360° NAVIGATE: INTERACTIVE EVSU COMPANION MAP WITH PANORAMIC PERSPECTIVE USING MOBILE APP

A Capstone Project

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In Partial Fulfillment

of the Requirements for the Degree

Bachelor of Science in Information Technology

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APPROVAL SHEET

The Capstone Project Study entitled **360 NAVIGATE: INTERACTIVE EVSU COMPANION MAP WITH PANORAMIC PERSPECTIVE USING MOBILE APP** prepared and submitted by Mark Kian B. Tisado, Bill Yuri D. Garcia, John Renzie P. Gerilla in partial fulfillment of the requirements for the degree of BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY has been examined and is recommended for acceptance and approval for **FINAL DEFENSE**.

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MK.B.T

BY.D.G

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ABSTRACT

Tisado, Mark Kian; Garcia Bill Yuri; Gerilla, John Renzie "360° NAVIGATE: Interactive EVSU Companion Map with Panoramic Perspective Using Mobile App" (Eastern Visayas State University, December 2024, Tacloban City)

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Navigating large campuses can be a challenging experience for students, faculty, staff, and visitors. To address this, the 360° Navigate mobile application was developed to provide an innovative navigation solution for Eastern Visayas State University (EVSU). This app combines advanced technologies, including 360-degree panoramic views, OpenStreetMap integration, and Dijkstra's algorithm for route optimization, to help users easily locate essential campus facilities such as faculty offices, administrative departments, and other areas. The application features a user-friendly interface, real-time GPS tracking, and optimized routing for navigation. Testing and evaluation confirmed the system's ability to enhance wayfinding efficiency and overall user experience. With its unique combination of functionality and interactivity, 360° Navigate serves as a valuable tool to transform campus navigation at EVSU.

Keywords: Campus navigation, mobile application, 360-degree panoramic views, Dijkstra's algorithm, OpenStreetMap, outdoor navigation, GPS, route optimization.

Chapter I

INTRODUCTION

Advanced digital technology has changed how people connect with and navigate university campuses. Historically, newcomers to large educational institutions whether students, faculty, or visitors faced difficulty orienting themselves in the often extensive and complex campus environment. Traditional approaches, such as printed maps and static signage, while important, failed to provide the detailed, real-time information required for effective navigation (Guo, 2020). As technological advancements occurred, there was a noticeable movement toward incorporating digital solutions to improve the campus experience.

The researchers interviewed students, staff, and visitors from Eastern Visayas State University (EVSU) and found persistent concerns with campus navigation. Although many students visited campus daily, they usually struggled to identify specific areas and asked for directions, making travel difficult for new and returning students. The interview also showed that students frequently had difficulty finding crucial buildings such as faculty buildings, and department offices in different buildings, which aligned with findings in similar studies highlighting the importance of clear campus signage for student satisfaction and efficiency (Ayyanchira et al., 2022). Visitors to the campus frequently reported having difficulty identifying transaction offices, a problem that significantly impacted their experience (Ruotsalainen et al., 2022). Transaction offices were often critical points of contact for administrative matters, including admissions, financial aid, and registration. When visitors could not easily locate these offices, it led to frustration and delays, hindering their ability to complete necessary tasks efficiently (López, et al., 2019) This problem was made worse by the experience of academics and staff, who frequently had trouble finding offices due to location changes without prior notice. Faculty and staff members, integral to the university's daily operations, often

faced significant challenges when office locations were altered without timely and effective communication. These changes could result from departmental relocations, administrative restructuring, or ongoing campus development projects.

These difficulties highlighted the crucial need for EVSU to invest in and deploy more effective campus navigation resources. Potential solutions included creating a thorough and regularly updated campus map, installing clear and uniform signage throughout campus, and utilizing digital navigation tools like mobile apps (Lucy, 2021). Addressing these issues would not only improve the campus experience for students but would also increase overall efficiency and happiness among visitors, teachers, and staff (Mappedin, 2023).

Digital campus systems emerged as a critical tool for solving these issues. These systems used mobile applications, cloud services, and immersive technologies to provide comprehensive and interactive navigation solutions. For instance, utilizing panoramic 360-degree views provided users with an immersive tour experience, significantly enhancing their ability to visualize and navigate campus areas (Aznoora Osman, 2020). This approach not only catered to practical navigation needs but also introduced digital freedom, allowing users to explore campus environments at any time and from anywhere (Samala et al, 2022). Furthermore, open-source mapping technologies like OpenStreetMap (OSM) gave accurate and up-to-date mapping data, improving digital navigation systems' effectiveness.

Navigating large and complex university campuses, such as EVSU, presented a significant challenge for students, faculty, and visitors alike. Addressing these challenges required the development of a comprehensive digital campus navigation system that used modern technologies. Such a system would enhance accessibility, improve efficiency, and ultimately increase overall user satisfaction.

Objectives of the Project

Designed and developed an interactive campus navigation mobile application for Eastern Visayas State University (EVSU)

The study accomplished the following specific objectives:

1. Developed a 2D map that updated in real-time to show the user's location and destination.
2. Incorporated 360-degree panoramic views of significant landmarks or points of interest to provide users with a more immersive experience.
3. Implemented route optimization using Dijkstra's algorithm to recommend the shortest path between two points on the campus map.
4. Evaluated the quality of the system using ISO 25010 Software Quality Standards.

Scope and Delimitations of the Project

The project aimed to develop and implement an interactive campus navigation mobile application for Eastern Visayas State University (EVSU) to enhance campus navigation and user experience. It included the creation of a mobile application that integrated advanced technologies such as panoramic footage 360-degree views and OpenStreetMap (OSM) for accurate mapping data. Additionally, the project incorporated Dijkstra's algorithm to compute the shortest paths between locations on campus, ensuring efficient routing for users. The mobile application supported the Android operating system. The application was designed to generate navigation directions between locations on the campus grounds, focusing on outdoor navigation. However, it did not support generating directions within the interiors of buildings, such as office layouts or room-to-room navigation.

Certain limitations were inherent in the project's scope. The application did not support the iOS operating system. It assumed users had access to smartphones or compatible devices capable of running mobile applications, which may have restricted accessibility for some individuals. The effectiveness of real-time navigation and data updates relied on stable internet connectivity, which varied across different areas of the campus.

Significance of the Project

The development of an interactive campus navigation mobile application for Eastern Visayas State University (EVSU) held significant importance and potential benefits for various stakeholders involved.

Administrators. The project provided administrators with useful data insights via user feedback and usage analytics via Google's Firestore, allowing them to make more informed decisions on campus infrastructure changes and service advancements.

Faculty and Staff. Enhanced navigation made it easier for faculty and staff to reach department offices, courses, and other campus services. This efficiency led to increased productivity and smoother operations in academic and administrative settings.

Students. Improved campus navigation using a user-friendly mobile application made it easier for students to find facilities, classes, and services, reducing the amount of time spent looking for specific locations. Virtual tours with immersive technologies gave a better understanding of campus architecture and amenities, resulting in a more engaging and productive campus experience.

Visitors and Guests. Visitors to EVSU, particularly prospective students and their families, had an easier time navigating the campus and exploring its options, potentially increasing positive impressions and enrollment rates.

Researchers. The initiative provided researchers with extensive data sets and analytics on campus usage, enabling studies on campus infrastructure, user behavior, and service utilization. This helped fund academic research, grant applications, and publications on campus development and smart technologies.

Chapter II

THEORETICAL FRAMEWORK

This chapter introduced the fundamental theories and principles that guided the creation of an interactive mobile application with panoramic navigation. Drawing on ideas from interactive map technology, mobile application development, and immersive navigation, this framework ensured a comprehensive and effective approach to designing user-centered applications.

Review of Related Literature

The review explored existing research on interactive mobile map applications and panoramic technologies to analyze their design principles and functionalities relevant to the development of 360° NAVIGATE: Interactive EVSU Companion Map with Panoramic Perspective using Mobile App.

Interactive Maps

Interactive mapping and navigation tools have become increasingly essential for users, providing a more engaging and immersive experience compared to traditional static maps (Cardoso & Cavadas da Costa, 2022). These tools leverage the advanced sensors and capabilities of modern mobile devices, such as GPS, gyroscopes, and cameras, to track the user's precise location and orientation within the physical environment, enabling seamless integration of digital information and visualization.

The field of interactive maps has advanced dramatically during the last decade. Driven by advancements in technology and user expectations, these tools have become increasingly sophisticated and versatile. Location awareness through GPS integration, real-time traffic updates, and the seamless integration of various data points have all contributed to this transition. Interactive maps facilitate various areas of spatial knowledge acquisition. 2D maps can improve comprehension

of spatial features in large-scale situations. It provides a bird's-eye view, which is useful for understanding metric characteristics and spatial orientation (König, et al., 2019).

In an educational context, interactive maps help students learn more deeply by visualizing complicated subjects in geography, history, and environmental sciences. It allows users to interact with spatial data, investigate historical trends, and recreate geographic phenomena. For example, in geography lectures, users might view climate patterns, population demographics, and geological formations to have a better grasp of spatial relationships (Xefteris et al., 2019).

In terms of navigation, interactive maps are valuable. They provide real-time directions, assist in route planning, and offer information about traffic conditions. This functionality is especially useful in educational settings where students can learn about navigation principles and the practical applications of Geographic Information Systems (Li & Hsu, 2022).

Moreover, interactive maps are beneficial for tourists by providing guides to attractions, historic places, and cultural icons. It makes it easier for travelers to plan itineraries, navigate unfamiliar regions, and find local points of interest. Multimedia components such as images, videos, and reviews further enhance the travel experience by offering personalized recommendations based on individual interests and preferences (Liu, 2020).

Panoramic Perspectives

The integration of panoramic perspective in the field of design research has been a topic of growing interest in recent years. This multi-faceted approach aims to bridge the gap between different aspects of design, including education, practice, and research. By adopting an integrated viewpoint, designers and researchers can explore the complex interplay between these domains, leading to a more holistic understanding of design processes and outcomes (Eilouti, 2020)

Virtual tours are a type of panoramic perspective technology that allows users to explore a scene or environment in a virtual environment. Virtual tours can be created using panoramic images and videos, and can be used to provide users with a more immersive and interactive experience (Zhang & Kou, 2020) The use of virtual tours has been shown to improve user engagement and retention, making it a popular tool for education and training (Grinberger et al., 2022).

360° imagery has found several applications in numerous fields, improving user experiences and presenting fresh views. In education, panoramic photos and videos are utilized to create immersive learning environments. 360° multimedia enhances virtual field trips, interactive lectures, and simulations, providing students with a more engaging and thorough grasp of topics. For example, students can use virtual reality to visit historical landmarks, natural habitats, and complicated machinery, acquiring insights that traditional media cannot supply (Chuang et al., 2020).

Interactive 360-degree panoramic views have emerged as powerful tools for exploration and knowledge acquisition. These immersive experiences, exemplified by platforms like Google Street View, enable users to virtually navigate environments and scrutinize points of interest. Such interactions increase user engagement and enhance spatial awareness (Lee et al., 2023).

Mobile Application Technology

Choosing the right platform for mobile app development is crucial for reaching a large audience and maximizing platform-specific capabilities. Android is the most popular mobile operating system, powering a broad ecosystem of devices spanning all price points and demographics. According to a report by Counterpoint, Android holds a global market share of 77% of Q1 2024, which translates to a massive pool of potential users (Counterpoint Research, 2024).

Modern Android smartphones are equipped with a variety of sensors, such as GPS, accelerometers, and Bluetooth, which can be leveraged to provide accurate indoor and outdoor positioning for campus navigation (Tansakul & Limpitaporn, 2019).

Optimizing the user interface (UI) and user experience (UX) for performance is essential. This involves designing intuitive and lightweight interfaces that do not strain the device's resources. Techniques such as lazy loading, efficient memory management, and reducing the number of on-screen elements can help in achieving better performance. Profiling tools built into development environments like Android Studio can be used to measure memory usage, CPU load, and other vital signs, allowing developers to identify and address performance bottlenecks early in the development cycle (Li & Zhu, 2019).

Ren, et al., (2021) highlighted the need to integrate encryption and anonymization to improve data privacy in interactive maps. Their findings revealed that, while encryption protects data, anonymization adds an extra degree of security by prohibiting data re-identification.

Geographical Information System

The development of campus navigation systems using Geographic Information Systems (GIS) technology has become increasingly important in recent years. As university campuses continue to grow and gain complexity, providing effective wayfinding solutions for students, faculty, and visitors is crucial. Several studies have explored the application of a GIS-based approach to campus navigation, highlighting the benefits and challenges of these systems.

OpenStreetMap (OSM) is a prominent example of a collaborative mapping project that utilizes GIS principles. It allows contributors worldwide to create and edit map data, making it a valuable resource for developing interactive maps in mobile apps. OSM data can be customized and integrated into applications to provide accurate and up-to-date geographic information. Incorporating

OSM into digital campus systems has effectively enhanced campus navigation and visualization. Beyond basic road networks and building footprints, OSM often includes intricate details such as pedestrian walkways, bicycle paths, or even specific points of interest relevant to the educational setting (Panek & Netek, 2019).

A review by Grinberger et al (2022) found that OSM data quality can vary significantly across different regions and feature types, with factors such as contributor activity, data editing, and feature completeness affecting the overall quality. The researchers also explored the engagement between the research community and the OSM community, identifying both bridges and barriers that impact data quality and collaborative efforts.

A study by Serere et al. (2021) evaluated the accuracy of OSM Nominatim API in geocoding campus addresses and found that it performed well, with a success rate of over 90%. The researchers also developed a campus navigation app using Nominatim API and OpenStreetMap data, demonstrating its feasibility for such applications.

The integration of 360° imaging with GIS data requires significant storage and bandwidth, which can be limiting for mobile applications. Efficient data compression and transmission techniques must be employed to handle these large datasets without compromising on speed or quality (Bill, et al., 2022).

Route Optimization

Dijkstra's algorithm has been implemented for campus navigation apps to help users find the shortest routes between locations. This involves creating a website-based application with a mobile-friendly interface that calculates the shortest distance between points of interest using the Dijkstra algorithm. The calculation begins by determining the nodes that will form the graph (Gunawan et al., 2019).

A study by Minhang Zhou and Nina Gao (2019) optimized the Dijkstra algorithm for practical applications where the optimal path selection is influenced by multiple conditions and requirements. The researchers proposed a new weight matrix that combines various factors to guide the path selection, improving the search efficiency and satisfying diverse user needs. Their experiments showed that the optimized algorithm can outperform the traditional Dijkstra algorithm when dealing with more complex real-world scenarios.

Zhu et al. (2021) applied Dijkstra's algorithm to real-time traffic routing. They use historical traffic data and real-time sensor inputs to predict link travel times and then apply Dijkstra's algorithm to find the shortest paths. Results show significant improvements in traffic routing efficiency and reduced travel times compared to traditional methods.

Studies have compared Dijkstra's algorithm with other shortest path algorithms, such as the A* algorithm. The results show that Dijkstra's algorithm and A* have similar performance in solving shortest path problems, with both finding the correct optimal path. However, the time complexity of Dijkstra's algorithm is higher, making it slower for large graphs. (Gustin & Rachmawati, 2020).

Conceptual Framework

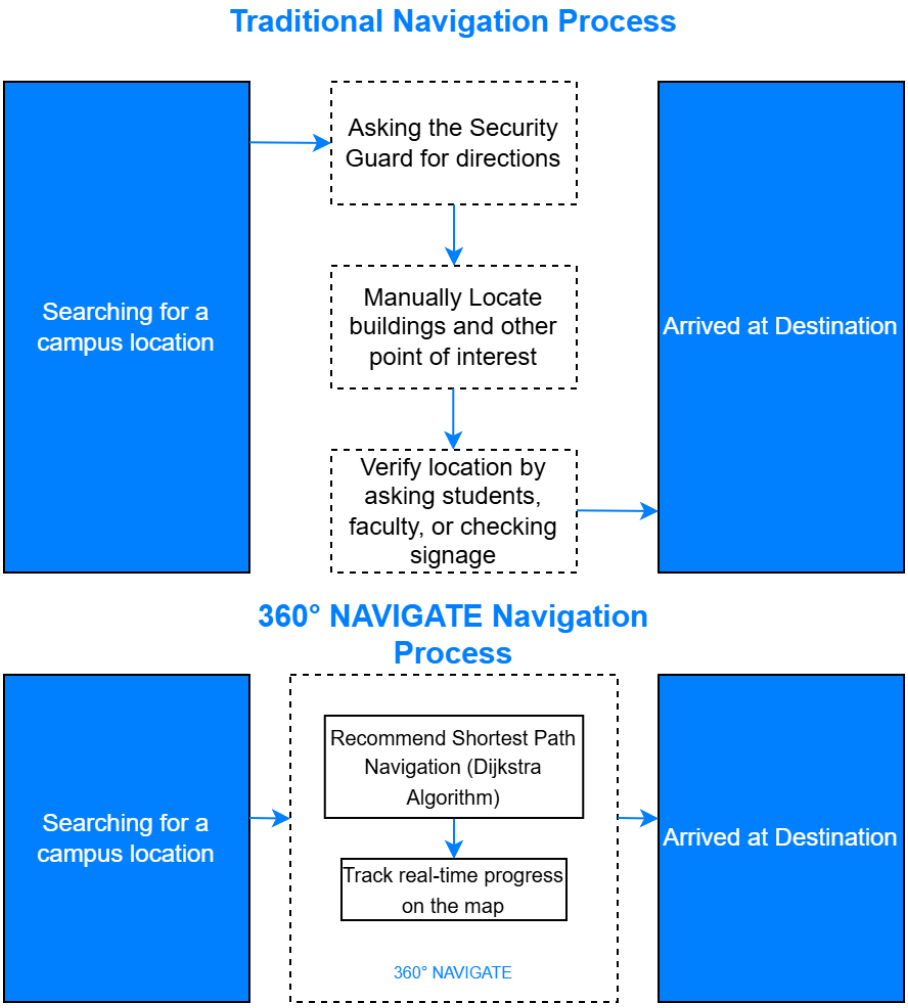

Figure 2-1. Conceptual Framework of the Study

Figure 2-1 image presents a comparative analysis between traditional and 360° NAVIGATE navigation processes as part of a research study.

Traditional Navigation Process

In the traditional navigation process, when an individual is searching for a campus location, the first step involves asking a security guard for directions. Following this, the individual manually locates buildings and points of interest. To verify the location, they may ask students or faculty or check the signage available on campus. This process, although straightforward, can be time-

consuming and relies heavily on the availability and knowledge of security personnel and other campus members.

