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A Survey on Mobile Augmented RealityBased Interactive Storytelling

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Abstract

Mobile technology improvements in built-in camera, sensors, computational resources and power of cloud sourced information have made AR possible on mobile devices. This paper surveys the field of mobile augmented reality and how it is used as interactive, collaborative and location based story telling medium. This survey provides a starting point for anyone interested in researching or using Mobile Augmented Reality and interactive storytelling irrespective of the application.
Keywords: *Human Computer Interaction, Immersive environment, Interactive storytelling.*

INTRODUCTION

This paper surveys the current state-of-the-art in Mobile Augmented Reality and how it is used as a medium for Interactive, Collaborative and location based storytelling.

A survey paper does not present new research results. The contribution comes from consolidating existing information from many sources and publishing an extensive bibliography of papers in this field. This paper provides a good starting point for anyone interested in beginning research in this area2].

Section 1 describes what MAR is, and Interactive storytelling. Section 2 explains the related works based on interactive book. Multimodal, Multi-User and Adaptive Interaction for Interactive Storytelling, Location based storytelling, Storytelling in Collaborative Augmented Reality Environments. Finally, Section 3 draws reviews and conclusions.

DEFINITION

1. *Augmented Reality:*

Extend Azuma's [Azuma et al. 2001] definition of AR to MAR in a more general way as follows:

- Combine real and virtual objects in a real environment.
- Interactive in real time.
- Register (align) real and virtual objects with each other.
- Run and/or display on a mobile device.

We do not restrict any specified technology to implement a MAR system. Any system with all above characteristics can be regarded as a MAR system. A successful MAR system should enable users to focus on application rather than its implementation. MAR is the special implementation of AR on mobile devices. Due to specific mobile platform requirements, MAR suffers from additionalproblems such as computational power and energy limitations. It is usually required to be self-contained so as to work in unknown environments. AR and MAR supplement real [1].

INTERACTIVE STORYTELLING

Interactive storytelling is a form of digital entertainment where authors, public, and virtual agents participate in a collaborative experience. [18]Defines interactive storytelling as a form of interactive entertainment in which the player plays the role of the protagonist in a dramatically rich environment. The experience offered to the public by an interactive story differs substantially from a linear story. An interactive story offers a universe of dramatic possibilities to the spectator. In this form of entertainment, the audience can explore an entire set of storylines, make their own decisions, and change the course of the narrative.

Typically, the way viewers interact with a storytelling system is directly linked to the story generation model: character or plot-based model. Character-based approaches [13][15][16] give to the system great freedom of interaction. Usually, the story is generated based on the interactions between the viewer and the virtual characters. In some cases, the viewer can acts as an active character in the story. In plot-based approaches [17], the interaction options are quite limited. The users can perform only subtle interferences to guide the progress of the narrative plot [3].

1. Interactive Augmented reality storybook:

Listening to stories draws attention to the sounds of language and helps children develop a sensitivity to the way language works'', said by Isbell [14]. She stated that children tend to learn more while they are listening to stories because stories are fiction which most of it are fairy tales that will not happened in the reality. It challenged children's imagination, hearing and seeing while listening to stories. Therefore, AR was brought in to build a system which include audio and graphics which allows children not only to read aloud with but interact with the system at the same time [4].

1.1 Multimedia Interactive Book (miBook)

Compared to previous AR book setup which needed some initial setup before usage, this mobile AR book concept can be used directly as a normal user reading a normal book. Thus, it will reduce the learning hassle as well as increasing the interactivity between user and book. This so called playbook is mainly focused on two parts which consist of physical book and mobile application. Mini Interactive Book is a new tool providing a responsive environment and an interactive learning, which handles with different type of content.

MiBook is the combination of a printed book (or its digital format) with the respective audiobook and its 3D models (as well as the 2D graphics). Technologically, miBook environment consists of a handheld camera, a personal computer (to generate user's individual scene views), and a physical book. MiBooks uses "normal books" with text and pictures on each page and have an additional audio content – the correspondent audiobook.

By supporting a real-time AR texture-tracking algorithm, which uses the novel feature detection technique from [19](see Figure 1), the enhancement of global algorithm performance allows the support of different hardware profiles, both in desktop and mobile setups. It also includes the possibility of tracking several images/textures at the same time and it supports several 3D standard formats (3DS, VRML, OBJ, DXF, Cal3D, among others). As we can see on Figure 1, there is no need to have the black borders as tracking marks. The first picture on Figure 1 (left side) is the 2D sheet of a book and the right side one shows a 3D object registration where someone is interacting in real time with miBook. As for interactivity enhancement, miBook features provide a physic engine to enable scientific simulations. It will also enable audio storytelling with virtual elements interaction (Script) and both artificial intelligence and speech recognition algorithms for user guidance. All features may be available both in desktop and mobile (PDA or Smartphones) setups, being one of the biggest breakthroughs for the AR community [5].

