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PROJECT REPORT

CENG 407

Innovative System Design and Development I

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Digital Storytelling on a Virtual Heritage Museum with Believable Agents

Hasan Saygın DİKBAYIR – 201511019

Oğulcan MERDİVANLI – 201511041

Utku Mert DEĞİRMENCİ – 201411017

Advisor: Murat YILMAZ, Dr. Instructor

Co-advisor: Ulaş GÜLEÇ, Dr. Lecturer

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ABSTRACT

Drawing on the fields of cultural heritage, digital storytelling on a set of believable agents, this project proposes a virtual museum, which is populated with virtual agents based on the Turkish horror folklore. Using the emerging trends in the field of game research, the goal is to demonstrate how selected characters from Turkish horror folklore could adequately be storied in a virtual museum environment, which aims to safeguard and transmit cultural heritage. This work aims to advance the immersion in interactive environments by exploring a selected set of believable agents. We will conduct a case-based reasoning approach to simulate virtual agents roles for exploring cultural heritage. In particular, virtual agents that would play different museum-based roles and ultimately interact with other role-based agents and some of which need to engage into interactions with human participants.

Keywords : Virtual Reality, Cultural Heritage, Virtual Heritage, Virtual Museum, Horror Culture

ÖZET:

Bu proje kültürel miras kavramını, dijital hikaye anlatımı ile birleştiren ve inandırıcılık unsurunu arttırma amacı doğrultusunda "inandırıcı ajanları" kullanan bir sanal müze projesidir. Projede bulunan sanal ajanlar, Türk korku kültüründen seçilmiştir. Oyun araştırmaları gündemindeki unsurları kullanarak, seçilmiş bu korku karakterlerinin bir sanal müze ortamında ve kurgusal bir olay örgüsü ile birlikte hikayeleştirilmesini amaçlayan projemiz, kültürel mirasımızı koruma ve aktarma amacı gütmektedir. Projemiz kapsamında, seçilen bir grup inandırıcı ajan ile etkileşime geçilmesi gayesi ile interaktif çevredeki gerçekçiliğin artırılması amaçlanmaktadır. Kültürel mirasımızın canlandırılması için simüle edilen sanal ajanlara, vaka bazlı bir akıl yürütme yaklaşımında bulunmaktayız. Sanal müzede bulunacak sanal ajanların, birbirinden faklı müze tabanlı rolleri paylaşırken, birbirleri ile etkileşime girmeleri aynı zamanda katılımcılar ile de etkileşime girmelerini amaçlamaktayız. Bu bağlamda sanal müzemizdeki inandıcı ajanların, müzeye yaşayan ortam hissiyatını katmalarını sağlayacağız.

Anahtar Kelimeler: Sanal Gerçeklik, Kültürel Miras, Sanal Miras, Sanal Müze, Korku Kültürü

1. INTRODUCTION

1.1. Motivation

As a result of literature review, it has been concluded that virtual museums attract attention by people by revitalizing the cultural elements that have been forgotten and giving the impression of visiting a museum on the spot (White, 2018). Within the scope of this project, we aimed to raise awareness about the written and verbal elements in Turkish culture.

With support of the Portakal Teknoloji company, the virtual museum to be developed taking into account the shortcomings and needs in the socio-cultural area, the rich Turkish oral culture that has been forgotten will be revived.

The benefits of people experiencing a culture in a virtual museum are given below.

- Models that are too old to be exhibited or objectionable can be exhibited to the visitors of the museum.
- To present the experience of living in the museum to those who visit the museum by fictionalizing the works which are not written but culturally valuable.
- Providing an isolated environment for a variety of research topics, focusing on the special interests of people visiting the museum
- To offer a more impressive museum experience in a Virtual Reality environment which is popular in recent years
- Saving time and costs by means of environment and tools created by simulation
- It is a pioneering project for innovative works and it is an framework for future projects.

1.2. Innovation

In recent years, the number of projects involving virtual reality has been increasing with the developments in technology (White, 2018). The virtual museum concept, which is one of the sub working areas of the virtual reality concept, is one of the project subjects that are in demand. In this project, which is planned to be developed, it is aimed to remind the culture again by bringing together the rich Turkish horror folklore and the modern virtual reality technology that has been forgotten along with the progress of the age and exhibiting it in a virtual museum. Although there is no study in our country yet, there are studies in the world that are only a replica of the museums and the valuable belongings in them (Wojciechowski, 2004). The virtual museum, which is planned to be made, will be a unique museum, and it will vary according to the similar ones and it can be considered first in its field. Although the realization of the project is a part of the culture of our country, it has a flexibility to be used in other subjects.

1.3. Methods and Tools

The process design in Figure 1 will be based on the project development. An extensive research will be conducted for the concept of believable agent and cultural heritage, one of the basic requirements of the project. In the light of the information obtained, it is aimed that the Turkish horror culture, which is processed in a virtual museum with a fictional story, contributes

to the user a unique experience and the user will learn this valuable culture. The level of progress of users in the storyline and puzzles in the virtual museum will be one of the main testing criteria of our game.
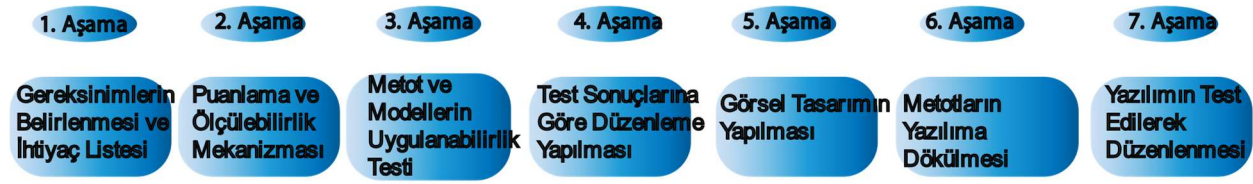

Figure 1: Development Cycles

Once the game is outlined, the game will be designed using the Unity3D platform in a three-dimensional environment. The Unity3D platform has achieved an increasing success in the practical and flexible playing field. This is because the user-friendly development environment and easy-to-understand user interface (Huang and Gui, 2015). Unity3D is also used to prepare simulation along with game development. This is an important factor for the virtual museum project to be realized. The virtual museum will provide realistic experience and facilitate the description of the plot. Another feature is cross-platform, easy to integrate. As programming languages, C #, Boo, UnityScript and JavaScript languages and multiple software platforms are supported (Okita, 2014). According to the alternatives, the C# programming language is stronger (Turk, 2016). C# is a fully object-oriented language, but it is a fast compiling programming language. In the development process of the project, the C# programming language will be used in the Microsoft Visual Studio 2017 development environment.

Due to the fact that the Virtual Museum is realistic, a detailed research has been carried out for the models, environment, animations and sounds to be created and certain tools have been selected depending on our level of competence. Autodesk Maya 2018, Z-Brush, Adobe Illusturator and Adobe Photoshop will be used for models, environment and animations. Due to the fact that the Virtual Museum is realistic, a detailed research has been carried out for the models, environment, animations and sounds to be created and certain tools have been selected depending on our level of competence. Autodesk Maya 2018, Z-Brush, Adobe Illusturator and Adobe Photoshop will be used for models, environment and animations. Autodesk Maya 2018, which will be used for modeling the characters and the environment, is determined as the most suitable program to create realistic feeling with the tools it contains. Characters and environment modeling will be done at Maya 2018. Z-Brush program will be used for baking and shaping the models. Z-Brush will help to increase the realism of the models to the next level thanks to the wide tool range. Adobe Illusturator and Adobe Photoshop programs will be used for basic concept designs of models. These programs are preferred because they can be quickly understood and have a user-friendly interface. The Maya 2018 program was chosen for the animations. The animations made with Maya 2018 were examined and it was decided to be the platform that would reflect the realistic feeling of the museum in the best way. The Virtual Reality laboratory, which is established within the Computer Engineering Department of Çankaya University, will be used for the completion of all of the studies successfully and safely. The aim of the Virtual Reality laboratory is to increase the quality of the software process and the quality of the product.

2. LITERATURE REVIEW

2.1. Introduction

The concept of virtual museums enables an experience based on the heritage of different cultures. Folklore, folk tales, decors, myths and motifs are part of cultural heritage [1]. The scope of this project is the treatment of the cultural elements belonging to horror stories of Turkish culture with a virtual museum concept. These characters will come to life with the help of a story set in the virtual museum. As a result of this, they will become more believable and passed to virtual environment by using dramatic elements of a game. Consequently, we revive this rich culture from its forgotten past and to allow people to interact with unique entities from the Turkish culture. In order to realize the project, a detailed research is conducted about the concepts of virtual museums and cultural heritage. The museums were examined by using similar techniques in different areas. Within the context of this work, firstly, we review the concept and requirements of the virtual museum. Next, we investigate the concept of cultural heritage with the virtual museum concept. Concurrently, the necessary information was given about the necessity of the notion of "Believable Agents" in the project and its contribution to make the museum fully alive. Last but not least, references to this information have been specified

2.2. Turkish Horror Culture and Cultural Heritage

Cultural Heritage is the accumulation of experiences, passed from generation to generation, including tradition, myths, space, object, artistic expression and values created by a society [1]. It produces concrete and abstract representations of value systems, beliefs, traditions and lifestyles as part of human activity. Therefore, it is an important part of a great whole culture. It does not only contain these visible and tangible traces of antiquity, but also includes various myths and folk stories that have not been written. A non-written cultural element contains superstitions, horror elements, and various symbols in it [2].