360° NAVIGATE Navigation Process:

The 360° NAVIGATE navigation process took advantage of modern technology to enhance efficiency. It recommended using the shortest path navigation through the Dijkstra algorithm, a well-known algorithm for finding the shortest paths between nodes in a graph. This method not only suggested the optimal route but also allowed the individual to track their real-time progress on the map, ensuring a seamless and accurate navigation experience.

Definition of Terms

The following terms are conceptually and operationally defined to aid researchers in understanding their significance in the current study.

Application Programming Interface (API). A set of rules that allows programmers to develop software for a particular operating system without having to be completely familiar with that operating system (Merriam-Webster, n.d.).

A set of specific protocols and tools, like Nominatim API, was used to connect and interact with external services and internal modules

Dijkstra's Algorithm. Algorithm for solving the shortest distance between two vertices on a graph (geeksforgeeks, n.d.).

Calculated the shortest paths between various campus locations in the study

Geographical Information Systems (GIS). A computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface (National Geographic, n.d.).

Supported the creation and manipulation of dynamic maps that users could interact with, improving navigation and spatial awareness during the project.

Nominatim API. Uses OSM data to find locations on Earth by name and address (Nominatim, n.d.).

Provided geographic coordinates for search results, enabling integration into map displays and routing features in the application.

OpenStreetMap (OSM). is a collaborative mapping project established in 2004 to create a free editable map of the world. It is the most comprehensive source of volunteered geographic information (Carleton, n.d.).

Provided accurate and up-to-date geographic information that was customized for campus navigation.

Panoramic Perspective. A panoramic perspective refers to an expansive, wide-angle view that captures a large portion of the surrounding environment or landscape. It provides a comprehensive, 360-degree visual representation of a scene (Ekpar, 2019).

Generated using specialized camera equipment installed at various key locations on campus. These views enabled users to virtually explore the campus environment in detail.

Chapter III

OPERATIONAL FRAMEWORK

This chapter presented the methodology and materials employed in the study. It outlined the process used and the tools utilized to gather and analyze data.

Materials

This section presented and specified the resources that were required for the project's development.

Software

The following table presents the software that was used to develop the system. These tools included development environments, build system plugins, programming languages, real-time database platforms, and libraries for displaying maps, all of which contributed to the functionality and implementation of the application.

Table 3-1. System Software

Software	Version	Description
Android Studio	2024.1.1	Integrated development environment (IDE) for Android development
Android Gradle Plugin	8.5.0	Build system plugin for Android projects, integrating with Gradle.
Kotlin	1.9.20	Programming language used for Android development.
Google Firebase	13.8.0	Building mobile applications with tools for real-time databases.

OpenStreetMap		Provided detailed map data.
Mapbox	6.1.18	Library for displaying OpenStreetMap maps in Android applications

Hardware

To develop the system, a variety of hardware components were utilized, including a laptop computer, an Android device, and a 360-degree camera. The table below details the specific models and specifications of these components.

Table 3-2. System Hardware

Hardware Used	Model	Specifications
Laptop Computer	Victus Gaming Laptop 15-fb1000ca	Windows 11 Home AMD Ryzen™ 5 7535HS RTX 2050 16 GB RAM 1 TB SSD
Android Device	Narzo 50 Pro 5g	Android 14 DIMENSITY 920 8GB RAM 128ROM
360-Degree Camera	Insta 360 One x2	360: 6080x3040 (2:1) Pano: 4320×1440 (3:1)

Data Source

This section provided an overview of the data sources used in the project, highlighting their significance and the methodologies employed for data collection.

Table 3-3. Data Source

Data Source	Description	Collection Method
OpenStreetMap	Provided detailed, up-to-date map data for the application.	API Integration (Mapbox)
User Interviews	Gathered insights on user needs, preferences, and feedback to improve app design and functionality.	Structured Interviews and Survey Questionnaires

System Environment

Locale. The study and implementation of the interactive campus navigation application were centered on the EVSU campus environment. It encompassed all campus buildings, departments, and facilities to meet the navigation needs of students, faculty, staff, and visitors. It was designed specifically to enhance navigation efficiency and user experience within the EVSU campus.

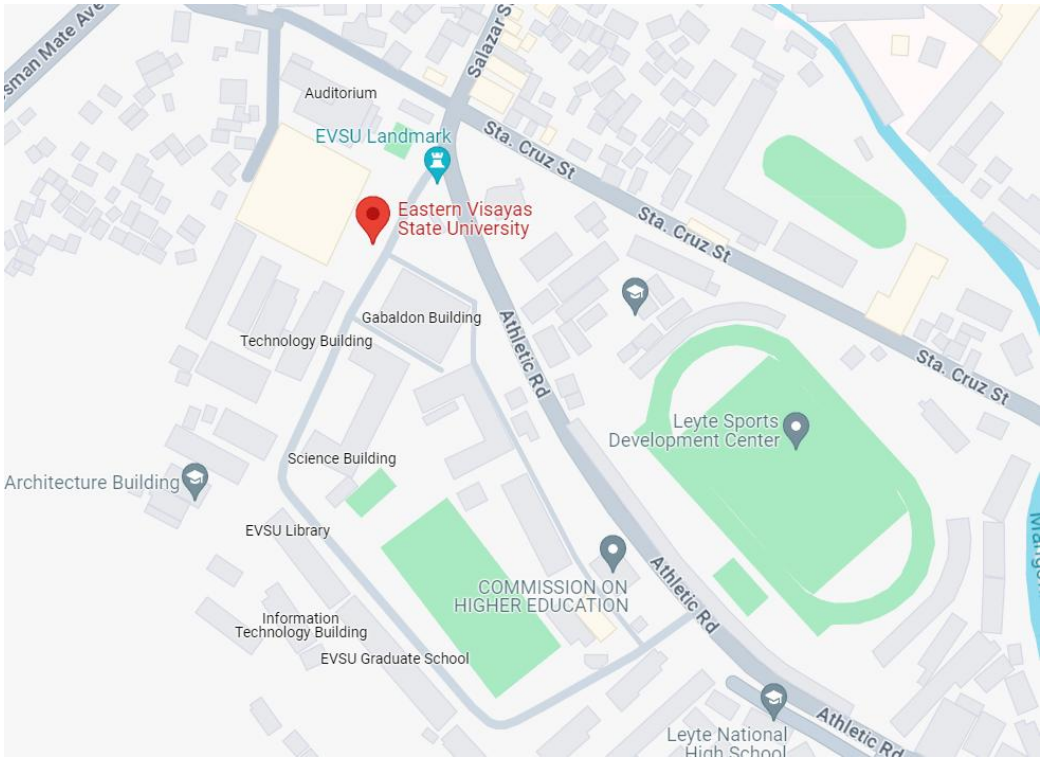

Figure 3-1. Map of EVSU

Figure 3-1 shows the boundaries of Tacloban City where the project was implemented. EVSU is located at Salazar St, Downtown, Tacloban City, Leyte.

Population of the Study

The population for this study encompasses 15 students, 10 faculty members and staff, and 10 visitors at EVSU who regularly navigated the campus. These participants, who represented various departments and courses, were interviewed to gain a thorough understanding of the campus navigation experience.

Description of the Present System

Currently, the organization uses the usual navigation system for campus wayfinding. This solution includes maps displayed on boards, traditional signs, and help desks for personalized

assistance. These features have been in place for several years and provide valuable navigational assistance to campus visitors and members.

Physical maps displayed on boards placed on parts of the campus provide a thorough overview of the campus layout, while traditional signage directs visitors to their destinations. The help desk gives users a personalized experience by allowing them to ask for directions and receive real-time support. This mix of tools has been beneficial in ensuring that people can easily navigate the campus.

The current system supports the organization's purpose of providing clear and accessible navigational aids. By using physical maps and signs, the organization assures that users can find their way around without relying on digital devices. The help desk provides an additional layer of support, catering to people who require extra assistance or prefer personal interaction.

Limitations and Drawbacks of the Present System

While the existing system performs its purpose, certain limitations can be addressed to improve the user experience. The physical maps and signage are static, which means they do not deliver real-time updates or dynamic content. This can be problematic during events, construction, or other temporary changes on campus that are not instantly reflected on static maps.

The reliance on physical help desks, while useful, can cause congestion and wait times during peak hours. Furthermore, the system's lack of interaction requires users to often cross-reference numerous sources of information, which can be time-consuming and possibly confusing.

The introduction of a 360° NAVIGATE would provide interactive maps with real-time navigation. The app intends to create a more efficient and seamless navigation experience, complementing the current system's traditional aspects.

Methods

The study employed a Rapid Application Development (RAD) methodology to develop the 360° NAVIGATE mobile application. RAD is an adaptive software development approach that prioritizes rapid prototyping and iterative feedback over traditional, time-consuming planning and design phases (Jevtic, 2019).

The RAD model was used for this project because it promoted rapid iteration and active user participation, both of which were important for creating an application that fulfilled the different needs of campus navigation. Given the 360° NAVIGATE app's interactive and visual nature, which included panoramic views and real-time location tracking, it was critical to continuously improve the user interface and functionality based on feedback from potential users.

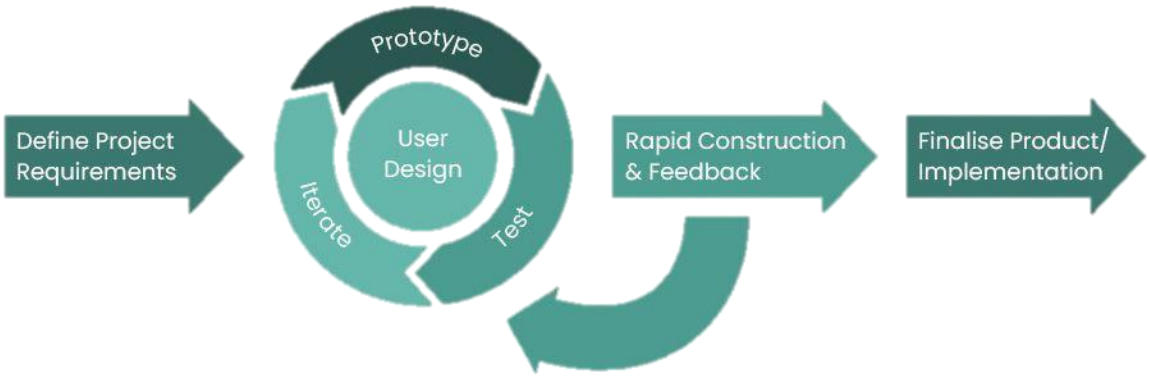

Figure 3-2. Rapid Application Development Model

Rapid Application Development Process

Define Project Requirements

In this stage, the researchers outlined the key features and goals of the 360° NAVIGATE mobile application. It involved defining the project's scope, identifying stakeholders, and gathering requirements through various methods such as surveys and interviews at EVSU.

Gantt Chart

The Gantt chart below outlined the timeline and key tasks involved in the development process of the 360° NAVIGATE mobile application. It provided a visual representation of the various phases, including requirements planning, user design, rapid construction, feedback, and implementation, ensuring a structured approach to achieving the project goals.

Table 3-4. Gantt Chart

ACTIVITIES	2024																							
	July				August				September				October				November				December			
Requirements Planning • Gathering Requirements • Data Gathering																								
User Design • Prototype • Test • Iterate																								
Rapid Construction • Implement Features • Integrating Mapbox • Develop navigation algorithms (Dijkstra's)																								
Feedback																								
Implementation																								

Table 3-4 indicates the duration of activities planned for the proposed system development. This phase served as the proponents' activity guide for the requirements planning, user design, rapid construction, feedback, and implementation stages.

User Design

This phase focused on building user prototypes, incorporating user feedback, and refining the design. The process was iterative, involving the following steps:

- **Prototype**: Developing initial versions of the application.
- **Test:** Evaluating the prototypes to identify any issues or areas for improvement.
- **Iterate:** Refining the prototypes based on test results and user feedback.

Rapid Construction & Feedback

In this phase, the researchers implemented features, integrated OpenStreetMap, and developed navigation algorithms (such as Dijkstra's). Continuous user feedback was essential to ensure the application met user needs.

Pseudocode for Dijkstra's Algorithm

The Dijkstra algorithm computes the shortest path between a starting node and any other node in a graph. The main concept is to iteratively compute the shortest distance from the initial node while updating the distances between nearby nodes. The algorithm includes the following steps:

1. Initialization of all nodes with distance "infinite"; initialization of the starting node with 0
2. Marking of the distance of the starting node as permanent, all other distances as temporarily.
3. Setting of starting node as active.
4. Calculation of the temporary distances of all neighbor nodes of the active node by summing up its distance with the weights of the edges.

5. If such a calculated distance of a node is smaller as the current one, update the distance and set the current node as antecessor. This step is also called update and is Dijkstra's central idea.
6. Setting of the node with the minimal temporary distance as active. Mark its distance as permanent.
7. Repeating of steps 4 to 7 until there aren't any nodes left with a permanent distance, which neighbors still have temporary distances.

```
1:  function Dijkstra(Graph, source):
2:      for each vertex v in Graph:                 // Initialization
3:          dist[v] := infinity                     // initial distance from source to vertex v is set to infinite
4:          previous[v] := undefined                // Previous node in optimal path from source
5:      dist[source] := 0                           // Distance from source to source
6:      Q := the set of all nodes in Graph          // all nodes in the graph are unoptimized - thus are in Q
7:      while Q is not empty:                       // main loop
8:          u := node in Q with smallest dist[ ]
9:          remove u from Q
10:         for each neighbor v of u:               // where v has not yet been removed from Q.
11:             alt := dist[u] + dist_between(u, v)
12:             if alt < dist[v]                    // Relax (u,v)
13:                 dist[v] := alt
14:                 previous[v] := u
15:     return previous[ ]
```

Figure 3-3. Dijkstra's Algorithm Pseudocode

Finalize Product/Implementation

This final phase includes testing, evaluation, and deployment. The application underwent thorough testing to ensure its functionality and usability. After successful testing, the app was deployed.

Data and Process Modeling

Context Diagram. A System Context Diagram (SCD) depicts the entities that interact with a system and defines the boundary between the system and its environment.

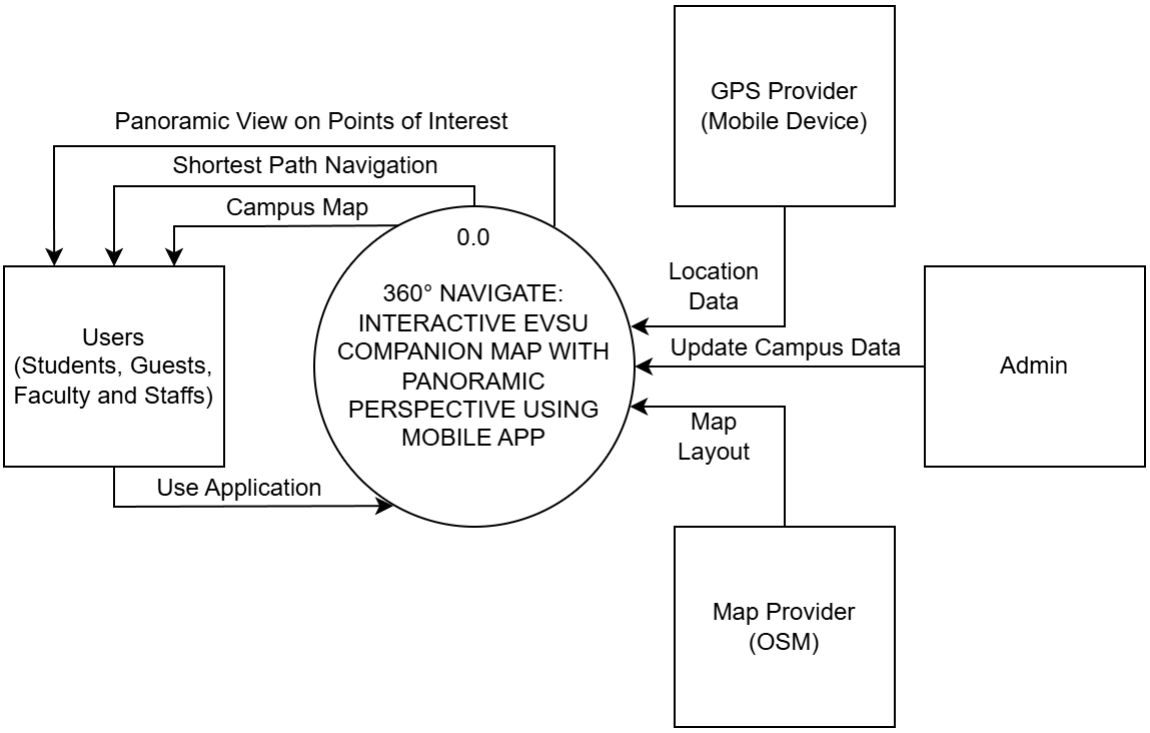

Figure 3-4. Context Diagram

Figure 3-4 shows the interaction of the campus navigation system with its external entities, which includes Users (Students, Guests, Faculty, and Staff), GPS Provider (Mobile Device), Admin, and Map Provider (OSM). The graphic illustrated the flow of data and services, including panoramic views, shortest path navigation, campus maps, location data, campus layout information, and campus data updates.

Data Flow Diagram (DFD) The figure shows how data flows through the system, including interactions between users (students, staff, and visitors) and app capabilities (map navigation, panoramic views, and location services).

