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College of Engineering - Department of Electrical Engineering

Bachelor of Science in Computer Engineering

EXPONENTIAL
Technical Report

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PROJECT OVERVIEW

UNav stands for University Navigation, and is a mobile application intended to make the campus life for students more interactive with intuitive navigation. With this enormous campus, the problems usually encountered by the students while reaching classrooms, clinics, etc., are immense. Therefore, this app provides a clear interface that can help out in navigation, and as well, thereby ensuring every student makes good use of their time on campus.

The app is designed to be an easy to use campus navigation just like in the navigation device in CEAFA. The app features a Profile Dashboard that allows users to generate personalized schedules and receive timely notifications before classes. The 2D map navigation system, powered by GPS, enables students to find their way easily.

Implementation of UNav does come with its challenges. Key hurdles include navigation difficulties, student time management, complex campus lay out, resource accessibility and reducing stress to students. By overcoming these challenges, UNav aims to create a seamless and enriching experience for students as they navigate their academic environment.

PROBLEM STATEMENT

Students often struggle with navigating the University campus, therefore leading the students to confusion, frustration, and wasted time. This is due to the complex campus layout wherein the campus is composed of numerous buildings that is overwhelming especially for new and returning students. These navigation difficulties can contribute to increased stress and anxiety for these students, as these students are worried about being lost or arriving late to their designated classes. Apart from this is inefficient time management caused by navigation challenges and lack of accessible information about room locations and campus facilities. Along with this is the lack of sufficient support systems, such as centralized assistance or tools that reduce students' frustration.

EXISTING PROJECTS

The development of mobile applications for universities has resulted in various projects aimed at improving campus navigation and information dissemination. Many existing apps focus on providing basic university information, such as details about faculties, departments, and news updates, but they often lack interactive or dynamic

features that address students' everyday needs. For instance, Mekelle University's campus navigation app integrates features like user location tracking, campus maps, and route directions. However, it primarily focuses on static navigation and does not offer real-time updates or personalized support (Haile, 2023).

Similarly, apps like "JUAN," developed by Dr. Jerome Songcuan, demonstrate innovation in academic navigation but have a limited scope, concentrating solely on navigation (Viduya, 2023). Other university apps tend to act as information hubs, offering details about the institution but failing to extend their functionality beyond this (Bragg, 2024). Some mobile applications serve as support tools for students' university life, addressing broader academic and social needs (Goyal, 2024). Additionally, many universities simply optimize their websites for mobile use and convert them into apps, offering a basic user experience (Das, 2023).

Indoor navigation applications often rely on advanced technologies like augmented reality (AR). These AR-based solutions dominate the market and provide enhanced interactive experiences, but their implementation in university contexts is still limited (Noradila Nordin et al., 2021).

While discussions on campus navigation apps emphasize the use of indoor mapping and advanced technology, many fail to provide holistic solutions that integrate both navigation and essential student support features, leaving gaps in addressing time management, personalized scheduling, or stress reduction.

UNav addresses these shortcomings by offering a student-centered and comprehensive approach to campus navigation. Unlike existing apps, which often focus narrowly on either information dissemination or static navigation, UNav integrates dynamic, real-time features designed specifically to meet student needs. It combines 2D GPS-based navigation with personalized schedules, ensuring students can efficiently manage their time and navigate campus stress-free. Additionally, timely notifications help students stay informed about important events, such as class schedules or deadlines, reducing anxiety and fostering better time management. By addressing both functional navigation and holistic student support, UNav overcomes the limitations of existing projects, delivering a superior and more engaging user experience.

ADVANTAGES

- Improves time management and reduces student stress.
- Tailored features like personalized schedules and real-time notifications enhance usability.

- Provides a user-friendly interface, accessible to all users.
- Seamless navigation using GPS APIs and A* algorithm ensures accuracy.
- Features like visual landmarks and accessibility route planning accommodate diverse user needs.

DISADVANTAGES

- Initial development requires significant time and resource investment.
- Challenges in ensuring accuracy and reliability of real-time tracking and notifications.
- High dependency on device capabilities like GPS and internet connectivity.
- Requires periodic updates to reflect campus changes.

