OCR Driven PDF Text Extraction

BITS ZC4999T: Capstone Project

MID REPORT

By

Student Name: Nishant Chaudhary

BITS ID: 202117b3876

Capstone Project work carried out at

HCLTECH Ltd., Noida

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE

PILANI (RAJASTHAN)

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Annexure 5G: Format for Mid semester progress evaluation Sheet

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI

WORK-INTEGRATED LEARNING PROGRAMMES DIVISION

BITS ZC499T : Capstone Project Mid-Semester Progress Evaluation Sheet

ID No.	**:**	**202117b3876**
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STUDENT'S EMPLOYING ORGANIZATION & LOCATION	**:**	**HCLTECH Ltd., Noida**
MENTOR'S NAME	**:**	**Vaishnani Dhruvkumar**
Mentor's Desgnation	**:**	**Senior Technical Lead**
MENTOR'S EMPLOYING (ORGANIZATION & LOCATION)	**:**	**HCLTECH Ltd., Pune**
MENTOR'S EMAIL ADDRESS	**:**	**vaishnanidhru.jiten@hcltech.com**
CAPSTONE PROJECT TITLE	**:**	**OCR Driven PDF Text Extraction**

1. Executive Summary:

This capstone project focuses on solving a major challenge faced by organizations: extracting text from scanned PDFs where important information is trapped within image-based documents. Manual text extraction is slow, costly, and error-prone, creating delays in compliance, auditing, reporting, and general operational workflows.

To address this, an OCR-based automated system has been developed using **Python** and **Tesseract OCR**, enabling efficient conversion of scanned PDFs into machine-readable formats such as **plain text** and **JSON**. This transformation allows easy indexing, searching, and seamless integration with enterprise applications.

The implemented solution reduces manual effort by **up to 70%**, improves reporting speed by **50%**, and enhances accessibility for legacy documentation. Planned enhancements—such as multilingual OCR, AI-driven summarization, and chatbot-based query interaction—aim to make the system scalable and intelligent for diverse industry needs.

2. Project Methodology:

The project follows an Agile Iterative Model:

- Development is divided into phases for frontend, backend, and AI integration.
- Each phase includes design, implementation, and testing.
- Regular feedback from mentors is incorporated to improve functionality.

Details of Work Done Till Date

The development of the OCR-based Document Processing System has progressed through multiple structured phases:

Phase 1 – Project Setup and Planning

The project began with defining the scope, objectives, and overall architecture for both backend automation and the user interface.
A foundational repository structure was created, including setup for Python, Tesseract OCR, and the environment needed for PDF processing.

Phase 2 – Backend OCR Pipeline Development

Core backend components were implemented, including:

- PDF-to-image conversion using pdf2image
- Text extraction logic using Tesseract OCR and pytesseract
- Initial preprocessing techniques to improve OCR accuracy

This phase ensured that scanned PDFs could be successfully read and processed.

Phase 3 – PDF & File Handling

The system was enhanced to allow users to upload scanned PDF files.
The backend now:

- Accepts PDF uploads
- Converts each page into images
- Extracts and returns the raw text

The extracted text is displayed in a simple frontend viewer for user review.

Phase 4 – Structured Output Generation (JSON/Text)

A structured output module was built to:

- Format extracted text into clean plain text
- Convert extracted results into JSON for future system integration

Error handling and logging mechanisms were added to manage corrupted or password-protected files.

Current Progress: Phase 5 – Performance Optimization & Multilingual Support Planning - (In Progress)

Work was done on optimizing OCR performance for large PDFs and multi-page files. Additionally, multilingual OCR support was planned using Tesseract language packs for regional and international document processing.

Phase 6 – AI Integration

The ongoing phase focuses on integrating AI features, starting with:

- Automated summarization of extracted text
- Intelligent text structuring
- Future chatbot-based interactive queries
  This will make the system more intelligent and capable of supporting real-time document understanding.

