AI-Powered E-learning System: Streamlining Content Delivery, Online Examination, and Grade Management for the Training Centers of Philippine Army

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Executive Summary

The AI-Powered E-Learning System is a robust software solution designed to enhance the training programs of the Philippine Army. This documentation provides a comprehensive overview of the system's architecture, design, and functionality, aimed at guiding developers, system administrators, and end-users in effectively utilizing and maintaining the software. It offers key features such as content delivery which is AI-enhanced, online examinations, and lastly, grade management all within a user-friendly interface. Developed using Next.js, Node.js, and Prisma, the system follows a modular architecture that supports easy updates and scalability. This documentation will serve as a living document, evolving alongside the system to ensure continued operational efficiency and growth.

1. Introduction

The ever-evolving landscape of technology demands software solutions that are not only powerful but also adaptable to specific user needs. Several advantages have been evident in utilizing technology such as ease of access to a system due to the internet, improved data storage management with the use of databases, boosts productivity and efficiency by automating tasks thus reducing errors, and lastly, it supports flexibility that can cut operational expenses [1].

1.1 Project Context

The client for this project was the Philippine Army, the oldest branch of the Armed Forces of the Philippines, which has played a key role in protecting Filipinos and contributing to nation-building [2]. Additionally, the Philippine Army operates multiple schools with training centers located across various regions in the Philippines.

Throughout the project's duration, the development team maintained consistent and open communication with the client to ensure that all requirements and expectations were aligned with their goals.

The project was initiated for two reasons. First is to provide a solution to the current problems faced by the client with a focus on enhancing their capabilities and effectiveness in fulfilling their vital duties. Second, is to ensure the development team gains the necessary knowledge and skills through Project-Based Learning (PBL) to complete their bachelor's degrees.

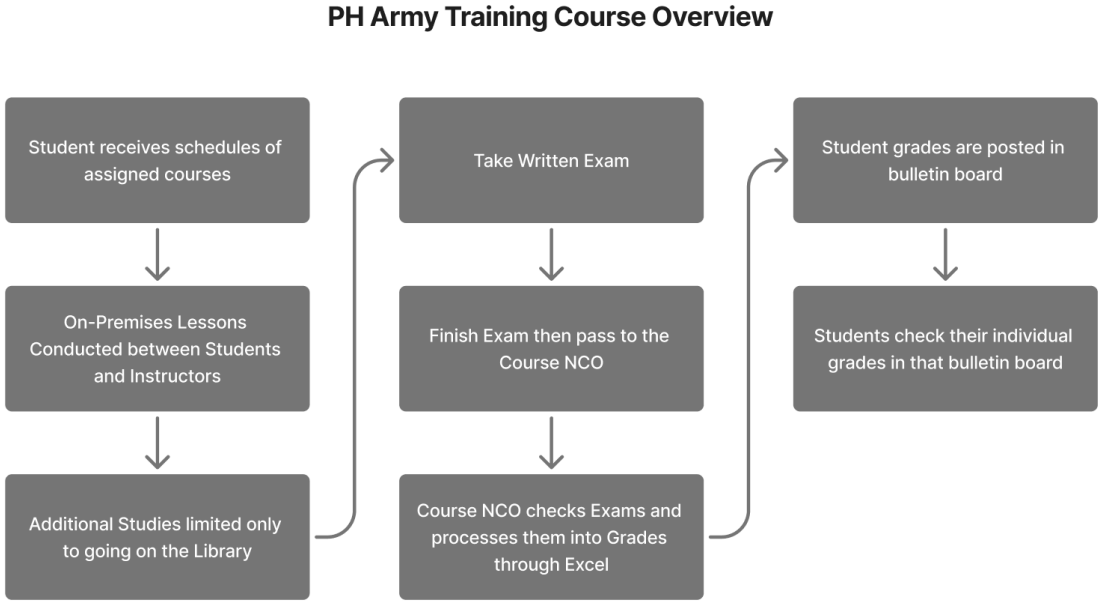

Fig. 1 Training course overview of Philippine Army in their training camps

Currently, the Philippine Army's training program is still heavily reliant on manual processes as shown in Figure 1. From students' tackling assigned courses limited to attending live sessions and self-studies to taking written exams and going to check their posted grades.

This setup leads to some difficulty managing the training program. The lack of innovation sets back their efficiency and heavily slows their pace in today's tech-driven world.

To address the problem that the Philippine Army is currently facing, the proposed AI-Powered E-Learning System will serve as a solution. This aims to digitize certain processes so that the organization can enhance their operational efficiency.

1.2 Statement of the Problem

The reliance on paper-based processes results in time-consuming tasks, increased risk of errors, and difficulty in tracking and managing student profiles [3]. The Philippine Army still does their processes in a traditional way.

The project developers have identified several concerns that need to be addressed:

1. **Instructors and students face challenges in addressing learning gaps during live classroom discussions:** The academic calendar restricts students' opportunities to fully grasp complex topics during live discussions, resulting in gaps in their understanding. Instructors face challenges in rediscussing content to address student queries who did not fully understand the lesson.

2. **Inability of students to immediately track their progress hinders their learning:** Students experience delays in receiving feedback on their grades from multiple-choice exams. This is due to the time-consuming process of manually checking the exams.

3. **Students encounters challenges in accessing Learning Resources:** Currently, the students' access to their learning resources are limited to class sessions or conversations with their instructor. This approach leads to ineffective learning, reduced study time, and a missed chance of utilizing learning materials.

4. **Instructors faces challenges in correcting grade input mistakes:** Manual data entry is prone to mistakes, especially when dealing with large volumes of student data or grades which can lead to inaccurate grades being recorded that can have negative consequences for students.

1.3 Objectives

In response to the problems, the primary goal of developing this e-learning platform is to digitize some of the process for the training programs of Philippine Army. Thus, enhancing the organization's operational efficiency [4]. To achieve this, the developers aim to:

1. Allow student to access the lesson content at their own pace and within the allotted academic timeframe by providing pre-recorded lessons and course materials such as PDFs or videos.

2. Improve transparency and offer timely grade feedback to students by implementing automated grading for online exams with multiple-choice questions.

3. Allow students to access all necessary educational resources outside of class by creating a Centralized Learning Materials Repository that ensures utilization of learning materials.

4. Reduce errors in grades by eliminating human intervention for checking of the multiple-choice exams.

1.4 Significance of the Project

Self-paced learning is acknowledged by educational policies and agencies for its ability to enhance individuals' awareness, skills, and efficiency. It allows students to pursue their education while simultaneously achieving their personal goals and maintaining their jobs, without being confined to a strict schedule [5]. This project will benefit the following:

Students of the Philippine Army. The students of the Philippine Army will benefit from this project as they will have a system where they will have access to the course materials such as pre-recorded lectures and PDFs. With the system, they can now study whenever they are, which allows more flexibility and efficient learning.

Instructors of the Philippine Army. Instructors of the Philippine Army will greatly benefit from the system as it will ease their teaching duties by offering pre-recorded lectures and without frequent assistance.

Course NCO of the Philippine Army. Course NCOs will benefit from this project since they will have a system that can automate the assessment and calculation of multiple choice answered exams.

In alignment with the SDG, this project matches Goal 4 which is Quality Education. By creating a new e-learning platform for the Philippine Army, the developers are helping to make sure everyone gets a good education by providing them with utmost flexibility to learn at their own pace.

1.5 Scope and Limitations

The core features of the e-learning system consist of registration, content delivery, online examination, and grade management. All these mentioned features will be integrated into the system, any elements beyond this scope will not be included in the project. In addition, the developers are not involved in implementing the hardware.

The project will be developed over the course of about one year, from March 2024 to March 2025. Since the developers are college students, their progress will be intermittent due to their academic schedule. The development period includes a one-month year-end break and a two-week semester break.

Additionally, the developers had difficulties collaborating with the client as their organization is being restrictive in online communication. As for the on-premises meetings, the client had to travel from Tarlac to Makati City which was time-consuming and logistically challenging mostly if it's weekdays because of traffic.

Furthermore, the developers faced a communication bottleneck. They were only able to interact with a single point of contact within the organization which is their representative. With the nature of the client's organization, the developers had a hard time interacting with other people inside the organization to gather information.

2. Review of Related Literature / Systems

In today's educational landscape, technology integration has become synonymous with progress, shaping how students and instructors engage with learning materials. This literature review delves into various perspectives on Digital Tools implementation, exploring their multifaceted impact from student and instructor viewpoints. It aims to analyze insights from students, instructors, and researchers to elucidate the diverse benefits and challenges associated with Digital Tools such as Pre-recorded Video Lectures, Online Exams, and Centralized Learning Materials Repository. Additionally, it investigates emerging trends in educational technology, including the deployment of AI-powered chatbots, the integration of video media, and the automation of student registration processes.

2.1 Student's Perspective on Integration of Digital Tools

The integration of digital tools in education has revolutionized the learning experience, offering flexibility, efficiency, and improved engagement. This discussion explores the impact of pre-recorded video lectures, online exams, and actionable feedback on modern education.

Pre-recorded Video Lectures

Pre-recorded video lectures (PRVLs) are a common and effective method for delivering course content, wherein instructors record lectures and share them digitally with students, simulating a traditional classroom experience online. This method offers significant flexibility, especially for students juggling work, studies, and other commitments [6]. Additionally, in [7] focusing on grade 11 mathematics students, the use of PRVLs combined

with home tutorial sessions significantly improved academic performance, underscoring the necessity of teacher assistance in self-learning modules. In [8], more than 70% of students found PRVLs effective for understanding the subject matter, and over 60% felt the content was sufficient. Additionally, 70% appreciated the flexibility of PRVLs, which helped them manage their time and provided an experience comparable to face-to-face classes. However, about 50% noted a lack of interaction and missed opportunities for asking questions and receiving feedback. Learners viewed PRVLs positively, finding them beneficial for concept comprehension and memorization. Students were satisfied with the audio-visual quality and primarily accessed the lectures via mobile phones, highlighting the convenience and accessibility of this learning method [8].

