Augmented Reality & 3D Planning

Cadent Lane Rental Industry Publication

TRANSPORT FOR LONDON

Introduction

Traffic Congestion in London has long been an issue, leading to London recently being ranked as the second most congested city in Europe, with drivers spending an average of £1,911 each in gridlock during peak hours. The aim of this project was to minimise traffic congestion so that London's road network can be managed more effectively.

Conventional methods of planning works are time consuming and can contribute to congestion through making unnecessary visits to site to assess traffic management requirements. Similarly, identifying the location and orientation of underground apparatus from a series of physical maps is also time consuming. It's often a manual process and can result in abortive/dry excavations or require exploratory excavations.

Transforming the way asset information is visualised could deliver operational efficiencies and contribute to reducing the impact caused by roadworks.

The Project

The project aims were to:

- Create a tool that allowed for the planning of excavations in a 3D environment, allowing easier visualization of traffic management; and to
- Create a working AR solution that allowed for easier, more intuitive asset location.

AR Maps

Augmented Reality (AR) is a technology that aims to address difficulties relating to underground asset location. The AR map solution proposed utilising existing GIS data by presenting assets at their exact location in an augmented form.

AR maps would allow users to see each asset and its location and orientation within the ground, so an engineer could simply point a device and instantly understand where and how many assets were in the vicinity. Ideally, this would increase the likelihood of an engineer locating an asset first time, by removing any ambiguity incurred from the use of a physical map. Users would also be able to select an asset, retrieve any additional information and to edit/modify the asset data should any of the information (such as location, asset type, etc.) be incorrect.

3D Planning Tool

The main goal of the 3D Planning Tool was to present users with an accurate 3D representation of a given worksite, which would include useful information such as, live traffic data, places of interest, and additional road asset data. By facilitating better planning it was anticipated that fewer exploratory excavations would be required, and less site visits would be expected to determine the most suitable traffic management layout.

Outcomes

A timeframe of six months was allocated to the project to develop both the 3D Planning Tool and AR Maps solutions, and whilst initially it was planned to have around 60% the project dedicated to the development of the 3D Planning Tool, this ended up being significantly more.

AR Maps:

It can be concluded that the project was unsuccessful in fully achieving its goals for the following reasons;

- Choosing an AR Framework In order to overlay 3D models, the functionality offered by various different AR frameworks had to be investigated. The ones selected for trial in this project turned out to be unsuitable for varying reasons, including a lack of Geolocation to platform incompatibility. After much consideration, Wikitude was used as it appeared to be the most well established and highly regarded within the AR community.
- In order to successfully augment virtual assets at locations based on GIS data, extremely accurate GPS was imperative. Global positioning through satellite triangulation requires an uninterrupted line of site. Augmented systems on mobile phones, with the use of a Wide Area Augmentation System (WAAS) and uninterrupted signals from several satellites can increase the general accuracy from 15m down to down to <1m. However, this is rarely the case, and in most circumstances the GPS accuracy of a handheld device is in the region of 5m, which is far too inaccurate for the intended purposes.
- Some test applications were developed to allow for the placing of objects at random locations, however this never progressed to a stage where it was possible to accurately render assets with a consistent level of accuracy that would provide any benefit to engineers.

3D Planning Tool:

In most cases the objectives of this task were achieved, and in some ways the goals were surpassed by creating and integrating additional features that made the planning tool a more successful application. The tool allows a user to set up a high level traffic management system, and to then send the site plan to an engineer. However, further refinement is needed before it is ready to be used in the field. A number of features would need to be added before this could be classified as a readily usable product and a viable replacement for current methods

Lessons Learnt

The project can be clearly separated into two distinct areas, which are fundamentally different, and in hindsight, it is felt that trying to develop these two separate solutions in the given time frame was too ambitious. That aside the project provided has provided some valuable insights that will aid any future development in these areas, which are set out below.

AR Maps

While the development of a viable AR Maps solution may have been unsuccessful, positives can be taken from the experience. As already highlighted, the inaccuracy of handheld GPS proved to be a huge challenge that greatly hindering development. The importance of fully investigating the current state of any technology that is to be used over the development lifecycle was something that should have been given more detailed consideration.. Whilst great advances have been made in recent years with regard to Augmented Reality, its application to this particular solution was nullified by the GPS inaccuracies experienced.

Further analysis of solutions to negate the inaccuracies of GPS should be considered, including allowing the user to provide / select a reference point to manually override the GPS. This would be useful in instances where GPS accuracy cannot be exactly determined, but users know the exact location based on a distinguishable reference point such as a building, a manhole, or any other easily identifiable landmark.

An alternative solution would be AugView, which is an augmented reality asset management solution for iOS and Android, sourcing its data from a variety of GIS web servers, such as ArcGIS Online and providing compatibility with various external devices that improve GPS accuracy.

