Sonic Onyx: Case Study of an Interactive Artwork

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Abstract. Software supported art projects are increasing in numbers in recent years as artists are exploring how computing can be used to create new forms of live art. Interactive sound installation is one kind of art in this genre. In this article we present the development process and functional description of Sonic Onyx, an interactive sound installation. The objective is to show, through the life cycle of Sonic Onyx, how a software dependent interactive artwork involves its users and raises issues related to its interaction and functionalities.

Keywords: Interactive artwork, software dependent artwork, case study, artist technologist collaboration.

1 Introduction

The relation between art and computer dates back to the 60s. The intersection of art and software interests, includes and attracts people with diverse background to come together and work in common projects [1]. The use of computer in art has increased with time covering computer graphics, computer composed and played music, computer-animated films, computer texts, and among other computer generated material such as sculpture. The development of software based sound technology and the interaction with art can relates back to a pre-digital era, which goes from the Italian futurist, Luigi Russolo (1913) to John Cage, Pierre Schaeffer, Pierre Boulez, Olivier Messiaen, Karlheinz Stockhausen, Iannis Xenakis, etc. [2]. MUSICOMP (Music Simulator Interpreter for Compositional Procedures), one of the first computer systems for automated composition was written in the late 1950s by Hiller and Robert Baker [3]. Popular software for creating interactive sound installations in recent years includes Max/MSP and Pure Data. Often these kind of interactive artworks rely heavily on software applications for realizing artistic expressions and interaction. Like Oates [4] who looks at computer artworks as Information Systems and proposes to extend Information System research agenda to include computer art, we suggest to extend software engineering research to include software dependent art projects. Our experience from projects involving both artists and software engineers such as *Flyndre* [5], and *Open Wall* [6] shows that software engineering can play important role in such interdisciplinary projects [7]. The struggle of software engineers to make technology more accessible to artists is recognized by researchers [8]. Besides, researchers have addressed collaboration between artists and technologists as an important

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issue in interdisciplinary projects which is often challenging due to the differences among the involved parties [9]. In this article we present the case study of Sonic Onyx by describing its technical and functional features and showing how it raises different issues related to its development, interaction and user experience.

The rest of the paper is organized in following way; section 1.1 describes our research background and research method. Section 2 gives technical and functional description of Sonic Onyx, where 2.1 describes the hardware and 2.2 describes the software components of the artwork and 2.3 describes how it works. Section 3 addresses the development context. In section 4 we evaluate the project and identify the issues raised by the project during and after development. This is in a way our lessons learned from the project. Section 5 concludes the article with indication of possible future extension of Sonic Onyx.

1.1 Research Background and Method

The work presented in this article is part of SArt research project at the intersection of art and technology [10]. The objective of SArt is to assess, develop, and propose model and process for developing art using technology and software. Sonic Onyx was chosen as a case study for SArt because of its involvement of both artist and technologists and its placing as a public art in a school with a purpose to use and experiment the sound installation with the pupils of the school. Besides, Media Lab at Norwegian University of Science and Technology (NTNU) was also involved in the process of development of the artwork. The objective is to find answers to the following research question set by SArt, *"What are issues and challenges that software engineering has to tackle to implement software dependent art projects?"*

The software of Sonic Onyx was created by a group of computer science students. The development lasted six months and researchers from SArt took part in the process as observers. They took part in the group meetings and received copies of all documentations produced during development. The case study was done following research strategy defined by Oates [11]. The type of the case study can be defined as explanatory and longitudinal with duration of six months. The data presented in this article about the project is collected from i) interviews, ii) project report, iii) project documentations and iv) participation in the group meetings. Interviews were conducted on the developers, the sponsor and the artist who is also an author of this article. Feedbacks from users were collected from school teachers. Documents consist of pre-project report, weekly reports, meeting minutes and the final project report. The developers of the project created a status report every two weeks. They also created meeting minutes on each meeting. Besides, project activities were closely observed by taking part in the project meetings.

2 Sonic Onyx – An Interactive Art Installation

Sonic Onyx is an interactive sound sculpture placed in front of a secondary school in Trondheim. The sculpture is about four meters high and the diameter of the "space" is about seven meters. There are fourteen static metal arms and a globe like sphere in the middle. The sculpture has seven loudspeakers located in seven arms and a subwoofer

located in ground at the center making it possible to provide 3D sound effects within the space created by the sculpture. People can communicate with the sculpture by sending texts, image and sound files from their Bluetooth enabled handheld devices such as mobiles or PDAs. These media files are processed and converted into unrecognizable sound that is played by the sculpture. The artwork was commissioned by the Municipality of Trondheim based on the following propositions made by the artist: i) the artwork should be interactive ii) use latest technology and iii) allow learning and pedagogy.

