O’key-Ask: Enhancing Written Assessment Efficiency for Schools and Universities Through AI

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O’key-Ask: Enhancing Written Assessment Efficiency for Schools and Universities Through AI

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Abstract

Traditional assessment alignment is manually intensive, compromising evaluative accuracy and contributing to educator burnout. To address this problem, this study evaluates "O'Key-Ask," an adaptable AI-powered kiosk designed to generate, grade, and analyze standards-aligned assessments. It is hypothesized that the system will significantly reduce assessment workflow time while maintaining strict alignment with Department of Education (DepEd) and Commission on Higher Education (CHED) standards. Utilizing an Input-Process-Output design, system performance was evaluated against manual baselines. User-acceptance testing was conducted via a Likert-scale 29 item questionnaire with a sample of 15 elementary teachers from NorthVille 15 Integrated School and a sample of 4 Computer Engineering faculty from Holy Angel University. Results indicate the system reduced the basic education assessment cycle from an average of 10.5 hours to 12.5 minutes, achieving a 97.78% efficiency gain. While outcomes for the higher education context indicate a 97.61% efficiency gain for complex, Washington Accord-aligned exams and essays, reducing the process from 19.5 hours to 26 minutes. Participants strongly agreed on the system's accuracy, efficiency, and usability, yielding an overall mean rating of 4.74 for basic education and 4.66 for higher education. These findings demonstrate that "O'Key-Ask" effectively alleviates administrative burdens across diverse educational levels, allowing educators to focus on high-impact instruction.

Introduction

Educators across the educational spectrum, from elementary schools to universities, face significant challenges in creating assessments that accurately measure learning outcomes. In the Philippines, elementary school educators are guided by the Department of Education's (DepEd) Table of Specifications (TOS) to ensure tests align with learning goals, a manually intensive process. Simultaneously, in higher education, particularly in technical fields like Computer Engineering, educators must align complex assessments with standards set by the Commission on Higher Education (CHED) and international frameworks like the Washington Accord. For both groups, the traditional assessment cycle is a time-consuming burden that can compromise evaluative accuracy and consistency.

To address these parallel challenges, this research explores the development of an AI-powered smart kiosk system adaptable to both basic and higher education settings. The "O’Key-Ask" system is designed to streamline the assessment workflow by automating the generation of test papers aligned with DepEd's TOS for elementary levels and with CHED, department requirements, and Washington Accord competency standards for engineering programs. The system facilitates efficient grading of various question types, including the automated checking of essays through Optical Character Recognition (OCR), and provides detailed item analysis and Mean Percentage Score (MPS) generation for both contexts. This unified approach aims to reduce educator workload and enhance grading accuracy across different educational frameworks.

This study will examine the system's effectiveness in generating and evaluating assessments that comply with both the DepEd TOS and the standards set by CHED, department

requirements, and the Washington Accord. It will measure the efficiency and accuracy of the grading process, including OCR-based essay evaluation, in both the elementary and university settings. Furthermore, the research will assess the system's user-friendliness and its perceived impact on the workload of both elementary and university educators. Ultimately, this study seeks to determine how a single, adaptable AI-powered assessment kiosk can influence assessment-related tasks and improve the overall quality of evaluation across diverse educational levels.

Review of Related Literature

The integration of Artificial Intelligence (AI) in education is rapidly transforming learning environments. AI-powered tools offer the potential to personalize learning experiences, adapting to individual student needs and learning styles (Holmes, Bialik, & Fadel, 2022). For example, adaptive learning systems use AI algorithms to analyze student performance data and provide tailored instruction, ensuring that students receive targeted support. This personalized approach can lead to improved student engagement and learning outcomes (Holmes, Bialik, & Fadel, 2022).

AI is also playing an increasingly important role in automating assessment processes. AI-driven platforms can automate the scoring of objective tests and provide feedback on student writing. These applications of AI can help to streamline assessment workflows, reduce teacher workload, and provide timely feedback to students (Ifenthaler, D., & Yango, J. 2021).

It is crucial to consider the ethical implications of AI in education, such as ensuring data privacy, addressing potential biases in AI algorithms, and maintaining human oversight in the learning process (Holmes, W., Bialik, M., & Fadel, C. 2022).

The Table of Specifications (TOS) is a vital tool in assessment, ensuring alignment between curriculum objectives and assessment content (Villanueva & Angeles, 2021). It provides a structured approach to test construction, which contributes to the validity and reliability of assessments (Villanueva & Angeles, 2021).

Despite the use of Table of Specification (TOS), many teachers still struggle to align test items with curriculum standards, which compromises the accuracy and fairness of student evaluation. Tiana and Maruf (2024) emphasized in their study, this misalignment reflects a lack of rigorous assessment design practices among educators, particularly when summative tests fail to represent essential competencies.

Furthermore, challenges in constructing valid assessments are amplified in small Philippine schools, where limited resources and heavy workloads hinder alignment with the Department of Education's Most Essential Learning Competencies (MELCs). Bendalian et al. (2024) found that mathematics teachers often struggled with tables of specification and item formats, particularly in later quarters when demands increased and preparation time decreased.

Technology plays a crucial role in supporting and enhancing learning environments. Integrating technology into education can provide personalized learning experiences, adapting to individual student needs and learning styles. Such personalized approaches have the potential to improve student engagement and overall learning outcomes. (Paiva, Leal, & Figueira, 2022)

Automated essay scoring (AES) systems, which utilize artificial intelligence, have been the subject of systematic review. These reviews analyze the development, application, and effectiveness of such systems in educational assessment. (Ramesh & Sanampudi, 2022)

Artificial intelligence is increasingly recognized for its potential to transform various aspects of education, including the enhancement of teacher productivity and efficiency.

Systematic reviews have been conducted to explore the multifaceted ways in which AI contributes to supporting educators in their daily tasks and responsibilities. (Ehtsham, Affandi, Shahid, Imran, & Aijaz, 2025) These reviews often highlight how AI tools can automate administrative tasks, streamline communication, and provide valuable insights into student learning, ultimately freeing up teachers' time for more direct instructional activities. For instance, AI can assist with tasks such as grading, lesson planning, and providing personalized feedback to students, allowing teachers to focus more on delivering engaging and effective instruction. (Ehtsham, Affandi, Shahid, Imran, & Aijaz, 2025) Furthermore, AI-driven systems can analyze student data to identify those who may be struggling or who require additional support, enabling teachers to intervene proactively and personalize their teaching strategies. (Ehtsham, Affandi, Shahid, Imran, & Aijaz, 2025)

Research has explored the application of Robotic Process Automation (RPA) within the field of informatics, including its relevance to job satisfaction in educational settings. (Zahurin, Mamat, Ali, & Abas, 2024) RPA, a technology that automates repetitive and rule-based tasks, has the potential to streamline various processes within educational institutions. (Zahurin, Mamat, Ali, & Abas, 2024) By automating tasks such as data entry, report generation, and scheduling, RPA can free up educators and administrative staff to focus on more complex and engaging activities. (Zahurin, Mamat, Ali, & Abas, 2024) Furthermore, studies have investigated the impact of RPA implementation on job satisfaction among employees in education, considering factors such as reduced workload, increased efficiency, and improved work-life balance. (Zahurin, Mamat, Ali, & Abas, 2024) Understanding the relationship between RPA, informatics, and job satisfaction can provide valuable insights into optimizing technology use within educational environments. (Zahurin, Mamat, Ali, & Abas, 2024)

The creation of assessments that align with curriculum standards is a significant challenge for teachers. In the Philippines, the Department of Education (DepEd) provides the Table of Specifications (TOS) as a framework to ensure this alignment. However, the traditional process of developing TOS-aligned assessments can be time-consuming and may lead to inconsistencies in evaluation. To address these issues, researchers are exploring automated methods for TOS construction. Duero (2024) investigated automating TOS construction to improve student teachers' proficiency in this area. This type of automation has the potential to streamline assessment development and enhance the accuracy and efficiency of the process.

Assessment is a crucial dimension in the educational process, serving to measure student learning and provide feedback for teachers to improve their instructional practices. Effective assessment necessitates the alignment of assessment tools with learning objectives, and in the Philippine educational context, the Table of Specifications (TOS) serves as a framework to ensure this alignment (Department of Education, 2016). The TOS outlines the content areas, learning objectives, and cognitive levels, such as lower-order thinking skills (LOTS) and higher-order thinking skills (HOTS), to guide test construction and ensure assessments measure intended learning outcomes. Orongan (2020) examined classroom assessment practices, noting the prevalence of multiple-choice questions (MCQ) in quarterly examinations and analyzed test items based on the TOS. Studies like Orongan's (2020) highlight the importance of analyzing test items and ensuring reliability in assessments. To address the challenges in traditional assessment, such as time-consuming processes and potential inconsistencies, AI-powered tools are being explored to automate and enhance assessment efficiency and accuracy.

According to a study conducted by Bansil et al. (2024) exploring the reservations, attitudes, readiness, openness, and general perceptions of Filipino teachers regarding the integration of AI in their classrooms, the study shows that teachers expressed a positive attitude

toward integrating AI tools in their classrooms. In addition, the teachers are ready and open to complementing traditional methods with new technologies such as AI. Teachers are aware of the potential benefits of AI tools for their students' individual learning needs. The study also mentioned that teachers reported a high level of support from their institutions, and recommendations were offered.

A study conducted by Umali, J.N.D. (2024) explores the integration and management of Artificial Intelligence (AI) technology in private schools located in Calamba City, Laguna, with an emphasis on how it affects teaching methods and the motivation of learners. The research examines the current implementation of AI in personalized learning, assessments, and administrative tasks, highlighting its role in enhancing teaching efficiency and student engagement. Additionally, the study investigates the perceptions of teachers and students regarding AI, including the challenges of adaptation, expectations, and overall impact on educational experiences. Findings suggest that while AI can optimize teaching strategies and improve learning outcomes, effective management and continuous faculty training are essential for successful integration.

According to a study by Estrellado, C.J. et al. (2024), the integration of Artificial Intelligence into the Philippine educational system has sparked discussions on its impact, challenges, and opportunities. AI in education (AIED) enhances learning experiences, supports data-driven decision-making, and improves efficiency. However, its implementation requires a robust technological infrastructure, strict data privacy policies, and continuous faculty training. To fully harness AI’s benefits while addressing ethical and social concerns, collaboration between educators and policymakers is essential. A well-structured AI adoption strategy can lead to a more effective and inclusive educational system.

Quizzes are essential in education as they help reinforce students' grasp of key concepts and promote self-directed learning. However, compiling or creating high-quality quizzes can be challenging, as it requires deep expertise and insight into specific subject matter. While LLMs have greatly enhanced the efficiency of generating quizzes, concerns remain regarding the quality of the quizzes generated using AI, along with the educational impact of these quizzes on students (Fu et al., 2025).

Automation grading systems powered by Artificial Intelligence are transforming the way exams are evaluated. As AI provides consistency, speed, efficiency, and scalability, these systems offer numerous benefits to both educators and students. AI technologies, including natural language processing, pattern recognition, and adaptive learning, play a pivotal role in revolutionizing exam evaluation. Accepting the potential of AI in exam evaluation will undoubtedly lead to a more efficient, accurate, and personalized learning experience for students worldwide (Balla, E. 2023)

A study by Gobrecht, A. et al. (2024) shows that grading open-ended questions requires a high-effort and high-impact task in education. By avoiding human subjectivity and error, automating this task promises to significantly reduce the workload for education professionals and provide more consistent grading outcomes for students. The study introduces a novel automatic short-answer grading (ASAG) system. The foundation of the system is a refined open-source transformer model that the researchers trained using a sizable collection of exam data from college courses in a wide variety of subject areas. The results of this study suggest that leveraging AI-enhanced grading can reduce human subjectivity, improve consistency, and ultimately increase fairness.

A study by Kim, N. J., & Kim, M. K. (2022) explored teachers' perceptions of an AI-enhanced scaffolding system designed to support students' scientific writing in STEM

education. The findings revealed that while most STEM teachers had a positive experience with the AI tool, recognizing its potential to provide superior scaffolding, concerns were raised regarding the shifting role of teachers in the classroom and the transparency of the AI system's decisions. These insights offer a foundation for developing future guidelines on AI integration in STEM education, emphasizing both the benefits and challenges associated with its implementation.

A study by Celik, I. et al. (2024) provides an overview of research on teachers' use of artificial intelligence (AI) applications and machine learning methods for analyzing teachers' data. The findings highlight that AI presents several opportunities for teachers, particularly in the areas of planning, implementation, and assessment. AI tools can help define students' needs, offer immediate feedback, and automated essay scoring. The study also emphasizes that teachers play vital roles in AI development, including acting as models for training AI algorithms and verifying the accuracy of AI-generated assessments. However, challenges in AI implementation in teaching were identified, offering valuable insights for the development and improvement of AI technologies in education.

AI is transforming education by empowering teachers through automation and intelligent support systems. By reducing the burden of repetitive tasks such as grading assignments, AI allows educators to focus on fostering meaningful relationships with their students and delivering personalized instruction (Ligot, 2023). With AI-powered kiosks capable of automatically grading answered papers and storing student scores, teachers can efficiently manage student records without the need for manual computation. This automation not only saves time but also ensures accuracy and consistency in grading. Additionally, AI-driven tools provide valuable insights into student performance, enabling teachers to make data-driven decisions that enhance lesson effectiveness. These advancements enable educators to transition from administrative-heavy roles

to facilitators of deeper learning experiences, ultimately improving the quality of education (Ligot, 2023).

AI integration in the Philippine educational system presents numerous opportunities to improve learning experiences and administrative efficiency. One key advantage is the automation of grading and record-keeping, which allows educators to focus on more critical aspects of teaching (Estrellado, 2023). By leveraging automated assessment, schools can provide precise and timely feedback, enhancing the accuracy of student evaluations while reducing the workload of teachers. AI-powered tools also help educators gain insights into student performance, enabling data-driven decision-making. These tools allow teachers to track learning progress more effectively and tailor instructional strategies accordingly (Estrellado, 2023). However, while AI adoption presents clear benefits, ethical considerations such as digital equity and the responsible use of AI in classrooms must also be addressed to ensure that technological advancements contribute positively to education

Teachers in the Philippines have expressed both enthusiasm and concerns regarding the integration of AI tools in classrooms. AI can assist educators by automating grading, reducing their workload, and enabling them to focus more on student engagement and instruction (Sibug et al., 2023). However, despite these advantages, some educators remain cautious due to the challenges associated with AI adoption, such as the need for training and concerns over digital ethics. Addressing these issues through proper guidelines and support systems will ensure that AI enhances rather than disrupts the learning environment (Sibug et al., 2023).

The integration of Artificial Intelligence (AI) in education brings both advantages and ethical challenges. While AI can automate tasks like grading and record-keeping, allowing teachers to focus more on student engagement (Ortiz, 2023), its use raises concerns about fairness, data privacy, and accessibility. Without proper regulations, AI may deepen existing

educational inequalities, disadvantaged underprivileged students who lack access to the necessary technology. To uphold a standard for equity, institutions must implement clear ethical guidelines, ensure AI tools are designed to be inclusive, and provide training for educators to use AI responsibly. Collaboration between educators, policymakers, and technology developers is crucial in making AI an asset rather than a barrier in education (Ortiz, 2023).

The emergence of Generative Artificial Intelligence (GenAI) presents a dual impact on Philippine higher education, offering significant opportunities for efficiency while raising critical concerns about academic integrity. On one hand, AI tools can automate burdensome administrative tasks, such as creating assessments and record-keeping, thereby reducing teacher workload and allowing educators to dedicate more time to high-impact instruction. On the other hand, the widespread availability of tools like ChatGPT has introduced major challenges, with academic integrity being a primary concern for educators. This has led to an inevitable shift in assessment methods, as traditional assignments are now more susceptible to being completed by AI, creating a need for clear institutional policies on responsible AI use (Vergara, 2024).

Scope and Limitations

This research will develop and evaluate an AI-powered smart kiosk system across two distinct educational settings: NorthVille 15 Integrated School in Angeles City for intermediate students (Grades 4-5) and Holy Angel University's Computer Engineering department for tertiary-level students. The study will assess the system's ability to generate exams based on parameters set by educators, automate grading, perform item analysis, and generate the Mean Percentage Score (MPS) and Course Outcome Report (COAR), while also evaluating its time efficiency, user-friendliness and impact on educator workload. While the study encompasses both basic and higher education, its findings will be limited to the context of these two institutions. Furthermore, the scope will exclude subjects heavy in numerical problem-solving and complex

equations, such as algebra, calculus, and electronic subjects, due to the complexities of interpreting non-text-based inputs.

General Objectives

To design, develop, and evaluate an adaptable AI-powered kiosk, the "O'Key-Ask" system, to determine its effectiveness in improving the efficiency, accuracy, and standards-alignment of the assessment process in both basic (DepEd) and higher education (CHED) settings.

Specifically, this study aims to:

To develop a functional "O'Key-Ask" system capable of:

- Generating test papers aligned with DepEd's Table of Specifications (TOS) from educator-provided materials.
- Generating complex assessments aligned with CHED standards, department requirements, and the Washington Accord for Computer Engineering.
- Automatically checking scanned answer sheets using Optical Mark Recognition (OMR) for objective tests and Optical Character Recognition (OCR) for essays.
- Calculating the Mean Percentage Score (MPS) and generating a detailed item analysis report for both educational levels.
- Generating Coarse Outcomes Narrative Report for CHED

To quantitatively evaluate the system's performance in terms of:

- The time required for assessment generation compared to manual methods in both DepEd and CHED contexts.
- The accuracy of the automated grading process for both OMR and OCR-based checking.

- The degree of alignment between AI-generated assessments and the standards defined by DepEd (TOS) and CHED (Washington Accord, departmental requirements).

To assess the system's usability and its perceived impact on educator workload through structured user-acceptance testing with participants from both elementary and university levels.

Statement of the Problem

1. How accurately does the "O'Key-Ask" system perform essential assessment-related functions?

- 1.1. How accurately does the system generate test items aligned with DepEd’s MATATAG Curriculum Competencies and Table of Specifications (TOS)?
- 1.2. How accurately does the system generate assessment items aligned with CHED’s Course Outcomes and Washington Accord competency standards?
- 1.3. How accurately does the system check and score objective test results using Optical Mark Recognition (OMR)?
- 1.4. How accurately does the system check and score essay-based test results using Optical Character Recognition (OCR)?
- 1.5. How reliably does the system conduct item analysis based on student performance?
- 1.6. How accurately does the system compute the Mean Percentage Score (MPS)?

2. What is the level of efficiency of the assessment workflow as experienced by the respondents using the system?

- 2.1. What is the level of efficiency in generating TOS-aligned test items for the Basic Education (DepEd) context?

- 2.2. What is the level of efficiency in generating outcome-based assessments for the Higher Education (CHED) context?
- 2.3. What is the level of efficiency in checking objective test results (OMR)?
- 2.4. What is the level of efficiency in checking essay-based test results (OCR)?
- 2.5. What is the level of efficiency in performing post-assessment analytics (Item Analysis and MPS)?

3. What is the level of usability and workload impact of the "O'Key-Ask" system?

- 3.1. What is the level of usability of the system’s interface and hardware integration?
- 3.2. What is the perceived impact of the system on the assessment-related workload of the educators?

Significance of the Study

The development and implementation of the "O'Key-Ask" system are expected to yield significant benefits across social, economic, and environmental dimensions.

Social Significance: The primary social benefit lies in its potential to improve the quality of education and the well-being of educators and students at all levels. For students, from elementary to tertiary, the system can provide more timely and consistent feedback, which is crucial for faster learning and deeper understanding. For educators, the automation of creating and grading assessments addresses the issue of excessive workload. By reducing this burden, educators can dedicate more time to direct instruction, student mentorship, and professional development, ultimately reducing burnout and improving job satisfaction. At an institutional level, the system supports schools, the Department of Education (DepEd), and the Commission on Higher Education (CHED) by promoting standardized, high-quality assessment practices that

are consistently aligned with curriculum standards, program outcomes, and professional benchmarks such as the Washington Accord.

Economic Significance: From an economic perspective, the system promotes efficiency and optimizes the use of valuable resources. An educator's time is a critical resource in any educational institution. By significantly reducing the hours spent on administrative assessment tasks, the system increases both teacher and faculty productivity. This allows educational institutions to maximize their investment in their academic staff, as educators can focus on higher-value activities that directly impact student learning and readiness for the workforce. For higher education, this operational efficiency can also support streamlined accreditation processes, representing a significant economic and reputational advantage for colleges and universities.

Environmental Significance: This research contributes to environmental sustainability by significantly reducing paper consumption within the assessment lifecycle. The "O'Key-Ask" system achieves this by digitizing the traditionally paper-intensive preparatory and analytical stages of assessment. Key processes, including the creation of the Table of Specifications, the iterative drafting of test items, and the generation of answer keys, are transitioned to a digital workflow, eliminating the need for multiple paper drafts. Furthermore, the digitization of grading and item analysis replaces manual, paper-based tally sheets. By minimizing the reliance on paper for drafting, record-keeping, and analysis, the system promotes resource conservation and aligns with environmentally conscious practices in education.

Conceptual Framework

This research is structured around the Input-Process-Output (IPO) model to conceptualize the functionality and intended impact of the "O'Key-Ask" system. This framework illustrates how raw educational materials are transformed into actionable assessment tools and data.

The Input phase consists of foundational materials including the DepEd and CHED Curriculum Guides and Learning Competencies educator parameters such as the number of items scanned student answer sheets and answered essay sheets. These inputs are subjected to the Process phase which involves AI-powered generation of assessment materials, mandatory teacher review and editing OMR-based grading data analysis and OCR for essays. Finally the Output phase produces tangible and analytical results. Direct outputs include TOS-aligned test papers item analysis reports Mean Percentage Scores and for the higher education context Course Outcome Assessments (COA) and Course Outcome Assessment Reports (COAR). The principal outcomes of this workflow also considered outputs in this model are increased efficiency and reduced teacher workload.

