InfoUNLP3D: An interactive experience for freshman students

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Abstract. The use of technology in educational environments is becoming a common standard. Current high-end mobile devices provide the necessary hardware to allow the execution of complex and resource-demanding 3D applications, at least in their simplest forms under low-end devices. Under this context, a multiplatform 3D mobile application is proposed, presenting a complete virtual scenario of the Faculty of Informatics (Universidad Nacional de La Plata, Argentina), with the main purpose of being an interactive guide for students. The application provides a navigational model of the building, several playing modes in order to get to know the facilities, and updated information about classrooms and courses.

Keywords: virtual buildings, 3D navigation, mobile devices

1 Introduction

Nowadays, the use of technology for helping purposes in everyday situations is something increasingly common. In this context, mobile devices such as cell phones, smart phones or tablets increase the possibilities of creating new technology to assist people under certain circumstances. This technology has the necessary potential to be also used in learning activities [1, 2, 3].

Additionally, the computational capacity of these devices have increased considerably in the past few years, allowing the execution of 3D applications with high levels of hardware requirements with ease. By doing this, it is now possible to create tridimensional experiences in which the user can even achieve a complete immersion within a virtual environment.

Thus, these two concepts (learning software and virtual 3D experiences) can be related in order to create a vast number of applications that aid users in their lives through easy-to-use and visually attractive solutions. One of these applications is the one proposed in the present paper. Its main goal is to visually help students with their first steps at the faculty to locate classrooms and place themselves within the building.

The rest of the paper is organized as follows. Section 2 presents the motivations for the proposed work. Sections 3 to 5 describe the main stages in the creation of the interactive experience. Section 6 presents the results achieved after its publication and use by the students. Section 7 presents a list of possible related work.

2   Motivation

For freshman students, the initial days within the faculty can be a challenging and stressful experience. For the most part, a new and more independent way of life begins; all this changes might overwhelm them [4, 5].

In view of this situation, and despite the fact that the building provides all corresponding signaling and information offices, this is sometimes not enough for freshman students, who, in some cases, present interaction difficulties in their first days at the university.

Nowadays, most of the students own mobile devices. This is even more noticeable in computer science careers. They are familiarized with this kind of technology and easily master a large variety of mobile applications, which are a fundamental part of their daily life.

Therefore, a mobile application that assists students in their first stages at the university turns out to be very useful, helping them to become familiar with the building, its main areas and offices.

The proposed application consists of a mobile interactive 3D virtual model of the Faculty of Informatics, Universidad Nacional de La Plata, Argentina. Users can navigate the building or take virtual tours all around its facilities, in which several signs with the most relevants points of interest are displayed in an *augmented information style*. Additionally, information about classrooms and courses is shown while navigating the virtual scenario.

3   From blueprints to 3D building model

The first stage in the development of the interactive solution was the creation of a 3D model of the whole building. This task implied constructing the mesh based on the original faculty blueprints.

The faculty is a 3 stories building, containing dozens of classrooms, administrative offices, bathrooms, elevators, a library, a cafeteria, a green area and a parking lot; all of which had to be reproduced in the mesh.

In addition to blueprints, web mapping services like Google Maps [6] and Bing Maps [7] were used as reference in order to consider additional visual information not included in the blueprints such as roof color, trees placed inside the green area, building orientation, etc.

During the design, a special consideration was given to possible performance issues if the application would be run on slow mobile devices. Key aspects like the number of objects in the scene, number of polygons per object, or the textures used

for the materials were taken into account with the goal of a correct balance between quality and performance.