Fig. 1. Sonic Onyx during night and daytime

2.1 The Hardware

Sonic Onyx consists of four main parts: i) Central server ii) Bluetooth server iii) Sound system and iv) Light system. Central server is a desktop computer with high configuration hardware. It's main task is to store art music, run the main application and support remote administration. The interactive part of the sculpture is based on Bluetooth technology that allows spectators to communicate with it by i) sending instructions to handheld devices in proximity of the sculpture and ii) receiving files from the handheld devices.

Table 1. Hardware components of Sonic Onyx

Part	Configuration/Tools
Server	PC with Dual Core 64 bit CPU, OS: Linux Debian
Bluetooth Systems	Bluegiga WRAP access server with 3 Bluetooth radios
Sound Systems	Sound Card - M-audio Delta 1010
	Speakers - CAP-15 (7 piece)
	Subwoofer - TIC GS50 omni
	Power Amplifier - IMG STA 1508
	Microphone mixer - Moncor MMX-24
Light System	DMX 512 Lanbox-LCX system

A Bluegiga WRAP access server [12] makes the Bluetooth system. It has an Ethernet interface which makes it possible to place it inside the sphere of the sculpture while the main server resides in a building close by. The sound system was carefully chosen since the installation is meant to be operational for many years in outdoor setting. The

speakers need to have robust design, good sound quality and outdoor specification. The light system consists of a LanBox DMX controller which controls the light located in the sphere of the sculpture [13]. The changing of color of the light is programmable

2.2 The Software

The main program which is called "Spamalot" runs in background all the time and calls other subprograms when necessary. The application has two major tasks which are: to receive files from the Bluegiga Bluetooth server and to process the files in order to modify and/or generate sound. The processing of the received file is done by Pure Data (called Pd here after) patches. Pd is an open source graphical programming language used for interactive computer music and multimedia works [14]. Modular, reusable units of code written in Pd are called 'Patches'. The transfer script is a shell script used to rename, timestamp and copy the files received from the Bluetooth server. The script is executed every time a file is received.

Table 2. Software components of Sonic Onyx

Name	Description	Tools Used
Spamalot	265 lines of code	Python
Processing Part	Pd patches – 20 patches for Sound, 13 for Image and 4 for text	Puredata, pd-zexy, pd-aubio, gem, decoders,speech synthesizers
Transfer Script	60 lines of code	Linux Shell
Web site	5 pages and a guestbook	PHP, MySQL,

Besides the main application for running the system, a website was considered as an important part of the project which will provide a) remote administration of art music, b) provide sample sound files online and c) a guest book. Thus it is an extension of the artwork that would allow flexibility in administration of the sculpture sound system. The website that was primarily built using PHP and MySQL and it supported uploading music files and guest book but no remote administration.

2.3 How Does It Work

The working process of the artwork can be described sequentially as follow: First, a user sends a file from Bluetooth enabled device. The Bluetooth server inside the globe receives the file and sends it to the central server located in the school building. Obexsender [15] software that comes with the Bluegiga access server is used to transfer the file.

An NFS-share is mounted on the main server as part of the access server file system; in that way all incoming files are copied to the nfs-shared drive of the server. Once the user file is in the server, it is converted into an audio file by the application 'Spamalot'. Appropriate file conversion libraries are called and many encoders and decoders are used in order to support a wide range of file formats. In case of text file, it is converted into wav file. But in case of image it is converted into a jpeg which is used to manipulate a preselected audio file by reverb and pitch shifting depending on

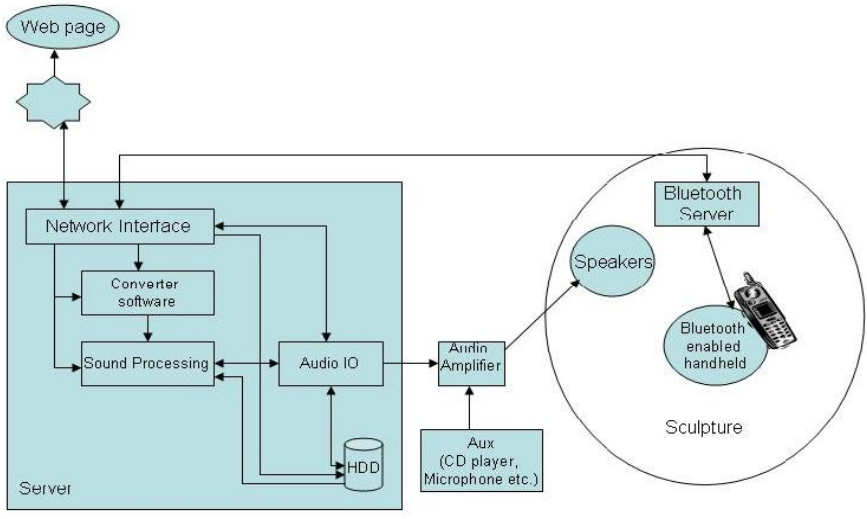

Fig. 2. The architecture of Sonic Onyx sound system

the color values of the picture. In case of sound file, it is processed and modified using random Pd patch. The modified file is then played by the sculpture using the amplifiers and loudspeakers.

