AUGMENTED REALITY IN CULTURAL CONTEXT – FROM A LIVING BOOK AND HIMBA BRACELETS TO PLAYING VIRTUAL MUSICAL INSTRUMENTS

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Abstract

Since the dawn of the Web, the relation between data and objects has changed radically. The Web is no longer a system for sharing information and documents on objects. Since the beginning of the 21st century, computers are more and more able to understand the real world by the informational structure of meta-data. We are living in an Augmented or a Mixed Reality and we are continuously changing the real world as well as the Virtual, Augmented and Mixed Reality by living in it. Hence, the rather traditional distinction between culture and technology has become obsolete. Mixed Reality is a challenge as well for the computer industry and for cultural workers.

This paper will discuss different approaches to create AR and VR applications as well as best practice AR and VR examples in a cultural context. We will describe several technical aspects of mobile devices, sensor networks, context sensitive services in information systems for museums developed at the INKA research group at the HTW Berlin, and at the NUST Windhoek. We will examine key features of technologies, show multiple methods of concealment using information systems and sensor networks as well as several Augmented and Virtual Reality best practice applications.

INTRODUCTION

The development of information and communication technology during the past 50 years is characterised through the continued technical development. These technical developments raise the possibility of new applications and application areas. It is important for the acceptance of new technologies, that new applications create additional value, use the advantages of basic technologies and are adapted to the needs of the user.By combining the advantages of established technologies with new approaches, and further-more adapting those criteria to

the different user needs and application scenarios, we are able to extend existing applications with new components and services and conceal the ICT.

This paper will discuss different approaches to create AR and VR applications as well as best practice AR and VR examples in a cultural context. We will describe several technical aspects of mobile devices, sensor networks, context-sensitive services in information systems for museums developed at the INKA research group at the HTW Berlin, and at the NUST Windhoek.

RELATED WORK

Since the first version of the Oculus Rift was successfully crowd funded in 2012, the topic of virtual reality (VR) has suddenly gained a lot of attention despite not being a new concept. Ivan Sutherland developed the first head-mounted displayin1968. However, the huge success of the Oculus Rift might be the cause for the variety of VR capable Head Mounted Devices (HMDs) developed by different companies that have been released in the past years. A side effect of the increasing popularity is the availability of mass produced, inexpensive VR devices, i.e. we can now buy the Google Cardboard for less than 3 € and the Samsung Gear for less than 200€, but have to add an smartphone.

Particularly in recent years it can be observed that VR and AR applications have been extended to many fields. One reason is that display technologies such as HMDs have changed from professional and expensive equipment to consumer electronics. Display devices such as the Oculus Rift, the Samsung Gear VR, Google Cardboard or AR Glasses bring these technologies to many areas. AR has a lot of potential for teaching, learning and entertaining in culture and art. AR applications are used for interactive entertainment, games, interactive story telling, visual and sound art installations as well as interactive opera, architecture or digital archives. Spatial augmentationfor example allows completely new opera experiences; a famous exampleis Mozart's "Zauberflöte" at the KomischeOper Berlin. A further best-practice example for a mobile AR application is Pokémon GO, which attracts millions of users.

We can also find many additional examples of Augmented und Virtual Reality installations in museums. Well-known examples are "Jurascope" in the Naturkundemuseum Berlin, "Speaking Cubes" and "Magic Mirror" in the Pergamonmuseum Berlin or the AR guide in the British Museum.

To present content only in the form of artefacts with texts, films and stories no longer matches the requirements of the audience. The visitors of a museumwant, in addition to the pure presentation of artefacts, information presented with modern technologies like Virtual and Augmented Reality, 3D visualisation as well as games and interactive approaches. Many users do not want to consume only, they want to participate, communicate and interact with the exhibition and the staff behind the exhibition.

BEST PRACTICE EXAMPLES

In this chapter wewill discuss different approaches to create AR and VR applications as well as best practice examples for each. We will describe several technical aspects of mobile devices, sensor networks, context sensitive services in information systems for museums, developed at the INKA research groupat the HTW Berlin, andat the NUST Windhoek. We will examine key features of technologies and show multiple concepts using information systems as well as several Augmented and Virtual Reality best practice applications.