KEY FEATURES AND FUNCTIONALITIES

- Interactive Campus Map
  - A digital map that provides information about the campus facilities
- Turn-by-Turn Navigation
  - Provides a pathway for the users to go to their desired locations on campus
- Room Finder
  - A feature that allows the users to search for the specific facilities, rooms, or offices that is based on their needs
- Personalized Schedules based on students
  - Allows the students to have a customized schedule based on the users' individual timetables including their subjects, room locations, and the time allotted
- Schedule notifications for students
  - A feature that notifies the users by means of sending timely notifications about the upcoming classes
- Real-Time Location Tracking
  - Allows the users to easily track the real-time location of the classrooms or facilities within the campus
- University Assistance
  - The users may contact the university to ask for help or question
- Accessibility Route Planning
  - A feature that accommodate all the users with the shortest path possible
- User-Friendly Design
  - Provides an easy-to-use interface that is accessible to all the users

- Visual Landmarks
    - Provides visual cues or landmarks that is designed to help the users to navigate the campus

TECHNICAL SPECIFICATIONS

This section outlines the application framework and interface utilized by our team in developing the UNav app. Our primary tools include Kivy, Python, HTML, CSS, and JavaScript, which serve as the foundation for building the application. Kivy, an open-source Python library, enables the creation of multitouch applications, allowing us to design a dynamic and responsive user interface tailored to our users' needs. The versatility of Python enhances our development process, enabling efficient coding and rapid iterations. Additionally, HTML and CSS are used to structure and style specific components of the interface, while JavaScript adds interactivity, ensuring a seamless and engaging user experience. By integrating these technologies, we have built a robust, visually appealing, and user-friendly application.

In addition to Kivy and Python, our team has integrated GPS APIs to facilitate accurate location tracking and navigation features within the app. These APIs enable real-time positioning, ensuring that users receive precise directions and updates as they navigate the campus.

To streamline our development process, we utilized Google Colab, a cloud-based platform that supports collaborative coding and provides access to powerful computational resources. This allowed our team to execute complex map functionalities and track user movements seamlessly.

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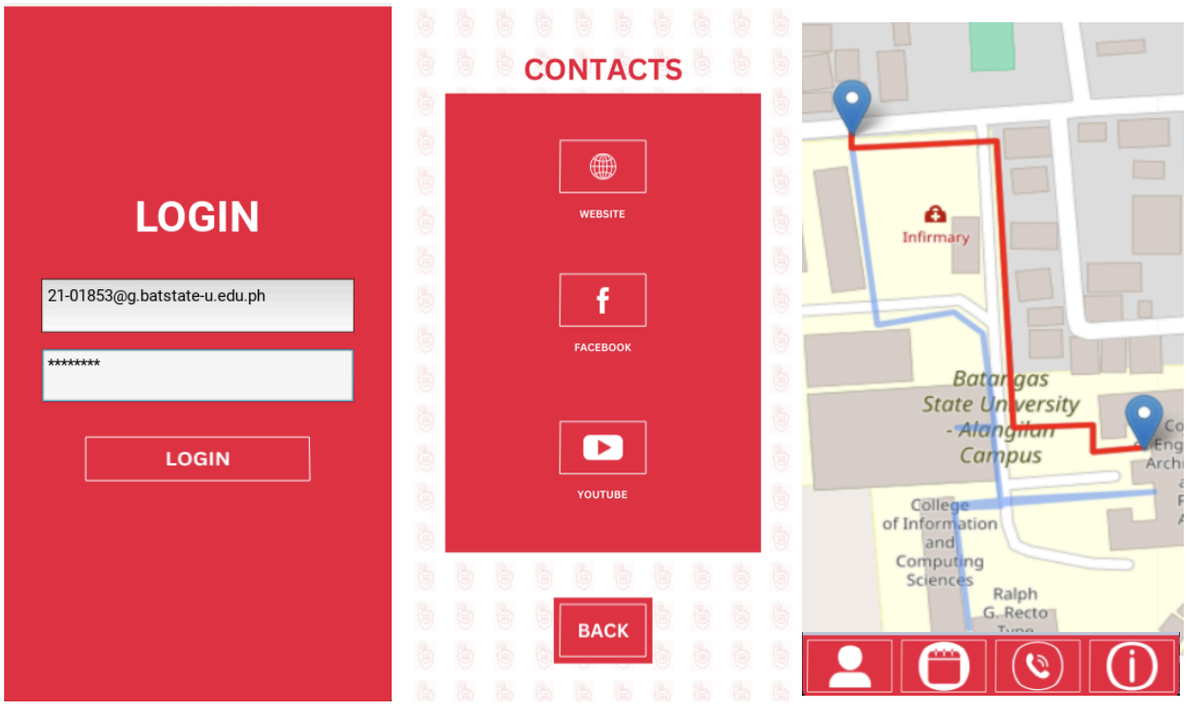