Figure 1: Example of virtual object registration in a real scene in miBook9 (texture image and registered scene) [5]

The application of the miBook solution to new forms of learning can be naturally and fully under control of users (both students and educators). The new interactive way of linking traditional pedagogical approaches (such as reading printed books), common devices capabilities (like handheld devices with camera) and the potential of multimedia technologies (audiovisual interpretation technologies) can provide a better understanding, knowledge acquisition and enhanced learning experience[5].

1.2 An Interactive Mobile Augmented Reality Magical Playbook:

Figure 2: General structure of the book [6]

The prototype concept of AR book presented in this paper is shown in Figure 2. The overall book design divided into story page and marker page. Story page covered the story line and illustration that illustrated the story within that current page. Marker page consists of marker that representing each 3D character with animation within that current page. This prototype is using handheld display (mobile device) for viewing the augmentation of the book because handheld display will help user to experience the AR concept while maintaining the context of reading normal book.

Natural interaction between user and the physical book should be included in AR book to maintain the context of normal user reading normal book. As AR book, it is aimed to enhance the traditional book, but not to replace the entire book [4]. Thus, the normal interaction with the book such as pointing will be presence in AR book. Tangible User Interface (TUI) in AR is the interaction that uses a physical environment to be tangible while interacting with the AR system [19]. In this prototype, finger can be used to interact with the AR book. Figure 3 shows the interaction with the AR book [6].

Figure 3: The interaction with the AR book using finger [6]

1.2.1 Mobile Application

Mobile AR application has gaining popularity nowadays due to mobile technology advancement. As mention early, mobile devices advanced in computing power and also in 3D graphic processing. This mobile application developed in Android platform. Figure 4 shows the mobile application installed in Android device.

Figure 4: Mobile application for AR book installed in Android device [6]

Figure 5: The user uses the mobile application via mobile device to augment the character of the book [6]

The mobile application included with the ability to augment the 3D character and animation (the crow) with audio onto the marker page of the book. Figure 5 shows the user using the mobile application with the book.Thisapplication is not only augmenting the 3D character, animation and audio, but it also provides the users with narrator. The narrator is aimed to help children as guidance for them to read throughout the storyline. The learning number part is shows in figure 6.

Figure 6: Learning number part [6]

Based on figure 6, learning number part is highly interactive designed for children. The user will interact with the book using their finger to count together with animation of the augmented 3D character on the book, leaving the natural means interaction between the user and the book. From here, the concept of engaging the student within learning environment in the learning process is fully applied[6].

1.3 Augmented Reality Children Storybook (ARCS)

The system will provide read aloud function so that children can listen and read along at the same time because much of the language children learn reflects the language and behaviour of the adult models they interact with and listen [8]. Figure 7 shows the system architecture [4]

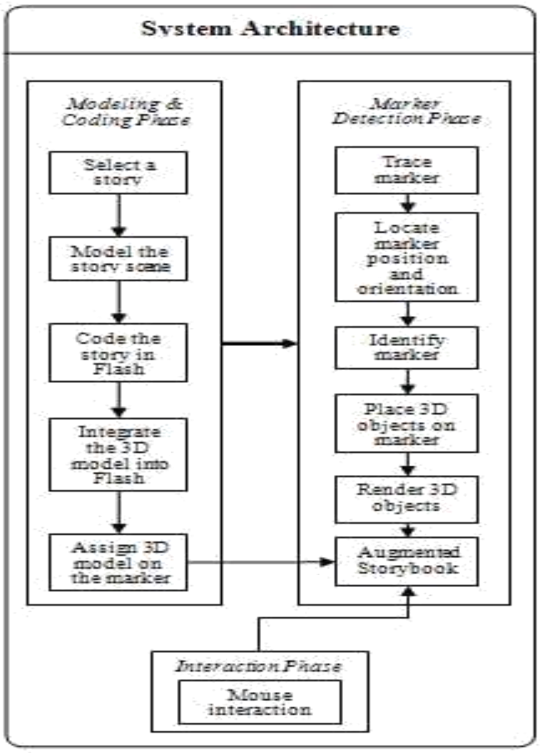


Figure 7: System architecture of Augmented Reality Children Storybook (ARCS)[4]

As the targeting audience were the young learners who aged from 4 to 12 in Malaysia, the application have to be engaging and enjoyable so that it will motivate them. Hence, fun and attractive interface will help to capture the children's interest. However, every child has different learning skills and levels. Therefore, various stories will be included in the application for different categories of interest. The stories will include categories such as picture books, fiction, traditional literature which includes myths, legends and fairy tales and so on[4].