The Best Practice examples demonstrate the integrating methods of design, interaction and development that is appropriate to mobile applications in the area of Augmented Reality. The examples will expose a wide range of mobile technologies available through mobile devices. It focuses on technologies such as wireless networks, communication, sensor systems, frameworks for software development, interaction design and the tools as well as Augmented and Virtual Reality.

Augmented Reality for Marketing Flyers:

The main focus of this project is to add digital content to standard paper leaflets. The selected field of application was Namibia's Wildlife Resorts (NWR). NWR is a Namibian state-owned company that has ownership of more than 20 travel and luxury resorts throughout Namibia. The actual situation is that the brochures in which the resorts are advertised do not fully showcase the features of the resort. As a digital extension it would be great to enhance the viewing of the brochure through AR utilisation. The NWR brochures come in soft and hard copy; they are usually distributed to travel information centres as well as on online travel sites. Given the issue with the brochures mentioned above, AR will be able to create an enhanced viewing experience. This experience includes viewing 3D models, movies and little games of what is shown in the brochure, for example if the brochure shows an elephant you will be able to view an enhanced version of that elephant or an animal race as a digital game.

Augmented Reality book KishiKishi:

The AR book KishiKishi is a mobile app using Augmented Reality technology to add digital content such as animations and audio to the physical book (KishiKishi: The Bad Monster by HelviItengeWheeler). This will enhance the reading experiencefor children.