Figure 1: User Interface and User Experience

The UNav app features a user-friendly interface composed of three main screens that enhance the user experience. The Login Screen serves as the entry point, allowing users to securely log in with their university credentials, featuring a clean design that reflects the institution's branding. The Contact Screen provides quick access to essential university resources, such as the official website, Facebook page, and YouTube channel, through easily clickable buttons, with a "Back" option for seamless navigation. The Interactive Map Screen displays a detailed 2D campus map where users can explore buildings, pathways, and landmarks, making it easier to navigate the university. This screen also includes a bottom menu with icons for quick access to key features like the home screen, calendar, contacts, and help, ensuring a smooth and intuitive experience for students, faculty, and visitors.

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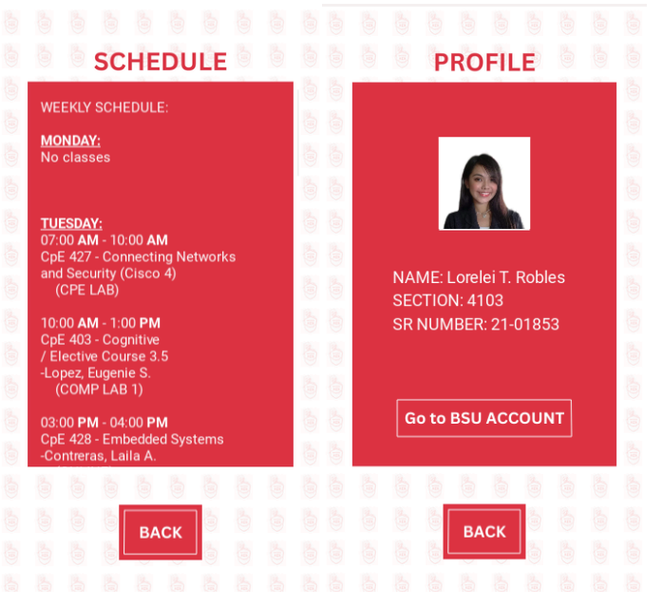

Figure 2: Schedule and User Profile

In this feature, it displays the customized schedule and the profile of the user. It also displays a user's class schedule with real-time updates on locations, changes, and cancellations. It also integrates campus events and activities, and provides customizable reminders for important dates.

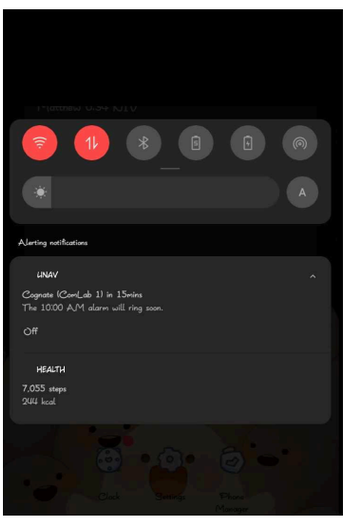

Figure 3: Notification Feature

This is the notification feature that the user will see if their class is near / about to take place. In this feature, it will notify the user to not be late to their respective classes or at their respective appointments.