Turkish culture has a very rich, valuable deep heritage of horror stories, that has passed down from generation to generation but today most of the non-written horror culture is about to be forgotten [3]. According to Çolakoğlu [4], the types and experiences in which social or extraordinary personal experiences are established within the Turkish socio-cultural structure are divided into sub-headings in many different groups. It has been pointed out the transformational interactions that are taking place between the ones that reflect the values of rural life in the Turkish socio-cultural structure and those that are occurring in the modern or new Turkish city life and which are considered as unconventional values and extraordinary experience related to them.

Folk tales, myths and memorates in Turkish culture encompass many valuable horror elements [42]. These horror elements have become essentials of Turkish culture and horror literature [5]. Each generation and each individual of this generation has made these horror elements richer by adding their own imagination to the stories under the influence of time, place and belief systems.

Socially accepted traditional extraordinary beings communicating within the Turkish socio-cultural structure as "Alkarısı" or "Alkızı", "Karabasan" or "Erkebit", "Karakoncolos" and "Gulyabani" [4]. All these are the assets mentioned in common Turkish horror stories in different regions. The names and descriptions of the beings vary from region to region, but the behaviors, fears, or ways of thinking of beings are similar.

The creatures that are mentioned above and their identities, habitats, relationships between humans and each other, and precautions for their harmful effects are widely known by the locals around Anatolia [24]. Especially in the East of Blacksea Region in Turkey, there is a commonly seen creature named Karakoncolos that shows itself to people and harm them in coldest days of winter. It crawls in the streets and questions the people who encounters to learn that where they are coming from and what is their destination. The word "kara", which stands for "black" in English, must be contained within the answers. Otherwise it kills them with the huge comb that it holds in its hand [5].

Another creature is "Alkarısı" which is seen in almost all Turkish regions. Even though Alkarısı [4] appears in various shapes but she is usually tall, has long fingers with long nails, with messy hair, greasy body, with small hands and feet, toothy, naked, with one of his breasts tossed back, very ugly with an eye on the top, is depicted as wearing red shirt. There are lots of rumors that women who have just given birth have been haunted by Alkarısı. According to some sources [37], sometimes she enters the barns and harm the animals and also make animals grumpy. People should stick a pin to Alkarısı's body. As long as pin won't removes from the body, it will stay as a slave of the person who sticks the pin.

Another entity is Erkebit [4]. Erkebit is a torturer, which haunts people during sleep. By pressing his right hand into the human's mouth, it prevents the person from making a sound. His right palm has a hole in order to ensure that the person who is tortured to not get asphyxiated. By hitting the scrap pieces in his left hand, he makes the person to go crazy and prevents the person's screams from being heard. There is a fez upon its head [41]. If tortured person reaches the fez during the torture, the torture stops and the monster begins to plead to the person to recover the fez.

Gulyabani is another entity that is allegedly seen in Azerbaijan and Eastern Anatolia [25]. It is portrayed as a very tall and feeble. Gulyabani calls people who wander at night alone with their names [38]. If they answer to it, Gulyabani will harm them seriously. This harm can cause people to die from madness. People may protect themselves with sunlight from Gulyabani.

All these characters and many others are part of the verbal culture that has been passed on from generation to generation in Turkish culture[39]. The characteristics of monsters are evidence of the existence of a unique horror culture. Unfortunately, this culture has been forgotten [40], but it contains many elements which are very valuable for cultural heritage. As a result of this notion virtual relity can be a great practice for reviving the cultural heritage. In the follow-up section of this article we will touch upon virtual reality comprehensively.

2.3. Virtual Reality

The term virtual reality (VR) is a computer technology that individuals experience the computer-based 3D environments in a visually simulated environment [8]. Users experience these virtual environments via using various peripheral devices (helmet display, etc.). According to Stone [6], the definition of VR is such a technology that is developed to increase the communication between individuals and machines, addressing human senses. In support, Oppenheim [7] has described the VR as a technology that seeks to increase the human-machine interaction through senses not only with visual and audio communication.

VR has found the one of the first application areas in video games and the world of entertainment [32]. Various elements of VR technology have played important roles in many science fiction movies [9]. As an example of the usage of VR can be said as the project called Canadian Rockies has been designed by computer scientists and photographers as a virtual model on the computer, allowing two people to experience without changing the same space. "The abbey of Cluncy", which was destroyed in the Burgundy region of France in the wake of the French Revolution, was rebuilt in the computer with the help of VR from the archival records. Those who want to wander through the VR through the floors of this building, even the finest details can be seen on the walls.

Green Telepresence Surgery System [43], developed by Dr. Philip Green, is a system that simulates surgical intervention on the battlefield. This remote workspace consists of a surgeon and a workstation. This system enables 3D visualization by using 3D vision [30]. The system has a 6-DOF sensor input for moving the surgical hands to the 5-DOF system with dual CCD cameras for stereo vision. With these two prototypes, the surgeon can remotely control the operation. This system is mounted on an armored mobile vehicle and in case of injury of a soldier, it carries out the operation by driving to the location of the soldier. Thus, the surgical intervention required on the battlefield will be delivered more quickly.

In the field of education, Mustafa Hussein and Carl Nätterdal (University of Gothenburg) [31] aim to teach the planets in the solar system by visualizing the planets and placing the planets in the perspective of another. Four of the planets that are closest the sun were modeled in different scenes. Planets' description and summary are in those scenes. As far as possible, it was justified and the planets' distance to each other and rotation velocities were calculated and transferred to the virtual environment. The work is available on both VR and mobile application. After a valuable progress, users feedbacks gathered. 8 out of 15 users had a positive experience. In the experiment on VR, 11 out of 25 users stated that it is a useful way to teach the planets with virtual reality practice.

As a result, VR can be used in different fields such as health, military and education [44]. The experience of being in a natural environment, which contained by the concept of particular VR technology, can be provided by these different fields.

2.4. Virtual Museums

Virtual museum is a platform that includes historical, scientific or cultural values accessed through digital images, audio files, text documents and to be exhibited in a virtual environment [25]. Virtual museums are an option for people who do not have the possibility or condition to go and visit a particular museum. Virtual museum's function according to Lepouras & Vassilakis [10] is the exploration of virtual reality technology usage by the premises of museums. The features of the virtual museums support, both researchers and the general public to help with the rendering the artifacts in the computer environment, learning their use and in viewing exhibits that were not usually displayed.

Virtual museums appeal to a variety of purposes, functional features and many different audiences [15]. Especially processing the verbal and vocal elements of cultural heritage in a virtual museum concept provides an impressive experience [45]. Virtual museums may contain unique and rare objects that are part of cultural heritage which needed to be protected from external damages which is important for educational, research or scientific purposes.

One of the most important goals of the virtual museum is a presentation of culture, myths, and archeological artifacts in an attractive manner that would provide an exciting and unique way to learn about concepts of these elements. Also, virtual museum concept provides a chance to people who want to inspect the exhibition from all different angles or compare these objects or study them in different purposes which is strictly restricted by the museum [28]. Virtual museum concept can offer a great solution for this situation. Virtual reality technology provides solutions by enabling visualization models of museum artifacts in both virtual and real environments. By this sequence, visitors can interact with models in vary ways [29].

Virtual museums has various examples of research and applications on different projects. One of the first examples of an interactive virtual exhibition is an automated guidance system using the Augmented Reality (AR) technology [33]. This system can create a meaningful sound according to the user's location. The advantage of this prototype is that it can enrich visitor's experiences without interfering with their social interactions. Another project similar to this project is the Meta Museum Guidance System [34]. The Meta Museum provides a global communication environment using the knowledge base of the museum archives.

Another project is the ARCO project [35]. The ARCO project offers tools that allow museum collections, museum works to be digitalized. The ARCO project allows users to navigate virtual museums in Web 3D, AR and VR environments simultaneously with a concrete interface. Museum visitors can interact with objects in the museum by using natural interactions and SpaceMouse technology.

Virtual Dig Experience [12] is a project, which can be considered as a virtual museum that installed in the Seattle Art Museum that is using virtual reality and augmented reality technologies to provide people to inspect cultural objects [11]. Museum has presented not only the cultural object but also their archeological context to visitors. Virtual museum contains the virtual models of the real objects such as brushes, small shovels etc. that is available for visitor interaction.

The 3D Murale project [13] – 3D Measurement and Virtual Reconstruction of Ancient Lost Worlds of Europe – is aimed at building a system that capable of recording archaeological processes using Virtual Reality techniques. Murale Project contains, not only artifacts and cultural findings but also area's layers as models. This application depends on evaluting various 3D seizure methods. Furthermore, the project contains the idea of making pottery, sculpture, and buildings look like they are in that virtual environment throughout ages [11].