The basic idea is to open the app on the user's mobile phone and point the camera to any specific page in the book. The app will detect the current page and augment digital content specific to that page. Depending on the specific page the digital information is a digital extension of the printed scene, i.e. with animations, audio and video sequences and interactive elements. The AR application was developed using Android Studio, Vuforia and Unity.
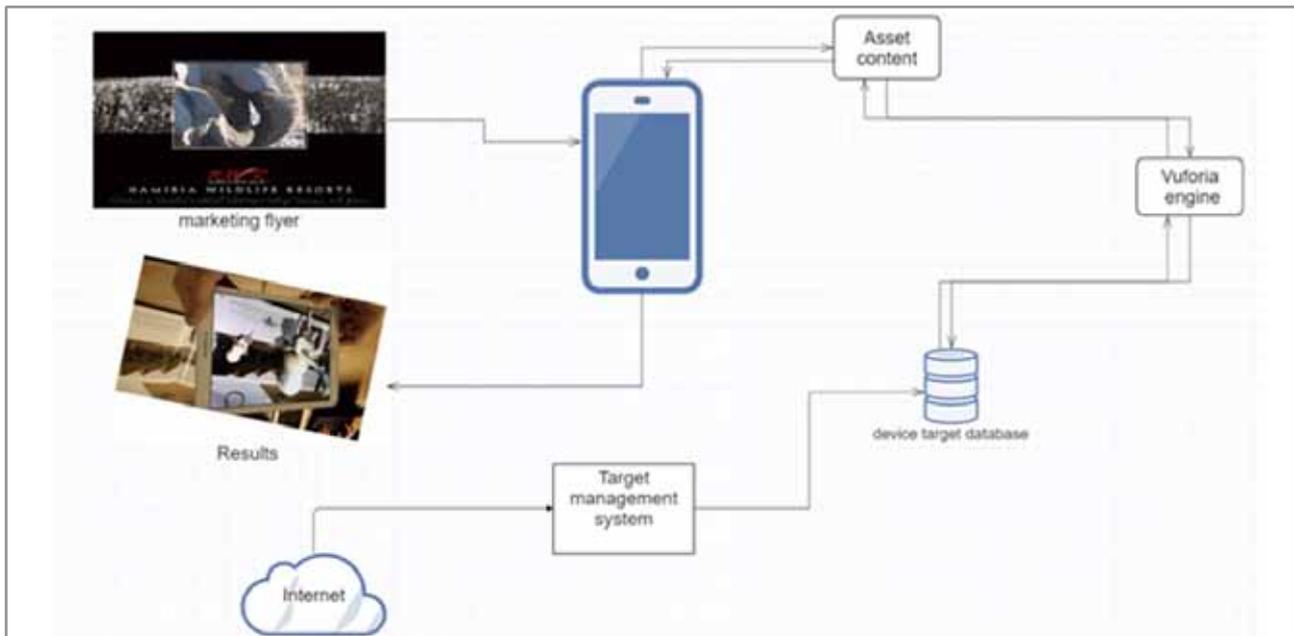
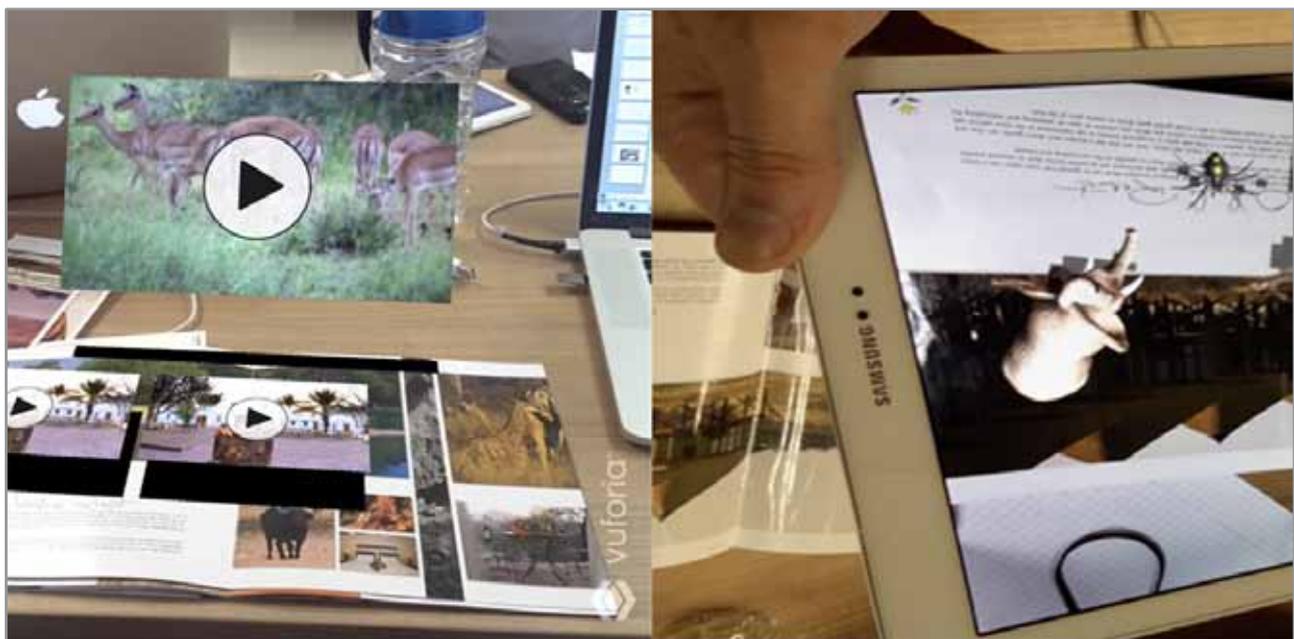Figure 1. Marketing Flyers' System Architecture

Figure 2. Marketing Paper Flyers and Corresponding AR Content

AR for Himba Bracelets:

Cultures and traditions have always been part of human history. Located in the southern part of Africa, the Himba people emanate from an immense civilisation and still live their distinct traditional lifestyle.Their traditional arts illustrate and express the presence of their existence through bracelet, sculpture, dance and much more. The

Himba bracelets are handcrafted, creative sculptures, not just jewellery, comprising multiple patterns and designs, illustrating their historical views, ideas, events and objects.

