Kinect Web Kiosk Framework

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Abstract. In this paper we present a web kiosk framework based on Kinect sensor. The main idea is to use the framework for creation of simple interactive presentations for informing, advertising and presenting knowledge to the public. The use of such a framework simplifies adaptation of existing web materials for presentation with the kiosk. We can also make use of touchless interaction for browsing through the interactive content, to animate the user and encourage her to spend more time browsing the presented content. We present the structure of the framework and a simple case study on using the framework as an interactive presentation platform and as an education resource. The developed framework has been used for presenting information on educational programs at Faculty of Computer and Information Science, University of Ljubljana.

Keywords: HCI, Kinect, interactive kiosk presentation, interactivity, interaction framework

1 Introduction

In recent years, several novel approaches to human-computer interaction became popular. Examples include mobile and large touch screens, as well as motion sensors such as Microsoft Kinect[1], Nintendo Wii[2] and Sony PlayStation Move[3] which are mostly used for gaming. While the former two systems still rely on the physical act of touching an appropriate surface, some of the touchless interfaces are able to support the interaction without the need of additional controllers.

To bring the digital content closer to the target audience, it is necessary to attract users attention with interactivity. This kind of presentation is not just suitable for advertising, but also for educational and work purposes. Later on we present a case study of using a touchless system for presentation and education purposes. The system uses the presented kiosk framework for easier preparation of content.

In the following section we present related work, where we point out the important contributions that drive the idea of a touchless kiosk system. In section

[1] http://www.microsoft.com/en-us/kinectforwindows/
[2] http://www.nintendo.com/wii
[3] http://us.playstation.com/ps3/playstation-move/

3 we present our implementation of a web kiosk framework and a touchless kiosk system. The case study is presented in section 4. In the last section we present future work and conclusions.

2 Related work

While touch interfaces are replacing all other forms of interaction on mobile devices, several authors [1,5,7] have presented examples where touchless interfaces could play an important role. Such scenarios are 3D puppetring or interacting with devices in operating rooms, where doctors usually can not interact by touching due to sterile environment limitations. While the idea of the touchless interfaces is not really new, greater attention for such devices as well as their usage was stimulated when Microsoft has released its Kinect sensor. Some of the methods incorporated in the sensor presented in article [10].

Several authors presented their own implementations of touchless frameworks [3,6,8,9,11]. Some of these approaches use the Kinect sensor as an input device, but several are using their own implementation of touchless interfaces for detecting the user input. Recently, some interest was also given to evaluation of touchless interfaces [4] as well as to the introduction of new challenges and opportunities [1].

In our previous work [2] we have already implemented a simple kiosk system for use with an ordinary web camera. The system supported only simple switching between different web sites and its robustness was quite low due to its basic gesture recognition system.

3 Method

To develop a touchless kiosk system, we first developed a web kiosk framework. We aimed for simple definition of content and possibility of creating content independently of the framework. This feature is very important when we want to use same the system for several different tasks, as it is not feasible to adapt the whole system each time the content changes. In contrast to the previously mentioned works our approach has a strict separation of content and functionality, which means faster adaptation of content for different end use scenarios.

3.1 Web Kiosk Framework

The web platform has been proven as a widespread and very adaptive platform for defining the content in many scenarios such as business and mobile applications, as well as online education platforms. This is also the main reason why we selected the web platform as the basis of our Web Kiosk Framework. The structure of the Web Kiosk Framework is shown in Figure 1, which also displays its relation to the Kinect Kiosk System.

