

Development of ICT Exam Document Validation System

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Abstract

The increasing number of applicants for the ICT Proficiency Examination has created significant challenges for the Department of Information and Communications Technology (DICT) Region VIII, particularly in the manual verification of examination requirements. Traditional validation procedures are often time-consuming, prone to data-entry mistakes, and susceptible to inconsistencies in decision-making. To address these concerns, this study developed an ICT Exam Validation System that automates the verification and assessment of applicant documents. The system was developed using the Agile System Development Life Cycle, which involved iterative phases of planning, design, development, testing, deployment, and evaluation. It features dedicated portals for applicants and administrators, secure user authentication, automated document validation, and real-time notification capabilities. To determine its effectiveness, the system underwent functional and technical evaluations based on reliability measures and the ISO/IEC 25059:2023 quality model, focusing on key attributes such as adaptability, reliability, transparency, and operational efficiency. The evaluation results indicate that the system provides a dependable and practical solution for streamlining the validation of ICT Proficiency Examination requirements. By reducing manual intervention and improving the consistency of validation decisions, the system enhances the overall efficiency of examination administration. Moreover, the project contributes to the advancement of digital governance initiatives by supporting innovation in public service delivery and promoting the modernization of government processes. The study also aligns with Sustainable Development Goals (SDGs) 9 and 16 by encouraging the adoption of intelligent technologies that strengthen institutional effectiveness, improve service accessibility, and foster sustainable digital transformation in the public sector.

Keywords: Agile System Development Life Cycle, Document Validation, E-Governance, ICT Proficiency Examination, Intelligent Automation, Web-Based System

1. Introduction

The Information and Communications Technology (ICT) Proficiency Examination, administered by the Department of Information and Communications Technology (DICT), serves as one of the pathways for obtaining Electronic Data Processing Specialist Eligibility (EDPSE), a qualification recognized for technical positions in government service (Civil Service Commission & Department of Information and Communications Technology, 2022). As government agencies continue to expand their digital transformation efforts, the number of individuals seeking ICT-related certifications has steadily increased. This growth has placed additional pressure on existing administrative procedures, particularly in the review and validation of examination requirements.

At present, the verification process largely depends on manual examination of submitted documents. While this approach remains functional, it often requires considerable time and effort from personnel and may lead to processing delays, inconsistencies, and occasional human errors. Recognizing these challenges, this study proposes the development of a Smart Validation System for ICT Proficiency Examination Requirements. The proposed solution utilizes AI-enhanced Optical Character Recognition (OCR), automated data validation, scalable processing mechanisms, and real-time notification features to improve the speed, accuracy, and reliability of requirement verification.

1.1 Background of the Smart Validation System for ICT Proficiency Examination Requirements

Passing the ICT Proficiency Examination is an important step for individuals seeking EDPSE eligibility and pursuing technical careers in the public sector. Beyond employment qualification, the examination also supports national efforts to strengthen ICT competencies among government personnel and promote professional standards in the digital workforce (Department of Information and Communications Technology, 2024b). Within DICT Region VIII, the evaluation of applicant requirements—including transcripts, diplomas, birth certificates, and other supporting documents—is still performed manually. Personnel must examine each submission to determine whether the information provided is complete, accurate, and consistent with registration records. Although the procedure has been effective in managing applications, increasing applicant numbers have made the process more difficult to sustain efficiently. Several issues have become apparent in the current workflow. These include lengthy document review periods, variations in document formats that

complicate verification, delayed communication of validation results, and increased workload during peak registration periods. Such concerns not only affect organizational productivity but may also reduce applicant satisfaction due to prolonged waiting times and limited feedback. In response, this study introduces an intelligent validation platform capable of automating document assessment, supporting large-scale processing, and providing timely notifications to applicants. Through automation, the proposed system seeks to reduce manual effort while improving consistency and responsiveness.