Today, the proliferation of computer technology allows us to show the culture and information behind the Himba bracelets. The key purpose of this project is to identify patterns on the bracelets and enhance them for example with an augmented object telling the story relative to each bracelet.
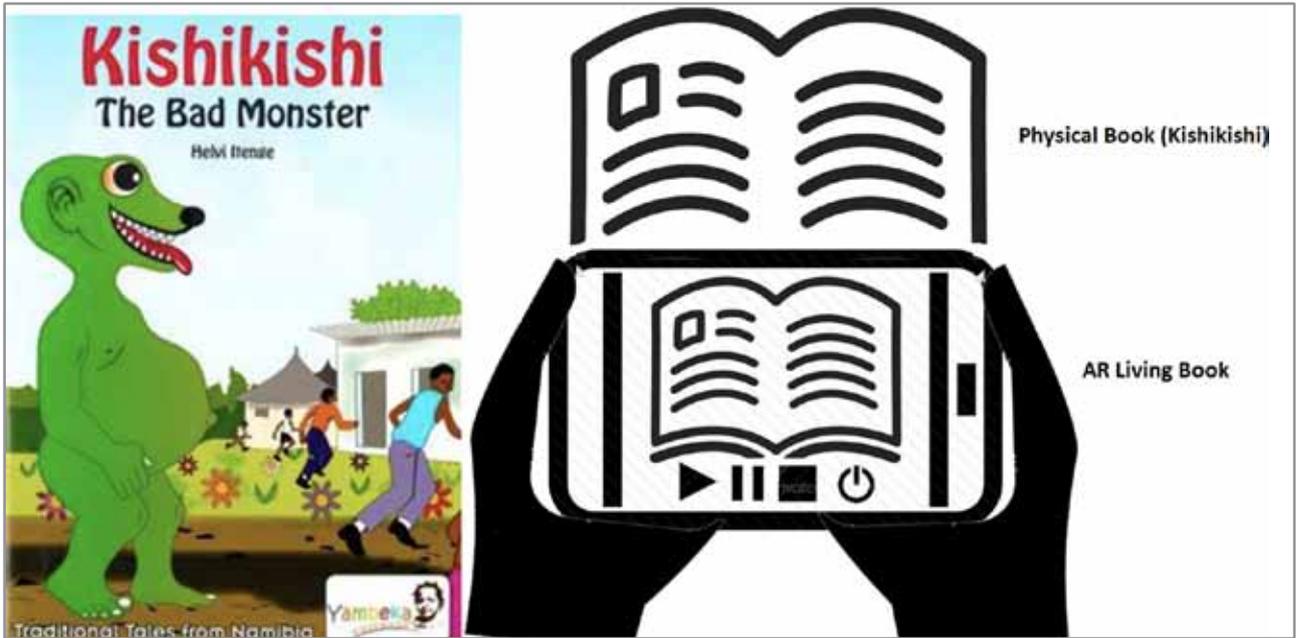
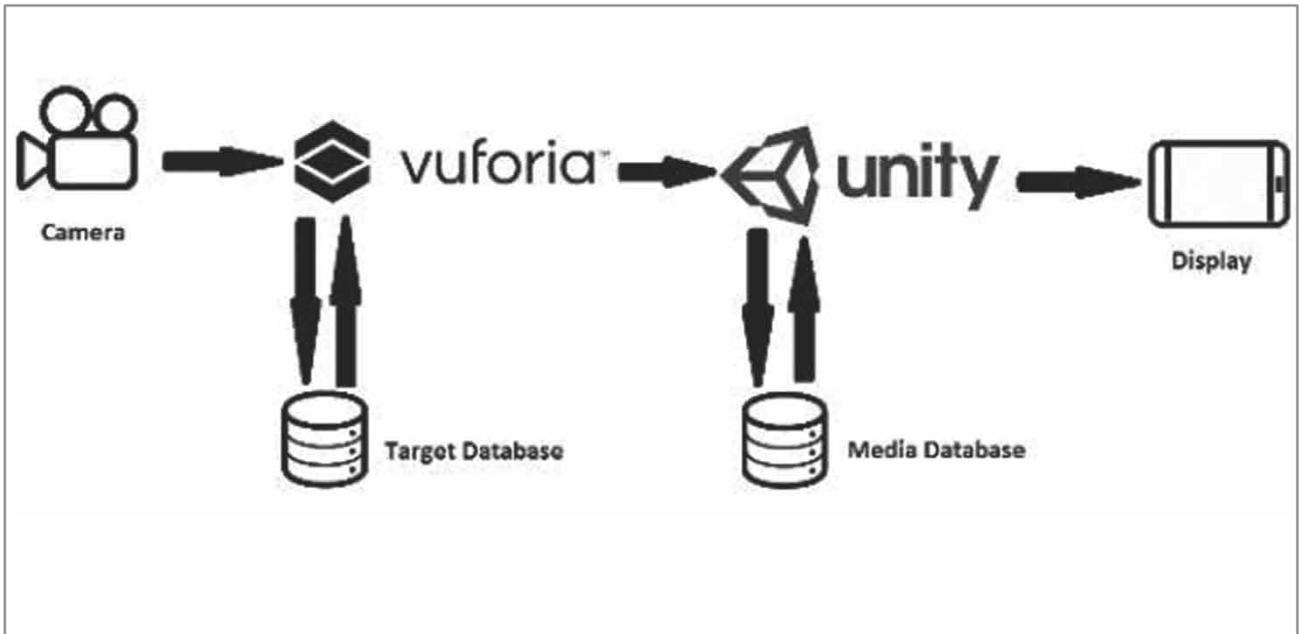Figure 3. Kishikishi Book and the Attached Living Book Idea

