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Development of PathPilot: Find Your Way a Campus Navigation-Based Application

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ABSTRACT—

This paper presents the design and implementation of PathPilot: Find Your Way, a cutting-edge mobile application designed to facilitate easy navigation and enhance the campus experience with an interactive 3D map. It is a dynamic platform that enables users to stay up to date about campus events and has a search functionality where users can search for information by searching their names. Key features include easy location selection by floor, staircase and destination, easy to use interface, real time updates on events and latest updates on campus, interactive 3D map. Overall, it is an innovative and practical solution to enhance their campus navigation experience.

Keywords- Campus navigation, Smart campus, Interactive map, 3D map, Mobile application, Mapping technology, Real-time updates, Search functionality

I. INTRODUCTION

PathPilot is a mobile application that simplifies campus navigation [1][2][3] and enhances the overall campus experience. The application has an easy-to-use design and user-friendly interface, making it effortless for students to navigate their college campuses. With PathPilot, users can select floors, staircases, and destinations to locate classrooms, offices, and other essential destinations within the campus efficiently. Besides being a navigation tool, PathPilot is also a dynamic platform, enabling users to stay up to date about campus events, making it easier to stay connected. It also has a search functionality where users can search for a person's name to get their contact information, location and their details. Moreover, PathPilot also features an interactive 3D map that enables users to navigate the campus environment with ease and efficiency. The map provides a comprehensive overview of the campus layout, allowing users to zoom in and out of the map. It is the ultimate solution for students and faculty who want to navigate their campus with ease and stay connected with their academic community. It is built using flutter framework [1][9][10], SQLite, blender. With PathPilot, users can have an enhanced campus navigation experience while staying up to date with campus community.

II. PROBLEM STATEMENT

The current methods for campus navigation lack efficiency, user-friendliness, updates about campus events, and search functionality, making the navigation experience less smooth. Navigation around a campus can often be a difficult task, especially for newcomers who struggle to find their way efficiently. The complex layout, multiple buildings, and scattered facilities often lead to inefficiencies and frustration. To enhance the campus experience, we need innovative solutions that simplify navigation and improve communication. This system must establish an easy-to-use interface, real-time updates, interactive 3D map, and search functionality to find information by searching names.

III. REVIEW OF LITERATURE

The integration of technology in campus navigation and management has led to the development of various innovative solutions aimed at enhancing the campus experience. These advancements include:

1. Flutter-based Interactive Maps: Utilizing the Flutter framework to create efficient, user-friendly campus maps that respond to HTTP requests for location searches, streamlining the process of finding important locations on campus.
2. GPS-based Android Navigation: Leveraging the Android SDK and Google Maps to provide real-time updates on campus events and locations, offering users the shortest routes and reducing navigation-related frustration.

3. Accessible Wayfinding Apps: Developing applications like Unibs4all, which use Google Maps API and Directions API to offer personalized navigation paths, considering architectural barriers and providing voice-over features for visually impaired users.
4. Smart Campus Tools: Introducing IoT applications to collect real-time data for better campus utilization and decision-making, addressing the challenges of campus development and operation.
5. IoT and AI in Smart Campuses: Exploring the role of IoT and AI in transforming campuses into smart environments that enhance learning experiences, promote sustainability, and facilitate data-driven decisions, despite challenges like energy consumption.
6. Augmented Reality Systems: Implementing AR technologies such as ARCore and ARKit to merge virtual content with the real world, providing immersive navigation experiences and improving library usability with marker-based AR for indoor navigation.
7. Campus Navigator Applications: Addressing the issue of campus navigation for new visitors by using beacons for accurate location determination and guidance, saving time and improving the overall campus visit experience.
8. AR in Campus Culture: Utilizing augmented reality to enrich the understanding of campus history, tradition, and culture, and integrating it with smart campus projects for a comprehensive information system.
9. The field of event management and security has seen innovative applications of technology to enhance efficiency and security. The Presentik model utilizes QR code recognition through the Flutter framework to manage attendance securely, preventing fraud with proximity restrictions and integrating Google's MLKit for scanning. It streamlines event organization by tracking attendance, managing time, and facilitating communication via email, supported by the Google Cloud Platform and various APIs.
10. Evecurate is a comprehensive event management app that simplifies the process of creating, sharing, and managing events. It features modules for event sharing, audience interaction, planning, and additional tools like vendor recommendations, all built using Flutter and Firebase for a seamless user experience.

These technologies not only facilitate navigation but also contribute to the broader vision of creating interconnected, efficient, and user-centric campus environments.

IV. METHODOLOGY

The research design aim is to simplify campus navigation and facilitate campus experience with an interactive 3D map, search functionality and updates on campus events.

Key aspects covered in system design:

- Enhancing the user experience with a user-friendly UI that includes search bars, interactive maps, clear navigation menus, and 3D mapping for an immersive experience.
- Providing real-time updates by enabling users to receive notifications.
- Integrating a campus mapping system with an interactive 3D map to easily locate campus facilities.
- Implementing a database to store user data (email id and password) and authenticate their login.