The WoofbertVR is an application that share world's leading museum's collections through visual as virtual reality experience developed by Boulevard [14]. There are several museums in this project such as The Courtauld Gallery. Users can reach this museum by peripherals like Samsung Gear VR, Google Daydream, Oculus Go and Oculus Rift [46]. This gallery was built in 18th century expressly for display art and show rich historical and architectural details. User can move around the gallery and study any painting. A zoom feature allows user to take a closer look to the painting. The experience of interaction with the paintings has reached to an upper level with WoofbertVR with feature of live paintings with audio narration that is provided by author Neil Gaiman. Application detects the focus point of the user by the sensors of the virtual technology, and when user locks into a painting the application pulls the user into the painting itself. This event makes paintings alive and allows user to dive

into painting. When users want to return to gallery, turning their head out of the picture frame will be enough to do it.

The concept of cultural heritage becomes open to new insights through the influence of modern information systems and resources [15]. The digital media is very diverse and contains a lot of information. Virtual museums play a multifunctional and important role in this environment.

As a result, the concept of virtual museum has a lot of potential to improve people's mindset both for educational and cultural purposes. Virtual museum is a shape of more efficient story telling, moving critical knowledge, more activities, more value and saving financial resources [16]. A virtual museum is a great way to show the people the verbal culture and cultural knowledge.

2.5. Believable Agents

Believable agents concept refers [17] to autonomous agents that has rich personality with the influential attributes of characters from the science, philosophy and art. They are a result of both the concept of believable characters from local myths and folklore and autonomous agent researches in the field of computer science.

The term "agent" derived from the researches of artificial intelligence area. Artificial intelligence researches desired to build agents that seem to do basic operations like thinking and feeling as closer as humans. Agents are entities with which you would want to have a role in your life. According to Bledsoe [18] from American Association of Artificial Intelligence Presidential address, told of his future dream to build a computer friend. He wants to create a partner that has a regular human activities such as thinking, loving, feeling, decision making, perceiving and hating as possible as human beings.

Interactivity is a feature that separates believable agent from aspects in traditional sophisticated fields and makes their creation even harder than usual techniques [36]. The creator of a believable agent cannot control or know the absolute result of the situations the agent will experience in time. In an on going story, the creator can bring all of its understanding of humanity to take on to decide how agent reacts to each situation in any phase that agent will encounter. In order to obtain a believable agent, a version, which contains all details of personality, must be created. The agent's reacts to situations that will be encountered should not always be dependent to its creator's expertise. To define the concept of believable agents, it is useful to consider some relevant but various goals [19]. According to Thomas and Johnston [27], this goal is to give emotions to believable agent. This emotion of the agent must be clearly defined. Loyall and Bates [27] define this goal as the suitability of the behaviors and argue that these behaviors should be the as close as possible to human nature. These behaviors can be exemplified as aggressiveness and alarm mechanism. The concept of virtual museum might be a suitable working environment for believable agent since a museum must be highly realistic, and the elements like staff members must convince the users of virtual reality experience that they are in a living environment.

Believable agents concept has been used for many years in several areas for both research and development purposes [47]. The entertainment industry is a practice of field for believable agent for such as games and simulations. Video games and simulations are perfect

practice and work areas for believable agents, to make the components like environment and non-player characters more natural and alive, in order to create a better experience to user.

In addition to entertainment industry, believable agent concept attracted attention in the psychology science. After that an environment built for research purposes in this field. Believable agent concept's aim is to make a "program" that is generated by a computer much more human like. The science of psychology [48] works and contributes on the idea of making "agents" to feel, think, hunger and hate like a human being. Related work on believable agents varies from entertainment industry to psychology.

The ICARUS [20] is a believable agent that created for an aerial combat simulation, which is a product of entertainment industry. The ICARUS agent is capable of performing two different types of discovery, both in physical and action fields. On a newly created map, users explore by moving around on mission map. The agent uses different approaches to exploration depending on whether the goal is to reach a region that is outdoor, indoor, or on a rooftop. The system also gathers the information of topological connections between regions as it encounters them, which it stores as new skills that encode path knowledge [49]. The agent prefers recently earned skills to explore the mission map. Sometimes the agent encounters a situation where objects block its path through a gateway or to a goal. The system then concentrates on trying to find the right activity to overcome the obstacle. The agent has previously taught a series of candidate actions including turning, running, jumping, ducking and climbing. The agent attempts these actions one by one, until they find the right method for the current obstacle. In this case, he learns a specific skill that he will perform when he encounters the same situation in the future.

Believable agent concept meet with psychology in the term of "believability" which stands for the agent's way of interact as natural as possible with humans. Psychologists have developed a system called ECA (Embodied Conversational Agents) [23] which has a goal to enhancing the believability feature in conversation between human computer interactions. Believability can be conceptualized both as a property of the ECA and as a property of the perceiver. ECA has provided a believability which is defined as the ability to communicate intuitively by applying the natural processes of human communication [50].

As a result, the concept of believable agent has done well so far with a set of projects and research. In any professional topic, believable agents are very useful in many different ways. Especially, the video games and simulations are cut out for believable agent concept. To feel like that you are in a real living environment in a game or simulation, believable agents are highly important.

3. SOFTWARE REQUIREMENTS SPECIFICATION

3.1. Introduction

The concept of virtual museums enables an experience based on the heritage of different cultures. Folklore, folk tales, decors, myths and motifs are part of cultural heritage [1]. The scope of this project is the treatment of the cultural elements belonging to horror stories of Turkish culture with a virtual museum concept. These characters will come to life with the help of a story set in the virtual museum, and the characters will become more believable and passed to virtual environment by using dramatic elements of a game. Consequently, we revive this rich culture from its forgotten past and to allow people to interact with unique entities from the

Turkish culture. In order to realize the project, a detailed research is conducted about the concepts of virtual museums and cultural heritage. The museums were examined by using similar techniques in different areas.

Within the context of this work, firstly, we review the concept and requirements of the virtual museum. Next, we investigate the concept of cultural heritage with the virtual museum concept. Concurrently, the necessary information was given about the necessity of the notion of "Believable Agents" in the project and its contribution to make the museum fully alive. Last but not least, references to this information have been specified.

3.1.1. Purpose of This Document

The purpose of this document is to plan and record the processes in the operation of the project. Processes in this project are divided as sections. The functional and non-functional requirements and system features of this project are clearly specified in this document.

3.1.2. Project Scope

Drawing on the fields of cultural heritage, this project aims to develop a computer game by contextualizing a virtual museum that is populated with virtual believable agents taken from Turkish horror folklore within the current field of game AI. In addition, it ultimately demonstrates how selected characters from Turkish horror folklore could adequately be simulated in a virtual museum that transmits cultural heritage in a digital medium. We are planning to conduct a case-based reasoning approach to simulate virtual agents' roles for exploring cultural heritage. Virtual agents should be able to play different museum-based roles and ultimately interact with other role-based agents and some of which need to engage into interactions with human participants. This study proposes an interactive drama (i.e. a serious game) based-on believable agent in virtual heritage museum.

3.1.3. Glossary

TERMS	DEFINITONS
Stakeholder	Any person who is a contibutor of this project.
Virtual Museum	A collection of digitally recorded images, sound files, text documents, and other data of historical, scientific, or cultural interest that are accessed through electronic media.(Marco Sampaolo, 2017)
Virtual Reality	A high- end user interface that involves real-time simulation and interaction through multiple sensorial channels. (Virtual and Augmented Reality Applications, Lucio Tommaso De Paolis)
NPC (Non-Player Characters)	Virtual agents controlled by the game, that interact with other NPCs, or with Player Characters controlled by humans.(Sabrina Campano ; Nicolas Sabouret, 2009)
Cultural Heritage	Traditional culture and ruled out all sort of things. (R. Kurin Museum International, 2004, UNESCO)
Believable Agents	Constructions that computational models of believable interact. (Thomas and Johnston 1981)

Figure 2: Glossary

3.2. Overall Description
3.2.1. Product Perspective

The virtual museum project, which features the elements of Turkish horror culture, aims to revive the forgotten or non-written Turkish culture and teach it to the future generations. At

the end of this project, this culture will be revitalized and raise awareness about the non-written Turkish culture.

3.2.1.1. Development Methodologies

Agile software methods are the same as their essence, but they are divided into various sub-branches that differ in their processes. A popular one of these arms is the Scrum method (M. John). Scrum is an administrative model with very simple rules at first glance [2]. It is implemented for the management of complex software projects whose requirements are not explicitly specific, open to change. Scrum does not specify the steps to be followed in detail in the project and instead offers a flexible management with a few simple but important rules. Scrum requires teamwork so everyone must act together. It makes the release within time and with the minimal cost. Scrum development methodology divides project development time into parcels and sub-works. In the project development process, sub-works are completed within a certain period of time. These periods are called "sprint". At the end of each sprint, the software product must appear to be available and applicable.

