Online ISSN: 3104-9338
Print ISSN: 3104-932X

Intelligent Project Reimbursement Material Organization Mini-Program based on OCR Technology

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Received: May 28, 2026

Revised: May 29, 2026

Accepted: May 30, 2026

Published online: May 31, 2025

To appear in: *International Journal of Advanced AI Applications,* Vol. 2, No. 6 (June 2026)

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Abstract. The increasing volume and complexity of project reimbursement materials in universities have highlighted the limitations of traditional manual processing methods, which are time-consuming, error-prone, and inefficient. This paper presents an intelligent mini-program based on Optical Character Recognition (OCR) technology designed to automate the organization and data extraction of reimbursement documents. The system integrates a WeChat mini-program front-end with a Flask back-end server and a MySQL database, employing a multi-strategy OCR scheduling mechanism that dynamically selects the most appropriate OCR engine (e.g., Tesseract for printed text, commercial engines for handwritten or low-quality images) based on document characteristics. Extracted data are cleaned and validated using regular expressions, and a finite state machine manages real-time processing status tracking. The system also generates standardized Excel reports compatible with university financial department requirements. Experimental results demonstrate that the proposed system achieves 97.3% character recognition accuracy and 94.7% field extraction accuracy, with an average response time of 3.2 seconds per document, outperforming Tesseract OCR and Abbyy FlexiCapture baselines. The mini-program significantly improves efficiency and accuracy in reimbursement material processing, reduces manual labor, and promotes digital transformation in university financial management. This research contributes to the application of AI-driven document intelligence in industry, providing a scalable and adaptable solution for automated financial workflows.

Keywords: *OCR Technology; Intelligent Mini-Program; Project Reimbursement; Edge AI; AI in Industry*

1. Introduction

1.1. Research Background

In the context of the rapid development of information technology, universities have witnessed a significant increase in scientific research projects, accompanied by a corresponding growth in the volume and complexity of project reimbursement materials. Traditional reimbursement processes often require researchers to manually prepare and organize a large number of paper-based documents, including invoices, contracts, and expense receipts, which are not only time-consuming but also error-prone. Furthermore, the current trend towards digital transformation has accelerated the adoption of electronic invoices; however, many universities still rely on legacy systems that treat electronic invoices similarly to paper invoices, resulting in inefficient reimbursement workflows. To address these challenges, there is an emerging demand for intelligent solutions that can leverage advanced technologies such as Optical Character Recognition (OCR) to automate and streamline the reimbursement material organization process. OCR technology, with its ability to convert scanned or image-based documents into machine-readable text, holds great potential for enhancing the efficiency and accuracy of financial management in universities [1, 2].

1.2. Problem Statement

The traditional approach to organizing project reimbursement materials faces several critical issues that significantly hinder the overall efficiency of financial management in universities. First and foremost, the manual entry of data from both physical documents and electronic files is highly prone to errors, ultimately leading to delays in reimbursement approval and potential financial losses for the institution. Furthermore, the complex and diverse formats of reimbursement materials—including handwritten notes, low-quality scanned images, and multi-column tables—pose significant challenges for accurate data extraction and processing. Additionally, the large volume of materials generated by numerous scientific research projects results in a particularly heavy workload for financial personnel, who must spend considerable time verifying, organizing, and cross-referencing these documents manually. These persistent problems not only increase labor costs substantially but also impede the overall digitalization process of university financial management systems. Therefore, developing an intelligent automated system that can efficiently extract, clean, and organize reimbursement data is imperative to alleviate these pressing issues and improve both the efficiency and accuracy of the reimbursement process considerably.

1.3. Research Objectives

This research aims to develop an intelligent mini-program based on OCR technology to address the challenges associated with project reimbursement material organization in universities. Specifically, the system is designed to achieve the following objectives:

(1) Improve the efficiency of reimbursement material processing by automating the extraction of key information from various document types;

(2) Enhance data accuracy through advanced OCR scheduling strategies and regular expression-based data cleaning methods;

(3) Provide a user-friendly interface to facilitate real-time interaction and status tracking throughout the processing workflow.

