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Data Science

Project Galileo: An AI Physics Lab Assistant

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Project Guide
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Outline

- Introduction
- Literature Survey of the existing systems
- Limitations of the existing systems
- Problem statement
- System Design
- Technologies and methodologies
- Implementation
- Conclusion
- References

Sustainable Development Goals (SDG)Mapped

1. SDG 4 – Quality Education
- Provides accessible lab support and AI tutoring for students.
- Improves learning outcomes through interactive guidance.
- Helps students in remote or resource-limited areas access lab knowledge.

2. SDG 9 – Industry, Innovation, and Infrastructure
- Uses AI and NLP technology to modernize education systems.
- Promotes innovation in laboratory learning environments.

3. SDG 10 – Reduced Inequalities
- Ensures equal access to lab knowledge regardless of geographical or economic background.
- Bridges the gap between students with and without access to physical lab instructors.

Introduction

1. Real-Time Observation of the Problem:

- Physics students at Mumbai University often face a disconnected learning process, juggling separate tools for theory, lab work, and data analysis. Significant time is spent on manual calculations, which detracts from a deeper conceptual understanding of physics principles.

2. Motivation:

- Our motivation is to solve these challenges using AI and modern web technology.

- We aim to create a single, cohesive tool that makes the physics learning experience more efficient, engaging, and effective for every student.

3. Objectives:

- Provide an AI Tutor for instant, curriculum-aware answers.
- Automate Data Analysis for lab work, including error propagation and OCR.
- Generate Adaptive Quizzes to help students identify and improve weaknesses.
- Deliver a Unified Platform with a secure and modern user interface

Literature Survey of the existing system

Sr. No.	Title	Author(s)	Year	Outcomes	Methodology	Result
1	[1] Virtual Teaching Assistant: Design and Evaluation of an AI-Powered Tutor	Smith, J., Kumar, R.	2018	Demonstrated how AI-based assistants can support students with FAQs, scheduling, and instant responses.	Used Natural Language Processing (NLP) and Machine Learning models to train a chatbot for educational queries.	We can adapt this approach to create an AI Lab Assistant that answers lab-related student questions automatically.
2	[2] Intelligent Laboratory Support Systems using AI	Li, H., Fernandez, M.	2019	Highlighted AI's role in automating lab procedures and reducing human errors.	Applied computer vision and AI models to monitor lab experiments and provide real-time feedback.	We can extend these techniques to design a system that guides students through lab steps safely and accurately.
3	[3] Conversational AI for Education: A Case Study of AI Assistants	Brown, T., Alvarez, L.	2021	Showed improvement in student engagement using conversational AI tutors.	Integrated speech recognition + dialogue management systems to interact with learners.	We can integrate voice interaction in our AI Lab Assistant to make lab sessions more interactive and hands-free.
4	[4] AI in STEM Education: Opportunities and Challenges	Wang, Y., Patel, S.	2022	Discussed benefits of AI in STEM labs and challenges like bias, accuracy, and reliability.	Literature review on AI applications in STEM learning environments.	Helps us identify limitations and plan reliable, unbiased AI models in our Lab Assistant project.

Limitations of existing systems

• Limited Scope of Assistance: Most AI assistants focus only on FAQs or simple tutoring, not on practical lab guidance.

•Accuracy & Reliability Issues: NLP/chatbot systems sometimes give incorrect or incomplete answers, which can confuse students during lab work.

•Lack of Real-Time Lab Integration: Current systems rarely connect with lab equipment or sensors, limiting their usefulness in hands-on experiments.

•Bias and Data Dependence: AI performance depends on training data quality; biased or incomplete data leads to unfair or inaccurate results.