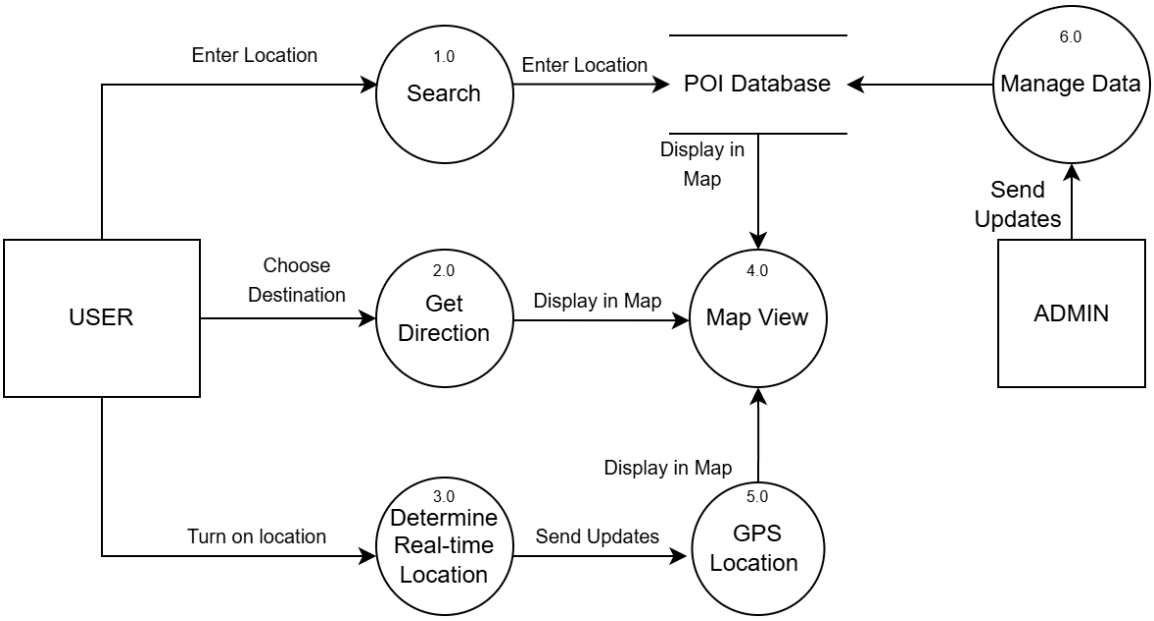

Figure 3-5. Data Flow Diagram

Figure 3-5 illustrates how users utilized the system to search for destinations, get directions, and view real-time location data. Users enter location data, which is analyzed and presented on the map. The system is managed and updated by the admin.

System Flowchart. A system flowchart shows the sequence of activities and data flow within a system, demonstrating how inputs are processed, and outputs are generated. It helps in understanding the logical flow and interactions among the system's many components.

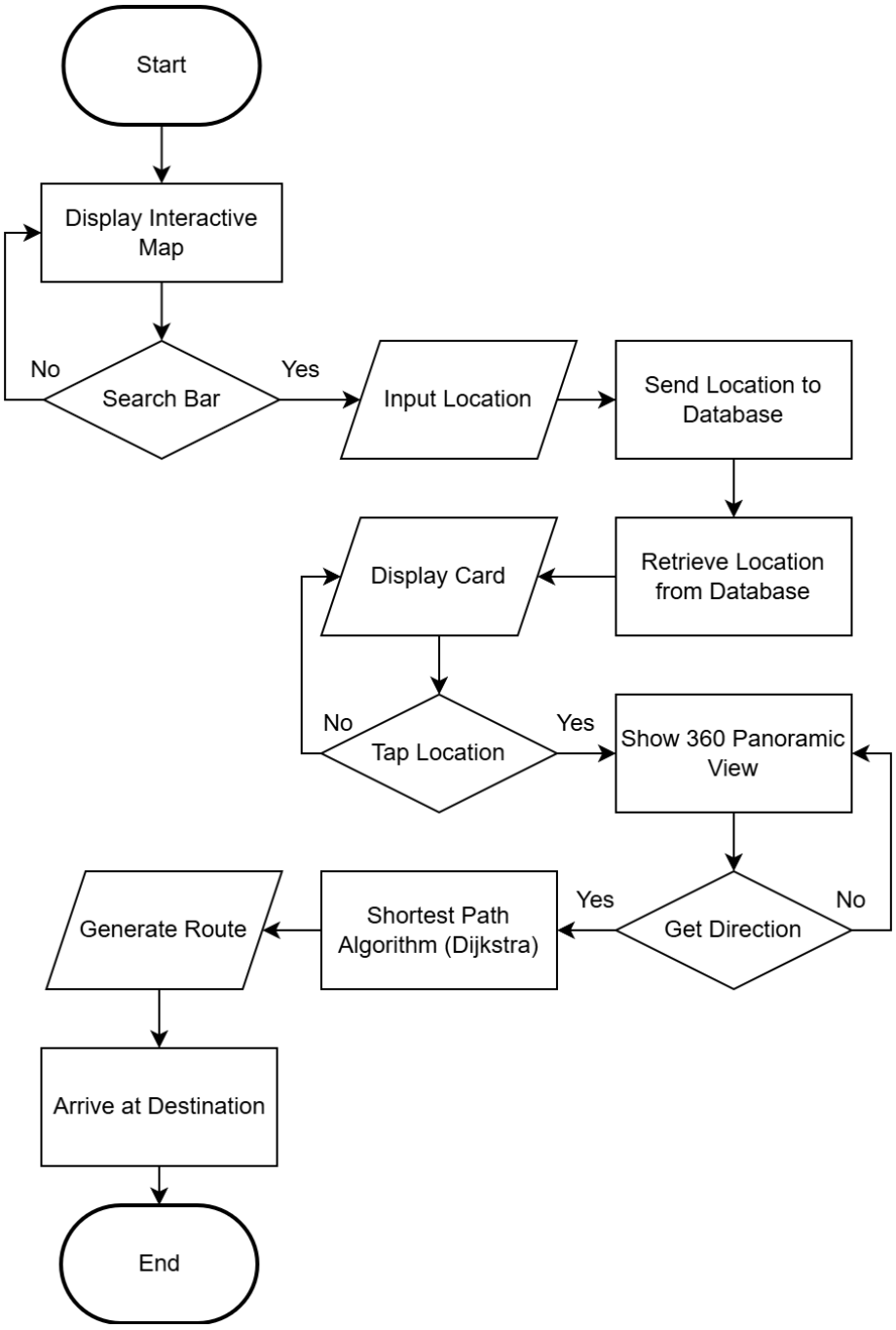

Figure 3-6. System Flowchart

Figure 3-6 shows the process that begins with the user entering a location into the search feature, which is then sent to and retrieved from a database. The position is presented on a map, and the user can choose a destination. Directions to the destination are then presented on the map, directing the user to their intended place.

Use Case Diagram. A use case diagram shows how users interacted with 360° NAVIGATE, including the interactions between actors and system operations. It visualized the application's functional requirements and interactions with external entities.

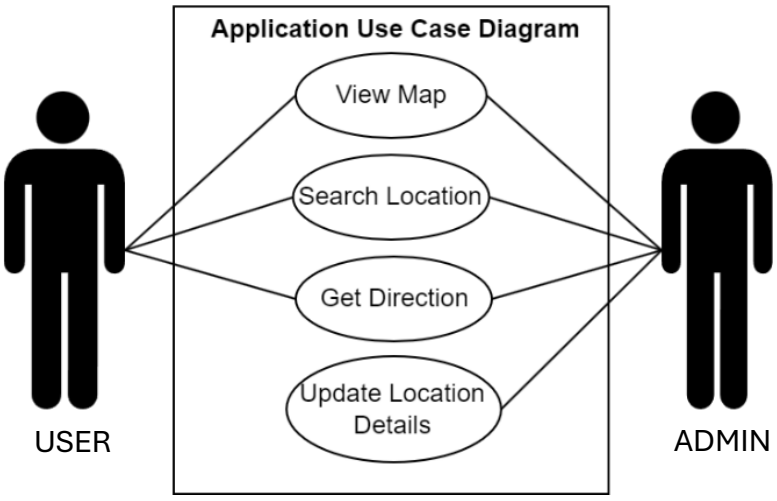

Figure 3-7. Use Case Diagram

Figure 3-7 The use case diagram explains how users and administrators interacted with 360° NAVIGATE, with a focus on important tasks such as data management, map navigation, location search, and directions. It visually outlines the roles and actions available to each type of actor within the system.

Database Schema. The schema is a set of information describing contents, format, and structure of a database and relationship between elements used to control, access to and manipulation of the database.

Figure 3-8. Database Schema

This figure 3-8 presents the database of 360° NAVIGATE which has different types of documents as the back end of the system.

System Architecture. The system architecture includes several components, including the expanded system, all of which are intended to work together to achieve the complete navigation solution. Each component is critical to the system's integration and functionality.

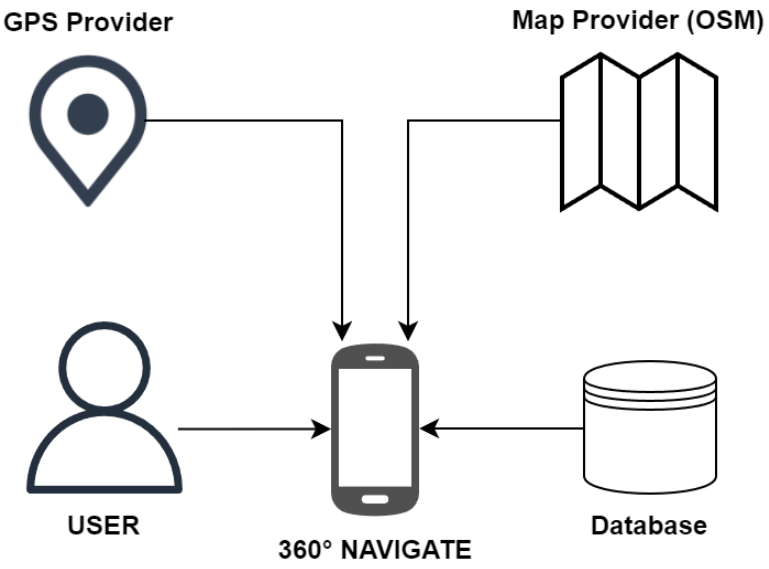

Figure 3-9. System Architecture

Figure 3-9 Illustrates how the navigation system integrates user input with GPS data, OpenStreetMap (OSM) map information, and the database that provided the location services and navigation. The user interacts with the system, which processes information from multiple sources to provide accurate navigation assistance.

User-Interface Design

The user interface design focuses on creating an intuitive and visually appealing layout that improves user engagement with the application. This section explains the design ideas and execution steps used to create a seamless interface.

Figure 3-10. Login Page

Figure 3-10. Illustrates the login page interface, where users can enter their credentials (email and password) to securely access the system**.**

Figure 3-11. Main Page

Figure 3-11. Shows the main page or explore interface, providing users with access to key features, navigation options, and an overview of available content or tools.

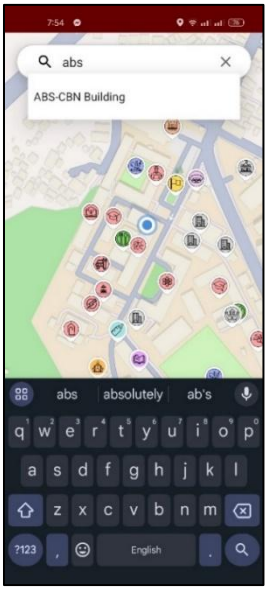

Figure 3-12. Search View

Figure 3-12. Shows the search bar, enabled users to locate desired items or information efficiently by typing relevant terms.

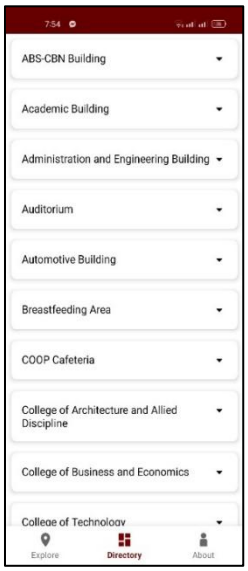

Figure 3-13. Directory Page

Figure 3-13. Presents the directory page, displaying an organized list of items or categories for easy navigation and selection**.**

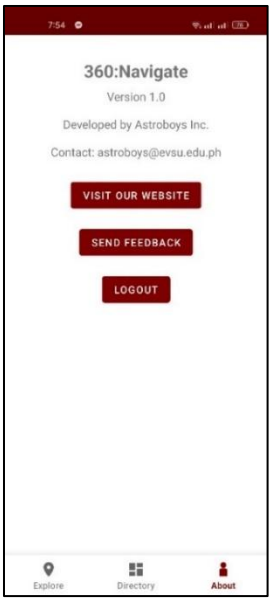

Figure 3-14. About Page

Figure 3-14. Displays the About page, providing information about the system, its purpose, and relevant details for users.

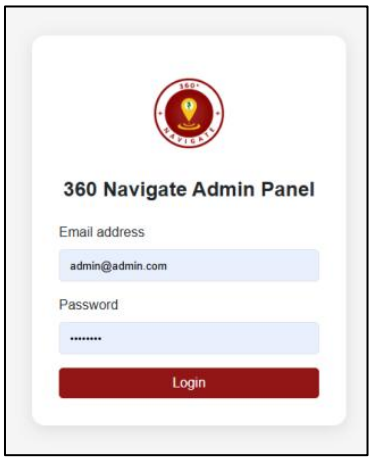

Figure 3-15. Admin Login

Figure 3-15. Shows the Admin Login Page, where administrators enter their credentials to access the system's management features.

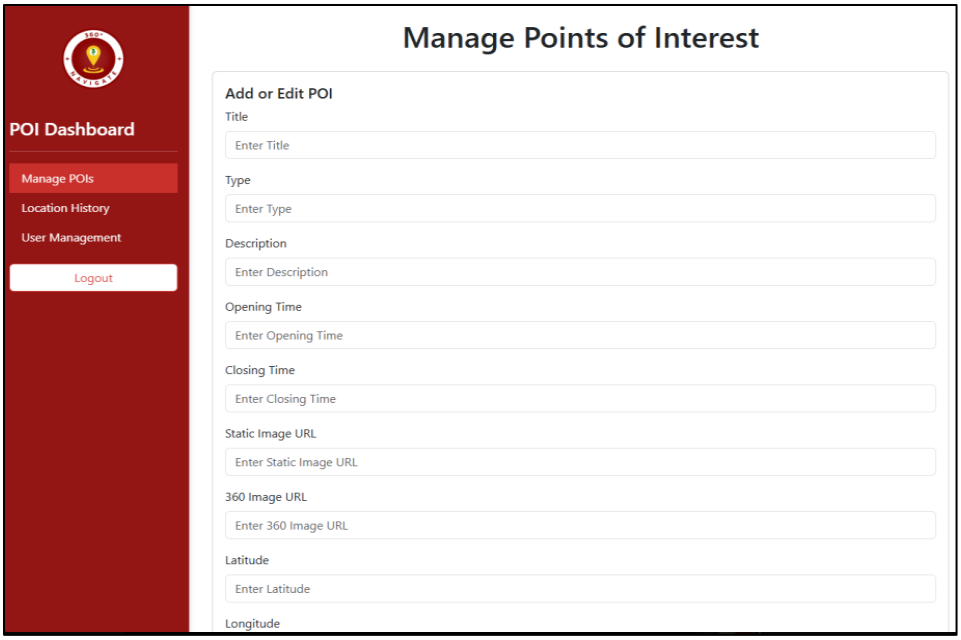

Figure 3-16. Manage POI Dashboard

Figure 3-16. Illustrates the Manage Points of Interest Page, allowing administrators to add, edit, or remove locations and related details.

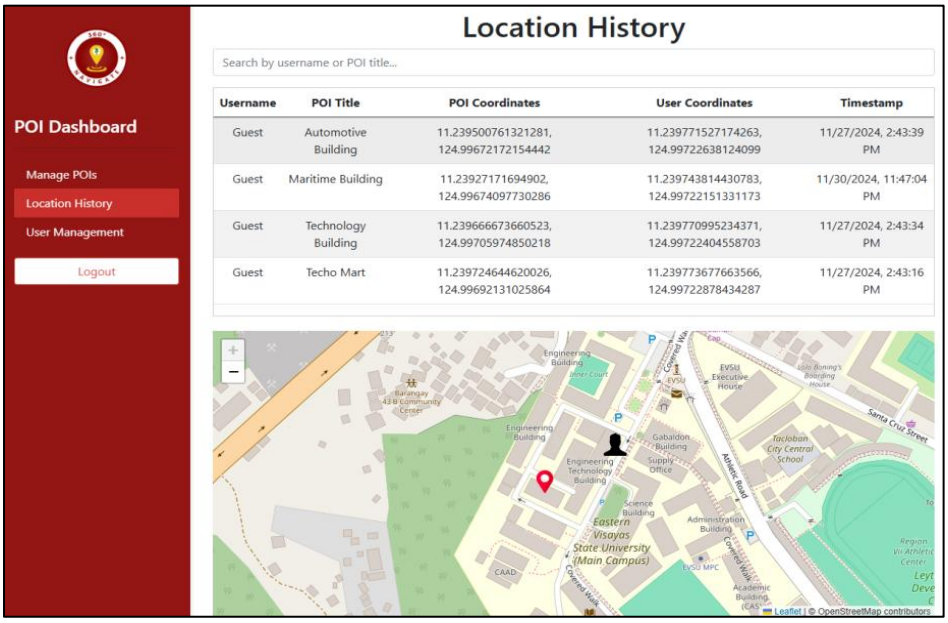

Figure 3-17. Location History Page

Figure 3-17. shows the Location History Page, displaying a record of previously visited or accessed locations for tracking and reference.

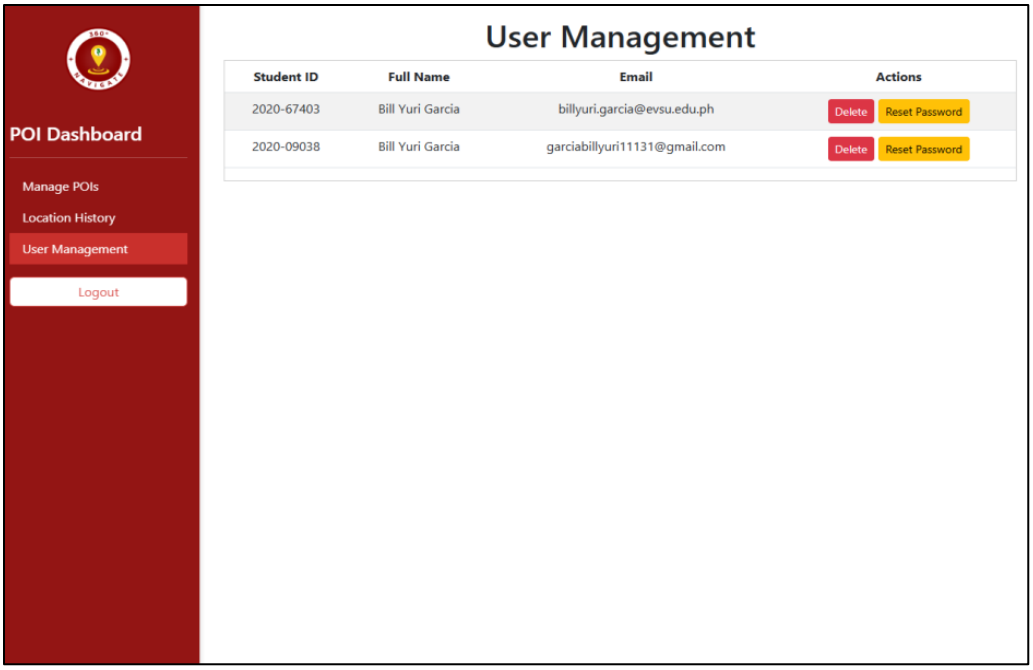

Figure 3-18. User Management Page

Figure 3-18. Manage Points of Interest Page, enabling administrators to oversee, update, or organize details about various locations.