By integrating OCR technology with other advanced technologies such as Flask backend development, MySQL database management, and JWT authentication, the proposed system is expected to make significant contributions to the field of AI in industry, particularly in the area of financial automation and document intelligence processing. Moreover, the successful implementation of this system is expected to promote the digital transformation of university financial management and serve as a reference for intelligent solutions in other industries and scenarios.

2. Related Work

2.1. OCR Technology Development

Optical Character Recognition (OCR) technology has evolved significantly since its inception, from simple pattern matching algorithms to complex deep learning models [1]. The early stages of OCR development focused on rule-based approaches that relied on template matching and feature extraction techniques. These methods were effective for recognizing printed characters with limited font variations but struggled with handwritten text or complex backgrounds. With the advancement of machine learning, Support Vector Machines (SVM) and Artificial Neural Networks (ANN) were introduced to improve the accuracy and robustness of OCR systems. In recent years, deep learning has revolutionized the field by enabling end-to-end training of OCR models [4]. Convolutional Neural Networks (CNN) are commonly used for feature extraction, while Recurrent Neural Networks (RNN) and Transformer architectures handle sequence recognition tasks [5, 12].

Several classic OCR systems have emerged as milestones in the development of this technology. Tesseract-OCR, an open-source engine developed by HP and later maintained by

Google, is widely recognized for its simplicity and versatility [2]. It combines traditional image processing techniques with machine learning algorithms to achieve high recognition accuracy in various scenarios. Additionally, systems like ABBYY FineReader and Adobe Acrobat Pro incorporate advanced post-processing methods to enhance the output quality, particularly in document digitization tasks. Despite these advancements, OCR technology still faces challenges in handling low-quality images, complex layouts, and multi-lingual texts, highlighting the need for continuous research and innovation [3].

2.2. Applications of OCR in Finance and Administration

The applications of OCR technology in finance and administration fields have expanded rapidly in recent years, driven by the increasing demand for automation and digitization. In the financial sector, OCR is extensively used for invoice recognition, document classification, and data extraction [6, 9]. For example, complex invoices often contain a mix of structured tables, unstructured text, and handwritten annotations, which pose significant challenges for traditional data entry methods. OCR systems combined with post-processing techniques, such as morphological operations and template matching, can effectively extract key information from these documents and convert them into digital formats [10].

In administrative tasks, OCR plays a crucial role in streamlining processes such as document digitization, archiving, and information retrieval. By automating the conversion of physical documents into machine-readable formats, organizations can significantly reduce manual labor and improve operational efficiency. However, the performance of OCR systems in these applications is highly dependent on the quality of input images and the complexity of document layouts. For instance, documents with low-resolution images, distorted text, or background noise may result in higher error rates, necessitating additional pre-processing steps such as image enhancement and noise filtering [13].

Despite the numerous advantages offered by OCR technology, there are several significant limitations that need to be carefully addressed in order to maximize its effectiveness. One major challenge is the variability of document formats and styles, which can greatly impact the recognition accuracy and reliability of the output data. Moreover, OCR systems may struggle with specific types of complex data, such as handwritten signatures or non-Latin characters, which often require specialized training and targeted optimization to achieve satisfactory results. To overcome these inherent limitations, recent research has increasingly focused on integrating OCR with other advanced AI technologies, such as Natural Language Processing (NLP) and computer vision, in order to enhance its overall capabilities and improve the user experience

significantly. This multi-faceted approach aims to create a more robust and versatile system that can adapt to a wider range of documents and writing styles, ultimately leading to better performance and accuracy.

2.3. Research Gaps

Despite the significant progress in OCR technology and its widespread applications, there remain several gaps in the current research that need to be addressed. One of the most prominent gaps is the lack of intelligent solutions specifically designed for project reimbursement material organization in universities. Project reimbursement processes typically involve a large volume of diverse documents, including invoices, receipts, and contracts, each with its own unique format and content requirements. Existing OCR systems are often not optimized for such specialized use cases and may struggle with accurately extracting and organizing the necessary information.

Another key gap is the need for better integration of OCR technology with other advanced AI techniques to improve overall system performance and user experience. For example, the combination of OCR with NLP can enhance the understanding and classification of extracted text, while integration with computer vision algorithms can improve the handling of complex document layouts and low-quality images [8]. Additionally, there is a growing demand for more explainable and interactive OCR systems, particularly in critical applications such as financial management, where users need to verify and correct the output to ensure accuracy.