Online Exams

A study on online exams in higher education in Palestine revealed that 77% of respondents found online exams more efficient than paper-based ones in terms of time, effort, and cost. The automation of processes like printing, grading, and result analysis reduces staff workload, particularly for large classes. However, challenges related to fairness, validity, and security remain. To ensure the effectiveness of online exams, they should be designed to be reliable, secure, and flexible, promoting learning and aligning with intended learning outcomes [9].

Feedback

A study by Dawson et al. [10] found that students considered actionable feedback highly effective. The most valued aspect of feedback was clear communication on what needed improvement, whether in their work, understanding, or learning strategies. The study emphasized that feedback should be viewed as a process aimed at improvement, designed by educators and undertaken by learners. Despite this, there remains a common belief among students and staff that feedback primarily involves providing comments that should lead to improvement, often without clear guidance.

Overall, these tools enhance flexibility, efficiency, and engagement, but also present challenges such as ensuring interaction, fairness, and effective communication. By addressing these challenges, educational institutions can fully harness the potential of digital tools to improve learning outcomes.

2.2 Instructor’s Perspective on Integration of Digital Tools

Pre-recorded Video Lectures

Affouneh and Raba [11] conducted a study to understand academic staff's perspectives on online lecture recordings, which offer students flexible, anytime-anywhere access to course material. This approach can particularly benefit students who face difficulties such as navigating checkpoints, allowing them to listen to lectures even in transit. Despite a limited number of faculty currently recording their lectures, the researchers strongly advocate for more staff to adopt this practice. They see recorded lectures as a valuable resource that can help ensure all Palestinian students receive quality education despite the constraints imposed by the Israeli occupation.

Online Exams

According to a study [9], academic staff require both time and specialized skills to effectively prepare quality questions, provide feedback, and manage exams in digital formats. Transitioning from traditional paper-based methods to digital pedagogy and learning is essential for leveraging online technology to alleviate staff workload, though this process is initially time-consuming and expensive. Furthermore, enhancing the efficiency of online exams necessitates training staff in developing adaptive test questions.

Feedback

The study [12] presents varied findings on the effectiveness of extensive feedback on assignments. It suggests that instructors should consider their goals when deciding how much feedback to provide. If the priority is to maintain positive student perception and rapport, and to avoid students feeling overly satisfied with their performance, a smaller amount of feedback or fewer comments may be preferable. This approach can foster a perception of fairness and increase student receptiveness to feedback. Limiting the amount of feedback given could enhance student satisfaction and their perception that their performance reflects their own effort. Since learning involves practice and repetition, focusing on prioritized feedback on each assignment might be appropriate. By doing so, instructors can ensure that feedback is well-received and effective, potentially reinforcing learning over subsequent assignments and courses as needed.

Centralized Learning Materials Repository

In [13] Lecturers in Saudi universities urgently need e-learning materials available in repositories to enhance their teaching processes. Essential materials include open-source content, flash files, and videos, while items like templates and dynamic maps are of moderate importance. Additionally, lecturers seek various repository functionalities, such as connecting similar subject materials, tagging for easy recall, and linking to external resources. However, the ability for teaching staff to evaluate others' materials is not considered crucial, as it is not a central aspect of the teaching process.

Incorporating digital innovations like pre-recorded video lectures, online exams, and effective feedback strategies presents both opportunities and challenges in modern education. These tools offer flexibility, accessibility, and efficiency, benefiting students and educators alike. However, their successful implementation requires careful consideration of instructional design, training, and student engagement.

Implementation of AI Chatbot

Most of the websites have frequently asked questions but many people are not interested in reading, chatbots are a good alternative to respond to any of the user’s inquiries or questions interactively and you can use chatbots anytime. The researchers, build an AI-powered chatbot using the Google Dialogflow platform for middle and high school cybersecurity camps. Selected questions were integrated into the chatbot, and relevant responses were created. During the initial evaluation of the chatbot, they gained positive feedback from the users. Such as the interface being user-friendly 89.6% agreed, 79.5% agreed that the chatbot

is easy to use, and 89.7% thought that the chatbot was helpful in terms of answering questions that are related to the camp or cybersecurity. To sum it up, 82.8% of the students were satisfied using the chatbot. In our opinion, chatbots can be more helpful than Q&A agents, and with additional development, they can become advanced virtual assistants that benefit both educators and students [14].

The rise of chatbots is rapidly transforming various industries, including higher education. Baah et al. [15] investigated the effectiveness of a chatbot by using a pretest-posttest design to compare it with traditional teacher interaction. Their findings suggest that students who are using chatbots achieved better academic performance compared to students who interacted with the instructor. This study shows that the implication of chatbots can be beneficial to improve student engagement and academic outcomes.

In conclusion, the deployment of AI-powered chatbots in educational settings, such as middle and high school cybersecurity camps, demonstrates significant potential for enhancing user engagement and satisfaction. The positive feedback and high satisfaction rates from initial evaluations underscore the chatbot's effectiveness in providing accessible, user-friendly, and helpful interactions.

3. Current Systems

3.1 Current System

Upon receiving the assigned course, students are required to attend their courses and face several problems. First, being limited to attending live sessions taught by instructors and conducting personal research by going to the library as their only means of learning makes it difficult for students that need more time to process the information provided. Second, the same matter also leads to the instructor having to repeatedly teach specific topics that other students are struggling with.

Furthermore, instructors lack a system where they can analyze each student’s progress, identifying areas where students struggle to evaluate overall learning effectiveness. The lack of observation of learning effectiveness makes it impossible to change the curriculum to help students excel.

Lastly, their grade distribution system is very outdated. At the end of their training, students are to take written exams and pass them onto the Course NCO that will provide their grade for the course. The Course NCO then starts processing the grades by manually inputting students’ records and calculate their grades in Microsoft Excel. After that, the Course NCO will then print out the documents with the students’ names with their grades on it and post it on a bulletin board for the students to check. This method adds heavily to the workload and causes delays in receiving current information.

In conclusion, the training program’s current processes hinder efficient administration and education. Students face challenges in accessing their course materials and information. Instructors lack tools to monitor student progress and adapt the curriculum, and the absence

of a centralized repository for resources complicates studies. Additionally, their grade distribution system increases workload significantly and delays information dissemination.

3.2 Technical Background

This section of the paper explores existing technologies that can be directly applied for the system that is proposed. Utilizing these readily available tools offers two key benefits. First, it can significantly reduce costs by avoiding the need for expensive custom-built components. Second, existing technologies often have established resources and support, which can streamline the implementation process.

Excel has been utilized by course NCOs in the current process of grades distribution. To be specific, after conducting the academic or physical exams, they input the grades of individual students inside the software. After that, the grades will be automatically computed with the help of the templates that organization is using.

Regarding the hardware, the library provided computers for student use. These desktops were freely available, allowing students to access them anytime during the working hours. In addition to that, most students have their own smartphones, and some students also have their own laptops that they bring to the training camps.

In addition to their existing infrastructure, their training camps also incorporated a network of Starlink satellites. These devices provide internet access to remote and underserved locations.

3.3 List of Processes

Though the established processes have laid the groundwork, there remains potential for further optimization. This section will identify specific areas within the current workflow that could benefit from improvement. By analyzing these inefficiencies and proposing potential solutions, the overall effectiveness and efficiency can be enhanced. Table 1 contains the list of current processes being performed by the Philippine Army.

Table 1 List of Processes

Process ID	Process Name	Process Details
P001	Traditional teaching methods	Figure 2
P002	Paper based academic exams	Figure 3
P003	Processing grades of students	Figure 4
P004	Traditional researching methods	Figure 5

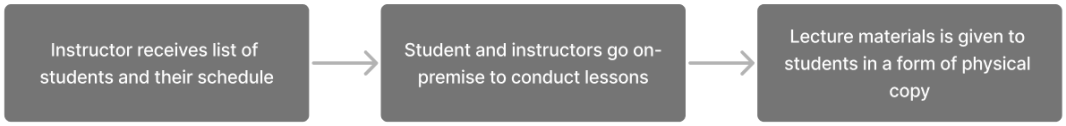

Fig. 2 Traditional teaching methods

Figure 2 describes the process of traditional teaching methods. The client faces a challenge in balancing the comprehensiveness of their training program with a shorter timeframe. The thing that is hindering them is that they need to conduct all the lectures on-premises.

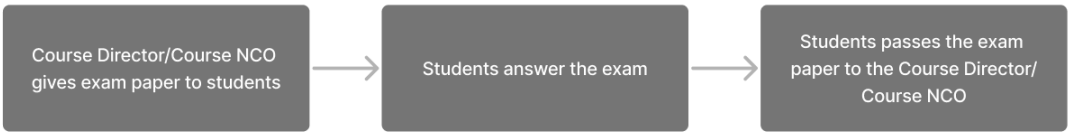

Fig. 3 Conducting academic exams

Figure 3 describes the process of conducting paper based academic exams. The client faces a challenge in manually checking the papers of the students. It takes a considerable amount of time mostly if there are a lot of students registered in a certain subject.