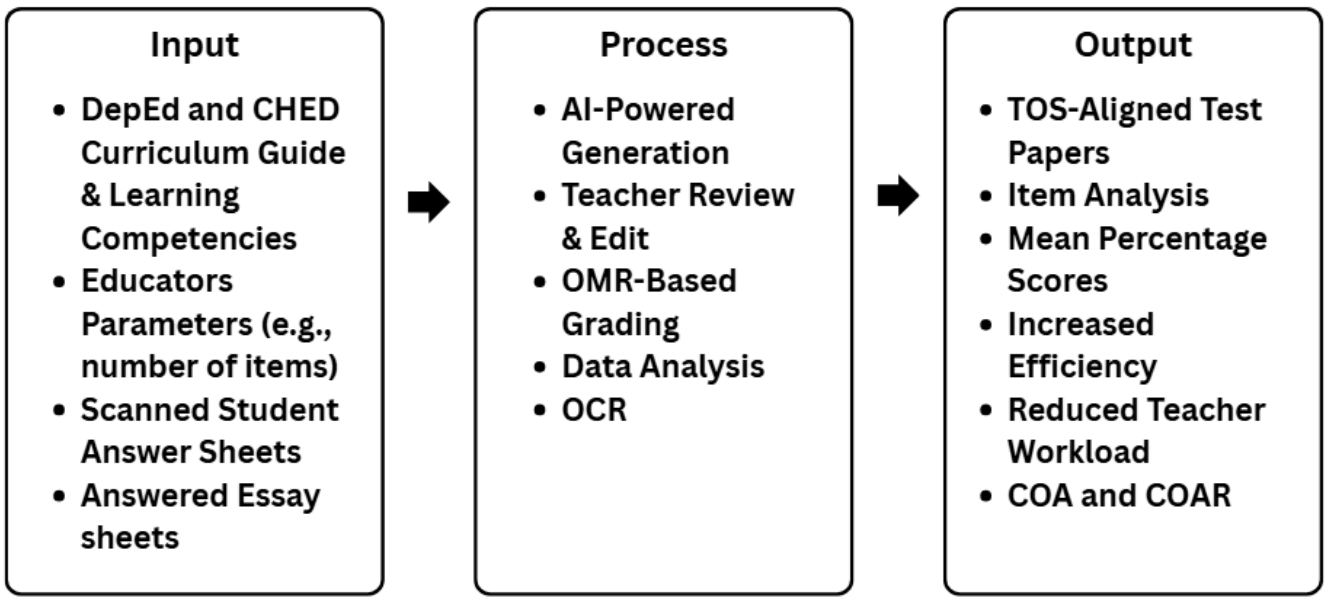


Figure 1.0

System Flowchart

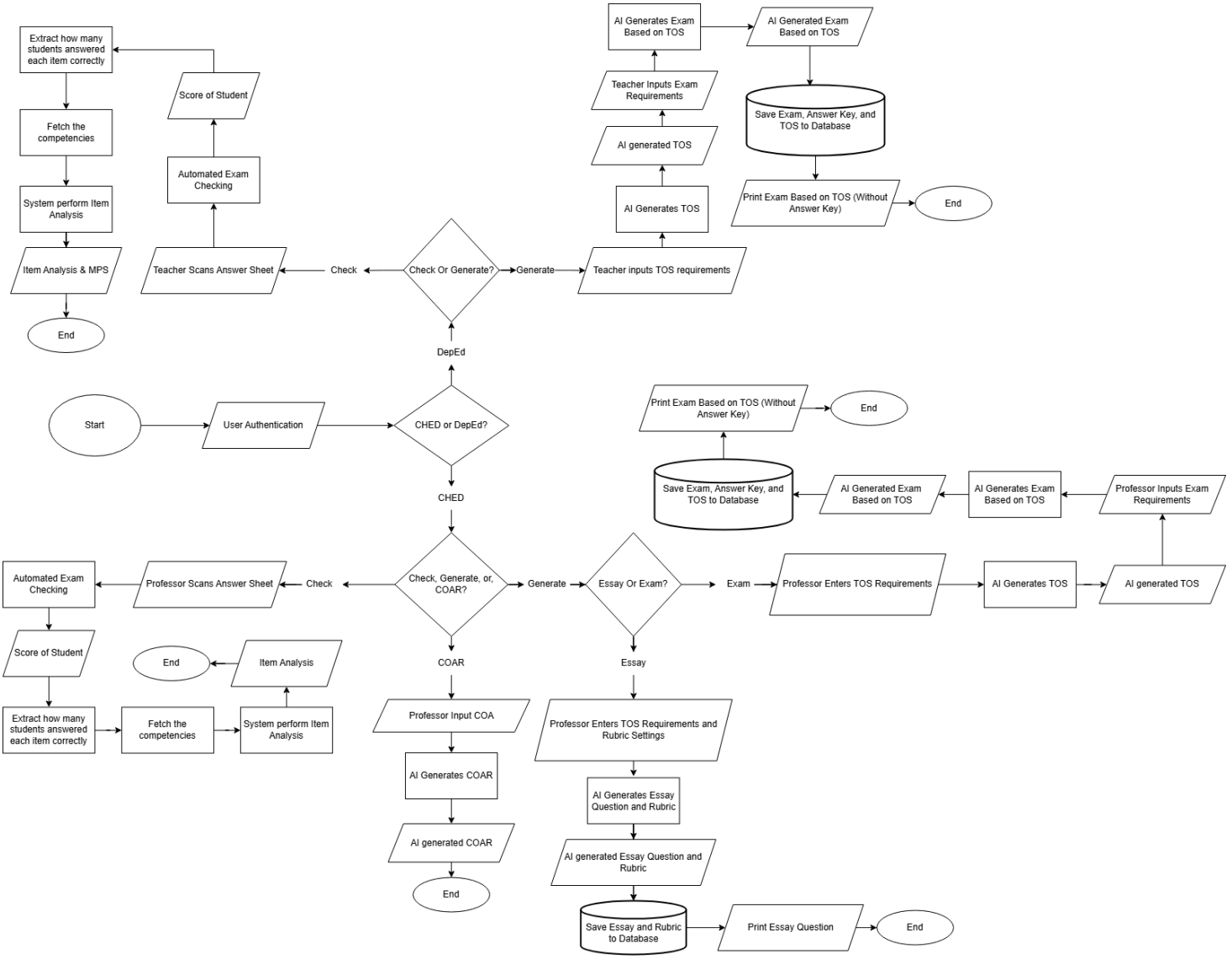


Figure 2.0

General Block Diagram

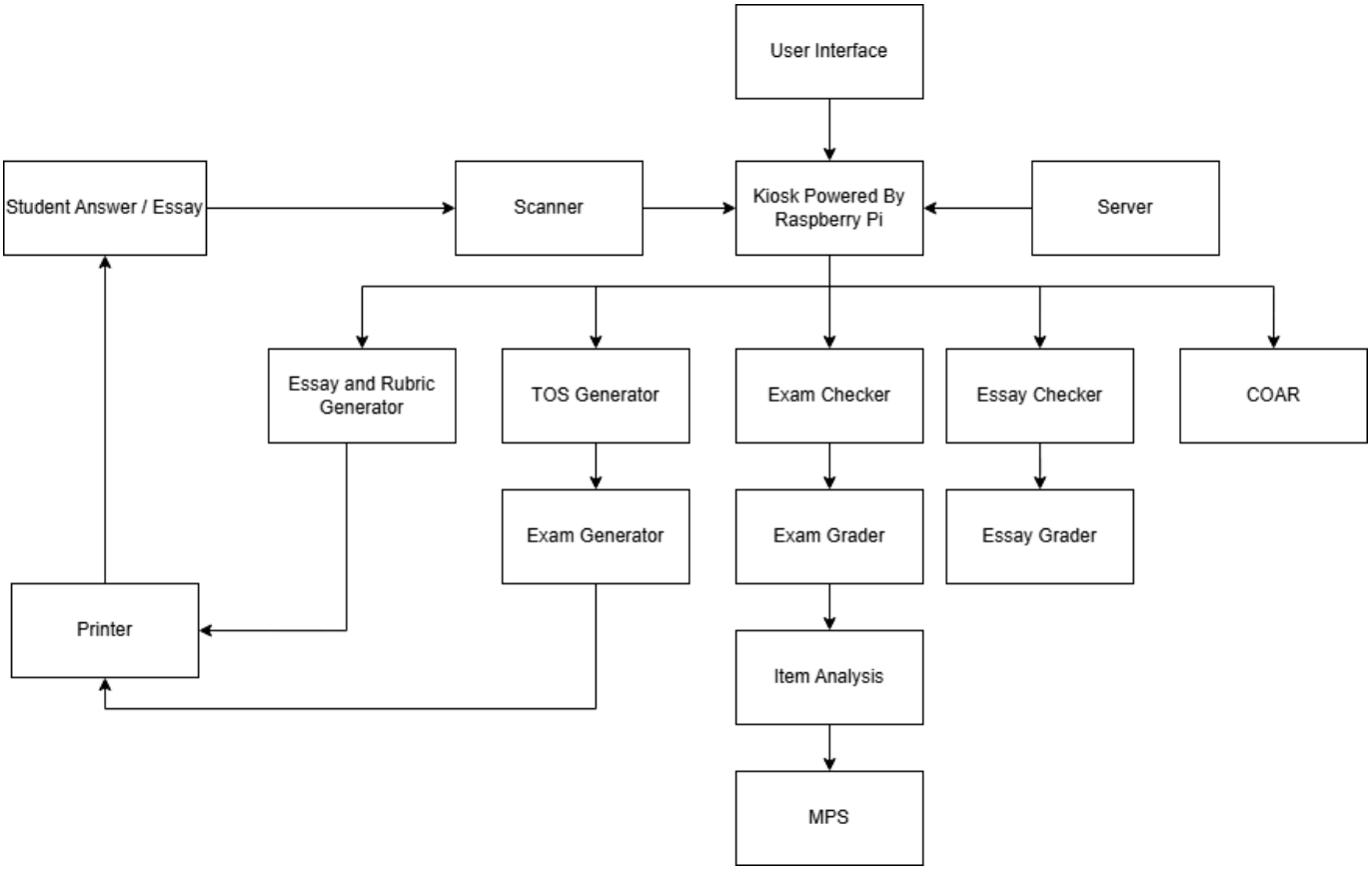


Figure 3.0

Methods

Research Design

This study will utilize both primary and secondary data sources. Primary data will be generated directly through the research activities including system performance metrics and quantitative feedback from participating educators. Secondary data will provide foundational knowledge and contextual information consisting of existing academic literature and official documents from the Department of Education (DepEd) and the Commission on Higher Education

(CHED). The curriculum guides and learning competencies from both DepEd and CHED will serve as the basis for generating the Table of Specifications (TOS) for their respective educational levels which will then be used to create the exams.

In addition, secondary sources were used to establish baseline values for the time required in manual assessment workflows, since the survey did not directly collect time measurements. Published studies and official guidelines (e.g., DepEd, 2020; Gobrecht et al., 2024; Villanueva & Angeles, 2021) consistently report that manual exam creation, grading, and item analysis can consume ~10.5 hours (average) per exam cycle for a typical class of 40–50 students. These literature-based estimates were adopted as the comparison benchmark against which the efficiency of the *O’Key-Ask* system was evaluated. By combining survey-based perceptions with literature-based time data, the study ensures a comprehensive assessment of both the subjective and objective efficiency of the system.

Procedure

Hardware and Design Development

The physical kiosk is constructed from several integrated hardware components designed for durability and efficiency. At its core, a Raspberry Pi 4B (8GB) serves as the local controller, managing peripheral interactions and user input. To optimize local resource consumption, the kiosk follows a hybrid deployment model: while the Raspberry Pi handles hardware orchestration and displays the user interface, the core software and AI services are hosted on a remote server. User interaction is handled through a standard monitor for visual display, along with a keyboard and mouse for input. A 2-in-1 Epson L3210 series printer is connected to handle both document scanning and printing tasks. For reliable printing and compatibility, the system uses the Epson Stylus Office BX305 driver with CUPS (Common UNIX Printing System), implemented through

Gutenprint. On the scanning side, SANE (Scanner Access Now Easy) was configured to support the built-in scanner of the Epson device, enabling efficient digitization of student answer sheets.

To further optimize scanning performance, the team integrated the Epson Scan2 driver package (epsonscan2-bundle-6.7.80.0.i686.deb.tar.gz), ensuring compatibility with the kiosk’s Linux-based environment. The scanner was configured to operate at a resolution of 400 dpi and set to colored mode, a combination that provides high clarity for both objective test sheets and essay-based responses while preserving the integrity of markings and handwritten text for reliable OCR interpretation. Finally, a custom-designed casing houses all hardware components, ensuring durability and creating a consolidated physical station suitable for a school environment.

Software and Design Development

The system is a web-based application developed on a modern technology stack. The server-side logic is implemented using JavaScript with Node.js and Express, which are responsible for handling API requests, processing data, managing user sessions, and interacting with the database. Persistent data, including user information, assessment parameters, generated Table of Specifications (TOS), exam questions, and student performance records, is stored in a PostgreSQL relational database. Prisma ORM is used for efficient database querying and management.

On the frontend, the user interface is built with React, utilizing Redux for state management and Axios for making API requests. This setup provides educators with a dynamic and responsive platform for reviewing and editing AI-generated content before final approval.

The system integrates several artificial intelligence services. The Google Vision API is used for Optical Character Recognition (OCR), extracting information from documents and converting it into text. OpenCV is employed to analyze scanned answer sheets for automated

grading. Additionally, the Gemini 3 Pro model is utilized to generate content such as exam questions, TOS, Rubrics, Essay questions and checking of Essay Answers .

The project follows the V-model development lifecycle, a sequential process where each development phase is validated by a corresponding testing phase to ensure quality. The process began with Requirement Analysis and proceeded through System and Module Design to the implementation phase. The subsequent verification and validation path included Unit, Integration, and System Testing to validate the software against its design specifications. The final stage was User Acceptance Testing, where educators evaluated the system to confirm it met the project's requirements.

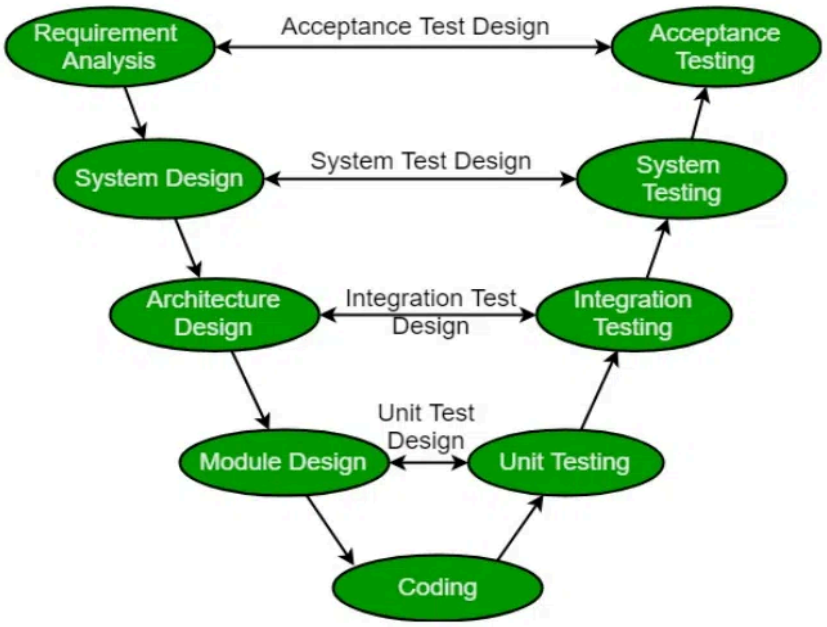


Figure 4.0

Instruments/Tools

Several instruments will be used to collect primary data. The "O'Key-Ask" system itself will serve as an instrument by measuring the time required for TOS, and exam generation and the accuracy of the automated grading compared to manual checks. Additionally, a structured questionnaire using rating scales, such as Likert scales, will be administered to participating educators to quantitatively measure system usability, user-friendliness, and the perceived impact on teacher workload.

Sources of Data

This study utilizes both primary and secondary data sources to evaluate the O'Key-Ask system. Primary data is generated through direct research activities, including system performance metrics and quantitative feedback from participating educators via structured Likert-scale questionnaires. Secondary data provides foundational knowledge and the comparative benchmarks necessary for efficiency analysis. This includes academic literature and official documents from the Department of Education (DepEd) and the Commission on Higher Education (CHED) to ensure alignment with curriculum guides and learning competencies. Crucially, secondary sources, specifically DepEd guidelines and published teacher workload studies are used to establish the manual labor time baselines for exam creation, grading, and item analysis. These literature-based estimates, which reflect a typical manual assessment cycle of approximately 10.5 hours, serve as the control variables against which the system's measured efficiency is validated.

Participants

The participants in this study will be drawn from two distinct educational institutions. For the basic education context the respondents will be Elementary school teachers from NorthVille 15 Integrated School in Angeles City specifically those teaching Grades 4 to 5. For the higher education context the participants will be faculty members from the Computer Engineering department of Holy Angel University. Educators from both institutions will serve as key participants in evaluating the "O'Key-Ask" AI system in terms of its accuracy, efficiency, usability and perceived impact on assessment-related tasks within their respective settings.

Data Analysis Plan

The collected data will be analyzed using frequency, weighted mean, and comparative percentage analysis to evaluate the "O'Key-Ask" system. Frequency counts will summarize categorical data, such as the demographic profile of the respondents. For quantitative performance metrics, the mean will be calculated for system generation and grading accuracy across multiple trials.

A Comparative Efficiency Analysis will be conducted by measuring the delta between the system’s primary performance data and the secondary manual benchmarks established in the literature. Efficiency gains will be quantified as a percentage of time saved per assessment phase. Data from the structured 24-item questionnaires will be analyzed using a weighted mean and interpreted through a 5-point Likert Scale to determine levels of usability, user-friendliness, workload impact, and TOS compliance. A weighted mean of 4.50–5.00 will be interpreted as "Strongly Agree," indicating a very high level of system acceptance. Finally, these findings will be synthesized to determine the overall impact on educator administrative burden.

Standard Set

To ensure the quality, reliability, and ethical development of the O'Key-Ask system, this research will adhere to principles outlined in established international standards where applicable. Key areas include usability, AI system management, data security, and research methodology.

For Usability and Human-Centered Design, the project will be guided by ISO 9241-210:2019 (Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems). This standard provides a framework for developing usable and useful interactive systems by focusing on the users and their needs throughout the development lifecycle.

Table 1

ISO 9241-210:2019 (Ergonomics of human-system interaction — Part 210: Human-centred design for interactive systems)

Characteristic	Sub-characteristic	Description
Understand Context of Use	• User Identification • Task Analysis • Environment Definition	Define users (educators/students), assessment tasks, & kiosk environment.
Specify User Requirements	• Needs Identification • Goal Definition	Define teacher needs regarding efficiency, usability, and TOS alignment.
Produce Design Solutions	• Interface Prototyping • Interaction Design	Create kiosk interface prototypes (e.g., wireframes, mockups) to meet requirements.
Involve Users Throughout	• Active Participation • Continuous Feedback	Actively engage educators for feedback on prototypes throughout the design process.
Evaluate Designs	• Usability Testing • Requirements Validation	Test prototypes with educators (e.g., via questionnaires) to evaluate usability and requirements.

Iterative Process	• Refinement Cycle	Use teacher feedback from evaluations to iteratively refine the interface design.
Address Whole User Experience	• Holistic Perspective	Consider the complete teacher interaction: input, output, workflow, and satisfaction.

Regarding AI System Quality and Management, the project will reference the framework provided by ISO/IEC 42001:2023 (Artificial Intelligence - Management system). This standard offers guidelines for establishing, implementing, maintaining, and continually improving an AI management system (AIMS) within an organization or project context.

Table 2

ISO/IEC 42001:2023 (Artificial Intelligence — Management system)

Characteristic	Sub-characteristic	Description
Organizational Context	• Understanding Needs • Stakeholder Identification	Defining the specific goals for using AI in the O'Key-Ask system (e.g., improving assessment efficiency) and identifying stakeholders (educators, students, school).
Leadership & Commitment	• Responsibility • Policy Alignment	Ensuring clear responsibility for the AI system's development and ensuring its use aligns with ethical considerations and educational objectives.
Planning	• Risk Assessment • Objective Setting	Identifying potential risks associated with the AI (e.g., bias in generation, grading errors - related to ISO/IEC 23894) and setting clear objectives for AI performance and responsible use.
Support	• Resources • Competence • Awareness	Allocating necessary resources (e.g., appropriate data, tools), ensuring the

		development team has adequate AI skills, and fostering awareness of responsible AI practices.
Operation	• AI System Lifecycle • Impact Assessment	Managing the development process, including data handling, model training/selection, and assessing the potential impact of the AI on users and assessment outcomes.
Performance Evaluation	• Nonconformity • Corrective Action	Planning how to monitor the AI's performance (e.g., accuracy, efficiency, fairness metrics) and evaluate its effectiveness in meeting the set objectives.
Improvement	• Holistic Perspective	Establishing a process to address any issues or non-conformities found during evaluation and continually improving the AI system based on performance data and feedback.

Given the handling of assessment data, Data Security and Privacy are paramount. Principles aligned with ISO/IEC 27001:2022 (Information Security Management Systems) will be considered for managing data securely, ensuring confidentiality, integrity, and availability. While full certification may be beyond the project scope, adopting relevant security controls and risk management practices is essential.