Figure 4. Kishikishi System Architecture

Holographic Display:

The focus of this Holographic Display project is to design and implement a 3D holographic display built with low-cost, recyclable material, using an electronic device (mobile phone, tablet or laptop) for projection. The display is controllable from iOS and Android applications.

The display is controlled by a mobile application running on Android or iOS. The device projecting video to the physical display can be any device with Wi-Fi capability and a Web browser – for example laptops, tablets or smartphones.

Figure 5. Kishikishi Book – Production Process in Unity

Figure 6. The Kishikishi Book – Testing the App

Magic Mirror Application:

The Magic Mirror system is an interactive game application for the Konzerthaus Berlin, developed using computer vision, pattern recognition and the Unity game engine. The game starts as soon asa player stands in front of the video camera. The main concept of the game is to listen to a piece of classical music and imitate gestures of playing a musical instrument. At certain moments a musician with a specific musical instrument is displayed on screen. The player of the game has to make the matching gesture to play this instrument (up to 10 seconds). The game uses a machine learning technology running on aKinect device to detect the poses and gestures.

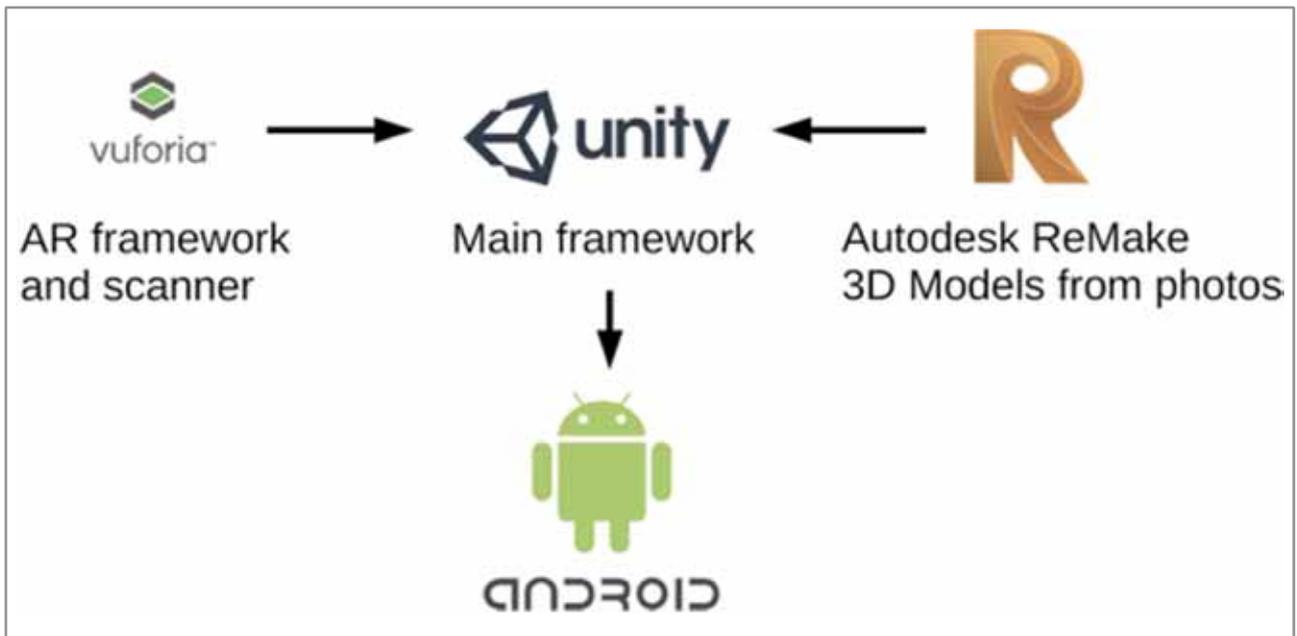Figure 7. Himba Bracelets Pattern Recognition, Bracelet Identification and Augmentation