3. Tools & Technology Used:

- ReactJS:
  Frontend JavaScript library used for building a responsive and interactive user interface for uploading files and displaying extracted OCR results.
- Material-UI (MUI):
  Component library used with React for creating clean, modern, and responsive UI elements.
- Python:
  Primary backend programming language for handling OCR processing, PDF conversion, text extraction, and structured output generation.
- Tesseract OCR:
  Open-source OCR engine used to extract text from scanned PDFs and image-based documents.

- pytesseract:
  Python wrapper for Tesseract OCR that connects the OCR engine with the backend Python workflow.
- pdf2image:
  Used to convert PDF pages into images before passing them into the OCR engine for accurate text extraction.
- PyMuPDF (fitz):
  Library for reading PDFs, extracting metadata, handling page operations, and processing password-protected or corrupted documents.
- Python-docx (future scope):
  Planned for handling and extracting text from .docx files if needed.
- JSON:
  Used for generating machine-readable structured output from extracted text.
- Python Logging Module:
  Used for error tracking, debugging, and maintaining traceability during text extraction.
- AI/NLP Libraries (future enhancement):
  Will be used for multilingual OCR, summarization, and chatbot-based query support.

4. Scope of Work Remaining:

- Integration of AI-based question generation (newly added scope)
- UI enhancements for better user experience
- Input validation for uploads, difficulty filters
- End-to-end testing, debugging, and performance optimization
- Final documentation, screenshots, and presentation preparation
- Completion of multilingual and AI-enhancement modules (planned)

5. Plan of Work Yet to be done:

Phase	Duration	Activity	Status
OCR Accuracy Improvement	**7-Dec-2025 to 15-Dec-2025**	Improve text extraction accuracy by applying image preprocessing (noise removal, thresholding, DPI adjustments) before OCR. Test with different types of scanned PDFs.	**Complete**
Multilingual OCR Support	**16-Dec-2026 to 07-Jan-2026**	Integrate Tesseract language models to support extraction in multiple languages and test accuracy on sample multilingual documents. readability, add loaders, and refine layout consistency.	**In Progress**
Input Validations	**08-Jan-2026 to 11-Jan-2026**	Add validations for PDF uploads, preventing unsupported file types, handling empty inputs, and validating multilingual OCR selections.	**Pending**
Performance Optimization & Error Handling	**11-Jan-2026 to 20-Jan-2026**	Optimize OCR speed for large multi-page PDFs. Enhance error handling for corrupted or password-protected PDFs. Improve logging and fallback workflows.	**Pending**
UI Enhancements	**20-Jan-2026 to 25-Jan-2026**	Enhance the web interface for file upload, OCR progress indication, and clear display of extracted text and JSON output. Add responsive layout improvements.	**Pending**

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EVALUATION:

Remarks of the mentor:

The project is progressing well. The student has a clear understanding of the problem and is effectively utilizing AI. With consistent progress, the final solution is expected to be highly valuable.

CAPSTONE PROJECT PROGRESS EVALUATION *(Please put a tick (✔) mark in the appropriate box)*

EC No.	Component	Excellent	Good	Fair	Poor
1.	Capstone Project Outline	☐	✔		
2.	Work Progress & Achievements	✔	☐		
3.	Initiative and Originality	✔			
4.	Documentation & Expression	☐	✔		
5.	Research & Innovation	✔	☐		
6.	Relevance to the work environment	☐		✔	

	Mentor	Additional Examiner
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	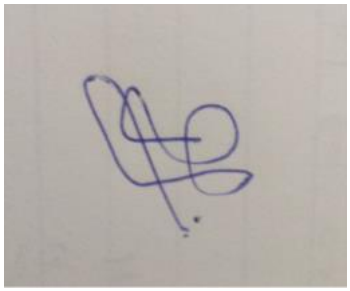	
Signature of Student	Signature of Mentor	Signature of Additional Examiner
Nishant Chaudhary	Vaishnani Dhruvkumar	Abhishek Dwivedi