Table 3

ISO/IEC 27001:2022 (Information Security Management Systems)

Characteristic	**Sub-characteristic**	**Description**
ISMS Framework	• Context & Scope • Policy Establishment	Defining the scope of security management for O'Key-Ask (e.g., data stored locally on the kiosk, potentially transmitted data) and

		establishing a basic policy for information security.
Leadership & Commitment	• Roles & Responsibilities	Defining who is responsible for data security aspects within the project team.
Risk Assessment	• Threat Identification • Vulnerability Analysis	Identifying potential threats to assessment data (e.g., unauthorized access to the kiosk, data corruption on the Pi) and assessing potential vulnerabilities in the system design or components.
Risk Treatment	• Control Selection • Mitigation Planning	Selecting appropriate security measures (controls) to address identified risks, such as implementing access controls, data backup procedures, or secure coding practices.
Security Controls (Examples)	• Access Control • Cryptography • Physical Security • Operations Security	Implementing specific technical and procedural controls relevant to the kiosk, such as user authentication for educators, potential encryption for stored scores, securing the physical kiosk, and ensuring secure data handling during operations (e.g., scanning, grading).
Performance Evaluation	• Monitoring • Internal Review	Planning how to monitor the effectiveness of implemented security controls and periodically reviewing the security posture of the system during development and testing.
Compliance	• Legal & Regulatory Awareness	Considering relevant legal or regulatory requirements for protecting student data within the Philippine educational context.

Furthermore, to ensure rigor and quality in the overall research process, particularly concerning the collection and handling of teacher feedback, the principles outlined in ISO 20252:2019 (Market, opinion and social research, including insights and data analytics —

Vocabulary and service requirements) will be referenced. This standard provides a framework for managing the research process, covering aspects from initial planning and methodology selection (including sampling and data collection like questionnaires) through data management, processing, and reporting. Adhering to the process quality requirements described in this standard helps ensure consistency, transparency, and reliability in the research activities, particularly in the gathering and analysis of teacher opinions on the O'Key-Ask system.

Software and AI Design Elements

High-Level Architecture

O’Key-Ask is an integrated kiosk + web-application system that automates assessment generation, scanning, grading, item analysis and reporting for both DepEd (basic education) and CHED/Washington-Accord (higher education) contexts. The system consists of three logical tiers:

(1) **Physical Kiosk** – Raspberry Pi with scanner, printer, and peripherals; handles exam administration and data capture at the point of use.

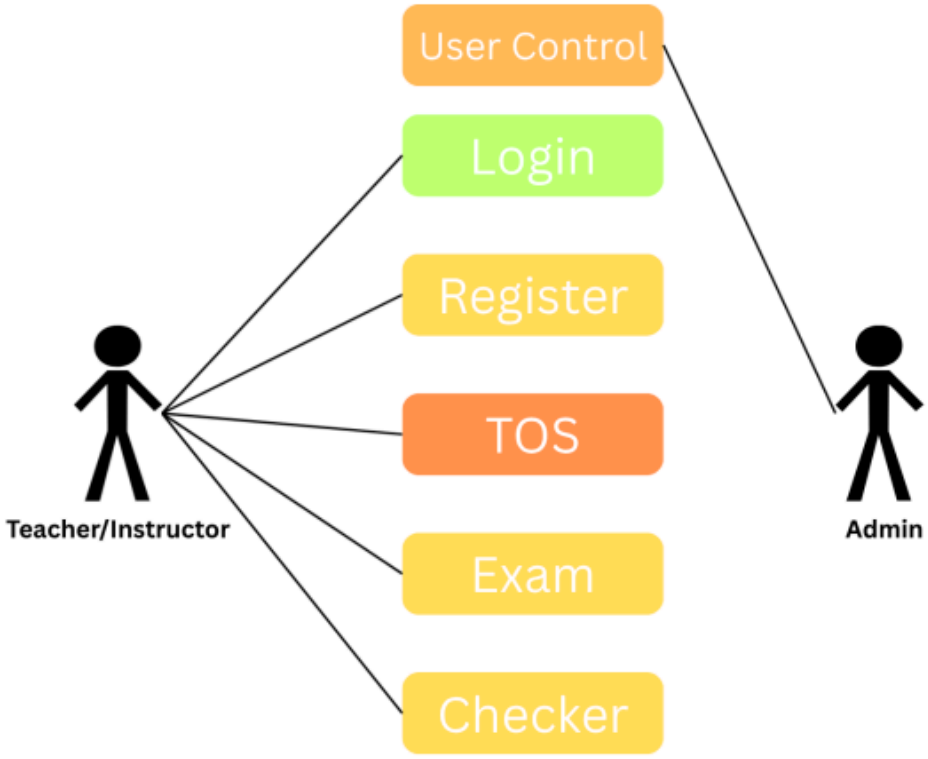
(2) **Web Application Frontend** – Built with React.js and TailwindCSS; provides a user-friendly interface for teachers, students, and administrators.

(3) **Backend & AI Services** – Developed in JavaScript using Express on Node.js; manages data storage (PostgreSQL), and AI-powered grading, text generation, and computer vision.

Detailed Software Architecture

UML Diagrams

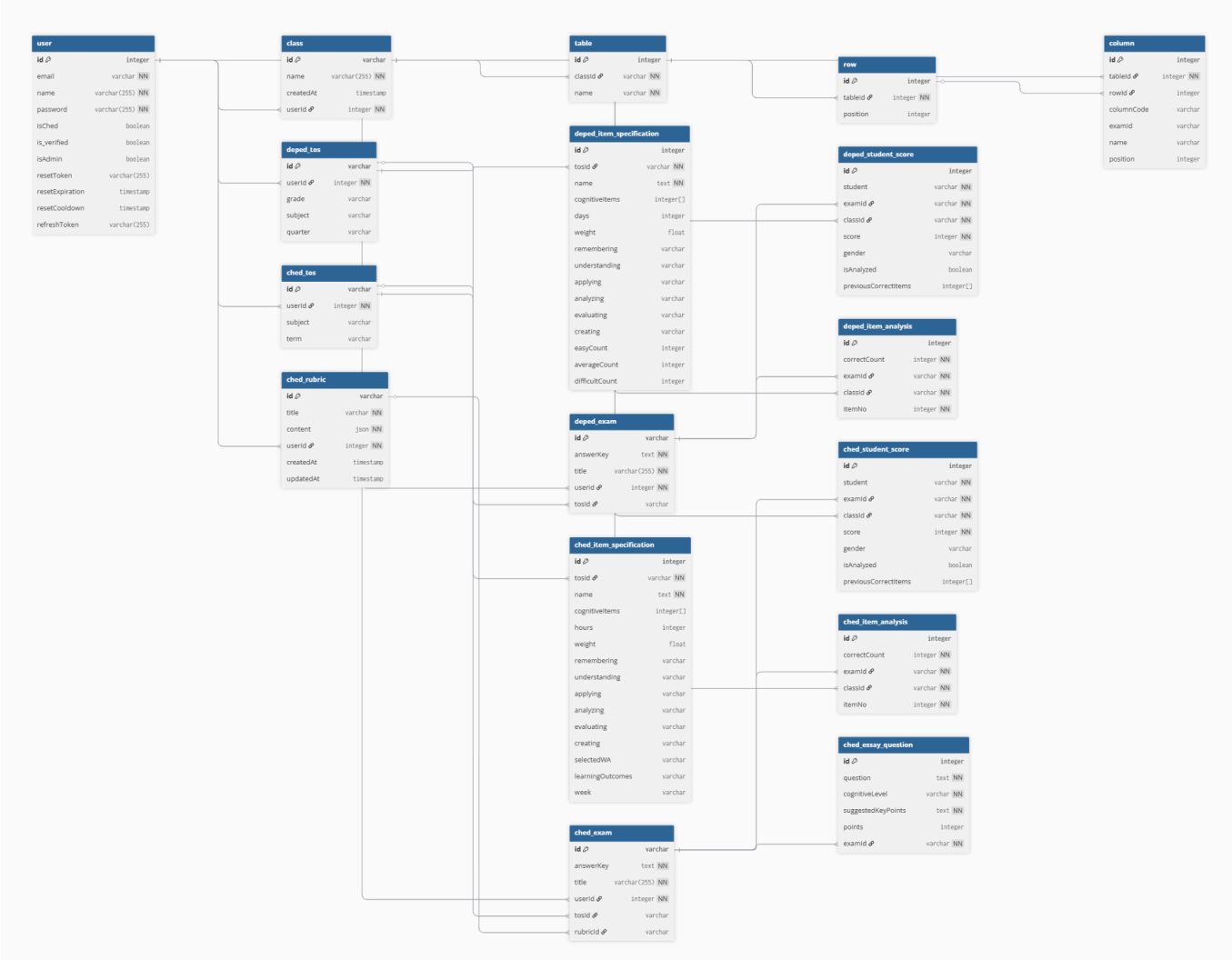
The system uses a Class Diagram to represent its structure and relationships between key components.

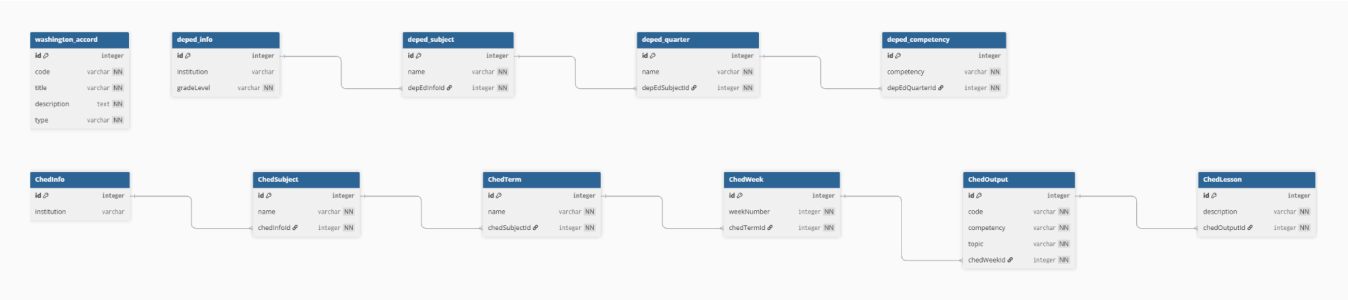


Database Design

The system utilizes PostgreSQL to manage its complex relational structures and ensure data integrity, with Prisma ORM facilitating type-safe backend interactions. At its core, the schema relies on a centralized User model that implements role-based access control (RBAC) to differentiate among standard educators, specialized higher-education faculty, and administrators. To maintain referential integrity, unique identification is enforced via UUIDs, and cascade deletion protocols are strictly applied across all entities; this ensures that orphaned assessment and student records are automatically purged when primary entities, such as a User or Class, are removed.

The database architecture abandons generic frameworks, partitioning directly into basic (DepEd) and higher education (CHED) modules to reflect Philippine educational standards . The DepEd schema automates TOS generation via a strict hierarchy of Grade Levels, Subjects, Quarters, and Competencies . Conversely, the CHED schema employs a granular structure of Terms, Weeks, Outputs, and Lessons , integrating a Washington Accord reference table and rubrics for engineering accreditation. Finally, dedicated Item Analysis and Student Score tables span both modules, enabling real-time computation of Mean Percentage Scores (MPS) and discrimination indices mapped directly to TOS cognitive levels .





System APIs and Protocol

API endpoints and expected inputs/outputs are the following:

Authentication

- **POST /api/auth/register**

  Body: { email, name, password1, password2 }

  Response: 201 { success }

- **POST /api/auth/login**

  Body: { email, password }

  Response: 200 { accessToken, refreshToken}

AI Generation

- **POST /api/deped-ai/generate-tos**

  Body: { subject, gradeLevel, quarter, totalItems, competencies } Response: 200 { success: resultString }

- **POST /api/ched-ai/generate-tos**

  Body: { subject, term, totalItems, outputs, includeWashingtonAccord, washingtonAccord } Response: 200 { success: resultString }

- **POST /api/ai/generate-exam**

  Body: { tosText, selectedTypes, promptGuidelines, quizTitle }

  Response: 200 { examId, generatedExam }

- **POST /api/ched-ai/generate-essay**

  Body: { topic, count, difficulty, learningOutcomes, washingtonAccord, questionDifficulties } Response: 200 { success: [questions] }

Exam Checking

- **POST /api/check/deped/exam-checker**

  Body: { examId, studentAnswer } Response: 200 { success: { studentScore, studentTotal, correctNumbers } }

- **POST /api/check/ched/exam-checker**

  Body: { examId, studentAnswer } Response: 200 { success: { studentScore, studentTotal, correctNumbers } }

Exam Checking

- **POST /api/ched-ai/check-essay**

  Body: { questionId, rubricId, studentAnswer, washingtonAccord, harshness } Response: 200 { success: gradingResult }

Algorithms and Data Structures

Algorithm Identification

The O’Key Ask Automated Examination System uses multiple algorithms to automate core academic processes. It employs prompt-based text generation algorithms powered by Google

Gemini for creating structured Tables of Specifications (TOS) and exam questions based on curriculum data. For scanning and grading, the system applies computer vision algorithms using Google Vision API for Optical Mark Recognition (OMR) to detect shaded answers, while Optical Character Recognition (OCR) algorithms are used to extract handwritten responses for evaluation. Furthermore, statistical algorithms compute item difficulty, discrimination indices, and Mean Percentage Scores (MPS) to assess student performance effectively. These algorithms work together to ensure accurate, scalable, and efficient automation of examination-related tasks.

Data Structures

The system uses flexible and fast data structures. JSON stores AI-generated questions and TOS templates for easy editing, and PostgreSQL tables manage users, exams, and grades with integrity. This combination ensures efficient data handling and smooth integration between the AI and database.

Design Patterns

To maintain scalability and modularity, the system follows the Model–View–Controller (MVC) architecture, separating business logic, user interface, and data management. The Factory Pattern is implemented for standardized creation of question objects generated by the AI, ensuring consistent formatting and structure. The Observer Pattern enables real-time updates in grading and reporting processes. These design patterns collectively improve maintainability, promote reusability, and simplify debugging, resulting in a more organized and efficient system architecture.

AI System Design

Model Selection

The project utilizes Google Gemini and ChatGPT OpenAI for generating exam content

and Google Vision API combined with OpenCV for detecting and interpreting handwritten or marked responses. Gemini was selected for its strong natural language understanding and structured output capabilities, which align with the academic context of TOS and question generation. The Google Vision API and OpenCV were chosen for their robustness in image processing and ability to handle varying handwriting styles and scan quality. Together, these tools create a cohesive AI system that efficiently automates both question creation and exam checking.

Performance Metrics

The system's efficacy and AI performance are evaluated quantitatively through structured user questionnaires administered to participating educators. Rather than programmatic logging, the study measures system success through User Acceptance Testing (UAT), focusing on perceived accuracy, efficiency, and usability. Evaluative criteria include the educators' assessment of OMR/OCR grading correctness, the alignment of AI-generated TOS and exam items with curriculum standards, and the system's tangible impact on reducing administrative workload. This approach ensures the evaluation is grounded in the practical utility and user-friendliness of the system within real-world educational settings.

Deployment Plan

The O’Key Ask Automated Examination System is deployed on a local server that hosts the core infrastructure within a private network. The backend, built with the Express framework on the Node.js runtime, is hosted on-site and exposes a local IP address to enable communication with the kiosk device over the Local Area Network (LAN). PostgreSQL for storage are also maintained locally, ensuring high-speed data handling and enhanced security for examination records. While the system processes most tasks locally, it maintains an internet connection specifically to access cloud-based AI modules, such as the Gemini API and OpenAI API, for

advanced text generation and analysis. This hybrid approach combines the reliability and low latency of local hosting with the power of external AI services.

Prototype Design

Minimum Viable Prototype

Core area	Essential Functionality	Purpose for our thesis
TOS generator (AI)	Accept educator inputs (subject, grade, competencies, days, total items); produce a Table of Specifications (structured JSON + downloadable Excel)	Demonstrates automated generation of TOS aligned with DepEd / CHED inputs and proves alignment pipeline for evaluation
Exam generator (AI)	Produce exam paper (MCQs, short answers, essay prompts) plus answer key from TOS; surface editable draft in UI	Shows end-to-end AI → educator pipeline for creating standards-aligned exams
Teacher review UI	WYSIWYG editor for exam & TOS, save/approve workflow, export (PDF/print)	Validates teacher-in-the-loop requirement and human oversight for fairness/compliance
Print / Scan integration	Print exam; scan completed bubble + written sheets into images/PDFs via SANE/CUPS	Demonstrates kiosk handling of physical exams and digitization for automated checking

OMR grading pipeline	Image ingest → pre-process → bubble detection (OpenCV) → answer mapping → per-student score JSON	Validates accurate automated checking of objective tests
OCR essay capture	Image/PDF → OCR (Tesseract/other) → text output; basic automated rubric scoring (keyword + length + ML-based similarity)	Demonstrates automated essay capture and first-pass scoring for analysis
Item analysis & MPS	Compute item difficulty, discrimination where possible; compute Mean Percentage Score (MPS); export report	Provides the analytical outputs required by research questions
Backend data store & API	Persist TOS, exams, scans, scores, users in PostgreSQL; expose /api/auth, /api/ai, /api/admin endpoints	Proves reproducible, testable system metrics for evaluation
Kiosk hardware control	Local service on Raspberry Pi to trigger printing, scanning, local storage, and start image-processing jobs	Shows complete kiosk-level orchestration for field deployment

Security + access control	Educator authentication, local access restrictions, optional encryption-at-rest for student data	Meets ethical / legal constraints for research and data privacy

Prioritization of essential vs. optional features

- Must-have:

  TOS Generator (AI)

  Exam Generator (AI)

  Essay Question Generator (AI)

  Essay Answer Checker (AI)

  Rubric Generator (AI)

  Teacher review UI (edit & approve)

  Print / Scan integration (CUPS + SANE working with Epson L3210)

  OMR grading pipeline (OpenCV + Google Vision API)

  Item analysis & MPS reporting

  Backend data store + core APIs (/api/ai, /api/auth)

  Raspberry Pi kiosk orchestration (headless operation, local job runner)

  Basic security (authentication, role separation, local data protections)

- Nice-to-have:

  Advanced OCR-based essay automated scoring using large LLM models (deeper rubric reasoning)

  Real-time network sync to cloud DB / cloud backup

  Webhooks / event notifications to educators (email/SMS)

  Multi-language support and advanced item templates (PISA-like)

  Fine-grained fairness/bias monitoring dashboards (ISO-aligned metrics)

  Offline-first replication and conflict resolution for multi-kiosk networks

  Direct integration with DepEd / CHED systems (SIS exports)

Prior Art Search

The researchers have identified existing patented technologies related to automated grading, OCR-based document analysis, exam generation, and assessment systems. These technologies were analyzed to assess their relevance and compare their features with the proposed O'Key-Ask system.

System Integration

Hardware-Software Integration

The prototype employs a distributed network architecture, strictly separating the core application logic from peripheral hardware control. A dedicated local server hosts the primary O’Key-Ask software suite, which includes the Node.js/Express backend, the React.js frontend,

and the PostgreSQL database. This central server manages data orchestration, user authentication, and API routing for all AI services.

Conversely, the physical kiosk is powered by a Raspberry Pi 4B (8GB) functioning as a specialized peripheral node and user interface terminal. Connected via USB to an Epson L3210 2-in-1 device, the Raspberry Pi exclusively manages hardware operations. Printing is handled via CUPS, while flatbed scanning is controlled by SANE. The kiosk provides the teacher-facing UI through an HDMI monitor and USB peripherals, housed in a custom enclosure with internal power distribution.

In this distributed model, the Raspberry Pi acts as a conduit rather than a data repository. Upon acquiring scan artifacts via SANE, the Pi transmits the files over the Local Area Network (LAN) to the primary local server. The local server then executes the Optical Mark Recognition (OMR) pipeline using OpenCV to classify filled bubbles and routes essay images to the Google Vision API for cloud-based Optical Character Recognition (OCR). All advanced text generation, including Table of Specifications (TOS) and exam drafting, relies on outbound HTTPS calls to the Google Gemini API originating from the local server, not the kiosk.

Interaction Diagram

The teacher interacts with the kiosk through the React.js UI which talks to the Express backend over HTTP. Login is POST /api/auth/login and session cookies are issued; TOS creation is POST /api/ai/generate-tos where the backend persists the TOS JSON to PostgreSQL and calls Google Gemini (HTTPS) to generate question templates. After teacher review and approval the frontend invokes /api/admin/print-exam?examID, the backend writes the final PDF to /srv/okeyask/uploads/exams/{examID}.pdf and sends it to the Epson L3210 via CUPS (lp/IPP localhost:631) for printing.

Printed exams are completed on paper and scanned via the kiosk UI, which triggers /api/admin/scan-start. The backend calls SANE (scanimage or Python wrapper) to save files under /srv/okeyask/uploads/scans/{examID}/{studentID}_{page}.jpg or multipage PDF. Local workers process images (deskew/crop/contrast), use OpenCV for OMR to produce JSON answers and confidences saved to PostgreSQL and /uploads/results/{examID}/{studentID}.json, and use Google Vision API (cloud OCR) for essay text, which may be routed to Gemini/local ML for provisional rubric scoring. Item analysis (/api/admin/compute-analysis?examID) aggregates scores to compute item difficulty, discrimination indices, and MPS, then stores reports and generates CSV/PDF outputs.

Teacher → Kiosk UI (React.js) → Express backend → PostgreSQL (5432); backend ↔ CUPS (localhost:631) → Epson L3210 (USB) and backend ↔ SANE → scans folder; backend → Google Gemini (HTTPS:443) for generation and optional OCR cloud; workers (local) ←→ perform OMR/OCR and write results to DB and /uploads. Failure paths include: low OMR confidence → flag for manual review, SANE error → retry/rescan. Deploy as systemd services on Raspberry Pi with secrets in /etc/okeyask/.env, Ethernet and UPS recommended.

Hardware Prototype

Bill of Materials (BOM) with component justification.