3 Development Context of the Project

The project was developed by a group of five computer science students from Trondheim and Sør-Trøndelag University College (HiST) as part of their bachelor's project. The group had some prior knowledge on programming, electronics, web design and project work but no experience of working in art projects. Besides the developers, there was one project supervisor who is a teacher at HiST, the artist, who is the main client of the project and a technical consultant from Media Lab, NTNU.

The development process that the group have followed can be described as an agile or rapid development method more specifically [16]. They chose Python and used DrPython IDE [17] to take the advantage of Python's fast testing, and debugging opportunities. They followed a two week iteration process with meetings every second week and created a report documenting work done in last iteration as well as the plan for next iteration. Communication between artist and the developers were pretty good. Artist's familiarity with technology and previous experience with similar project made the communication smooth. But since the artist was not living in the same town, he was invited to the meetings only when the developers had something significant to consult him. Communication among developers was easy since they were all students of the same class and many of them knew each other before. As the developers had little experience and technical skill needed for this kind of artwork, a technically experienced person was needed as a consultant in the development team. Experts from Midgard Media Lab [18] took part in group meetings and helped the

group regarding domain related knowledge and expertise. Technologists also took part with the artist in the conceptualization phase to define the concept of the artwork. The functionalities of the system were defined, modified and changed through explorations.

4 Evaluation of the Project

The project is special in a way that students did not have previous experience of working artist and on the other hand artist did not work with student developers. But all in all, the project ran smoothly. The management of the project was good; everyone was serious about the meetings and project deliveries and collaboration between all members was very good. The group was very optimistic during the development period. The project was a success in a way that students covered most of the requirements except a few due to lack of time or load of complexity. For example, sending a welcome instruction by the Bluetooth receiver was not completed. Besides, the web site [19] of the project was not completed. The website made by the group was not used by the artist mainly because: i) he did not like the layout and the design of the web site and ii) the site was incomplete.

Unlike traditional sculpture or painting, the development of interactive art does not end with the completion of the artwork; rather it continues enhancement and changes with users' responses and interaction with the sculpture. Besides, software dependent artwork needs timely maintenance and upgrading. Interactivity and experimenting with artwork increases the importance of maintenance and upgrading.

Sonic Onyx was built with the objective that pupils from the school will use it and experiment different possibilities around the artwork. It was not meant to be an end product, rather a developing one which will evolve with response to the users. Often the sponsors of the artwork do not consider this difference and as such they overlook the after delivery maintenance and upgrading of the system. This might be because of their lack of awareness of maintenance and upgrading issues related to the interactive installations or their unfamiliarity with technology dependent artworks. So the artist has to take care of this factor and make the sponsor understand the necessity of maintenance and upgrading. In case of Sonic Onyx, the artwork came across some afterward maintenance problems such as hardware and configuration related problems. Since there was no one responsible for maintaining, it was hard for the school to use it continuously without interrupt. Placing an artwork in the public space specially in outdoor setting without any supervision bring other safety issues, such as the subwoofer placed in the ground was destroyed by the pupils from the school even though it had protective cover.

Locating the artwork in a public space with a neighborhood raises some issues due to its interruption of the environment such as how loud should it play, which time it will play, when the light should be turned off during day time etc. These issues are based on users' feedbacks which actually evoke enhancements and modification of the artwork and its software.

Involving students in the project as part of a coursework has certain issues such as limitation of time. Besides developing the system, students need to get a good grade in the course. In sonic Onyx, when a part of project was lagging behind due to manufacturing delay of the arms, students could not wait till the end for deploying the sculpture and the software system on the site. This was a bit surprising for the artist; on the other hand students did not have any contract in the project, so they were not

bound to wait until everything was ready. The artist was expecting a proper delivery of the system including in site deployment and testing.

