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# AI-POWERED HANDWRITTEN DOCUMENT AND DIAGRAM DIGITIZATION SYSTEM USING COMPUTER VISION AND OCR

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**ABSTRACT :**

This project introduces an AI-powered document processing software that efficiently converts physical documents into editable Word files. The system integrates OCR and CV to extract text from old and handwritten documents while maintaining the original structure. AI tools reconstruct missing words from torn book pages, and handwritten diagrams are automatically converted into Word shapes. Additionally, embedded images are either cropped and repositioned or replaced using AI-generated alternatives. This innovation enhances document restoration, benefiting students, archivists, and researchers.

**KEYWORDS**: OCR (optimal character recoginition), Computer vision, Machine learning, Artificial intelligence, Python, Document digitilization, Shape recognition, Django/flask, Cloud-Based System

**HIGHLIGHTS**

- **Document digitilization** : Software that scans and converts handwritten and old documents into structured Word files..
- **Diagram digitilization:** Digitize handwritten diagrams and shapes using Word's shape tools.
- **Applications:** To assist students, professionals, and archaeologists in document preservation and accessibility.

## INTRODUCTION :

In today's fast-paced digital world, the need to convert handwritten documents into structured, editable formats is more pressing than ever. Historical manuscripts, academic notes, legal records, and various handwritten documents hold valuable information, but their accessibility remains limited due to the challenges of digitization. Traditional OCR systems often struggle with handwritten text, varying writing styles, and complex document layouts. This project introduces an AI-powered handwritten document digitization system that leverages deep learning-based OCR models, computer vision, and natural language processing (NLP) to overcome these limitations. The system accurately extracts handwritten text, digitizes hand-drawn diagrams, and organizes structured content into high- quality Word documents with minimal data loss. By incorporating state-of-the-art AI techniques, it ensures high accuracy, multilingual support, and document layout preservation, making it a robust solution for diverse applications. Computer vision techniques, including CNNs and OpenV, are used to detect, classify, and digitize hand-drawn shapes and diagrams. The system accurately preserves the spatial structure and relationships between different elements, converting sketches into vectorized formats that integrate smoothly into digital documents.

## PROBLEM DEFINITION :

In many organizations, educational institutions, and government departments, vast amounts of valuable information are stored in handwritten documents and diagrams, which are prone to physical degradation and difficult to search, edit, or archive digitally. Manual transcription of these documents is time-consuming, error-prone, and labor-intensive. Additionally, most traditional OCR systems struggle with complex handwritten text and cannot interpret diagrammatic content like flowcharts or sketches. The lack of automation in digitizing such content leads to inefficiency and data loss over time. This project addresses these challenges by developing an AI-based solution capable of extracting handwritten text and diagrammatic structures from scanned or captured images, converting them into structured, editable Word documents—preserving both textual and visual layout, thus significantly improving data accessibility, usability, and longevity.

## OBJECTIVE :

The primary objective of this project is to develop an AI-powered system that accurately converts handwritten documents into structured, digital formats while preserving their integrity. The system focuses on leveraging deep learning-based OCR models to enhance the accuracy of handwritten text recognition across various handwriting styles and languages. Additionally, it integrates computer vision techniques to detect, classify, and digitize hand-drawn diagrams and sketches, ensuring that spatial structure and graphical elements are maintained. Ensuring document layout integrity is a key aspect of this project, as it preserves text placement, formatting, and multilingual handwriting recognition for high-quality digital output. Furthermore, NLP-driven automation is employed to organize extracted text into well-structured Word documents, ensuring proper headings, paragraphs, bullet points, and tables. Ultimately, this system aims to improve the accessibility and usability of handwritten records across various domains, including historical preservation, academia, and legal documentation.

## SUMMARY OF ISSUES :

- Lack of Automation Real-Time Data Processing
- Scalability of Solution
- Improper Handwritting

## EXISTING SYSTEM :

- Traditional Optical Character Recognition (OCR) systems analyze scanned documents and extract text using pattern recognition and feature extraction techniques. These systems work well with printed text.
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- They work well for structured, high-quality printed documents.