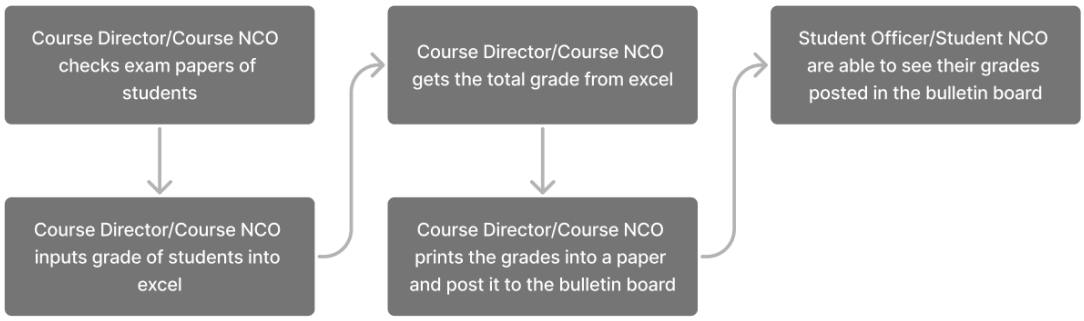

Fig. 4 Processing grades of students

Figure 4 describes the process of processing the grades of students. The client relies on paper handouts to deliver student grades. This can be cumbersome for both instructors and students. Instructors spend extra time printing and distributing papers, and there's always a risk of losing or misplacing physical copies. Students might not have immediate access to their grades, making it harder to track their progress or ask questions.

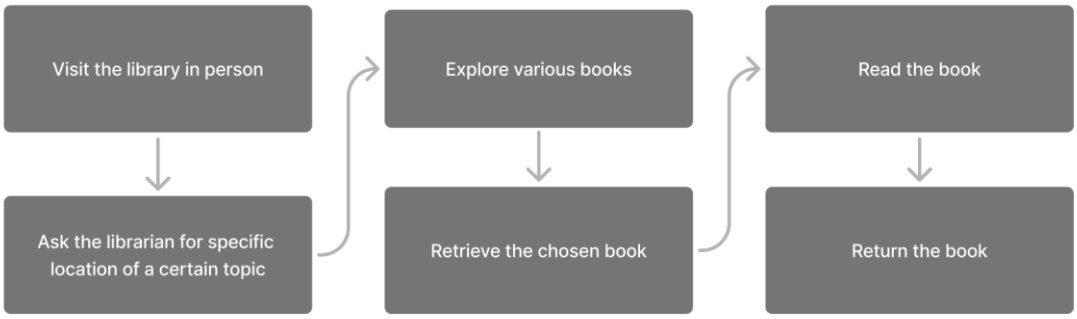

Fig. 5 Traditional researching methods

Figure 5 describes the process of researching in traditional method. Availability of the books in library can only be acquired by visiting the library in person. This makes it inconvenient for students to do researching because it requires time and effort to do so.

3.4 Gap Analysis

3.4.1 Fishbone Diagram

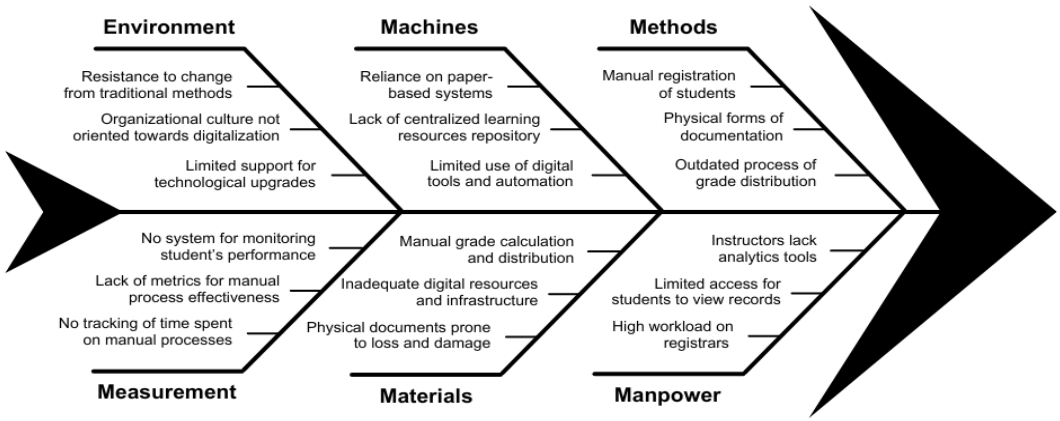

Fig. 6 Fishbone diagram for Philippine Army training centers

The current environment faces significant challenges in adopting new technologies due to resistance to change and a culture not oriented towards digitalization. This is compounded by limited support for technological upgrades. The reliance on paper-based systems leads to

inefficiencies, with physical documents being time-consuming and prone to loss and damage. There is also a lack of centralized digital resources and insufficient use of automation.

Addressing these issues across environment, machines, methods, measurement, materials, and manpower is essential to transition from manual to digital processes, improving efficiency, accuracy, and user satisfaction.

3.4.2 Gap Analysis

Table 2 Gap Analysis

Current State	Desired State	Impact
P001	Implement a self-paced learning PRL platform	Reduction to the number of weeks of a training period and adds flexibility to the students
P002	Digitalize the academic exams through online forms	Checking of academic exams will be automated and errors in checking are reduced
P003	Centralize the processing of grades of students	Reduce costs for printing and students will be able to see their grades anytime if they have internet
P004	Implement a centralized repository platform for learning resources for all courses	Increase accessibility of learning materials so students can effortlessly research topics

P001

The client wanted to shorten the time span of every training period. Unfortunately, they lack the necessary technical resources to do so since they still rely on the on-premises lectures. In response to that situation, implementing a self-paced learning that is conducted online will be the solution. Students will now have the flexibility to take the module whenever and wherever they wanted to.

P002

As manually checking papers costs a considerable amount of time for the Course Director/Course NCO, the client wanted to find a way to automate this process. With the digitalization of conducting the academic exams, it checks the answers of students automatically. Thus, having a reduced time and error for doing this task.

P003

The way the client handles the process of computing grades was inefficient. They use excel to compute but still prints the results into a physical copy then displays it to a bulletin board.

Having a centralized process to do all of this will improve the efficiency of the process. There will be a no need for having an additional cost with printing. Also, students can view their grades anytime or anywhere if they have access to internet connections.

P004

As students' capabilities to acquire learning resources are limited to visiting the libraries, they face constraints in accessing a variety of materials. This limitation can hinder their research efforts because finding the right book for them will take hours of exploring various books in the shelves.

4. Proposed Solution

4.1 Lean Canvas

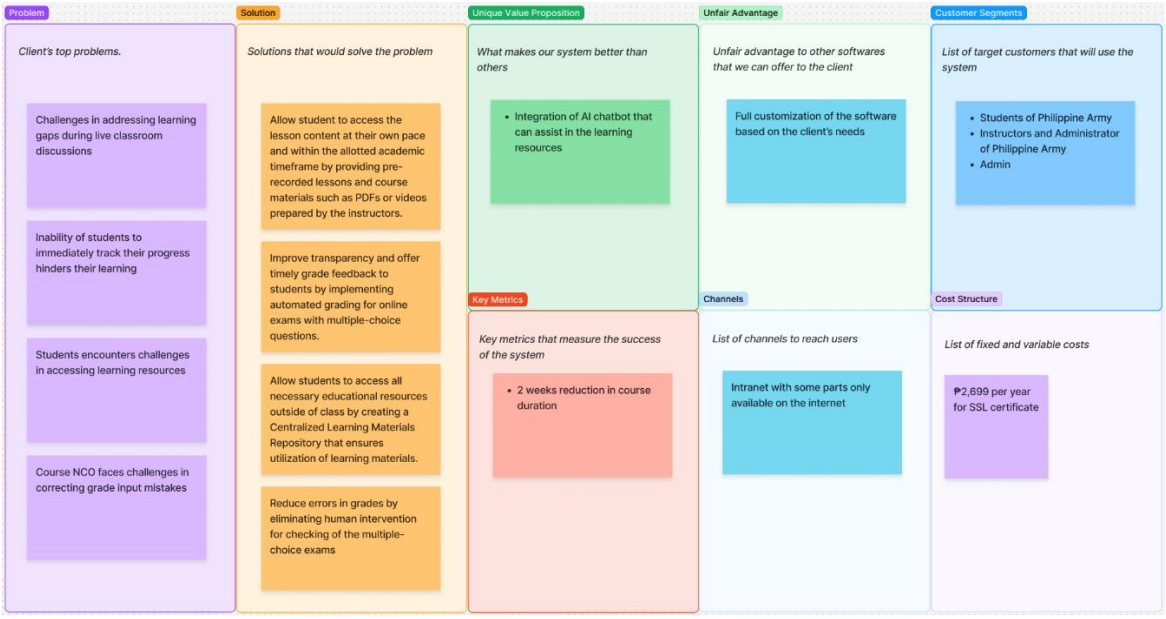

Fig. 7 Lean canvas for AI-Powered E-learning System

This project streamlines the training program of the Philippine Army. Unique features include an AI chatbot for learning support with full customization to fit specific needs. The developers connect with users through intranet with some parts of it only available to the internet. Key benefits include course duration reduction. This system enhances efficiency and improves the overall training experience for the Philippine Army.

4.2 Product Vision

Atlas is an E-learning platform designed specifically for the training camps of the Philippine Army. It addresses the challenges of outdated methods for processes by providing a website application for digital learning environment and process automation. Unlike generic school-focused applications, this product provides an AI assistant designed for learning, with customized features tailored to the specific needs of military training environments.

4.3 Technology Specification

Developers will employ a range of technologies to build robust solutions for the proposed project. These include operating systems, version control systems, design tools, programming languages, and database management systems. Each technology serves a crucial role in ensuring the project's success by providing stability, collaboration support, design capabilities, interactivity, and data management functionalities.

Git: A version control system that efficiently tracks changes in computer files and code. It keeps a record of every modification made, allowing to revert to previous versions if needed. This is particularly valuable for this project, where multiple people will be working on the same files. Git ensures everyone is on the same page and facilitates smooth coordination.

Figma: In using Figma, individuals have the capability to craft prototype designs for websites or mobile applications. Through this platform, users can specify interactions such as button clicks, swipes, and scrolling functionalities. Additionally, Figma enables the sharing of prototypes with collaborators, facilitating feedback gathering. In this particular project, Figma serves as the primary tool for developing the prototype.