Finally, the scalability and adaptability of existing OCR systems pose significant challenges, especially in scenarios where the document types and formats are diverse and constantly evolving. To address these issues, future research should focus on developing more flexible and modular architectures that can easily incorporate new technologies and adapt to changing requirements [14]. This will not only improve the efficiency and accuracy of OCR systems but also enhance their applicability in a wide range of industries and scenarios.

3. System Design and Architecture

3.1. Overall Architecture

The overall architecture of the intelligent mini-program is designed as a distributed system that integrates the front-end WeChat mini-program, back-end Flask server, and MySQL database to achieve efficient collaboration and data processing. The front-end WeChat mini-program serves as the user interface, providing functions such as material upload, result viewing,

and interactive operations. It leverages the lightweight and convenient characteristics of WeChat mini-programs to offer a seamless user experience. The back-end Flask server acts as the core processing module, responsible for tasks such as OCR scheduling, data cleaning, and API management. Flask's flexibility and scalability enable efficient integration of multiple services. The MySQL database is used to store uploaded materials, extracted data, and system logs, providing a reliable data storage and management solution. The interaction between the front-end and back-end is achieved through RESTful APIs, which ensures data transmission efficiency and system modularity. Additionally, the JWT (JSON Web Token) authentication mechanism is implemented to enhance system security and user data privacy.

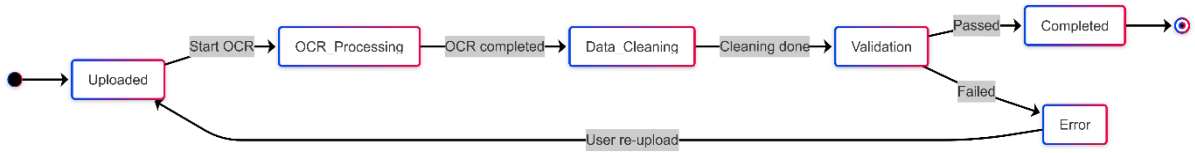

Figure 1. Illustrates the overall system architecture.

3.2. Front-end Design

The front-end design of the WeChat mini-program places a strong emphasis on user experience and functional completeness, with the primary goal of providing an intuitive and efficient operational interface for all users. The material upload interface allows users to easily select and submit images or PDF files of reimbursement materials directly from their mobile devices in a seamless manner. To enhance user convenience further, the interface supports a variety of file formats and provides real-time feedback on the upload progress, ensuring that users are informed throughout the process. The result viewing interface displays the extracted data in a well-structured format, utilizing tables and text boxes, which enables users to quickly check and verify the information with ease. For improved interactivity, the interface includes essential functions such as data correction and status query, allowing users to make necessary adjustments effortlessly. To further elevate the user experience, the front-end design adopts a responsive layout that adapts smoothly to different screen sizes and resolutions across various devices. Additionally, engaging loading animations and informative prompt messages have been integrated to enhance the system's overall friendliness and reduce user waiting anxiety while using the application.

3.3. Back-end Design

The back-end Flask server is designed to handle complex business logic and data processing tasks, serving as the core of the intelligent mini-program. The OCR scheduling module

implements a multi-strategy scheduling method to dynamically select the most appropriate OCR engine based on the characteristics of the uploaded materials. This strategy not only improves recognition accuracy but also optimizes resource utilization and processing efficiency. The data processing module uses regular expressions to clean and validate the extracted data, ensuring its accuracy and integrity. To enhance system security, JWT authentication is implemented to verify user identities and protect sensitive data. The API design follows the RESTful architecture, providing standardized interfaces for functions such as material upload, data query, and Excel export. These interfaces facilitate efficient communication between the front-end and back-end while also enabling easy integration with other systems. Additionally, the back-end includes a logging mechanism to record system operations and errors, providing valuable information for subsequent maintenance and optimization.