1.4 Children's Interaction with Augmented Reality Storybooks

The story used for the prototype of the AR storybook was written in collaboration with two friends. The artefact in this study is a prototype of an AR storybook and the target group is eight-to ten-year-old Norwegian children. The AR book will be augmented using virtual 3D models, sound and interactive tasks. Sketching up a use case diagram, cf. Figure 8, where user activities as well as system responses are the main focus [9].

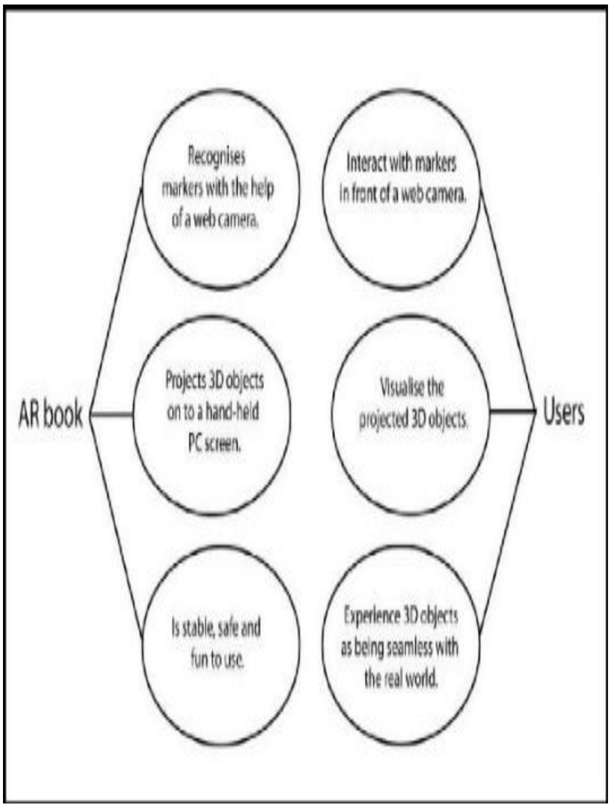


Figure 8: Use case diagram of Children's Interaction with Augmented Reality Storybooks [9].

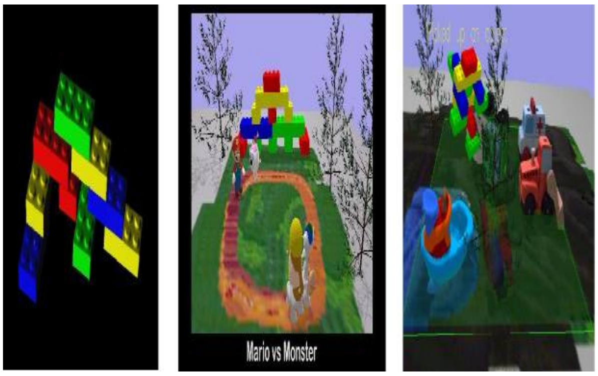
BuildAR Pro tracks and identifies markers in order to overlay the real world with virtual content. While writing the story, it had been decided that animals would be used for augmentation. Therefore, it was only natural that the pattern on the markers would also be animals, and markers were designed using more or less the same degree of detail [9].

1.5 Interactive Playspaces for Object Assembly and Digital Storytelling

A. Playspace

A playspace is an interactive system that aims to combine the advantages of doing a task physically and virtually. Figure 9 shows the novel active systems for virtual 3D content design applications – Block model assembly, Digital storytelling and 3D Scene design .In this setup, the user works on a planar work surface. The surface is divided into two parts – Play Area and Control Boxes. Any physical objects in the Play Area are tracked in real-time using the Kinect R color+depth camera.

The Play Area is exactly mapped to a part of the virtual world which is rendered on the display



Block Model Assembly | Digital Storytelling | 3D Scene Design

Figure 9: The novel interactive systems for virtual 3D content design applications – Block model assembly, Digital storytelling and 3D Scene design [7].

Screen in front of the user. The tracked motion of physical objects is reflected in the virtual world in real-time. The Control Boxes can be used for gesture-based inputs [7]. Software framework of a playspace is shown in figure 10. The streams from the input modalities are given as input to the playspace algorithms – RGBD Processing module (for camera feed), Voice Recognition module (for microphone feed) and Event handlers for keyboard and mouse. The outputs of these algorithms are given as controls to the application running on the playspace. The application renders the virtual world and provide context-specific visual feedback on the display screen.

B. Assembly of Block Models.

Building block models with Lego R or Duplo R blocks is a popular hobby across adults and children. The block sets usually come with a set of instructions to put together a preconfigured model.