Ideal Scrum team must include Product Owner, Scrum Master, and Development team. Each member has its own tasks. Scrum describes this as a self-organizing and cross-functional team. For large enterprise projects, ideal team size should be 7 people. For smaller projects, team size should be 4 people (Jasper van der Hoek, 2017).

Sprint 1 : Game Components Design	Sprint 2 : Environment and Believable Agents	Sprint 3: Believability and Behaviors of Agents	Sprint 4: Testing
3D Modelling	3D Modelling	Coding	Unit Testing
Coding	Coding	Sound Effects and Animation	Acceptance Testing
Test Plan Documentation	Unit Testing	Unit Testing	System Testing
Acceptance Testing	Acceptance Testing	Acceptance Testing	Project Report
Unit Testing	Presentation & Demo	System Testing	Final Presentation
Deployment	Documentation	Deployment	Demo Preparation
Release	Deployment	Release	Final Release
Agile Retrospective Meeting	Release	Agile Retrospective Meeting	Agile Retrospective Meeting
	Agile Retrospective Meeting		

Figure 3: Sprints of the Project

Sprints are small, iterative, cross-functional and important development cycles of the scrum methodology. Sprints show us which jobs will be finished during the time period created. The entire project process is divided into sprints to provide a short version release. The structure of the sprints are intended to minimize errors in the continuation of the project. Unlike traditional methods, the sprint structure is flexible. Because our project is comprehensive and requires a multi-disciplinary study, sprint provides a significant benefit. We planned the sprint design as four sprints as seen in the figure. We took care to keep the tasks distributed to the sprints at an optimal level throughout the project. As the needs of the project may vary in the ongoing processes, the usage of the traditional method will increase the cost due to changing requirements, so this method is not suitable for the project. However, due to the reasons mentioned above we preferred to use agile methodologies in the project as the agile method minimizes the cost of changing requirements.
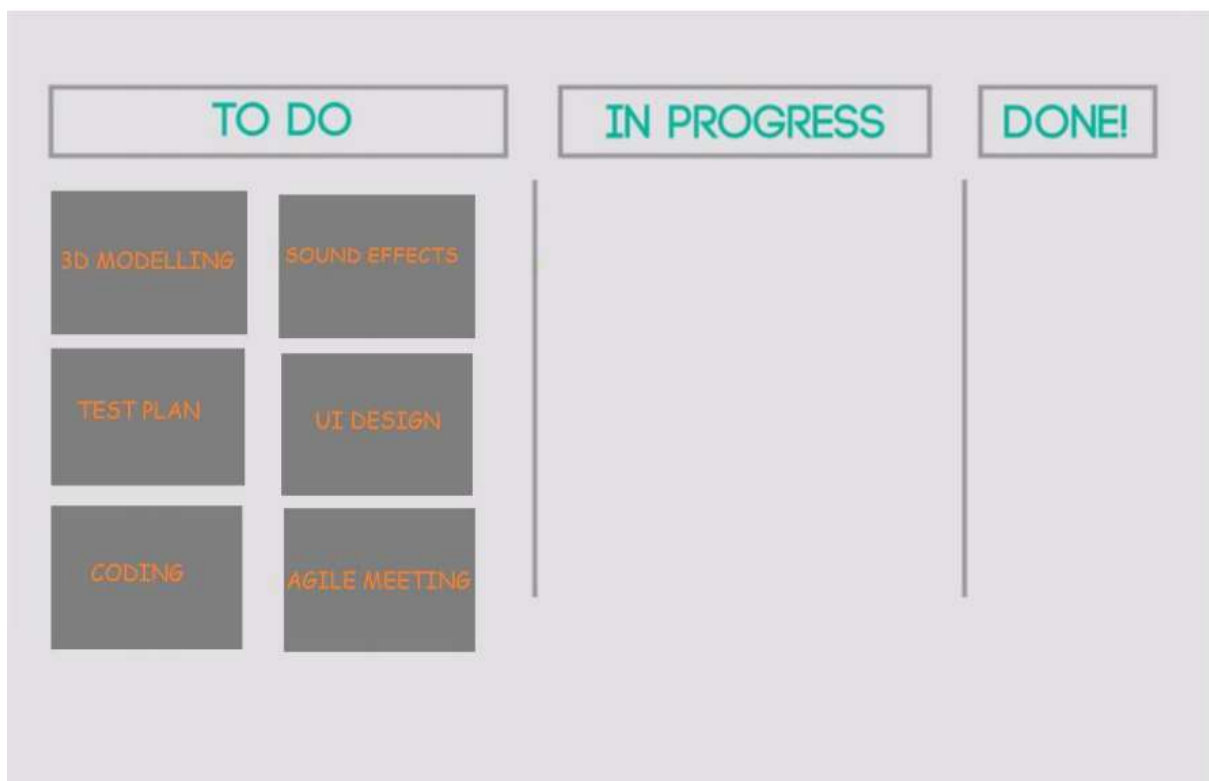

Figure 4: Scrum Board

A scrum board (Fig. 4) was also used to organize and plan tasks in existing sprints. The tasks are written to the cards. Scrum boards are divided into three stages, which can be increased or decreased according to different projects. The stages in the project are "To Do", "In Progress" and "Done" respectively. The "To Do" phase includes the definition of tasks according to their priority and the cards of defined tasks. "In Progress" phase represents the tasks currently being worked on. In the "Done" phase, successfully completed tasks are specified. These specified tasks are mentioned below.

• Game Components Design

• Environment and Believable Agents

• Believability and Behaviours of Agents

• Testing

3.2.2. User Characteristics

3.2.2.1. Player

• Player must have a basic knowledge about VR and its tools' usage.

• Player must not have a heart condition.

• Player should be immune to anxiety and eppilepsy problems which may be caused by loudness and screen change.

• Player must be at least 15 years old or higher.

3.3. Requirements Specification

3.3.1. External Interface Requirements

3.3.1.1. User Interfaces

The user interface will be competible with Virtual Reality Headsets and PC(Windows OS).

3.3.1.2. Hardware Interface Requirements

For HTC Vive;

GPU: Nvidia GeForce GTX 970, AMD Radeon R9 290 equivalent or better. CPU: Intel i5-4590, AMD FX 8350 equivalent or better.

RAM: 4 GB or more.

Video Output: HDMI 1.4, DisplayPort 1.2 or newer.

USB Port: 1x USB 2.0 or better port.

Operating System: Windows 7 SP1, Windows 8.1 or later, Windows 10.

For Oculus;

GPU: Nvidia GeForce GTX 1070, AMD Radeon RX 580 equivalent or better. CPU: Intel i56700, AMD First generation Rizen5 equivalent or better.

RAM: 8 GB or more.

Video Output: HDMI 1.4, DisplayPort 1.2 or newer.

USB Port: 1x USB 2.0 or better port.

Operating System: Windows 10.

3.3.1.3. Software Interfaces

There are no external requirements for software interface.

3.3.1.4. Communications Interfaces

There are no external requirements for communication interfaces.

3.3.2. Functional Requirements

3.3.2.1. Main Menu Use Cases
Use Cases

- Create new game
- Load game
- Open settings
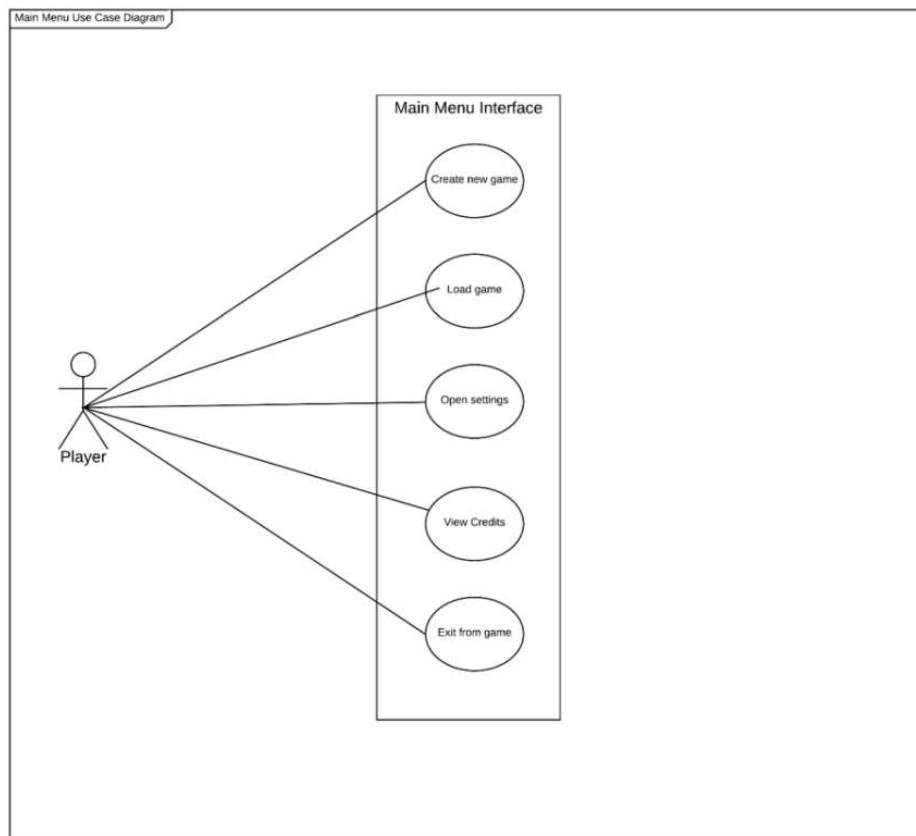- View credits
- Exit from game

Diagram:

Figure 5: Main Menu Use Case Diagram

3.3.2.1.1. Brief Description

The use case diagram of main menu diagram is shown in Figure 3. Player can use the "Create new game", "Load game", "Open settings", "View credits" and "Exit from game" functions in the main menu. As player opens the game, he/she will encounter with the main menu. Player can create a new game by simply pressing the "New Game" button. If a game has already created before, they can load their previous progress via "Load Game" button. Settings

can be changed by pressing the "Settings" button. "Exit" button will close the game and return them to desktop.