Component	Cost (₱)	Justification
Raspberry Pi 4B 8GB Kit	₱5,885.00	Serves as the central processing unit for the kiosk; chosen for its modularity, GPIO access, and ability to run full backend

		services locally. Purchased at a discounted price using store vouchers.
Printer and Scanner (Epson L3210)	₱2,000.00	Enables physical exam printing and answer sheet scanning; selected due to availability after the initial Canon unit proved defective.
Plyboard (Kiosk Enclosure)	₱2,040.00	Used to construct the kiosk body, providing a sturdy and customizable housing for hardware.
Angle Bar (Kiosk Frame)	₱1,020.00	Reinforces the kiosk structure for durability and secure mounting of components.
Delivery (Plyboard + Angle Bar)	₱200.00	Covers logistics for transporting kiosk materials to the build site.
Total	₱11,145.00	

Component Selection and Justification

The Raspberry Pi 4B 8GB was selected as the core microcontroller due to its excellent balance of performance, power efficiency, and compatibility with peripheral devices. It supports full Linux-based operating systems, making it ideal for running backend services, AI workflows, and hardware orchestration. Its GPIO pins allow for future expansion, and its low power

consumption ensures reliable operation in kiosk deployments. Availability was also a key factor—the unit was acquired at a reduced price thanks to store vouchers, making it a cost-effective choice for prototyping.

For printing and scanning, the Epson L3210 was chosen after a second-hand Canon printer initially procured turned out to be defective. The Epson unit was readily available and compatible with CUPS and SANE, allowing seamless integration into the Raspberry Pi environment. It supports both printing and flatbed scanning over USB, which is essential for the kiosk’s dual functionality in exam distribution and answer sheet digitization. Its reliability and driver support made it a practical and efficient solution for the hardware prototype.

Software Prototype

Proof-of-Concept Implementation

The system prototype was developed using JavaScript with the Express framework on the Node.js runtime for the backend, and React.js for the frontend. PostgreSQL is used for persistent data storage, while Prisma ORM ensures efficient and type-safe database management.

The backend served as the main hub, processing API requests and coordinating communication between the user interface, database, and AI services. Three main routes were implemented:

- /api/auth for authentication, session management, and user table management
- /api/ai for AI-assisted exam generation and grading
- /api/admin for administrative functions

This implementation demonstrated the system’s capability to integrate AI services, manage data efficiently, and assist educators in automating exam preparation and evaluation. The following are the screenshots of the code implementation.

```
require("dotenv").config();
const express = require("express");
const app = express();
const port = process.env.PORT || 5000;
const cors = require("cors");
const path = require("path");
const cookieParser = require("cookie-parser");
const { userRoutes } = require("./routes/userRoutes");
const { aiRoute } = require("./routes/aiRoutes");
const { adminRouter } = require("./routes/adminRoutes");
const { tableRoutes } = require("./routes/tableRoutes");

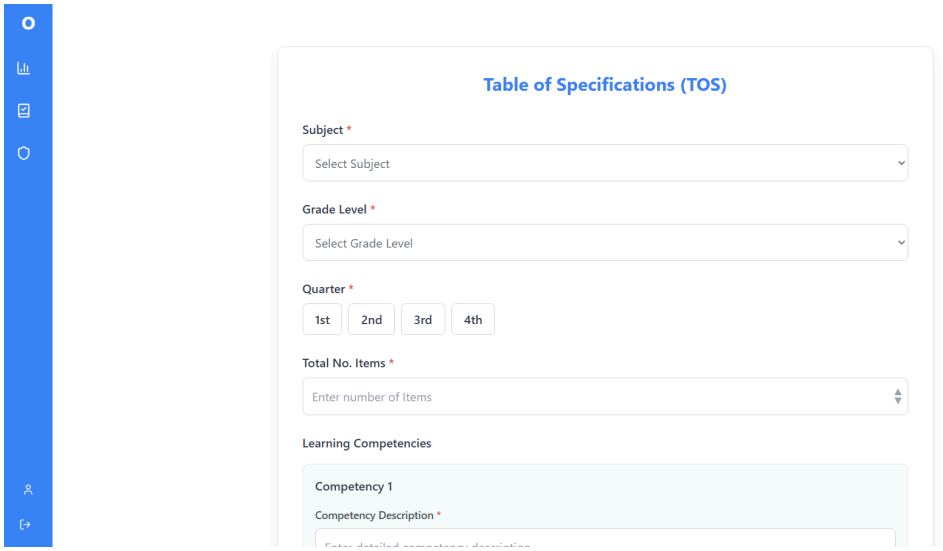
app.use(
  cors({
    origin: process.env.CLIENT_URL,
    credentials: true,
  })
);

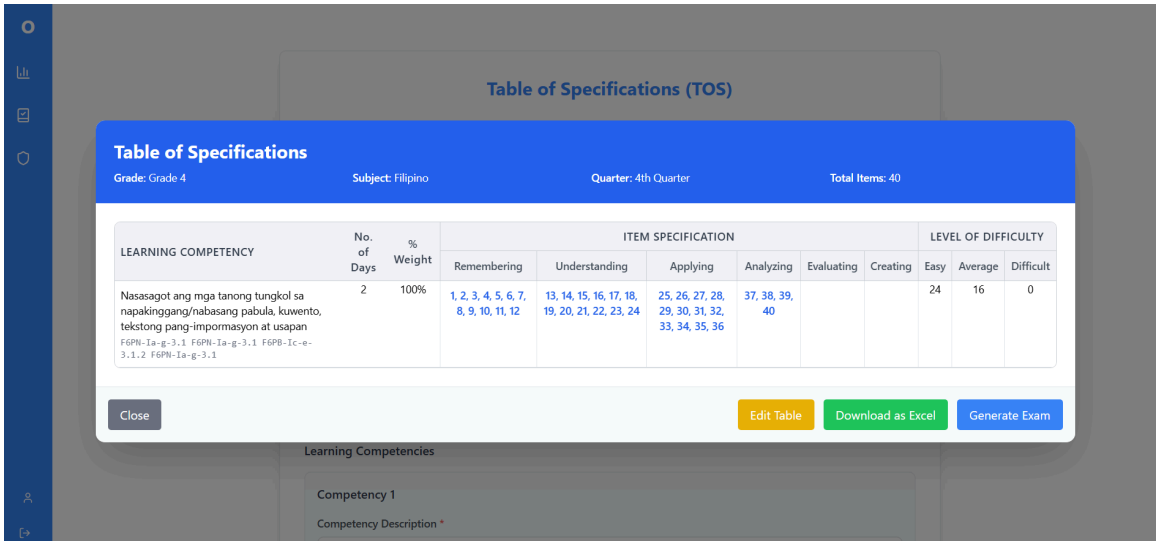
app.use(cookieParser());

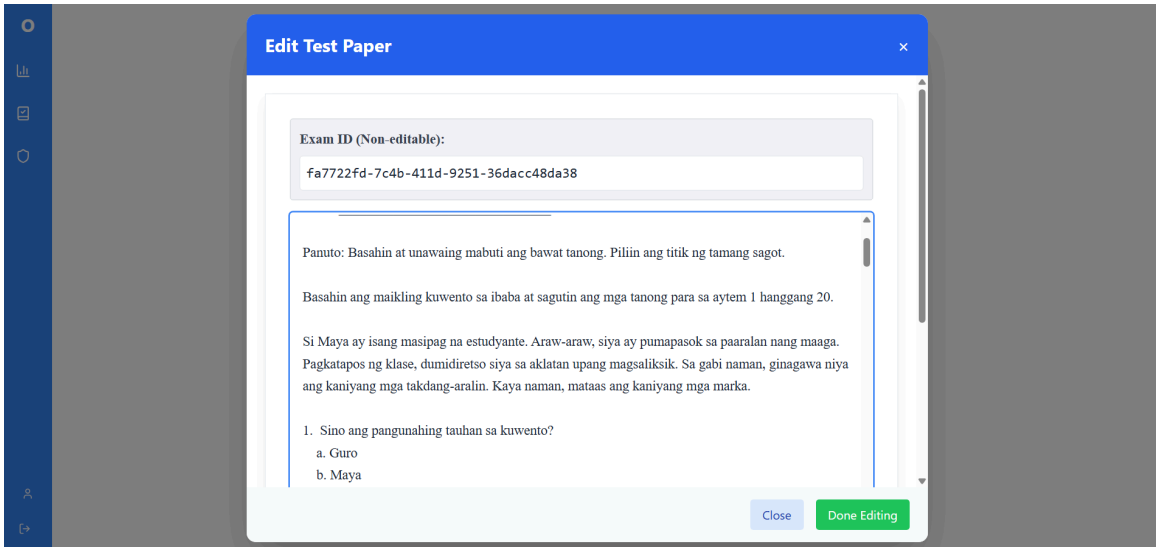
app.use("/uploads", express.static(path.join(__dirname, "uploads")));
app.use(express.json());
app.use(express.urlencoded({ extended: true }));

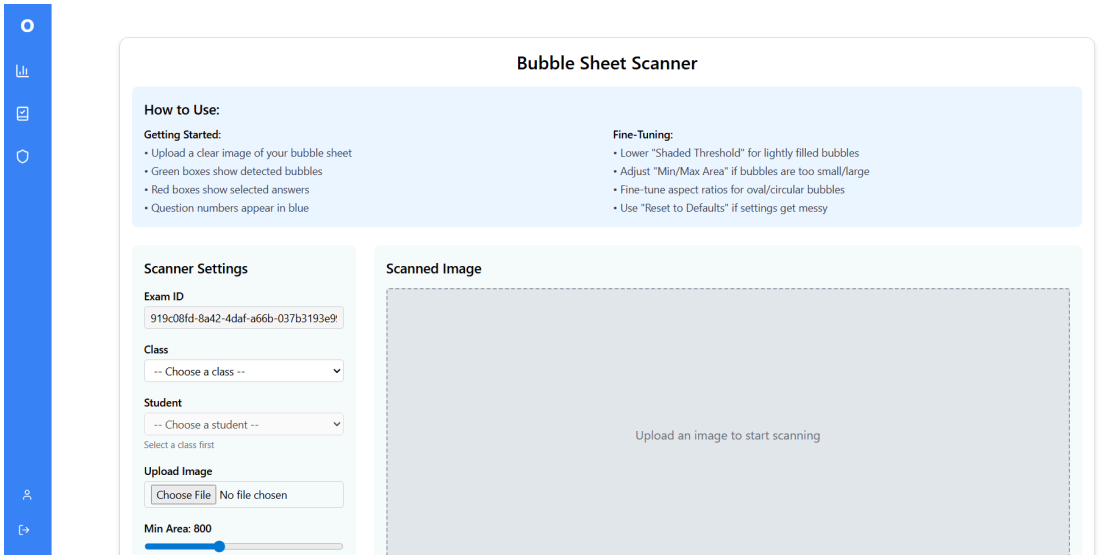
app.use("/api/auth", userRoutes);
app.use("/api/auth", tableRoutes);
app.use("/api/ai", aiRoute);
app.use("/api/admin", adminRouter);
```

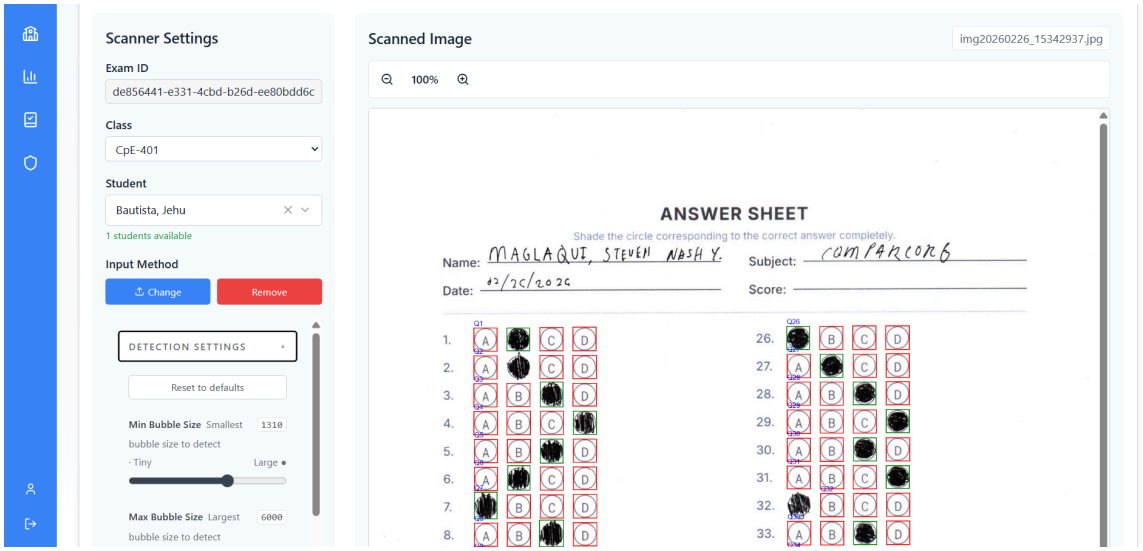
```
"crypto": "^1.0.1",
"dotenv": "^16.5.0",
"express": "^5.1.0",
"jsonwebtoken": "^9.0.2",
"multer": "^1.4.5-lts.2",
"nanoid": "^3.0.0",
"nodemailer": "^6.10.1",
"nodemon": "^3.1.9",
"validator": "^13.15.0"
},
"devDependencies": {
"prisma": "^6.7.0"
}
```


Table of Specifications (TOS)
Subject *
Select Subject
Grade Level *
Select Grade Level
Quarter *
1st
2nd
3rd
4th
Total No. Items *
Enter number of Items
Learning Competencies
Competency 1
Competency Description *


Table of Specifications (TOS)
Table of Specifications
Grade: Grade 4
Subject: Filipino
Quarter: 4th Quarter
Total Items: 40
LEARNING COMPETENCY
No. of Days
% Weight
ITEM SPECIFICATION
Remembering
Understanding
Applying
Analyzing
Evaluating
Creating
LEVEL OF DIFFICULTY
Easy
Average
Difficult
Nasasagot ang mga tanong tungkol sa napakinggang/nabasang pabula, kuwento, tekstong pang-impormasyon at usapan
F6PN-Ia-g-3.1 F6PN-Ia-g-3.1 F6PB-Ic-e-3.1.2 F6PN-Ia-g-3.1
2
100%
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24
25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
37, 38, 39, 40
24
16
0
Close
Edit Table
Download as Excel
Generate Exam
Learning Competencies
Competency 1
Competency Description *

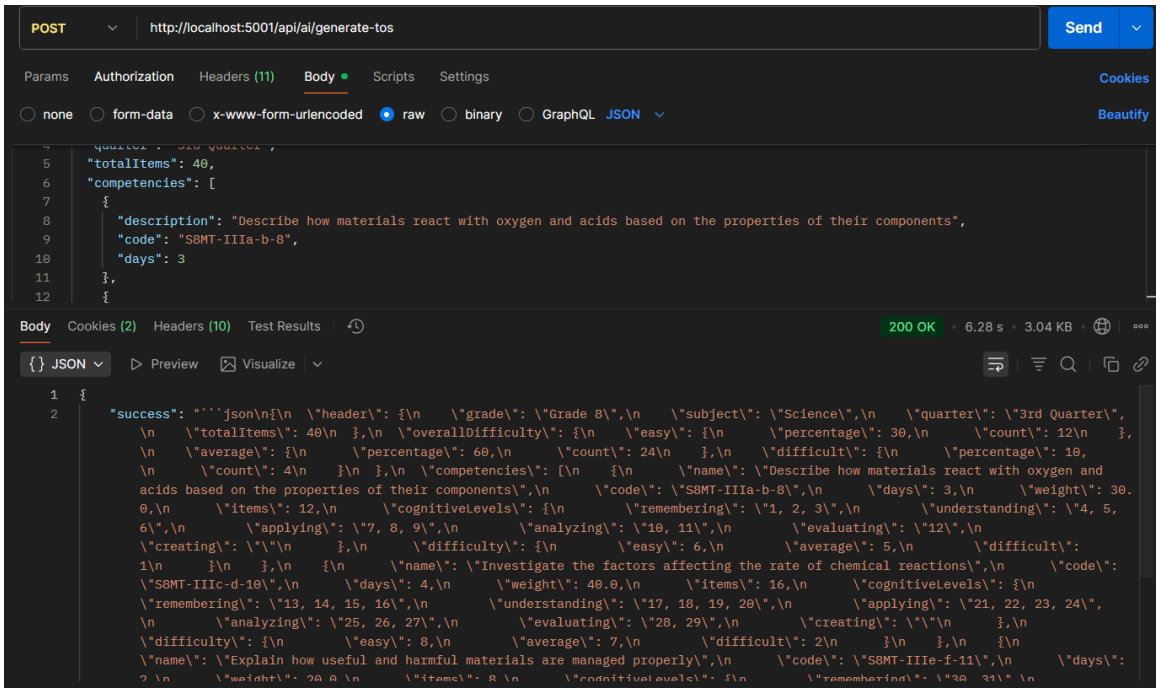

Edit Test Paper
Exam ID (Non-editable):
fa7722fd-7c4b-411d-9251-36dacc48da38
Panuto: Basahin at unawaing mabuti ang bawat tanong. Piliin ang titik ng tamang sagot.
Basahin ang maikling kuwento sa ibaba at sagutin ang mga tanong para sa aytem 1 hanggang 20.
Si Maya ay isang masipag na estudyante. Araw-araw, siya ay pumapasok sa paaralan nang maaga. Pagkatapos ng klase, dumiretso siya sa aklatan upang magsaliksik. Sa gabi naman, ginagawa niya ang kaniyang mga takdang-aralin. Kaya naman, mataas ang kaniyang mga marka.
1. Sino ang pangunahing tauhan sa kuwento?
a. Guro
b. Maya
Close
Done Editing

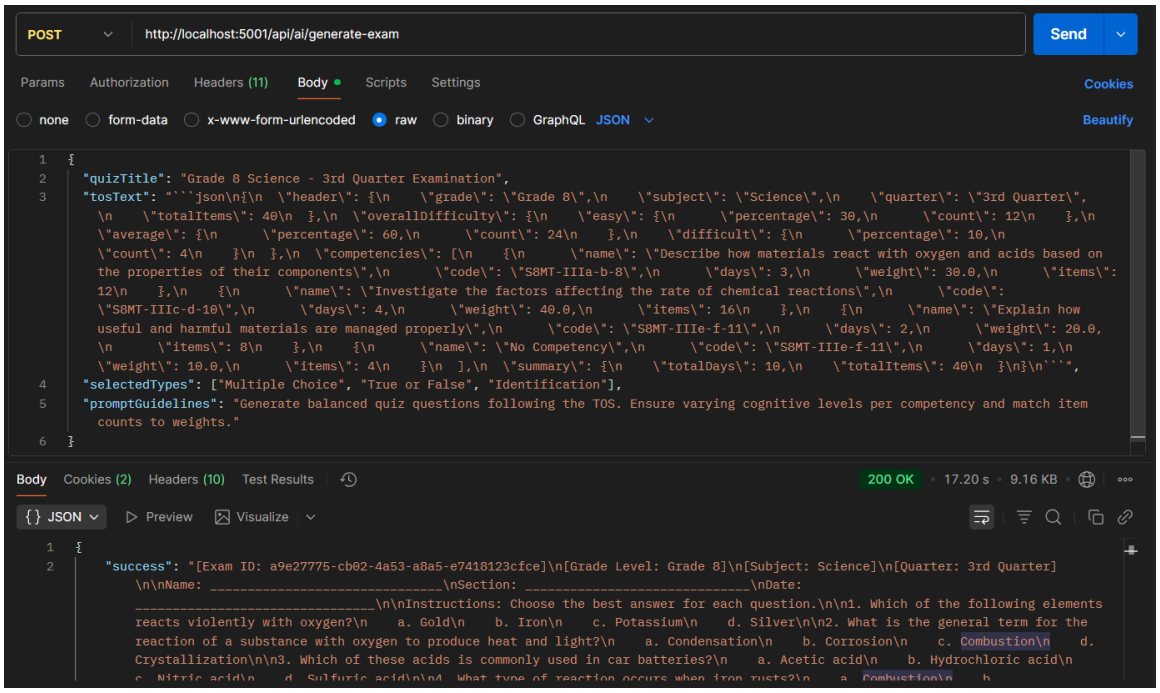

Bubble Sheet Scanner
How to Use:
Getting Started:
• Upload a clear image of your bubble sheet
• Green boxes show detected bubbles
• Red boxes show selected answers
• Question numbers appear in blue
Fine-Tuning:
• Lower "Shaded Threshold" for lightly filled bubbles
• Adjust "Min/Max Area" if bubbles are too small/large
• Fine-tune aspect ratios for oval/circular bubbles
• Use "Reset to Defaults" if settings get messy
Scanner Settings
Exam ID
919c08fd-8a42-4daf-a66b-037b3193e9
Class
-- Choose a class --
Student
-- Choose a student --
Select a class first
Upload Image
Choose File No file chosen
Min Area: 800
Scanned Image
Upload an image to start scanning

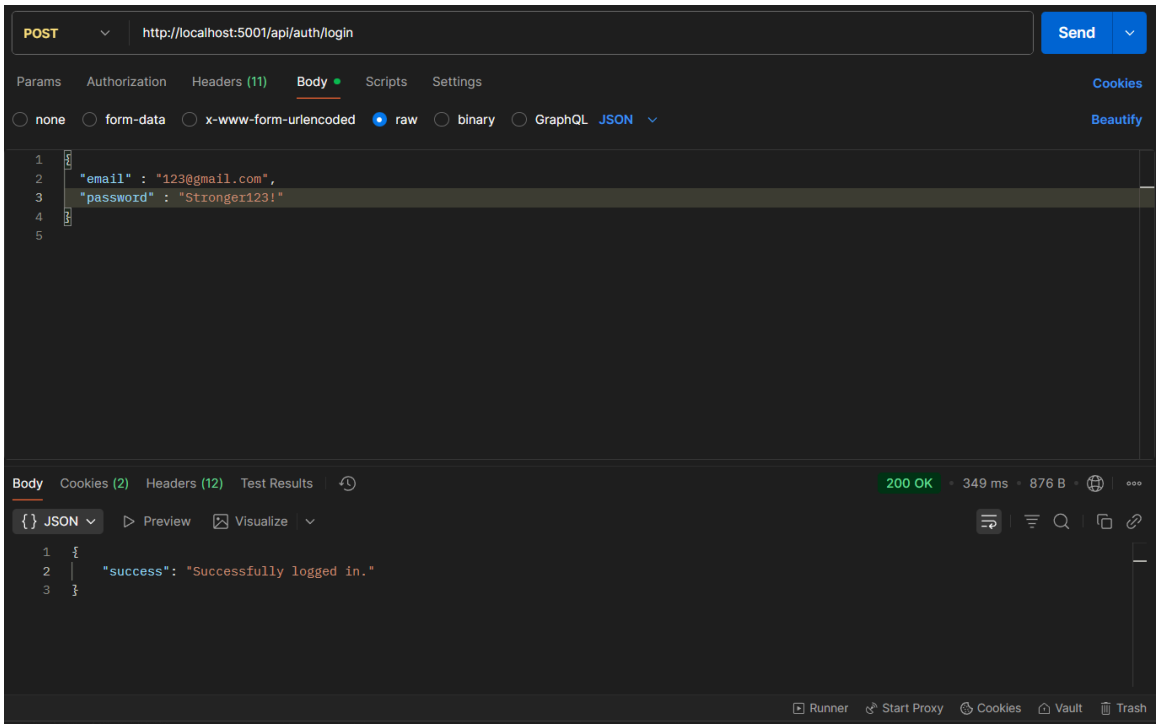


Test Procedure

The test procedure involved testing the major function and endpoint to ensure they worked correctly and returned successful responses.




