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AI-POWERED DOCUMENT TRACKING AND VERSION CONTROL USING DEEP LEARNING ALGORITHM

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ABSTRACT
Academic institutions had always been faced with issues of coping with increasing amounts of documents such as lost files, lack of coherent classification, time lags in accessing records and the lack of version records that indicate the history of revisions. It was found that manual processes were slow, prone to errors, and inadequate to the demands of accountability, transparency, and accessibility of academic administration in the present day. This study tackled these problems by coming up with an AI-powered Document Tracking and Version Control System which was meant to automate the classification of documents, systematize records and make sure that version histories were properly maintained. The system introduced Tesseract Optical Character Recognition (OCR) to read the text on scanned and digital documents to allow the conversion of both physical and electronic records to structured and searchable format. Hugging Face Transformers (CNN) were also used to carry out deep learning-based classification and semantic tagging, which assisted in accurate categorization of documents and effective search. PostgreSQL was adopted as the database to store document metadata, user records, and version histories in a safe and trustworthy way whereas a mobile application interface was designed to make it usable and accessible to the faculty and staff. Experiments revealed that OCR was able to extract text accurately with a wide range of document types and the classification model gave stable categorization results. The version control system was effective in tracking changes, recording revisions and keeping detailed document histories that enhanced accountability in institutional record keeping. Evaluations of users were positive in terms of usability of the system, which is the clarity of the interface, the rationality of the navigation structure, and cross-platform responsiveness. Other feedback included the fact that the speed and reliability of searching, uploading, and retrieving documents were also improved as compared to manual processes. Lack of support of real-time collaborative editing, inability to recognize the handwritten text and failure to provide integration with other cloud storage systems were identified as limitations. Regardless of such limitations, the system fulfilled its goals of enhancing efficiency, accuracy, and reliability in document management. The research has shown that the artificial intelligence techniques can help in dealing with the issues of managing academic records to minimize the human error, automation of repetitive processes and offer systematic strategies of tracking versions and structuring of documents. The system provided an avenue on which further improvements could be made in the future which would enable the system to be expanded like the addition of handwriting recognition, adding collaborative editing capabilities and the addition of third party storage systems. Such improvements would enhance the system to be

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more flexible and scalable to adapt to the wider use in academic institutions where document management is required to be safe, secure, and smart.

Keywords:
Academic institutions, Document management, Document tracking, Version control system, Artificial intelligence (AI), Deep learning, Optical Character Recognition (OCR), Tesseract OCR, Convolutional Neural Networks (CNN), Hugging Face Transformers, Document classification, Semantic tagging

INTRODUCTION

Artificial Intelligence and Machine Learning have transformed document management by enabling automated classification, retrieval, and processing of digital records. AI refers to the development of intelligent systems capable of performing tasks that typically require human cognition, while ML, a subset of AI, allows systems to learn patterns from data and make predictions without explicit programming. This project utilizes deep learning techniques, specifically Convolutional Neural Networks (CNNs) and Optical Character Recognition (OCR), to develop an AI-powered document tracking system. By integrating these technologies, the system can efficiently classify, search, and track digital documents within a university setting. The purpose of this study is to enhance the efficiency of document organization and retrieval by the implementation of an AI-based document tracking system for the universities. Many challenges pertaining to document mismanagement and slow retrieval processes will be addressed by the project. Secondly, it will also address some inefficiencies in tracking academic and administrative records.

The system is smooth and user friendly enough to enable users to upload, classify, and retrieve documents with deep learning models working in the background. This project's scope includes several automated classification such as improved smart search functionalities and continuous real time document status tracking. It will not at all cover things like legal document authentication, or multi-institution document sharing at all. The proposed system will help the university to have a more structured and intelligent way of document management. This also cuts down on the dependence on full manual process and introduces such features as automated classification, version tracking, and search based on content. University administrators, faculty and staff will have a more systematic means to handle essential documents, including accessibility, traceability and organization of academic and administrative records. AI and deep learning technologies are involved in the modernization and a data driven approach to the management of institutional documents within the educational environment.

