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USER-CENTRIC WEB-BASED LOCATION NAVIGATION SYSTEM FOR BABCOCK UNIVERSITY

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ABSTRACT

Purpose driven movement is a paramount characteristic of living things. People, however, often face challenges with navigation especially in unfamiliar terrane which can lead to frustration, anxiety, loss of valuable time, lateness and more. This is of immense consequence especially in an academic environment. Hence, there arises the need for a campus navigation system. The campus navigation system therefore is built as a comprehensive, user-centric solution for seamless navigation and combines interactive mapping, categorized location access, and visual previews, which enhances user experience and accessibility for students, visitors, and parents altogether.

Keywords: Campus, Categorized Location Access, Navigation, User-Centric, Web-based System

INTRODUCTION

Movement is a vital necessity in our society today. People have need to move and search for people, places or things (Barnard & Woodburn, 2024). However, one prominent need is that of locating places which, if not meticulously aided, can quickly make people descend into unpalatable modes such as that of delirium, panic, anxiety, stress, frustration, cognitive overload, wandering into isolated, restricted or unsafe areas, increased lateness, missed activities such as meetings, exams, and appointments. This can result in consequences that can affect confidence, perception, efficiency and in extreme cases lead to injuries or death as a result of inability to access emergency services in the case of health and fire incidences or exposure to unsafe areas.

Babcock University began in 1959 as the Adventist College of West Africa with only seven students, but over the decades it evolved into a full-fledged university in 1999 and has since experienced remarkable expansion in both population (over 13,000) and physical development. From its modest origins, the institution has grown into a thriving academic community with thousands of students across multiple schools and postgraduate programmes, supported by extensive infrastructure such as modern lecture halls, residence halls, a major cafeteria, a well-equipped library, and a full teaching hospital. This steady rise in enrolment and continuous investment in facilities has transformed Babcock into one of Nigeria's leading private universities (*Our History - Babcock University*, n.d.). However, with this success story, the problem of navigation is fast rising.

Location navigation systems are becoming a useful tool as a result of the proliferation of mobile phones, increased internet penetration and other information and telecommunication infrastructures (Akinyemi, 2013; Mrs. S.Hemalatha & Mrs. Srividhya, 2015; Oguntunde, 2017). With these technologies navigation systems are able to dynamically aid in the determination and transmission of location of person, places and things by means of interface (Domb & Domb, 2020;). This work leverages on these enablers to produce a web-based system to serve as a trustable guide and effective and efficient assistant for visitors, students, teachers and others in locating places on the Babcock University campus environment unlike many works in the past whose focus is limited to students only or navigation for mobile application. Also, this work contributes to the SDG goals on sustainable environment by engendering improved and safer environmental experience of people within the campus environment. Although this work focuses on outdoor navigation it can be extended to indoor navigation (Chaudhari, 2016; Hadwan et al., 2020; Magsi et al., 2021; N. S. b. Sulaiman; M. A. bin Nordin, A. S. Hizam, n.d.). It could be further extended with Artificial Intelligence into a smarter navigation system as well (Neelakantappa, 2025).

Location-based systems encompass a range of technologies designed to determine, track, and utilize the geographic position of users or objects for various purposes. These include GPS-, cellular-, Wi-Fi-, Bluetooth-, and RFID-based systems for identifying precise locations; navigation and routing systems that guide users through outdoor, indoor, or campus environments; tracking systems that monitor assets, people, or vehicles in real time; context-aware systems that deliver relevant information such as notifications, geo-fencing alerts, or location-based advertising; and emergency-focused systems that support safety, disaster response, and rapid alerts (Abdirahman et al., 2025; Adebiyi et al., 2019; Anusiuba Alex et al., 2025; Magsi et al., 2021; Moon et al., 2024). Navigation systems have found usefulness in personal lives and organizational engagements like manufacturing as a result the integration of diverse capabilities through available technologies location-based solutions have contributed to enhance mobility, security, and operational efficiency. However, implementing a web-based system for Babcock University is provides a device-independent access with seamless updates, real-time interaction and requires no local installations. Thus, the system is not just scalable but easy for a wider range of users.