JavaScript: In the world of web development, HTML and CSS come together to create a user's experience. HTML serves as the foundation, laying out the content and structure of the web page. CSS takes over from there, applying visual styles to bring the page to life. JavaScript enters the scene to add a layer of interactivity. It can sort or filter data lists, and even enable live updates, all to keep users engaged and foster a dynamic experience.

SQL: Stands as a widely recognized language tailored for managing databases. Employing SQL within the web application framework enables the retrieval, manipulation, and administration of data. This utilization ensures seamless accessibility of essential data, thereby contributing to an optimal user experience within the web application.

4.4 Feasibility Study

In the world of software development, there's a crucial step which is a feasibility study. This study acts as an assessment to determine if the software you envision is actually practical to create.

A feasibility study would involve dissecting this idea from various angles to see if it's truly achievable. By taking the time for this study upfront, wasted efforts and resources will be avoided. This allows the developers to adjust course if needed, ensuring they’re on the right track before significant development begins

4.4.1 Operational

The proposed software was fully supported by the Philippine Army. Its impact will be significant to the organization as it boosts the productivity and job satisfaction by reducing work hours and streamlining operations. In regard to addressing varying technological literacy, steps are implemented to solve this problem. This fosters an inclusive environment and promotes a culture of continuous learning, crucial for the software's long-term success within the organization.

This support from the people inside the organization is crucial as it ensures a smooth implementation process and guarantees that the necessary resources and infrastructure will be available for successful deployment. The commitment from the Army's leadership highlights the perceived value and potential impact of the software, reinforcing the motivation of all involved parties to see it succeed.

One of the significant advantages of the software is its ability to reduce the hours of work time required for various tasks. This efficiency gain means that personnel can redirect their attention and energy toward other important duties and activities that contribute to their personal and professional development. By streamlining processes and minimizing time spent on routine tasks, the software enhances overall productivity and job satisfaction.

However, despite these advantages, there is a notable challenge: not all users are tech-savvy. This technological literacy gap can hinder the effective use of the software among some students. To address this issue, each unit includes an information officer whose role is to assist and guide their peers in navigating and utilizing the system. These officers are trained to provide support, ensuring that all users, regardless of their initial skill level, can effectively engage with the software. This support structure is essential in fostering an inclusive and supportive environment where everyone can benefit from the technological advancements offered by the software.

Moreover, continuous training and development programs are planned to keep all users updated on new features and best practices, ensuring that the entire team remains proficient and confident in using the new system. This approach not only mitigates the initial setbacks but also promotes a culture of continuous learning and adaptation, which is vital for the long-term success and sustainability of the software within the organization.

4.4.2 Economic

The proposed software promises substantial economic benefits for the organization, impacting multiple facets from productivity enhancement to cost reduction. One of the primary advantages is its ability to streamline operations, leading to a significant increase in overall productivity. By automating routine tasks and facilitating more efficient workflows, the software enables personnel to focus on higher-value activities that drive the core mission of the organization. This shift not only improves the effectiveness of operations but also fosters a more engaged and motivated workforce.

In terms of cost reduction, the software is designed to minimize expenses associated with manual processes and administrative overhead. For instance, by reducing the reliance on paper-based systems and the associated costs of printing, storage, and distribution, the organization can realize immediate financial savings. Additionally, the automation of data entry and management reduces the likelihood of errors, which can be costly to correct and may lead to further financial implications.

Moreover, the software’s ability to provide real-time data and analytics supports more informed decision-making. By having access to accurate and up-to-date information, leaders can make strategic decisions that enhance operational efficiency and financial performance.

This data-driven approach ensures that investments are made in areas that yield the highest returns, further strengthening the organization’s economic position.

Furthermore, the software's scalability allows for future growth without proportional increases in cost. As the organization expands, the system can accommodate additional users and functionalities without the need for significant additional investments. This scalability ensures that the initial investment in the software continues to deliver value over time, supporting the organization’s evolving needs and objectives.

4.4.3 Technical

The technical feasibility of the proposed software is promising, given the resources and flexibility provided by the client. The client has committed to covering the costs associated with the development and implementation of the software such as the servers and cloud computing subscriptions, provided that these costs are justifiable and aligned with the expected benefits. This financial support ensures that the project has the necessary funding to secure high-quality development tools, skilled personnel, and robust infrastructure, all of which are critical for the successful delivery of the software.

The system is designed to accommodate an estimated number of 5,000 users per training period. This high volume of users necessitates a robust and scalable architecture capable of handling significant concurrent usage without performance degradation. Ensuring that the system can support this user load involves rigorous testing and optimization of the software's backend infrastructure, including server capacity, database management, and network bandwidth. The development team will employ best practices in software engineering to build a scalable system that can efficiently manage user authentication, data processing, and real-time interactions.

Additionally, user training and support mechanisms will be put in place to ensure a smooth onboarding process for all users. Given the large number of users, comprehensive training materials, including user manuals, video tutorials, and interactive workshops, will be developed to facilitate easy adoption of the software. Ongoing technical support will also be available to address any issues that arise and to assist users in maximizing the software's potential.

The development team will leverage modern technologies and JavaScript frameworks to ensure that the software is not only functional but also secure and reliable. Security measures, such as encryption, secure access controls, and regular security audits, will be implemented to protect sensitive data and maintain user privacy. Reliability will be ensured through continuous integration and deployment practices, automated testing, and robust error handling mechanisms.

5. Requirements Analysis

5.1 User Stories

Table 3 User stories for AI-Powered E-learning System

ID	As a...	I aim to...	So that...
001	Admin	Register users	I can grant them access to the system
002	Admin	Create courses	I can group related contents
003	Instructor	Upload learning materials	Students can access the necessary resources for their studies
004	Student	Access learning materials	I can learn and complete my coursework
005	Admin	Create online exam	Students can be assessed on their knowledge and skills
006	Student	Take online exam	I can complete my assessments and progress in the course
007	Instructor	Check essay part of the exam	I can provide detailed feedback and grades to students
008	Instructor	Upload grades from practical exam	Students can see their results and understand their performance
009	Student	View grades	I can know my performance in the course

5.2 Fully Dressed Use Cases and Diagram

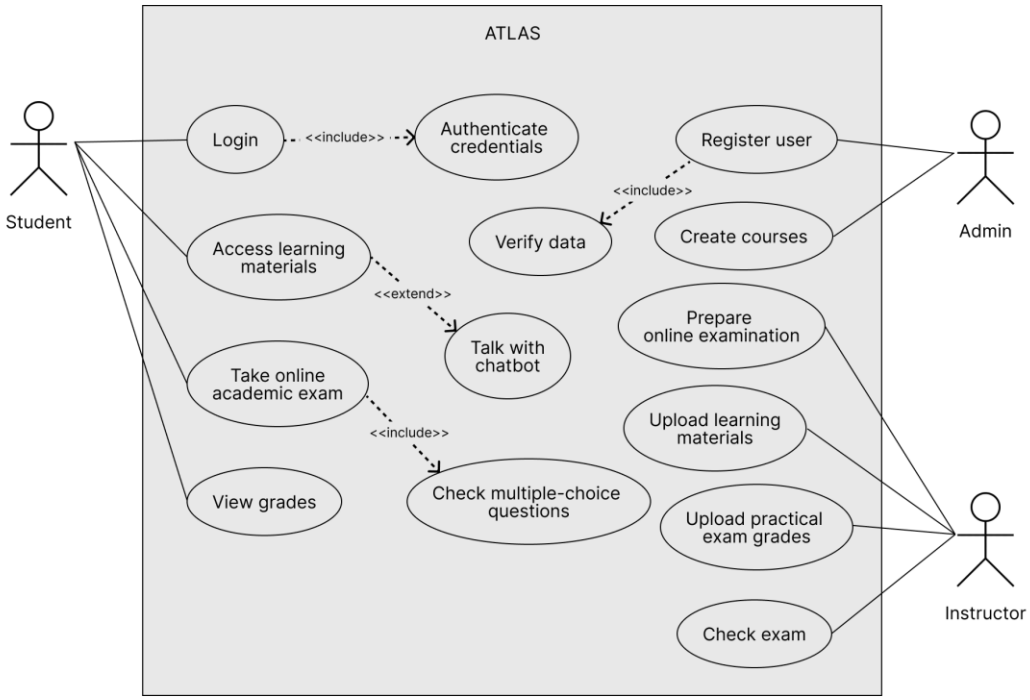

Fig. 8 Use Case Diagram

The above use case diagram illustrates the key interactions within ATLAS, an AI-powered e-learning system designed exclusively for the Philippine Army training centers. The diagram highlights three primary actors: the Student, the Instructor, and the Admin. This diagram provides a clear overview of how each user role interacts with the system, ensuring a comprehensive understanding of the system's functionality and supporting the training objectives of the Philippine Army.

ID	UC1
Name	Create course catalog
Created By	Jason
Date Created	9/7/2024
Primary Actor	Admin
Stakeholders and Interests	Admin - Wants to create courses for the training program.
Preconditions	• Admin is logged into the system.
Success Guarantee	• Course catalog is created.
Main Success Scenario	1. Admin opens a new form to create an AFOS. 2. Admin enters AFOS details.

	3. Admin submits form. 4. System saves the AFOS in database. 5. Admin selects the created AFOS. 6. Admin opens a new form to create a module. 7. Admin enters module details. 8. Admin submits form. 9. System saves the module in database. 10. Admin selects the created module. 11. Admin opens a new form to create subjects. 12. Admin enters list of subjects and their details. 13. Admin submits form. 14. System saves the courses in database.
Extensions	3a. Duplicate AFOS entered: 1. System detects error. 2. System will display the duplication error. 8a. Duplicate module entered: 1. System detects error. 2. System will display the duplication error. 13a. Duplicate course entered: 1. System detects error. 2. System will display the duplication error.
Special Requirements	• All data of content must be encrypted both in transit and at rest.