A system named DuploTrack is introduced, where a user works in a playspace with physical Duplo R blocks to build a pre-defined model. The system uses a novel 3D-tracking based guidance method to present instructions to the user. It also tracks the assembly process in real-time, points out any mistakes and helps correct them. The capability to track the assembly process also enables the system to learn how a new block model is assembled by a user. This learnedrepresentation can be used to share the model with other users via automatically generated representations like virtual 3D mesh models, static instructions, instruction videos or by boot-strapping it back into the system for guiding a new user [7].

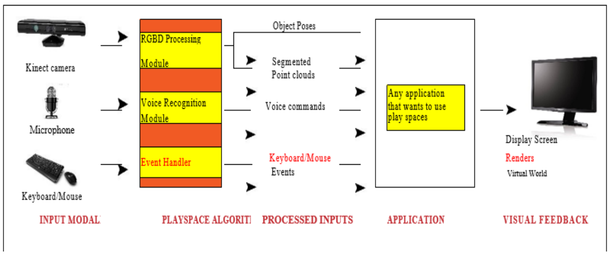


Figure 10: SoftwareFramework of a Playspace [7]

C. Digital storytelling:

The system allows a user to act out a story using rigid puppets and automatically converts that into an animation. Further, it also allows the user to record multiple takes for the same story and merge them automatically after the user has roughly annotated them based on his liking. This is helpful when the user wants to try out different styles and later merge them.

Figure. 11(a) Toys for storytelling

Figure 11 (b): 3D-Puppetry systemfor story telling

Figure 11: Natural and intuitive interfaces for storytelling. (a) Toys and puppets are the traditional ways of natural story telling. (b) The 3D-Puppetry system tracks the moving physical objects using a Kinect R camera.

An intuitive interface to tell a visual story for novice users is through physical puppets and toys (Figure 11.a).

Hence we can develop systems which automatically track and transfer the acted out motion to virtual characters and hence record an animation.

The 3D-Puppetry system uses the framework of a playspace. Figure 11.b shows a user using the system. As is the case with playspaceframework, the user first scans in the physical objects that he intends to use in the story. Then he acts out the story using objects in the Play Area which the system tracks in real time and renders replicas in a pre-selected virtual environments on the display screen in front of the user. This rendering is also recorded as a video which is the resulting animation. This system allows user to use some keyboard and mouse-based controls to edit the animation later by changing light positions, camera viewpoint etc. [7].

2. Multimodal, Multi-User and Adaptive Interaction for Interactive Storytelling

The design of multimodal, multi-user, and adaptive interaction model follows some requisites for the design of multimodal interfaces. Adapting some of these concepts to the interactive storytelling domain, defines the following requisites to the interaction system [8]:

Natural Interaction: The multimodal interaction must be natural. The viewers must feel comfortable interacting with the system;

Adaptable Interaction: The multimodal interface must adapt itself to the needs and abilities of different viewers;

Consistent *Interaction*: The result of an input shared by different interaction modalities must be the same;

Error Handling: The system must prevent and handle possible mistakes in the interaction, as well allowing the viewers to easily undo their actions;

Feedback: The system always must give a feedback to the viewer's when some action resultant from a multimodal interaction be executed.

Equal Interaction: In a multi-user scenario, the interaction system must offer equal possibilities of interaction to all viewers [8].

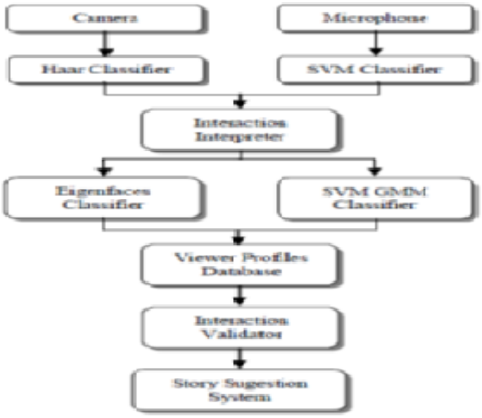


Figure12: Multimodal, Multi-User and Adaptive Interaction architecture [8]

The multimodal interaction interface is based on gestures and speech. The choice of these interaction modalities was made due to the need of natural interaction modalities in a multi-user setting. Gestures and speech provide a natural interaction interface and allow the interaction of several users by using computer vision and speech recognition technique. The viewers are free to use both interaction modalities.