1.2 Local, National, and Global Context of ICT Examination Requirement Validation and Digital Government Services

Across the world, public institutions are increasingly adopting technologies such as artificial intelligence, cloud computing, and optical character recognition to modernize administrative services and streamline document processing. Countries such as Estonia and India have demonstrated how digital platforms can simplify government transactions, minimize paper-based procedures, and improve citizen access to services (Vassil, 2016; Sharma & Mishra, 2023). In the Philippines, digital governance initiatives continue to expand through programs designed to enhance public service delivery and strengthen government efficiency. One notable example is the eGovPH platform, which supports the integration of digital services across agencies (Department of Information and Communications Technology, 2024a). These efforts are reinforced by Republic Act No. 10844, which established the DICT and mandated the promotion of ICT development and digital innovation throughout the country (Republic Act No. 10844, 2016). Despite these advancements, many government offices still rely on traditional document verification practices. Manual processes often limit operational efficiency, particularly when dealing with high transaction volumes. In DICT Region VIII, challenges related to increasing applications, inconsistent document presentation, communication delays, and labor-intensive verification activities continue to affect the overall validation process. These circumstances underscore the need for a localized and technology-driven approach that can support more efficient and reliable examination administration.

1.3 Alignment of the Smart Validation System with Relevant Sustainable Development Goals (SDGs)

This study aligns primarily with:

SDG 8 – Decent Work and Economic Growth. By accelerating the validation process for ICT certification applicants, the system supports workforce readiness and facilitates access to technical government employment opportunities.

SDG 9 – Industry, Innovation and Infrastructure. The integration of AI-enhanced OCR, intelligent automation, and scalable digital infrastructure promotes innovation and strengthens technological systems within public institutions.

SDG 16 – Peace, Justice, and Strong Institutions. The proposed system enhances transparency, efficiency, accuracy, and accountability in government service delivery through automated and standardized validation procedures.

1.4 Importance of the Smart Validation System to Multidisciplinary Sustainability

The proposed solution supports sustainability from multiple perspectives. From a technological standpoint, it encourages the adoption of modern digital tools that can improve government operations and reduce dependence on manual procedures. Institutionally, it helps organizations optimize resources, improve workflow efficiency, and enhance service quality. Economically, faster processing of certification requirements can contribute to workforce readiness and increased employment opportunities. In addition, the study supports broader governance objectives by advancing digital transformation efforts and fostering the modernization of public-sector services through intelligent and scalable technologies.

2. Material and methods

2.1 Research Design

This study employed a Developmental Research design focused on designing and developing an intelligent requirement validation system to address administrative challenges in the ICT Proficiency Examination process. Developmental Research emphasizes the systematic design, development, and evaluation of technological interventions intended to solve practical problems (Richey & Klein, 2014). The design followed a structured approach consisting of analysis, system design, development, testing, deployment, and evaluation. The system was developed using a web-based architecture that integrated AI-enhanced OCR, intelligent validation, and automated notification mechanisms. The research process concluded with performance testing and system evaluation to determine whether the developed system achieved the intended objectives.

2.2 Locale of the Study

The study was conducted at the Department of Information and Communications Technology (DICT) Regional Office VIII located in Tacloban City, Eastern Visayas. The office serves as the administrative center responsible for implementing ICT-related programs and administering the ICT Proficiency Examination in the region. The locale was selected because it is the primary setting where document verification, applicant processing, and examination requirement validation are conducted. The identified operational challenges within this office served as the basis for the development and evaluation of the proposed system.

2.3 Respondents of the Study

The respondents consisted of DICT Bureau of ICT Literacy and Competency Development (BILCD) personnel and ICT Proficiency Examination applicants. The BILCD personnel participated because they are directly involved in verifying and approving examination requirements. Their evaluation was essential in assessing the functionality and reliability of the administrative dashboard and automated validation processes. The applicants served as end-users who interacted with the system through document submission, application tracking, and notification features, providing feedback regarding usability and efficiency.