ID	UC2
Name	Sign up the student
Created By	Jason
Date Created	9/7/2024
Primary Actor	Admin
Stakeholders and Interests	Admin – Wants to register the students into the system.
Preconditions	• Admin is logged into the system. • Courses are created.
Success Guarantee	• Admin successfully registers the users.
Main Success Scenario	1. Admin opens a new form for registration. 2. Admin uploads student information. 3. System performs validation.

	4. System registers the user to the database. 5. System displays success message.
Extensions	2a. Admin wants to manually input data: 1. Admin chooses manual registration. 2. Admin enters student information. 3. Admin submits the form. 2b. Admin wants to automatically extract data from PDF: 1. Admin chooses automated registration. 2. Admin uploads PDF with list of students. 3. System uses OCR to extract data from PDF. 4. Admin reviews extracted data. 5. Admin approves the data. 3a. Data entered not valid: 1. System detects error. 2. System displays corresponding error.
Special Requirements	• All user data must be encrypted both in transit and at rest to protect sensitive information.

ID	UC3
Name	Sign up the instructor
Created By	Jason
Date Created	9/22/2024
Primary Actor	Admin
Stakeholders and Interests	Admin – Wants to register the instructors into the system.
Preconditions	• Admin is logged into the system. • Courses are created.
Success Guarantee	• Admin successfully registers the instructor.
Main Success Scenario	1. Admin opens a new form for registration. 2. Admin selects instructor. 3. Admin enters instructor information. 4. Admin assigns course to the instructor. 5. Admin submits the form. 6. System performs validation. 7. System registers the instructor to the database. 8. System displays success message.
Extensions	6a. Data entered not valid: 1. System detects error. 2. System displays corresponding error. 3. System let user retry their entry.
Special Requirements	• All user data must be encrypted both in transit and at rest to protect sensitive information.

ID	UC4
Name	Login to the system
Created By	Jetter
Date Created	9/7/2024
Primary Actor	Student
Stakeholders and Interests	Student – Wants to interact with the system features.
Preconditions	• Student must be registered in the database.
Success Guarantee	• Student is successfully authenticated and will be redirected to their dashboard.
Main Success Scenario	1. Student opens login form. 2. Student enters credentials. 3. Student submits the form. 4. System verifies credentials. 5. System authenticates the user.

	6. System redirects the user to their respective dashboard.
Extensions	4a. Student enters incorrect credentials: 1. System detects that credentials doesn't match. 2. System displays the corresponding error.
Special Requirements	• All data of content must be encrypted in transit. • Password must adhere to security policies

ID	UC5
Name	Upload course materials
Created By	Jetter
Date Created	9/7/2024
Primary Actor	Instructor
Stakeholders and Interests	Instructor - Wants to upload course materials for its respective course.
Preconditions	• Instructor is logged into the system. • Courses are created. • Instructor is given permission by the admin to manage certain courses. • Instructor is assigned to at least one course
Success Guarantee	• Course materials are uploaded to the permanent storage in server.
Main Success Scenario	1. Instructor opens an existing course. 2. Instructor opens a new form for uploading course material. 3. Instructor enters information and files for the course material. 4. Instructor submits the form. 5. System performs validation. 6. System saves the course material. 7. System displays success message.
Extensions	5a. Instructor uploaded an incompatible file: 1. System detects that file is not recognizable. 2. System displays an error that file format is not supported. 5b. Instructor submitted incomplete information: 1. System detects missing data from the input. 2. System displays an error where the input is empty.
Special Requirements	• All data of content must be encrypted both in transit and at rest. • The system must support specific file formats for course materials.

ID	UC6
Name	Watch PRL videos
Created By	Paul
Date Created	9/7/2024
Primary Actor	Student
Stakeholders and Interests	Student – Wants to watch assigned PRL videos to comply with requirements. Chatbot – Wants to answer the queries of student regarding the video.
Preconditions	• Student is logged into the system. • Course materials are available in the system.
Success Guarantee	• Student watched course videos.
Main Success Scenario	1. Student selects a course. 2. System displays list of PRL videos. 3. Student selects a video. 4. System streams the video. 5. Student watches the video.
Extensions	3a. Video failed to load: 1. System detects the unexpected error. 2. System displays the corresponding error and a refresh page button. 5a. Student wants to talk with chatbot: 1. Student opens the chatbot interface. 2. Student sends a message to chatbot. 3. Chatbot responds to the message of student. 5b. Student finishes watching the video: 1. System marks video as completed when student finishes it. 2. System auto plays next video. 5c. Student doesn't want to auto play the next video: 1. Student toggles the auto play-button inside the video controls. 2. System will stop auto playing videos.
Special Requirements	• All data must be encrypted both in transit and at rest to protect sensitive information. • The system must ensure that the entire video is watched before marking it as "completed." • The system must be able to handle large volumes of concurrent video streams

ID	UC7
Name	Read PDF materials
Created By	Paul
Date Created	9/7/2024
Primary Actor	Student
Stakeholders and Interests	Student – Wants to read additional learning materials to expand knowledge beyond their AFOS. Chatbot – Wants to answer the queries of student regarding the video.
Preconditions	• Student is logged into the system.
Success Guarantee	• Student reads the content of a PDF learning material.
Main Success Scenario	1. Student opens the repository for additional learning resources. 2. System displays list of PDF files. 3. Student selects a PDF. 4. Student reads the content of the PDF.
Extensions	2a. Repository is empty: 1. System displays a message indicating that there is no uploaded PDF at the current moment. 4a. Student wants to talk with chatbot 1. Student opens the chatbot interface. 2. Student sends a message to chatbot. 3. Chatbot responds with the message of student.
Special Requirements	• All data must be encrypted both in transit and at rest to protect sensitive information. • The system must support all standard PDF formats and be able to display PDFs with embedded images, annotations, or interactive elements without rendering issues

ID	UC8
Name	Prepare online examination
Created By	Jason
Date Created	9/7/2024
Primary Actor	Instructor
Stakeholders and Interests	Instructor - Wants to upload the exam and ensure it is accessible to students.
Preconditions	• Instructor is logged into the system. • Instructor is given permission by the admin to create an online exam. • Courses have been created.

Success Guarantee	• Instructor has uploaded the exam. • Schedule of availability has been set for the exam.
Main Success Scenario	1. Instructor selects an existing course. 2. Instructor opens a new form for creating exam. 3. Instructor uploads the exam questions. 4. Instructor uploads answer keys for multiple choice questions. 5. Instructor schedules the exam date and time of availability. 6. Instructor submits the form. 7. System saves the questions, answer keys and the availability of exam.
Extensions	6a. Instructor forgot to fill a field but is required: 1. System detects error. 2. System will display message indicating that fields must not be empty.
Special Requirements	• The system must allow enough characters for essay responses. • Student answers must be saved at client machine regularly. • There must be validation for text inputs to prevent code injections.

ID	UC9
Name	Answer online examination
Created By	Wayne
Date Created	9/7/2024
Primary Actor	Student
Stakeholders and Interests	Student - Wants to take and complete the exam successfully.
Preconditions	• Student is logged into the system. • Exam must be available to take.
Success Guarantee	• Instructor has uploaded the exam. • The student has completed and submitted the exam successfully.
Main Success Scenario	1. Student selects an exam. 2. System displays instructions. 3. Student starts the exam. 4. System starts the timer and displays the questions. 5. Student answers multiple-choice and essay questions. 6. Student clicks next 7. Repeat step 5 to 6 until all questions are answered 8. Student submits their answer. 9. System displays message to confirm submit. 10. System saves the answers to the database. 11. System displays a confirmation message.

Extensions	1a. Exam is not available yet: 1. System disables the start button. 2. System displays that exam is not available to be taken yet. 6a. Student missed a question and forgot to answer: 1. System identifies the empty field. 2. System gives an error indicating that field cannot be empty.
Special Requirements	• The system must allow enough characters for essay responses. • Student answers must be saved at client machine regularly. • There must be validation for text inputs to prevent code injections.

ID	UC10
Name	Check examination
Created By	Jetter
Date Created	9/7/2024
Primary Actor	Instructor
Stakeholders and Interests	Instructor - Wants to grade the essay answered questions in the exam.
Preconditions	• Student has submitted their exam. • Instructor is logged into the system. • Instructor is given permission by the admin to grade the exam of students.
Success Guarantee	• The instructor has graded and provided feedback for the essay-answered questions. • The system has accurately checked the multiple-choice questions. • The system has accurately calculated the total score for the whole exam.
Main Success Scenario	1. System retrieves answers of students. 2. System automatically checks the answers from multiple-choice questions. 3. System gets total score for multiple-choice questions. 4. Instructor reviews essay answers of a student. 5. Instructor inputs grade and feedback to the answer. 6. System computes for total score in essay answered questions. 7. System computes for the total score of the overall exam. 8. System stores the scores in the database. 9. Instructor reviews the given grades and feedback.
Extensions	9a. The correct answer was incorrectly marked. 1. Instructor edits the correct answer for the question. 2. System rechecks the whole questions for multiple-choice.

	9b. Instructor realizes that they incorrectly graded an essay answer. 1. Instructor opens the student's answers. 2. Instructor edits the grade. 3. Instructor submits the changes. 4. System updates the database.
Special Requirements	• The system must allow enough characters for feedback. • There must be validation for text inputs to prevent code injections. • All data must be encrypted both in transit and at rest to protect sensitive information.