POST
http://localhost:5001/api/ai/generate-exam
Send
Params
Authorization
Headers (11)
Body
Scripts
Settings
Cookies
none
form-data
x-www-form-urlencoded
raw
binary
GraphQL
JSON
Beautify
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Body
Cookies (2)
Headers (10)
Test Results
200 OK
17.20 s
9.16 KB
{ } JSON
Preview
Visualize
{
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\n\nName: _____\nSection: _____\nDate:
_____\n\nInstructions: Choose the best answer for each question.\n\n1. Which of the following elements
reacts violently with oxygen?\n a. Gold\n b. Iron\n c. Potassium\n d. Silver\n\n2. What is the general term for the
reaction of a substance with oxygen to produce heat and light?\n a. Condensation\n b. Corrosion\n c. Combustion\n d.
Crystallization\n\n3. Which of these acids is commonly used in car batteries?\n a. Acetic acid\n b. Hydrochloric acid\n


POST
http://localhost:5001/api/auth/login
Send
Params
Authorization
Headers (11)
Body
Scripts
Settings
Cookies
none
form-data
x-www-form-urlencoded
raw
binary
GraphQL
JSON
Beautify
{
"email" : "123@gmail.com",
"password" : "Stronger123!"
}
Body
Cookies (2)
Headers (12)
Test Results
200 OK
349 ms
876 B
{ } JSON
Preview
Visualize
{
"success": "Successfully logged in."
}
Runner
Start Proxy
Cookies
Vault
Trash

Safety Standards

To ensure safety in both electrical and user-facing aspects, the prototype adheres to IEC standards for low-voltage electronics. All components, including the Raspberry Pi and Epson L3210, operate within safe voltage and current limits. The kiosk enclosure is designed to minimize risk, with proper insulation, cable management, and physical locks to prevent accidental contact with wiring or moving parts. These measures help ensure safe usage in school environments, especially for educators and students interacting with the system.

Environmental Standards

Environmental considerations were also factored into the design. The Raspberry Pi and Epson L3210 are both energy-efficient devices, consuming minimal power during operation. Materials used for the kiosk, such as plyboard and metal framing, are recyclable and were chosen to reduce environmental impact. By digitizing traditionally paper-heavy processes like exam creation and grading, the system also contributes to reduced paper consumption and promotes sustainable practices in education.

Industry-Specific Standards

Industry-specific standards were considered throughout the development. The system architecture aligns with IEEE guidelines for computing and networking, while software development and data handling practices follow ISO standards for quality assurance and information security. USB-connected peripherals like the Epson L3210 comply with FCC regulations for electromagnetic interference, ensuring that the hardware meets recognized benchmarks for safe and reliable operation in educational settings.

Intellectual Property and Legal

Title: O’key-Ask: Enhancing Written Assessment Efficiency for Schools and Universities Through AI

Short Description: Kiosk for automating exam generation from educator parameters

Date: October 9, 2025

Patent Search

Keywords Used: Automated grading, OCR, Exam Generation, Assessment System

Existing Trademarks or Proprietary Design

Keywords Used	Patent Number, Title	Key Claims	Distinction of your Technology over this Patent
Automated grading	CN118115330A, Real-time exam paper reading and evaluation via AI	Uses AI to evaluate exam papers and map answers to knowledge points	Focuses on grading logic; lacks kiosk hardware, modular architecture, and integrated exam generation workflow
OCR	CN114973290A, Intelligent order examination via OCR engine	Extracts structured data from documents using OCR	Not designed for educational use; lacks grading, analytics, and kiosk deployment

Exam generation	WO2021079562A1, Exam question creation system	Generates questions using predefined patterns and weakness analysis	Strong overlap in generation logic; lacks grading pipeline, kiosk interface, and educator-facing analytics
Assessment system	WO2017165399A1, Automated assessment and grading of computerized algorithms	Grades programming assignments using isolated execution environments	Focused on code execution; not applicable to paper-based exams or OCR/OMR workflows

CN118115330A – Real-time exam paper reading and evaluation via AI

This patent describes an AI-based system that evaluates exam papers and maps student answers to specific knowledge points. It focuses on grading logic and performance analysis.

Distinction: While it shares the goal of automated grading, it lacks the modular kiosk hardware, integrated exam generation, and educator-facing analytics that define O'Key-Ask.

CN114973290A – Intelligent order examination via OCR engine

This invention uses OCR to extract structured data from documents, enabling automated document analysis.

Distinction: It is not designed for educational use and does not include grading, item analysis, or integration into a kiosk-based deployment.

WO2021079562A1 – Exam question creation system

This system generates exam questions using predefined patterns and analyzes student weaknesses to tailor assessments.

Distinction: It overlaps with O'Key-Ask in question generation logic but lacks a grading pipeline, kiosk interface, and real-time educator feedback mechanisms.

WO2017165399A1 – Automated assessment and grading of computerized algorithms

This patent focuses on grading programming assignments using isolated execution environments and approximate grading functions.

Distinction: It is tailored to code execution and digital assignments, making it incompatible with paper-based exams, OCR/OMR workflows, and the hybrid architecture of O'Key-Ask.

4.2 Open Source Licenses

License Identification The project integrates several open-source frameworks, libraries, and tools:

- Frontend/Backend Stack (React.js, Node.js, Express, TailwindCSS): MIT License
- Development & ORM (JavaScript, Prisma ORM, OpenCV, Google Vision API): Apache 2.0 License
- Database (PostgreSQL): PostgreSQL License (Permissive, BSD-style)
- Printing/Scanning (CUPS, Gutenprint, SANE): Apache 2.0, GPLv2
- Proprietary Services (Google Gemini API): Google Cloud Platform Terms of Service

Compatibility Review The combination of permissive licenses (MIT, Apache 2.0) and copyleft licenses (AGPL, GPL) is acceptable for an academic, non-distributed prototype. The project complies with these obligations:

- Permissive licenses are satisfied through attribution.
- Use of the AGPL-3.0 licensed Google Vision API model for an internal academic project does not require source code distribution. However, any public release or sale of the "O'Key-Ask" system would mandate releasing the project's entire source code under the AGPL-3.0 license.
- The Google Gemini API is a commercial service; its use is governed by Google's Terms of Service, not an open-source license.

Documentation of Attribution Requirements The project's documentation acknowledges all open-source dependencies, satisfying the requirements of permissive licenses like MIT and Apache 2.0. The use of Google's Gemini API is also noted. For AGPL and GPL components, the project is compliant as it is not currently distributed publicly.

4.3 Copyright and Patent Considerations

Original Contributions The novelty of this project lies in the unique integration of existing technologies into a cohesive system:

- **Dual-Standard AI Engine:** A system designed to generate assessments aligned with two distinct educational frameworks: DepEd for basic education and CHED/Washington Accord for higher education.
- **Integrated Kiosk Workflow:** A physical kiosk that automates the entire assessment lifecycle from AI-powered test generation to printing, scanning (OMR/OCR), grading, and item analysis.

- **Teacher-in-the-Loop Design:** The system mandates a "Teacher Review & Edit" step, ensuring human oversight and accountability for all AI-generated content.

Copyright Issues

- **Software:** All original source code for the backend (JavaScript, Express), frontend (React.js), and Python scripts is copyrighted by the project authors: Yabut, Escaño, and Maglaqui.
- **Third-Party Content:** The use of DepEd and CHED curriculum guides as input data for the AI falls under fair use for academic and research purposes.
- **Documentation:** All original diagrams, flowcharts, and the contents of the research paper are the copyrighted intellectual property of the authors.

Patentability Check A prior art search revealed existing patents for individual components like AI grading and exam generation. However, "O'Key-Ask" is distinct from prior art in the following ways:

- **CN118115330A & WO2021079562A1:** These focus on either grading or generation. "O'Key-Ask" provides an integrated end-to-end hardware and software solution for both.
- **CN114973290A & WO2017165399A1:** These patents are for general OCR or specialized code grading and are not designed for the paper-based, multi-level educational assessment workflow of this project.

The novelty of "O'Key-Ask" is its specific, integrated system architecture for a physical kiosk. This unique combination presents potential patent eligibility if developed into a commercial product.

4.4 Fair Use and Ethical Consideration

AI Ethics and Compliance with Data Privacy Laws The project adheres to ethical principles guided by international standards mentioned within the research paper:

- **Algorithmic Fairness:** To mitigate risks of AI bias in test generation or grading, the system explicitly includes a mandatory "Teacher Review & Edit" stage. This aligns with the risk assessment principles of **ISO/IEC 42001:2023**, ensuring human oversight and accountability.
- **Data Security:** Student assessment data, including scores and answer sheets, is handled with security in mind. The project acknowledges the importance of security management principles aligned with **ISO/IEC 27001:2022** to ensure data confidentiality and integrity.

Compliance with Data Privacy Laws The project is designed to comply with the **Data Privacy Act of 2012 (Philippines)**. All collected student data is directly related to academic assessment and is managed within the system's PostgreSQL database. Access is limited to authorized educators through user authentication, preventing unauthorized use of student performance records.

Fair Use in Education The project operates entirely within an academic and research context.

- The use of copyrighted **DepEd and CHED curriculum guides** as source material for the AI is transformative, creating new assessment tools for educational purposes and constitutes fair use.
- All open-source software is used within the permissions of their respective licenses for non-commercial, educational development.

Results

DepEd

Table 1

Standard Manual Assessment Workload (DepEd)

Assessment Phase	Task Description	Standard Duration (Manual)	Basis / Source
Pre-Assessment	TOS Preparation (Listing topics, computing weights, cognitive distribution)	1.5 – 3.0 Hours	Villanueva & Angeles (2021); DepEd (2020)
	Exam Construction (Item drafting, alignment, revision, formatting)	2.0 – 4.0 Hours	Villanueva & Angeles (2021); DepEd (2020)
Post-Assessment	Checking & Grading (Per class of 40–50 students, manual checking)	1.5 – 3.0 Hours	DepEd (2020)
	Item Analysis (Data encoding, index calculation, reporting)	1.5 – 3.0 Hours	Villanueva & Angeles (2021); DepEd (2020)
	MPS Generation (Consolidation and computation)	0.5 – 1.0 Hours	Villanueva & Angeles (2021); DepEd (2020)
TOTAL	Total Cycle Time	~10.5 Hours	(Cumulative Assessment Cycle)

Note. Estimates are derived from DepEd guidelines (DepEd Order No. 8, s. 2015; DepEd Order No. 31, s. 2020), teacher workload studies (David et al., 2019), and standard psychometric procedures (Villanueva & Angeles, 2021). Durations represent the typical time range required for a single subject per quarterly assessment period. Manual processing times may vary based on teacher experience and class size.

Table 2

Comparative Efficiency Analysis: O'Key-Ask vs. Manual Benchmark (DepEd)

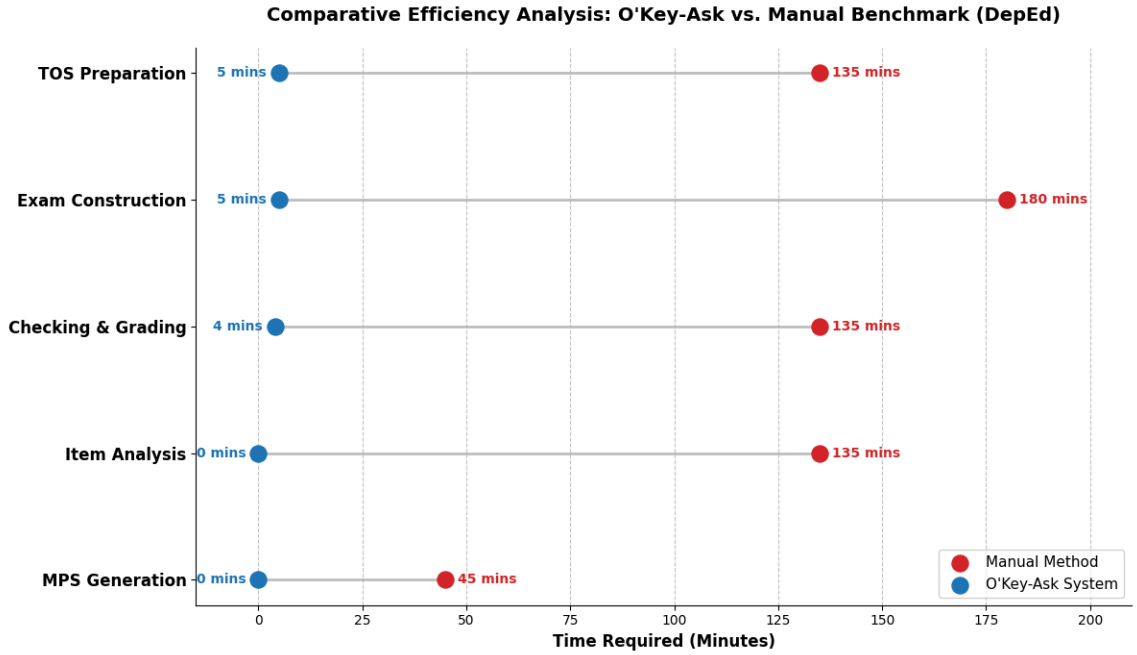
Assessment Phase	Manual Baseline (Median)	O'key-ask System (Measured)	Time Saved	Efficiency Gain
TOS Creation	135 mins (2.25 hrs)	5 mins	130 mins	96.30%

Exam Creation	180 mins (3 hrs)	5 mins	175 mins	97.22%
Checking & Grading	135 mins (2.25 hrs)	4 mins	131 mins	97.04%
Item Analysis	135 mins (2.25 hrs)	0 mins	135 mins	100.00%
MPS Generation	45 mins (0.75 hrs)	0 mins	45 mins	100.00%
TOTAL CYCLE	630.0 mins (10.5 hrs)	12.5 mins	616 mins	97.78%

Note. Manual baseline median are derived from DepEd guidelines (2015, 2020) and PIDS studies (2019). O'Key-Ask durations are measured experimental averages.

Figure 1

Comparative Efficiency Analysis: O'Key-Ask vs. Manual Benchmark (DepEd)



Note:

Table 3

Demographic Profile of Respondents

Grade Level Taught	Frequency (F)	Percentage (%)
Grade 5	8	53.30%
Grade 4	7	46.70%

TOTAL	15	100.00%

Note. Data reflects the distribution of participating teachers from NorthVille 15 Integrated School (N=15) who evaluated the O'Key-Ask system during the testing phase.

Table 4

Teacher Perception of O'Key-Ask System Performance (Summary of Findings)

Sop Category	Weighted Mean	Standard Deviation	Interpretation
SOP 1: Accuracy (Content & Grading)	4.75	0.32	Strongly Agree
SOP 2: Efficiency (Perceived Workload)	4.77	0.28	Strongly Agree
SOP 3: Usability (Interface & Hardware)	4.69	0.41	Strongly Agree
SOP 4: Workload Impact (Stress Reduction)	4.73	0.35	Strongly Agree
OVERALL SYSTEM RATING	4.74	0.34	Strongly Agree

Note. Data gathered from N=15 DepEd teachers (NorthVille 15 Integrated School) using a 5-point Likert Scale (5=Strongly Agree, 1=Strongly Disagree). Means were computed based on responses to the 29-item structured questionnaire. A weighted mean of 4.50–5.00 is interpreted as "Strongly Agree," indicating a very high level of acceptance.

CHED

Table 5

Standard Manual Assessment Workload (CHED - Engineering)

Assessment Phase	Task Description	Standard Duration (Manual)	Basis / Source
Pre-Assessment	Outcomes Mapping (Aligning items to TOS)	3.0 – 5.0 Hours	Respondents
	Exam Construction (Technical drafting, Rubric design)	4.0 – 6.0 Hours	Respondents

Post-Assessment	Checking & Grading (Multiple Choice + Essay)	4.0 – 8.0 Hours	Respondents
	Item Analysis	2.0 – 4.0 Hours	Respondents
	COAR Generation	1.0 – 2.0 Hours	Respondents
TOTAL	Total Cycle Time	~20.0 Hours	(Cumulative Assessment Cycle)

Note. Range of the CPE Professors in Holy Angel University working on Assessment Workload

Table 6

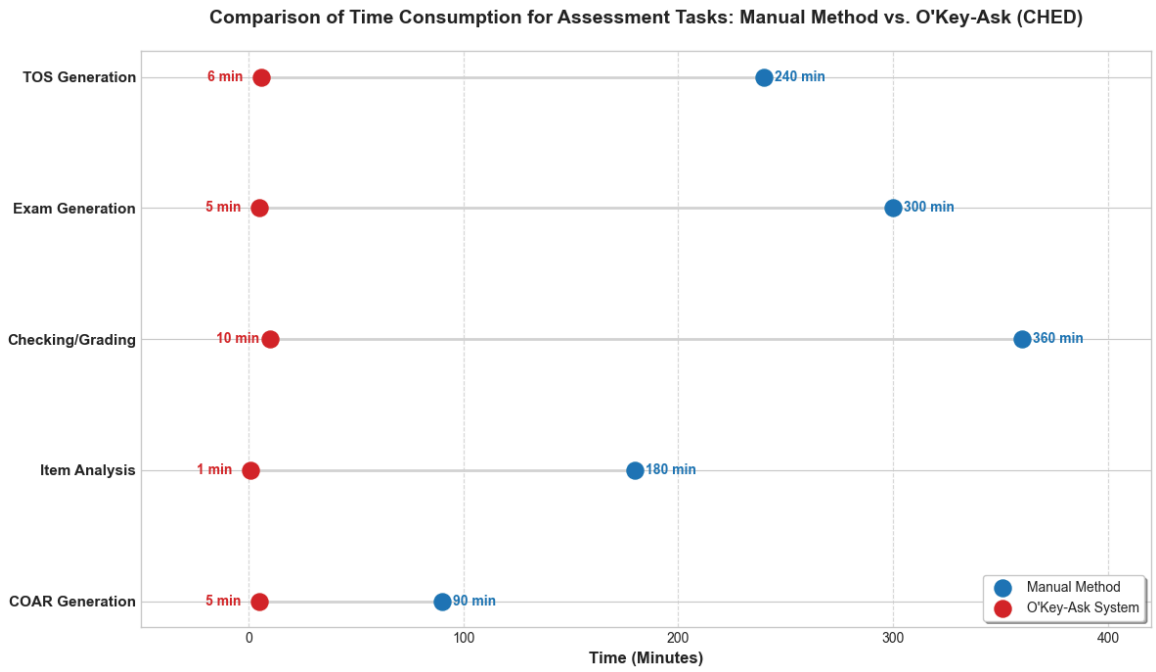
Comparative Efficiency Analysis: O'Key-Ask vs. Manual Benchmark (CHED)

Assessment Phase	Manual Baseline (Median)	O'key-ask System (Measured)	Time Saved	Efficiency Gain
TOS Generation	240 mins (4.0 hrs)	6 mins	234 mins	97.50%
Exam Generation	300 mins (5.0 hrs)	5 mins	295 mins	98.33%
Checking/Grading	360 mins (6.0 hrs)	10 mins*	350 mins	97.22%
Item Analysis	180 mins (3.0 hrs)	0 mins	180 mins	100.00%
COAR Generation	90 mins (1.5 hrs)	5 mins	85 mins	95.00%
TOTAL CYCLE	1,170 mins (19.5 hrs)	26 mins	1,144 mins	97.61%

Note. Manual baseline medians are derived from CHED professors. O'Key-Ask durations are measured experimental averages. **Checking/Grading for CHED includes OCR-based essay evaluation.*

Figure 2

Comparative Efficiency Analysis: O'Key-Ask vs. Manual Benchmark (CHED)



Note: The O'Key-Ask System significantly optimizes compliance with CHED’s assessment standards by reducing total task duration from 1,170 minutes to just 27 minutes. This 97.7% efficiency gain demonstrates the system's ability to automate labor-intensive faculty workflows while maintaining rigorous academic reporting.