Backing up of the whole system at regular interval is important especially for a system like Sonic Onyx which is supposed to be upgraded. For a complex interactive system to carry on experimenting and adding, updating or modifying functionalities it is necessary that the artist can roll back to a safe state after any kind of problems during the experimentation. The system can also go down or crash any time and back up is important to restart the system. Otherwise it can be a complete mess with the application.

Sonic Onyx is targeted to involve school pupils with music activities. Besides playing files received from user's handheld devices, it provides the possibility to add auxiliary instruments such as microphone, mixer etc. Students can interact with Sonic Onyx directly through its MIDI interfaces to control both light and sound allowing them live performances. In this way it allows students of the school to create and store music in the server, play directly and or mix different instruments with the help of the sculpture. Thus the artwork not only enhances the school yard with its aesthetics value but also involves the students with activities for learning and practicing music.

When in rest, the sculpture plays songs stored in the hard drive of the server. The idea is to promote contemporary artists by playing their music in stand by mode and bringing them closer to the audience. The web site of the project is planned to give the artists the possibility to register, create account, and upload music files which will be later played by the sculpture. In this way, besides the students it has the possibility of engaging contemporary artists as well.

5 Conclusion

In this article we have presented the technical and functional descriptions of an interactive artwork. We have presented here how artwork is very similar to a computer application and raises many issues related to maintenance, upgrading, interaction, and development process. Technology dependent artwork placed in a public place might have similar issues that deserve consideration. We have also presented through Sonic Onyx how interactive art has the possibilities of engaging people in an artful way. We have shown how the artwork can involve students in learning and playing with technology as well as attract contemporary artists to use the artwork to play their music. Future work of Sonic Onyx includes live streaming of the playing of sculpture through the project web site. Thus it will allow contemporary artists to upload, store and administer music files through their web account and reach to the audience through artwork playing their music. It would be also a nice extension to have the possibility of user sending request via SMS or Bluetooth from the site of the sculpture to play certain music. Based on user request ranking of music and playlists can be made which will help engage all participant more enthusiastically.

References

1. Ahmed, S.U., Jaccheri, L., Trifonova, A., Sindre, G.: Conceptual framework for the intersection of software and art. In: Braman, J., Vincenti, G., Trajkovski, G. (eds.) Handbook of Research on Computational Arts and Creative Informatics. Information Science Reference, p. 26 (2009)

2. A Brief History of Algorithmic Composition, http://ccrma.stanford.edu/~blackrse/algorithm.html
3. Techniques for Algorithmic Composition of Music, http://alum.hampshire.edu/~adaF92/algocomp/algocomp95.html
4. Oates, B.J.: New frontiers for information systems research: computer art as an information system. European Journal of Information Systems 15, 617–626 (2006)
5. Trifonova, A., Jaccheri, L.: Software Engineering Issues in Interactive Installation Art. In: Designing Interactive Systems Conference (DIS 2008), Cape Town, South Africa (2007)
6. Ahmed, S.U.: Achieving pervasive awareness through artwork. In: 3rd International Conference on Digital Interactive Media in Entertainment and Arts, pp. 488–491. ACM, Athens (2008)
7. Trifonova, A., Ahmed, S.U., Jaccheri, L.: SArt: Towards Innovation at the intersection of Software engineering and art. In: 16th International Conference on Information Systems Development. Springer, Galway (2007)
8. Machin, C.H.C.: Digital artworks: bridging the technology gap. In: Proceedings of the 20th Eurographics UK Conference, 2002, pp. 16–23. IEEE Computer Society, Los Alamitos (2002)
9. Meyer, J., Staples, L., Minneman, S., Naimark, M., Glassner, A.: Artists and technologists working together (panel). In: Proceedings of the 11th annual ACM symposium on User interface software and technology, pp. 67–69. ACM Press, San Francisco (1998)
10. SArt Project Web Page, http://prosjekt.idi.ntnu.no/sart/
11. Oates, B.J.: Researching Information Systems and Computing. SAGE Publications Ltd., Thousand Oaks (2006)
12. Bluegiga Access Servers, http://www.bluegiga.com/more_229x
13. LanBox DMX Controller, http://www.lanbox.com/
14. Pure Data, http://puredata.info/
15. Access Server: User's and Developer's Guide, http://bluegiga.com/as/current/doc/html/c2034.html
16. Asphaug, T., Bielsa, C., Grytå, E.M., Thorsrud, E., Tollefsen, T.: Sculpture with 3D Interactive Sound. Department of Electronical and Computer Engineering, Faculty of Technology, vol. Bachelor HiST, p. 110 (2007)
17. DrPython, http://drpython.sourceforge.net/
18. Midgard Media Lab., http://www.ntnu.no/midgard
19. Sonic Onyx, http://www.soniconyx.org