3.3.2.1.2. Exemplary Scenario

When the player first opens the game, he will encounter the main menu screen. First, the player makes the desired changes by entering the settings menu. If the player is going to play the game for the first time, it starts a new game. The player encounters the loading screen. After the loading screen, the game begins. The player interacts with various objects in the game and tries to understand the story set in the game. Player makes investigations to solve the mystery with respect to the information that player obtained. The player saves the game in order not to lose their progress. To do this, player interacts with the object specified in the game. After some progress, player quits the game. When player wants to play the game again, player loads the game file that saved before. As a result of the information that player has acquired, the player reveals the creatures hidden in the museum. Exposed creatures take their place in the exhibition.

3.3.2.2. Settings Window Use Cases
Use Cases

- Video Settings
  1. Change shadow preferences
  2. Change resolution preferences
  3. Change graphics quality

- Audio Settings
  1. Adjust master volume
  2. Adjust environment volume
  3. Adjust music volume

- Apply changed settings
- Confirm changed settings
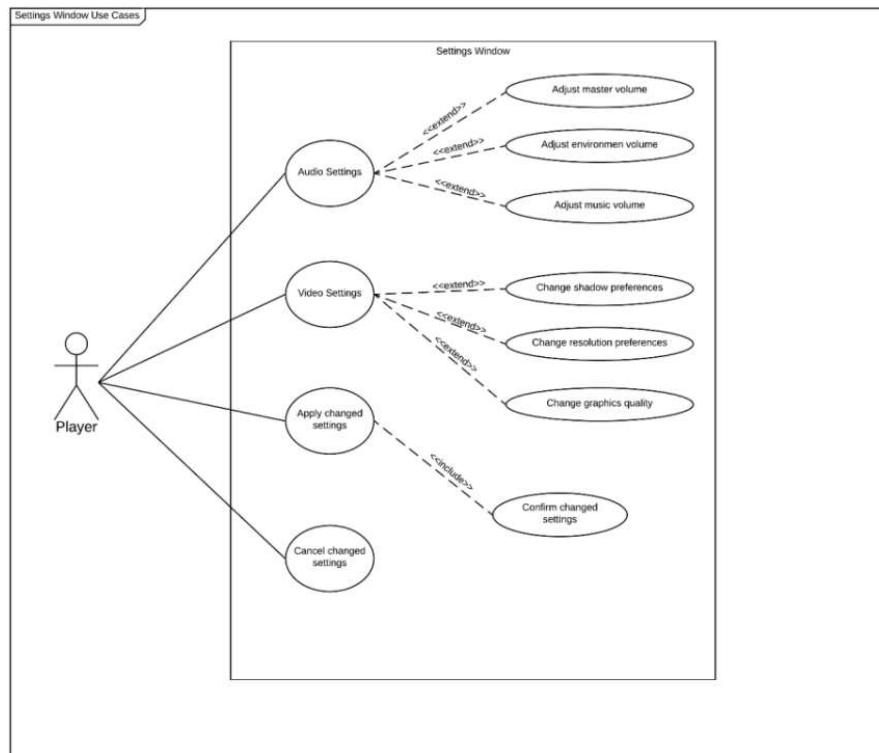- Cancel changed settings

Diagram:

Figure 6: Settings Window Use Case Diagram

3.3.2.2.1. Brief Description

The use case diagram of settings window is shown in Figure 6. Player can change the "Audio Settings", "Video Settings" in different tabs respectively. In audio settings tab users are allowed to change different volume settings. "Adjust master volume" function can be used for changing overall volume level of the game by shifting along the volume slider. "Adjust environment volume" function can be used for changing only environmental sounds. "Adjust music volume" function can be used for changing background music of the game. In video settings tab users are allowed to change video settings. "Change shadow preferences" setting is used to change the shadow quality with three options of low, medium and high, also users are able to switch off/on the shadow feature. "Change resolution preferences" setting ables players to run the game on different screen resolution sizes. There are options available gathered from worldwide statistics. In that manner, "1920x1080", "1366x768", "1280x800", "1440x900", "1280x1024", "1600x900", "1024x768", "1680x1050" and "1920x1200" resolution sizes are available. "Change graphics quality" setting ables player to choose desired graphics quality among 3 options low, medium and high. Graphics quality changes scales the shaders, texture 10 quality, particle animations, reflections automatically. There is no option to change them one by one.

3.3.2.3. In-game Use Cases
Use Cases

• Move along environment

• Interact with objects

• Interact with NPC's

    i) View dialogue options

    ii) Choose response

    iii) End dialogue

• Open in-game menu

    i) Resume the game

    ii) Open settings window

    iii) Return to main menu

    iv) Exit to desktop

• Open inventory

    i) View collected items

    ii) Use collected items

    iii) Close inventory

• Open progress diary
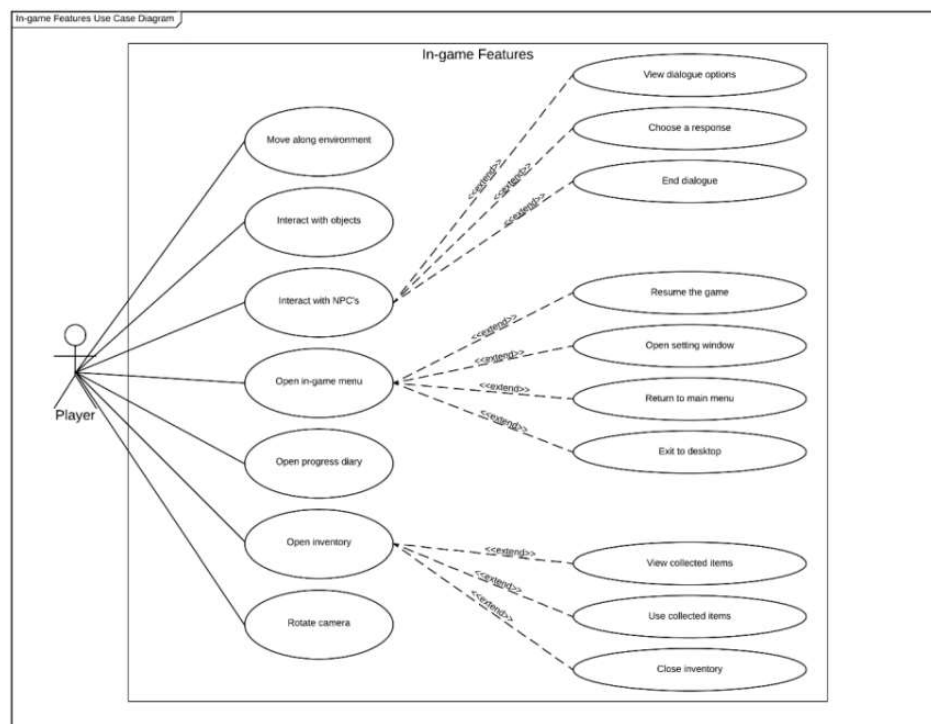
• Rotate camera

Figure 7: In-game Features Use Case Diagram

3.3.2.3.1. Brief Description

The use case diagram of in-game features is shown in Figure 7. Players are able to experience in-game mechanics like "Move along environment", "Interact with objects",

"Interact with NPC's", "Open in-game menu", "Open progress diary", "Open inventory" and "Rotate camera". "Move along environment" feature provides the walking function and ables players to move around the corridors of the museum. "Interact with objects" feature is used to make interactions with objects inside the museum. For example, reading a tablet, inspecting an exhibition and picking up items. "Interact with NPC's" feature ables player to interact with NPC's inside the museum, in our case, believable agents. Interacting with agents gives player the opportunity to talk with agents by "View dialogue options" feature. They can use the "Choose a response" feature to reply in the dialogue. If players want to end the dialogue they can use the option "End Dialogue". "Open in-game menu" feature can be accessed by pressing the pre-defined button on the VR controller. In in-game menu, there are 4 options to choose. "Resume the game" feature takes player back to game. "Open settings window" feature ables player to change settings while in-game. It simply opens up the settings window that we mentioned in part 3.3.2 Settings Window Use Cases. "Return to main menu" feature ables player to return to main menu that we mentioned in part 3.3.1 Main Menu Use Cases. "Exit to desktop" feature closes the game and takes player back to their desktop. "Open progress diary" feature is used to view progression in the game. It includes some information like unlocked monsters, their drawings, stories. Information will be blurred if player has not 12 discovered the information in the museum. "Open inventory" feature is used for viewing collected items and using them. Items collected inside the museum will be stored in the player's inventory. Player can close the inventory with "Close inventory" feature by pressing pre-defined controller button. "Rotate camera" feature ables player to look around to environment by rotating their head while VR headtset is on.