Problem statement

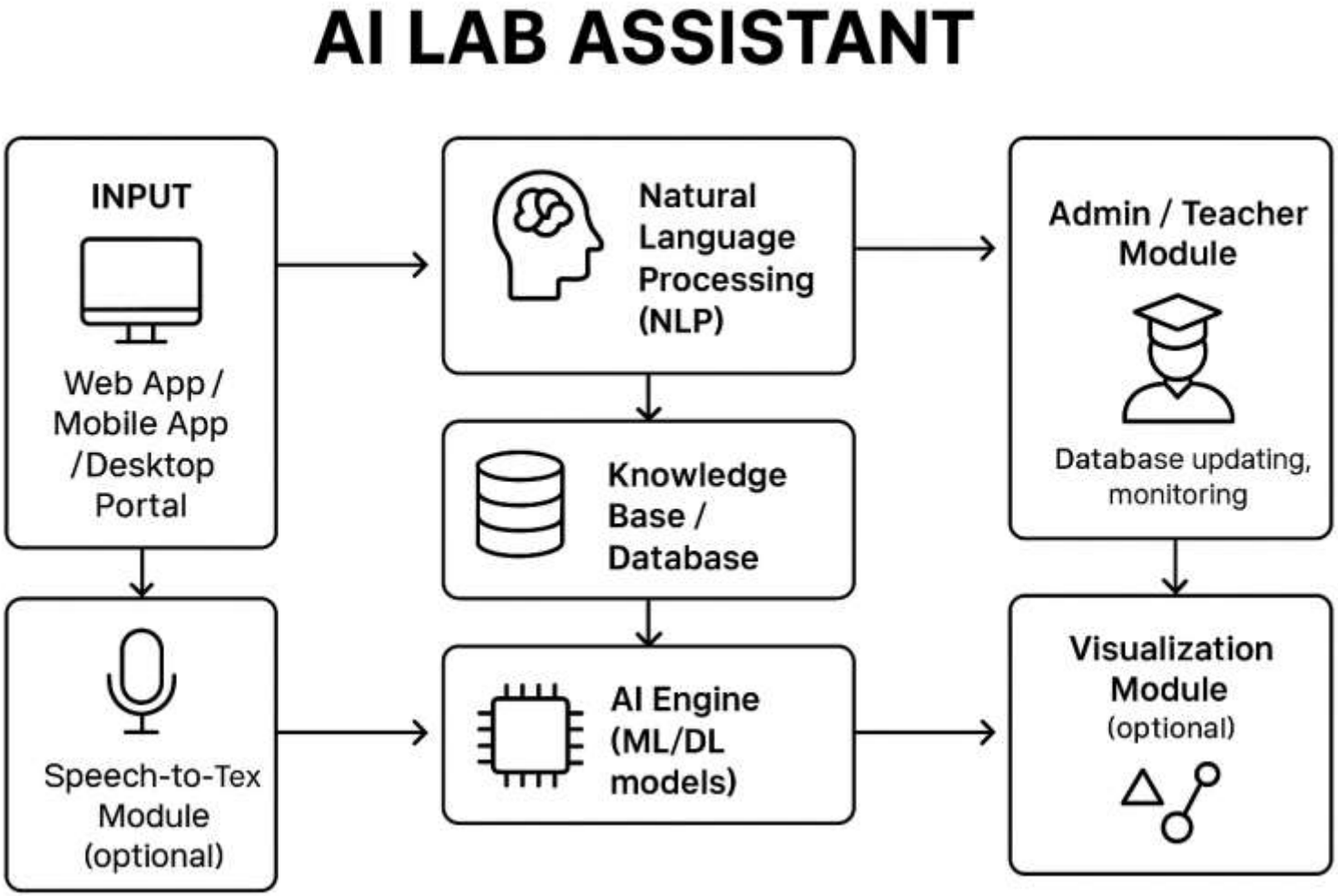
• Mumbai University physics students lack a unified, intelligent platform that seamlessly integrates theoretical learning, practical lab data analysis, and personalized assessment

• Excessive time spent on manual, error-prone tasks.

• Current solutions force students to switch between textbooks, lab notebooks, separate analysis tools, and online resources, creating a fragmented workflow.