ID	UC11
Name	Manage grades
Created By	Wayne
Date Created	9/7/2024
Primary Actor	Instructor
Stakeholders and Interests	Instructor - Must accurately input practical exam grades and approve computed grades. Student - Wants to view their total grade after release.
Preconditions	• Instructor is logged into the system. • Instructor is given permission by the admin to manage grades.
Success Guarantee	• Grades are accurately computed, approved, and released.
Main Success Scenario	1. Instructor selects a course. 2. System displays download button for Excel template. 3. Instructor downloads an Excel template from the system. 4. System displays a list of students enrolled in the selected course. 5. System retrieves the written exam grades for every student. 6. Instructor clicks on upload practical grades. 7. System computes the total grade based on both the written and practical exam grades. 8. System updates the grade records with the computed total grade. 9. System displays computed grades. 10. Instructor reviews the computed grades. 11. Instructor approves the computed grades. 12. System releases the grades.
Extensions	6a. Instructor needs to directly input the student grade: 1. Instructor opens form for uploading practical grades. 2. Instructor selects a student. 3. Instructor inputs the practical exam grades for the student.

	4. Instructor submits the form. 6b. Instructor wants to upload an excel file containing grades of student: 1. Instructor opens form for uploading excel file 2. Instructor uploads list of students and their grade for the subject from an Excel file. 3. System extract data from Excel. 4. Instructor reviews the grades. 5. Instructor submits the grades. 11a. Instructor identifies input error in grades: 1. System displays the grade entry interface for editing current data. 2. Instructor inputs the corrected grade. 3. System updates the database.
Special Requirements	• Only authorized instructors can access and modify grades of students. • All grade-related data, including individual student grades and grade calculations, must be encrypted both in transit and at rest to ensure privacy and data integrity. • The system must ensure accurate grade computations based on predefined grading rubrics, weights, and formulas.

ID	UC12
Name	View grades
Created By	Wayne
Date Created	9/7/2024
Primary Actor	Student
Stakeholders and Interests	Student - Wants to view their grade for subjects and their GWA.
Preconditions	• Student is logged into the system. • Grades has been released
Success Guarantee	• The student can view their final grades.
Main Success Scenario	1. Student opens the grades page. 2. System displays list of their subject grades and the GWA. 3. Student views their grades.
Extensions	1a. Student tries to view their grades, but it is not released yet: 1. System will display a message that grades is not available for viewing yet
Special Requirements	• All grade-related data, including individual student grades and grade calculations, must be encrypted both in transit and at rest to ensure privacy and data integrity.

5.3 User Classes and Characteristics

Table 4 User Classes and Characteristics

Roles	Description
Admin	Possesses excellent organizational skills, ensuring the platform runs smoothly by efficiently managing courses, user accounts, and technical issues. They are highly proficient with digital tools and online learning systems, quickly resolving technical glitches to provide a seamless experience for students and instructors.
Student	Demonstrates a high level of discipline, consistently following the rigorous schedule and structure of the training camp. They maintain focus both in physical drills and academic courses, balancing the mental and physical demands of army training with dedication. They undertake basic or advance training based on the AFOS that they were assigned to by the headquarters.
Instructor	Highly skilled in their subject areas, combining deep expertise with the ability to break down complex topics into understandable lessons. They create content and teach it with creative ways for the students in the training camps. They also ensure that students not only understand but also retain the knowledge they are teaching.