Figure 8. Himba Bracelets – System Architecture

CONCLUSION

If the player imitates successfully, a sound clip of the specific instrument will be played, otherwise a terrible off-key sound of the instrument will be generated. For each correctly recognised gesture and pose the player receives points. At the end of the game, the total score will be displayed.

Many visitors to cultural institutions do not only want to consume, they want to participate, communicate and interact with the objects in the exhibition, the staff behind the exhibition and with the exhibition itself. AR, MR, 3D and new interaction methods can help to solve the problem. Augmented and Mixed Reality is a challenge for the

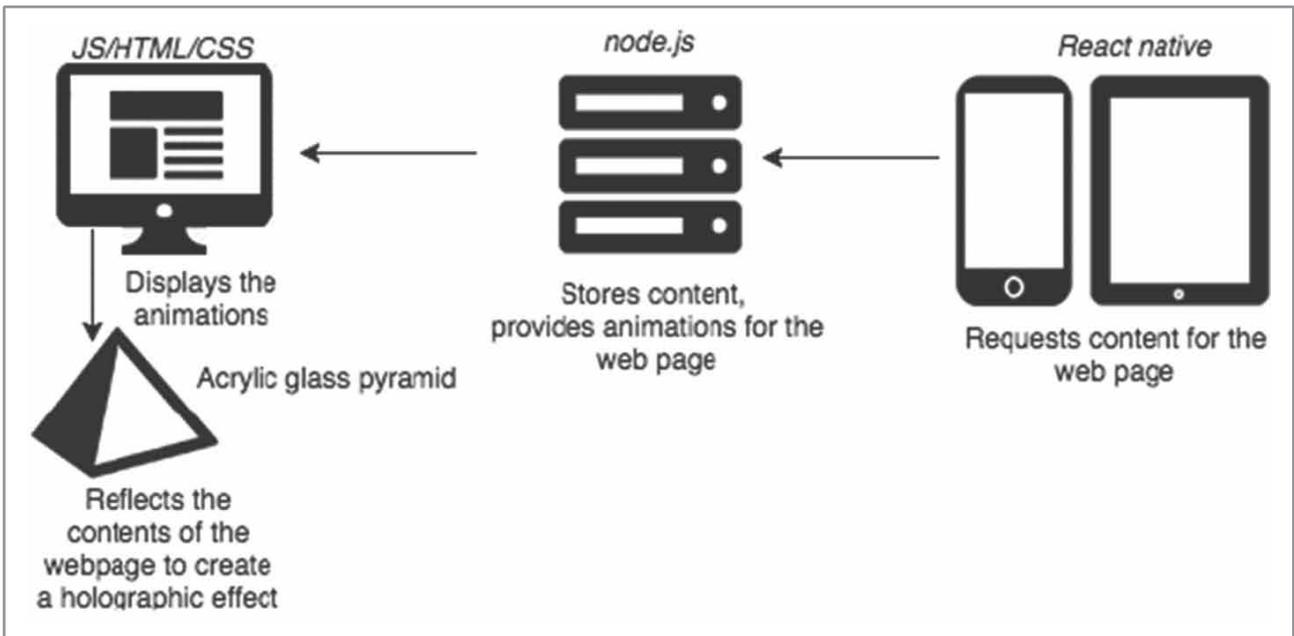Figure 9. Himba Bracelets –Use of the App