OBJECTIVES

This study aimed to design, develop, and implement an AI-powered document tracking and version control system that automates the classification, monitoring, and management of institutional documents using deep learning algorithms. It sought to create a platform capable of digitizing scanned and uploaded files through Optical Character Recognition (OCR) technology and intelligently categorizing them to ensure faster and more accurate retrieval. The system was intended to provide a reliable version control feature that records and monitors document revisions, enabling users to maintain organized records and track changes over time. Furthermore, it aimed to integrate a centralized and secure database for storing document metadata, user access logs, and version history while offering a user-friendly interface that allows authorized users to efficiently track, manage, and search documents in real time. Lastly, the study aimed to evaluate the system's overall performance, accuracy, and usability based on established software quality standards to ensure that it meets the needs of institutions in managing various types of documents effectively and securely.

METHODOLOGY

Methodology means the process followed for designing the system following the set of objectives. It represents the steps, tools and strategies that are implemented to make sure that the project is done systematically and efficiently in system development. A methodology well defined will construct the system as it solves the problems which are being addressed within the given (and use cases) requirements. In this study, the Agile methodology, a system development iteration and incremental approach, flexible, collaborative, and continuous improvement, has been adopted. The development of the system is done in small, manageable cycles, called sprints, in which the user feedback is kept up to date and the system is adapted for it. In particular, this approach is very suitable for

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academic projects because requirements could evolve and early validation with an end user is critical to guarantee the system credibility.

A. Methods

This study employed a developmental research approach to design and implement an AI-powered document tracking and version control system. The approach focused on developing a functional prototype that addressed the challenges of manual document management and improving efficiency in classification, retrieval, and version control. Data were gathered through interviews and observation of existing workflows to understand institutional needs and requirements. The system was evaluated based on functionality, usability, performance, and reliability using the ISO/IEC 25010 software quality standard. Testing methods included functionality testing, performance benchmarking, and user acceptance evaluation conducted among selected faculty and staff.

B. System Development

The development of the system followed the principles of the Software Development Life Cycle (SDLC) using the Agile methodology. This iterative approach allowed continuous improvement through planning, development, testing, and feedback integration. The following phases were undertaken:

Figure 1: Agile Methodology Diagram

1) Planning: The initial phase involved identifying the problem, defining the project objectives, and outlining the scope and limitations. This stage also included understanding user needs, determining functional requirements, and establishing the system's key features and components.
2) Requirements Analysis: In this phase, the detailed system requirements were analyzed, including user roles, document workflows, security protocols, and data storage needs. The integration of Tesseract OCR for text extraction and Hugging Face Transformers for document classification was planned. PostgreSQL was chosen as the database for secure data storage and version history tracking.
3) System Design: The architecture of the system was designed, including database structure, AI model integration, and user interface layout. The system flow, use case diagrams, and wireframes were created to guide development. The interface was designed to be intuitive, user-friendly, and responsive across devices.
4) Development: During this stage, the system was implemented by coding and integrating all components. The OCR module was developed to extract text from scanned documents, while the deep learning model was trained for classification and tagging. Backend services were built using PostgreSQL, and the frontend was developed for smooth user interaction.
5) Testing: The system underwent several testing procedures, including unit testing, integration testing, and user acceptance testing. Performance testing ensured that the system could handle multiple documents efficiently, while security testing verified the protection of sensitive data.
6) Deployment: After successful testing, the system was deployed in a controlled environment where faculty and staff could access and use it. User training and documentation were provided to ensure smooth adoption and usage.

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7) Evaluation: The final phase involved evaluating the system's performance against the project's objectives and quality standards. The evaluation was based on functionality, usability, reliability, and efficiency, as well as user satisfaction collected through surveys and feedback.

RESULTS AND DISCUSSION

The survey results were obtained from a total of 300 respondents regarding the evaluation of the AI-Powered Document Tracking and Version Control System. The data collected focused on eight quality criteria, namely Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, Security, Maintainability, and Portability. Results were analyzed using a Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) and presented through mean scores and visual graphs for clearer interpretation. This section discusses the findings and their alignment with the objectives of the study.

A. FUNCTIONALITY

The system received an average mean score of 4.31 (Very Good) regarding functional suitability. The majority of respondents agreed that the application provides appropriate features, such as document uploading, automated OCR text extraction, CNN-based document classification, approval workflows, and version history tracking. This indicates that the system addresses the functional requirements of faculty and administrative personnel effectively. Respondents confirmed that features like content-based search and version control are useful in organizing institutional records, ensuring that documents remain accessible, accurate, and updated.