5.4 Prototype

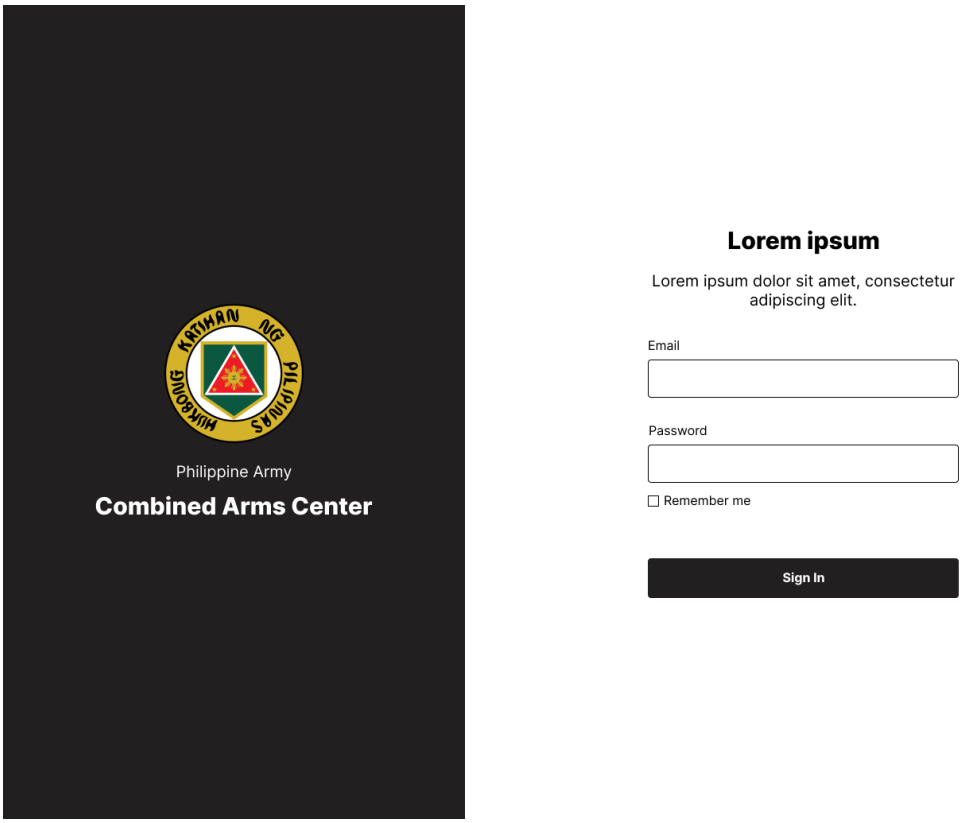

Fig. 9 Login

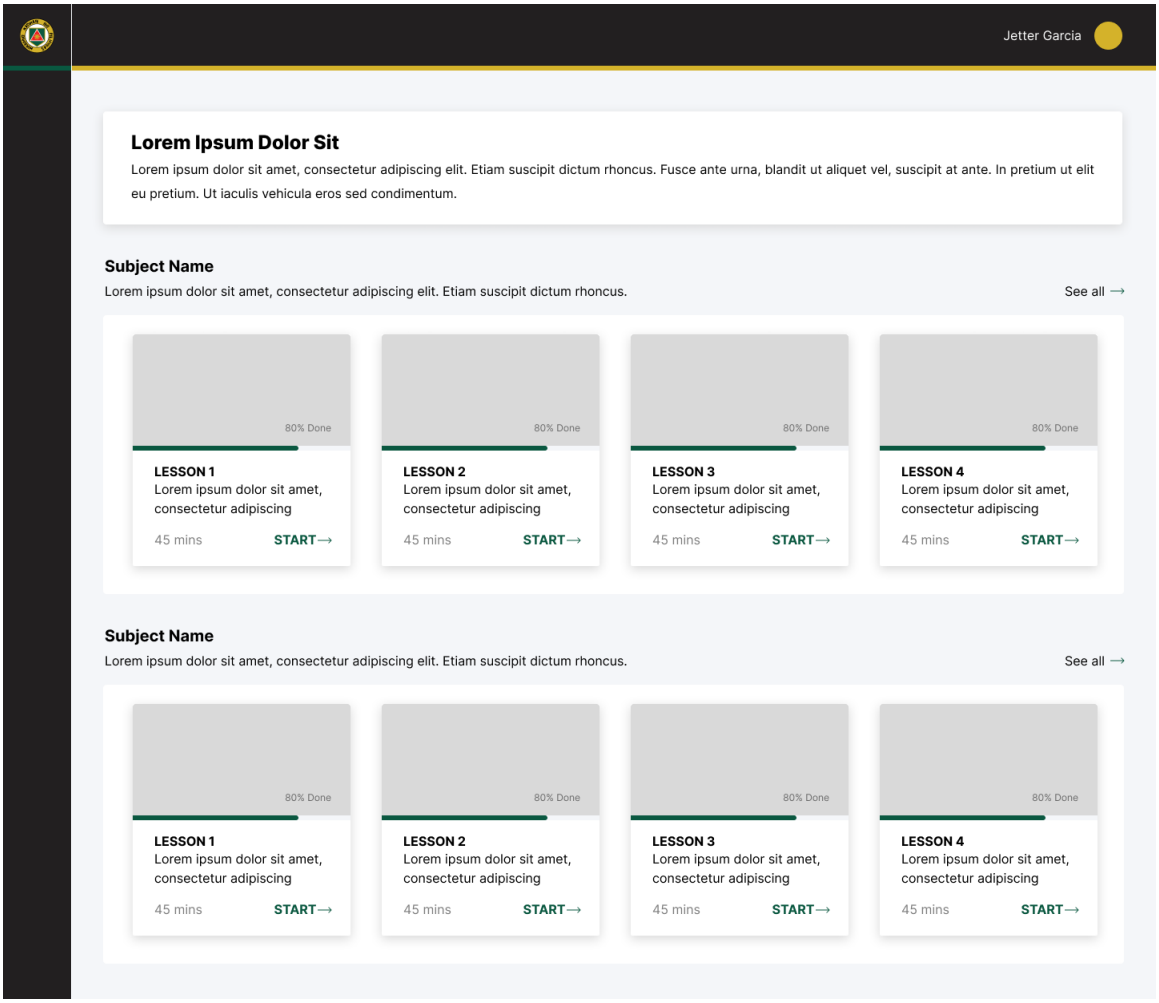

Fig. 10 PRL Videos

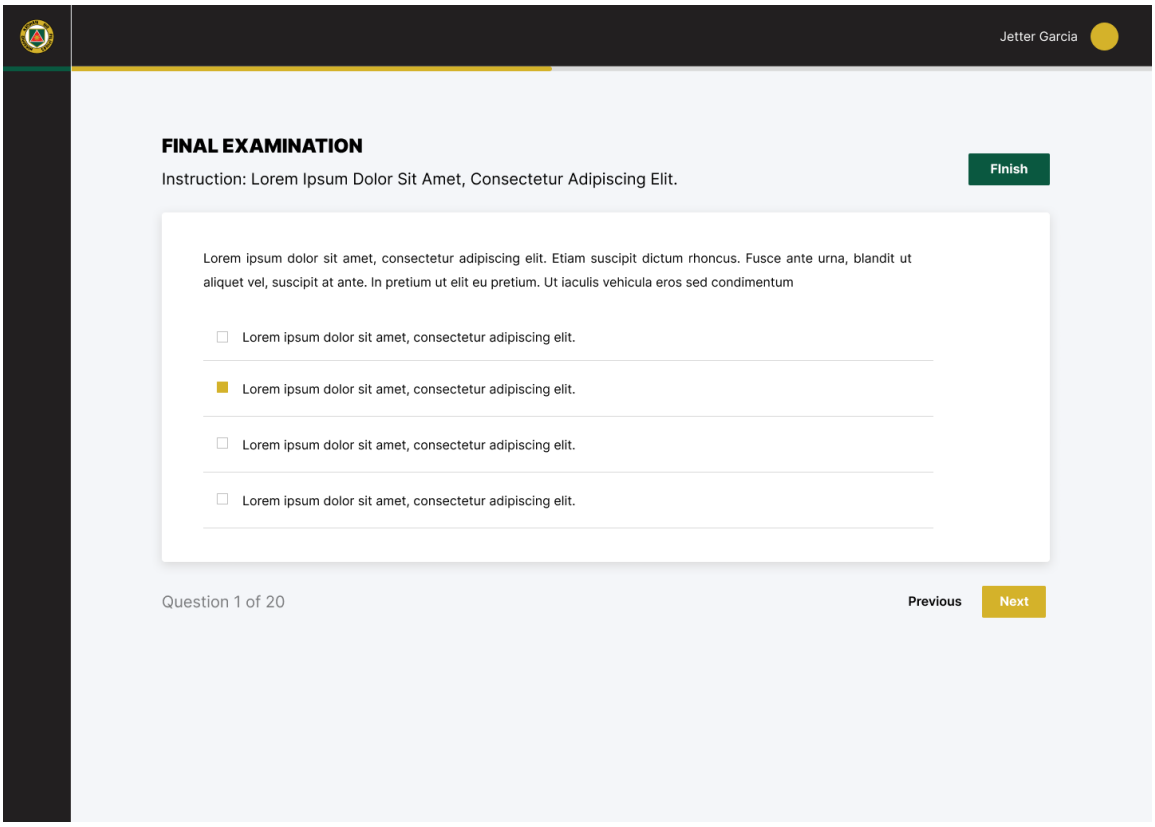

Fig. 11 Written Examination

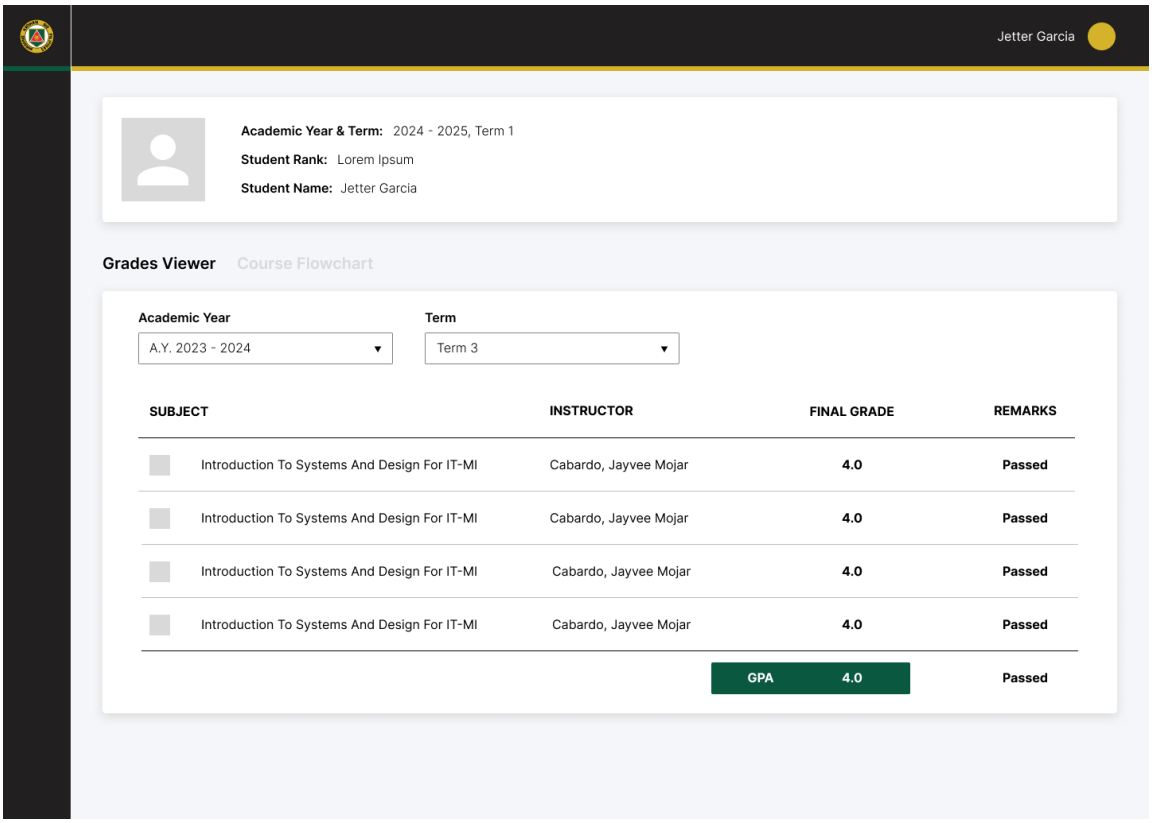

Fig. 12 Grades

5.5 Release Plan

The team has successfully completed several key milestones and is continuing to progress steadily through the development plan. Below is an updated release plan highlighting our progress, upcoming tasks, and milestones.

Table 5 Release Plan

Milestone	Task	Status
Initial Development and Setup	Figure out the client's problem	Completed
	Gather relevant data	Completed
Solution Validation	Develop an overview of potential solutions	Completed
	Validate the solution	Completed
Detailed Planning and Design	Develop a detailed project plan	Completed
	Begin the design	Completed
	Create a prototype	In progress
	Conduct initial testing	In progress

Pilot Implementation	Develop pilot implementation of solution	Planned
	Monitor and evaluate the pilot implementation	Planned
	Make necessary adjustments to improve the system	Planned
Full Implementation	Roll out full implementation of the system	Planned

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Appendices

Appendix A: Project Vision

Atlas is an E-learning platform designed specifically for the training camps of the Philippine Army. It addresses the challenges of outdated methods for processes by providing a website application for digital learning environment and process automation. Unlike generic school-focused applications, this product provides an AI assistant designed for learning, with customized features tailored to the specific needs of military training environments.

The product vision for Atlas centers on transforming the training camps of the Philippine Army by digitizing and automating various processes that are currently paper based. Designed specifically for military training environments, Atlas aims to address the needs of the army's students, instructors, and admins. Transitioning to digital learning allows for more efficient management and accessibility of course materials, while the development of an e-learning platform provides a centralized location for trainees to access their grades and track their performance.

The introduction of Atlas also includes pre-recorded lectures and evaluation of training outcomes, creating a repository for learning resources to facilitate easy access to training materials, and centralizing score processing to streamline the grading system. These features are designed to overcome current challenges such as cumbersome method of grade distribution via bulletin boards, which not only inconveniences users but also incurs additional printing costs.

With the implementation of Atlas, the Philippine Army can expect a significant boost in productivity and a reduction in operational costs. This transition to a digital platform will be supported by installing new infrastructure, including Wi-Fi in training camps and dedicated computers. Although gathering feedback and making continuous improvements may be challenging due to limited direct communication with end-users, Atlas will strive to incorporate insights through representatives to ensure the system evolves to meet users' needs effectively. Overall, Atlas envisions a streamlined, efficient, and modernized training environment that aligns with the specific requirements of military training.