Literature Review

Some studies embarked on web-based campus navigation which is shift from the usual static, printed guides that were earlier in vogue. This shift offered a real-time update and interaction maps. (Akinyemi, 2013; Anusiuba Alex et al., 2025) developed web-based systems for UNIZIK and Covenant University respectively. This attest to the value of using web technologies. However, their focus centered on supporting new students rather than serving broader audience that includes visitors, parents and other stakeholders.

Furthermore, multi-modal navigation is also gaining traction. Systems that blend outdoor GPS tracking with indoor positioning technologies such as Bluetooth Low Energy (BLE) beacons or Wi-Fi triangulation (Domb & Domb, 2020; Moon et al., 2024; Neelakantappa, 2025). In their work (Adebiyi et al., 2019) integrated visual maps, pictorial previews, and audio navigation to enrich guidance features in order to improve clarity and user experience.

However, a core limitation of some of the systems reviewed is the absence of holistic user-centric design across existing solutions. Many systems provide navigation (Adebiyi et al., 2019; Adewale, A.O.; Oyeyemi, E.O.; Oyebola, O.O.; Odeyemi, O.O., Olugbon, B.; Odetola, J.A.; Akindolire R.T.; Obafaye, 2019; Akinyemi, 2013; Anusiuba Alex et al., 2025; Mrs. S.Hemalatha & Mrs. Srividhya, 2015), but extend their location navigation access beyond students to include visitors, parents and other stakeholders via accessible interfaces, intuitive interaction, and inclusive features. This gap motivated the development of a centralized, scalable web-based navigation platform that prioritizes usability, integrates visual and interactive mapping tools as well as supports a wider community navigating Babcock University's growing and complex campus environment.

MATERIALS AND METHODS

The design approach for this work is the User-Centered Design (UCD) methodology (Emma, 2024) which focuses on iterative development and frequent user feedback to ensure that the final system meets user needs effectively. The specific software development methodology adopted is the agile model. The agile methodology is a framework that breaks projects down into several dynamic phases, commonly known as sprints. An agile organization is a technology-enabled network of teams with a people-centered culture that operates in rapid-learning and fast-decision cycles as depicted in figure 1. Since customer satisfaction is a key driver for software development, this design is very amenable to this study and involves planning, designing, developing, testing, deploying and reviewing the software iteratively to ensure it meets functional and non-functional requirements.

Figure 1: Agile Model Design Approach (Asana, n.d.)

The system utilized Figma (Figma, n.d.) for wire framing the concept prototypes, some detailed layouts and flows for the user interface. These prototypes provided a static simulation experience for the navigation functionalities thus enhancing early identification of any potential user experience issues. HTML, CSS, and JavaScript libraries were used for the development of the interactive and responsive interface for a smooth user experience whereas the backend tool PHP, MySQL, jquery handled server-side logic and the integration of the location data from google maps API for real-time navigation as well as the storing of user data to ensure fast access and data persistence. Iteratively, usability testing was conducted with representative users to evaluate system ease-of-use, performance, and satisfaction.

The system architecture follows a three-factor model, that is, physical, functional and communicational layers. These three architecture descriptions provide a complete description of the system's components is given, including the working and relations as shown in figure 2. In the physical layer, the user interacts with the system through a web browser on any internet-enabled device to submit location queries, request for directions, or access the navigation services without having to install any additional software. On the other hand, the communication layer manages user's requests and interactions between the client and the server while the functional layer is the core logic that powers the entire navigation system.