Software Specification

Table 3-5 below shows the necessary requirements to use 360° NAVIGATE mobile application.

Table 3-5. Software Specification

Item	Minimum	Required
Operating System	Android 9.0	Android 10
Internet Connectivity	Stable 3G or Wi-Fi connection to load basic map.	Reliable 4G/5G or Wi-Fi connection for optimal performance, including real-time map updates, image loading, and database sync.

Hardware Specification

Table 3-6 below shows the necessary requirements that are required to use the 360° NAVIGATE mobile application.

Table 3-6. Hardware Specification

Item	Minimum	Required
Processor	Quad-core 1.5 GHz	Octa-core 2.0 GHz or higher
RAM	2 GB	4 GB or more
Storage	16 GB	32 GB or more

Network	Support for 3G/4G LTE	Support for 5G, with fallback to 4G LTE
Battery	Minimum 2500 mAh	3000 mAh or higher
GPS	Integrated GPS receiver	Advanced GPS with GLONASS and Galileo support

Evaluation

The evaluation of the 360° NAVIGATE: Interactive EVSU Companion Map with Panoramic Perspective was conducted to ensure the system met its intended objectives and adhered to user expectations. To achieve a comprehensive assessment, the researchers employed a structured evaluation instrument and conducted surveys among diverse groups, including students, faculty, staff, and visitors.

Evaluation Instrument

The evaluation instrument used was carefully designed to capture various aspects of software quality, aligning with ISO 25010 Software Quality Standards. The instrument consisted of multiple indicators categorized under the following criteria:

Functional Suitability - Assessed whether the application fulfilled its intended purpose and provided accurate outputs.

Performance Efficiency - Measured the speed and effectiveness of the application in meeting user needs.

Compatibility - Evaluated the app's performance across different devices and multitasking conditions.

Usability - Determined ease of use, user interface appeal, and error prevention.

Reliability - Examined the consistency of output, fault tolerance, and ability to recover from failures.

Security - Validated measures for data protection, unauthorized access prevention, and reliability of security logs.

Maintainability - Assessed the system's adaptability and operation with minimal maintenance.

Portability - Verified the stability and ease of installation/uninstallation across various devices and platforms.

Each indicator was rated using a five-point Likert scale, with responses ranging from Strongly Disagree (1) to Highly Acceptable (5). This structured approach enabled quantitative and qualitative analysis of the system's performance.

The evaluation utilized a Likert Scale to assess user perceptions across multiple software quality criteria. The scale ranged from 1 (Strongly Disagree) to 5 (Highly Acceptable), providing a structured way to quantify user feedback. The specific ratings and their corresponding descriptive interpretations are shown in Table 3-7 below

Table 3-7. Likert Scale

Rating	Score Range	Descriptive Interpretation
5	4.21 – 5.00	Highly Acceptable
4	3.41 – 4.20	Acceptable
3	2.61 – 3.40	Moderately Accepted
2	1.81 – 2.60	Disagree
1	1.00 – 1.80	Strongly Disagree

These ratings were then used to calculate the weighted mean for each category, offering a clear measure of how well the system performed according to user feedback. The following report discusses the performance of each category, highlighting strengths and identifying areas for improvement based on the input collected.

Chapter IV

RESULTS AND DISCUSSIONS

Chapter IV presented the results of the study and evaluated how the implementation of 360° NAVIGATE achieved its objectives in enhancing campus navigation at Eastern Visayas State University (EVSU).

System Features and Functionality

This section provides a detailed description of the key features and functionalities of the 360 NAVIGATE mobile application. Each feature was designed to address specific navigation challenges on the EVSU campus.

Interactive Map with User Location

The interactive map is the central feature of the 360° NAVIGATE application, combining real-time OpenStreetMap data with campus-specific information to provide users with a dynamic navigation experience. Users can pan, zoom, and interact with the map, allowing them to explore the entire campus or zoom in on specific areas.

Clickable elements on the map, such as buildings and facilities, enhanced user engagement by providing detailed information on each location, such as department names and room numbers. This functionality made it easier for users to navigate around the campus and access relevant details

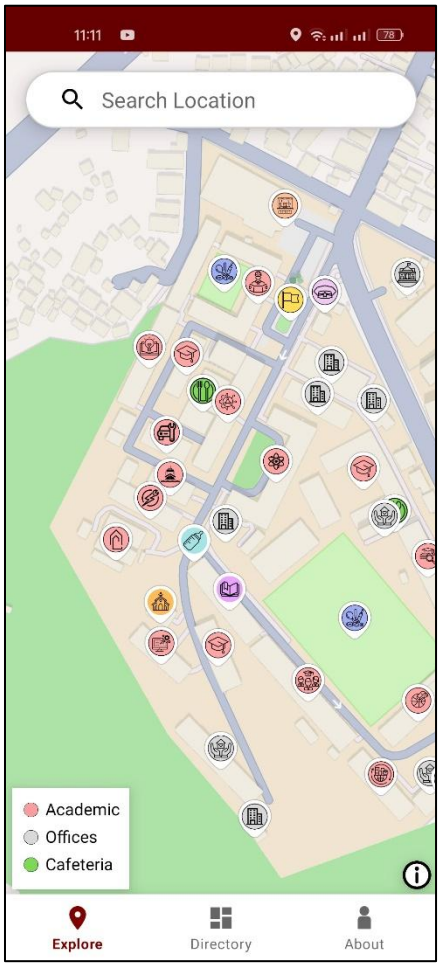

Figure 4–1. Interactive Map Page

Figure 4-1 presents the interactive map feature providing a detailed layout of the EVSU campus, displaying points of interest (POIs) using categorized icons. It shows the user's real-time location and their desired destination on a 2D map of the EVSU campus. By utilizing live GPS data, the map updates dynamically to display the user's position and the route to their destination. Users can pan, zoom, and interact with the map to explore locations such as academic buildings, offices, and cafeteria

360-Degree Panoramic Views of Landmarks and Points of Interest

The 360 NAVIGATE provided an immersive campus experience through its 360-degree panoramic view feature, which allowed users to virtually explore key campus landmarks. This feature helped users familiarize themselves with important locations such as academic buildings, administrative offices, and recreational areas. The 360-degree views were integrated directly into the app, enabling users to navigate locations visually before physically visiting them..

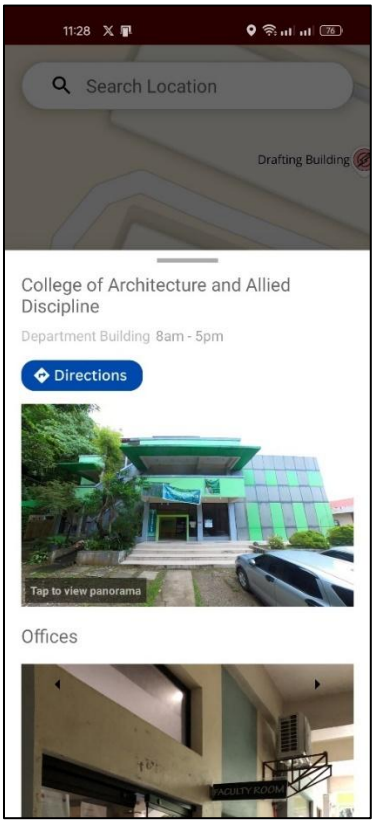

Figure 4-2. Point of Interest Card View.

Figure 4-2 shows the Point of Interest (POI) card view, which includes a preview of the 360-degree panoramic view of the location along with details about the office or building. This feature helps users virtually explore the campus and get familiar with key landmarks.

Figure 4-3. 360-degree Panoramic View

Figure 4-3 displays the 360-degree panoramic view of the selected point of interest, providing users with an immersive, interactive visual experience.

Figure 4-4. Office View

Figure 4-4 displays the Office View, highlighting the offices located within the selected point of interest. This feature provides users with a clear and organized overview of the offices in the area, making it easier to identify and locate specific administrative or academic departments on the campus.

Route Optimization Using Dijkstra's Algorithm

The system used Dijkstra's algorithm to optimize routes, calculating the shortest path between the user's current location and their destination. This feature ensured that users were provided with the quickest routes, reducing travel time and improving campus navigation.

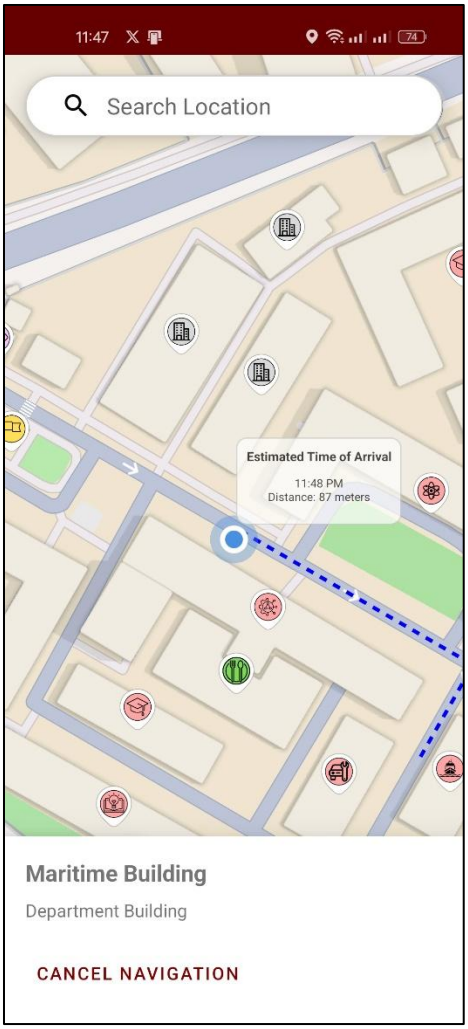

Figure 4-5. Navigation Mode View

Figure 4-5 displays the navigation mode view, which shows the results when the user clicks "Directions." This feature presents the route between the user's current location and their selected destination, based on the shortest path calculated by Dijkstra's algorithm. The visual representation helps users easily follow the recommended route, ensuring a smooth and efficient navigation experience across the campus.

System Evaluation Overview

The evaluation presented the mobile application based on ISO 25010 Software Quality Standards. It focused on the following quality characteristics: Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, Security, Maintainability, and Portability. The primary purpose of this evaluation was to determine the system's success in meeting user requirements and delivering the expected quality.

Additional Features

This section focused on the extra features of 360Navigate that enhanced the user experience and made the app even more useful for navigating the campus.

Figure 4-6. Account Login Page

Figure 4-6 shows the login page of the 360 Navigate app, where users have the option to log in, register a new account, or continue using the app in guest mode.

Figure 4-7. Account Registration Page

Figure 4-7 shows the registration page of the 360 Navigate app, where users can create a new account by entering their details

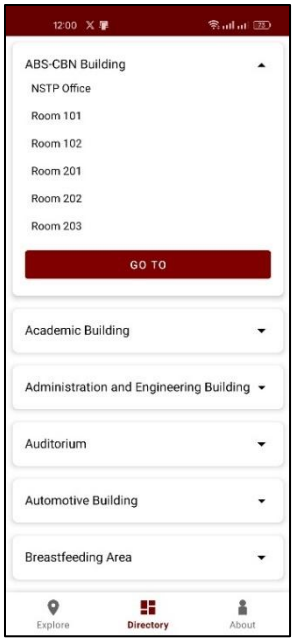

Figure 4-8. Directory Dashboard Page

Figure 4-8 shows the directory dashboard of the 360 Navigate app, providing users with an alphabetized list of campus points of interest. This feature allows users to easily browse and search for specific locations, helping them quickly find what they need within the campus.

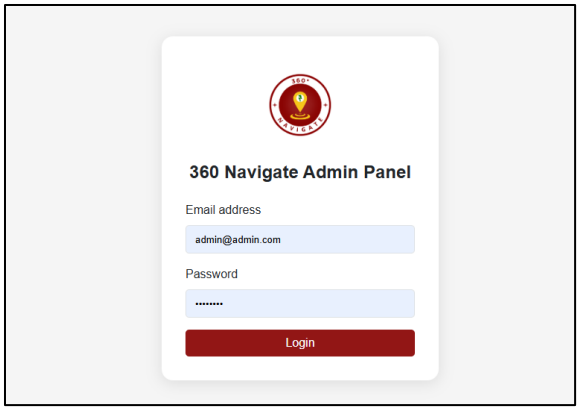

Figure 4-9. 360 Navigate Admin Website Login

Figure 4-9 shows the login page for the admin website of the 360 Navigate system. This page allows administrators to securely access the backend system for managing campus data, including updating maps, locations, and user accounts.

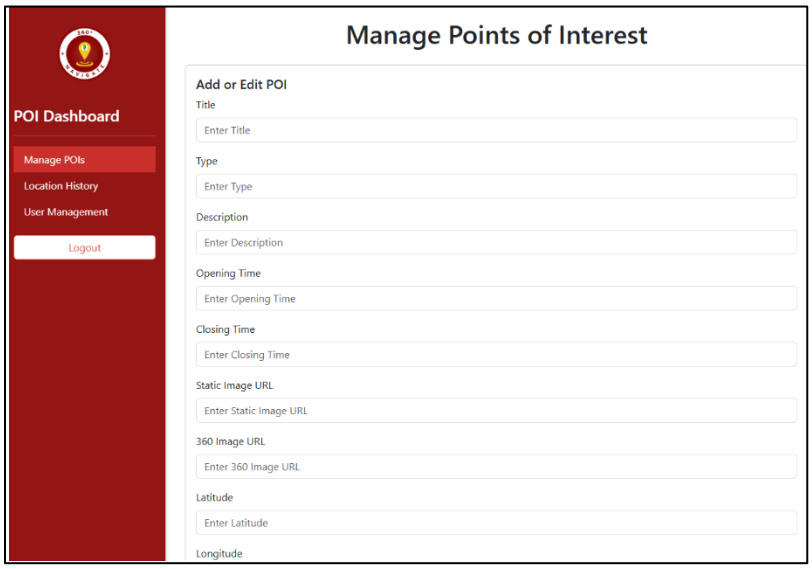

Figure 4-10.1. Manage POI Dashboard (Add or Edit POI)

Figure 4-10.1 shows the Manage POI (Point of Interest) Dashboard on the admin website of the 360 Navigate system. This dashboard allows administrators to add, edit, or remove points of interest on the campus map, ensuring accurate and up-to-date location information for users.

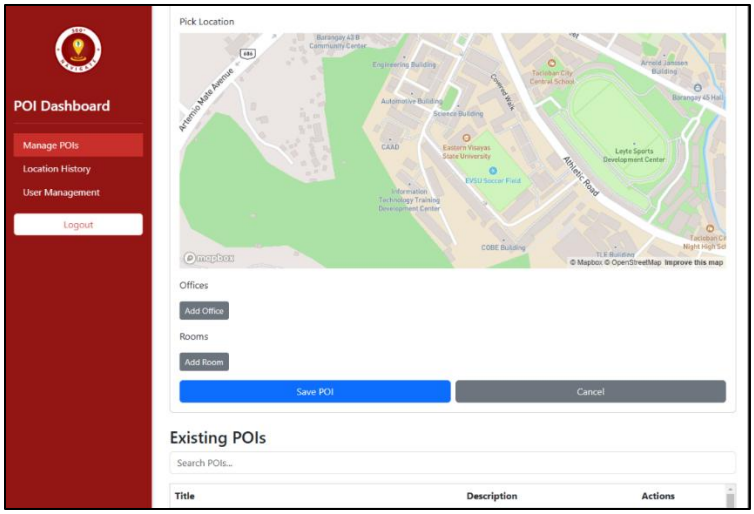

Figure 4-10.2. Manage POI Dashboard (Map View)

Figure 4-10.2 shows the Map View section of the Manage POI Dashboard. This part of the dashboard allows administrators to visually manage and place points of interest directly on the campus map, ensuring accurate location data for each POI.

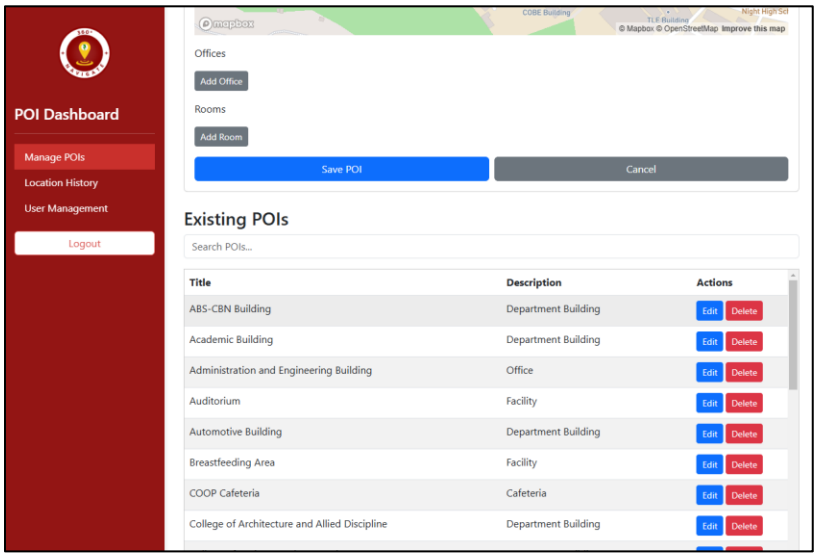

Figure 4-10.3. Manage POI Dashboard (Existing POIs)

Figure 4-10.3 shows the Existing POIs section of the Manage POI Dashboard, where administrators can view, edit, or remove previously added points of interest on the campus map. This section provides an overview of all current POIs, allowing for easy management and updates.

