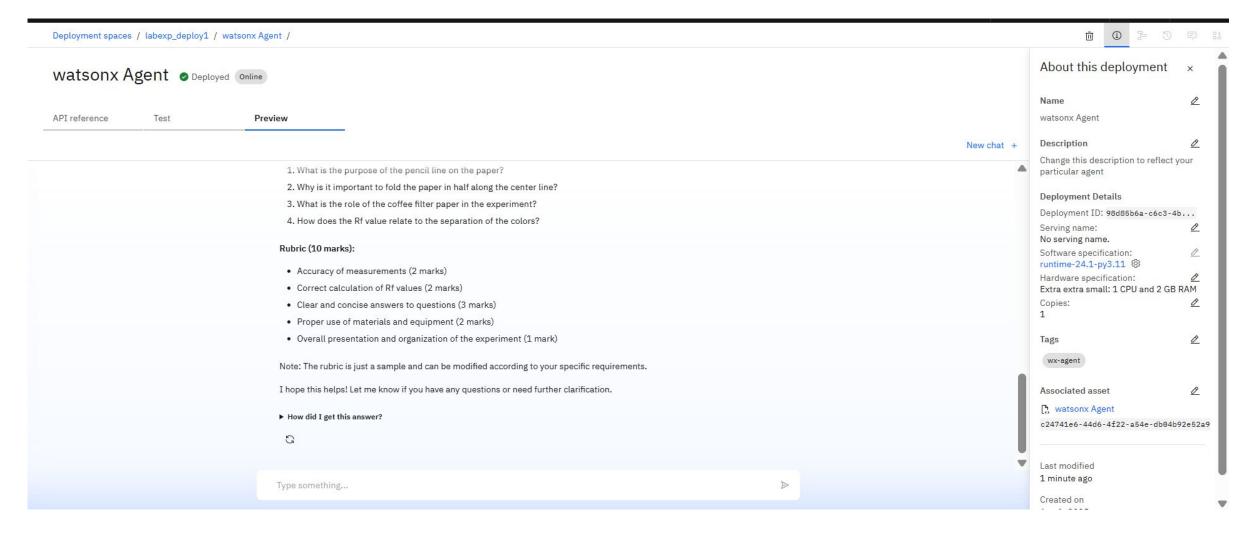
Test Case 1: Providing subject code and preferred topic
Test result: Matches the experiment provided in our input document along with rubrics.