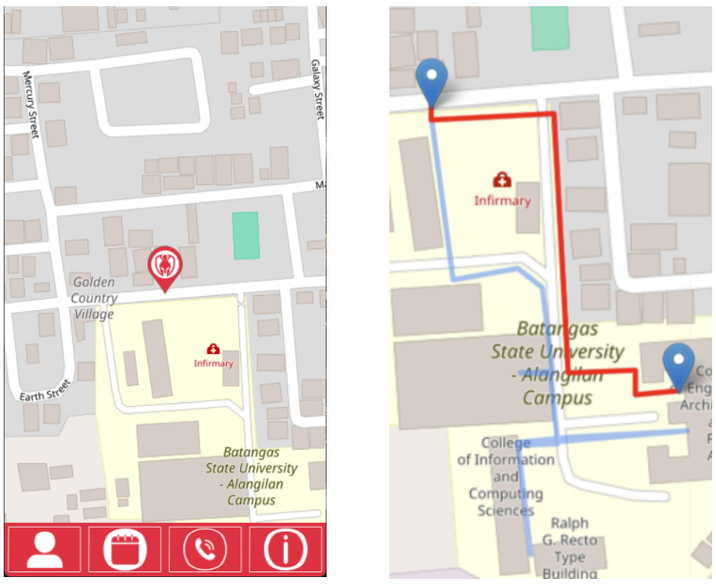

Figure 4: User Navigation and Interactive Map

This feature demonstrates the dynamic digital map designed to simplify campus navigation. The users can effortlessly explore the intricate layout and locate specific buildings, classrooms, and points of interest.

IMPLEMENTATION CHALLENGES

This was the most major obstacle our team experienced when developing the UNav application. Navigating the difficulties requires not only technical competence, but also substantial teamwork and problem-solving abilities. This issue tested our endurance and dedication to providing a quality product by requiring us to integrate several features while retaining an intuitive user interface. The team's ability to collaborate and creatively handle this issue was critical in making the app a dependable resource for students. Finally, conquering this problem enhanced our application while also instilling a feeling of togetherness and purpose in the team, propelling us toward our objective of improving the campus experience for all users.

- Path Finding
  - One of the most significant challenges we encountered during the development of our app was the pathfinding feature. Initially, our team's approach to pathfinding did not align with the timeline we had set. Recognizing the need for a more effective solution, we decided to completely redesign the pathfinding system. We adopted a node-based

structure to implement the A* algorithm, which allowed us to calculate the shortest paths more efficiently. This pivot not only enhanced the accuracy of our navigation but also ensured that the feature could be completed within our project timeframe.

- Map Making
  - Another critical issue we faced was related to map creation. With the need to overhaul our pathfinding system, we also recognized that our existing map was insufficient. Initially based on observational data gathered from the campus, it lacked the specificity required for effective navigation. To address this, we meticulously redesigned the map, focusing on delineating separate paths based on the actual roads and walkways present on campus. This enhancement was vital for the pathfinding feature to function correctly, ensuring a seamless user experience.

- User Tracking
  - User tracking presented its own set of challenges, particularly in the initial implementation phase. It took our team two days to successfully integrate the blinker feature that indicates user location. We faced numerous complications in connecting to the device and accurately capturing user location data. Much of the difficulty stemmed from issues with the compiler, which repeatedly returned incorrect location readings that did not correspond to the actual user. Resolving these issues was crucial for providing reliable real-time tracking within the app.

- Android Conversion
  - The conversion of our app for the Android platform also posed significant challenges. This process took longer than anticipated, primarily because we utilized Google Colab for the conversion. Additionally, we encountered complications with referencing the Kivy Garden module for the maps, which hindered our progress. Navigating these technical obstacles required extensive troubleshooting and collaboration, ultimately reinforcing our commitment to delivering a high-quality application for our users.

REFERENCES

Haile, Bereket. (2023, July).Enhancing Campus Navigation with Mobile Applications. https://www.researchgate.net/publication/372643496_Enhancing_Campus_Navigation_with_Mobile_Applications

Viduya, Maricon (2023, March).JUAN: Jerome's Unusual Academy Navigator App. https://www.dmmmsu.edu.ph/2023/03/22/juan-jeromes-unusual-academy-navigator-app/

Bragg, Lucy. (2021, September). Implementing a successful campus navigation app. https://www.mappedin.com/resources/blog/implementing-a-successful-campus-navigation-app/

Das, P. K. (2023, June). Development of a mobile application: From university website to mobile app. https://www.researchgate.net/publication/372359722_Development_of_a_Mobile_Application_From_University_Website_to_Mobile_App

Goyal, A.G. (2024, Aug). University mobile app development: Cost and Features in 2024. https://www.octalsoftware.com/blog/university-mobile-app-development

Noradila Nordin et al (2021). A Web-Based Campus Navigation System with Mobile Augmented Reality Intervention. https://iopscience.iop.org/article/10.1088/1742-6596/1997/1/012038/pdf