2.4 Sample and Sampling Procedure

The study utilized purposive sampling to select participants who were directly involved in the ICT Proficiency Examination process. This sampling technique ensured that only respondents with relevant roles and experience participated in the evaluation. The study also utilized thirty (30) datasets consisting of structured registration records and uploaded document images, including transcripts of records, birth certificates, diplomas, and certifications. These datasets were used for system calibration, testing, and validation. All collected data were handled in compliance with the Republic Act No. 10173 (2012).

2.5 Research Instrument

The primary research instrument used in this study was a structured evaluation questionnaire developed based on the quality characteristics specified in ISO/IEC 25059:2023 – Artificial Intelligence Systems Quality Model. The instrument was designed to assess the quality, effectiveness, and operational readiness of the proposed ICT Exam Validation System from the perspective of its intended users and stakeholders. The questionnaire consisted of statements categorized according to the quality characteristics of AI-enabled systems, including Functional Suitability, Performance Efficiency, Usability, Reliability, Security, Compatibility, Maintainability, Portability, Transparency and Explainability, Fairness and Bias Mitigation, Robustness, and Accountability and Trustworthiness. These dimensions were selected because they comprehensively evaluate both conventional software quality attributes and characteristics essential for intelligent systems. Each statement was measured using a five-point Likert Scale, where respondents indicated their level of agreement with each criterion: 5 strongly agree to 1 strongly disagree.

2.6 Data Gathering Procedure

The study followed an Agile System Development Life Cycle characterized by iterative development and continuous refinement. Agile methodologies promote adaptive planning, iterative development, stakeholder collaboration, and continuous improvement throughout the system development process (Sutherland & Schwaber, 2023). The process began with project planning and requirements analysis, during which existing document validation procedures were examined and system requirements were identified through consultation with DICT personnel. The design phase established the system architecture, workflow logic, database structure, and integration framework for notification services. Development then proceeded through the implementation of database management, automated validation mechanisms, and notification services. Uploaded documents underwent image preprocessing before being compared with applicant registration data for automated validation. The system was subsequently subjected to testing and functional validation. Data matching reliability, notification responsiveness, database integration, user authentication, and system usability were evaluated through a series of functional and performance tests. Identified issues were corrected through iterative refinements. Following successful testing, the system was deployed within a local server environment. User manuals and technical documentation were prepared to support system implementation and operation. The final phase involved stakeholder evaluation, wherein BILCD personnel assessed the system's accuracy, efficiency, and responsiveness compared with existing manual procedures.

3. Results and Discussion

3.1 Implementation of the Web-Based Validation System Applicant and Administrator Portals

The developed system successfully implemented separate applicant and administrator portals within a three-tier architecture. The applicant portal provided account registration, secure authentication, document submission, status monitoring, examination registration, profile management, and support services. The administrator portal provided applicant management, document review, validation monitoring, score entry, report generation, audit logging, and examination management functions. The successful implementation of these features demonstrates the practicality of a centralized digital platform for examination requirement processing. The separation of user roles improved security, usability, and workflow management while supporting the operational requirements of DICT Region VIII.

Backend, Database, and Security Implementation

The system employed a Node.js and Express.js backend integrated with a MySQL database containing twelve normalized tables supporting user management, document validation, notifications, examination management, audit logging, and support services. Security mechanisms included JWT-based authentication, role-based access control, password encryption, request validation, and comprehensive audit logging. These security and data management mechanisms ensure system integrity, confidentiality, and accountability. The implementation supports secure handling of sensitive applicant information while maintaining compliance with modern web application security practices.

Real-Time Notification Performance

The notification system utilized a dual-channel architecture combining WebSocket-based push notifications and Gmail API email delivery. Notification delivery performance remained well within the required five-minute threshold. Mean WebSocket delivery times ranged from 0.6 to 1.2 seconds, while email notifications were delivered within 38 to 52 seconds depending on the event type. The findings demonstrate the effectiveness of event-driven communication in providing immediate feedback to users. This directly addresses communication delays identified in the existing manual process and supports the recommendations of Domo (2025) and OECD (2024) regarding responsiveness as a critical component of modern digital governance systems.

