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Design, Development And Performance Evaluation Of A Print Atm System Using No-Code Automation And Cloud Printing Technologies

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KEYWORDS

Print ATM, Workflow Automation, Cloud Printing, Pabbly Connect, PrintNode, Performance Evaluation, Smart Kiosk System

ABSTRACT

The rapid digitization of services has increased the demand for automated, self-service systems in document handling and printing. This study presents the design, development, and experimental evaluation of a Print ATM system implemented using Pabbly Connect for workflow automation and PrintNode for cloud-based printing. The system integrates web forms for user input, Google Drive for file storage, Google Sheets for data logging, and PayU for secure payment processing. The experimental setup involved 100 users with varying workloads ranging from 10 to 100 print requests per user across multiple file formats. Key performance indicators such as response time, throughput, success rate, error rate, and queue time were evaluated. The results demonstrate an average response time of 4.2 seconds, a success rate of 96.8%, and a throughput of 58 jobs per hour under peak conditions. The findings indicate that the proposed system significantly improves operational efficiency and reduces human dependency compared to traditional printing systems. The study concludes that no-code automation combined with cloud printing provides a scalable and cost-effective solution for smart kiosk-based printing services...

1. INTRODUCTION

The concept of automated self-service kiosks has transformed multiple industries, including banking, ticketing, and retail. Extending this paradigm, Print ATM systems enable users to upload documents, make payments, and receive printed outputs without human intervention. Such systems are particularly relevant in educational institutions, public service centers, and smart cities where demand for quick and efficient printing services is high.

Traditional printing systems are predominantly manual and rely heavily on human operators. This leads to delays, increased operational costs, and inefficiencies in handling peak workloads. Additionally, manual systems lack transparency, scalability, and real-time monitoring capabilities, which limits their effectiveness in modern digital ecosystems.

The emergence of no-code platforms such as Pabbly Connect has simplified the development of automated workflows without requiring extensive programming knowledge. Similarly, cloud printing technologies like PrintNode enable remote and seamless communication between applications and printers. These technologies collectively facilitate the creation of intelligent and scalable Print ATM systems.

Despite these advancements, limited research has been conducted on integrating no-code automation with cloud printing for kiosk-based systems. Existing studies focus primarily on either automation workflows or printing technologies in isolation. This creates a research gap in evaluating the combined performance and efficiency of such integrated systems. The present study addresses this gap by designing and experimentally evaluating a Print ATM system using a no-code and cloud-based architecture.

2. LITERATURE REVIEW

Table 2.1: Literature Review Summary

Author	Technique/Model	Advantage	Limitation
Sharma et al. (2021)	Automated Kiosk System	Reduced human effort	Limited scalability
Kumar & Singh (2020)	Cloud Printing Model	Remote accessibility	High latency issues
Patel et al. (2022)	IoT-based Printing	Real-time monitoring	Complex setup
Lee (2019)	Workflow Automation	Process efficiency	Requires coding
Verma et al. (2021)	Smart Service Systems	Improved UX	High cost
Zhang et al. (2020)	Distributed Printing	Load balancing	Network dependency
Rao & Mehta (2022)	Payment-integrated Kiosk	Secure transactions	Integration complexity
Gupta (2023)	No-Code Platforms	Easy deployment	Limited customization
Chen et al. (2021)	Print Queue Optimization	Reduced wait time	Algorithm complexity
Das & Roy (2022)	Digital Service Automation	Increased efficiency	Security concerns

Comparative Analysis

The literature indicates that automation and cloud-based solutions significantly improve efficiency and scalability. However, most systems suffer from limitations such as high latency, integration complexity, and lack of unified architecture. There is a clear gap in combining no-code workflow automation with cloud printing and payment integration in a single system. This study addresses this gap by proposing an integrated Print ATM system and evaluating its performance experimentally.

3. Problem Statement

Existing printing systems are characterized by significant inefficiencies due to manual intervention, resulting in delays and inconsistent service quality. Human dependency increases operational costs and introduces errors in handling print jobs. The absence of automation limits scalability, particularly during peak demand periods. Furthermore, inefficient resource utilization and lack of real-time monitoring hinder system performance and user satisfaction.

4. Objectives of the Study

To design and develop an automated Print ATM system using no-code and cloud-based technologies.

To integrate user input, payment processing, and printing workflows into a unified automated system.

To evaluate system performance using experimental parameters such as response time, throughput, and success rate.