The architecture of the interaction system presented in this paper as show in figure 12. The system uses a conventional camera and a microphone to capture the input of the system. The viewers are located on the video input by the HaarClasifieralogrithm, and the viewer's speech is recognized by the SVM Classifier based on the audio input. The interaction Interpreter module analyses and interprets and the viewer's gestures and speech commands. Next, the EigenfaceClassifer and the SVM GMM Classifier identify the viewer based on the profile of the viewers (which is stored in the Viewers Profiles Database). Each interaction is the recorded in the appropriated viewer's profile. The profile management updates the viewer's profile based on the viewer's interactions and the atmosphere traits associated to the events as modelled in the Atmosphere Database. Before the viewer's interaction affects the system, the Interaction Validator module checks if the viewer is not interacting for the second time in the same option (for example to avoid a viewer voting more than one time in the same option). Finally, the user interaction is sent to the Story Suggestion System [8].

3. Location-based Storytelling in the Urban Environment

The user experience and user interaction with the system was designed using sketching, mock-ups, and paper prototypes in parallel with the story writing activity. We wanted to combine the digital elements of the story with tangible interactions with real-world locations and objects such as inscriptions and symbols on buildings, paper maps, and physical props similar to what might be found in a theatre production of the story. Other props explored included marked envelopes with physical evidence or clues to be opened at particular points of the story, and to be passed between the users. Another approach explored to tie the digital experience closely to the physical surroundings was the use of printed photographs of actual locations in the user's current surroundings overlaid with fictional characters and objects from the storyline [10]. Technical set-up of the prototype is shown in figure 13.

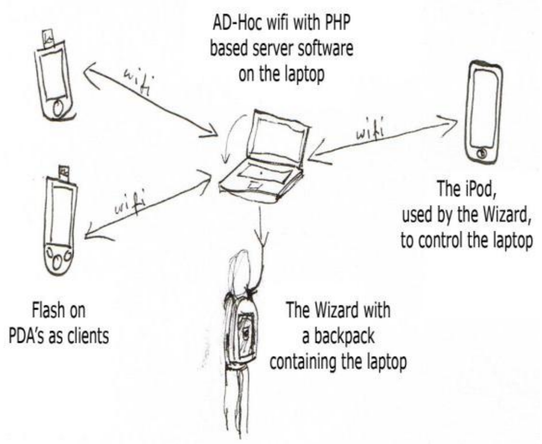


Figure 13: Technical set-up of the prototype. Proceeding from one scene to the next [10]

Once the two detectives have gathered enough pieces of information at a particular location they are prompted to move on to the next scene at a different place. Rather than providing way-finding information on the PDAs for this purpose, the users are provided with a physical map of the city with key locations of the story highlighted. However, in order to keep the path through the city flexible and secret, each location is annotated with a unique symbol rather than numbers or letters, making it impossible for the detectives to know where to go next. Increasing the challenge, the correct symbol can only be obtained through collaboration. Based on the information gathered from individual interrogations, each detective will at some point in time be provided with half the symbol needed to move on. Only when both halves have been obtained is it possible for the two participants to work outgo to next by locating the corresponding composite symbol on the physical map (figure 14) [10].

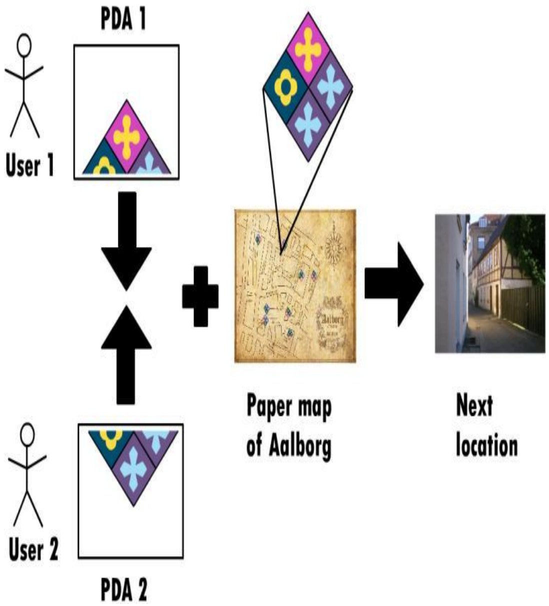


Figure 14: Finding the next location of the story from a composite symbol and a physical map [10].

4. Storytelling in Collaborative Augmented Reality Environments

Figure 15 shows the architecture of the system in regard to the several modules and layers used. Every layer is parted in several AI sub-modules to improve the possible evolution of the systems abilities, as we wanted to design a reusable software system with the possibility to replace modules in regard to project specifications and scientific research ideas [11].

