Geospatial Mobile Application for Navigation and Emergency Response using Google Photorealistic 3D Tiles and Cesium for Unity

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Abstract

The goal of this project is to develop and evaluate a Geospatial Mobile Application for Navigation and Emergency Response using Google Photorealistic 3D Tiles and Cesium for Unity. The Mobile AR Application can be used for navigation and emergency response at UNT campus. Cesium for Unity combines the 3D geospatial capability with the Unity ecosystem. The developed location-based mobile application provides more immersive navigation experiences and emergency information to users on campus. The developed mobile application makes navigation more intuitive with a 3D model of the user's location at UNT campus by displaying location-based content and integrating Google Photorealistic 3D Tiles perfectly with the real world.

Introduction

Current procedural information are buried in PDF formats that make it difficult to access in emergency situations. This application focuses on local-scale emergency navigation and creates an interactive experience. The application relays critical safety and procedural information in accordance with UNT Risk Management guidelines. The following resources were frequently referenced during the development of the application.

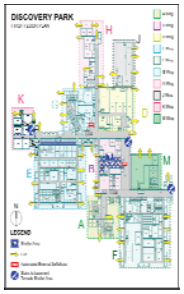

Figure 1. Discovery Park Emergency Floor Plan

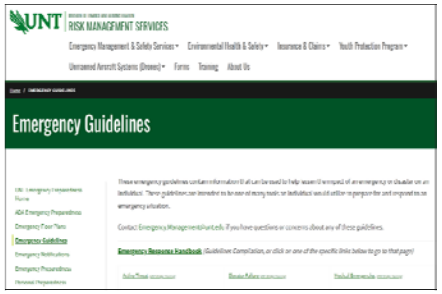

Figure 2. UNT Risk Management Emergency Guidelines

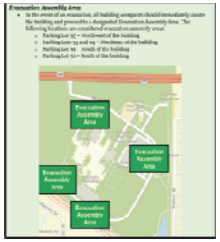

Figure 3. UNT Emergency Evacuation Procedures

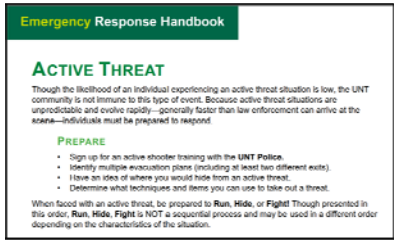

Figure 3. UNT Emergency Response Handbook

Methodology: Cesium for Unity

Cesium for Unity combines the 3D geospatial capability of Cesium and 3D Tiles with the Unity ecosystem. This technology allows us developers to create immersive virtual reality experiences based on real world locations. The 3D tiles act as a digital twin for the Discovery Park campus, where we can overlay information to be displayed in the application.

Figure 5. Cesium data for UNT Main Campus and Discovery Park

Mobile Application Implementation

Key markers such as exits, severe weather shelter locations, and evacuation assembly points are overlaid on a detailed 3D map of campus, to aid navigation. The app functionality allows users to quickly access essential safety information and toggle features on and off as needed.

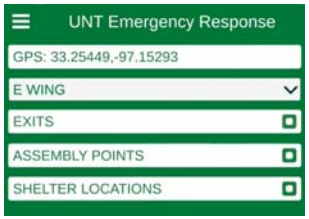

Figure 6. Application User Interface

Figure 7. Discovery Park Evacuation Assembly Points

Figure 8. Severe Weather Shelter Locations marked

Figure 9. GPS Pin to track user location

UNT Emergency Response App Demo youtube.com/watch?v=ls4cyhPFagk&t=2s

Conclusions

The application uses real-time GPS tracking to update and enhance spatial awareness as users navigate through the building. This functionality facilitates improved orientation within complex environments. The application also offers a variety of view options, enabling users to explore and interact with their surroundings from multiple perspectives.

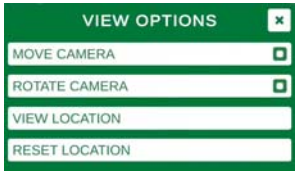

Figure 10. Application User Interface

Figure 11. GPS Pin to track user location

Future Work

Future work will focus on integrating Generative AI and ChatGPT to provide users with navigation guidance and procedural information. Additionally alerting systems will be implemented to deliver timely notifications and updates during emergencies. Also, digital twin for visualizing geospatial data for UNT campus will be explored.

Acknowledgments

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Publications

1. Sharma, S and Pesaladinne R.,"Spatial Analysis and Visual Communication of Emergency Information through Augmented Reality", Journal of Imaging Science & Technology (JIST), JIST, Vol. 67, Issue 6, https://doi.org/10.2352/J.ImagingSci.Technol.2023.67.6.060401, 2023.
2. Chellatore, M.P., Sharma, S, "Mobile application for identifying anomalous behavior and conducting time series analysis using heterogeneous data", Proceedings of the 26th International Conference on Human-Computer Interaction (HCI International 2024), Thematic Area: Virtual, Augmented and Mixed Reality, Copenhagen, Washington Hilton Hotel, Washington DC, USA, 29 June - 4 July 2024.
3. Sharma, S., Pesaladinne R., "Spatial analysis and visual communication of emergency information through augmented reality", Proceedings of the IS&T International Symposium on Electronic Imaging (EI 2024) in the Engineering Reality of Virtual Reality Conference, January 21-25, 2024.