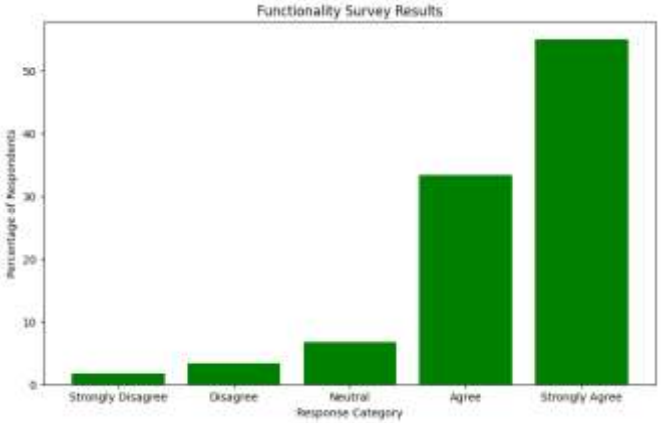

Figure 2: Functionality Bar Graph

B. PERFORMANCE

The system achieved an average mean score of 4.07 (Very Good) for performance efficiency. Respondents noted that the application responds promptly, processes uploads smoothly, and runs OCR and classification without significant delays. The results show that the system is able to handle document processing tasks effectively, even when multiple records are uploaded simultaneously. This performance evaluation further validates that the AI-powered functionalities can run efficiently within a mobile-based environment, contributing to faster and more reliable workflows for academic institutions.

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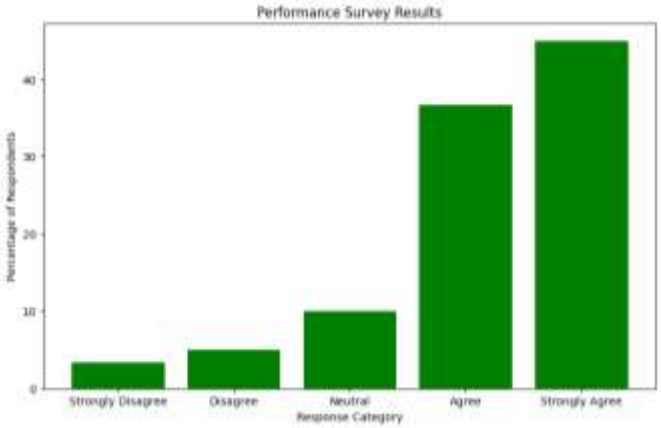

Figure 3: Performance Bar Graph

C. COMPATIBILITY

The system earned an average mean score of 4.07 (Very Good) for compatibility. Users confirmed that the application works on different Android devices and integrates well with the intended institutional environment. This shows that the system can function across devices with different screen sizes and operating system versions, making it practical for deployment.

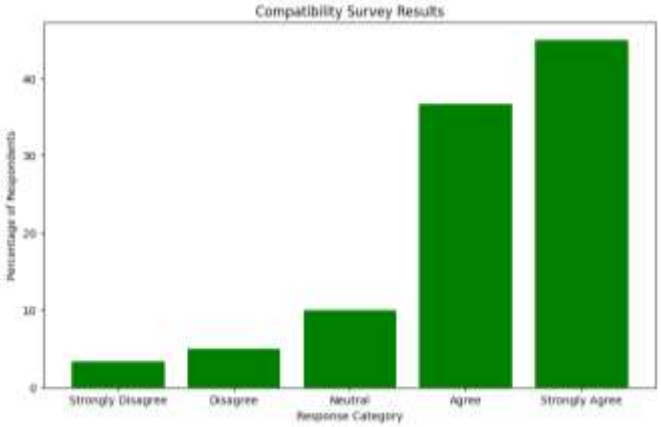

Figure 4: Compatibility Bar Graph

D. USABILITY

The system obtained an average mean score of 4.36 (Very Good) for usability. Most respondents agreed that the application is user-friendly, providing clear navigation, labeled buttons, and simple workflows for both faculty and registrar roles.The results indicate that minimal training is required, and the system design allows users to focus on tasks without difficulty.