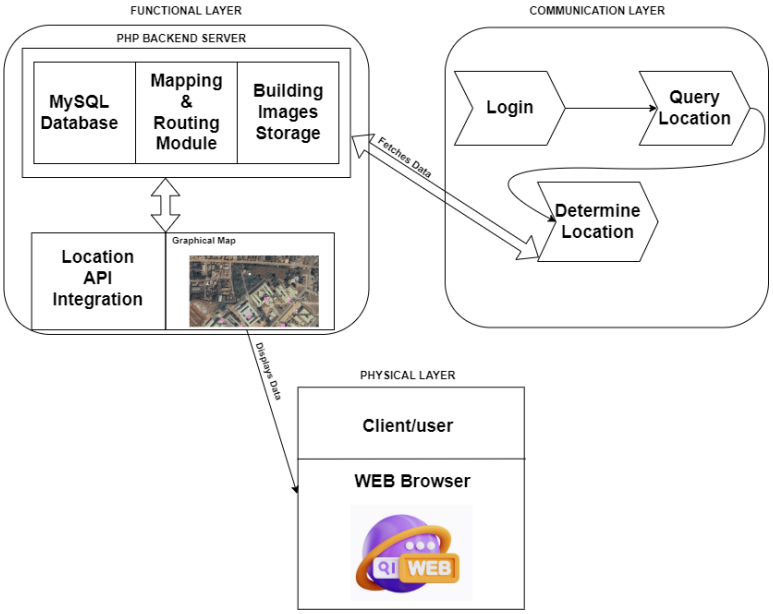

Figure 2: Web-based Location Navigation System Architecture

The system backend was implemented using PHP and MySQL database was used to enable records retrieval and processing of spatial relationships and also the generation of the best possible route for navigation. The functional layer integrates with the location application programming interface to access geographical maps and then display the graphical representations of the Babcock University campus environment.

RESULTS AND DISCUSSION

The graphical view of the system is discussed as follows:

The landing page depicted in figure 3 Shows the landing/Home Page in where the user will be directed to after logging in to the application.

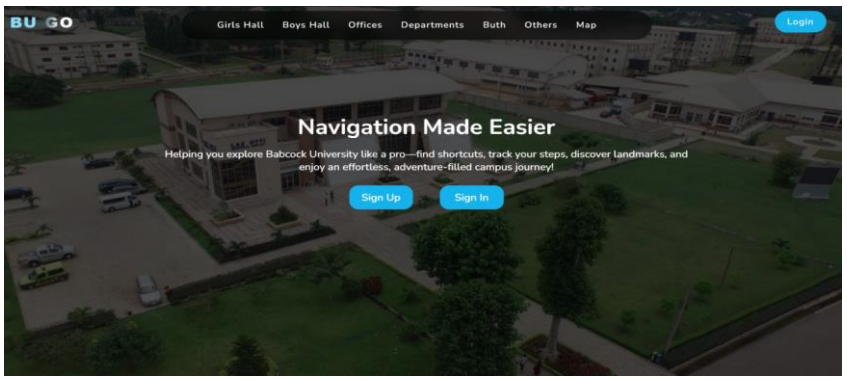

Figure 3: Landing Page

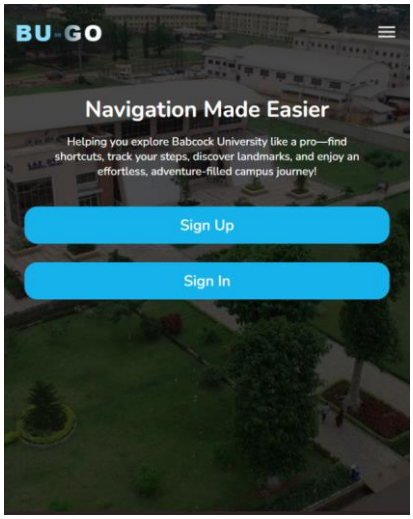

Figure 4: The Mobile View of the landing page

Figure 5 depicts the possibility of signing up as a new user by providing the necessary information required and figure 6 shows the login page.