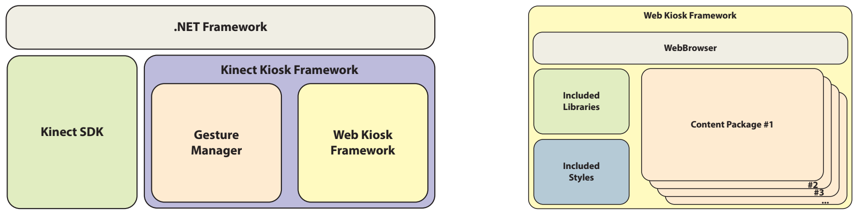

Fig. 1. Structure of the system is presented in the left image. Structure of the Web Kiosk Framework is presented in the right image

The implementation of the framework is done in C# with the .NET Framework[4]. We use the `WebBrowser` class from .NET Framework for displaying the content of our packages. Javascript support in the browser component is used to augment the content with interactive components and for achieving a more attractive look and feel. We leave the support for additional Javascript libraries to content creators, but provide the general interaction functions and support in the framework. Extensive use of libraries such as jQuery[5], Impress.js[6] and similar are supported and encouraged to create a pleasant and appealing content.

The functionalities of framework are available through methods implemented in the framework. We can split functionalities into two distinct groups. The first group consists of methods for loading, displaying and transitioning the content and the second group includes methods for interacting with the content such as *clicking, dragging* and responding to gestures. While some frameworks also provide the predefined user interface, this is not the case with our framework. The navigational functionalities are part of the framework, however the navigational GUI is considered as a part of the provided content and must be defined as such.

3.2 Kinect Kiosk System

The presented framework was used in a demonstration system. The structure of the system is shown in Figure 2. It consists of a Kinect sensor, PC and display. Kinect is used for capturing the user input. On PC, the Kinect SDK takes care of tracking the motion of joints, while the Gesture Manager (see Figure 1) performs hand tracking and gesture recognition and sends the interaction data to the Web Kiosk Framework. The Web Kiosk Framework changes the displayed content according to incoming gesture messages and displays the requested content. The user gets immediate feedback of his actions on the display.

[4] http://www.microsoft.com/net
[5] http://jquery.com/
[6] https://github.com/bartaz/impress.js/

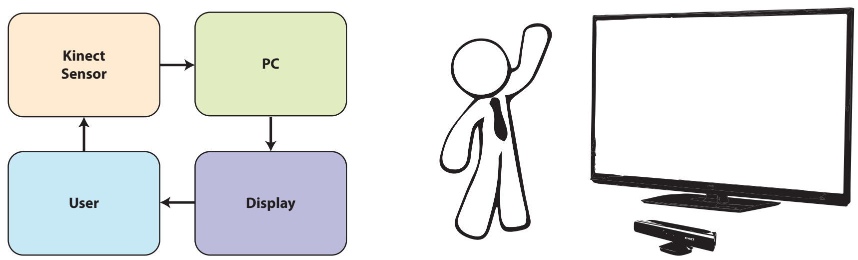

Fig. 2. Interaction cycle of the system is presented in the left image. The hardware setup of the system is presented in the right image

4 Case Study

During our research we have completed a case study and planned another one that will be done in near future. The first case study addressed the scenario of using the developed system as a presentation kiosk, while the second case study will involve educational use of the system.

In this study we have prepared a kiosk presentation of our laboratory. The presentation consists of several parts such as: personnel introduction, information on their contact hours and locations, information on available diplomas, current projects in the laboratory, information on special events such as summer schools and information on the courses held by our members.

Subjects in our case study were future first year students at our faculty. We have displayed our system in the main hall to get a feedback from end users. Users did not have many problems using the system if they were the only one interacting with it. The system worked well and users could browse through the content without problems. However, if there were more users in the detectable area, users had more problems with the system, as it did not always recognise the user that wanted to interact with the system. In the future development of the system we have to make the selection of the active user more robust. The case study was open for anyone and was conducted only for testing the proof of concept in the real-life environment.

As feedback we got suggestions that the system should pick the closest user for interaction and that it should give some visual feedback to see which user is currently the one that the system has selected. Another suggestion was that we should mark the area where the system detects users and limit it to a certain distance from the system. The system should not detect users that are too far away or at least ignore them when there is an user that is already interacting with the system.

5 Conclusions and Future Work

In this paper we have presented our work on developing the Web Kiosk Framework as a framework for defining content packages and defining the modes of interaction, as well as the Kinect Kiosk system, which is a touchless kiosk system that uses the Kinect sensor for interaction with the user.