Figure 1 shows an early stage of the modeling process. The blueprint is used as a reference in order to create the walls, floor, etc. The corresponding constructed 3D model is shown at figure 2.
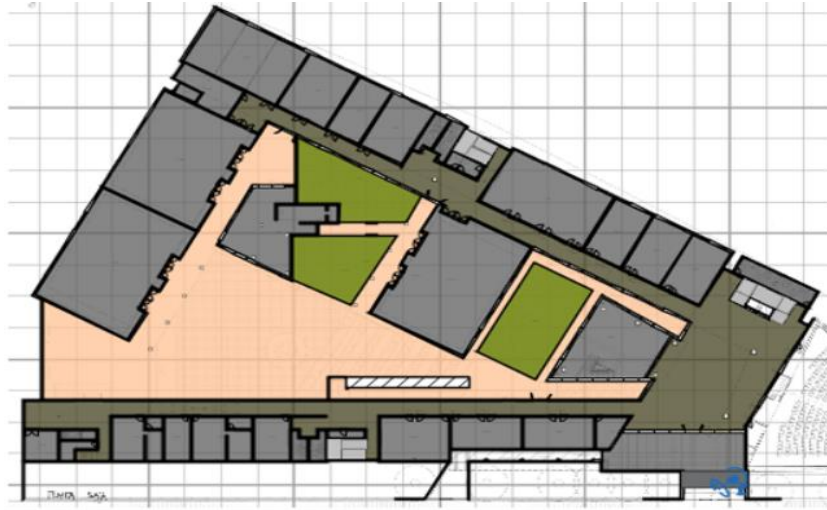

Fig. 1. Blueprint used as reference.

Fig. 2. The constructed 3D model.

4 Interactive experience

The main goal of the experience is to allow students to become acquainted with the differents areas of the faculty, and how to get to them.

This is achieved in several ways or playing modes available in the application:

● *General tour*: this option automatically navigates the whole building; starting from the main entrance, the tour presents a complete walkthrough though the hallways for each story, ending in a general bird's-eye view of the complex.

● *How to get to…*: in order to easily locate a bathroom, the cafeteria, etc. several preloaded navigations were included so that the student simply selects the location of interest, and the tour will explain how to get there from the main entrance.

● *Free roam*: the student will be able to navigate any area of the faculty in a first person perspective, virtually *walking* through the building hallways, stairs, etc.

These modes - in more extent the free roam one - requires an application with full user interaction support.

To achieve this goal, the application was created using Unity [8], a 3D development framework for creating interactive solutions, games, etc. Being a 3D solution, Unity supports the use of 3D meshes [9,10, 11, 12]. In particular, the model previously created in Sweet Home 3D [13] was exported and imported in Unity.

Once imported, a series of activities were necessary to adapt the 3D object for its correct use in Unity. The most important ones were the scale correction of the 3D model for proper handling and a mesh collider application on its members in order to run the simulation as expected in the free roam mode.

Together with the model, visual text hints were created as quick references for each place of interest, such as the library, bathrooms, etc. These hints are always displayed on foreground so that students can recognize these places along the use of the application, wherever they are placed.

The free roam mode required a special user interface, which allows the user to control the virtual character to move throughout the building. The mobile versions of the application present two virtual controls in order to move and change its orientation, while the desktop versions control the character by using keyboard and mouse.

Figure 3 shows the model already imported and adapted for Unity. Individual animations were created for each tour, setting camera position and rotation for each keyframe along time, as shown at the bottom of the image.
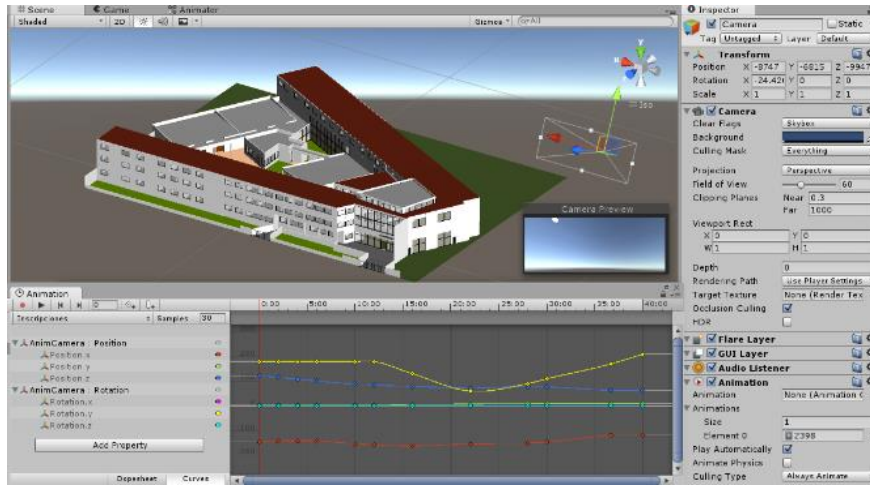
Fig. 3. The 3D model in Unity.