Table 7
Demographic Profile of CHED Respondents

Employment Status	*Frequency (F)*	*Percentage (%)*
Full-time Faculty	*2*	*50.00%*
Part-time Faculty	*2*	*50.00%*
TOTAL	*4*	*100.00%*

Note. CHED Respondents are CPE Professors at Holy Angel University

Table 8
Engineering Faculty Perception of O'Key-Ask Performance (CHED)

Sop Category	***Weighted Mean***	***Standard Deviation***	***Interpretation***
SOP 1: Accuracy (CO Alignment & OCR Grading)	*4.68*	*0.61*	*Strongly Agree*

SOP 2: Efficiency (Workflow Streamlining)	*4.72*	*0.45*	*Strongly Agree*
SOP 3: Usability (Interface & Hardware)	*4.38*	*0.81*	*Strongly Agree*
SOP 4: Workload Impact (Stress & Productivity)	*4.88*	*0.35*	*Strongly Agree*
OVERALL SYSTEM RATING	*4.66*	*0.59*	*Strongly Agree*

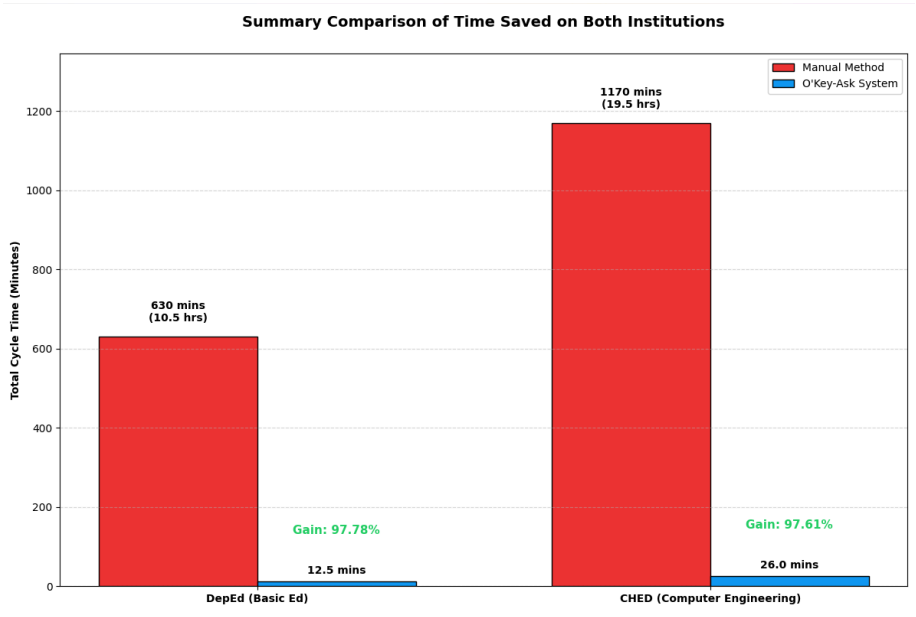
Note. Data gathered from N=4 Engineering faculty members using a 5-point Likert Scale (5=Strongly Agree).

Summary

The O’Key-Ask system significantly reduced assessment workloads for both DepEd and CHED educators. DepEd teachers saw their standard 10.5-hour cycle drop to 12.5 minutes (a 97.78% efficiency gain), while CHED engineering faculty reduced a 19.5-hour process to 26 minutes (a 97.61% efficiency gain).The system accurately generated tests aligned with specific curriculum standards. It reliably graded multiple-choice questions via Optical Mark Recognition (OMR) and evaluated complex technical essays using Optical Character Recognition (OCR).

Figure 3

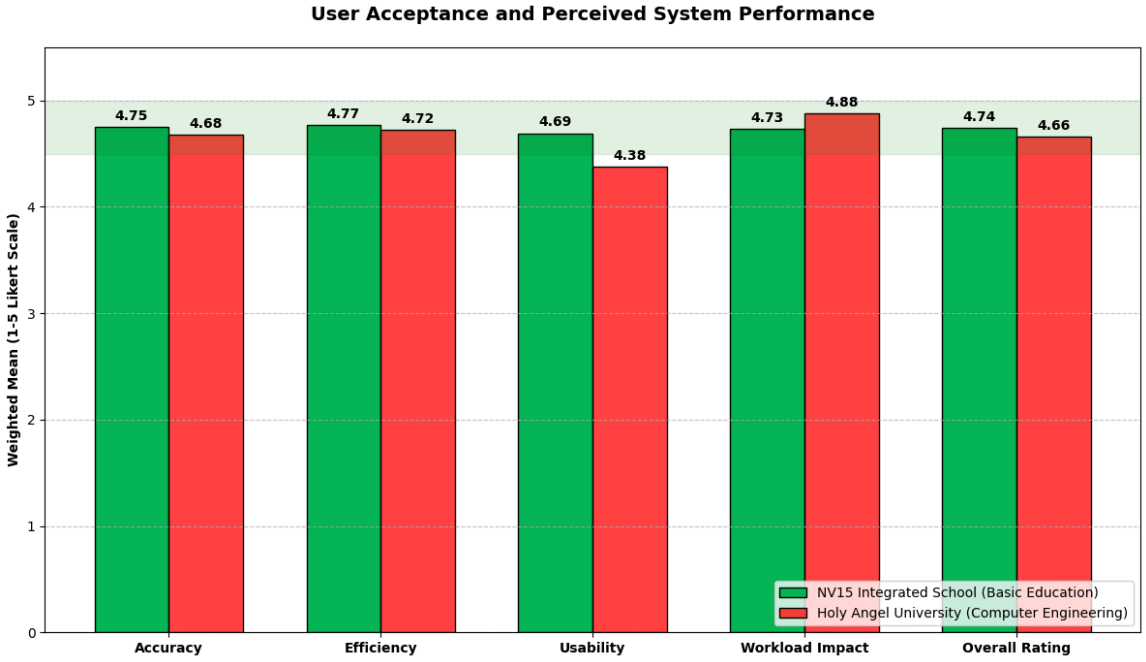
Summary Comparison of Time Saved on Both Institutions



Note: The O’Key-Ask System demonstrates consistent performance across different educational levels, achieving a 97.78% efficiency gain in DepEd (Basic Ed) and a 97.61% gain in CHED (Computer Engineering). Total cycle time was reduced from 10.5 hours to 12.5 minutes for DepEd tasks, and from 19.5 hours to 26 minutes for CHED tasks.

Figure 4

Summary of User Acceptance Results



Note: The O’Key-Ask System received high user acceptance ratings across all criteria, with overall ratings of 4.74 for basic education and 4.66 for higher education on a 5-point Likert scale. Notably, the system achieved its highest scores in workload impact (4.88) and efficiency (4.77), indicating strong user satisfaction regarding its ability to streamline academic administrative tasks.

Conclusion

The O’Key-Ask system effectively solves the administrative bottlenecks for both DepEd and CHED educators. By automating the entire assessment cycle from exam creation to item analysis the system reduced manual workload by over 96%, cutting hours of labor down to mere minutes.

The data proves that the system is both accurate and fully aligned with DepEd and CHED standards. With high approval ratings (4.74 for DepEd and 4.66 for CHED), O’Key-Ask is a

highly accepted tool that significantly boosts productivity and reduces teacher burnout through its integrated OMR and OCR technologies.

Recommendations

Institutional Integration: DepEd and CHED should adopt AI-powered assessment kiosks into standard school infrastructure to reduce systemic teacher fatigue.

Hardware & Software Upgrades: Future versions should include automatic document feeders (ADF) for faster scanning and local fine tuned AI models (SLMs) to allow offline grading in areas with poor internet and make the output more specialized and accurate.

Subject Matter Expansion: The system should be updated to support a wider range of subjects, and other specialized college courses, ensuring utility across all academic fields.

Future Research: Conduct long-term studies to measure how automated grading impacts student learning outcomes and classroom teaching methods.

Data Governance: Institutions must establish clear AI ethics and privacy guidelines to secure student performance data.

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Appendices

User’s Manual

O’Key-Ask





Workplan

CPEPRACDSN1 WORKPLAN

(1) Course Title: Computer Engineering Practice and Design 1
(2) Thesis Title: O’Key-Ask: Enhancing Written Assessment Efficiency for DepEd Schools Through AI
(3) Total Duration (in months): **11 months** **(4) Planned Start Date:** **May 15, 2025** **(5) Planned End Date: March**

(6) OBJECTIVES	(7) TARGET ACTIVITIES	(8) TARGET ACCOMPLISHMENTS (Quantify, if possible)	Week/Month										
			May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Develop a system that generates TOS (Table of specifications) based on learning competencies and number of	Consult a Master Teacher to help us break down the TOS for us to implement in the system	Development of the blueprint for the TOS generation system	X										

O'Key-Ask

an Exam based on the generated TOS, and make sure that the exam is accurately aligned with the TOS.	Figuring out the AI to use for Exam generation		X											
	Development of the Exam generation system			X										
	Testing if the Exam generated is based and accurate on the TOS	Accurate Exam Generation system		X										
	Ensuring that the answers in the exam are correct			X										
	Tweaking some parameters to ensure the robustness of the system	Accurate Exam Generation System		X										
	Testing the system			X										
Develop a system that would check and grade the TOS based Exam	Determine the software for checking exams.	A checking system that would accurately check and grade the answered exams			X	X								
	Building the checking system				X	X								
	Tweak the checking system				X	X								
	Test the checking system				X	X								
Begin the hardware configuration and carry out the integration of the printer and scanner components	Headless configuration of the Raspberry Pi system	A working hardware setup with all the peripherals integrated			X									
	Connecting the peripherals (printer, scanner, monitor, keyboard, and mouse) to the Raspberry Pi				X									
	Establish the configuration of the printer via CUPS system and the scanner via SANE interface				X									

	Integrate the Hardware with Software into the kiosk					X	X						
	Test the fully integrated kiosk					X	X						
Final Presentation Prototype Preparation	Summarize and identify the necessary information to be included in the presentation.	O'Key-Ask: Enhancing Written Assessment Efficiency for DepEd Schools Through AI Final Prototyping Presentation				X	X	X					
	Design and create the presentation.					X	X	X					
	Create the script for the final presentation.						X	X					
	Practice the final presentation.						X	X					
Final Documentation Prototype Preparation	Consult the adviser and subject coordinator regarding the documentation paper	O'Key-Ask: Enhancing Written Assessment Efficiency for DepEd Schools Through AI Final Prototyping Documentation					X	X					

	Revise and verify the documentation paper.						X	X					
	Follow-up consultation with the adviser and the subject coordinator regarding the documentation paper.						X	X					
	Finalize the documentation paper.						X	X					

	Conduct a survey questionnaire for teachers	Fully Tested system								X	X	X	
	Conduct a testing for teachers									X	X	X	
Final Documentation Preparation	Consult the adviser and subject coordinator regarding the documentation paper	O’Key-Ask: Enhancing Written Assessment Efficiency for DepEd Schools Through AI Final Documentation										X	X
	Revise and verify the documentation paper.											X	X
	Follow-up consultation with the adviser and the subject coordinator regarding the documentation paper.											X	X
	Finalize the documentation paper.											X	X

Program/Source Code

The "O'Key-Ask" system integrates a physical hardware kiosk, a full-stack web application, and distinct AI modules to automate the entire educational assessment workflow. The kiosk hardware,

centered around a Raspberry Pi, manages the physical tasks of printing exams and scanning answer sheets. The web application provides an interface for educators to define assessment parameters and review results. All data is processed by the backend, which coordinates with AI services to generate test materials and grade scanned papers automatically.

Appendix B. Server Code Snippet (Backend Setup)

```
require("dotenv").config();
const express = require("express");
const app = express();
const port = process.env.PORT || 5000;
const cors = require("cors");
const path = require("path");
const cookieParser = require("cookie-parser");
const { userRoutes } = require("./routes/userRoutes");
const { depedAiRoutes } = require("./routes/depedAiRoutes");
const { adminRouter } = require("./routes/adminRoutes");
const { tableRoutes } = require("./routes/tableRoutes");
const { classRoutes } = require("./routes/classRoutes");
const { checkRoutes } = require("./routes/checkRoutes");
const { examsRoutes } = require("./routes/examsRoutes");
const { itemAnalysisRoutes } =
require("./routes/itemAnalysisRoutes");
const { mpsRoutes } = require("./routes/mpsRoutes");
const { tosRoutes } = require("./routes/tosRoutes");
const { competenciesRouter } =
require("./routes/compentenciesRoutes");
const { chedTosRoutes } = require("./routes/tosChedRoutes");
const { chedAiRoutes } = require("./routes/chedAiRoutes");
const { scoreRoutes} = require("./routes/scoreRoutes");
const rubricRoutes = require("./routes/rubricRoutes");
const essayRoutes = require("./routes/essayRoutes");
const scanRoutes = require("./routes/scanRoutes");
const { fileRoute } = require("./routes/fileRoutes");
require("./routes/itemAnalysisRoutes");
const { mpsRoutes } = require("./routes/mpsRoutes");
const { tosRoutes } = require("./routes/tosRoutes");
const { competenciesRouter } =
```

```
require("./routes/compentenciesRoutes");
const { chedTosRoutes } = require("./routes/tosChedRoutes");
const { chedAiRoutes } = require("./routes/chedAiRoutes");
const { scoreRoutes} = require("./routes/scoreRoutes");
const rubricRoutes = require("./routes/rubricRoutes");
const essayRoutes = require("./routes/essayRoutes");
const scanRoutes = require("./routes/scanRoutes");
const { fileRoute } = require("./routes/fileRoutes");



app.use(
  cors({
    origin: [process.env.CLIENT_URL, "http://192.168.100.31:3000",
"http://192.168.100.11:3000" ],
    credentials: true,
  })
);

app.use(cookieParser());
app.use("/uploads", express.static(path.join(__dirname, "uploads")));
app.use(express.json());
app.use(express.urlencoded({ extended: true }));
app.use("/api/auth", userRoutes);
app.use("/api/table", tableRoutes);
app.use("/api/class", classRoutes);
app.use("/api/check", checkRoutes);
app.use("/api/deped-ai", depedAiRoutes);
app.use("/api/admin", adminRouter);
app.use("/api/exam", examsRoutes);
app.use("/api/item-analysis", itemAnalysisRoutes);
app.use("/api/mps", mpsRoutes);
app.use("/api/tos", tosRoutes);
app.use("/api/ched-tos", chedTosRoutes);
app.use("/api/ched-ai", chedAiRoutes);
app.use("/api/compe", competenciesRouter);
app.use("/api/score", scoreRoutes);
app.use("/api/rubric", rubricRoutes);
app.use("/api/essay", essayRoutes);
app.use("/api/scan", scanRoutes);
app.use("/api/file", fileRoute)
app.listen(port, "0.0.0.0", () => {
```

```
  console.log(`Server is running on port ${port}`);
});
```

Appendix C. Server Code Snippet (Frontend Setup)

```
import {
  BrowserRouter,
  Routes,
  Route,
  Navigate,
  useLocation,
} from "react-router-dom";
import { LandingPage } from "./screen/landingPage";
import { HomePage } from "./screen/userScreen/homepage";
import { AboutPage } from "./screen/about";
import { ProfilePage } from "./screen/authScreen/profile";
import ContactPage from "./screen/contact";
import { ProtectedRouting } from "./utils/protectedRouting";
import { DetailClass } from "./screen/userScreen/detailClass";
import { ExamGenerator } from "./screen/userScreen/examGenerator";
import { TableOfSpecs } from "./screen/userScreen/tosInput";

import { ListOfExams } from "./screen/userScreen/listOfExams";
import { ExamCheck } from "./screen/userScreen/examCheck";
import { ItemAnalysisOutput } from
"./screen/userScreen/itemAnalysis";
import { PublicRoute } from "./utils/publicRouter";
import { AdminUsersScreen } from "./screen/adminScreen/admin";
import { motion, AnimatePresence } from "framer-motion";
import { useEffect, useState } from "react";
import { MPS } from "./screen/userScreen/mpsScreen";
import { PreItemAnalysis } from "./screen/preScreen/preItemAnalysis";
import { ToastContainer } from "react-toastify";
import "react-toastify/dist/ReactToastify.css";
import CombinedGenerator from
"./screen/userScreen/combinedGenerator";
import ReviewScreen from "./screen/userScreen/reviewEssayRubric";
import EssayCheckerScreen from "./screen/userScreen/essayCheck";
import { PreMps } from "./screen/preScreen/preMPS";
import COARUploadScreen from "./screen/userScreen/coarGenerator";
function MotionLayout({ children }) {
```

```
  const location = useLocation();
  const [prefersReduced, setPrefersReduced] = useState(false);

  useEffect(() => {
    const mediaQuery = window.matchMedia("(prefers-reduced-motion:
reduce)");
    setPrefersReduced(mediaQuery.matches);
    const handler = (e) => setPrefersReduced(e.matches);
    mediaQuery.addEventListener("change", handler);
    return () => mediaQuery.removeEventListener("change", handler);
  }, []);

  const variants = prefersReduced
    ? {}
    : {
        initial: { opacity: 0 },
        animate: { opacity: 1 },
        exit: { opacity: 0 },
        transition: { duration: 0.3 },
      };

  return (
    <AnimatePresence mode="wait">
      <motion.div
        key={location.pathname}
        variants={variants}
        initial="initial"
        animate="animate"
        exit="exit"
        transition={{ duration: 0.2 }}
      >
        {children}
      </motion.div>
    </AnimatePresence>
  );
}

function App() {
  return (
    <div className="App">

      <BrowserRouter>
```

```
      <ToastContainer position="top-right" autoClose={3000} />
    <Routes>
      <Route path="*" element={<Navigate to="/" />} />

      <Route
        path="/"
        element={
          <PublicRoute>
            <MotionLayout>
              <LandingPage />
            </MotionLayout>
          </PublicRoute>
        }
      />
      <Route
        path="/contact"
        element={
          <PublicRoute>
            <MotionLayout>
              <ContactPage />
            </MotionLayout>
          </PublicRoute>
        }
      />
      <Route
        path="/about"
        element={
          <PublicRoute>
            <MotionLayout>
              <AboutPage />
            </MotionLayout>
          </PublicRoute>
        }
      />

      <Route
        path="/home"
        element={
          <ProtectedRouting>
            <MotionLayout>
              <HomePage />
            </MotionLayout>
```

```
    </ProtectedRouting>
  }
/>
<Route
  path="/profile"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <ProfilePage />
      </MotionLayout>
    </ProtectedRouting>
  }
/>
<Route
  path="/classroom/:id"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <DetailClass />
      </MotionLayout>
    </ProtectedRouting>
  }
/>
<Route
  path="/exam-generate"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <ExamGenerator />
      </MotionLayout>
    </ProtectedRouting>
  }
/>
<Route
  path="/generate-coar"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <COARUploadScreen/>
      </MotionLayout>
    </ProtectedRouting>
  }
```

```
/>
<Route
  path="/tos-generate"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <TableOfSpecs />
      </MotionLayout>
    </ProtectedRouting>
  }
/>

<Route
  path="/essay-rubric-generator"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <CombinedGenerator />
      </MotionLayout>
    </ProtectedRouting>
  }
/>

<Route
  path="/review-screen"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <ReviewScreen />
      </MotionLayout>
    </ProtectedRouting>
  }
/>

<Route
  path="/exams"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <ListOfExams />
      </MotionLayout>
    </ProtectedRouting>
```

```
  }
/>
<Route
  path="/exams/checker/:id"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <ExamCheck />
      </MotionLayout>
    </ProtectedRouting>
  }
/>

<Route
  path="/item-analysis/:examId"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <PreItemAnalysis />
      </MotionLayout>
    </ProtectedRouting>
  }
/>

<Route
  path="/item-analysis/:examId/:classId"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <ItemAnalysisOutput />
      </MotionLayout>
    </ProtectedRouting>
  }
/>

<Route
  path="/essay/checker/"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <EssayCheckerScreen />
      </MotionLayout>
```

```
    </ProtectedRouting>
  }
/>

<Route
  path="/mps/:examId/:classId"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <MPS />
      </MotionLayout>
    </ProtectedRouting>
  }
/>
<Route
  path="/mps/:examId/"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <PreMps />
      </MotionLayout>
    </ProtectedRouting>
  }
/>

<Route
  path="/mps/:examId/:classId"
  element={
    <ProtectedRouting>
      <MotionLayout>
        <MPS />
      </MotionLayout>
    </ProtectedRouting>
  }
/>

<Route
  path="dashboard"
  element={
    <ProtectedRouting adminOnly>
      <MotionLayout>
        <AdminUsersScreen />
```

```
                </MotionLayout>
              </ProtectedRouting>
            }
          />
        </Routes>
      </BrowserRouter>
    </div>
  );
}

export default App;
```

Appendix D. Environment Setup

Server Environment

```
PORT = "Port number where the backend server runs"
DATABASE_URL = "Database connection string"
EMAIL = "System email address used for sending messages"
EMAIL_PASS = "Password or app password for the system email"
JWT_SECRET = "Secret key for generating and verifying access tokens"
REFRESH_SECRET = "Secret key for generating and verifying refresh
tokens"
NODE_ENV = "Application environment mode (development or production)"
CLIENT_URL = "Frontend application URL"
GEMINI_API_KEY = "API key for Google Gemini AI"
GOOGLE_VISION_KEY_PATH = "File path to Google Vision service account
key"
OPENAI_API_KEY = "API key for OpenAI services"
GEMINI_MODEL = "Gemini model name to be used"
OPENAI_MODEL = "OpenAI model name to be used"
AI_PROVIDER = "Selected AI provider (gemini or openai)"
```