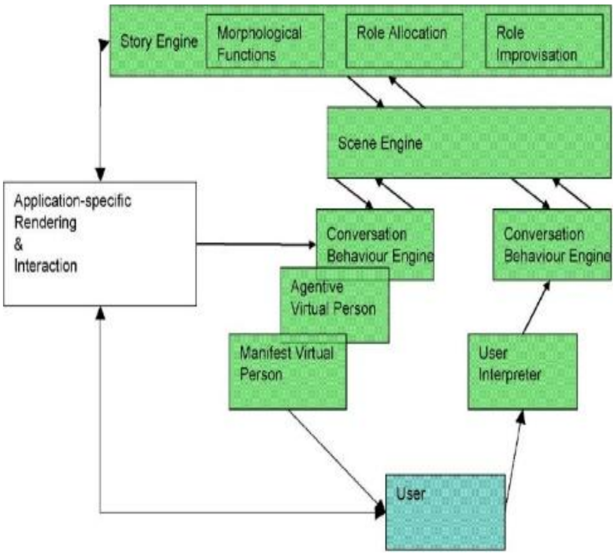


Figure 15: Architecture of CSCIS system [11]

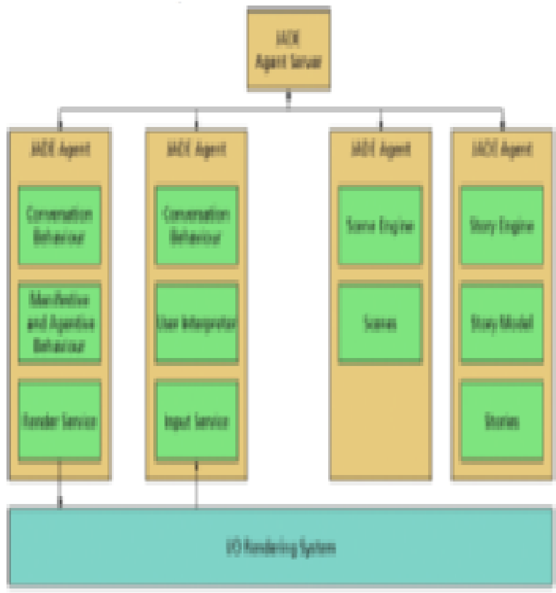


Figure 16: Development of the CSCIS System[11]

Figure 16 provides a sketch of the implementation of the system. We used several AI- related software packages to develop the story engine (done with Prolog), as well as the conversational behaviour, agentive and manifest modules of the several agents, with this agents playing roles (virtual characters) in AR story environment (done with Jess, theJava Expert System shell. Communication between the several modules is done using the JADE Agent Platform.

The authoring process of Interactive Stories is supported in regard to the definition of scenes for the AR environment and the relation of scenes to the morphological story model (functions and roles), as well as to improvisational features. [11].

Digilog book for temple bell tolling experience based on interactive augmented reality

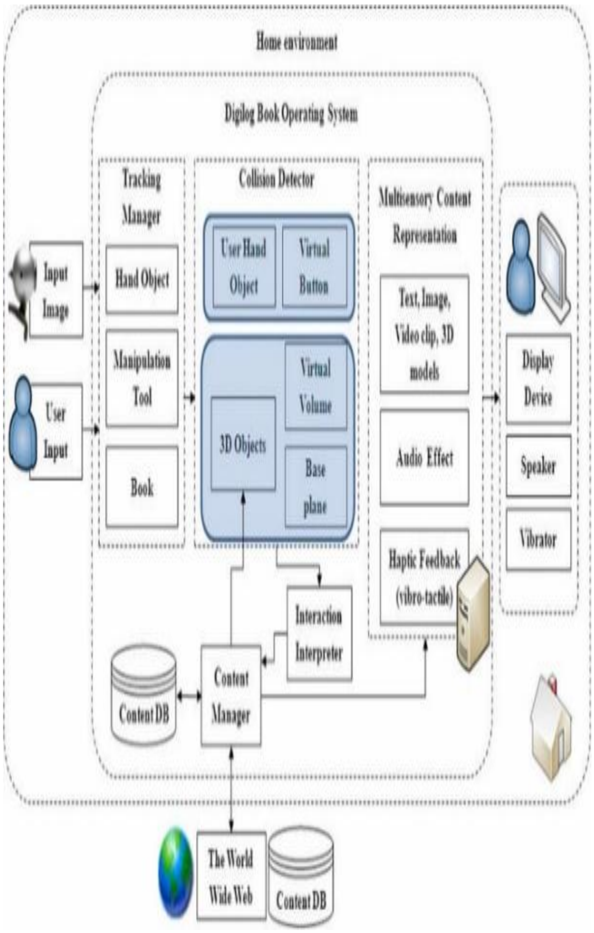


Figure17: Dialog Book system architecture[12]

Fig. 17 shows the Dialog Book system architecture based on the proposed interactive AR system. Based on input images from a camera, a computer vision based tracking manager recognizes and tracks a paper book, a manipulation tool, and a hand object. The collision detector then inspects penetrations between a virtual line created by the manipulation tool and a bounding volume of the augmented 3D objects that are based on the book. The detector also checks an occluded area between the virtual buttons and the user's hand objects. At this point, the interaction interpreter conducts examinations like 3D object pointing and hitting, movement interactions or hand interactions for pushing virtual buttons [12].

