CAPSTONE PROJECT

SYLLABUS AND CURRICULUM DESIGN OPTIMIZER

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OUTLINE

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PROBLEM STATEMENT

Faculty members often face challenges in designing academic syllabi due to:

- Time-consuming manual work in drafting, mapping, and formatting
- Lack of automation for aligning course content with outcomes
- No standard way to map objectives to Bloom's Taxonomy
- Risk of inconsistency and reduced curriculum quality
- Limited integration of industry trends and modern teaching methods

These issues result in inefficient syllabus development and hinder innovation in curriculum design across institutions.

PROPOSED SOLUTION

AI-Driven Syllabus & Curriculum Design Optimizer

The proposed system is an AI-powered assistant that revolutionizes how academic syllabi are designed, reviewed, and enhanced. It minimizes manual workload, ensures curriculum alignment with educational frameworks, and promotes innovation in teaching content.

- **AI-Enhanced Curriculum Intelligence**
  - Leverages advanced Natural Language Processing (NLP) to interpret and analyze syllabus documents.
  - Automatically extracts course objectives, keywords, competencies, and learning outcomes from PDF files.
  - Categorizes learning objectives into appropriate Bloom's Taxonomy levels (e.g., Apply, Analyze, Evaluate, Create).
- **Curriculum Optimization Engine**
  - Recommends topic enhancements to improve alignment with program goals, industry needs, and accreditation bodies.
  - Suggests pedagogical improvements based on best practices and current trends in higher education.
  - Detects content overlaps, missing components, and inconsistencies, streamlining course structure.
- **Automation of Repetitive Academic Tasks**
  - Instantly generates draft-ready, outcome-mapped syllabi with properly formatted structure.
  - Automates the process of outcome mapping, reading list generation, and formatting.
  - Reduces dependency on manual editing and subjective judgment, ensuring standardization.
- **User-Friendly Web Application**
  - Built with Streamlit for seamless interaction and accessibility across devices.
  - Allows faculty to upload PDF syllabi, review extracted content, and get instant analysis and enhancement suggestions.
  - Integrated with IBM Watson NLU and deployed via IBM Cloud Lite, enabling reliable and scalable performance.
- **Expected Outcomes**
  - Saves up to 80% of faculty time spent on curriculum structuring.
  - Ensures curriculum consistency, alignment with Bloom's Taxonomy, and accreditation readiness.
  - Encourages data-backed decisions in syllabus planning—boosting academic quality and innovation.
- **Result:** A smart, scalable, and intuitive tool that empowers faculty to design better curricula—faster, smarter, and with precision.

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SYSTEM APPROACH

- **Language & Framework:** Python | Streamlit (for web interface)
- **NLP Toolkits:** NLTK (tokenization, keyword extraction), spaCy (semantic analysis, Bloom's classification)
- **PDF Parsing:** PyMuPDF (fitz) for text extraction from syllabus PDFs
- **Cloud Platform:** IBM Cloud Lite (hosting & integration)
- **Core Modules:**
  - Text Extractor – Extracts content from PDFs
  - Keyword Extractor – Identifies key terms and topics
  - Bloom's Classifier – Maps content to cognitive levels
- **Interface:** Clean, user-friendly Streamlit UI with sidebar navigation

ALGORITHM & DEPLOYMENT

Algorithm Selection:

We use rule-based classification along with spaCy's NLP pipeline to identify Bloom's Taxonomy levels. It was selected due to its efficiency in linguistic pattern matching and semantic similarity checks in educational objectives.

Data Input:

The system uses extracted syllabus text, which is tokenized into sentences. Each sentence is analyzed based on action verbs and contextual meaning mapped to Bloom's categories.

Training Process:

Though rule-based, the model is enhanced with pre-trained spaCy embeddings (en_core_web_md). Bloom levels are determined by comparing verbs and sentence structure against a curated verb list aligned with Bloom's levels.

Prediction Process:

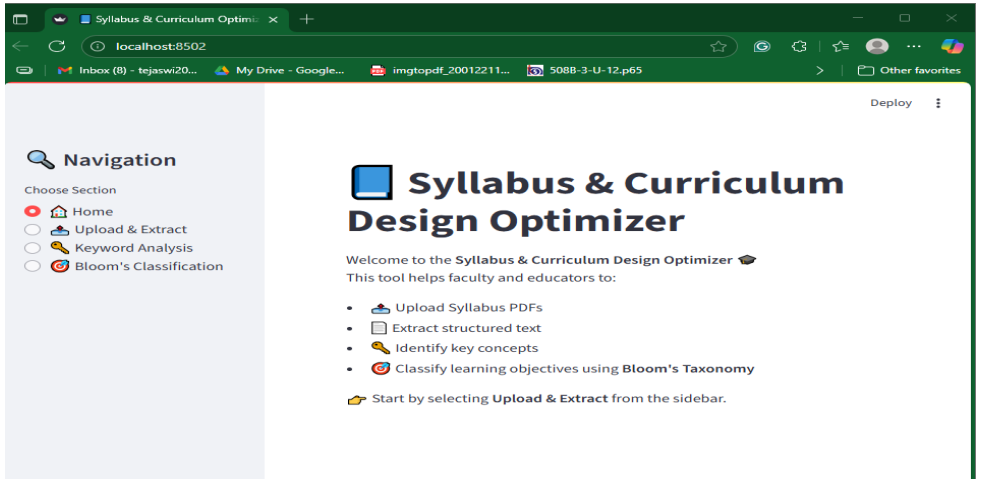
Each sentence is classified into levels like Remember, Understand, Apply, Analyze, Evaluate, Create. This enables curriculum evaluation and ensures alignment with learning outcomes and educational standards.

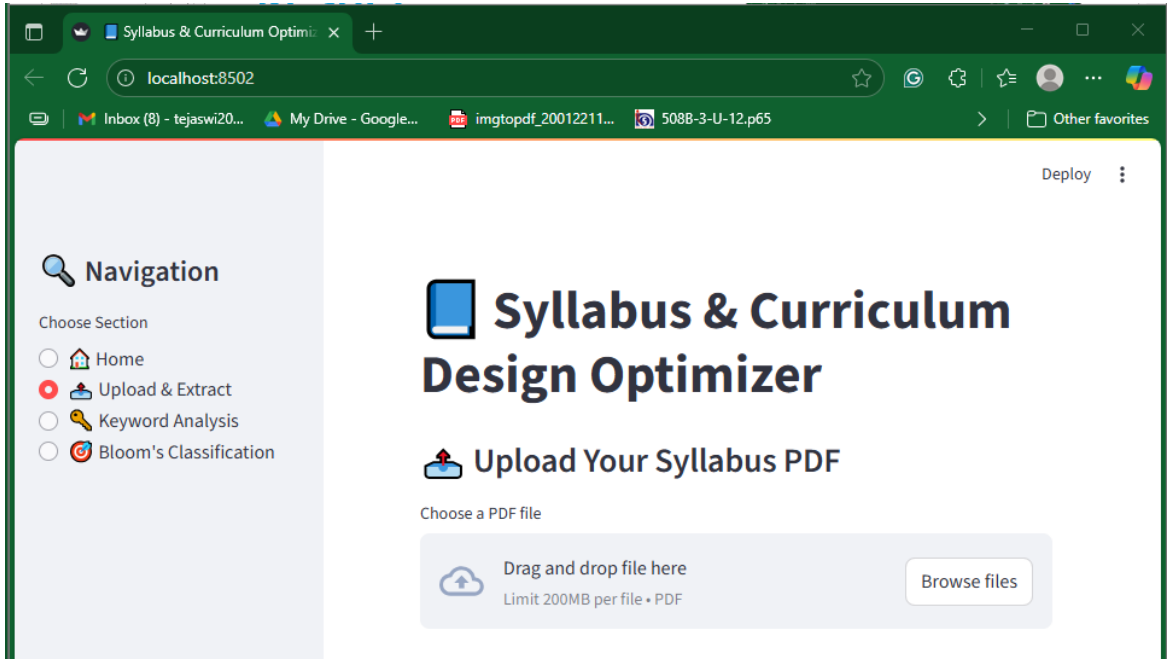
Deployment:

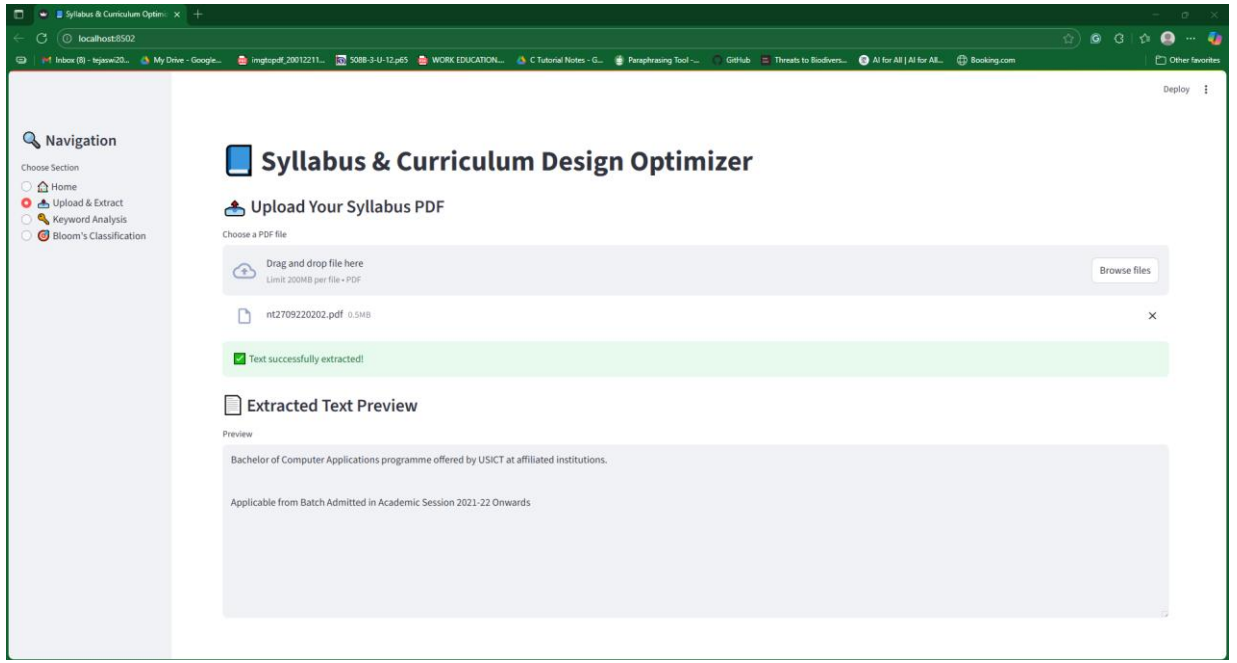
The system is deployed via a Streamlit web interface on IBM Cloud Lite, enabling real-time syllabus analysis. The UI is intuitive, allowing users to upload PDFs and view keyword extraction and Bloom classifications instantly.

RESULT

- Text extracted from syllabus PDF
- Keywords highlighted for topic refinement
- Bloom’s classification mapped to each sentence