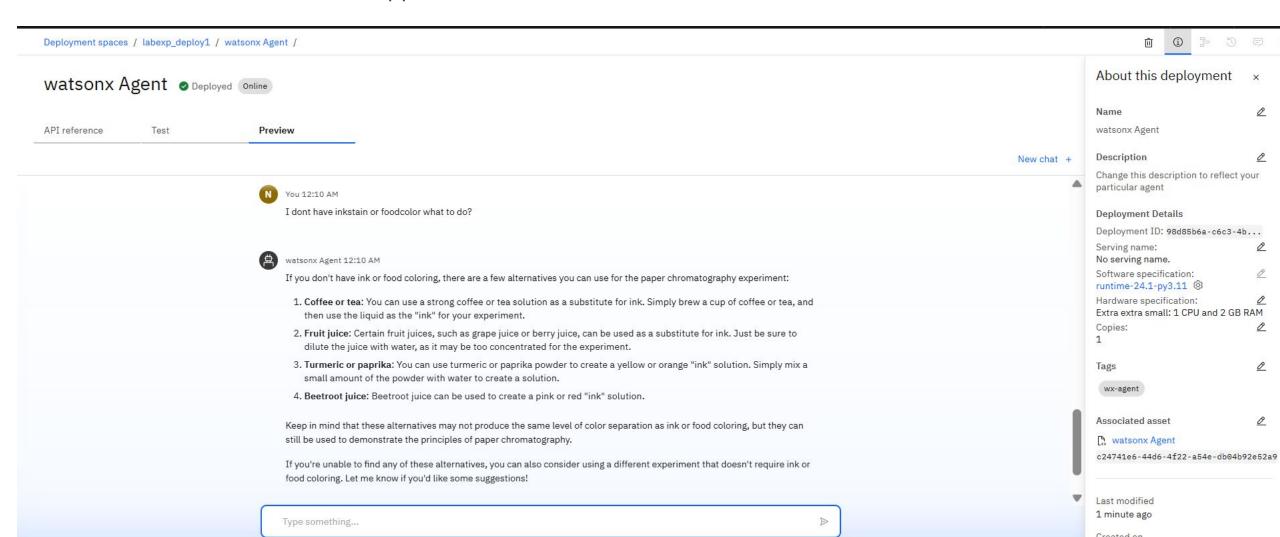






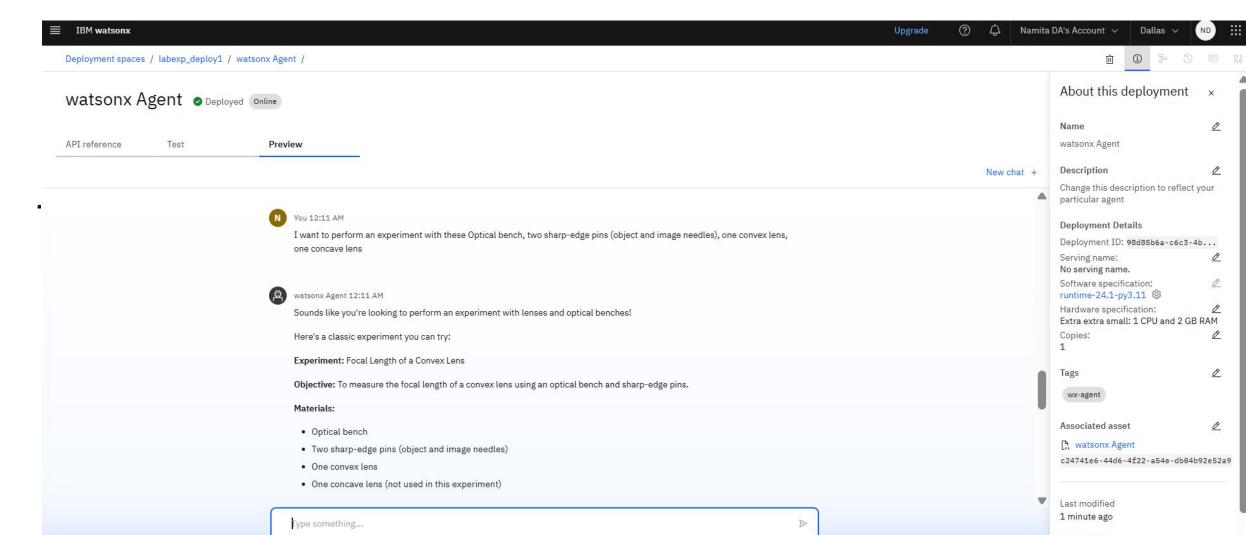


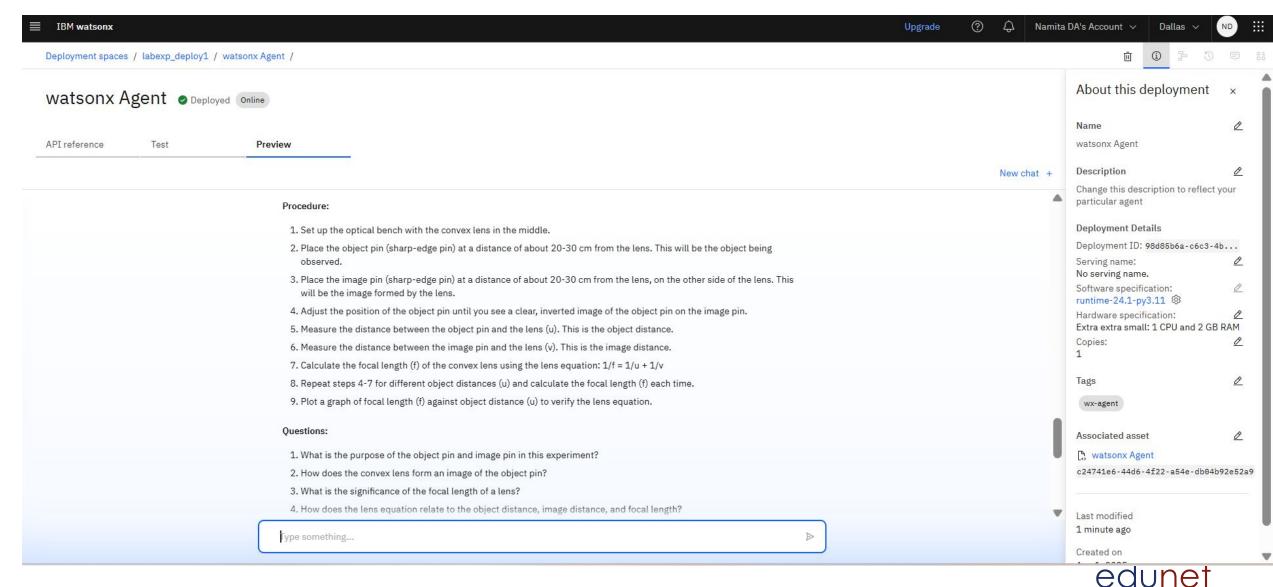
Test Case 2: Asking for alternative Apparatus. Test result: Provided alternative Apparatus.