5   Integration with the classrooms information API

The *free roam* mode allows a useful additional feature. Every time the user is near a classroom, the daily schedule of courses for that classroom is displayed with information such as course name, professor in charge, type of course, hour of the day, duration, etc. The user can also browse the schedule through different days of the week, or even search courses for another quarter.

To achieve this functionality, the application interacts with an external system, also developed at the faculty: *Teachers Management System* [14], in particular with the *Classrooms Information API*. This API allows to query for a particular classroom information through a REST call [15].

The complete schedule for every classroom is prefetched and processed at the application startup time, so that all the information is already loaded by the time the user starts using the application. This eradicates any possibility of display lag when the user approaches a classroom.

Figure 4 shows an example of this feature. Every time the user moves towards a different classroom, the information will change accordingly.

Fig. 4. Detailed information about the courses schedule is displayed while the user walks near the classroom.

6 Results

Once the development stage was completed, the resulting application was released for distribution. The binaries are available in the *institutional* section of the faculty's official website [16].

The application was released under different builds for several platforms:

- An Android version for mobile devices such as cell phones or tablets.
- A Windows version for traditional desktop/notebook devices
- A Web version for any other type of device/operating system.

The main difference between the native versions (Android/Window) in contrast to the Web one is that the achieved performance is better in the former ones. New builds are planned to be created, such as distributions for iOS and Linux in order to include the whole range of users using native versions.

Students were notified about the application through the use of social networks like the faculty page at Facebook (around 3000 followers). A positive feedback was received by users, which *shared* and *liked* the publication [17].

The application's *General Tour* mode was even used at the inauguration of a new area of the faculty building [18, 19].

Figure 5 depicts the final application running on an LG device with Android OS. The different *playing modes* can be selected from the menu on the left, or any of the predefined destinations in the *How to get to…* mode. Virtual controls are displayed along the screen for moving and rotating the camera in the *free roam* mode.
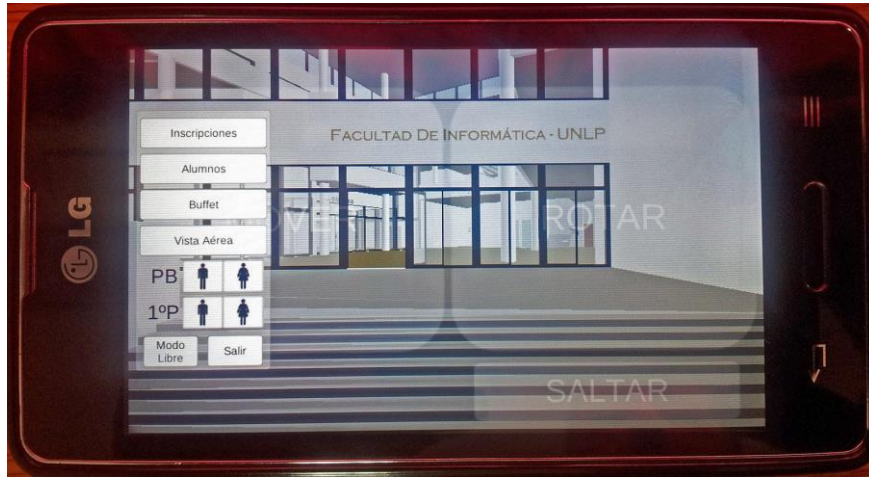
Fig. 5. The final application running on an LG device with Android OS.

7 Conclusions and future work

This paper presented a novel application that aids students to have a better knowledge of the faculty where they are starting their studies, through a virtual experience which shows the highlights of the building.

Several playing modes are available in order to enrich the experience, including a free-roam mode that allows a completely free navigation of the installations.

The application is available for several platforms, spanning a wide range of desktop and mobiles devices. There is also a web-based version in order to extend its use to any type of device.

The application was well received by students and general users, who gave positive feedback about it and even suggested new features, which now are the main objectives planned for future work.

First, a mid-term goal is to expand the interactive experience increasing the augmented information displayed in the application, which will be useful not only for students but also for teachers. For instance, when a user is positioned in front of a room, the system will provide related information such as:

- Room capacity
- Room equipment (computer, projector, etc.)
- Number of students

Second, a long-term goal is to extend the virtual scenario with new models from other faculties, so that the whole university will be included in the experience. In this way, the application will not be targeted only for informatics, but for a wider range of students from any other area.

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