Figure 10. Holographic Display – System Architecture

computer industry as well as for cultural workers.The new technologies and algorithms for recognising objects, context and locationsmust be reliable, stable and with a very shortresponse time. It is also possible to develop AR and MR applications for all relevant operating systems in a short time. The process to integrate AR and MR in cultural institutions has commenced but there are still many fields of applications waiting for further best practice examples.
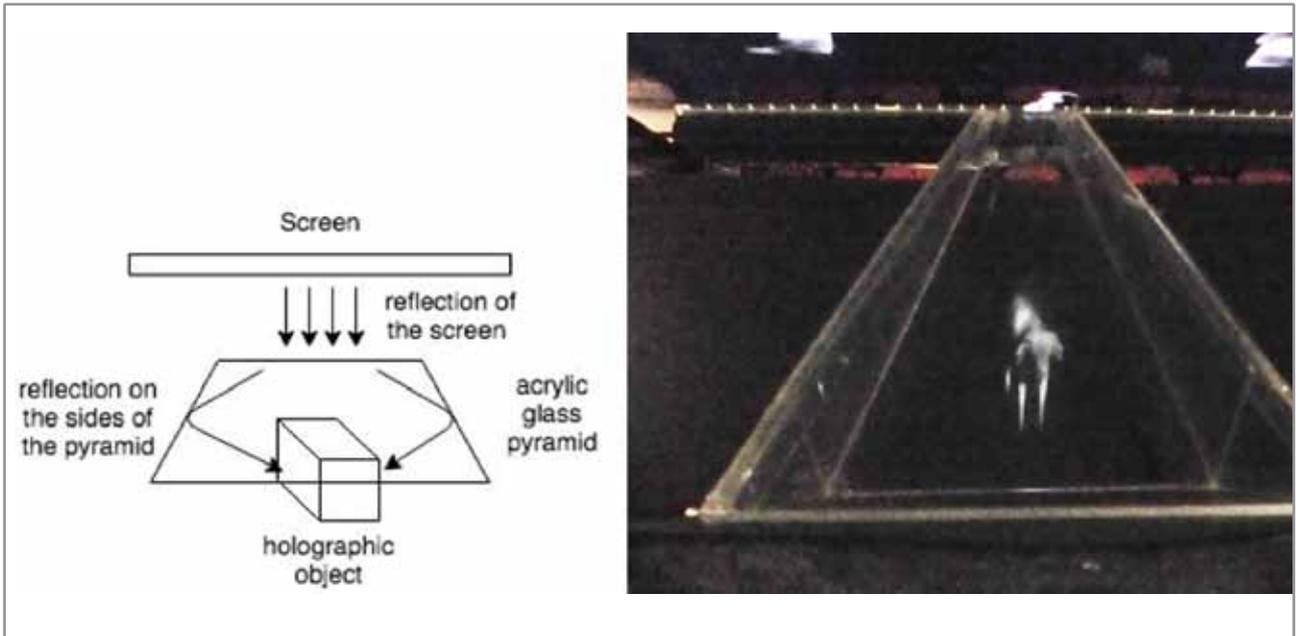
ACKNOWLEDGEMENT