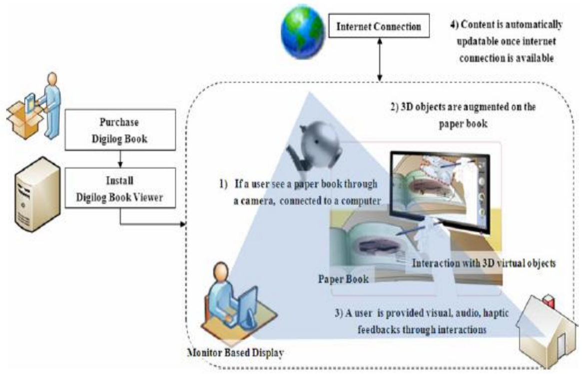


Figure 18: Conceptual figure of Dialog book usage [12]

Next, the content manager composes proper multisensory content in order to react to the user input. The multisensory content consists of visual feedback (text, images, background sounds) and haptic feedback (vibro-tactile interactions). Finally, a display device, a speaker, and a vibrator of the manipulation tool represents the multisensory content. Additionally, if AR content in a remote database is updated, then the AR content in a remote database is updated, then the AR content of a Dialog Book will be updatable through an Internet connection [12]. Fig 18 shows conceptual figure of Dialog book usage.

5. User Interaction in Mixed Reality Interactive Storytelling

The approach used in [13] is character-based, which means that the narrative is driven by the individual roles of each of the virtual actors, rather than by an explicit plot representation. The actors' roles are formalised as plans, which are executed in real time using a modified Hierarchical-Task Network planning algorithm. During execution, the planner selects the next action for a character, this action being played in the virtual environment, which is also updated to take into account its consequences. When an action fails (i.e. its intended outcome is not achieved), another course of action is generating through re-planning. The real-time selection of action supports interactivity, as the user can interfere with the environment, changing the executable conditions of potential actions [13]. The system overview of user interaction is shown in figure 19.

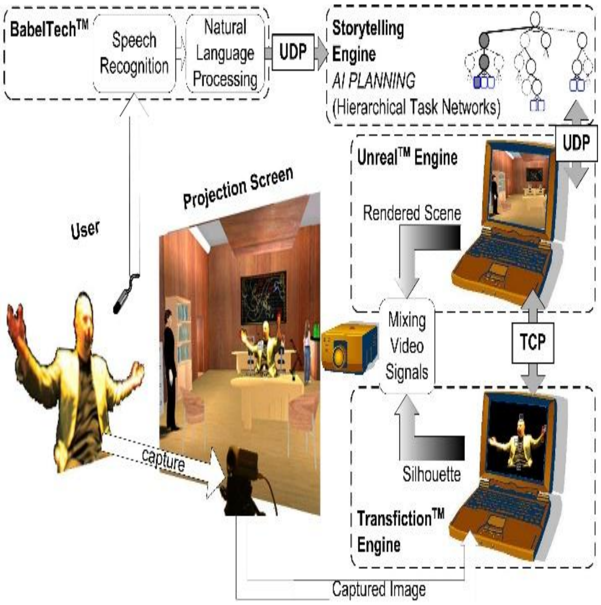


Figure 19: System overview of User Interaction in Mixed Reality Interactive Storytelling [13].

REVIEW AND CONCLUSIONS

The combination of mobile augmented reality and interactive storytelling can be used in various applications. The Interactive augmented reality storybook surveyed in this paper are available both as physical book and AR book[5][6]. It can also be used in Mobile phones (PDA and smart phones)[4][6] and [5] can be used in desktop and mobile phones. With reference to markers, [4] author as used visible, black bordered markers whereas, work [5][6] uses invisible markers which is one of the added advantage to the application. The basic difference between all the surveyed paper lies in the different user interaction. [4] Uses mouse interaction, [6] uses tangible user interface (finger), [8] uses multimodal interactions (gesture and speech), [12] uses hitting, movement interaction or hand interaction. The real- time selection of action supports interactivity, as the user can interfere with the environment changing the executable condition of potential actions [13]. Considering the story engine, several AI related software package are used to develop the story engine in [11]. Some of the other features are multi modal (gesture and speech), multi-user, Adaptive Interaction (based on viewer's option), location based, Collaborative and Interactive options.