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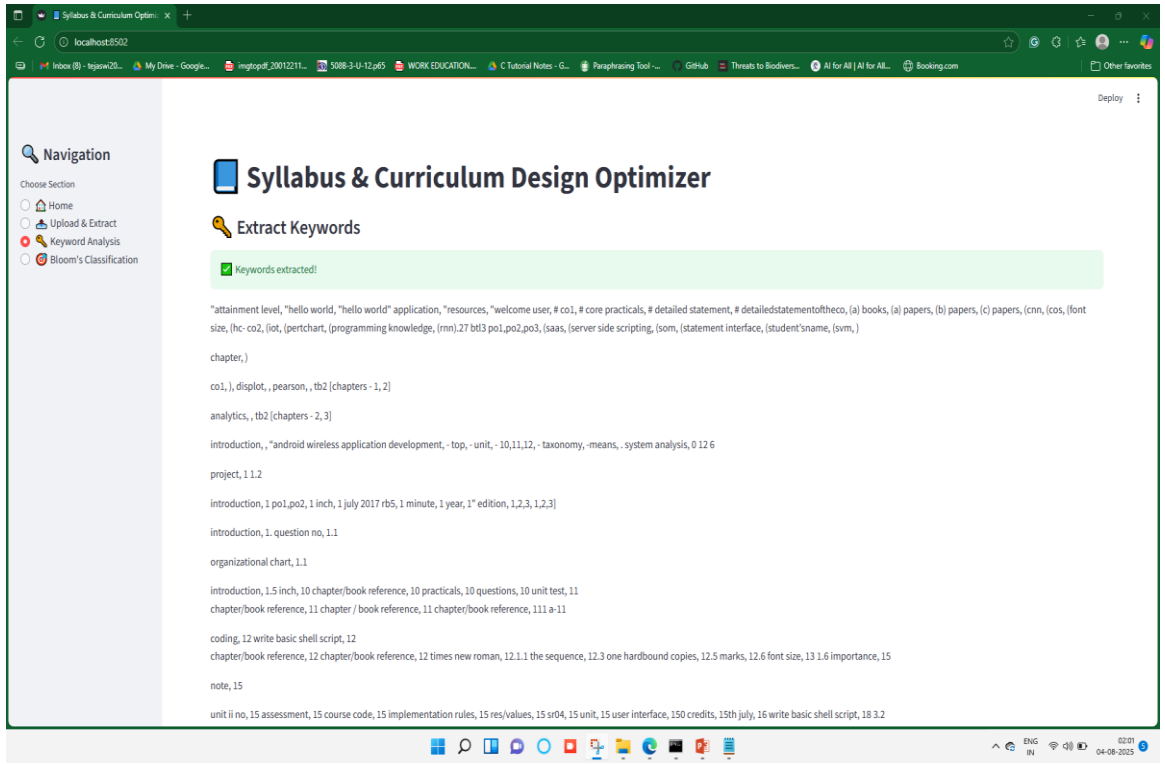
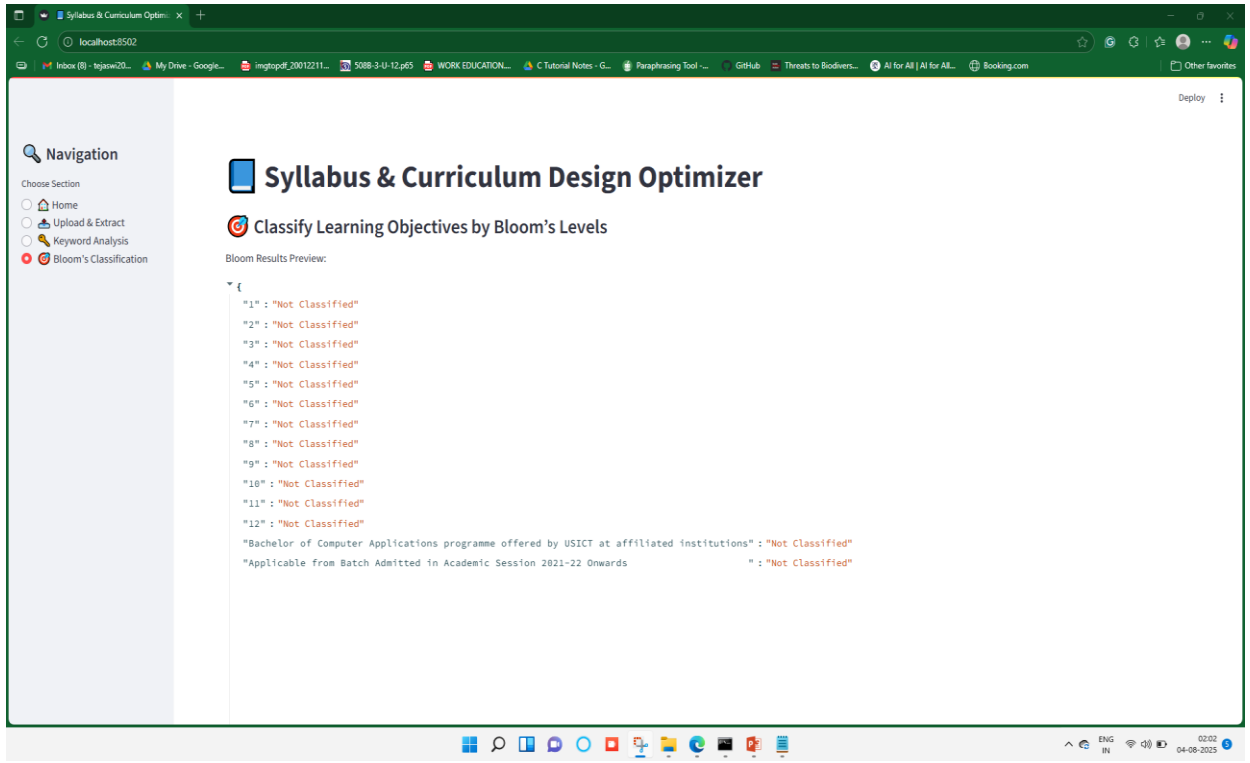
RESULT





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CONCLUSION

- Built a smart and user-friendly web tool tailored for faculty and curriculum designers.
- Automated syllabus review by integrating NLP-powered modules.
- Enabled alignment of course content with Bloom’s Taxonomy and academic objectives.
- Improved efficiency, accuracy, and standardization in curriculum development.
- Simplified PDF processing, keyword extraction, and objective classification in one interface
- Reduced manual errors and ensured consistency in syllabus design workflows.

FUTURE SCOPE

- Deploy the complete solution as a SaaS platform via IBM Cloud for institutional use.
- Integrate machine learning to dynamically classify Bloom's levels for improved accuracy.
- Support multi-language syllabus files (e.g., Hindi, Spanish, French) using language models.
- Provide course-specific templates with auto-filled objectives and keyword suggestions.
- Enable DOCX/PDF export of optimized syllabus drafts for sharing and archiving.
- Add integration with Learning Management Systems (LMS) for seamless curriculum planning

REFERENCES

- NLTK Documentation – https://www.nltk.org
- PyMuPDF (fitz) – https://pymupdf.readthedocs.io
- spaCy NLP Library – https://spacy.io
- IBM Cloud Lite – https://cloud.ibm.com
- Streamlit Framework – https://docs.streamlit.io
- Bloom's Taxonomy Resources – ERIC, JSTOR, Google Scholar
- Python Official Docs – https://docs.python.org/3/

IBM CERTIFICATIONS

- Screenshot/ credly certificate(getting started with AI)

IBM CERTIFICATIONS

- Screenshot/ credly certificate(Journey to Cloud)

IBM CERTIFICATIONS

- Screenshot/ credly certificate(RAG Lab)

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THANK YOU

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