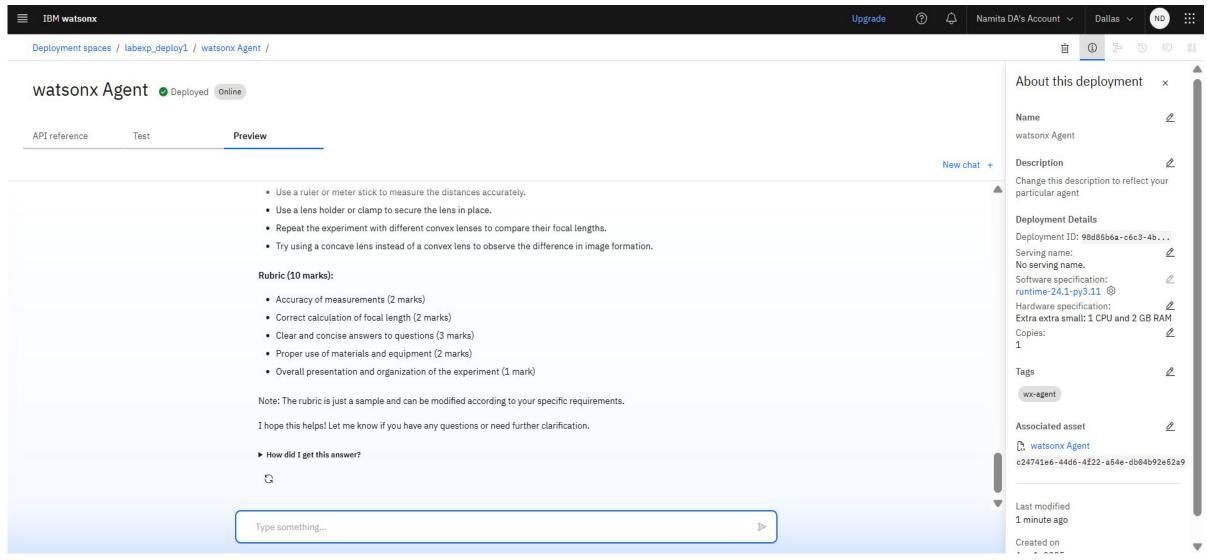


Test Case 3: Asking for experiment suggestions with available equipment.

Test result: Provided a detailed documentation of an experiment using the available equipment.









#### **Deployment Link:**

https://dataplatform.cloud.ibm.com/ml-runtime/deployments/98d85b6a-c6c3-4bd5-9a38-d789639e7eea/chat?space\_id=c5a8351d-42f6-43b0-b2a3-d3c0ea83cf07&context=wx&flush=true



## CONCLUSION

The Agentic AI Lab Manual & Experiment Generator, built using the LangGraph framework with Retrieval-Augmented Generation (RAG), successfully automated the creation of structured, syllabus-aligned lab manuals for Class 12 Physics, Chemistry, and Biology. The system was able to:

- Generate detailed experiment sections (aim, apparatus, procedure, safety standards, and rubrics) accurately.
- Customize content based on syllabus inputs and subject selection.
- Maintain consistency and format readiness across all experiments.
- Reduce manual effort by automating information retrieval, formatting, and evaluation criteria inclusion.

This agentic system proved especially effective for educators seeking standardized, printable, and customizable lab documentation aligned with NCERT and CBSE norm



#### **FUTURE SCOPE**

- Multilingual and voice input
- Adaptive and Personalised learning
- Real-time safety compliance monitoring
- Integration with virtual lab and Stimulators



### REFERENCES

- Central Board of Secondary Education <a href="https://cbseacademic.nic.in">https://cbseacademic.nic.in</a>
- Laboratory Manual Physics Class XII, NCERT
- Laboratory Manual Chemistry Class XII, NCERT
- Laboratory Manual Biology Class XII, NCERT Available at: <a href="https://ncert.nic.in/textbook.php">https://ncert.nic.in/textbook.php</a>
- Automating with Al Agents IBM Documentation
   URL:https://dataplatform.cloud.ibm.com/docs/content/wsj/analyze-data/fm-agents-overview.html?context=wx&audience=wdp



#### IBM CERTIFICATIONS

Getting Started with In recognition of the commitment to achieve professional excellence Namita DA 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/91a02503-4d23-47a5-a58f-a44e408d684b



#### IBM CERTIFICATIONS

Journey to Cloud: In recognition of the commitment to achieve professional excellence Namita DA Has successfully satisfied the requirements for: Journey to Cloud: Envisioning Your Solution Issued on: Jul 21, 2025 Issued by: IBM SkillsBuild Verify: https://www.credly.com/badges/5bebb744-5478-450b-b16d-f4029f8a64bd



#### IBM CERTIFICATIONS

IBM SkillsBuild

**Completion Certificate** 



This certificate is presented to

Namita DA

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**