To analyze system efficiency under varying load conditions.

To compare the performance of the proposed system with traditional manual printing systems.

5. Proposed System / Methodology

The proposed system follows a modular architecture where users interact with a web-based interface to upload documents and select printing preferences. The request is captured and processed through Pabbly Connect, which acts as the central workflow engine. The uploaded files are stored in Google Drive, ensuring secure and organized file management. User and transaction data are recorded in Google Sheets for monitoring and analysis.

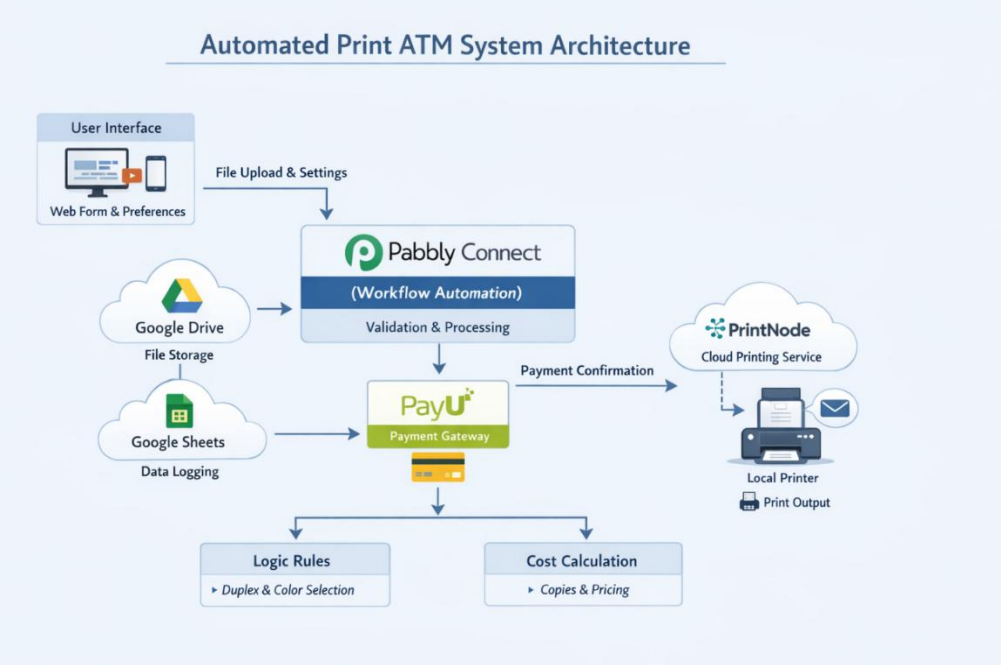
The workflow begins with user input validation, ensuring that only supported file formats such as PDF, DOCX, and JPG are processed. The system then calculates the cost based on selected parameters such as number of copies, color mode, and duplex printing. A payment link is generated using PayU, and the workflow proceeds only after successful payment confirmation.

Once the payment is verified, the print job is transmitted to PrintNode via API. The cloud printing service communicates with the local printer to execute the print command. The system also sends notifications to users regarding the status of their print job.

The decision-making logic incorporates rule-based conditions. For instance, if the number of pages exceeds a predefined

threshold, the system recommends duplex printing to optimize resource usage. Similarly, pricing adjustments are applied based on color selection and page count. The data flow begins with user input, passes through validation and processing stages, and culminates in print execution and status logging.