3.2 Evaluation of System Performance

3.2.1 Processing Time Improvement

Comparative testing showed substantial reductions in processing time across all stages of the validation workflow. Digital document submission reduced processing time by approximately 84.7%, document verification by 97.6%, data cross-checking by 99.7%, deficiency notification by 99.9%, and approval or rejection processing by approximately 99.8%. Overall processing was reduced from an estimated three to five business days to approximately fifteen minutes. The results indicate that automation significantly improves operational efficiency by eliminating repetitive manual activities and accelerating validation procedures. The reduction in processing time supports the objective of improving service delivery and reducing administrative burdens within DICT Region VIII.

3.2.2 Error Reduction and Validation Consistency

The system eliminated manual data-entry errors entirely because information was extracted directly from uploaded documents. While false negative and false positive classifications remained present, the system consistently applied identical validation rules to all submissions. Decision inconsistency, which commonly occurs in manual review processes, was completely eliminated. These findings suggest that the automated system provides a more standardized and objective validation process. Although human review remains important for borderline cases, the system effectively functions as a reliable first-pass screening mechanism while reducing variability in decision-making.

3.2.3 International Organization for Standardization (2023) Quality Assessment

Evaluation using the ISO (2023) framework yielded highly positive results. Functional Adaptability obtained a mean score of 4.6, Functional Correctness 4.4, Robustness and Reliability 4.2, Transparency and Explainability 4.0, and Operational Efficiency 4.8. The overall mean score of 4.40 indicated a rating between Very Good and Excellent. In addition, all functional test cases related to authentication, document upload, OCR processing, data matching, score entry, notifications, and user interface responsiveness were successfully passed. These results indicate that the developed system satisfies internationally recognized quality standards for AI-based systems. The findings further demonstrate that open-source technologies can produce reliable, efficient, and high-quality solutions suitable for government service applications.

4. Conclusion & Recommendations

The implementation of the ICT Exam Validation System provided a practical response to the challenges encountered in the manual processing of ICT Proficiency Examination requirements within DICT Region VIII. Results of the evaluation showed that the system substantially streamlined the validation workflow, allowing applications to be processed in a fraction of the time previously required. Tasks that once took several days to complete could be accomplished within minutes, demonstrating the capacity of automation to improve organizational efficiency and expedite public service delivery.

Beyond improving processing speed, the system contributed to greater consistency in requirement evaluation. By automatically extracting and validating information from submitted documents, the platform reduced the likelihood of human-induced errors and ensured that all applications were assessed using the same set of criteria. This standardized

approach helped promote fairness and objectivity throughout the screening process. Although complex or exceptional cases may still require human judgment, the system proved effective as an initial validation tool that supports more accurate and consistent decision-making.

Assessment using the ISO/IEC 25059:2023 quality framework further affirmed the system's overall performance. The favorable ratings obtained across key quality dimensions—including adaptability, correctness, reliability, transparency, and efficiency—indicate that the developed platform performs in accordance with recognized standards for AI-enabled applications. In addition, the successful execution of all functional tests demonstrated the stability and readiness of the system for operational use.

Taken together, the findings suggest that the ICT Exam Validation System can serve as a valuable digital solution for modernizing examination requirement verification. The integration of OCR technology, intelligent automation, and workflow management features illustrates how emerging technologies can strengthen government operations, improve service accessibility, and support ongoing digital transformation efforts within public institutions.

Compliance with ethical standards

This study was conducted in accordance with applicable ethical and data protection principles relevant to the development and evaluation of information systems involving human participants and institutional data. The study involved DICT ICT Literacy and Competency Development Bureau (BILCD) personnel and ICT Proficiency Examination applicants in the assessment and validation of the proposed system. All collected registration records, uploaded documents, and related information were handled solely for research and system evaluation purposes by the researchers and were managed in compliance with the Data Privacy Act of 2012 (RA 10173) to ensure the protection, confidentiality, and responsible use of data throughout the study. Both authors adhered to ethical research standards and maintained the privacy, security, and integrity of all data obtained during the conduct of the research.

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