• Need: AI-driven integration of tutoring, lab analysis, and quizzes

System Design



Technologies and methodologies

1. **Technologies:**

- **Frontend:**
- i. HTML, CSS
- ii. JavaScript
- **Backend:** Python 3.11.0, ML-based prediction integrated with APIs
- **Data Sources:**
- **Database :**
- **Data set :**
- **Data size:**

Technologies and methodologies

2. Methodologies:

1) **Machine learning model**:

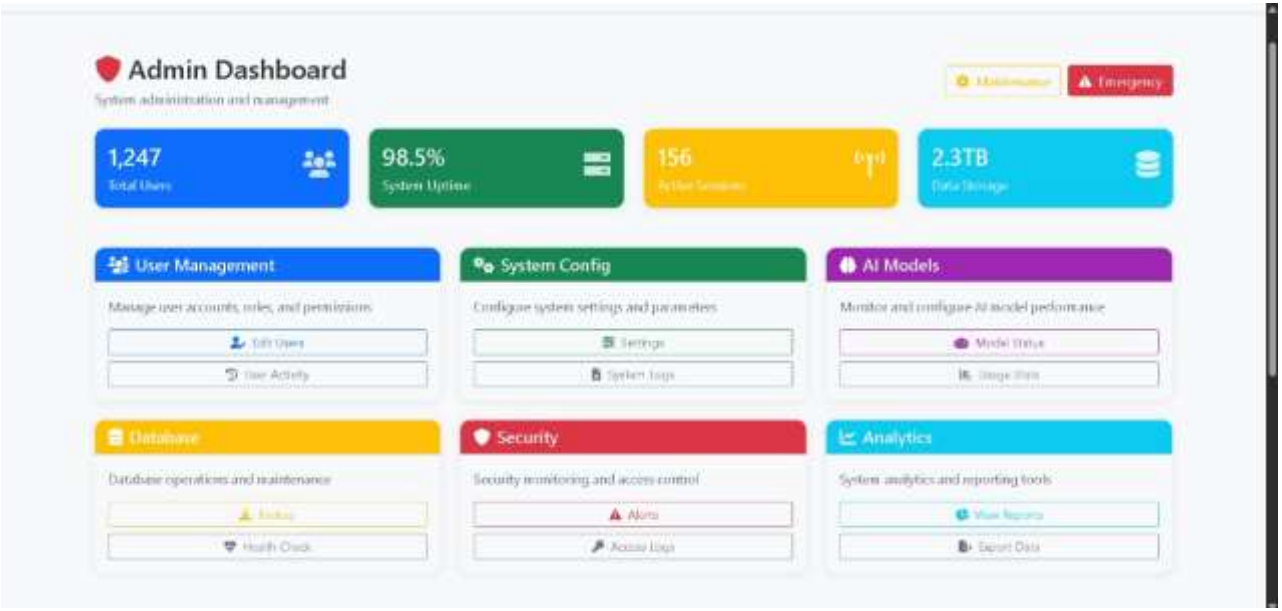
2) **Data Preprocessing:**

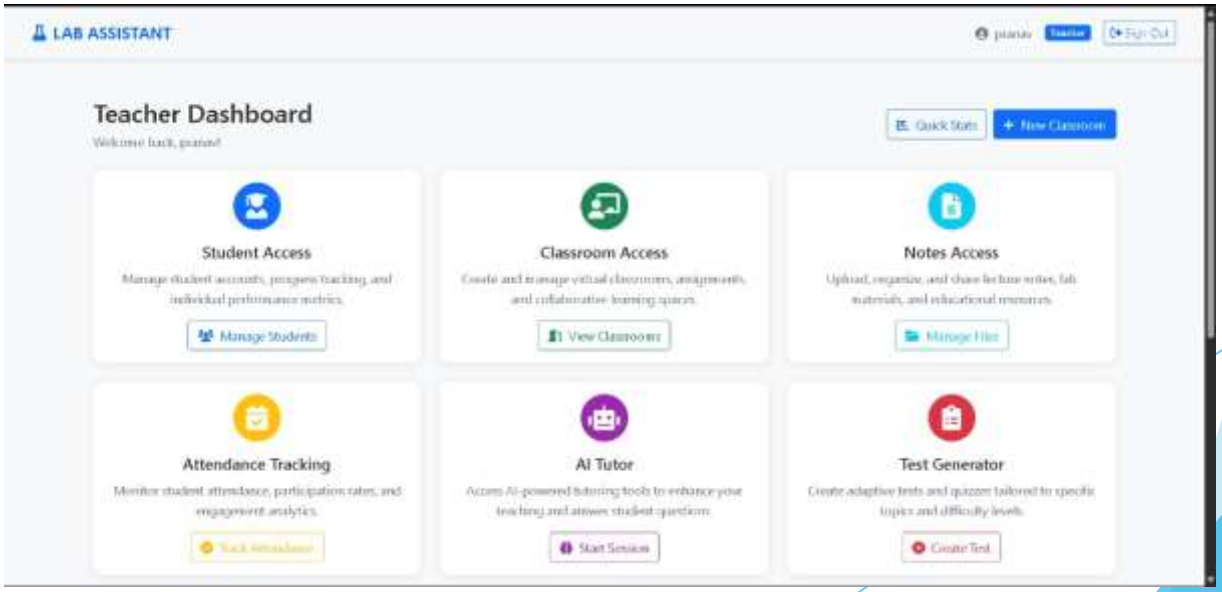
3) **Algorithms:**

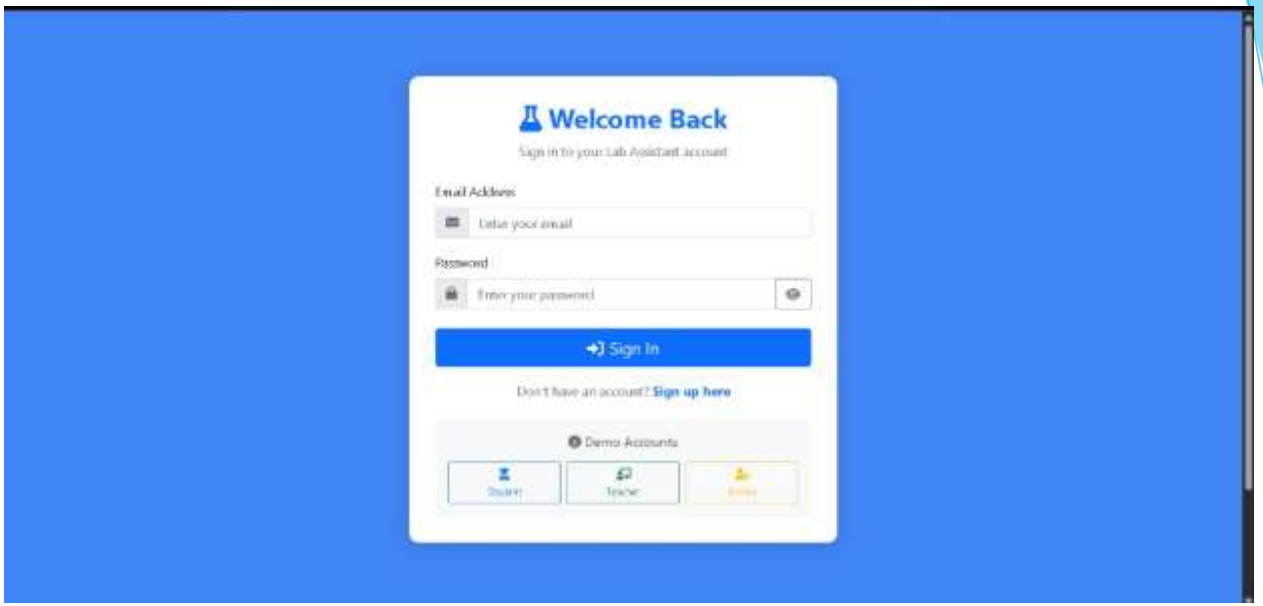
Algorithm Used:-

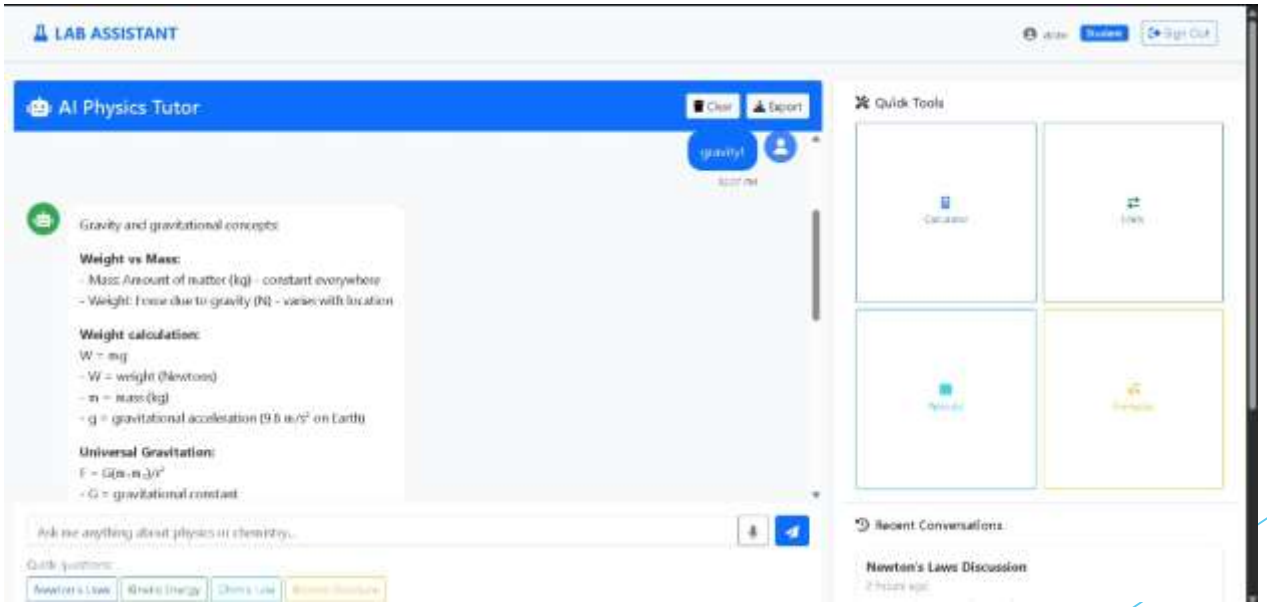
i. CURVE FITTING
ii. ERROR PROPOGATION(LINEAR REGRESSION)
iii. OCR

Implementation






Welcome Back
Email Address
Password
Sign In
Don't have an account? Sign up here