This system design emphasizes the key features of PathPilot, including campus navigation, real-time updates, communication tools, campus mapping, and an easy-to-use interface. By addressing these aspects, the app can effectively simplify campus navigation and enhance communication within the academic community.

Hardware Requirements:

- 8GB RAM
- 256GB storage
- i5 Intel processor

Technology Stack:

- Flutter framework
- Android Studio software
- Figma, which is used to design the UI and has facilitated the application’s development.
- SQLite, used to store user data (email ID, password) and authenticate their login.

- Blender, for creating a 3D map.

V. DESIGN DETAILS

PathPilot application combines several key components to build a seamless user experience. The key components are:

1. SQLite Integration: It functions as the local database for PathPilot, characterized by its lightweight, self-contained, and serverless nature. Key features:
   i. Ensure data consistency and reliability.
   ii. No need for a separate database server as it simply creates a new file and connects to it via SQLite3 API.
   iii. Occupying less than 1MB in size.
2. Flowchart Overview: The flowchart depicts the login and sign-up processes within PathPilot. Login for Existing Users: Users who already have accounts can log in using their credentials. Sign-Up for New Users: New users can sign up by providing the necessary details.

After signing up, users proceed to log in, gaining access to the app's features.

To build PathPilot, we first need to create a Flutter project in Android Studio and installing all the necessary tools. Once the setup is done, we can proceed with the development of the splash screen, login screen, sign-up screen, homepage, search page, map page, and profile page. The search page, includes a function that displays names; when selected, it opens their detailed description page.

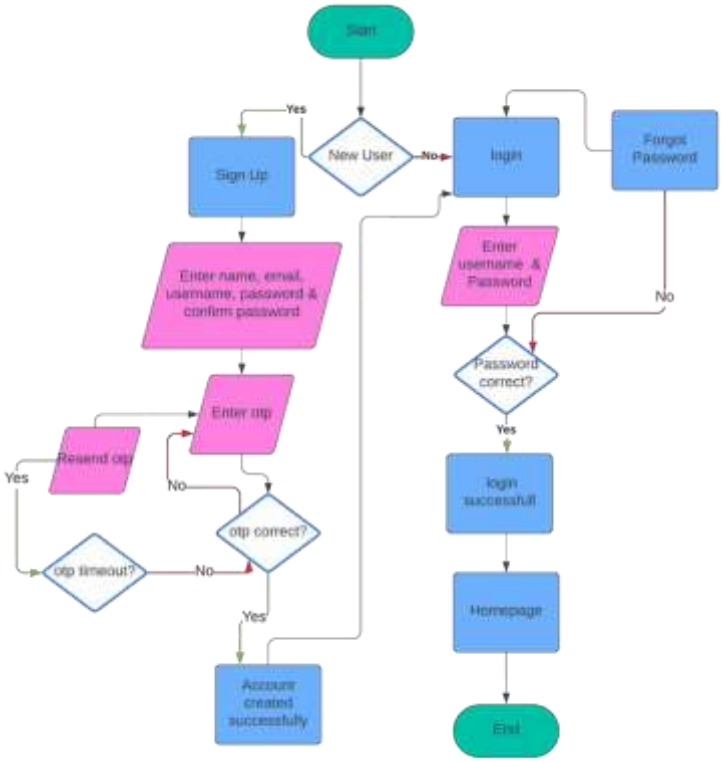
On the map page, we implement a function allowing users to switch floors, select staircases, and choose their destination. This function displays a 3D map with the route and zooming capabilities. Additionally, users can access detailed descriptions of destinations, including timings and associated professors.

The login and sign-up pages, after their creation, are integrated with the SQLite database to store user data and authenticate the login process.

The homepage features a function that presents updates; when selected, it displays the detailed descriptions and is same for event information as well. Also, a push notification alert system can be implemented integrated with the database to provide real-time alerts.

For creation of a 3D map, Blender software is used. A 3D map of one campus floor is created, with routes added from various staircases to destinations. Multiple files are created for this purpose. When a user selects a staircase and a destination, the corresponding the corresponding map with the route.

VI. FLOWCHART



VII. CONCLUSION

In conclusion, PathPilot has emerged as an innovative mobile application that simplifies campus navigation. With its user-friendly interface and easy-to-use design, PathPilot facilitates seamless navigation for students, enabling them to easily locate classrooms, offices, and other campus destinations. It provides real-time updates on academic events and facilitates instant notification alerts, thereby enhancing connectivity with the campus. Moreover, PathPilot's interactive campus map feature and the inclusion of a 3D map offer users a more immersive and engaging experience, providing a realistic depiction of the campus environment that enhances navigation and exploration. Overall, PathPilot emerges as the ultimate solution for students and faculty seeking to navigate campuses effortlessly while staying connected with the campus community.

VIII. FUTURE SCOPE

1. Integration of indoor positioning systems (IPS) for enhanced navigation accuracy.
2. Implementing augmented reality (AR) features for a more immersive navigation experience.
3. Develop a chat page to enable interaction between students and teachers.
4. Optimize the algorithm for real-time performance to provide instant route suggestions.
5. Implementing encryption and blockchain technology to improve security levels.
6. Features like student progress tracking, displaying results and attendance records, etc. can be added.

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