A Serious Game for Flood Mitigation: Automated Level Generation

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Introduction/Background

Since interpreting raw data from hydrological surveys can often be difficult for non-experts, it is beneficial to simplify the data into a form abstracting certain features of the disaster, for example, exact geographical features and drainage. Indeed, even subject experts require more visual approaches to simulating and referencing hydrological data, as seen in the Iowa Flood Center's simulation (Krajewski et al. 2017). Interactive simulations have often been used to simulate the condition of a land area during a flood, and as been conducted by various games, such as Prevent Disasters and others. We created a Google Maps API based game able to allow users to simulate a flooding situation using any available terrain, which can be used to spread awareness regarding a flooding situation among individuals with little to none training regarding hydrology or engineering (Felicio et al. 2014).

In this paper we will discuss a JavaScript based game that generates terrain based of Google Maps static API. The game is able to generate a 3D terrain map off a section of the world map of the player's choosing. Previous examples of similar games often use a pre-generated terrain map which may become repetitive, though our model is rooted in an actual terrain map with a flooding threat. In order to do so, the application allows the user to select a rectangle as the base map, then generates an in-game map by abstracting several features.

Though similar research has been conducted for the purpose of returning data alone (Khoury et al. 2018), this study seeks to create a way to generate a in-game terrain using Google Maps static API and JavaScript, using red-green-blue-alpha (rgba) analysis of Google Maps static images in order to generate a game map by identifying the elements of the selected area present.

Research Objectives

Create a simulator game able to generate a real-world terrain in the in-game environment in order to create realistic game levels and possibly allow simulations of flooding to demonstrate a situation in which an area is flooded and shown solutions for preventing damage.

Methodology

We created the simulation from two parts by two different sections. Section one involves the creation of an in-game level which the player can select from the full map by clicking on one set of diagonal points. Section two involves generating the field and the flood threat in the simulation. This research covers section one.

Then, the program generates on region on the map that can be manipulated by the player to conform with the player's desired playing field. The program then analyzes the region with, starting with converting the Google Maps into a static image in the Google Maps Static API. Then, the program removes labels to allow for ease of analysis and assigns each pixel to a rgba

(Red-Green-Blue-alpha) value and identifies it as a type of terrain since the map already colors it. These can then be processed by the game and generated into a level. The division into terrain types is precise since for Google Maps similar types of constructions (i.e. buildings, roads, etc.) are marked with similar colours, though there are a few exceptions.

Finally, the terrain types can then be mapped to a tiling system and tiled into a game level. That is the main involvement of the second section and is beyond the scope of the first. The generation of levels requires the program to read the pixels of the map and generate a corresponding map. The process of generating a map is concluded in the second section of the program separate from this study.

Results

We were able to create a simulation that demonstrates a terrain on Google Maps API that covers an area of a player's choosing. The game was able to, within reason, identify correctly the tile it was to put based on the pixel of the static api, though this was limited by the fact that the static image was intentionally more pixelated to ease the process of identification. This created an accurate though obscure map that deleted details from the original. It is recommended that an analysis be done on a full-scale map which is capable of being analyzed first, then mapped to tiles, though this is beyond the capabilities of this time frame and requires further inquiry and research if the game is to be further developed.

Conclusions/Implications

The serious game developed would help raise general awareness of flood threats and how to countermand them in civilian populations. Furthermore, simulations of this type could seek to incorporate features of reading of Google Maps API into a more realistic 3D game, as seen in Sermet et al. 2018. A fully informative game would include data sourced from official banks in addition to Google static API and return research-worthy data in addition to becoming a tool to demonstrate the workings of a flood to civilian users.

References

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