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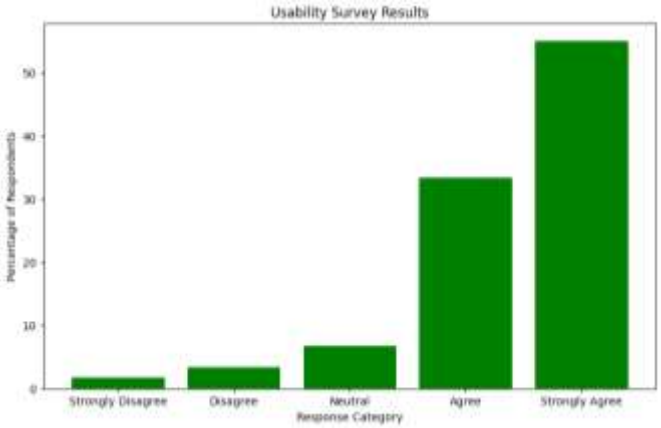

Figure 5: Usability Bar Graph

E. RELIABILITY

The system received an average mean score of 4.18 (Very Good) for reliability. Respondents noted that the application rarely crashes, maintains stable operations, and consistently saves document versions without data loss. This demonstrates that users can trust the system to preserve the integrity of records while ensuring continuity of workflows.

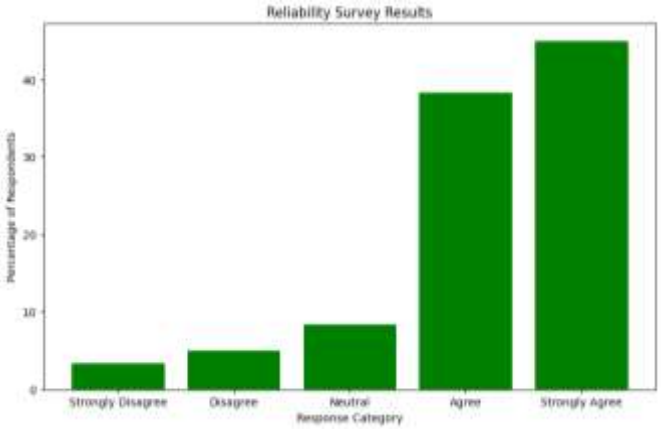

Figure 6: Reliability Bar Graph

F. SECURITY

The system achieved an average mean score of 4.21 (Very Good) for security. Respondents expressed confidence that the system protects sensitive records through authentication and role-based access control. This suggests that documents are safeguarded against unauthorized access and modifications, aligning with the study's objective of ensuring secure document handling.

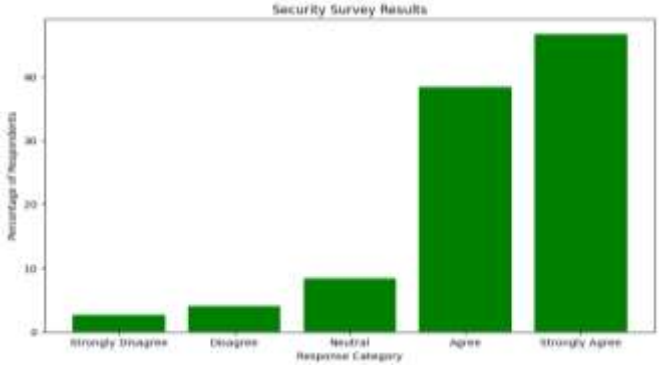

Figure 7: Security Bar Graph

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G. MAINTAINABILITY

The system scored 4.09 (Very Good) for maintainability. Users believed that the design and structure of the system make it possible to update, fix bugs, and enhance features without difficulty. This indicates that the system can be maintained efficiently over time, supporting future improvements or upgrades.

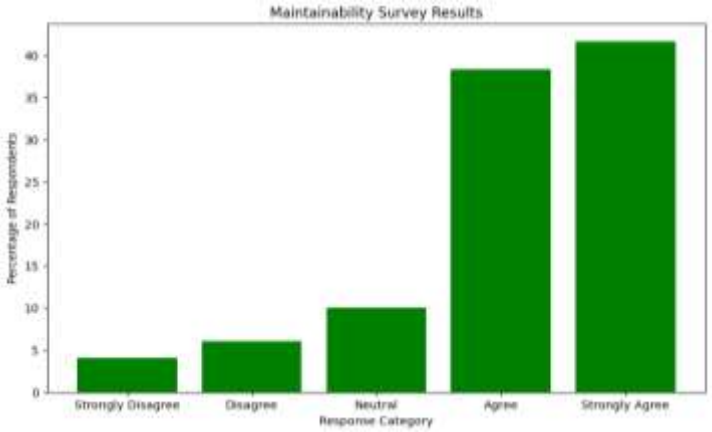

Figure 8: Maintainability Bar Graph

H. PORTABILITY

The system received an average mean score of 4.25 (Very Good) for portability. Respondents agreed that the application installs easily, adapts to different screen sizes, and functions across devices without compatibility issues. This demonstrates that the system is accessible and convenient for users across a variety of devices, which is essential for widespread adoption.