Case study shows that the system allows an interesting and engaging way for users to actively browse the presentation and interact with the content. Furthermore we will assess the use of the system for educational purposes. We do not think that the presented system could be used for education in classes, however it could be used in self learning environments such as museums or "hands-on" science centers. We believe that it could also be used in schools, not as the main resource of knowledge but rather as an additional knowledge resource for children and youngsters whose curiosity exceeds the formally established curriculum.

Future work will include a case study conducted on a group of high school teachers at the international conference on using Information technologies in education (SIRikt[7]). We will present a knowledge kiosk at the conference and study the possible usages of our system for education purposes.

In the future we also plan to extend the Web Kiosk Framework for improved interaction with both hands and the entire body. We plan to incorporate the possibility of spawning actions when users enter a certain pose (sitting, standing, etc.). We also plan to extend the framework with a library for easier creation of interactive content. To further evaluate the system, we plan to use the system and create content for a "hands-on" science center as an example of interactive knowledge kiosk.

References

1. Barré, R., Chojecki, P., Leiner, U., Mühlbach, L., Ruschin, D.: Touchless interaction-novel chances and challenges. In: Jacko, J. (ed.) Human-Computer Interaction. Novel Interaction Methods and Techniques, Lecture Notes in Computer Science, vol. 5611, pp. 161–169. Springer Berlin Heidelberg (2009)
2. Bohak, C.: Gesture based user interface (2007)
3. Burnar, S.: Computer interaction using kinect sensor (2012)
4. Fikkert, W., van der Vet, P., Nijholt, A.: User-evaluated gestures for touchless interactions from a distance. In: ISM 2010, 12th IEEE International Symposium on Multimedia, Taichung, Taiwan, December 13-15, 2010. pp. 153–160. IEEE Computer Society (2010)
5. Held, R., Gupta, A., Curless, B., Agrawala, M.: 3d puppetry: a kinect-based interface for 3d animation. In: Miller, R., Benko, H., Latulipe, C. (eds.) UIST. pp. 423–434. ACM (2012)
6. Hirte, S., Seifert, A., Baumann, S., Klan, D., Sattler, K.U.: Data3 – a kinect interface for olap using complex event processing. In: Proceedings of the 2012 IEEE 28th International Conference on Data Engineering. pp. 1297–1300. IEEE Computer Society, Washington, DC, USA (2012)
7. Johnson, R., O'Hara, K., Sellen, A., Cousins, C., Criminisi, A.: Exploring the potential for touchless interaction in image-guided interventional radiology. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. pp. 3323–3332. CHI '11, ACM, New York, NY, USA (2011)

[7] http://www.sirikt.si/

8. Papadopoulos, C., Sugarman, D., Kaufmant, A.: Nunav3d: A touch-less, body-driven interface for 3d navigation. In: Virtual Reality Short Papers and Posters (VRW), 2012 IEEE. pp. 67 –68 (march 2012)
9. Ryu, D., Um, D., Tanofsky, P., Koh, D.H., Ryu, Y.S., Kang, S.: T-less : A novel touchless human-machine interface based on infrared proximity sensing. In: Intelligent Robots and Systems (IROS), 2010 IEEE/RSJ International Conference on. pp. 5220 –5225 (oct 2010)
10. Shotton, J., Fitzgibbon, A., Cook, M., Sharp, T., Finocchio, M., Moore, R., Kipman, A., Blake, A.: Real-time human pose recognition in parts from single depth images. In: Proceedings of the 2011 IEEE Conference on Computer Vision and Pattern Recognition. pp. 1297–1304. IEEE Computer Society, Washington, DC, USA (2011)
11. Spano, L.: Developing touchless interfaces with gestit. In: Paternò, F., Ruyter, B., Markopoulos, P., Santoro, C., Loenen, E., Luyten, K. (eds.) Ambient Intelligence, Lecture Notes in Computer Science, vol. 7683, pp. 433–438. Springer Berlin Heidelberg (2012)