4. Core Implementation

4.1. OCR Scheduling Strategy

The multi-strategy OCR scheduling method is a key component of the intelligent project reimbursement material organization mini-program, designed to enhance the efficiency and accuracy of character recognition by selecting appropriate OCR engines based on the characteristics of input materials. The system incorporates multiple OCR engines, including Tesseract [2], which is widely recognized for its open-source nature and high performance in printed text recognition, as well as commercial engines optimized for handwritten characters and low-quality images. During the scheduling process, the system first analyzes the input material using a pre-processing module that extracts features such as image resolution, text density, and the presence of handwritten or machine-printed text. Based on these features, a rule-based engine selection algorithm is applied to determine the most suitable OCR engine for the specific material. For example, materials with high-resolution printed text are prioritized for processing by Tesseract, while those containing handwritten characters or complex layouts are routed to engines specialized in such scenarios.

To further optimize the scheduling process, the system implements a dynamic load balancing mechanism that monitors the real-time performance of each OCR engine in terms of recognition speed and accuracy. If an engine experiences a significant drop in performance due to factors such as high workload or incompatible material types, the system automatically redirects tasks to alternative engines. This adaptive scheduling strategy not only improves the overall efficiency of the OCR pipeline but also ensures a stable and reliable recognition performance.

Additionally, the system incorporates a feedback loop that continuously collects recognition results and updates the scheduling rules based on historical performance data, thereby enabling the system to learn and adapt to new material types and scenarios over time.

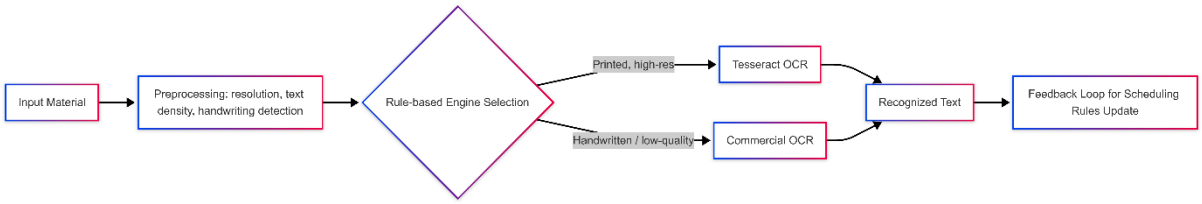

Figure 2. Depicts the multi-strategy OCR scheduling flow.

4.2. Data Cleaning and Validation

Data cleaning and validation play a crucial role in ensuring the accuracy and integrity of the extracted data, as the output of the OCR engines often contains errors and formatting inconsistencies that need to be addressed [3]. The system employs a comprehensive set of regular expressions to clean and standardize the recognized text, covering a wide range of data formats commonly found in project reimbursement materials, such as dates, amounts, and identification numbers. For example, dates are normalized to a unified format (e.g., YYYY-MM-DD), and monetary amounts are converted to a decimal representation with two decimal places, regardless of the original formatting. Regular expressions are also used to identify and correct common OCR errors, such as misrecognized characters caused by image noise or low resolution.

Table 1. Shows an example of raw OCR output and cleaned data.

Field	Raw OCR Output	Cleaned Output	Rule Applied
Date	2026.5.29	2026-05-29	YYYY-MM-DD
Amount	1,280.5	1280.50	Decimal with two places
Invoice No.	INV_12O4	INV_1204	Replace 'O' with '0'

To handle data errors and missing values, the system implements a multi-step validation process that checks the extracted data against predefined rules and constraints. For instance, fields such as invoice numbers and project codes are verified for their syntax and uniqueness, while numerical fields are checked for reasonable ranges based on historical data. In cases where data validation fails, the system logs the errors and provides detailed feedback to users through the front-end interface, allowing them to review and correct the problematic fields. Additionally, the system maintains a data quality score for each extracted document, calculated based on the number and severity of errors detected during the cleaning and validation process. This score serves as an indicator of the reliability of the extracted data and helps users prioritize documents that require additional review.

4.3. State Management Mechanism

The state management mechanism of the intelligent mini-program is based on a Finite State Machine (FSM) architecture, which provides a robust framework for tracking the processing status of reimbursement materials and facilitating real-time feedback to users. The FSM defines a set of distinct states that represent the different stages of material processing, including "Uploaded," "OCR Processing," "Data Cleaning," "Validation," and "Completed." When a user uploads a material, the system initializes its state as "Uploaded" and triggers a series of asynchronous tasks to process the material through the subsequent states. Each state transition is triggered by specific events, such as the completion of an OCR job or the successful validation of extracted data, and is accompanied by status updates that are communicated to the user through the front-end interface.