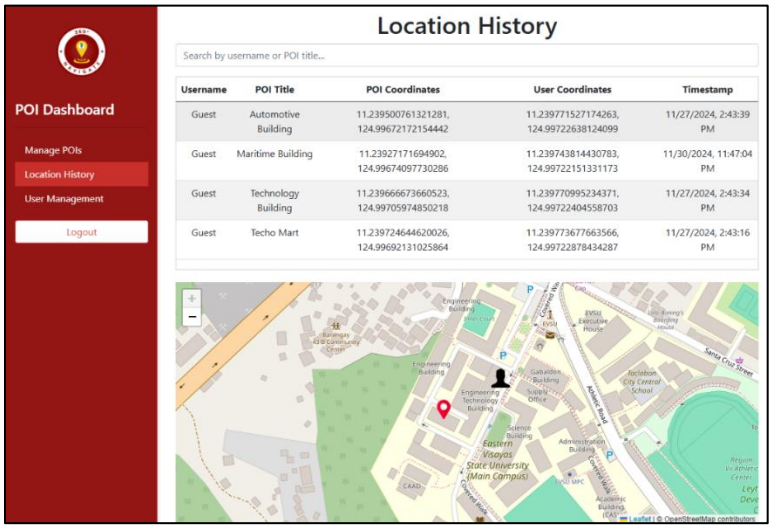

Figure 4-11. Location History Dashboard

Figure 4-11 shows the Location History Dashboard, which tracks the last destination selected by users. Administrators can view the most recent destinations accessed within the campus, providing insights into user behavior

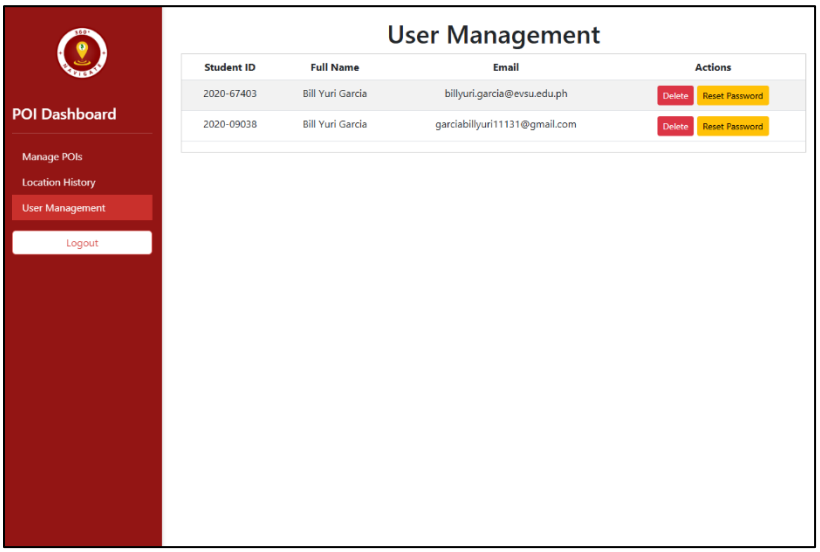

Figure 4-12. User Management Dashboard

Figure 4-12 shows the User Management Dashboard, where administrators can manage user accounts by deleting accounts or resetting passwords. This functionality ensures easy maintenance of user access and security within the system.

Overview of Evaluation Results

The system received good feedback across all evaluation categories, with weighted mean scores ranging from 4.17 to 4.34, indicating that it matched users' expectations in terms of functional suitability, performance efficiency, usability, and portability. While users praised the system's ability to serve its intended function and its broad compatibility across devices, there were some minor issues about reliability and performance under specific conditions. Usability was generally scored positively, however a few users identified areas for improvement, such as reducing user errors.

Overall, the review indicates that the system is functional and well-received; nevertheless, minor improvements in dependability and compatibility could further improve the user experience.

Discussion of Results

The evaluation results showed that the system met user expectations in several key categories, including usability, functionality, and compatibility. Faculty and staff consistently gave excellent feedback, praising the application's intuitive design and its ability to successfully meet their demands. Visitors also provided positive recommendations, particularly highlighting the system's user-friendly UI.

Despite these characteristics, certain opportunities for development were identified, particularly in performance efficiency and reliability. A few users experienced temporary delays during use and slight difficulties in sustaining constant data output despite equipment limitations. These concerns highlight areas for improvement in the application's performance and ensuring smooth operation under specific scenarios.

Future improvements may focus on better optimizing the system to handle environments with slower or inconsistent Wi-Fi connections, even though the system already includes an offline mode. This could involve refining synchronization methods to ensure data updates occur seamlessly

once connectivity is restored, as well as enhancing performance when handling partial or intermittent data transfers. Additionally, support features such as interactive help tools or an onboarding tour could assist users in navigating the system during such circumstances. These improvements would ensure a smooth and reliable experience, even in the face of network issues.

Table 4-1. Overall Weighted Mean

Category	Average Weighted Mean	Rating Interpretation
A. Functional Suitability	4.20	Acceptable
B. Performance Efficiency	4.20	Acceptable
C. Compatibility	4.26	Highly Acceptable
D. Usability	4.23	Highly Acceptable
E. Reliability	4.23	Highly Acceptable
F. Security	4.23	Highly Acceptable
G. Maintainability	4.23	Highly Acceptable
H. Portability	4.26	Highly Acceptable

Table 4-1 Summarize the evaluation categories presents an average weighted mean ranging from 4.20 to 4.26, reflecting strong user approval. While functional suitability, usability, and reliability were well-rated, the results underscore the importance of addressing minor performance issues and expanding feature adaptability to further enhance the user experience.

Chapter V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presented the summary of the study, highlighting the key findings derived from the evaluation of the developed system.

Summary

The purpose of 360 NAVIGATE was to develop a navigation system that integrated real-time map updates, 360-degree panoramic views, and route optimization techniques to improve user navigation, particularly within a campus. The primary objectives were to create an interactive, user-friendly platform that facilitated efficient navigation while enhancing the experience of exploring Points of Interest (POIs) through immersive technology.

To achieve these objectives, the system was built using OpenStreetMap, Firebase Firestore for storing and retrieving POI data, and the Dijkstra algorithm for optimizing the shortest path between two locations. The system was also designed with an offline mode to ensure functionality in areas with limited or no internet connectivity, addressing the critical need for reliable navigation in varying environments.

A key component of the project was the integration of 360-degree panoramic views of significant landmarks and POIs, providing users with an immersive and visually engaging experience. This feature was created to help users better understand and interact with their surroundings, delivering a more holistic and fulfilling experience.

The evaluation of the system was conducted using the ISO 25010 Software Quality Standards, assessing various aspects such as functional suitability, performance efficiency, usability, reliability, and security. Data was gathered through a structured questionnaire, including both

quantitative and qualitative assessments from a diverse group of users. The results revealed that the system met its intended functional goals, with positive feedback regarding its usability, reliability, and security features. However, certain aspects, such as performance efficiency, were identified as areas for future improvement, particularly in handling larger datasets or complex map features.

The system's performance, while generally strong, would benefit from further optimization to support scalability and improve efficiency in real-time data processing. The project also laid a foundation for future advancements in interactive navigation technology, with potential applications extending beyond campus environments, including urban planning and tourism.

Conclusions

The project successfully achieved its primary objectives of developing an advanced navigation system designed to enhance user experience through real-time map updates, immersive 360-degree panoramic views, and optimized route suggestions. The system incorporated key features such as location tracking, POI exploration, and offline functionality, which were well-received by users during the evaluation phase. Based on the study's findings, the following conclusions were drawn in alignment with the objectives:

The integration of a dynamic 2D map with real-time location updates was successfully implemented using OpenStreetMap. This feature allowed users to track their movements accurately, enhancing their navigation experience. The system performed well in updating the user's location in real-time, meeting the intended objective of providing an interactive and responsive navigation tool.

The addition of 360-degree panoramic views improved the user experience, allowing users to virtually explore important landmarks and POIs. User feedback indicated that this feature provided an immersive and engaging way to learn about and interact with significant locations, fulfilling the objective of enhancing the exploration of POIs.

The implementation of Dijkstra's algorithm for route optimization successfully delivered the shortest and most efficient paths between two points. This feature met the project's goal of providing users with accurate, optimal routes. However, some performance improvements are needed to enhance efficiency when handling larger datasets or more complex map features.

The system was evaluated based on the ISO 25010 Software Quality Standards, which assessed several critical aspects, including functional suitability, performance efficiency, usability, security, and reliability. The evaluation results showed that the system generally met the desired criteria, with positive feedback on functionality, usability, and reliability. However, performance efficiency, particularly when processing larger datasets, indicated areas for future improvement.

The 360 NAVIGATE system proved to be a functional, reliable, and user-friendly navigation tool that met its original objectives. While future improvements could focus on optimizing performance and increasing scalability, the project lays a robust foundation for further advancements. Potential applications extend beyond campus navigation, with opportunities to integrate technologies such as artificial intelligence for enhanced route optimization and predictive navigation. These developments could contribute to a more advanced and adaptive navigation experience in various real-world contexts.

Recommendations

For future researchers aiming to improve and advance the system and mobile application, the following recommendations are proposed:

1. Integrate an Interactive Street View Feature. Enhance the user experience by implementing an interactive street view capability. This feature would allow users to virtually explore the surroundings of points of interest (POIs) with 360° panoramic imagery, providing a more immersive and detailed navigation experience.
2. Implement Real-Time Notifications and Alerts. Incorporate real-time notification system to inform users about critical updates, such as unexpected route changes, POI closures, scheduled maintenance, or special events. Alerts could also include personalized reminders for appointments or location-based notifications when users are near a specific POI.
3. Expand Multi-Platform Support (iOS and Web). Extend the application's accessibility by developing support for additional platforms, including iOS devices and a web-based interface. This would broaden the user base, ensure cross-platform synchronization of user data, and make the system accessible across a wider range of devices and operating systems.
4. Turn-by-Turn Directions: Provide detailed step-by-step instructions for navigation, improving usability for walking or driving routes.

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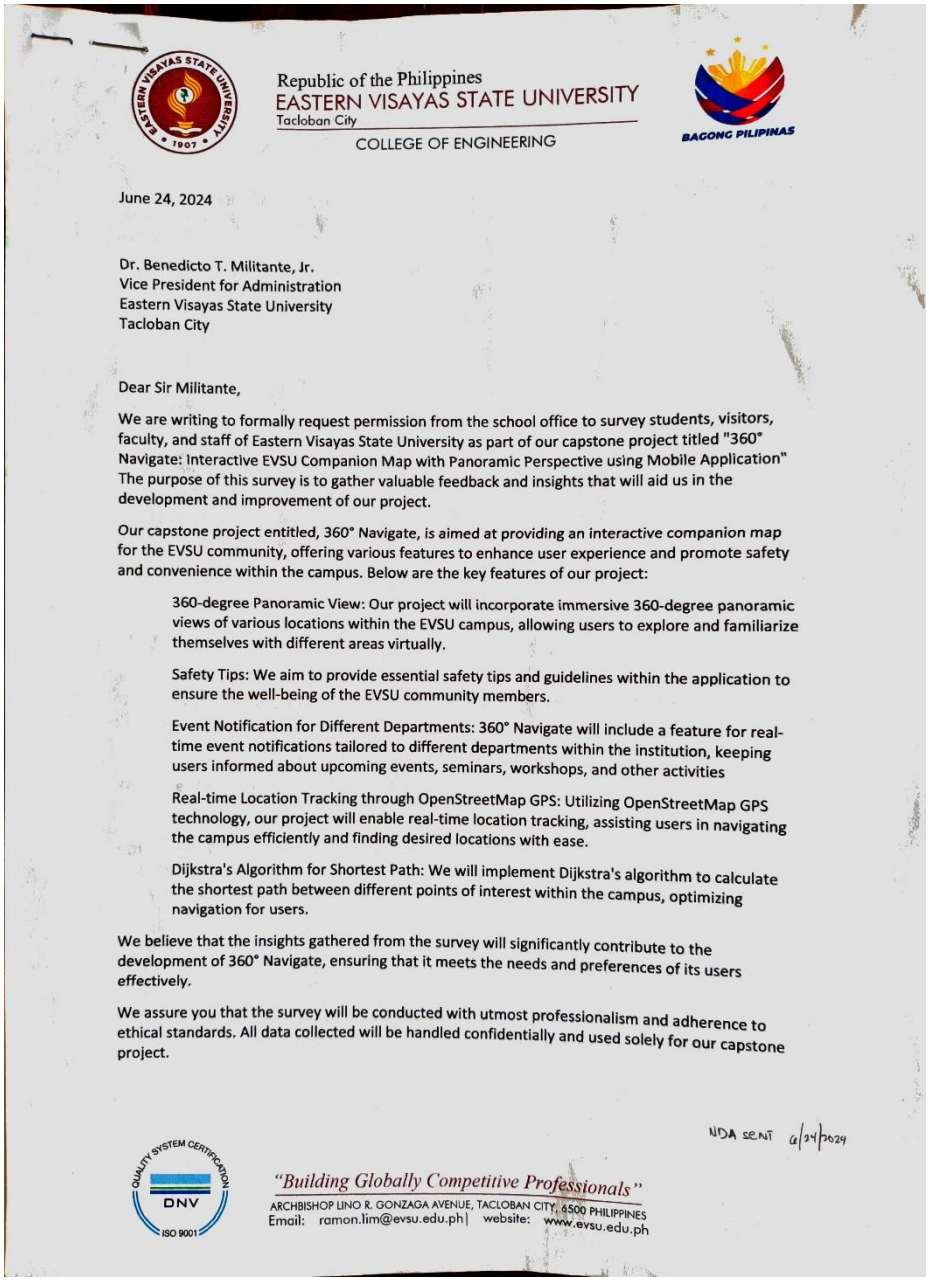
APPENDIX A

Request Letter to Conduct Survey



Republic of the Philippines
EASTERN VISAYAS STATE UNIVERSITY
Tacloban City
COLLEGE OF ENGINEERING

BAGONG PILIPINAS

June 24, 2024

Dr. Benedicto T. Militante, Jr.
Vice President for Administration
Eastern Visayas State University
Tacloban City

Dear Sir Militante,

We are writing to formally request permission from the school office to survey students, visitors, faculty, and staff of Eastern Visayas State University as part of our capstone project titled "360° Navigate: Interactive EVSU Companion Map with Panoramic Perspective using Mobile Application" The purpose of this survey is to gather valuable feedback and insights that will aid us in the development and improvement of our project.

Our capstone project entitled, 360° Navigate, is aimed at providing an interactive companion map for the EVSU community, offering various features to enhance user experience and promote safety and convenience within the campus. Below are the key features of our project:

360-degree Panoramic View: Our project will incorporate immersive 360-degree panoramic views of various locations within the EVSU campus, allowing users to explore and familiarize themselves with different areas virtually.

Safety Tips: We aim to provide essential safety tips and guidelines within the application to ensure the well-being of the EVSU community members.

Event Notification for Different Departments: 360° Navigate will include a feature for real-time event notifications tailored to different departments within the institution, keeping users informed about upcoming events, seminars, workshops, and other activities

Real-time Location Tracking through OpenStreetMap GPS: Utilizing OpenStreetMap GPS technology, our project will enable real-time location tracking, assisting users in navigating the campus efficiently and finding desired locations with ease.

Dijkstra's Algorithm for Shortest Path: We will implement Dijkstra's algorithm to calculate the shortest path between different points of interest within the campus, optimizing navigation for users.

We believe that the insights gathered from the survey will significantly contribute to the development of 360° Navigate, ensuring that it meets the needs and preferences of its users effectively.

We assure you that the survey will be conducted with utmost professionalism and adherence to ethical standards. All data collected will be handled confidentially and used solely for our capstone project.

NDA sent 6/24/2024

QUALITY SYSTEM CERTIFICATION DNV ISO 9001

"Building Globally Competitive Professionals"

ARCHBISHOP LINO R. GONZAGA AVENUE, TACLOBAN CITY, 6500 PHILIPPINES
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Republic of the Philippines
EASTERN VISAYAS STATE UNIVERSITY
Tacloban City
COLLEGE OF ENGINEERING

BAGONG PILIPINAS

We kindly request your approval to distribute the survey questionnaire among the EVSU community members and seek their participation in providing valuable feedback. Your support in this matter would be greatly appreciated.

Thank you for considering our request. Should you have any questions or require further information, please do not hesitate to contact us at 09666985910 or garciabillyuri11131@gmail.com.

Sincerely,

BSIT 3rd Year Students:

MARK KIAN TISADO

JOHN RENZIE GERILLA

BILLYURI GARCIA

Noted:

SARAH JANE L. CABRAL, MIT
Capstone Project 1 Adviser

JESSIE R. PARAGAS, DIT
Head, Information Technology Department

Recommending Approval:

DORIS ANN S. ESPINA, CSEE
Chief Administrative Officer. Administrative Service Division

Approved:

BENIDICTO T. MILITANTE, JR., PhD, JD
Vice President for Administration and Finance

QUALITY SYSTEM CERTIFICATION DNV ISO 9001

"Building Globally Competitive Professionals"

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APPENDIX B

Survey Form

Survey on Campus Navigation and User Experience for the 360° Navigate Mobile Application

Purpose: To gather feedback to aid in the development and improvement of the 360° Navigate mobile application. (Pagkuha hin feedback nga magamit ha pagpa-uswag han 360° Navigate nga mobile application.)

Section 1: Demographic Information (Impormasyon nga Demograpiko)

Name (Optional): _____

1. What is your role at EVSU? (Ano an imo papel ha EVSU?) (Select one / Pili hin usa)
    - Student
    - Faculty
    - Staff
    - Visitor
2. How often do you visit the EVSU campus? (Gin-aano ka kasagaran nga napakadto ha EVSU campus?)
    - Daily
    - Weekly
    - Monthly
    - Rarely

Section 2: Navigation Experience (Kasinatian ha Pag-navigate)

3. How easy is it for you to find specific locations on the EVSU campus? (Gaano kadali ha imo an pagpangita hin partikular nga mga lugar ha EVSU campus?)
    - Very easy
    - Easy
    - Neutral
    - Difficult
    - Very difficult
4. How often do you get lost or have trouble finding your way around the campus? (Gaano ka kasagaran nga nawawara o nagkakamay-ada problema ha pagpangita han imo dalan ha campus?)
    - Frequently
    - Occasionally
    - Rarely
    - Never
5. What are the most challenging locations to find on campus? (Ano an pinaka-makuri nga mga lugar nga pagpangitaan ha campus?) (Open-ended / Bukas nga baton)

6. Which resources do you currently use to navigate the campus? (Ano nga mga paagi an imo ginagamit yana ha pag-navigate ha campus?) (Select all that apply / Pili-a ngatanan nga angay)
    - Campus maps
    - Asking for directions
    - Mobile apps
    - Signage

- Other (please specify): _____

7. What specific navigation problems have you encountered on campus? (Ano an partikular nga mga problema ha pag-navigate an imo na-eksperyensya ha campus?) (Open-ended / Bukas nga baton)

Section 3: General Feedback (Heneral nga Feedback)

8. What features would you like to see included in the 360° Navigate app? (Ano nga iba pa nga mga feature an imo karuyag nga isali ha 360° Navigate app?) (Open-ended / Bukas nga baton)

9. Do you have any additional comments or suggestions for improving the app? / Mayda ka pa ba iba nga mga komento o suhestyon para ha pagpa-uswag han app? (Open-ended / Bukas nga baton)

APPENDIX C

Evaluation Instrument

A. Evaluator's Profile

Name: (Optional)_____

Occupation:_____

B. Software Evaluation

Instruction:

The researchers are presently conducting a Capstone project in partial fulfilment of the requirements for the degree Bachelor of Science in Information Technology.

