PhD Proposal

MAP-i

Title: **Realtime Interactive High Quality Graphics**

Abstract:

Current PC's architecture support different levels of parallelism. There are multi-core CPUs and GPUs that are inherently parallel. These features have been explored in isolation so far, as graphics are concerned.

In this project we would like to explore the parallelism between the GPU and the CPU focused on real time image synthesis. The goal is to study the algorithms commonly used for non real time rendering, such as ray tracing, radiosity, or photon mapping, and algorithms commonly used in real time, such as shadow mapping, or normal and parallax mapping and deferred rendering. Deploy new strategies for real time graphics combining these two different approaches, exploring the potential of the two processors simultaneously.

Supervisor:

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CCTC/ Universidade do Minho

PhD Proposal

MAP-i

Title: **Time, the Fourth Dimension**

Abstract:

3D models of buildings, or constructions, commonly represent a snapshot in a particular moment of time. Therefore, to show the evolution of a model in time, several snapshots are required, each portraying a particular moment.

There are many situations where two consecutive snapshots in time contain many elements in common. Finding these common elements, or the differences between two snapshots, may not be a trivial task, if for instance the two instances in time were modelled separately.

In this project we seek to explore time as the fourth dimension of graphic models, adding temporal primitives to the specification of graphic models, thereby allowing the temporal component to be included in the 3D graphical model. Hence a single time extended model definition may contain all the information of the object through time.

The specification must be simple to incorporate in already built models, yet powerful enough to deal with common situations that arise for instance in archaeology, or historical buildings that have been altered during their existence.

Supervisors:

António Ramires Fernandes
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PhD Proposal

MAP-i

Title: **Location Based Augmented Reality in Mobile Devices**

Abstract:

Mobile Devices as the iPhone, iPad, or Android operating devices are becoming very powerful and have an increasing set of functionalities such as GPS, accelerometer and gyroscope. This new devices are also capable of rendering high quality real-time 3D graphics. The goal of this proposal is to explore augmented reality applications in this type of devices. The case study will be the Ponte de Lima in 3D (PL3D) project. A scenario for such an application will be to use the camera of the device to capture an image, and get the location and orientation of the device with the location finding features of the device to determine the camera parameters. The virtual model of city wall from the XIV century can then be superimposed to the captured image. As the PL3D project also contains a model with the actual buildings in Ponte de Lima, it is possible to determine the occlusions between the city wall and the actual buildings, and perform a correct superposition depth wise.

Furthermore, basic 3D reconstruction techniques can be used to identify the buildings in the scene, and comparing these to the actual model of Ponte de Lima can compensate for the inaccuracy of the GPS systems. In a latter stage of development the 3D reconstruction techniques should supply enough information to avoid using the model of the actual village to obtain a depth wise correct superimposition.

Supervisors:

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PhD Proposal

MAP-i

Title: **Procedural Urban planning + Virtual Inhabitants**

Abstract:

Archaeologists often have incomplete knowledge of a location. For instance, in Ponte de Lima there is physical evidence regarding the city wall which dates back to the XIV century. However, none or little information is available of the constructions inside the city wall. What is proposed in the this project is to create a plausible reconstruction, or reconstructions, of the inner buildings of the city wall.

Adding virtual inhabitants which interact with each other and the village provides an enhanced legibility of the virtual architecture by filling it with life, albeit virtual. Virtual inhabitants should have behaviours that will lead to a better understanding of the virtual urban planning(s).

Both the behaviours and the virtual urban planning should be subject to a set of rules that are congruent with the epoch, climate, local customs, geography, and other features that influence real urban planning and our day-to-day behaviour.

Supervisors:

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