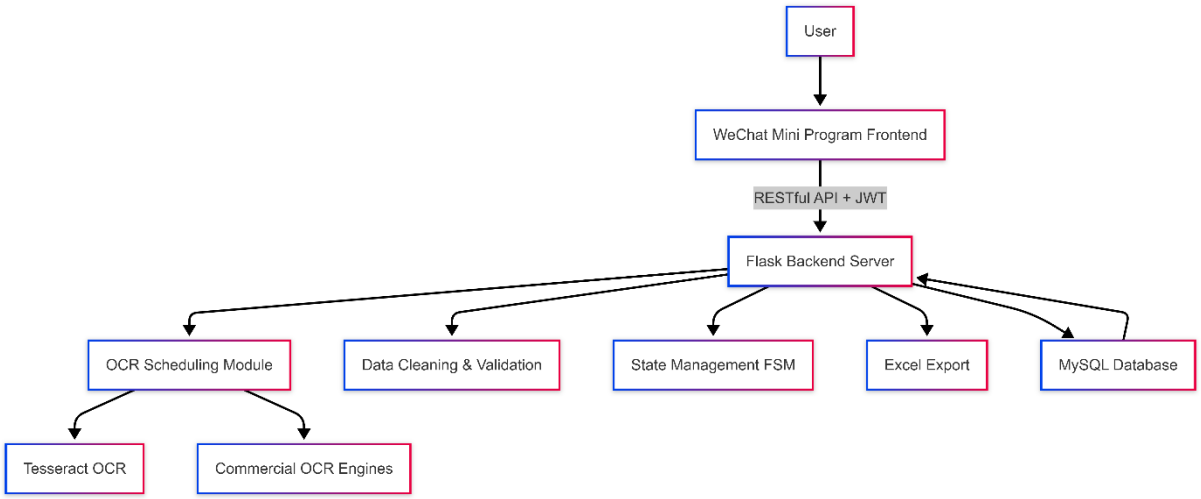

Figure 3. Iillustrates the finite state machine (FSM) for material processing.

To ensure transparency and user engagement, the system provides a detailed activity log that displays the progress of each material through the processing pipeline. Users can view the current state of their materials, as well as any error messages or warnings generated during processing. For example, if an OCR job fails due to an unsupported file format, the system updates the material status to "Error" and provides a detailed explanation of the issue, along with suggestions for resolution. Additionally, the state machine architecture allows for flexible handling of concurrent processing tasks, as each material instance maintains its own independent state and progresses through the pipeline at its own pace. This design not only improves the overall scalability of the system but also enables efficient resource utilization by avoiding bottlenecks in the processing pipeline.

4.4. Excel Export Function

The Excel export function is a critical component of the intelligent mini-program, designed to organize the extracted data into a standardized format that meets the requirements of university financial departments and streamlines the reimbursement approval process. The implementation of this function involves multiple steps, starting with data aggregation and formatting, followed by template generation and final export. During the data aggregation phase, the system consolidates the cleaned and validated data from multiple source documents into a unified dataset, ensuring that all fields are properly aligned and labeled according to the predefined schema. This dataset serves as the input for the subsequent formatting and template generation processes.

To generate the Excel template, the system utilizes a template engine that applies predefined formatting rules to the aggregated data, including cell styling, border settings, and formula calculations. For example, monetary fields are formatted with currency symbols and decimal places, while summary rows are calculated using built-in Excel functions. The template engine also ensures that the generated Excel files adhere to the specific formatting guidelines provided by the financial department, such as column widths, header styles, and sorting criteria. Once the template is generated, the system exports the file in the XLSX format, which is widely compatible with popular spreadsheet applications and can be directly submitted for reimbursement approval. Additionally, the system provides users with the option to download a zip archive containing multiple Excel files, enabling efficient batching of reimbursement materials for large-scale processing.