3.3.3. Performance Requirements
The virtual museum will be created by using Unity 3D. Therefore, version of Unity 3D 2018 or higher versions must be supported. Operating system must be Windows 10 for Oculus, if you are playing the game with HTC Vive, Windows 7 or higher is required.

3.3.4. Software System Attributes

3.3.4.1. Portability
• The project does not need equipment other than the basic equipment. (mentioned in the document) This situation increases the portability of the project.

• The project to be developed with Unity 3D can be transferred to different platforms. Therefore, it provides advantages for portability to different platforms.

3.3.4.2. Performance
• In this project actions has consequences. The player can not see the consequences of that action before decide.

• The player needs some clues to solve the mystries. These clues cannot be obtained unless specific actions occur.

• The player needs to draw from NPC's behavior

3.3.4.3. Usability

• The project does not include complex hardware components. Thus, the installation and configuration of the project is simple as long as the required system requirements (mentioned in the documentation) are met.

3.3.4.4. Maintainability

• New features, add-ons and improvements can be made for the system with emerging technology. For this reason, object-oriented programming will be used to make changes, minimize maintenance costs and make improvements.

3.3.4.5. Security Requirement

Since the project is done on VR, it contains some requirements. These requirements for the player:

• Should not have epilepsy, heart disease or migraine.

• Must be at least 15 years old.

• Should be mentally strong.

4. SOFTWARE DESIGN DESCRIPTION

4.1. Introduction

4.1.1 Purpose

The aim of the Software Design Development Document is to detail the architectural and system design of the project called the Cultural Museum. The concept of virtual museums enables an experience based on the heritage of different cultures. Folklore, folk tales, decors, myths and motifs are part of cultural heritage [1]. The scope of this project is the treatment of the cultural elements belonging to horror stories of Turkish culture with a virtual museum concept. These characters will come to life with the help of a story set in the virtual museum, and the characters will become more believable and passed to virtual environment by using dramatic elements of a game. Consequently, we revive this rich culture from its forgotten past and to allow people to interact with unique entities from the Turkish culture. In order to realize the project, a detailed research is conducted about the concepts of virtual museums and cultural heritage. The museums were examined by using similar techniques in different areas.

4.1.2. Project Scope

Drawing on the fields of cultural heritage, this project aims to develop a computer game by contextualizing a virtual museum that is populated with virtual believable agents taken from Turkish horror folklore within the current field of game AI. In addition, it ultimately demonstrates how selected characters from Turkish horror folklore could adequately be simulated in a virtual museum that transmits cultural heritage in a digital medium. We are planning to conduct a case-based reasoning approach to simulate virtual agents' roles for exploring cultural heritage. Virtual agents should be able to play different museum-based roles and ultimately interact with other role-based agents and some of which need to engage into interactions with human participants. This study proposes an interactive drama (i.e. a serious game) based-on believable agent in virtual heritage museum.

4.1.3. Glossary

TERMS	DEFINITONS
UML Diagram	UML diagram A diagram represents the structure of an object-oriented software design
Virtual Museum	A collection of digitally recorded images, sound files, text documents, and other data of historical, scientific, or cultural interest that are accessed through electronic media.(Marco Sampaolo, 2017)
Virtual Reality	A high- end user interface that involves real-time simulation and interaction through multiple sensorial channels. (Virtual and Augmented Reality Applications, Lucio Tommaso De Paolis)
NPC (Non-Player Characters)	Virtual agents controlled by the game, that interact with other NPCs, or with Player Characters controlled by humans.(Sabrina Campano ; Nicolas Sabouret, 2009)
Cultural Heritage	Traditional culture and ruled out all sort of things. (R. Kurin Museum International, 2004, UNESCO)
Believable Agents	Constructions that computational models of believable interact. (Thomas and Johnston 1981)
Gannt Chart	The graphical demonstration of project schedule with the end dates, finish dates elements of the project. (Investopedia 2017)
Block Diagram	A diagram that illustrates the relation between components of the system with shapes and lines (BusinessDictionary.com, 2017).

Figure 8: Glossary

4.1.4. Motivation

Literature review had showed that people interested in virtual museums to learn about forgotten culture and feel realistic ambience of a real museum. In this project, we aimed to raise awareness about rich Turkish culture elements.

With the support of Portakal Technology, long forgotten rich Turkish vocal culture will be revived with the virtual museum that created along the needs and lack of things within the socio-cultural area. Advantages of virtual museum experience are listed below:

• Pieces that are too old or restricted can be exhibited through one-to-one models of each piece,

• Creating a fictional ambience to let people to live that moments which are not written but precious along cultural structure,

• Providing a isolated medium for researchers for their personal interests and different research topics,

• Lowering the cost with the help of Virtual Relaity technology, while maintaining impressive experience,

• Give opportunities to learn about folklore and horror stories to next generations,

• Saving from time and cost with the tools and environments that created with simulation,

• Providing a framework to further projects, while being first in the topic.

4.2. Architecture Design

4.2.1. Simulation Design Approach

Agile software methods are the same as their essence, but they are divided into various sub-branches that differ in their processes. A popular one of these arms is the Scrum method (M. John). Scrum is an administrative model with very simple rules at first glance [2].([2] Cohn, M. (2017). Scrum Methodology and Project Management. Mountain Goat Software. Available at: http://www.mountaingoatsoftware.com/agile/scrum Marco Sampaolo, The Educational Technology Journal - Virtual Museums, Mar 27, 2017. (Accessed 23.11.2018)) It is implemented for the management of complex software projects whose requirements are not explicitly specific, open to change. Scrum does not specify the steps to be followed in detail in the project and instead offers a flexible management with a few simple but important rules. Scrum requires teamwork so everyone must act together. It makes the release within time and with the minimal cost. Scrum development methodology divides project development time into parcels and sub-works. In the project development process, sub-works are completed within a certain period of time. These periods are called "sprint". At the end of each sprint, the software product must appear to be available and applicable.

Ideal Scrum team must include Product Owner, Scrum Master, and Development team. Each member has its own tasks. Scrum describes this as a self-organizing and cross-functional team. For large enterprise projects, ideal team size should be 7 people. For smaller projects, team size should be 4 people (Jasper van der Hoek, 2017).

Sprint 1 : Game Components Design	Sprint 2 : Environment and Believable Agents	Sprint 3: Believability and Behaviors of Agents	Sprint 4: Testing
3D Modelling	3D Modelling	Coding	Unit Testing
Coding	Coding	Sound Effects and Animation	Acceptance Testing
Test Plan Documentation	Unit Testing	Unit Testing	System Testing
Acceptance Testing	Acceptance Testing	Acceptance Testing	Project Report
Unit Testing	Presentation & Demo	System Testing	Final Presentation
Deployment	Documentation	Deployment	Demo Preparation
Release	Deployment	Release	Final Release
Agile Retrospective Meeting	Release	Agile Retrospective Meeting	Agile Retrospective Meeting
	Agile Retrospective Meeting		

Figure 9: Sprints of the Project

Sprints are small, iterative, cross-functional and important development cycles of the scrum methodology. Sprints show us which jobs will be finished during the time period created. The entire project process is divided into sprints to provide a short version release. The structure of the sprints are intended to minimize errors in the continuation of the project. Unlike traditional methods, the sprint structure is flexible. Because our project is comprehensive and requires a multi-disciplinary study, sprint provides a significant benefit. We planned the sprint design as four sprints as seen in the figure. We took care to keep the tasks distributed to the

sprints at an optimal level throughout the project. As the needs of the project may vary in the ongoing processes, the usage of the traditional method will increase the cost due to changing requirements, so this method is not suitable for the project. However, due to the reasons mentioned above we preferred to use agile methodologies in the project as the agile method minimizes the cost of changing requirements.
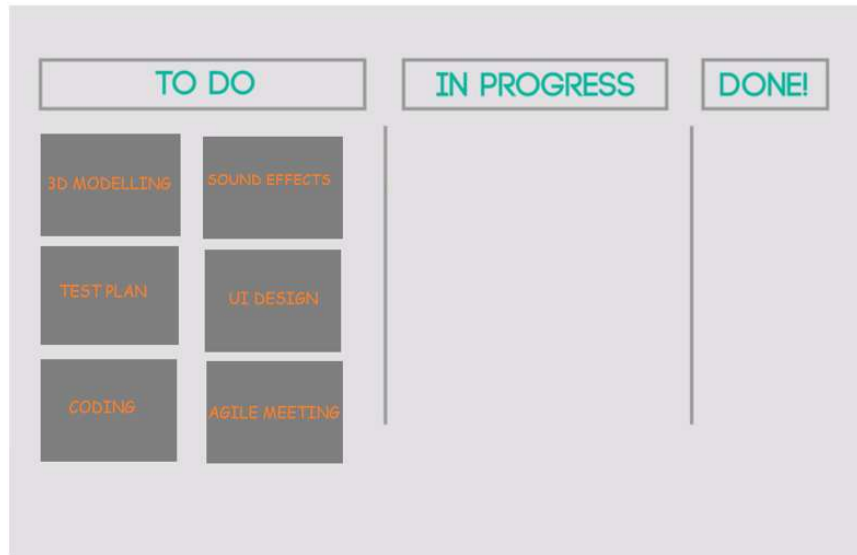