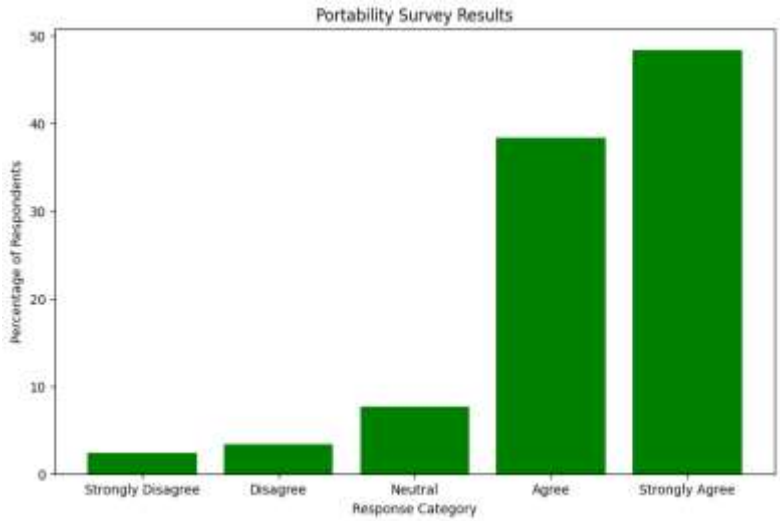

Figure 9: Portability Bar Graph

H. EVALUATION METRICS

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CRITERIA	GENERAL WEIGHTED MEAN	VERBAL INTERPRETATION
Functional Suitability	**4.31**	**Very Good**
The system provides all necessary features for document tracking.	4.35	Very Good
The system provides accurate tracking and versioning results.	4.41	Very Good
Features improve workflow efficiency in document handling.	4.28	Very Good
The system supports the necessary document types and tracking functions required in institutional settings.	4.29	Very Good
Document classification is performed without errors.	4.23	Very Good
Performance Efficiency	**4.07**	**Very Good**
Documents load and respond quickly during operations.	4.1	Very Good
The system uses memory and resources efficiently.	4.06	Very Good
The system handles large volumes of documents efficiently without noticeable performance issues.	4.09	Very Good
Search and retrieval times are acceptable.	4.09	Very Good
The app runs smoothly even with many concurrent users.	4.03	Very Good
Compatibility	**4.07**	**Very Good**
The system operates alongside other software without issues.	4.02	Very Good
It can exchange data with internal platforms.	4.11	Very Good
External apps and tools function properly while using the system.	4.05	Very Good
Exported documents integrate with other tools (e.g., PDF readers).	4.08	Very Good
Supports integration with future tools/systems.	4.09	Very Good
Usability	**4.38**	**Very Good**
The system is easy to learn and understand, even for first-time users.	4.45	Very Good
Common tasks (uploading, tracking) are easy to perform.	4.38	Very Good
The system prevents and alerts users about common input mistakes.	4.32	Very Good
Interface is accessible to admins, staff, and faculty.	4.37	Very Good
The layout and visual design are pleasant and professional.	4.3	Very Good
Reliability	**4.18**	**Very Good**
The system operates consistently with minimal errors or crashes.	4.22	Very Good
Always accessible when needed.	4.15	Very Good
Continues to work even after small system faults.	4.14	Very Good
Lost files or versions can be restored easily.	4.2	Very Good
Alerts and notifications are consistently delivered.	4.19	Very Good
Security	**4.21**	**Very Good**
Access to documents is role-based and secure.	4.25	Very Good
Document versions cannot be altered without permission.	4.18	Very Good
User actions are traceable and accountable.	4.22	Very Good
Logs record actions clearly for each user.	4.2	Very Good
Only verified users can perform document operations.	4.21	Very Good
Maintainability	**4.09**	**Very Good**
System components are structured and manageable.	4.15	Very Good
Modules or parts can be reused in future projects or features.	4.08	Very Good
Errors can be easily found and diagnosed.	4.05	Very Good
Changes and updates are easy to implement.	4.09	Very Good
It is easy to test new or updated features.	4.08	Very Good
Portability	**4.25**	**Very Good**
The system works well in various departments.	4.28	Very Good
The installation process is simple and clear.	4.2	Very Good
Can replace old/manual systems easily.	4.24	Very Good
Works on various devices and screen sizes.	4.26	Very Good
Compatible with different operating systems and browsers.	4.27	Very Good