In this regard, please evaluate the developed system by using the given scale below and placing a checkmark (√) under its corresponding numerical rating.

Numerical Rating	Descriptive Interpretation
5	Highly Acceptable
4	Acceptable
3	Moderately Accepted
2	Disagree
1	Strongly Disagree

INDICATORS	Responses				
	1	2	3	4	5
A. FUNCTIONAL SUITABILITY					

1. The application functions according to the intended purpose. (Ang application ay gumagana alinsunod sa kanyang layunin.)					
2. The application can produce outputs with the required accuracy. (Ang application ay nagbibigay ng accurate o tama na output.)					
3. The application functions are easy to understand and easy to use. (Madaling intindihin ang mga feature/function na nakapaloob sa application.)					
B. **PERFORMANCE EFFICIENCY**					
1. The application produces the desired output in a short amount of time. (Nagagawa ng application ang nais na output sa maikling panahon.)					
2. The application can perform the user's needs. (Nagagawa ng application ang pangangailangan ng user.)					
3. The application's limits does not hinder its ability to produce the required results. (Hindi nagiging hangganan ang mga limitasyon ng application upang magawa ang mga kailangang resulta/output.)					
C. **COMPATIBILITY**					
1. The application is smooth and stable on the user's device. (Ang application ay gumagana nang maayos sa device at hindi nagbabagal o nagc-crash.)					

2. The application performs well while other applications are running at the same time. (Maayos na gumagana ang application habang may ibang bukas na application.)					
3. Other applications run well while the application is running. (Gumagana nang maayos ang ibang application na nakabukas habang nakabukas ang application ng Sakahanda.)					
D. **USABILITY**					
1. The application can perform the user's needs. (Naibibigay ng application ang pangangailangan ng user.)					
2. The application interface is easy to understand. (Madaling maintindihan ang interface/design ng application.)					
3. The application is intuitive and prevents the users from making simple errors. (Madaling unawain ang application at may mga tulong upang hindi magkamali ang user.)					
4. The application interface is visually-appealing. (Maganda tingnan ang application.)					
5. People coming from different backgrounds and with different characteristics can use the application effectively. (Ang application ay magagamit nang maayos ng iba't ibang user na may iba't ibang background at katangian/kakayahan.)					
E. RELIABILITY					

1. The application provides accurate output with consistency. (Palaging nakakapagbigay ang application ng tamang output.)					
2. The application runs properly when needed. (Gumagana nang maayos ang application tuwing ito ay kailangan.)					
3. The application produces consistent information processing and output despite the device's limitations. (Nakakapagbigay ng maayos na impormasyon at output ang application gamit ang aking device.)					
4. The application produces and saves the necessary information/data after failures and restart the system. (Nakakapag-save ng impormasyon/data ang application matapos ang mga failures/crashes at kaya nitong mai-restart nang maayos.)					
F. SECURITY					
1. The application ensures that the data is only accessible to the user. (Tanging ang user lamang ang makakakita sa data na nakapaloob sa application.)					
2. The application prevents unauthorized access. (Napipigilan ng application ang ibang tao sa hindi awtorisadong paggamit ng application.)					
3. The application records the events taking place in the application and makes it accessible for reference. (Inire-record ng application ang mga event o pangyayari na nagaganap sa loob ng application, at naise-save ito upang tingnan muli kung kailangan.)					

4. The application's security records are reliable and authentic. (Ang security records ng application ay tama at maaasahan.)					
G. MAINTAINABILITY					
1. The application can operate accurately with minimum maintenance. (Nagagamit nang maayos ang application nang hindi kailangan ang mataas na lebel ng maintenance.)					
2. The application is adaptable to changes. (Madaling lagyan ng pagbabago ang application.)					
H. PORTABILITY					
1. The application is stable on different devices and platforms. (Ang application ay gumagana nang maayos sa iba't ibang device at platform.					
2. The application can be installed and uninstalled with ease. (Ang application ay madaling i-install at uninstall.)					

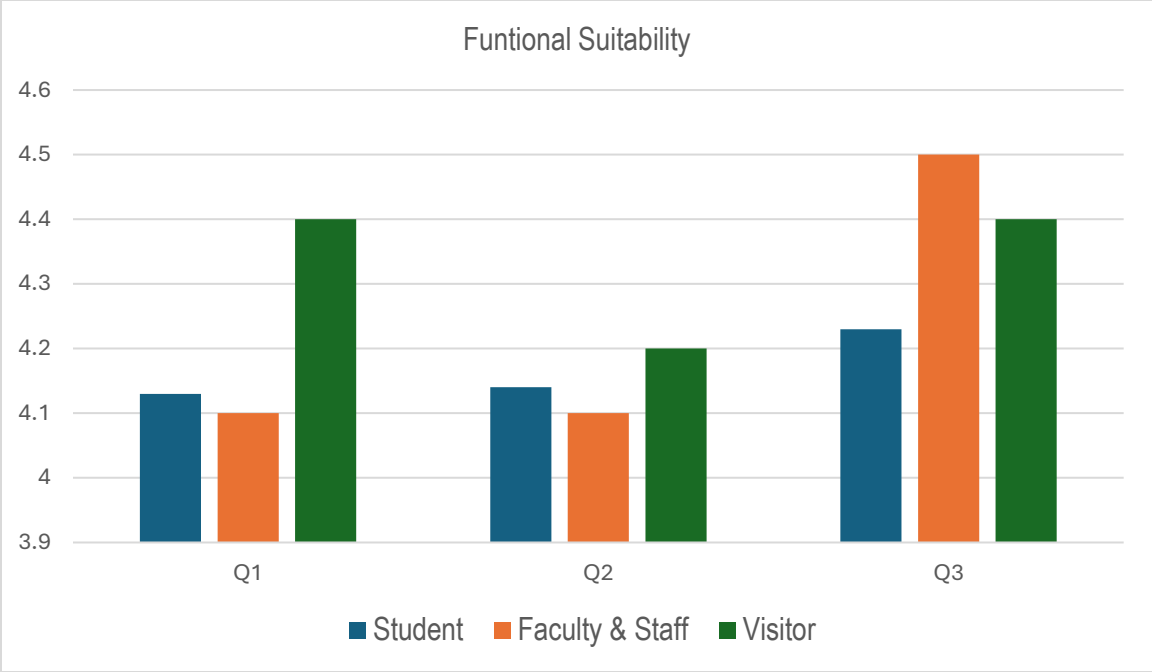
APPENDIX D

Evaluation Tool Result

Breakdown of Result by Category

Functional Suitability

Question	Students (15)	Faculty & Staff (10)	Visitors (10)	Weighted Mean	Rating Interpretation
Q1. The application functions according to the intended purpose.	4.13	4.10	4.40	4.20	Acceptable
Q2. The application can produce outputs with the required accuracy.	4.14	4.10	4.20	4.14	Acceptable
Q3. The application functions are easy to understand and easy to use.	4.23	4.50	4.40	4.23	Highly Acceptable
Average for Category A	4.17	4.23	4.33	4.20	Acceptable

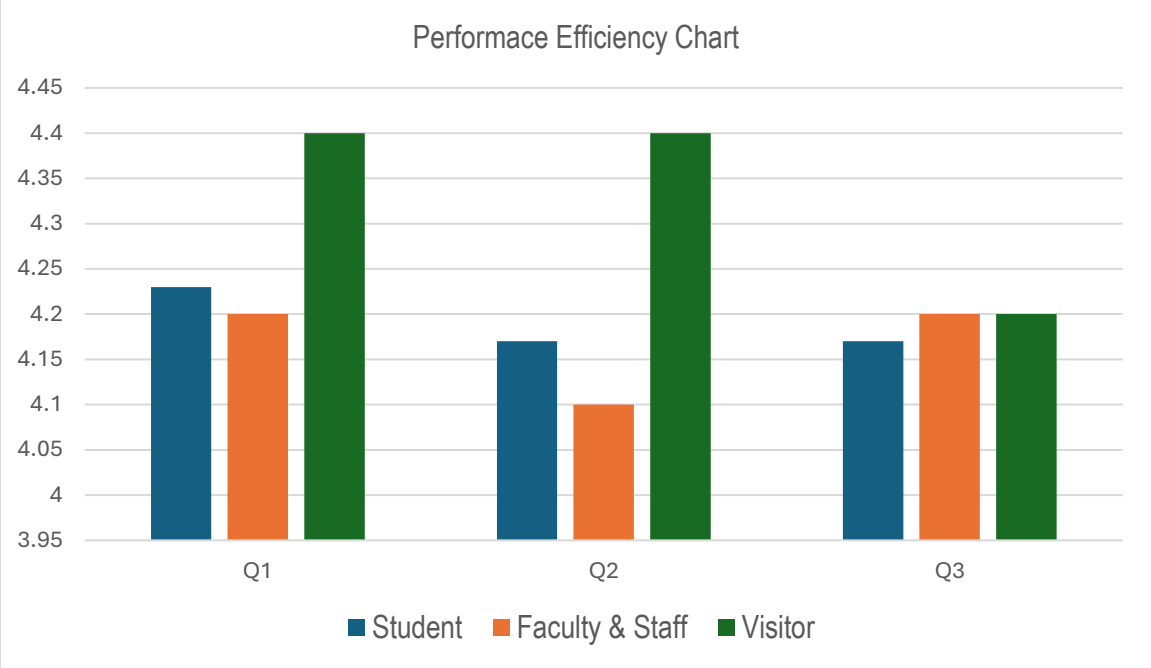


Functional Suitability displays a weighted average of 4.20 for Functional Suitability, indicating that the app effectively serves its intended function. However, students ranked accuracy somewhat lower, indicating that there is room for minor improvements in producing exact results. Improving student usability, such as optimizing navigation paths or boosting error tolerance, could help users better meet their needs.

Performance Efficiency

Question	Students (15)	Faculty & Staff (10)	Visitors (10)	Weighted Mean	Rating Interpretation
Q1. The application produces the desired output in a short amount of time.	4.23	4.20	4.40	4.23	Highly Acceptable

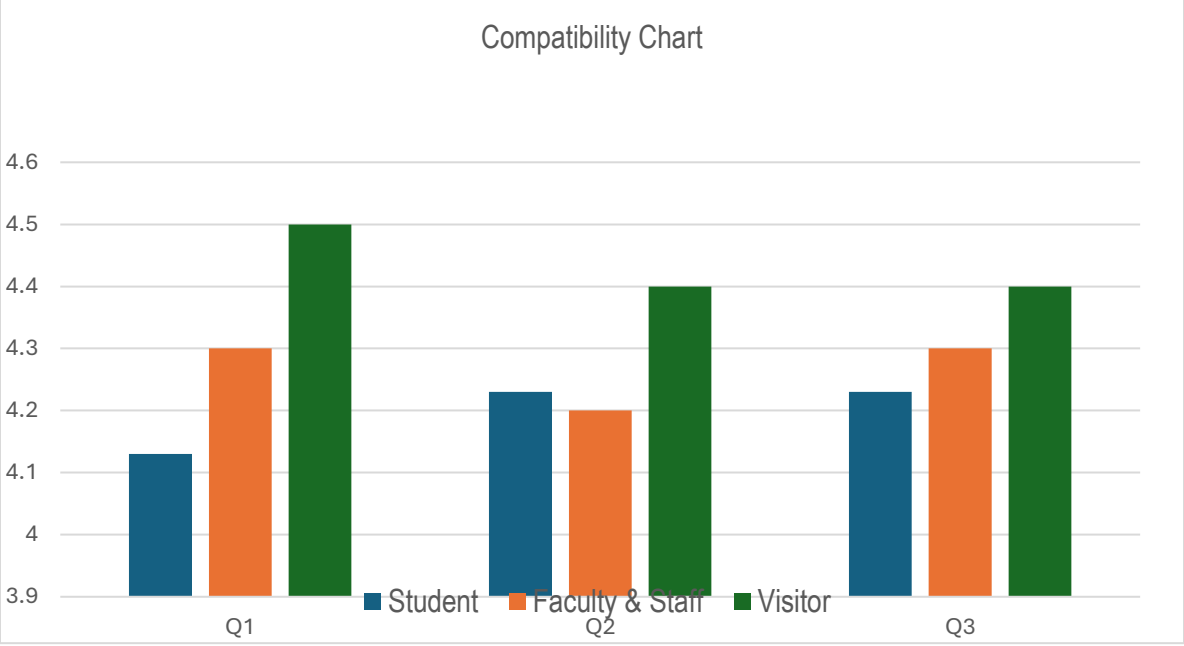
Q2. The application can perform the user's needs.	4.17	4.10	4.40	4.17	Acceptable
Q3. The application's limits do not hinder its ability to produce the required results.	4.17	4.20	4.20	4.17	Acceptable
Average for Category B	4.19	4.17	4.33	4.20	Acceptable



Performance Efficiency reflects a weighted mean of 4.20, with most users satisfied with the app's responsiveness and output speed. Some delays experienced highlight opportunities for optimizing the algorithm or load management features, particularly for faculty and students who noted room for improvement.

Compatibility

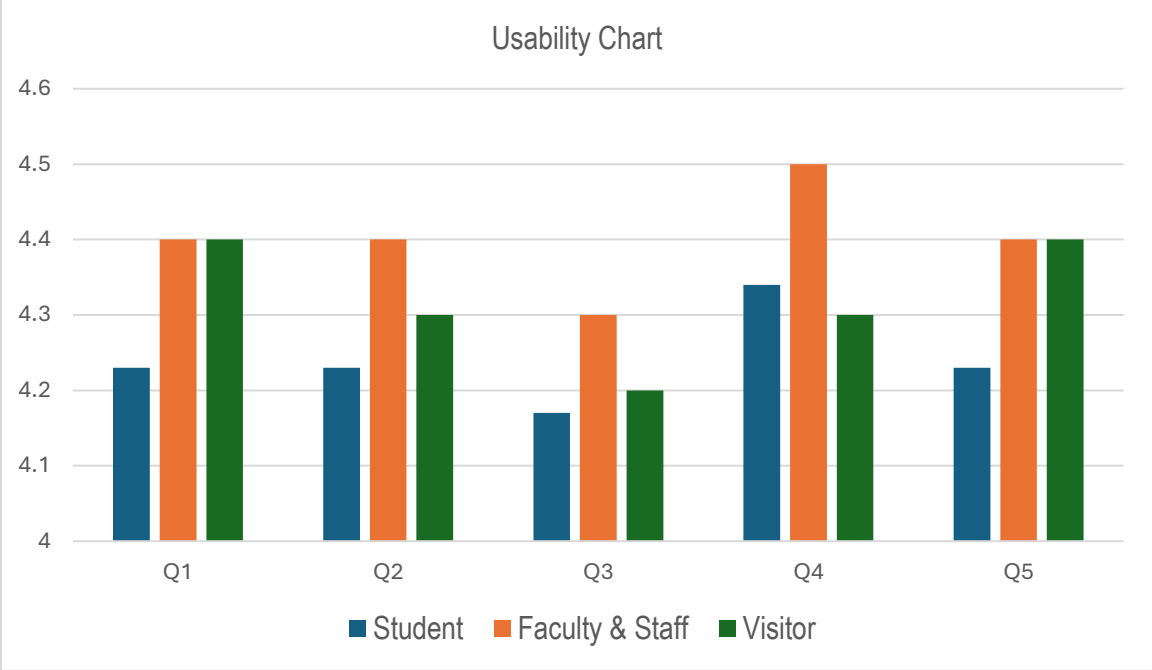
Question	Students (15)	Faculty & Staff (10)	Visitors (10)	Weighted Mean	Rating Interpretation
Q1. The application is smooth and stable on the user's device.	4.13	4.30	4.50	4.26	Highly Acceptable
Q2. The application performs well while other applications are running at the same time.	4.23	4.20	4.40	4.23	Highly Acceptable
Q3. Other applications run well while the application is running.	4.23	4.30	4.40	4.23	Highly Acceptable
Average for Category C	**4.20**	**4.27**	**4.43**	**4.24**	Highly Acceptable



With an overall mean of 4.26, Compatibility emerged as one of the app's strongest areas. Multitasking issues were reported by some faculty. Enhancing performance in multitasking scenarios could further solidify user satisfaction.