Figure 10: Scrum Board

A scrum board (Fig. 10) was also used to organize and plan tasks in existing sprints. The tasks are written to the cards. Scrum boards are divided into three stages, which can be increased or decreased according to different projects. The stages in the project are "To Do", "In Progress" and "Done" respectively. The "To Do" phase includes the definition of tasks according to their priority and the cards of defined tasks. "In Progress" phase represents the tasks currently being worked on. In the "Done" phase, successfully completed tasks are specified. These specified tasks are mentioned below.

- Game Components Design
- Environment and Believable Agents
- Believability and Behaviors of Agents
- Testing

The Gantt Chart represented in Appendix A shows the time schedule of the project. It consists of two parts. The first part consists of research and documentation. Documentations contains literature review and also preparation of SRS and SDD documents. In addition, the preparation of the project's website is among the works to be done in this section. All the jobs in the first section cover approximately 90 days. The second part deals with the development of the project. It consists of 4 sprints. Each sprint covers a 21-day period. In the Sprints, Scrum development was accepted as the work scheduling method, and at the end of each sprint a period of time was used for the test.
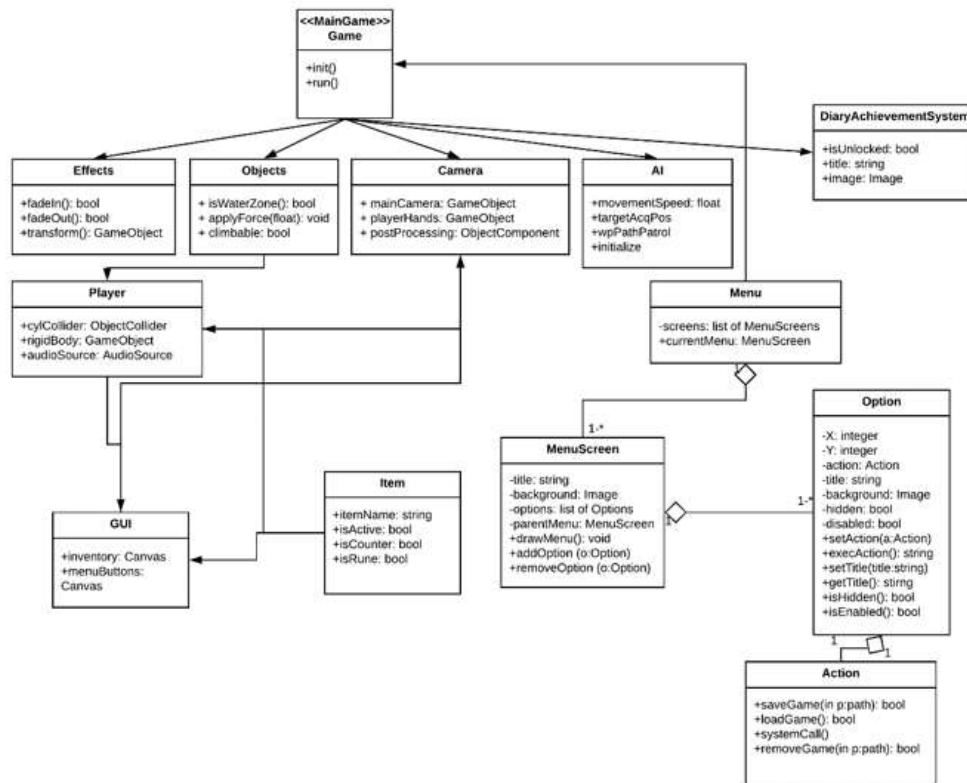
4.2.1.1. Class Diagram

Figure 11: Class Diagram

UML diagrams are a standard method for modelling and planning the system's software. Figure 3 above shows the UML diagram for Museum Corvus. The "MainGame" class is the main class that involves all systems. It has a direct connection to all other subsystems. "MainGame" class includes "Effects", "Objects", "Camera", "AI", and "Diary Achievement System" classes. The main class provides the connection between subclasses. The "Player" class represents users who use the system and it holds FPS player object that contains player and movement related components, such as the player's capsule collider, rigidbody, and an audio source for sound effects like walking, player voices. The "Objects" class used for water zones and climbable objects and all apply forces or affect the player's rigidbody velocity. The "Camera" class is used for FPS Camera object and its parent to all cameras used by the scene, including the main camera and the hand camera which is used for rendering hands on 2D canvas on the top of the main scene. The "AI" class is used for the script controls most of the NPC's behavior including movement speed, target aquisition, waypoint path patrolling, initialization and character animation. The "Effect" class holds several scripts which includes visual effects such as fade in and fade out or even transform. The "GUI" class is used for to display certain things to player such as inventory, main menu, diary progress panel. The "Item" class contains objects that gathered through game which may need to use further encounters. The "DiaryAchievementSystem" is used for track the progress of the player and make player drive through game for unique challanges. The "Menu" class holds the all menu related components of the game and it contains both main menu aspects and options tabs. The system performs a

QTE between the player and the monster. If the player succeeds, the monster diary updates and the game continues with the next stage.

4.2.2. Architecture Design of Simulation
4.2.2.1. Progress Tracking

Summary: This game system can be used to keep track of the early achieved progresses. The player can access this system using an in-game item which is a diary.

Actor: Player

Precondition: The game must be started.

Basic Sequence:

     I.   Player opens the diary.
     II.   Player encounters with a screen full of information about the monsters in the game.
     III.   Player perceives the undergoing progress from the screen.

4.2.2.2. Settings Menu

Summary : This system is used to make changes about the game. Player can use this menu to see and use alternative choices about in-game settings including audio and graphics etc.

Actor: Player

Precondition: The game must be in a running state.

Basic Sequence:

     I.   Player opens the settings menu using the button or the defined hotkey.
     II.   Player encounters with a settings screen with panels dividing sections and buttons to change default settings.
     III.   After making the changes, player must use Apply button to carry the new settings into effect.
     IV.   Player presses Confirm button to exit the settings menu. If player does not apply the new changes, player exits the menu without changing the properties.

4.2.2.3. Game Page

Summary: This system covers all the playable parts. Player advances while making decisions and taking actions inside the story and tries to reach to the end.

Actor: Player

Precondition: The game must be in a running state.

Basic Sequence:

     I.   Player spawns in a pre-defined location.
     II.   Player can walk inside the environment freely and encounter & interact with NPC's.

III. The game makes player to make choices.
IV. Story differs and evolves with each given choice.
V. Player follows the story and solves the challanges to get to the end of the story.
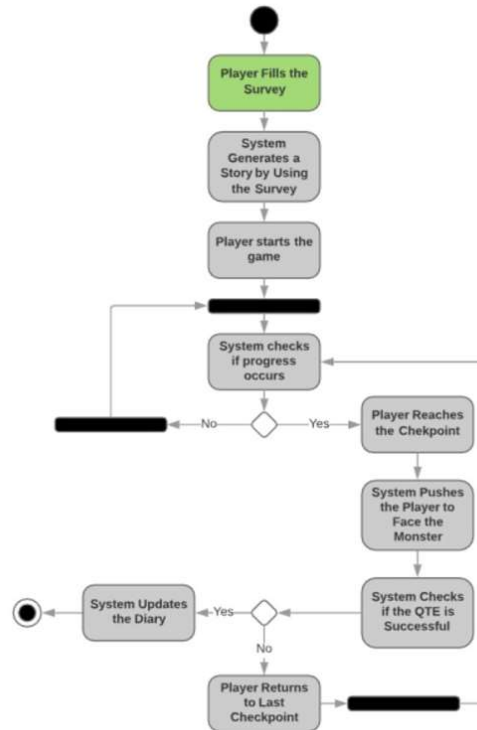