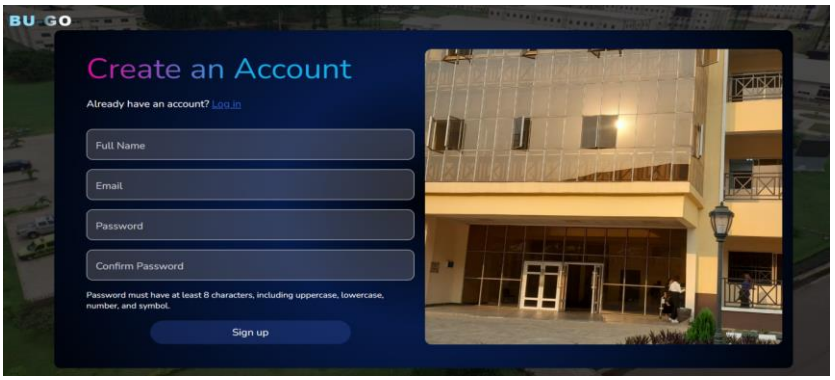

Figure 5: Sign Up Page

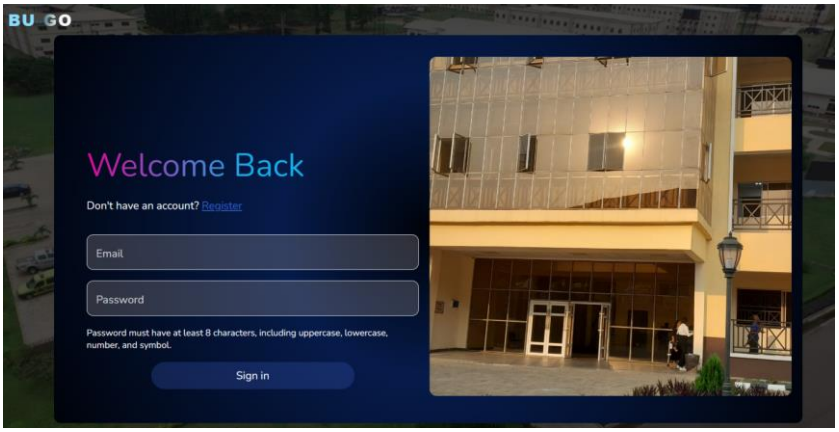

Figure 6: Login Page

After a successful login, the user is brought to a dashboard as depicted in figure 7. Here the user can click on the view map button.

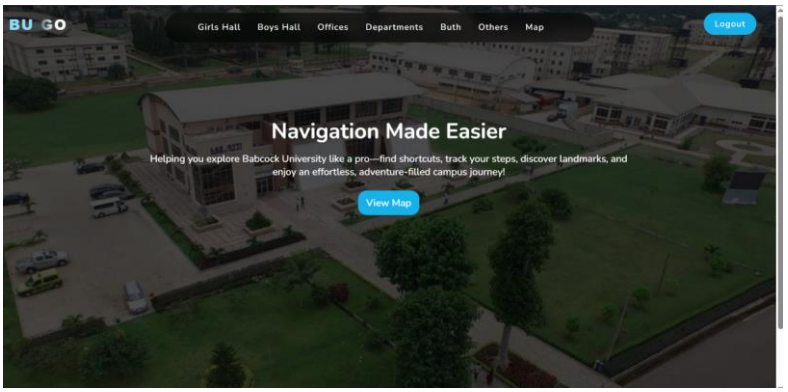

Figure 7: Dashboard After Login

Figures 8-13 show various places within the university campus ranging from schools, department, offices, hospital, student administration building, hostels, supermarket and the Amphitheatre to mention a few. Each of these places have a carousel functionality for aided guidance as shown in figure 14.