Figure 10: Overall Summary Survey

Overall, the AI-Powered Document Tracking and Version Control System received positive evaluations across all eight quality criteria. Usability and Functional Suitability earned the highest ratings, showing that users found the system intuitive, easy to navigate, and equipped with the essential functions for document management such as OCR-based search, version control, and approval workflows. Portability and Security also scored highly, reflecting that users were able to install and use the system on different devices without difficulty while trusting its ability to safeguard institutional records. Meanwhile, Performance Efficiency, Compatibility, Reliability, and Maintainability received favorable but slightly lower ratings compared to the top categories, suggesting that while the system is stable and effective, further optimization could improve responsiveness, long-term sustainability, and adaptability across more environments. Overall, the survey results confirm that the system meets user expectations by providing an accessible, functional, and secure platform for document handling within a university setting, while also highlighting opportunities for enhancement in terms of performance optimization and maintainability for future development.

DISCUSSION

The survey results reveal how the AI-Powered Document Tracking and Version Control System can significantly improve the workflow of university administrators, faculty staff, teachers, and the registrar's office by streamlining document handling processes.

First, the results show that users rated Functional Suitability and Usability highly, indicating that the system's core features such as OCR-based text extraction, version history, and approval workflows are effective and easy to use. The favorable responses confirm that the interface is user-friendly, allowing users to quickly adapt to the system without requiring extensive training.

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Second, Performance Efficiency and Compatibility were also evaluated positively, showing that the system is capable of handling multiple tasks smoothly and is adaptable to different devices and environments within the university. This ensures that users can reliably access documents across platforms with minimal issues.

Third, Security and Reliability were highlighted by the respondents as essential aspects. Users expressed confidence in the system's ability to safeguard institutional records and maintain stable performance, though some noted that additional features such as multi-factor authentication could further enhance protection.

Fourth, Maintainability and Portability were rated as good, but results indicate areas for improvement. While the system can be deployed across devices, long-term sustainability and updates need to be continuously monitored to keep up with evolving university needs.

Finally, the overall feedback confirms that the proposed system is practical, reliable, and highly beneficial for academic institutions. While some areas such as performance optimization and maintainability require further refinement, the favorable survey responses demonstrate that the system meets its objectives of enhancing document tracking, version control, and accessibility. The findings highlight that the integration of AI techniques, particularly OCR and CNN, not only improves accuracy in document management but also provides a structured, modernized, and scalable solution for universities.

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CONCLUSION

In summary, the development of the AI-Powered Document Tracking and Version Control System using Deep Learning Algorithms demonstrates how Artificial Intelligence, particularly Convolutional Neural Networks (CNN) and Optical Character Recognition (OCR), can significantly improve institutional document management processes. The system addresses key challenges such as the absence of automated classification, lack of structured version history, difficulty in retrieving content, and inefficiencies in organizing documents. By implementing AI-powered document classification, automated version tracking, and intelligent search functionalities, the system provides universities with a modernized approach to document handling that ensures better accessibility, improved accuracy, and more efficient workflows.

The adoption of agile methodology throughout the development process ensured user-centered design, iterative refinement, and flexibility, resulting in a functional and responsive system prototype. Results from the user evaluation survey indicated that the system performed well across multiple ISO 25010 software quality attributes, including functionality, usability, portability, and security, with high mean scores ranging from 4.07 to 4.36, all interpreted as "Very Good." These findings confirm that the system is reliable, user-friendly, and beneficial for academic institutions.

Ultimately, this study highlights the significance of integrating AI technologies into document management to create a structured and intelligent environment that reduces redundancy, enhances collaboration, and ensures that faculty, staff, teachers, and administrators can access up-to-date and accurate documents. While limitations exist, such as the exclusion of handwritten text recognition, multi-institution integration, and third-party cloud services, the proposed system establishes a strong foundation for improving institutional workflows and can be expanded in future iterations to meet broader academic needs.

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