### *DISADVANTAGES*

- Unscalability: Old documents may have faded ink, inconsistent spacing, or cursive writing, making them difficult for OCR and AI models to process.
- Unreliabilty: Current systems cannot accurately process hand-drawn sketches or shapes, making it difficult to digitize historical engineering documents or illustrations.

## PROPOSED SYSTEM :

- The proposed system aims to enhance existing OCR and handwriting recognition technologies by developing an AI-driven solution that accurately converts handwritten documents into an editable Word format. Unlike traditional OCR tools, which struggle with inconsistent handwriting and multilingual text, this system leverages advanced machine learning, deep learning, and natural language processing (NLP) to improve recognition accuracy and contextual understanding.
- In addition to text digitization, the system incorporates AI-driven Computer Vision to detect, recognize, and convert hand-drawn diagrams, sketches, and flowcharts into structured digital formats. Traditional OCR solutions often fail to accurately interpret complex visual elements, leading to a loss of information. To overcome this, the proposed system utilizes deep learning for shape recognition, contour detection, and object classification, allowing it to segment and reconstruct diagrams with high precision.

### *ADVANTAGES*

- *Digitilization: Converts handwritten and old documents into editable Word files.*
- Diagram digitilization: Converts hand-drawn diagrams into digital Word shapes.
- Image Processing & Enhancement: Crops, repositions, or replaces images with AI-generated visuals.

## SYSTEM REQUIREMENT SPECIFICATION :

This chapter describes about the requirements. It specifies the hardware and software requirements that are required in order to run the application properly. The Software Requirement Specification (SRS) is explained in detail, which includes overview of dissertation as well as the functional and non-functional requirement of this dissertation.

A SRS document describes all data, functional and behavioural requirements of the software under production or development. SRS is the most basic document, which forms the base of the software development process. It is the complete description of the behaviour of a system to be developed. Requirement Analysis discusses the conditions to be met for a new or altered product. Requirement Analysis is critical to the success to a development project.

The requirement must be documented, measurable, testable, and related to in identified business needs or opportunities and defined to a level of detail sufficient for system design. The SRS can be said to serve like a blueprint for the completion of a project. The preparation of the SRS document is for the purpose of:

- Facilitating communication between the customer, analyst, system developers, maintainers.
- To form a foundation for the design phase.
- Support system testing facilities.
- Controlling the evolution of the system.

## SYSTEM ARCHITECTURE :

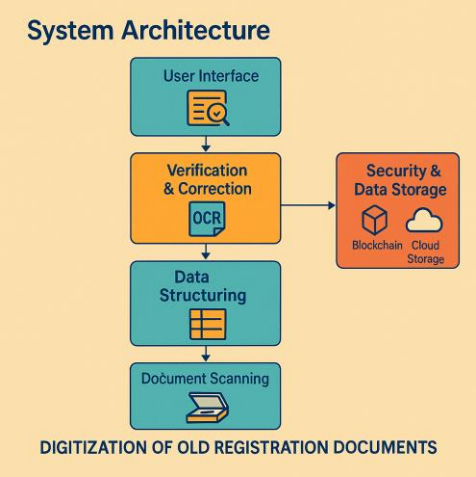
***HARDWARE REQUIREMENT***

- Scanner
- High end camera

***SOFTWARE REQUIREMENT***

- Tesseract OCR
- Computer Vision
- Python
- Docker
- Django/Flask

***SYSTEM ARCHITECTURE :***




***PROCEDURE***

- Upload scanned images or photos of handwritten documents through the application interface
- Apply deep learning-based OCR models
- Store extracted text in temporary memory for processing
- Use computer vision techniques to identify shapes
- Generate a .docx file using Python libraries like python-docx
- Final structured Word document is made available for download

## CONCLUSIONS :

This project successfully demonstrates an intelligent system capable of converting handwritten or printed documents especially those containing both textual content and diagrams into structured digital Word documents. By integrating Optical Character Recognition (OCR) with deep learning language models and computer vision techniques, the system efficiently extracts, formats, and reconstructs both textual and diagrammatic data. The use of a local language model ensures privacy and reduces dependency on external APIs. This solution proves valuable for digitizing historical records, academic notes, hand-drawn flowcharts, and other paper-based materials, paving the way for smarter document management and preservation.

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