Lessons Learnt

3D Planning Tool

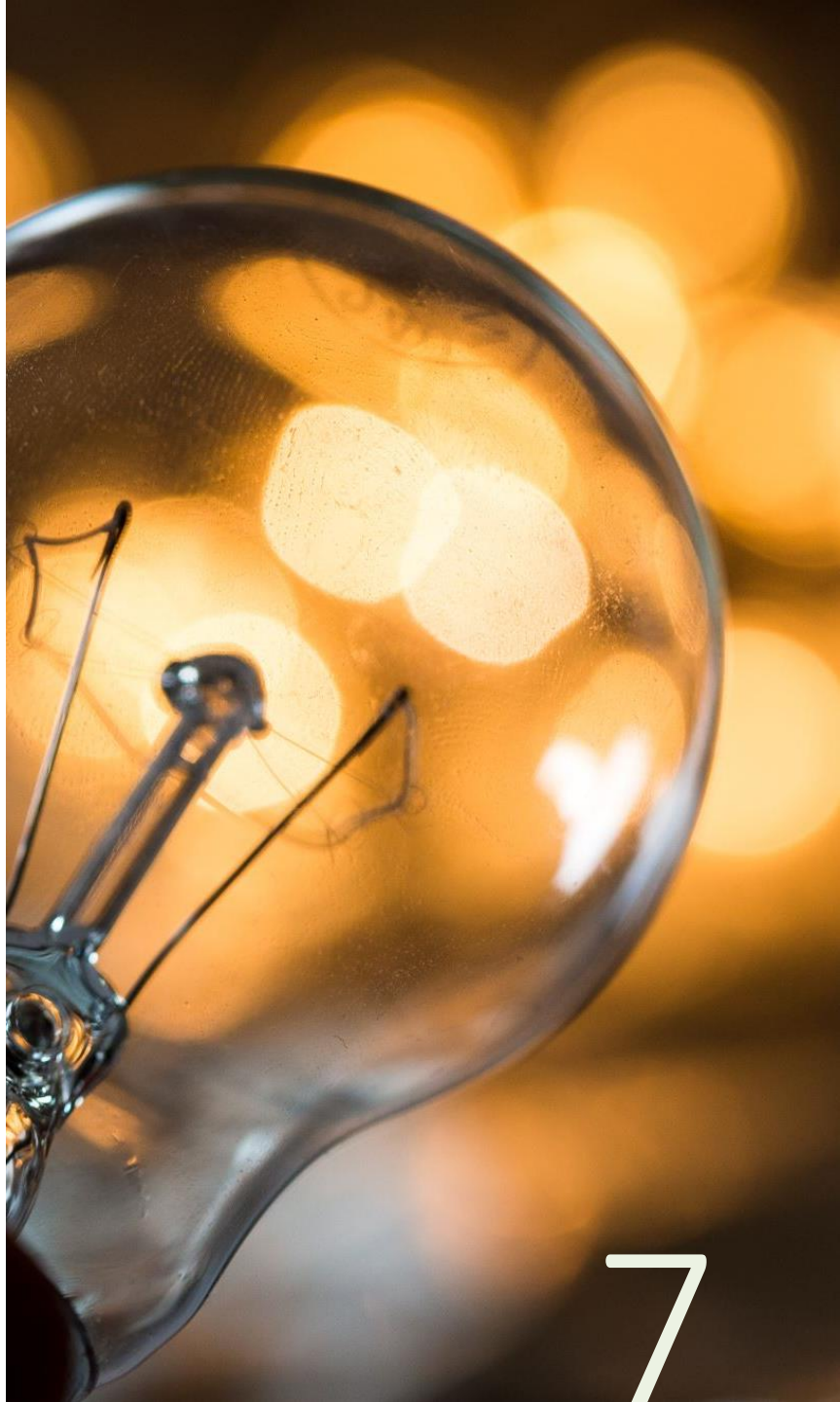
Overall, the development of the planning tool was a success, with many positives being taken from the experience. One of the main lessons learned from the completion of this project was around user feedback. One of the first activities prior to starting development was to engage with the end users on how current methods of planning could be improved upon. This resulted in having a clear focus from the very beginning and maintaining this throughout the lifecycle, with the solution being regularly tailored based on the feedback.

There were several other features the development team would have liked to include in the planning tool, which are as follows:

- Unexpected Obstructions: Having an accurate scale for vehicles and maps has resulted in the ability to determine whether it is viable to send larger vehicles through certain streets in London to an excavation site. However, one challenge the planning tool has not been able to circumvent is that of unexpected obstructions such as parked vehicles. This is something the development team would be keen to address in a future iteration of the planning tool.
- Traffic Database: The ability to view the average traffic level for London areas over the course of a few months as well as real time information would allow users to see the predicted traffic level for any given street.
- WRLD VR SDK: The WRLD VR SDK is a dynamic mapping platform that allows users to create interactive 3D worlds. There are many ways in which this newer platform improves on the Mapbox SDK used, such as the ability to create interactive indoor environments, and more extensive geocoding options.
- Google Earth VR: Google Earth VR is a virtual reality solution that works on a variety of different VR headsets which incorporates Google Earth VR to work with their Street View API, meaning that users can now view a multitude of locations at street level. Unfortunately, Google have not yet granted public access to the SDK, and so it is not possible to merge traffic management functionality with the street view functionality. However, there would still be value in being able to view a location prior to the excavation taking place.

Conclusion/ Recommendation

The project had mixed success; the development of the 3D Planning Tool was successful, meeting the goals outlined in the original proposal, but the development of the AR Maps solution was unsuccessful due to the lack of a working solution being developed.



TfL Lane Rental Scheme

Optimising customer journeys through the delivery of safer, innovative and sustainable roadworks

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Date Created: November 2017

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