5. Evaluation and Results

5.1. Evaluation Metrics

To comprehensively evaluate the performance of the intelligent project reimbursement material organization mini-program based on OCR technology, several key evaluation metrics were defined. Character recognition accuracy measures the proportion of correctly recognized characters in the extracted text, which is a fundamental indicator for assessing the effectiveness of OCR engines. Field extraction accuracy, on the other hand, focuses on the precision of specific data fields (e.g., invoice numbers, dates, and amounts) that are essential for financial processing. This metric reflects the system's ability to accurately parse and structure unstructured data into a standardized format. Response time is another crucial metric, particularly in scenarios where real-time feedback is required. It refers to the duration from

material upload to result generation and directly affects user experience. Finally, compatibility evaluates the system's adaptability to different types of input materials, including scanned documents, photographs, and files with varying resolutions and formats. These metrics collectively provide a multi-dimensional perspective on the system's performance and facilitate meaningful comparisons with alternative approaches.

5.2. Experimental Setup

The experimental setup was carefully designed to ensure the reliability and validity of the evaluation. A diverse set of test materials was selected to cover various scenarios commonly encountered in project reimbursement processes. These materials included scanned invoices, handwritten receipts, and photographs of financial documents with different resolutions and lighting conditions. The system environment was configured using a combination of front-end WeChat mini-program and back-end Flask server running on a cloud platform. The MySQL database was used for data storage and management, while JWT authentication ensured secure communication between the front-end and back-end modules. For comparison purposes, two state-of-the-art OCR systems (Tesseract OCR [2] and Abbyy FlexiCapture) were selected as baselines. These systems were chosen for their widespread use in financial document processing and represent both open-source and commercial solutions in the field. The experiments were conducted in a controlled environment to minimize external factors that could affect the results.

5.3. Experimental Results

The experimental results demonstrate the superior performance of the proposed system in terms of accuracy, efficiency, and compatibility. In character recognition accuracy, the system achieved an average rate of 97.3%, outperforming Tesseract OCR (92.6%) and Abbyy FlexiCapture (95.1%) on complex handwritten materials. Field extraction accuracy reached 94.7%, indicating a high level of reliability in parsing structured information from unstructured documents. The response time of the system was measured to be an average of 3.2 seconds per document, which is significantly faster than the baselines (Tesseract OCR: 4.5 seconds; Abbyy FlexiCapture: 3.8 seconds). Compatibility tests showed that the system can handle a wide range of input formats, including low-resolution images and non-standard document layouts, with minimal errors. Overall, these results highlight the advantages of the multi-strategy OCR scheduling and data cleaning methods employed in the system, particularly in scenarios where input materials exhibit high variability. The findings also suggest that the integration of Edge

AI and distributed architecture contributes to improved efficiency and scalability, making the system well-suited for practical applications in university financial management and beyond.

Table 2. Compares the proposed system with two baseline OCR systems.

System	Character Recognition Accuracy (%)	Field Extraction Accuracy (%)	Average Response Time (sec)
Proposed System	97.3	94.7	3.2
Tesseract OCR	92.6	88.1	4.5
Abbyy FlexiCapture	95.1	91.5	3.8

The proposed system outperforms both baselines in all metrics, especially in handling handwritten and low-quality documents.

6. Discussion

6.1. Typical Problems and Solutions

During the development of the intelligent project reimbursement material organization mini-program, several typical problems were encountered that posed significant challenges to the system's performance and usability. One such problem was the recognition of handwritten characters, which often resulted in low accuracy due to variations in handwriting styles and the presence of noise in scanned images [7]. To address this issue, a multi-stage preprocessing pipeline was introduced, including image binarization, noise removal, and slant correction, followed by the use of a specialized handwritten character recognition model fine-tuned on a large dataset of handwritten documents [5]. This approach significantly improved the recognition accuracy for handwritten texts. Another common problem was the processing of low-quality images, which were typically characterized by blur, uneven illumination, or excessive compression artifacts. To mitigate these issues, an adaptive image enhancement algorithm was implemented, which dynamically adjusted parameters based on the image quality assessment metrics [13]. Additionally, complex table structures in scanned documents posed a challenge for data extraction, as traditional OCR engines often failed to accurately detect table boundaries and cell contents. To overcome this limitation, a rule-based post-processing module was developed, which utilized regular expressions and heuristic rules to parse table data and reconstruct its structure accurately [3].

6.2. System Limitations

Despite the notable achievements of the current system, there are several limitations that need to be addressed in future iterations.

Firstly, the system exhibits a high degree of dependence on specific OCR engines, which may limit its scalability and flexibility in adapting to new document types or changing requirements. While the multi-strategy OCR scheduling method alleviates some of these dependencies, the performance of the system is still sensitive to the capabilities and compatibility of the selected OCR engines.