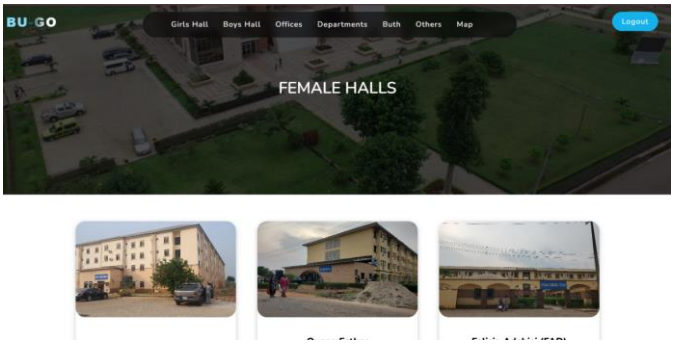

Figure 8: View of The Female Halls

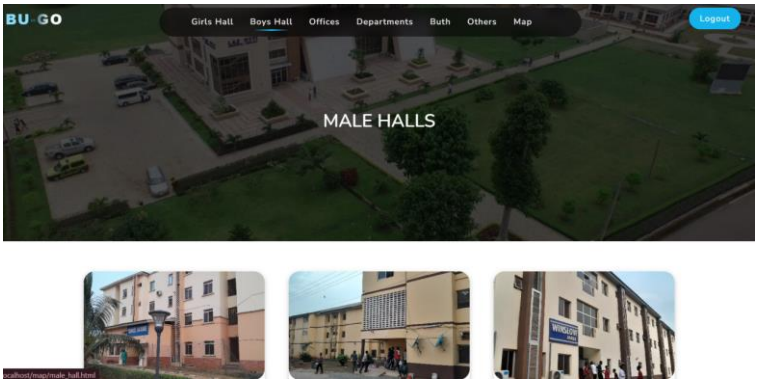

Figure 9: View of The Male Halls

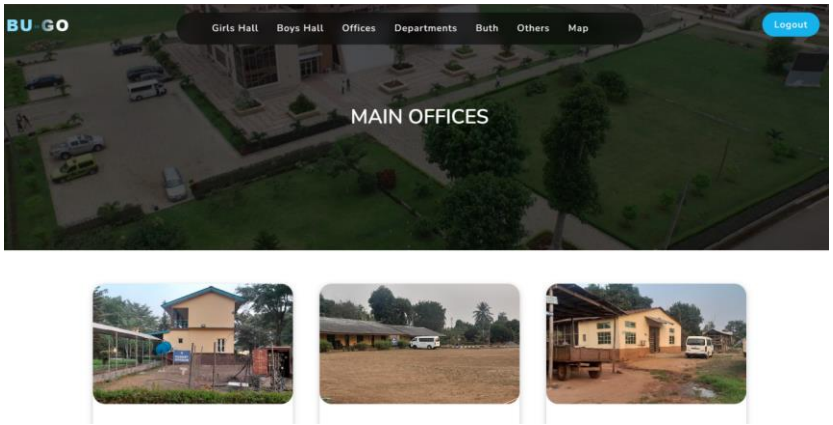

Figure 10: View of Some Offices

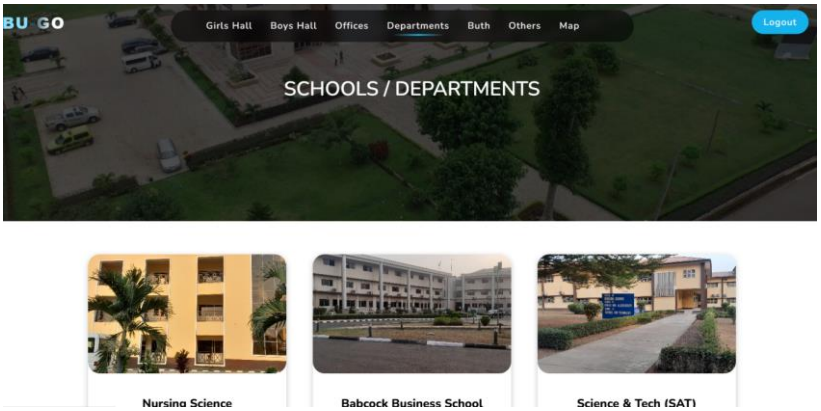

Figure 11: View of Some Schools/Departments

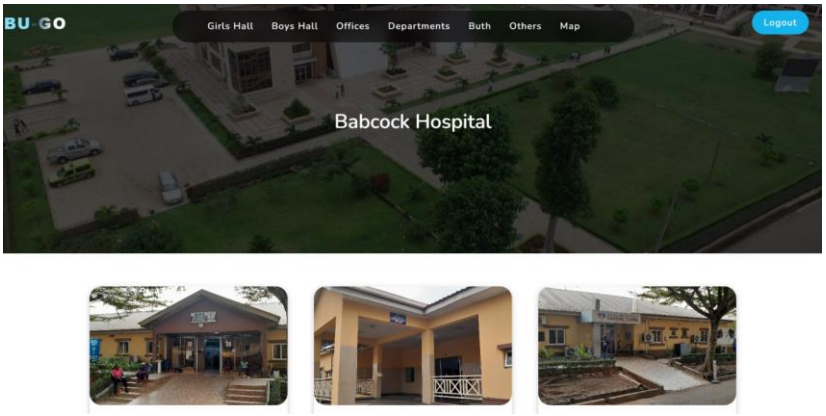

Figure 12: View of Some Parts of the Babcock University Teaching Hospital

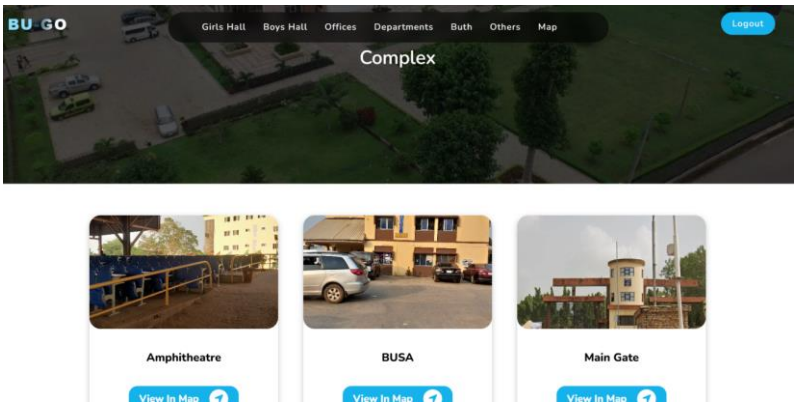

Figure 13: View of Some Other Places Within the Campus

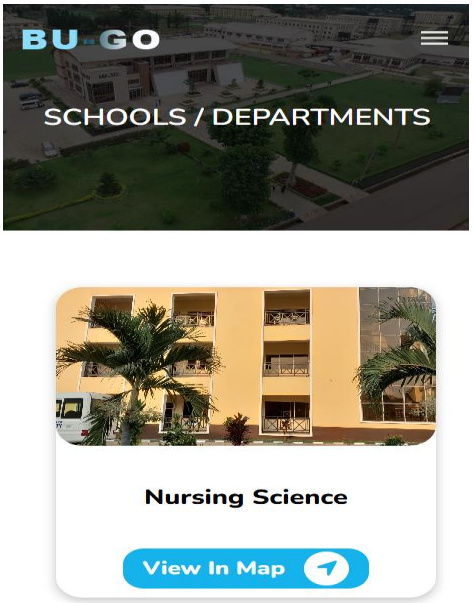

Figure 14: Nursing Science Building with A Carousel Functionality for Aided Guidance

Figure 15 displays the map interface that allows user to see their current location and also using the search bar search for locations within campus which then provides directions to the location requested.

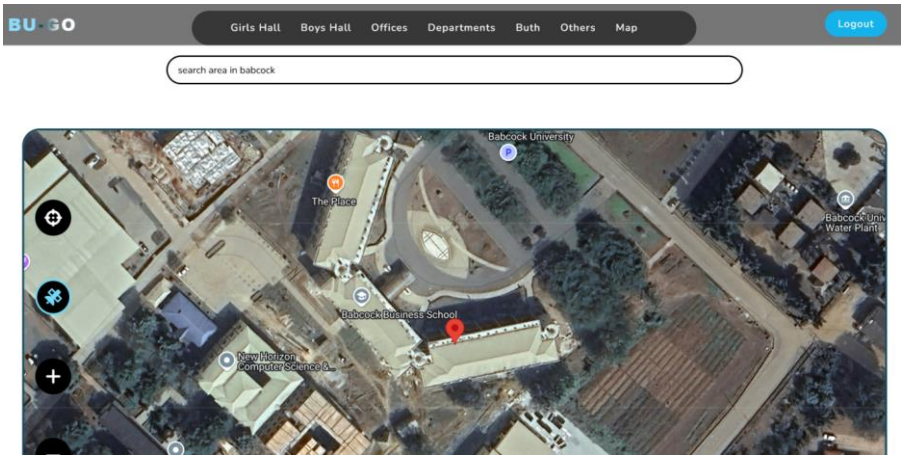

Figure 15: Map Interface

CONCLUSION

The developed web-based location navigation system in the context of Babcock university has been presented in this work. The system provides guidance and includes images of the buildings which further aids the recognition of the places when the user finally arrives at their desired destination. The simplicity of the system and its responsiveness both for web and mobile use appeals s to usability and enhances user experience. Essentially, this system contributes to solving the problem of navigation and provides benefits which are not limited to reducing inconveniences, frustration, confusion, anxiety, time and valuable resource wastage, and possible risk to life. It therefore recommends that although this work focused on outdoor navigation it can be extended to indoor navigation. It could be further extended with Artificial Intelligence into a smarter navigation system as well.

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