Virtual interactive catalogue for viewing bibliographic content using Kinect 2

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Abstract

The main objective of gesture recognition in computer science is to interpret human movements and body language through mathematical algorithms. The Human-Computer Interface Technologies developed at the University of Informatics Sciences are committed to integrating this solution in a virtual catalogue that allows the visualization and dynamic interaction with bibliographic contents, making use of the Kinect 2 gesture sensor and the Unity 3D game engine. This catalogue offers a positive experience to users who need to explore the university´s bibliographic collection, by integrating elements that enrich the constant teaching and learning process, in the interests of acquiring better professional training.

Keywords

Virtual catalogue, gesture recognition, kinect 2, bibliographic content

1. Introduction

In recent years, countless technological advances have contributed to the development of gesture-based interfaces. The creation of revolutionary devices such as MS-Kinect, Leap Motion and MyO has marked a milestone in the proliferation of a new generation of applications with which users interact without the need for physical contact, thanks to the use of machine vision algorithms to interpret gestures. The aforementioned, together with the constant rise of information technologies, resulting from the emergence and use of the Internet, has revolutionized the traditional information systems in place to date, making them increasingly immersive and interactive with users.

The University of Informatics Sciences (UCI) constantly supports the Teaching and Learning Process, combining innovation with the knowledge of a wide range of professionals in order to train engineers who are increasingly prepared in the area of informatics. To support this task, the Directorate of Scientific and Technical Information proposes the use of virtual libraries, which constitute a necessary resource for the access and management of digitized information. With this new resource, teachers can gain an insight into the texts and other subjects they wish to research, after having consulted them according to their own search criteria. Similarly, new ways of accessing content are needed to meet the new realities and challenges facing the teaching-education process.

Hence, the use of the virtual catalogue aims to solve deficiencies associated with difficulties in user-information interaction, as well as in user access to information. It should also have a balance in the amount of content offered, in a way that benefits the user´s experience without affecting their attention. The aim of this research is to develop a digital catalogue for viewing and interacting with books, journals, scientific papers and other bibliographic content using Kinect 2.

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2. Materials and Methods

In order to formalize a proposed solution, it is essential to approach the current environment in which the research is framed and to understand the important concepts, the characteristics of the tools and the processes that the application automates.

2.1. Necessary Concepts

For a better understanding of the solution, definitions were studied for the terms: Online Public Access Catalogues (OPACs) [1], Natural User Interfaces (NUI) [2, 3], Gesture-Based Interfaces [4, 5] and Gestures [6].

2.2. Related Work

The works studied [5, 6] allow the creation of a solid base from which the development of all kinds of applications oriented to gesture control, either for educational or entertainment purposes, can be initiated. Based on this idea, and in order to obtain the best possible results in terms of visualization, interaction with the contents and user experience, it is determined to develop a digital catalogue based on gestures for educational use that provides a solution to the research problem in question.

2.3. Data extraction and generation with the Kinect 2

For the extraction and control of data provided by the Kinect 2 it was essential to understand the architecture of the device; how the software is managing the hardware and how the Kinect responds to it. Figure 1 shows a general schematic of how the application works in its interaction with the Kinect 2. First, the sensor is connected to the USB 3.0 port of the computer. At the user level of the operating system, there is the SDK 2.0 that makes the connection to the Kinect 2 and allows to obtain the data from the depth sensors, the infrared color camera, as well as the microphone array [7].

2.4. System Design

Based on the study carried out, an architecture based on the principles of the architectural pattern is proposed: layered architecture, with components ordered within it, in such a way that the elements necessary for a platform application of this type are structured. The components in each layer communicate with those in other layers through defined interfaces or instances of classes [8].

The above analysis allows to elaborate the details of each of the components used so that they can provide sufficient information at the time of implementation. As part of the solution, all interfaces that allow classes to communicate and collaborate with each other are determined, depending on the layer where they are located. The layers are defined as follows:

1. **Presentation Layer:** It is made up of the main elements of the system, such as: the main application controller **(AppManager)**, the Sound controller **(Sound Manager)**, the gestures **(KinectManager)** and the scenes **(SceneManager)**.
2. **Contents Layer:** In this layer are the different scenarios, as well as the objects and contents associated with them.

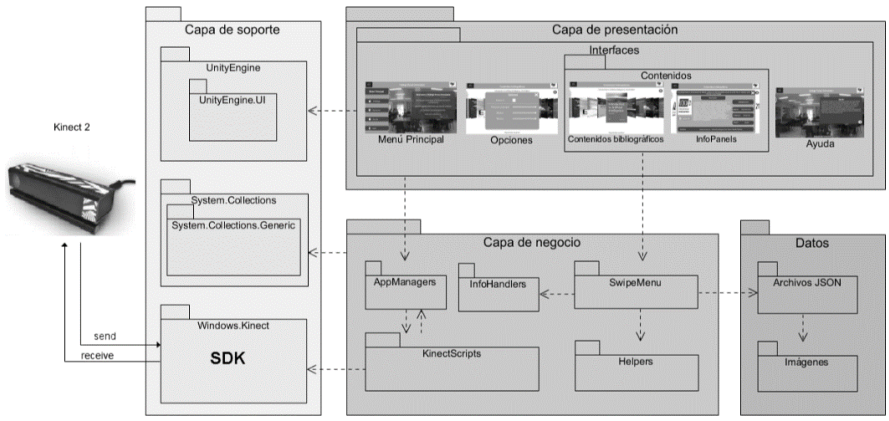

Figure 1. Architecture of the interactive virtual catalog

2.5. Results

After the research, an interactive virtual catalogue was implemented for the visualization of bibliographic content with Kinect 2. In order to guarantee the necessary services, the following functionalities were implemented in the application: **Content Catalogue**, **Content Management Module** and **Gesture Recognition Module**. For the development of the proposed modules, the steps established by the agile XP methodology will be followed, where the scheme explained by [9] will be respected.

Figure 2. Application menu view

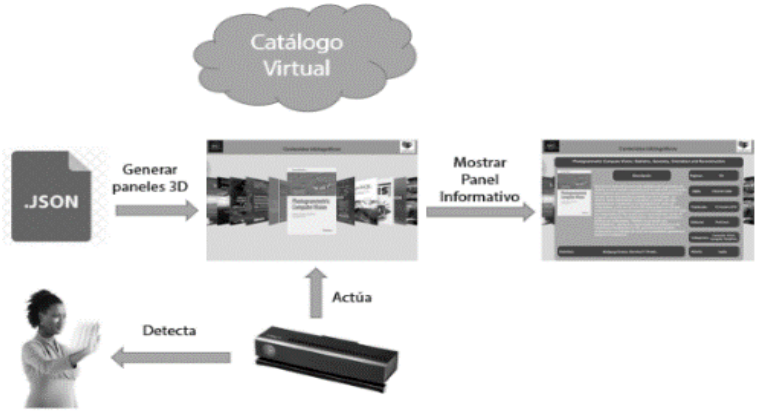

Figure 3. In-App Workflow Scenario

2.6. Conclusions

Based on this document, a virtual catalogue was developed which resulted in a novel model for the visualization and interaction with the contents stored in it. The application brings this content to the users, no longer in the traditional way, but in a completely new and interesting way. This is achieved thanks to the interoperability of the technologies and tools used, which, together with the application created, contribute to increasing the knowledge of the students and employees of our university.

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