Client Environment

```
REACT_APP_API_URL= "Server URL"
```

Python Script Server

```
import os
```

```
import datetime
import subprocess
from flask import Flask, jsonify, send_from_directory, request
from flask_cors import CORS
app = Flask(name)
BASE_DIR = os.getcwd()

UPLOAD_FOLDER = os.path.join(BASE_DIR, 'scanned_images')
if not os.path.exists(UPLOAD_FOLDER):
    os.makedirs(UPLOAD_FOLDER)

app.config['UPLOAD_FOLDER'] = UPLOAD_FOLDER
CORS(app, resources={r"/*": {"origins": "*"}})

@app.route('/')
def home():
      return "Scanner Online. Storage Cleanup Enabled."
@app.route('/scan', methods=['POST', 'GET'])
def scan_document():
      try:
        print("--- CLEANING UP OLD IMAGES ---")
      for filename in os.listdir(app.config['UPLOAD_FOLDER']):
            file_path = os.path.join(app.config['UPLOAD_FOLDER'],
filename)
            if os.path.isfile(file_path):
                os.unlink(file_path)
      except Exception as e:
        print(f"Cleanup Error: {e}")
      timestamp = datetime.datetime.now().strftime("%Y%m%d_%H%M%S")
      filename = f"scan_{timestamp}.png"
      filepath = os.path.join(app.config['UPLOAD_FOLDER'], filename)
      print(f"--- STARTING SCAN: {filename} ---")

      command = ["scanimage", "--format=png", "--mode", "Color",
"--resolution", "300"]

      try:
      with open(filepath, "wb") as f:
            subprocess.run(command, stdout=f, check=True)

        print(f"--- SAVED: {filepath} ---")
```

```
        host_url = request.host_url.rstrip('/')
        file_url = f"{host_url}/images/{filename}"

        return jsonify({
              "status": "success",
              "message": "Scan completed",
              "filename": filename,
              "url": file_url
        })

        except Exception as e:
          print(f"SCAN ERROR: {e}")
        return jsonify({
              "status": "error",
              "message": str(e)
        }), 500

@app.route('/images/<path:filename>', methods=['GET'])
def get_image(filename):
      return send_from_directory(app.config['UPLOAD_FOLDER'],
filename)

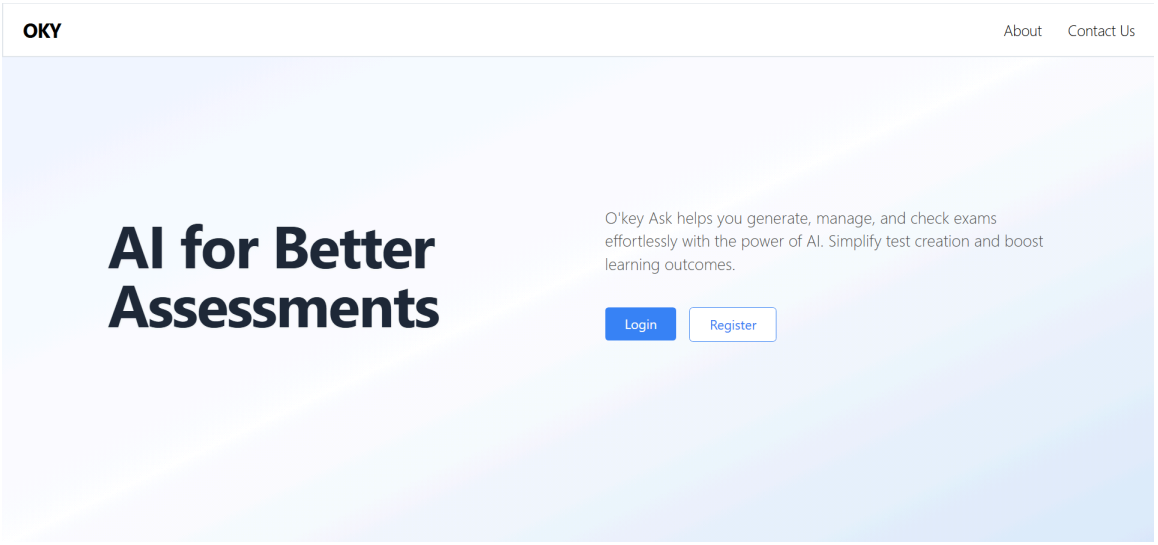
if name == 'main':
    print(f"Server starting on port 5000...")
    app.run(host='0.0.0.0', port=5000, debug=True)
```

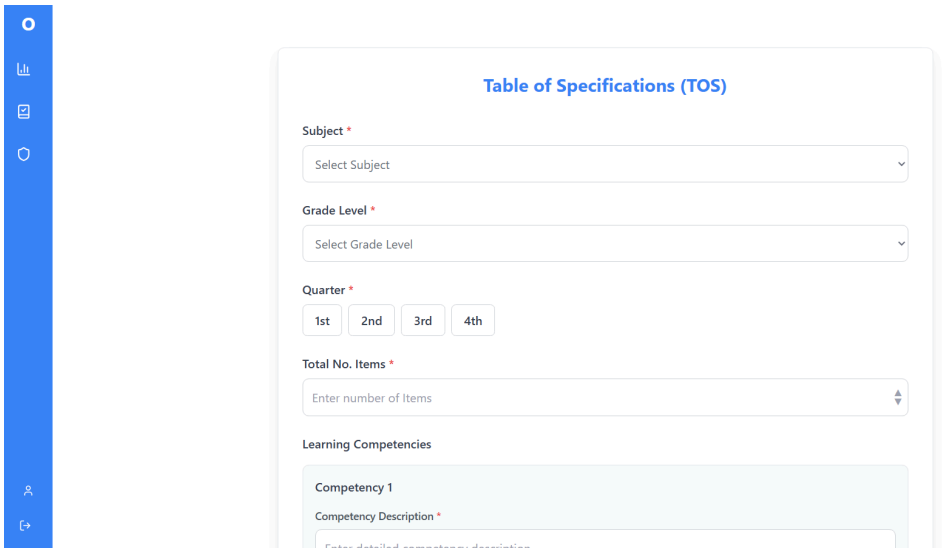
Appendix E. Testing Procedure Summary

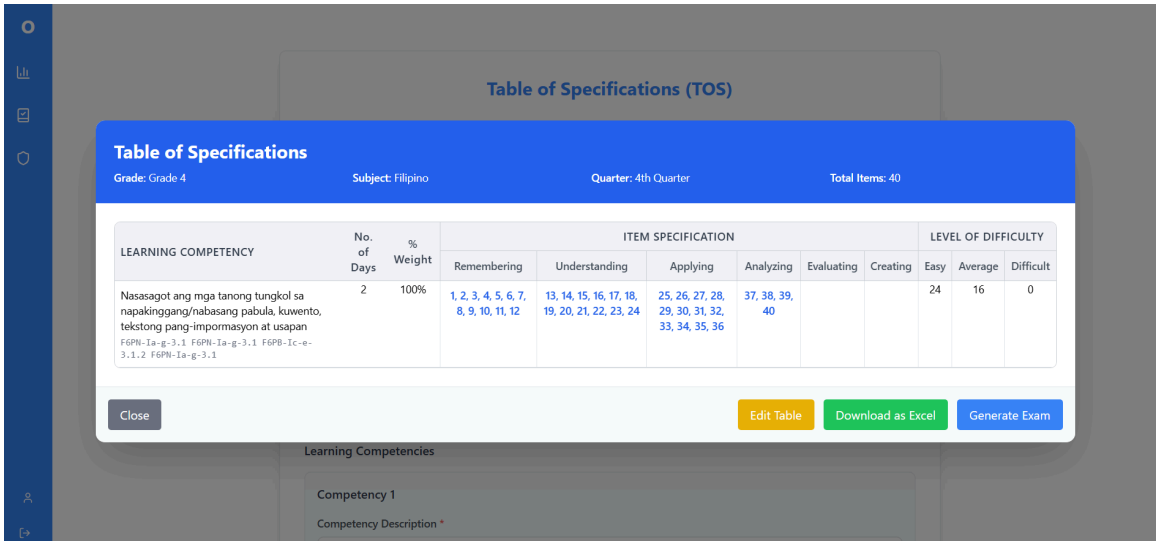
Testing Type	**Description**	**Expected Outcome**
Unit Testing	Individual software modules (e.g., API endpoints, OMR script) are tested in isolation to verify their correctness.	Each component functions according to its design specifications without errors.
Integration Testing	Individual modules are combined and tested as a group to expose faults in their interaction. This includes the frontend, backend, database, and AI services.	Data flows correctly between components; for example, a frontend request successfully triggers the backend AI service and updates the database.
System Testing	The complete and integrated	The end-to-end workflow

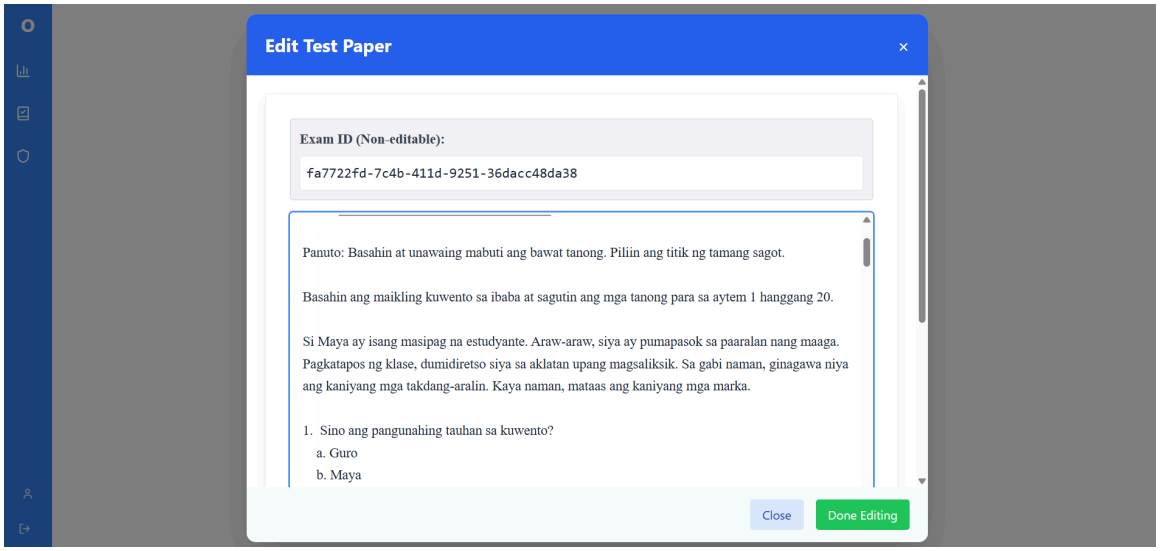
	hardware/software system is tested to evaluate its compliance with all specified requirements.	from exam generation to grading and analysis is validated on the kiosk hardware without failure.
User Acceptance Testing (UAT)	Conducted with target users (educators from elementary and university levels) to confirm the system meets their needs. Usability and impact are measured via structured questionnaires.	Educators validate that the system is accurate, efficient, and user-friendly, confirming its positive impact on their workload.

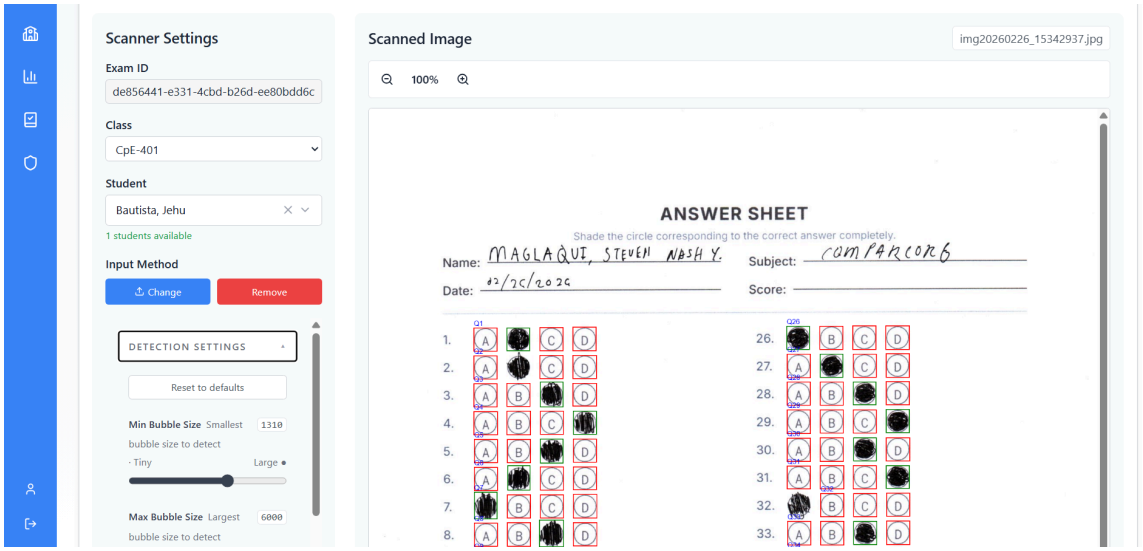
Appendix F. GUI mockups or wireframes



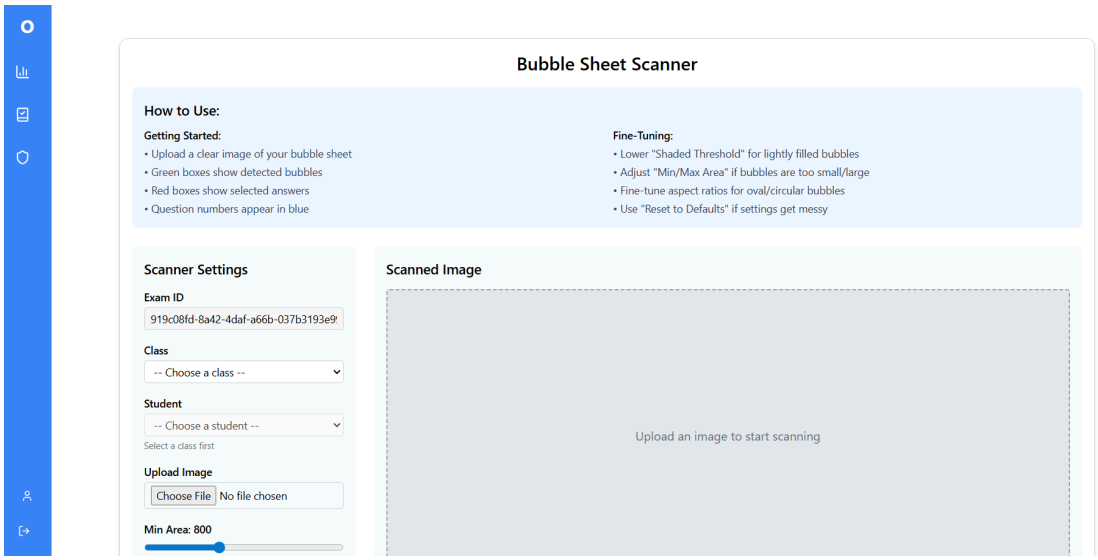

Table of Specifications (TOS)
Subject *
Select Subject
Grade Level *
Select Grade Level
Quarter *
1st
2nd
3rd
4th
Total No. Items *
Enter number of Items
Learning Competencies
Competency 1
Competency Description *


Table of Specifications (TOS)
Table of Specifications
Grade: Grade 4
Subject: Filipino
Quarter: 4th Quarter
Total Items: 40
LEARNING COMPETENCY
No. of Days
% Weight
ITEM SPECIFICATION
Remembering
Understanding
Applying
Analyzing
Evaluating
Creating
LEVEL OF DIFFICULTY
Easy
Average
Difficult
Nasasagot ang mga tanong tungkol sa napakinggang/nabasang pabula, kuwento, tekstong pang-impormasyon at usapan
F6PN-Ia-g-3.1 F6PN-Ia-g-3.1 F6PB-Ic-e-3.1.2 F6PN-Ia-g-3.1
2
100%
1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24
25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
37, 38, 39, 40
24
16
0
Close
Edit Table
Download as Excel
Generate Exam
Learning Competencies
Competency 1
Competency Description *


Edit Test Paper
Exam ID (Non-editable):
fa7722fd-7c4b-411d-9251-36dacc48da38
Panuto: Basahin at unawaing mabuti ang bawat tanong. Piliin ang titik ng tamang sagot.
Basahin ang maikling kuwento sa ibaba at sagutin ang mga tanong para sa aytem 1 hanggang 20.
Si Maya ay isang masipag na estudyante. Araw-araw, siya ay pumapasok sa paaralan nang maaga. Pagkatapos ng klase, dumiretso siya sa aklatan upang magsaliksik. Sa gabi naman, ginagawa niya ang kaniyang mga takdang-aralin. Kaya naman, mataas ang kaniyang mga marka.
1. Sino ang pangunahing tauhan sa kuwento?
a. Guro
b. Maya
Close
Done Editing


Scanner Settings
Exam ID
de856441-e331-4cbd-b26d-ee80bdd6c
Class
CpE-401
Student
Bautista, Jehu
1 students available
Input Method
Change
Remove
DETECTION SETTINGS
Reset to defaults
Min Bubble Size Smallest 1310
bubble size to detect
Tiny Large
Max Bubble Size Largest 6000
bubble size to detect
Scanned Image
img20260226_15342937.jpg
100%
ANSWER SHEET
Shade the circle corresponding to the correct answer completely.
Name: MAGLAQUI, STEVEN NASH Y.
Subject: COMPARCOMS
Date: 02/26/2026
Score:

O’Key-Ask



Questionnaires and Letters

Letter to DepEd

HOLY ANGEL UNIVERSITY
School of Engineering and Architecture
Angeles City, Philippines

January 23, 2026

MR. RAY JASON C. SANGUYU
Principal
Northville 15 Integrated School Northville 15, Angeles City 2009 Pampanga

Subject: Request to Conduct Research Survey

Dear Mr. Sanguyu:

We hope this letter finds you well.

We are 4th-year Bachelor of Science in Computer Engineering students from the School of Engineering and Architecture at Holy Angel University. We are writing to respectfully request permission to conduct a survey at your reputable institution on Thursday, February 5, 2026.

We are currently conducting our thesis research entitled "O'Key-Ask: Enhancing Written Assessment Efficiency for Schools and Universities Through AI". The study aims to develop an

Survey Questionnaire (DepEd / Basic Education)

Target Respondents: Grade 4-5 Teachers (NorthVille 15 Integrated School)

Rating Scale: Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree

Part I: System Accuracy (SOP 1.1, 1.3, 1.5, 1.6)

1. The system generates test items that are accurately aligned with the MATATAG Curriculum Competencies provided.
2. The generated Table of Specifications (TOS) correctly distributes items across the cognitive levels (Remembering, Understanding, etc.).
3. The difficulty level of the AI-generated questions is appropriate for the target grade level.

4. The content of the generated questions is factually accurate and relevant to the subject matter.
5. The number of items generated per topic corresponds accurately with the inputs in the TOS matrix.
6. The system accurately matches learner answers to the correct answer key using OMR (Optical Mark Recognition).
7. The system reliably detects and flags invalid, blank, or double-shaded answers on the bubble sheet.
8. The learner scores generated by the system are mathematically correct and consistent with manual re-checking.
9. The system accurately tallies the number of correct responses per item for Item Analysis.
10. The Mean Percentage Score (MPS) computed by the system is mathematically accurate.
11. The Item Analysis correctly identifies "least mastered skills" or difficult items based on student performance.
12. The system reports are consistent with the official DepEd forms for class performance.

Part II: System Efficiency (SOP 2.1, 2.3, 2.5)

13. The system significantly reduces the time required to create a TOS compared to the manual method.
14. Generating a printable, TOS-aligned test paper is faster using the kiosk than typing it manually.
15. The system quickly ensures a balanced distribution of topics, saving me time on manual sorting.
16. I spend less time formatting and layouting the exam paper because the system automates it.

17. Checking objective (multiple choice) tests using the kiosk scanner is significantly faster than manual checking.
18. The automated checking removes the repetitive physical fatigue of grading large batches of papers.
19. Real-time scoring results are available almost instantly after scanning.
20. The Item Analysis is generated immediately, eliminating the need to manually tally mistakes on the blackboard or paper.
21. The MPS is calculated automatically in seconds, removing the need for calculator work.
22. The system saves time by automatically generating reports that are ready for submission.
23. Overall, the system streamlines the post-examination administrative work.

Part III: System Usability (SOP 3.1 - 3.2)

24. The kiosk user interface is easy to navigate and understand.
25. The hardware integration (Raspberry Pi, Scanner, Printer) functions reliably enough for daily use.
26. The "Review & Edit" feature is intuitive and makes it easy to correct AI suggestions.
27. The requirement for account verification by an administrator is an acceptable security measure.
28. Using the O'Key-Ask system reduces the overall mental stress associated with the grading period.
29. The system minimizes the total time spent on assessment tasks, allowing me to focus more on teaching.

Letter to CHED

February 12, 2026

MR. JEFFREY NEIL S. NEPOMUCENO
Executive Director, Campus Services and Development Office
Holy Angel University

Dear Mr. Nepomuceno,

We are Fourth Year Computer Engineering students completing our thesis, **"O'Key-Ask: Enhancing Written Assessment Efficiency for Schools and Universities Through AI."**

We are writing to request permission to bring our kiosk prototype to the **Computer Engineering (CpE) Lab (SH-102)** starting **February 23, 2026**, for User Acceptance Testing (UAT). Additionally, we request to temporarily store the kiosk within the lab until our **Final Defense on February 28, 2026.**

Technical Specifications:

- **Hardware:** The kiosk is a single, compact unit containing a Raspberry Pi 4B, an Epson L3210 printer/scanner, and a monitor.
- **Enclosure:** The unit is housed in a secure, custom-built wooden enclosure designed for stability and safety.
- **Space & Safety:** The unit operates on standard low-voltage electronics and will be placed in a designated area to ensure it does not obstruct lab activities.

This setup is essential for evaluating our system's performance with faculty members. We have coordinated this request with our adviser, **Engr. Jeunesse Gatuz**.

Thank you for your guidance and support.