Usability

Question	Students (15)	Faculty & Staff (10)	Visitors (10)	Weighted Mean	Rating Interpretation
Q1. The application can perform the user's needs.	4.23	4.40	4.40	4.23	Highly Acceptable
Q2. The application interface is easy to understand.	4.23	4.40	4.30	4.23	Highly Acceptable
Q3. The application is intuitive and prevents the users from making simple errors.	4.17	4.30	4.20	4.17	Acceptable
Q4. The application interface is visually appealing.	4.34	4.50	4.30	4.34	Highly Acceptable
Q5. People from different backgrounds can use the application effectively.	4.23	4.40	4.40	4.23	Highly Acceptable
Average for Category D	4.24	4.38	4.32	4.30	Highly Acceptable

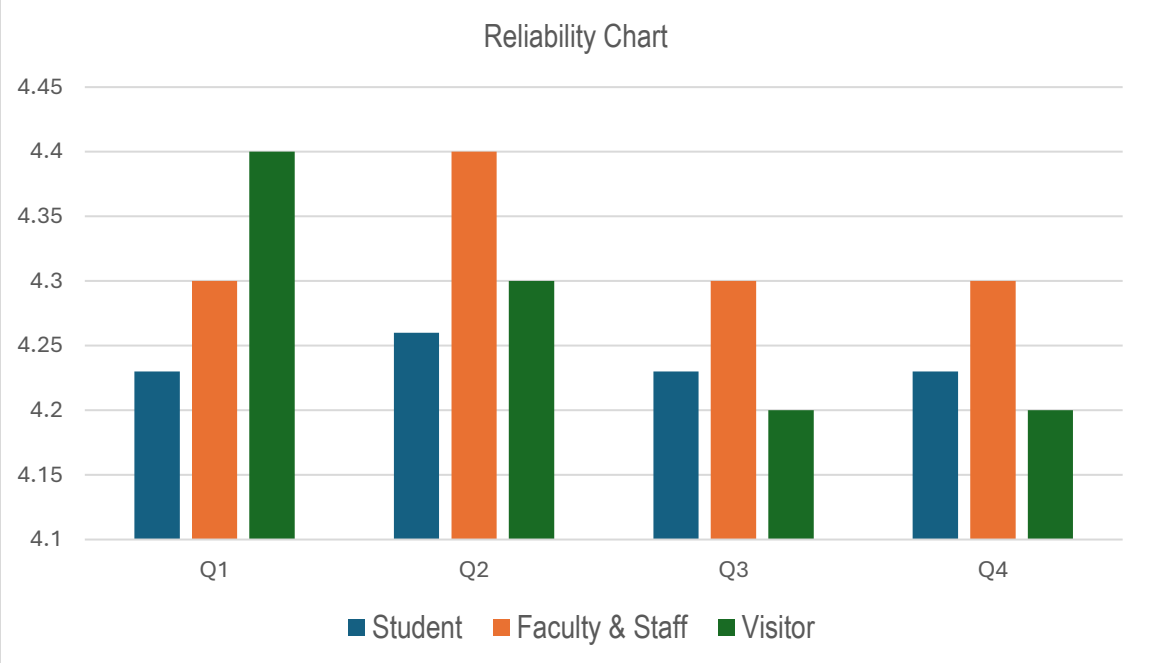


Usability scored a weighted mean of 4.23, highlighting the app's User interface and visual appeal. While the interface was praised for its intuitiveness, students identified areas for improvement in error prevention. Introducing features like guided tutorials or predictive text could enhance the onboarding experience and reduce user errors.

Reliability

Question	Students (15)	Faculty & Staff (10)	Visitors (10)	Weighted Mean	Rating Interpretation
Q1. The application provides accurate output with consistency.	4.23	4.30	4.40	4.23	Acceptable

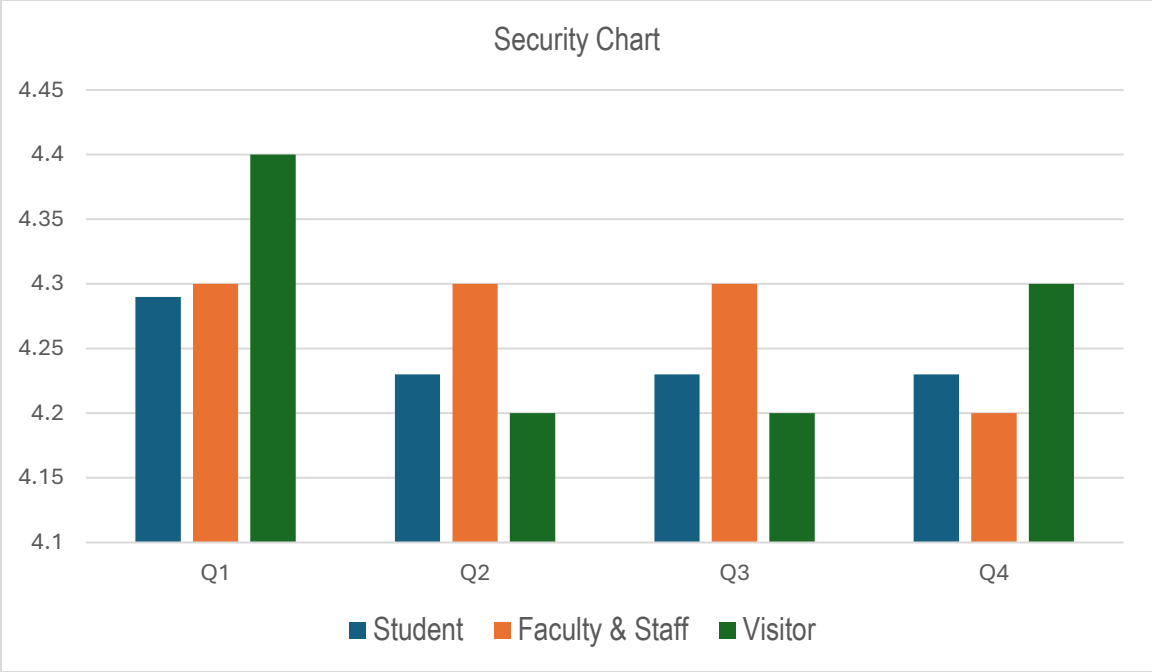
Q2. The application runs properly when needed.	4.26	4.40	4.30	4.26	Highly Acceptable
Q3. The application produces consistent information processing and output despite device limitations.	4.23	4.30	4.20	4.23	Highly Acceptable
Q4. The application produces and saves the necessary data after failures and restarts.	4.23	4.30	4.20	4.23	Highly Acceptable
Average for Category E	4.24	4.33	4.28	4.28	Highly Acceptable



Reliability indicates consistent performance in generating correct results. Some concerns about reliability due to device limits were raised, implying that enhancing data processing and recovery techniques for low-end devices could improve the app's robustness.

Security

Question	Students (15)	Faculty & Staff (10)	Visitors (10)	Weighted Mean	Rating Interpretation
The application ensures that the data is only accessible to the user.	4.29	4.30	4.40	4.29	Highly Acceptable
The application prevents unauthorized access.	4.23	4.30	4.20	4.23	Highly Acceptable
The application records the events taking place in the application and makes them accessible.	4.23	4.30	4.20	4.23	Highly Acceptable
The application's security records are reliable and authentic.	4.23	4.20	4.30	4.23	Highly Acceptable
Average for Category F	4.25	4.28	4.28	4.23	Highly Acceptable

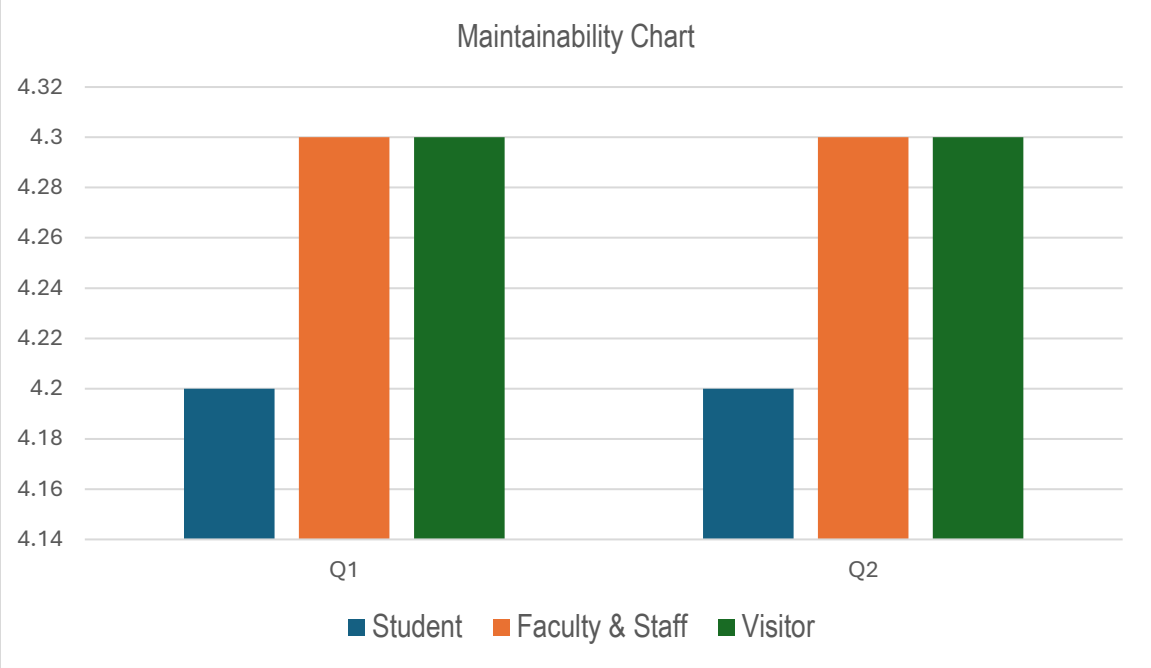


Security category received a 4.23, indicating user confidence in data protection and the prevention of illegal access. Users praised the event tracking features but proposed small changes to login procedures. Multi-factor authentication could help alleviate these concerns.

Maintainability

Question	Students (15)	Faculty & Staff (10)	Visitors (10)	Weighted Mean	Rating Interpretation
The application can operate accurately with minimum maintenance.	4.20	4.30	4.30	4.23	Highly Acceptable
The application is adaptable to changes.	4.20	4.30	4.30	4.20	Acceptable

Average for Category G	4.20	4.30	4.30	4.23	Highly Acceptable

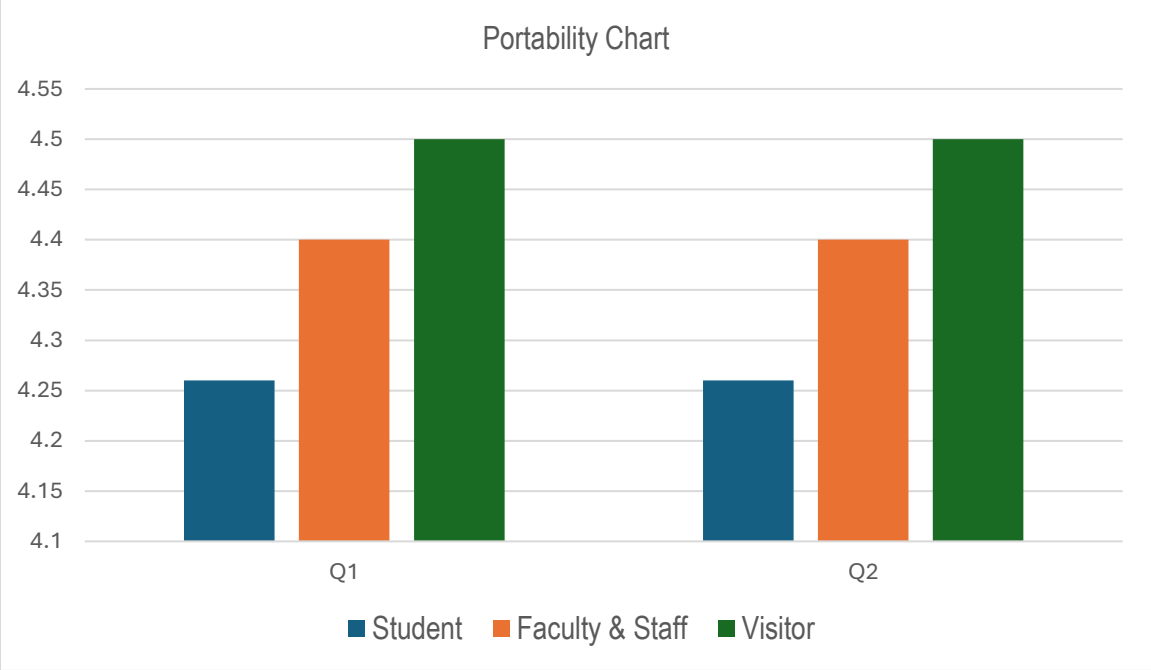


Maintainability received a mean score of 4.23, indicating satisfaction with low-maintenance operation and adaptability to changes. Suggestions for improving feature flexibility could include making updates more user-driven or customizable.

Portability

Question	**Students (15)**	**Faculty & Staff (10)**	**Visitors (10)**	**Weighted Mean**	**Rating Interpretation**
The application is stable on different devices and platforms.	4.26	4.40	4.50	4.26	Highly Acceptable

The application can be installed and uninstalled with ease.	4.26	4.40	4.50	4.26	Highly Acceptable
Average for Category H	4.26	4.40	4.50	4.26	Highly Acceptable



Portability scored the highest with an overall mean of 4.26, demonstrating exceptional stability across devices and platforms. Ease of installation and uninstallation were noted as key strengths. These findings reinforce the app's versatility and readiness for broader deployment.

APPENDIX E

Application User Manual

User Manual: 360 NAVIGATE

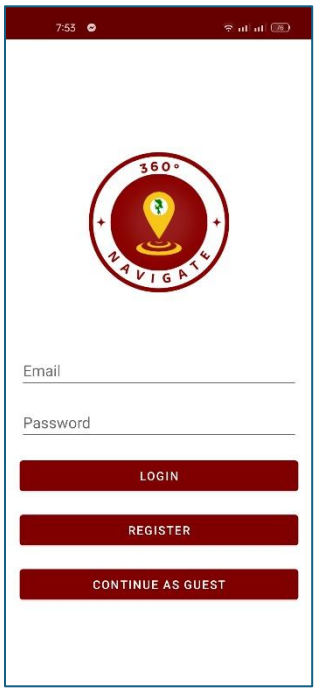
Welcome to the 360 Navigate app! This app provides an immersive map navigation experience with real-time updates for your location and destination, featuring 360-degree panoramic views of key landmarks and optimized routes. Whether you're navigating a campus or exploring new places, 360 Navigate is your perfect companion for seamless, interactive navigation.

Features

1. 2D Map with Real-Time Updates: View your location and destination in real time.
2. 360-Degree Panoramic Views: Explore significant landmarks with immersive panoramic views.
3. Route Optimization: Get the shortest path between two points using Dijkstra's algorithm.

Getting Started

1. Download and Install:
    a. Download APK from the link
    b. After downloading, tap install and wait for the installation to finish.
2. Launch the App:
    a. Open the app after installation.
    b. Follow onscreen instruction regarding first time opening the app.
    c. You may need to grant location permissions for accurate real-time tracking.



3. Set Up:

    a. You may sign in (optional) to the app or wish to continue as guest

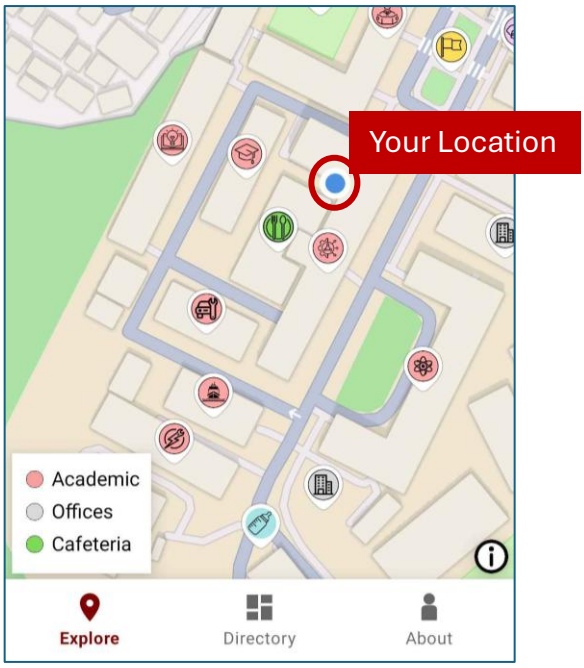
    b. You can also register, click the register button and input needed data:

Map Navigation

1. Viewing the Map:

a. The main screen displays an interactive map of the EVSU campus.

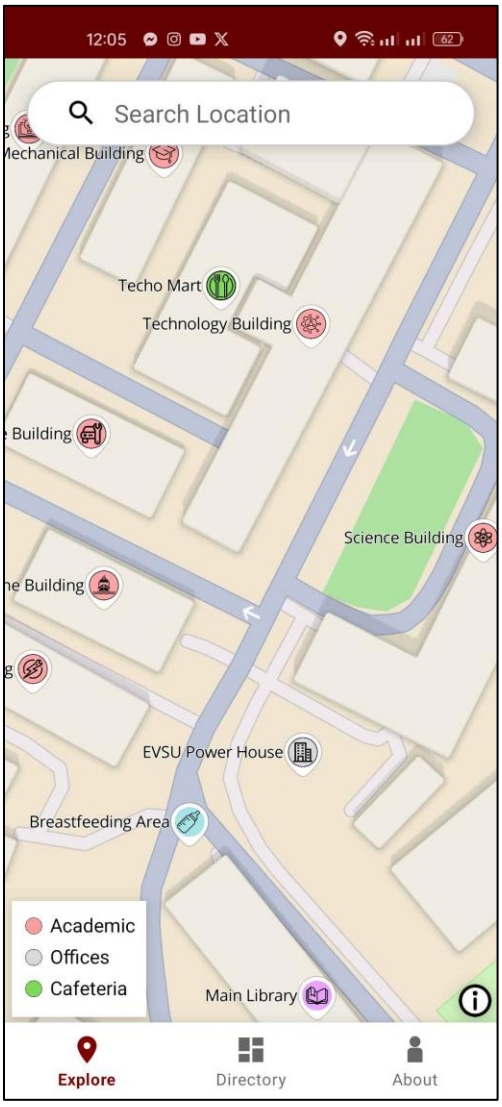
b. Your Position is marked by a blue dot.



2. Zooming In/Out:

a. Use pinch-to-zoom to zoom in and out of the map.

b. Zoom in to be able to see names of the location of each marker.

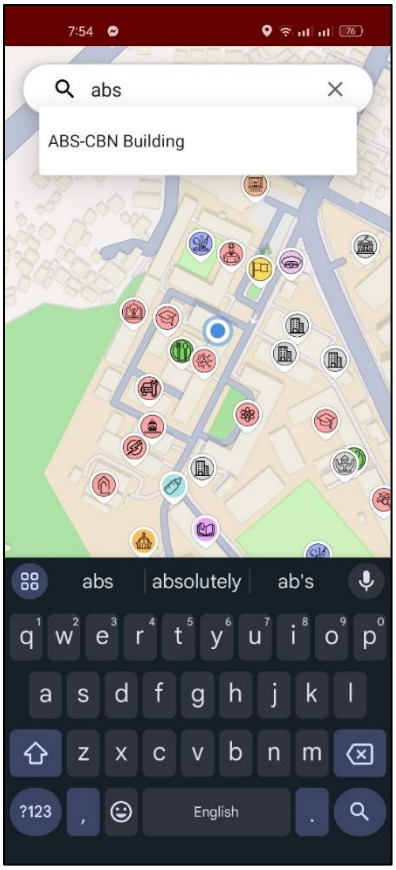


c. Zoom out to hide the marker again

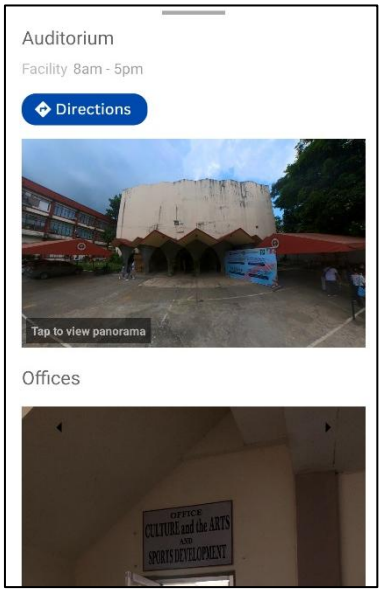
3. Getting Directions:

a. Tap a POI marker to get started.

b. Or you can tap the search bar to search for your desired location.