Appendix B: Schedule

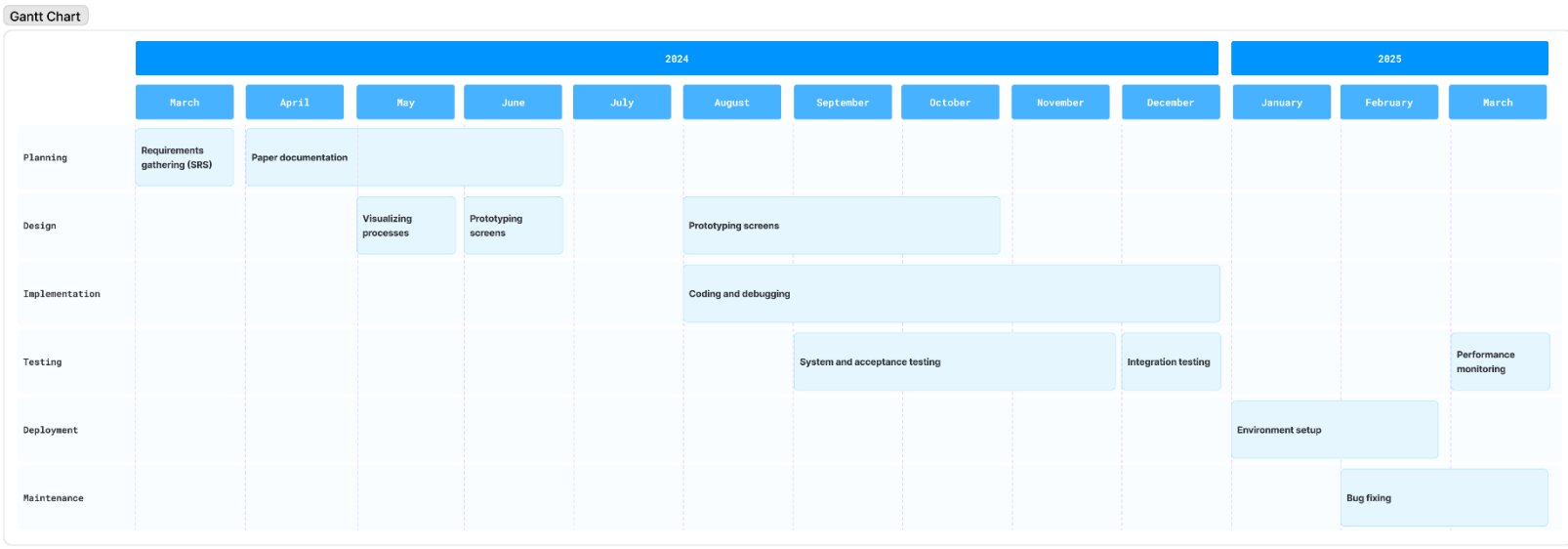


Fig. 13 Gantt Chart for the Development of Atlas

The Gantt chart above presents a timeline spanning from March 2024 to June 2025. For the MNTSDEV, which runs from March to June 2024, the team is focused on understanding the client's problem and developing an overview of potential solutions. Once the solutions are proposed, they will begin creating a prototype.

During the MSYADD1, from August to November 2024, the team will create diagrams and workflows to visualize the processes involved inside the system that they are developing. Along with this, they will start on creating a minimum viable product.

In the MCSPROJ, from November 2024 to March 2025, the team will complete the coding, set up the environment, fix bugs, and monitor performance.

Appendix C: Product Roadmap

Fig. 14 Product Roadmap

Phase 1	Phase 2	Phase 3	Phase 4
Milestone 1 • Figure out the client's problem • Gather relevant data Milestone 2 • Develop an overview of potential solutions	Milestone 3 • Develop a detailed project plan Milestone 4 • Begin the design • Create a prototype • Conduct initial testing	Milestone 6 • Develop pilot implementation of solution • Monitor and evaluate the pilot implementation • Make necessary adjustments to improve the system	Milestone 7 • Roll out full implementation of the system

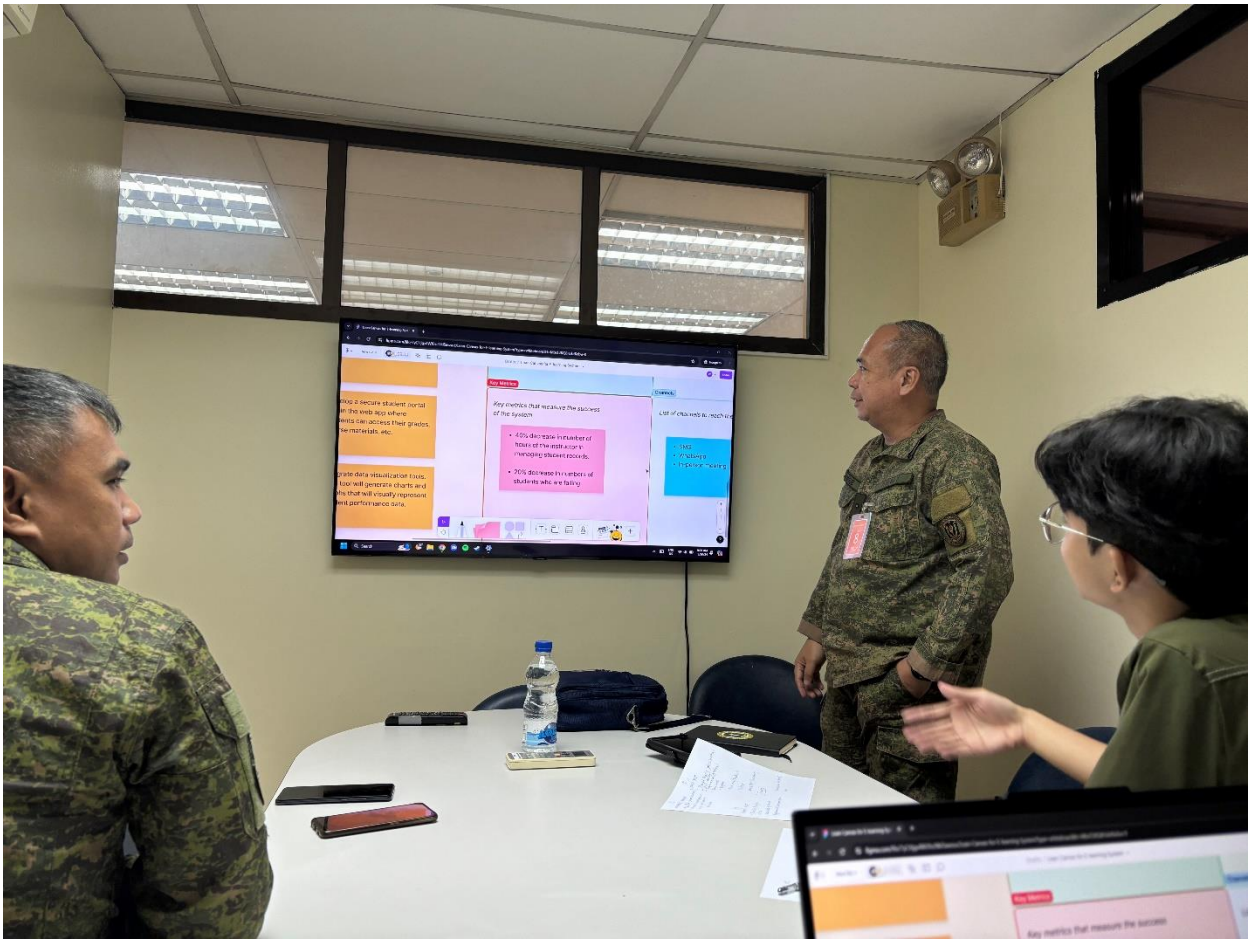
• Validate the solution	Milestone 5 • Develop a minimum viable product		

Appendix D: Team Meetings

Date: May 10, 2024

Agenda: Discussion on Lean Canvas

Screenshot:

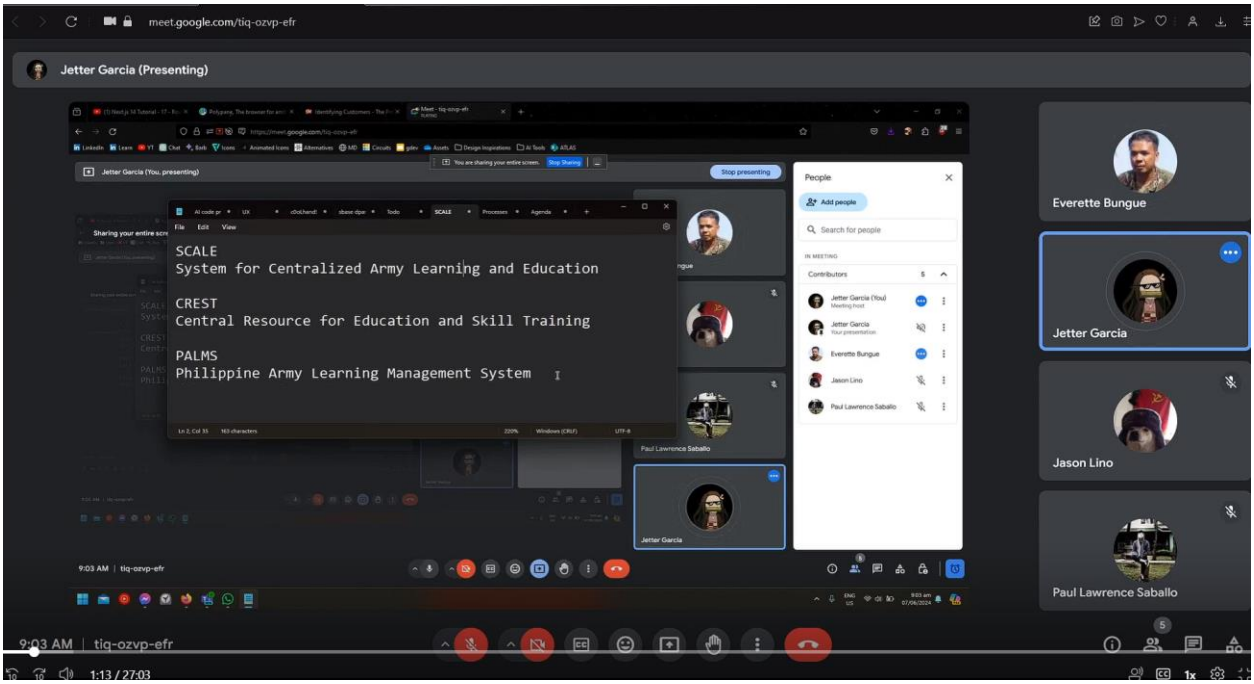


The meeting's agenda was about ensuring the solution being built satisfies the needs of the client. It focused on aligning the problems being solved and the proposed solutions with the client's overall vision for the system. Additionally, it covered the desired functionality of the system, such as including an AI chatbot to assist learners.

Date: June 7, 2024

Agenda: System Name and Use Case Diagram

Screenshot:



During the meeting, the team presented the potential names for the system to the client. Additionally, they showed a use case diagram that detailed the system's functionalities and how different user types would interact with it. The team actively sought clarity by asking questions. By working together, they were able to fully understand the client's needs and modify the system for maximum efficiency.