Education can be much more interesting and interactive by applying computer technologies such as multimedia into in. In order to promote the reading habit to the children nowadays, the Interactive AR Storybooks not only provides knowledge but entertainment at the same time. With so many successful examples of how computer technologies were applied in education, this Interactive Storybooks based on Mobile augmented reality will be one of it as well. The Augmented reality storybooks are used to learn either English, learning numbers using an old folklore literature or any other subject. Since the children prefer audio and graphics, the Augmented Reality Storybook will provide not only these but allow interaction so that children can learn and play a role in the story at the same time.

REFERENCE

[1] Zhanpenghuang, pan hui, christophpeylo, dimitrischatzopoulos"Mobile augmented reality survey: a bottom-up approach", arxiv:1309.4413v2 [cs.gr] 18 sep 2013

[2] Veronica teichrieb, joaopaulosilva do monte lima, eduardolourenc¸oapolinario, thiagosoutomaiorcordeiro de fariasmarcioaugustosilvabueno, judithkelner, and ismael h. F. Santos, "A survey of online monocular markerless augmented reality", International journal of modeling and simulation for the petroleum industry, vol. 1, no. 1, august 2007

[3] Edirleisoares de lima, brunofeijó, simonebarbos , fabioguilherme da silva, antonio l. Furtado, cesar t. Pozzer , angelo e. M. Ciarlini , "multimodal, multi-user and adaptive interaction for interactive storytelling applications" , sbc - proceedings of sbgames 2011"

[4] Behrangparhizkar, tan yi shin, arashhabibilashkari, yap sing nian, "Augmented reality children storybook (ARCS) ", 2011 international conference on future information technology ipcsit vol.13 (2011) © (2011) iacsit press, singapore

[5] Albertinadias, "Technology enhanced learning and augmented reality:An appli-cation on multimedia interactive books",International business & economics review, vol.1, n.1 issn 1647-1989

[6] Azfar bin tomi,

dayangrohayaawangrambli,"An interactive mobile augmented reality magical playbook: learning number with the thirsty crow", 2013 international conference on virtual and augmented reality in educationdoi:10.1016/j.procs.2013.11.015

[7] Ankitgupta , "Interactive playspaces for object assembly and digital storytelling", university of Washington 2013

[8] Edirleisoares de lima, brunofeijósimonebarbosa ,fabioguilhermedasilva, antonio l. Furtado, cesar t. Pozzer,angelo e. M. Ciarlini, "multimodal,multi-user and adaptive interaction for interactive storytelling applications",sbc - proceedings of sbgames 2011

[9] Olaugeiksund, "children's interaction with augmented reality story books a human-computer interaction study", spring 2012

[10] Jenipaay and jesperkjeldskov , anderschristensen, andreasibsen, danjensen, glen nielsen and renévutborg, "location-based storytelling in the urban environment", OZCHI 2008 Proceedings ISBN: 0- 9803063-4-5

[11] Norbert braun, "storytelling in collaborative augmented realityenvironments" , WSCG'2003,Feburary 3-7 , 2003, Plzen Czeh Republic

[12] Taejin Ha, Youngho Lee, Woontack Woo,"Digilog book for temple bell tolling experience based on interactive augmented reality", Virtual Reality (2011) 15:295–309 DOI 10.1007/s10055-010-0164-8

[13] Cavazza, M. O. et. al. (2003) 'User interaction in mixed reality interactive storytelling', 2nd IEEE/ACM international symposium mixed and augmented reality in Proceedings of the 2nd IEEE/ international symposium on mixed and augmented reality. Washington: IEEE, p.304.

[14] Isbell, R.," Telling and retelling stories – learning language literacy", Young Children, 2002, 57(2), 26–30.

[15] YOUNG, M., 2001. An Overview of the Mimesis Architecture: Integrating Intelligent Narrative Control into an Existing Gaming Environment. In: Working Notes of the AAAI Spring Symposium on Artificial Intelligence and Interactive Entertainment.

[16] AYLETT, R., DIAS, J., PAIVA, A., 2006. An affectively driven planner for synthetic characters. In: Proceedings of 16th International Conference on Automated Planning and Scheduling, pp. 2-10.

[17] GRASBON, D., BRAUN, N., 2001. A morphological approach to interactive storytelling. In: Proceedings of the 2001 Living

[18] CRAWFORD, C,2004. ChrisCrawford on Interactive Storytelling. Berkeley, EstadosUnidos, New Riders.

[19] Bastos, R. and Dias, M., 2007. Efficient Texture Tracking using Optical Flow and Backprojection Information, Proceedings 15th EPCG, Microsoft Portugal, Tagus Park, Porto Salvo (Best Paper Award).

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