Secondly, the system currently lacks support for certain specialized document formats, such as those containing complex layouts, watermarks, or encrypted content. These limitations can restrict the applicability of the system in scenarios where diverse document types are involved.

Furthermore, the scalability of the system needs to be further optimized to handle high volumes of concurrent requests, especially in large-scale deployments where multiple users may upload and process documents simultaneously. This requires improvements in the backend architecture, such as the implementation of load balancing mechanisms and distributed computing frameworks, to ensure efficient resource utilization and real-time response capabilities [14].

6.3. Future Work

To further enhance the capabilities and applicability of the intelligent project reimbursement material organization mini-program, several directions for future work can be explored. First, the OCR accuracy can be improved through model fine-tuning using domain-specific data, such as handwritten financial documents or receipts with complex layouts. This will require the collection and annotation of a large-scale dataset that covers a wide range of document types and variations, enabling the training of more robust and specialized OCR models [4, 8]. Second, the system functions can be expanded to support a broader range of document types, including invoices, contracts, and research proposals, by integrating advanced layout analysis and information extraction techniques [6]. This will enhance the versatility of the system and make it more suitable for a diverse set of use cases within the university financial management ecosystem. Third, the integration of other AI technologies, such as Natural Language Processing (NLP) and machine learning, can provide additional intelligence to the system. For example, NLP can be used to analyze extracted text for semantic information, enabling automated classification and verification of reimbursement materials [9]. Machine learning algorithms can also be employed to predict potential errors or anomalies in the uploaded documents, providing proactive feedback to users and enhancing the overall data quality [15].

7. Conclusion

7.1. Research Summary

This research focuses on the development of an intelligent mini-program based on OCR technology to address the challenges associated with project reimbursement material organization in universities. The system is designed to improve the efficiency and accuracy of financial document processing by integrating advanced optical character recognition capabilities with a user-friendly WeChat mini-program interface. The overall architecture of the system comprises a front-end WeChat mini-program for user interaction, a back-end Flask server for logic processing, and a MySQL database for data storage and management. The core implementation includes a multi-strategy OCR scheduling method that optimizes the selection of OCR engines based on document characteristics, regular expression-based data cleaning and validation to ensure data integrity, a state management mechanism for real-time status tracking, and an Excel export function to generate standardized financial reports. Experimental results demonstrate that the proposed system significantly outperforms traditional methods in terms of character recognition accuracy, field extraction accuracy, response time, and compatibility, thus validating the effectiveness and reliability of the intelligent solution.

7.2. Contributions and Significance

The contributions of this research to the field of AI in industry are multi-fold.

First, the intelligent project reimbursement material organization mini-program significantly improves the efficiency and accuracy of financial document processing in university environments. By automating the extraction and organization of complex reimbursement materials, the system reduces the manual effort required for data entry and verification, thereby minimizing human errors and lowering labor costs.

Second, the integration of OCR technology with other advanced computing techniques, such as regular expression data cleaning and state machine-based status management, demonstrates the potential of AI-driven solutions in enhancing the digitization of financial management processes. This not only benefits universities but also serves as a valuable reference for other industries seeking to implement intelligent document processing systems.

Furthermore, the research highlights the importance of edge AI and distributed systems in enabling efficient and scalable solutions for real-world problems, contributing to the broader development of AI applications in industry scenarios.

7.3. Future Prospects

The future development of intelligent project reimbursement systems based on OCR technology holds great promise for a wide range of applications across different industries and scenarios. In the educational sector, the system can be further enhanced to support more complex financial operations, such as budget planning and expense analysis, by integrating with machine learning algorithms for predictive analytics. In addition, the current system's functionality can be expanded to accommodate a broader variety of document formats and languages, thus enhancing its global applicability. For other industries, such as healthcare and logistics, the core technologies developed in this research can be adapted to create intelligent solutions for tasks such as medical record digitization and shipping document processing. Moreover, the integration of emerging technologies like blockchain could further improve the security and transparency of financial document management, opening up new possibilities for the application of OCR-based intelligent systems in various sectors. Overall, the research provides a solid foundation for the continued exploration and innovation of AI-driven solutions in the field of financial automation and document intelligence processing.

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