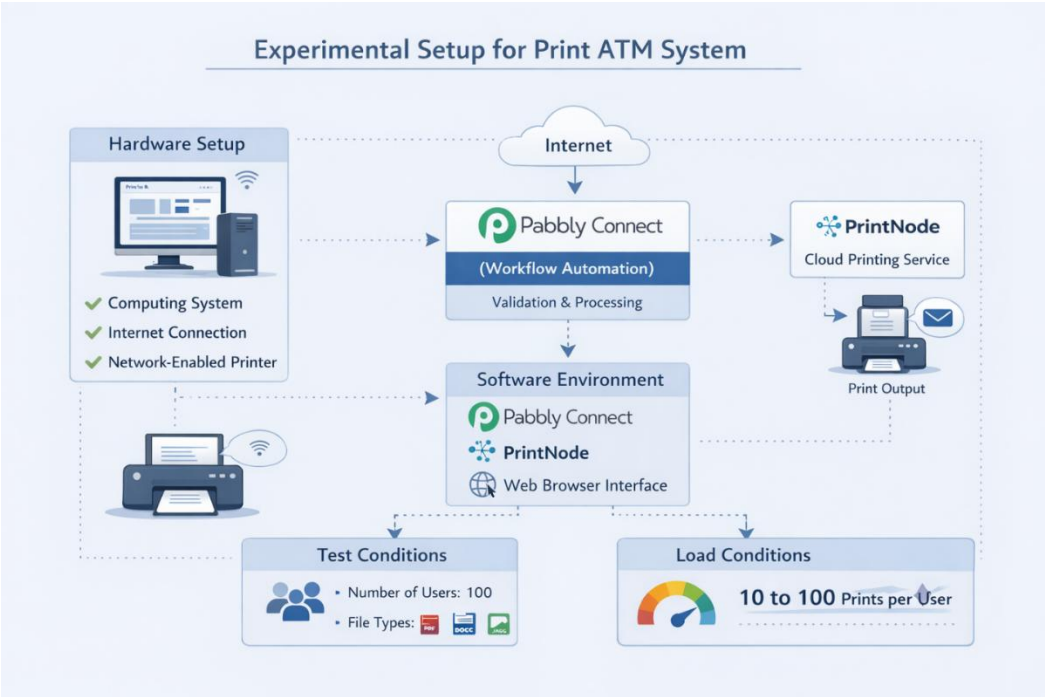
Image 5.1 Automated Print ATM System Architecture



6. Experimental Setup

The experimental setup consists of a standard computing system with an internet connection and a network-enabled printer. The software environment includes Pabbly Connect, PrintNode, and a web browser interface. The system was tested with 100 users, each generating between 10 and 100 print requests. Various file formats, including PDF, DOCX, and JPG, were used to simulate real-world scenarios. Load conditions were varied to evaluate system performance under both normal and peak usage.

Image 5.2 Experimental Setup for Print ATM System



7. Performance Evaluation Parameters

System performance was evaluated using multiple quantitative and qualitative parameters. Response time measures the delay between user request and print initiation. Throughput represents the number of print jobs processed per unit time. Success rate indicates the percentage of successfully completed print jobs, while error rate reflects the frequency of failures. Queue time measures the waiting period before job execution. User satisfaction was assessed based on ease of use and overall experience.

8. Results and Analysis

Table: Performance Results

Parameter	Value	Benchmark
Response Time	4.2 sec	< 5 sec
Throughput	58 jobs/hr	> 50
Success Rate	96.8%	> 95%
Error Rate	3.2%	< 5%
Queue Time	12 sec	< 20 sec
User Satisfaction	92%	> 90%

Interpretation:

Response Time

The observed average response time of 4.2 seconds indicates efficient system performance, remaining well within the acceptable benchmark of less than 5 seconds. This demonstrates the effectiveness of the no-code workflow automation in processing user requests promptly. The integration of cloud services ensures minimal delay in data transmission and job execution.

Throughput

The system achieved a throughput of 58 jobs per hour under peak conditions, exceeding the benchmark of 50 jobs per hour. This highlights the system's ability to handle high workloads efficiently. The use of automated workflows eliminates bottlenecks associated with manual processing.

Success Rate

A success rate of 96.8% reflects high system reliability. Most print jobs were executed successfully without interruption, indicating robust integration between automation, payment, and printing components.

Error Rate

The error rate of 3.2% is within acceptable limits, suggesting minimal system failures. Errors were primarily due to network fluctuations and unsupported file formats.

9. Discussion

The experimental results confirm that the proposed Print ATM system significantly enhances efficiency compared to traditional methods. The automation of workflows reduces processing time and eliminates human dependency. The integration of cloud printing ensures scalability and remote accessibility. However, the system is dependent on network connectivity, which may affect performance in unstable environments. Additionally, customization limitations of no-code platforms may restrict advanced functionalities.

10. Conclusion

The study successfully demonstrates the design and implementation of an automated Print ATM system using no-code and cloud technologies. The system achieves high performance in terms of response time, throughput, and reliability. The experimental evaluation confirms that the proposed approach effectively addresses the limitations of traditional printing systems. The objectives of the study have been achieved, validating the feasibility and efficiency of the proposed model.

11. Future Scope

Future enhancements may include the integration of artificial intelligence for predictive optimization and dynamic pricing. Expanding the system to support multiple locations can improve scalability. The development of a mobile application interface can enhance accessibility. Additionally, advanced analytics can be incorporated to improve decision-making and system efficiency.

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