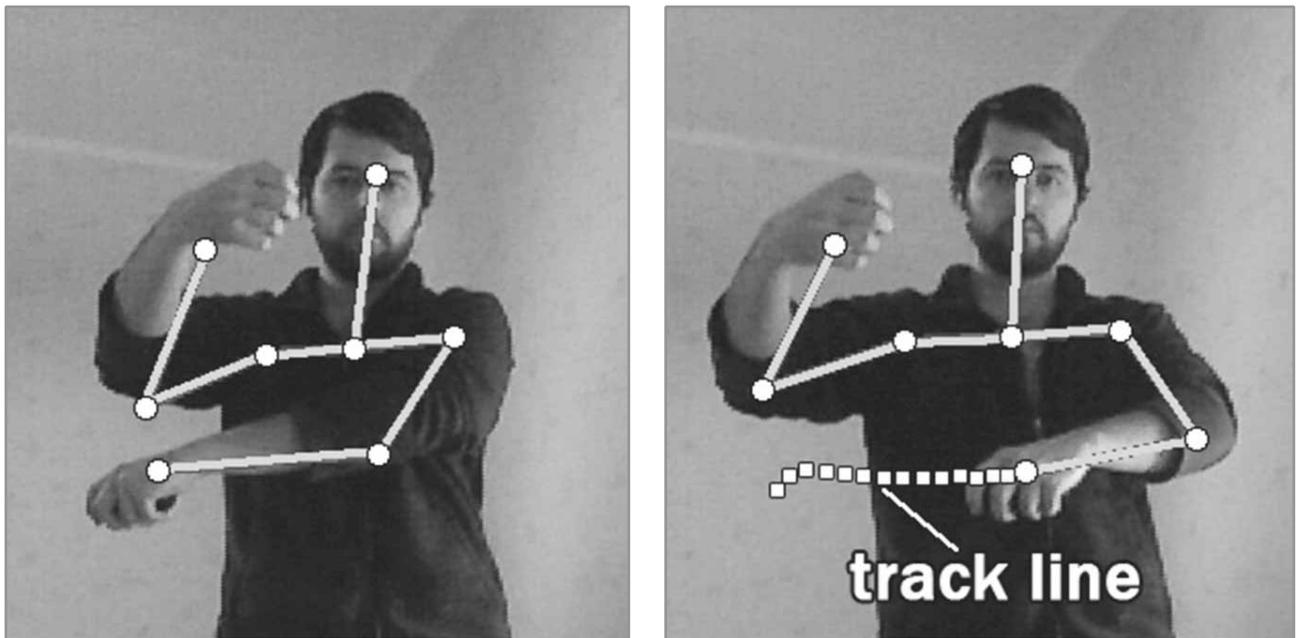Figure 11. Functionality of the Holographic Display System

Figure 12. Recognition of Gestures and Poses of Playing a Virtual Music Instrument

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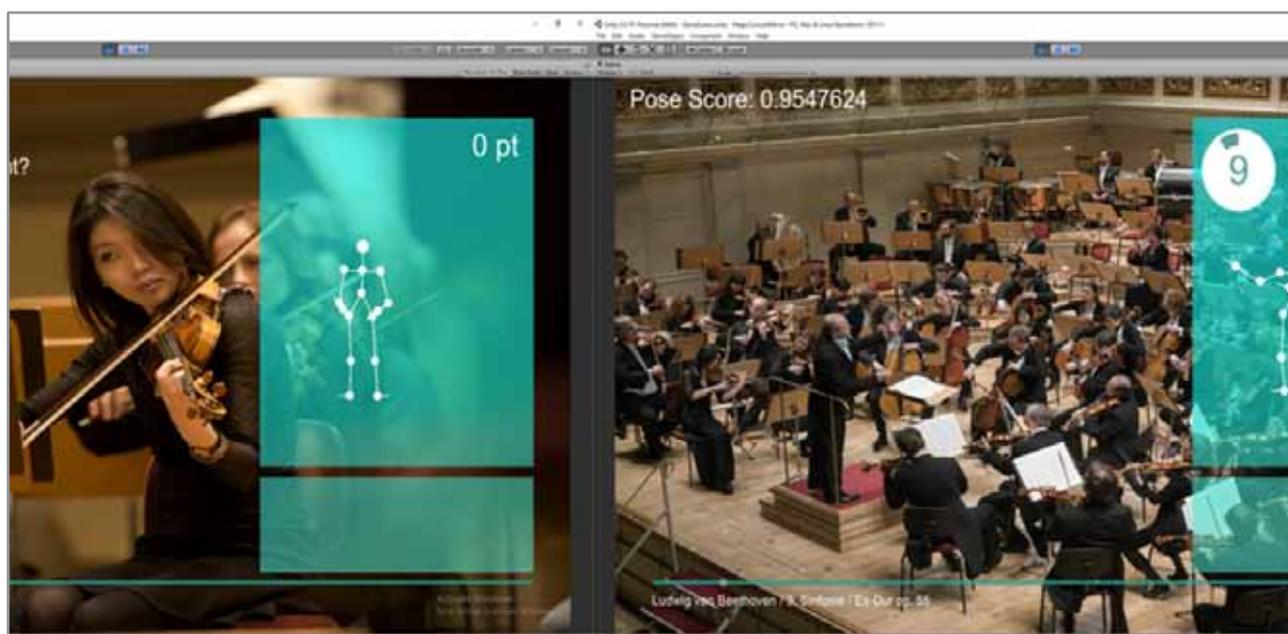
Figure 13. Magic Mirror Game in Action

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