Sincerely,

Josh Mark F. Escaño
Steven Nash Y. Maglaqui
Reinael B. Yabut
Researchers, BSCPE

Endorsed by:

Engr. Jeunesse Christian Gatuz
Thesis Adviser

Dr. Jaypee B. Pajarillaga
School of Engineering Dean

Engr. Niyo Kenn Jimenez
Computer Engineering Program Coordinator

Mr. Mark Evan Lumbang
Lab Custiodian

Survey Questionnaire (CHED / Higher Education)

Target Respondents: CPE Professors (Holy Angel University)

Rating Scale: Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree

Part I: System Accuracy (SOP 1.2 - 1.6)

1. The system generates assessment items that are accurately aligned with the specific Course Outcomes (COs) of the subject.
2. The generated questions reflect the competency standards required by the Washington Accord for engineering programs.
3. The items correctly target Higher Order Thinking Skills (HOTS) suitable for tertiary-level engineering students.
4. The system accurately maps the generated questions to the department's syllabus and Program Outcomes (POs).
5. The technical terminology used in the AI-generated questions is accurate and appropriate for the course.
6. The system accurately matches student answers to the correct key using OMR (Optical Mark Recognition).
7. The system reliably detects and flags invalid or ambiguous marks on the answer sheet.
8. The learner scores generated by the system are mathematically correct and free from computational errors.
9. The OCR feature accurately extracts text from student essay answers for evaluation.
10. The system provides accurate keyword matching or rubric-based suggestions for essay scoring.
11. The system accurately generates detailed item analysis useful for departmental audits.
12. The performance data generated is accurate enough to be used for Course Outcome Assessment Reports (COAR).

13. The system correctly identifies student performance gaps related to specific Course Outcomes.
14. The grading results are consistent and objective across different student papers.

Part II: System Efficiency (SOP 2.2 - 2.5)

15. Mapping questions to Course Outcomes (COs) is much faster using the AI system.
16. The system makes it quicker to create engineering exams that meet required standards.
17. Checking multiple-choice exams with the system saves me a lot of hours.
18. The system efficiently checks exams for large classes.
19. AI assistance speeds up the slow process of grading essay questions.
20. Scores and class statistics are ready immediately after scanning the papers.
21. The system automatically creates item analysis reports, saving time at the end of the term.
22. The system makes it easier and faster to prepare required course documents.
23. Overall, the system streamlines the preparation of necessary course requirement documents.

Part III: Usability & Workload Impact

24. The kiosk user interface is easy to navigate and understand.
25. The hardware integration (Raspberry Pi, Scanner, Printer) functions reliably enough for daily use.
26. The "Review & Edit" feature is intuitive and makes it easy to correct AI suggestions.
27. The requirement for account verification by an administrator is an acceptable security measure.
28. Using the O'Key-Ask system reduces the overall mental stress associated with the grading period.

29. The system minimizes the total time spent on assessment tasks, allowing me to focus more on teaching.

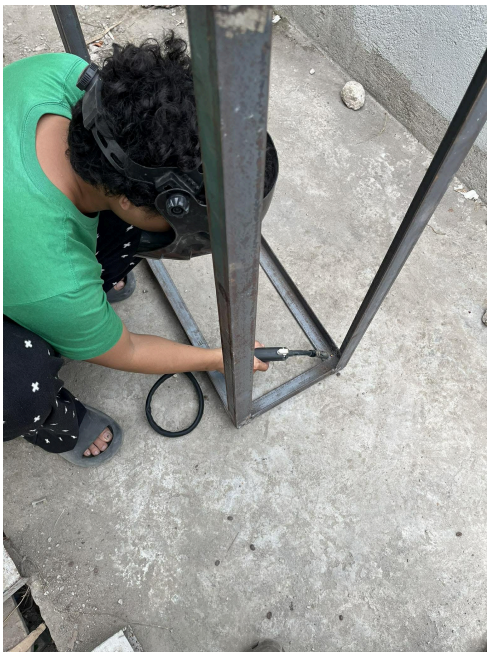
Project Documentation





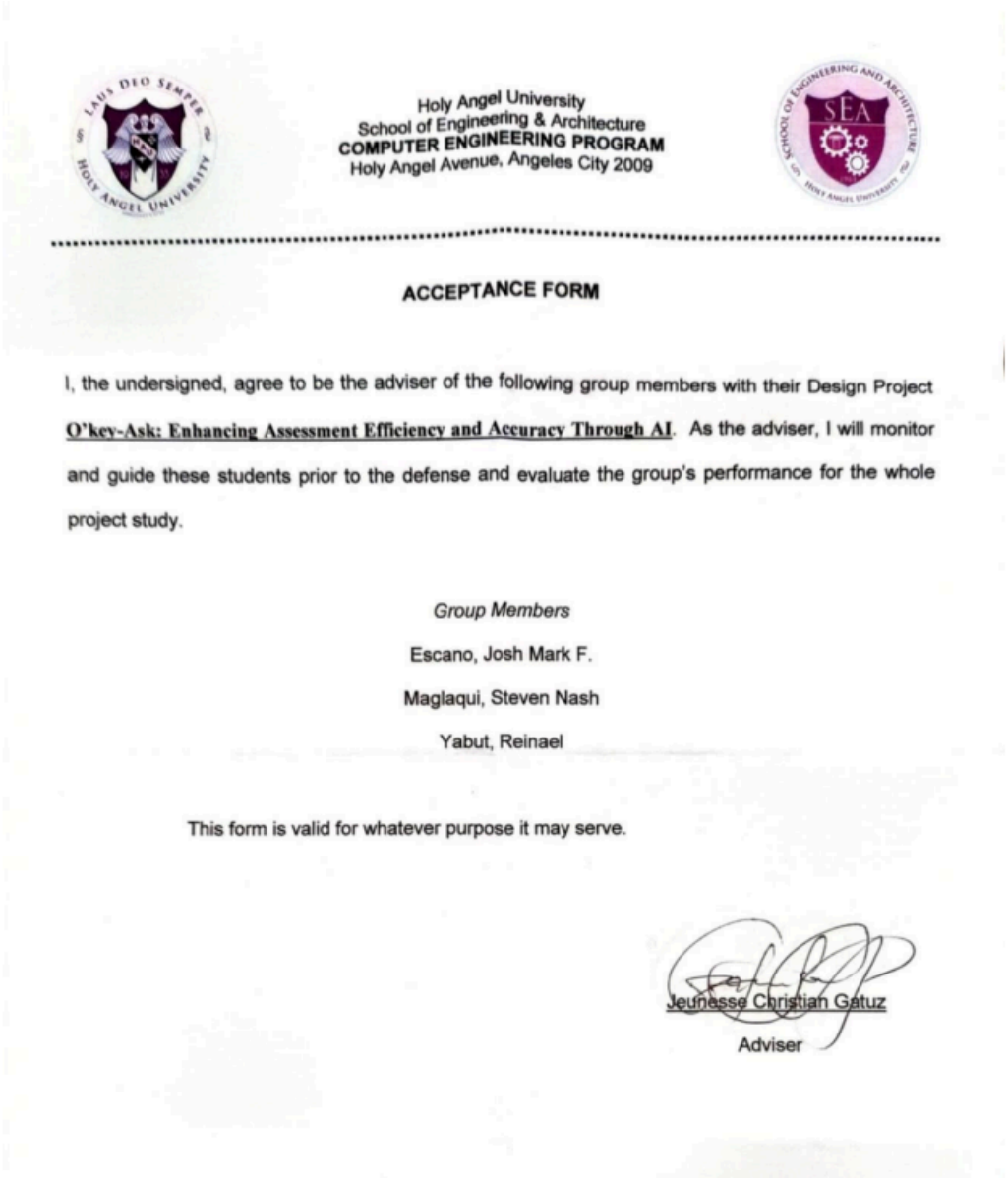










Holy Angel University
School of Engineering & Architecture
COMPUTER ENGINEERING PROGRAM
Holy Angel Avenue, Angeles City 2009

ACCEPTANCE FORM

I, the undersigned, agree to be the adviser of the following group members with their Design Project **O’key-Ask: Enhancing Assessment Efficiency and Accuracy Through AI**. As the adviser, I will monitor and guide these students prior to the defense and evaluate the group’s performance for the whole project study.

Group Members

Escano, Josh Mark F.

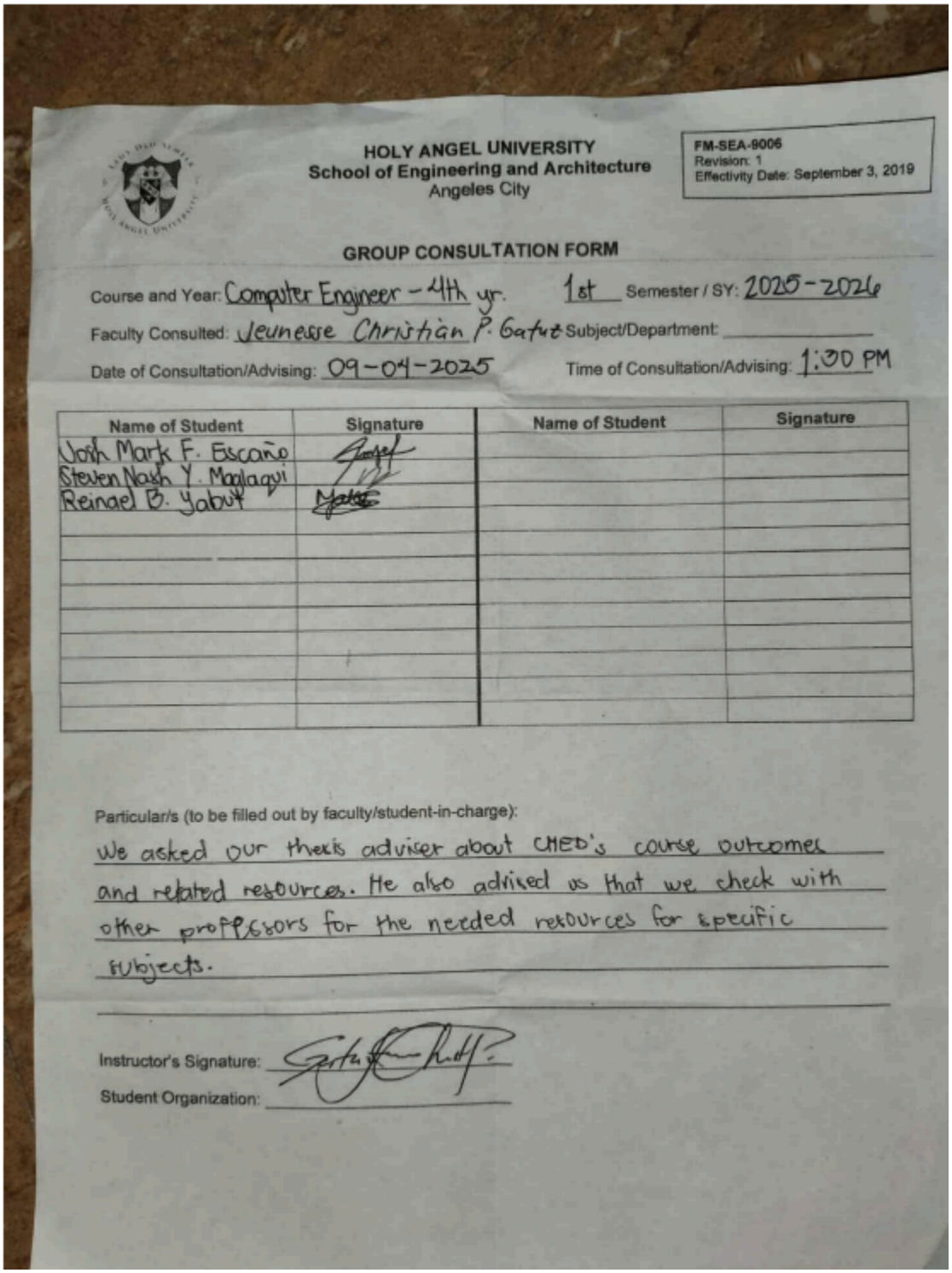
Maglaqui, Steven Nash

Yabut, Reinael

This form is valid for whatever purpose it may serve.

Jeunesse Christian Gatuz
Adviser

Advisers Form



HOLY ANGEL UNIVERSITY
School of Engineering and Architecture
Angeles City

FM-SEA-9006
Revision: 1
Effectivity Date: September 3, 2019

GROUP CONSULTATION FORM

Course and Year: Computer Engineer - 4th yr. 1st Semester / SY: 2025-2026

Faculty Consulted: Jeunesse Christian P. Gatus Subject/Department: _____

Date of Consultation/Advising: 09-04-2025 Time of Consultation/Advising: 1:30 PM

Name of Student	Signature	Name of Student	Signature
Josh Mark F. Escaño			
Steven Nash Y. Maglaqui			
Reinael B. Yabut			

Particular/s (to be filled out by faculty/student-in-charge):

We asked our thesis adviser about CHED's course outcomes and related resources. He also advised us that we check with other professors for the needed resources for specific subjects.

Instructor's Signature:

Student Organization: _____



Holy Angel University
School of Engineering and Architecture
Computer Engineering Program



CPEPRACDSN1
PROGRESS REPORT No. 1

Project Study Title: **O'key-Ask: Enhancing Written Assessment Efficiency for Schools and UniversitiesThrough AI**

Project Study Group Name : **Incognare**

Group Members : **Escaño, Josh Mark F.**

: **Maglaqui, Steven Nash Y.**

: **Yabut, Reinael B.**

Adviser : Jeunesse Gatuz

Date of Meeting : 9/5/2025

Venue/Mode of Meeting : CPE Lab, Face-to-face

Introduction

- ***Purpose:*** *This report documents the current status, progress, and recent scope revisions for the "O'Key-Ask" project.*
- ***Background:*** *The "O'Key-Ask" project is an AI-powered kiosk designed to automate the educational assessment workflow. It addresses the time-intensive manual process of creating, grading, and analyzing exams. The system generates standards-aligned test papers, performs automated grading using Optical Mark Recognition (OMR) and Optical Character Recognition (OCR), and provides item analysis to reduce educator workload and improve assessment quality.*
- ***Scope:*** *The project scope has been revised to broaden its applicability and modernize its technical foundation. Key updates include:*

Curriculum Vitae

Reinael Yabut

Reinael Yabut

reinaelyabut1234@gmail.com | +639757367574 | linkedin.com/in/reinaelyabut

Computer Engineer specializing in **Data**, **AI/ML**, **Automation** and **Software Engineering**. Focused on building **impactful**, efficient solutions through **innovation** and **continuous upskilling.**

DIGITAL PORTFOLIO: https://www.reinaelyabut.dev/

Experience

PARALLAXX — Auckland, New Zealand
AI Developer | L1 Support (Intern) — November 2025 - February 2026

- Built an end-to-end **AI agent** (PXX SPARK) on a local server using n8n and **RLHF**, achieving **100% uptime** via **self-optimizing** feedback loops and **context-aware** prompting.
- Developed an AI-powered market intelligence pipeline using RSS and LLMs to automate reporting, reducing processing time from **3–5 days** to under **30 seconds**.
- Engineered a high-volume data migration script to reorganize **1.5TB** of archival data and provided **L1 hardware and software support**, ensuring **zero data loss** and **operational continuity**.

SILICON BARRACKS (FREELANCING) — Angeles City, PHL
Data Analyst — June 2022 –November 2024

- Executed comprehensive **data cleaning** and **validation** protocols on raw datasets using Google Sheets and SQL, ensuring **100% data integrity** and accuracy for client deliverables.

Technical Skills

- **Languages:** Python, SQL (MySQL, PostgreSQL), JavaScript, TypeScript
- **Data & Machine Learning:** Pandas, NumPy, Scikit-Learn, Power BI, PyTorch
- **Developer & AI Tools:** Google Colab, Gemini CLI, Prompt Engineering, Git, Docker
- Software Engineering: Flask, FastAPI, Express.js, React, JS, HTML, CSS, Next.JS, Streamlit
- **Productivity Suites:** Microsoft 365 (Excel, PowerPoint, Word), Google Workspace (Sheets, Docs)

Projects

O'Key-Ask: Enhancing Written Assessment Efficiency for Schools and Universities Through AI (Thesis)

- Engineered an AI kiosk (Raspberry Pi, OpenCV, Gemini) for DepEd and CHED-aligned TOS creation and OMR grading; streamlined item analysis, MPS, and COAR generation, significantly reducing processing time.

PXX Spark

- Architected an end-to-end autonomous AI agent hosted on a local server using n8n, Docker, and RLHF, achieving 100% uptime via self-optimizing feedback loops and context-aware prompting.

B.A.I. | Real-Time Tagalog to Cebuano Translator

- Engineered a real-time Tagalog-to-Cebuano voice translation pipeline integrating Vosk for speech recognition, Gemini API, and Microsoft Edge TTS.

Education

HOLY ANGEL UNIVERSITY (COLLEGE) — Angeles City, PHL
Bachelor of Science Computer Engineering — Graduation April 2026
Dean's Lister, President's Lister

HILLCREST HEIGHTS INSTITUTE (SENIOR HIGH SCHOOL) — Magalang, Pampanga, PHL
Science Technology Engineering and Mathematics
Graduated with High Honors — Graduated March 2022

Certifications

- Microsoft Azure: AI 900
- Datacamp | Data Analyst Associate
- Datacamp | SQL Associate
- Lean Six Sigma Yellow Belt
- IBM | AI Fundamentals
- Data Engineering Associate

Steven Nash Maglaqui

Steven Nash Y. Maglaqui

nashmaglaqui9@gmail.com | github.com/nashmglq | linkedin.com | Portfolio

Education

Holy Angel University Bachelor of Science in Computer Engineering | Angeles City, PHL | Expected April 2026
Bachelor of Science Computer Engineering

- **Dean’s Lister**: SY 2022–2023 (1st & 2nd Semester), SY 2023–2024 (2nd Semester), SY 2024–2025 (1st Semester)
- **President's Lister**: SY 2025-2026 (1st Semester)
- Participated in **Python Programming Competition** – Regional Institute of Computer Engineering, Philippines

Technical Skills

- **Programming Languages:** TypeScript, JavaScript, Python
- **Backend Development:** Node.js, Express.js, NestJS
- **Frontend Development:** React.js, Next.js, HTML5, CSS3
- **Databases:** MySQL, PostgreSQL, MongoDB
- **DevOps & Tools:** Docker, Git, GitHub, AWS S3
- **UI/UX & Styling:** Figma, Tailwind CSS, Bootstrap
- **Generative AI: LLM** Context Engineering, Prompt Optimization (Gemini, ChatGPT)

Projects

O’Key-Ask: Enhancing Written Assessment Efficiency for Schools and Universities Through AI (Thesis)

- Engineered an AI-powered exam generation and grading system using Raspberry Pi, OpenCV, and Gemini API, automating TOS creation, OMR grading, item analysis, and MPS/COAR generation
- Reduced total assessment cycle time by **97.8%**, cutting processing time from **10.5 hours to 12.5 minutes**
- Achieved **96–97% efficiency** gains across individual phases including TOS creation, exam generation, and paper grading

Budge-It Buddy — Lead Developer | BPI DataWave Hackathon

- Led a **4-person** team to build a full-stack AI budgeting app in **1 day** among **1,000+ student participants** nationwide
- Architected backend and Gemini AI integration to analyze user financial data and deliver personalized spending insights

Experience

System Sense Corp. (Japan) — Lead Backend Developer Intern | Nov 2025 – Dec 2025 | Remote

- **Led 2** fellow interns, conducting PR reviews and providing guidance on Git version control workflows
- Engineered backend APIs achieving **sub-500ms** response times through optimized query design and efficient data retrieval
- Containerized application with **Docker**, enabling supervisors to spin up the environment instantly without manual setup

IT Squarehub — Full Stack Developer Intern | Dec 2025 – Feb 2026 | Remote

- Refactored a core internal project by consolidating **600+ lines** of redundant code into reusable components and services, improving maintainability across the codebase
- Built an internal ID card generator replacing manual editing, reducing generation time from **2–5 minutes to seconds** per employee, deployed company-wide
- Integrated AWS S3 with pre-signed URLs across **3 projects** for secure image and PDF file handling, replacing ad-hoc file management

Certifications

- **FreeCodeCamp | Javascript Algorithm and Data Structures**
- **DataCamp | GitHub Foundations**
- **DataCamp | AI Fundamentals**

Josh Mark Escaño

JOSH MARK F. ESCAÑO

Network-focused with experience in network configuration, ensuring seamless connectivity and optimal performance. Eager to expand my knowledge and skills in networking, with a strong interest in exploring new technologies and challenges to enhance network reliability and efficiency.

CONTACT

- 0955-405-4146
- joshmarkescano@gmail.com
- www.linkedin.com/in/escanojoshmark
- San Francisco, Magalang, Pampanga

EDUCATION

2022 - Present
HOLY ANGEL UNIVERSITY

- BS in Computer Engineering

SOFT SKILLS

- Collaboration
- Adaptability
- Time Management
- Critical Thinking
- Attention to Detail
- Strategic Communication

TECHNICAL SKILLS

- Basic Linux CLI
- Subnetting & IP Addressing
- EVE-NG
- Cisco Packet Tracer
- Basic Network Troubleshooting
- Github

EXPERIENCE

(Cisco) Capture the Flag, NetAcad Riders 2025

A virtual competition designed to challenge networking students on CCNA-aligned topics through timed online assessments. Applied technical knowledge in areas such as routing, switching, subnetting, and network troubleshooting under pressure.

Clark International Airport Corporation (Internship)
2025 Nov to 2026 Feb

As a Management Information System Intern at Clark International Airport Coporation (CIAC), I supported IT operations by handling network cabling projects accross multiple departments, troubleshooting user devices, and assisting with network patching.

CERTIFICATES

- Cisco IT Essentials: PC Hardware and Software
- CCNAv7: Introduction to Networks
- CCNAv7: Switching, Routing, and Wireless Essentials
- CCNAv7: Enterprise Networking, Security, and Automation