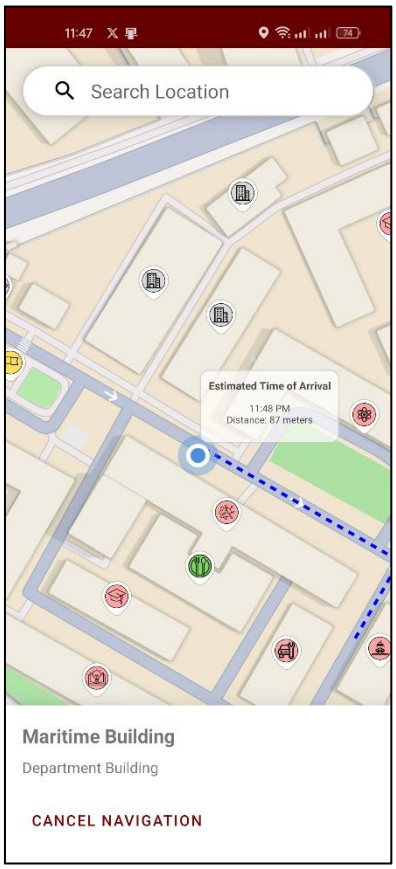
c. After selecting a location tap Direction button to start navigating.



d. The map will calculate the fastest route using Dijkstra's Algorithm for route optimization.

e. The system will show you the estimated time of arrival and the distance to your location.

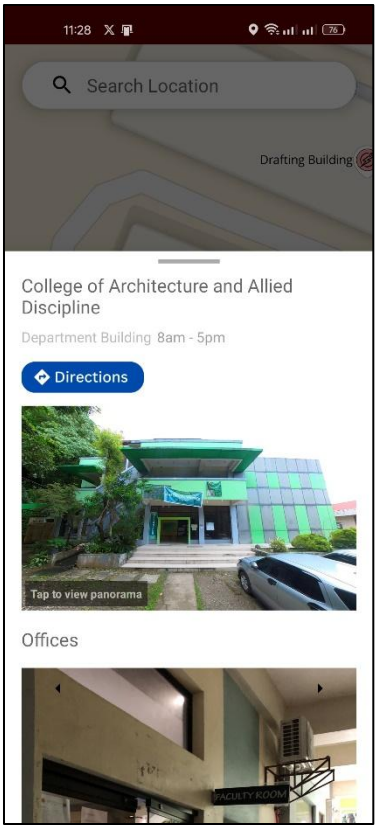
f. Wait for it to load and click cancel navigation once you arrived at your destination to exit the navigation screen.



360-Degree View

1. Accessing 360-Degree views:

   a. Inside the POI screen, tap the panoramic preview of the picture to view the full panoramic picture.



b. After tapping the panoramic picture wait for it to download, once finished you can start to navigate the 360-degree view of the location.

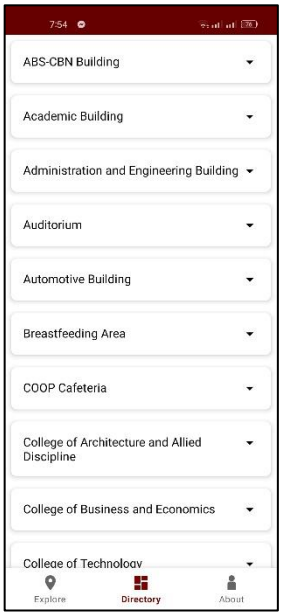
c. To close the 360 views, simply press the upper right back button.

Directory Mode

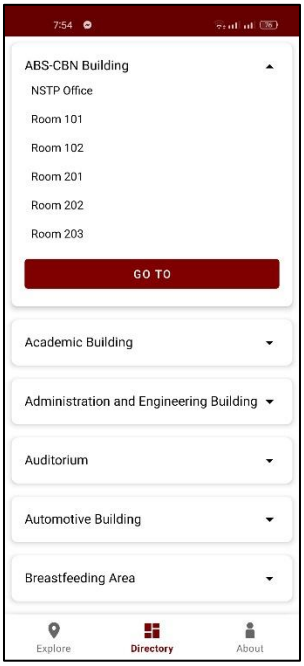
1. Accessing Directory Mode

a. To access directory mode simply press the middle navigation that says “Directory”

b. In directory mode you can access the list of all POI in the map, you can also see the list of Rooms and Offices for each POI and go to it.



c. To be able to see the contents of a POI simply tap on it.

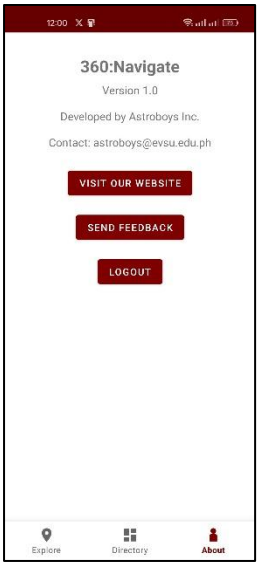


d. Press GO TO button to switch back to the Explore Page of the app and navigate to that location.

About Page

1. Accessing About Page

    a. To access the about section of the app tap the third navigation that says “About”



b. In the about section of the app, you can go to our website to be able to see updates for the app.
c. You can also send feedback for us to know more about you or the issues that you have encountered
d. You can logout to switch account or to go back to the login screen.

Troubleshooting

1. The app isn't showing my location:
    a. Make sure location services are enabled.
    b. Check if your device has GPS enabled.
2. No internet connection:
    a. Make sure you have a stable internet connection if not using guest mode.
3. App is crashing:
    a. Try restarting the app or reinstalling it from our website.

APPENDIX F

Admin User Manual

User Manual: 360 NAVIGATE Admin Panel

Welcome to the 360 Navigate Admin Website! This platform enables administrators to manage map data, monitor user activities, upload 360-degree views, and optimize navigation routes for a seamless user experience.

Features:

User Management: Edit or reset password.

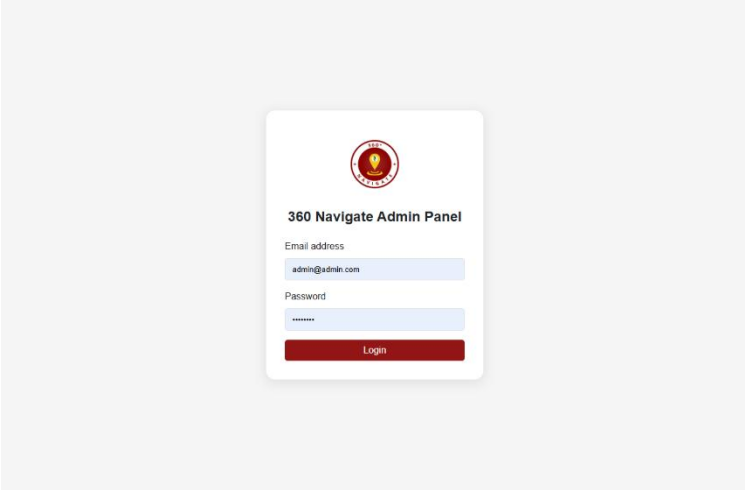
POI Management: Create, update, and remove Points of Interest on the map.

360-Degree View Uploads: Manage panoramic images for immersive navigation.

View Location History: View location history of users.

Getting Started:

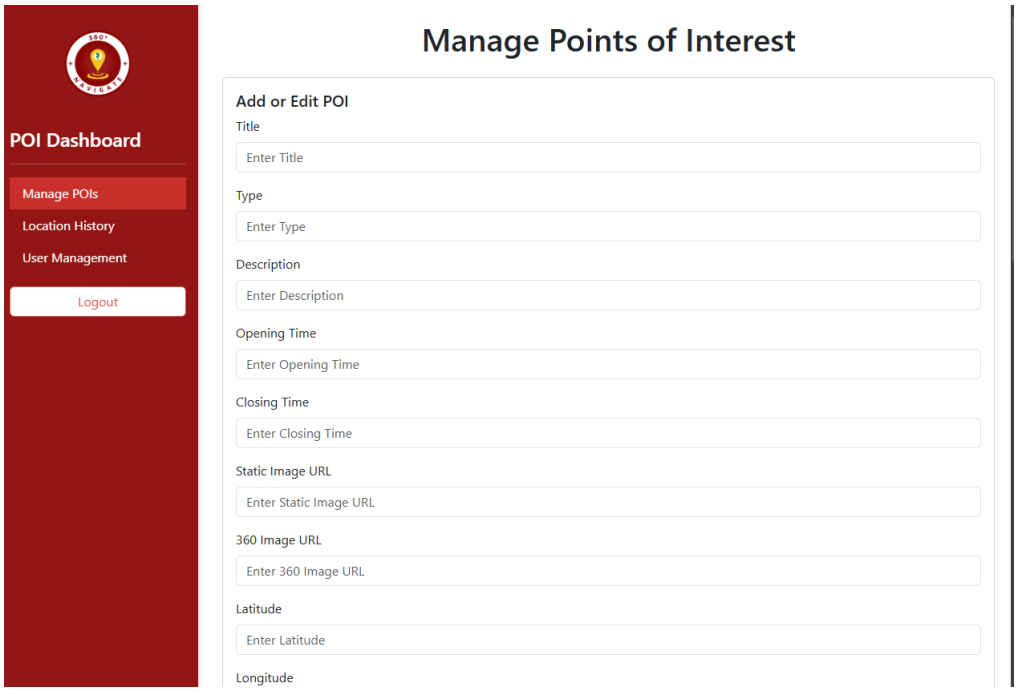
1. Accessing the Admin Website:
    a. Open your web browser and go to admin.360navigate.hostingerapp.com.
2. Logging In:
    a. Enter your admin credentials (email and password).



b. Click "Login."

2. Navigating the Interface:

a. After logging in, you'll see the main dashboard.



b. Use the sidebar to access various features like User Management, Location History and Manage POIs.

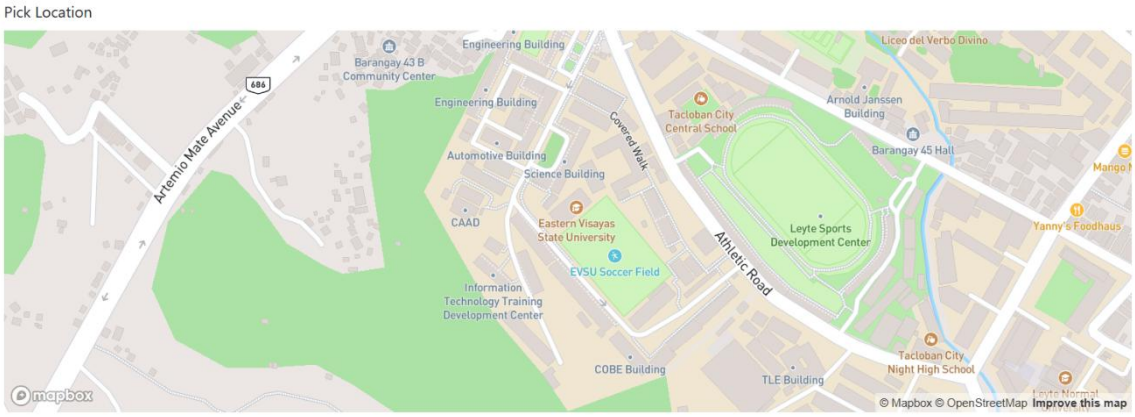
Manage POIs

1. Adding a POI

    a. Go to Manage POI tab to start adding POIs.

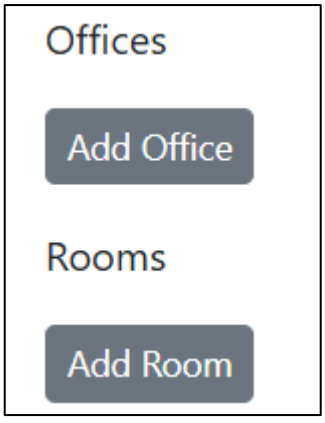
    b. Enter details like title, description, upload image closing and opening time

    c. To enter latitude and longitude use the given drag and drop map.



    d. Click a location to make the latitude and longitude appear in their respective field.

    e. To add office and rooms click the “Add Office” button or the “Add Room” button.



    f. Click save to save the data to the Firestore or cancel to erase inputted data.

2. To View or Edit Existing POIs

    a. To view Existing POIs just scroll down to the bottom of the page.

b. To edit Existing POIs, click the edit button in order for the detail of the existing POI go to the fields above.

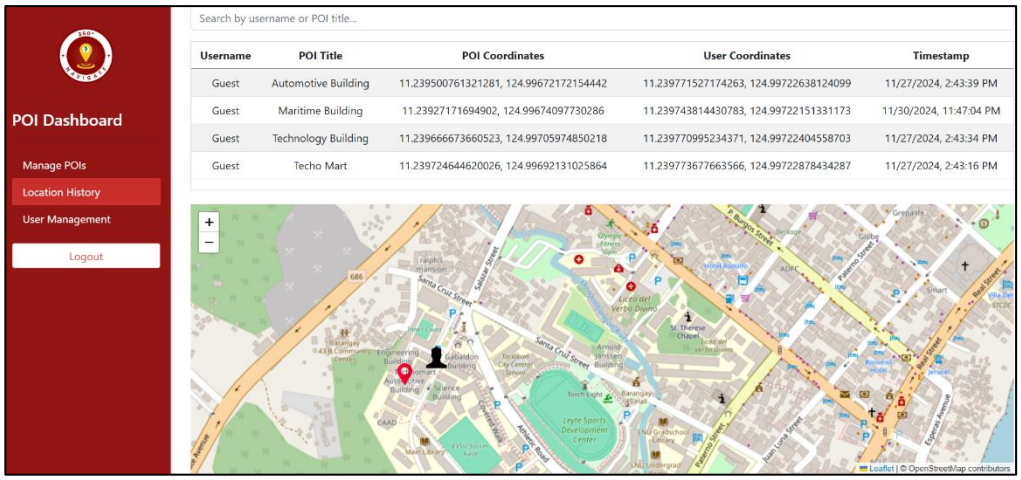
c. To delete an existing POI simply just click delete and confirm.

Location History

1. To view location history.

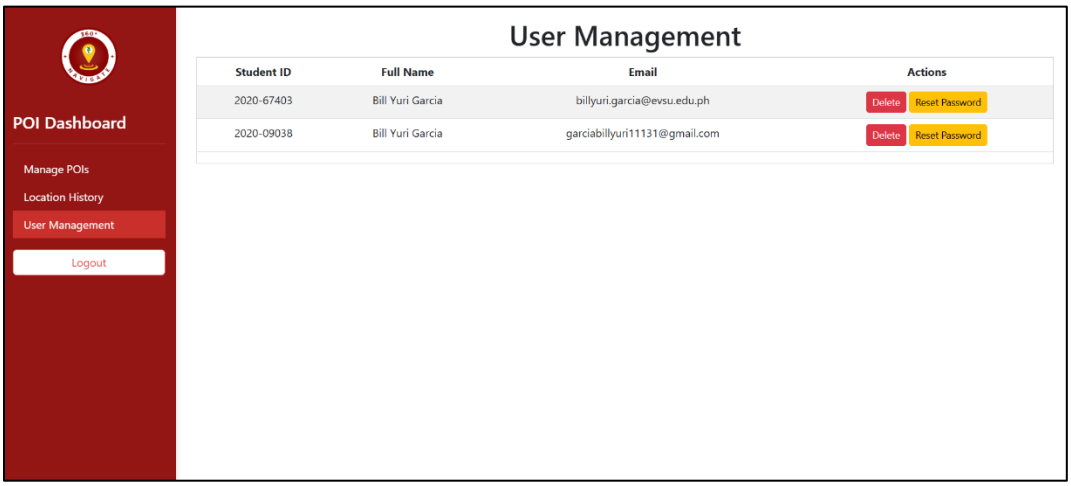
    a. To View previously visited location of a user you can use the search bar to search for the user or the location.

    b. Click the desired user for the history to show on the map



User Management

1. Manage Users
    a. You can delete user or reset their password, just click the respective button and click confirm.



Troubleshooting

1. Unable to Login:
    a. Check your internet connection.
    b. Ensure credentials are correct.
2. Website Not Loading:
    a. Check if the server is online.
    b. Contact technical support if the issue persists.

APPENDIX G

Turnitin Certificate

Republic of the Philippines
EASTERN VISAYAS STATE UNIVERSITY
Tacloban City

INFORMATION TECHNOLOGY DEPARTMENT

Certificate of Similarity Index

This is to certify that the Capstone Project entitled:

360° NAVIGATE: Interactive EVSU Companion Map with Panoramic Perspective Using Mobile App

authored by:

Bill Yuri Garcia
Mark Kian Tisado
John Renzie Gerilla

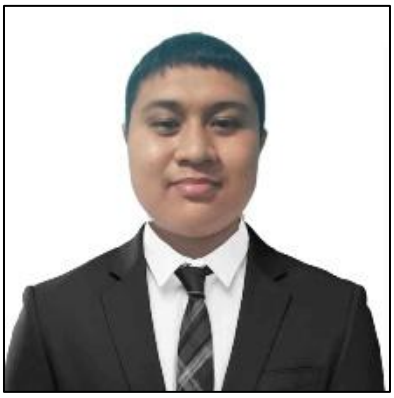
Bachelor of Science in Information Technology
has been subjected to similarity check on March 2, 2025
with a generated Similarity Index of 10 %
Certified true and correct:

SARAH JANE L. CABRAL, MIT
Capstone Project Adviser

Noted:

LYRA K. NUEVAS, PhD
Capstone Project Instructor

CURRICULUM VITAE



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Civil Status: Single

SKILLS

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- PHP
- PYTHON
- VIDEO EDITING

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