Demo Accounts


LAB ASSISTANT
AI Physics Tutor
Clear
Export
gravity!
Gravity and gravitational concepts:
Weight vs Mass:
- Mass: Amount of matter (kg) - constant everywhere
Weight calculation:
W = mg
Universal Gravitation:
Quick Tools
Recent Conversations
Newton's Laws Discussion

Conclusion

- Project Galileo integrates AI tutor, automated lab, and adaptive assessment into one platform.
- Provides a seamless workflow: Theory → experiment → analysis → assessment.
- Tailored for Mumbai University curriculum with a modern UI
.
- Modular design ensures scalability and future growth.

Future Enhancements:

- Mobile application for easy access.
- Expansion to other science departments.
- Advanced predictive analytics for personalized learning.

References

[1] Smith, J., & Kumar, R. (2018). *Virtual teaching assistant: Design and evaluation of an AI-powered tutor.* Journal of Educational Technology Systems. Retrieved from
URL- http://example.com/virtual-teaching-assistant-2018

[2] Li, H., & Fernandez, M. (2019). *Intelligent laboratory support systems using AI.* Computers & Education. Retrieved from
URL- http://example.com/intelligent-lab-support-AI

[3] Brown, T., & Alvarez, L. (2021). *Conversational AI for education: A case study of AI assistants.* International Journal of Artificial Intelligence in Education. Retrieved from
URL- http://example.com/conversational-AI-education

[4] Wang, Y., & Patel, S. (2022). *AI in STEM education: Opportunities and challenges.* Education and Information Technologies. Retrieved from
URL- http://example.com/AI-STEM-education

Thank You...!!