Figure 12: Activity Diagram

The activity diagram in the Figure 12 indicates working system of the overall system. First, player should answer the questions of survey. The system then adjusts the story according to the answers given by the player. The player starts the game and encounters the NPCs set by the system and tries to find a useful tip. The player makes an event by using hints, and the user accesses a checkpoint if the event is considered valuable by the system. Then the system encounters the player with monsters.
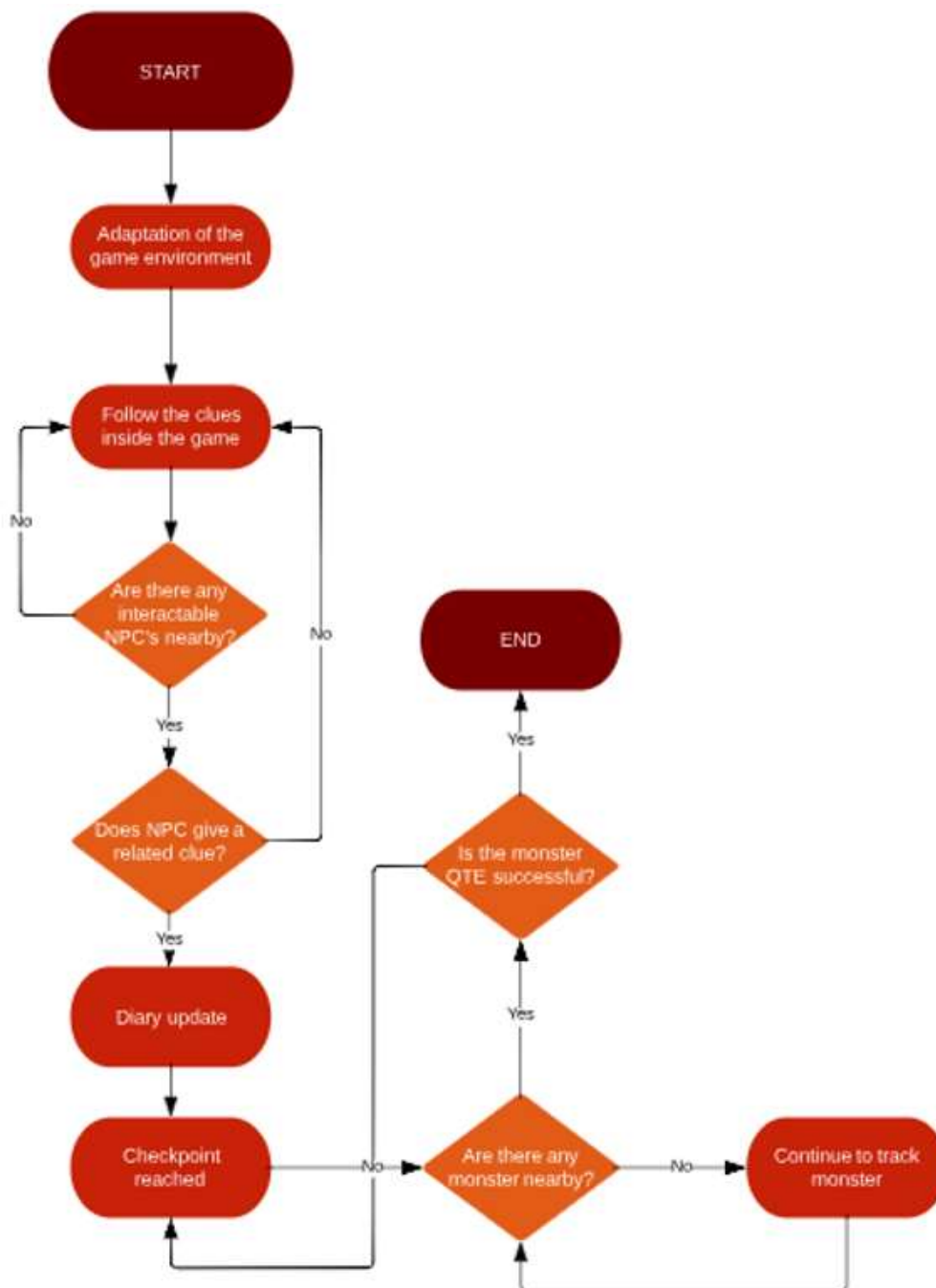
4.2.2.4. Flow Chart

Figure 13: Flow Chart

In the Figure 13, flow of the game is illustrated with flowchart according to view of the player.
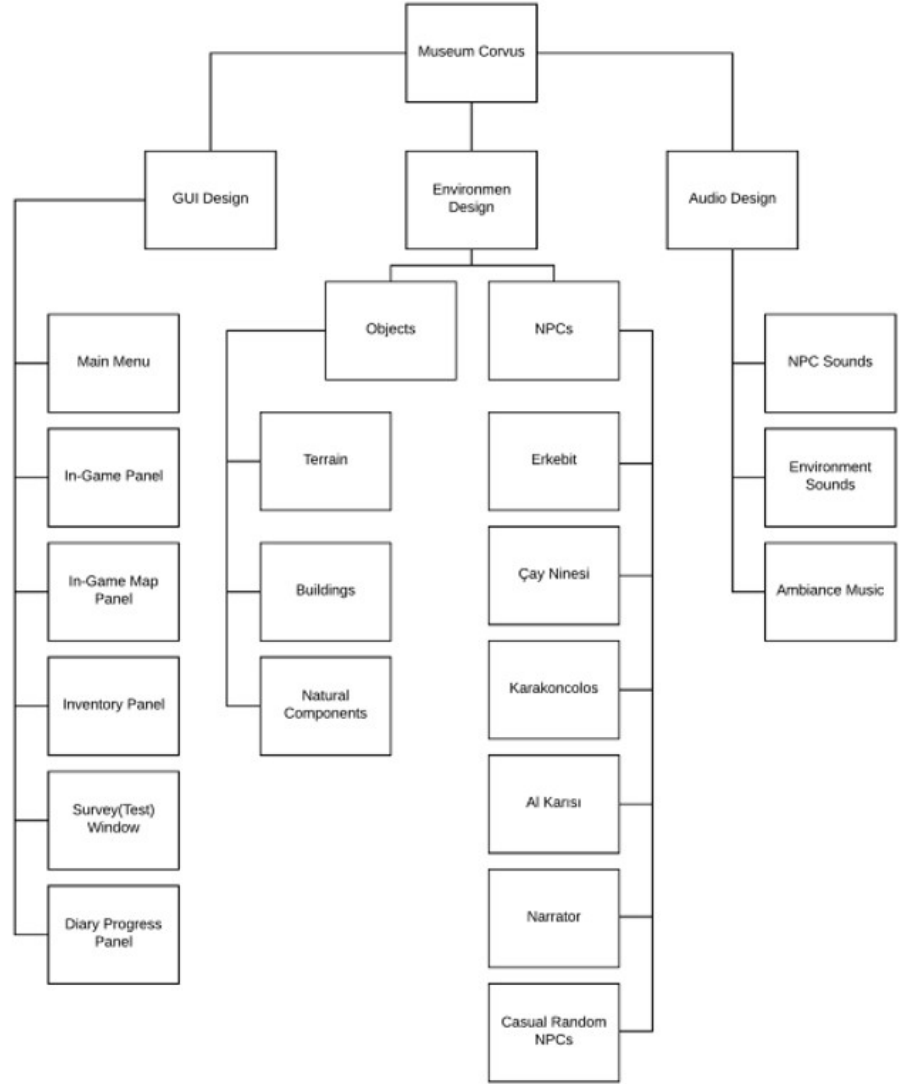
Figure 14: Components of the Museum

4.3.1. Components of Museum

In the figure 14, designed components of the museum is demonstrated with a block diagram. The system consists of three main components, and each component has own sub-system.

4.3.1.1. GUI Design

GUI design provides interaction between the player and the system. It comprises main menu, In-Game Map Panel, Inventory Panel, Diary Progress Panel and Survey(Test) Window. First of all, the player encounters with main menu which is the start page of the system. In addition, players are able to change the default settings from the options menu. At the beginning of the game player encounters with a survey. Survey need to be filled by player in order to determine player's psychology. Game starts as player finish the survey. Inside the game, there is an in-game panel which contains the inventory, map and diary progress panels. Inventory panel holds the items that player gathered throughout the game. In-game map panel shows

player the game's map. Diary progress panel holds the information about current progress of the player.

4.3.1.2. Environment Design

The game will contain different environment such as main story terrain and the museum lobby section. Main story will be experienced in the main map and player will interact with narrator and statues inside the museum lobby. The environments will contain non-player characters and object such as little girl as first encounter, villages, rivers, Erkebit, Çay Ninesi, Karakoncolos, Al Karısı etc.

4.3.1.3. Sound Design

Sound design gives the game it's reality closeness as player needs to experience a unique living environment. According to main story, related sounds such as wind, fire, ambiance music, voice actings etc.

4.4. Environment

4.4.1. Modelling Environment

This project will be developed by using Unity3D and its tools. In order to model realistic environment we will be using Autodesk Maya 2018 and Zbrush. Also project will contain some free assets from Unity's Asset Store in order to develop the game faster.

Figure 15: Screenshot from the Game

In the project, plan is to design different environments for the main story and museum lobby. One map will contain different themes for each horror character (Erkebit, Çay Ninesi, Karakoncolos, Al Karısı) and these environmental aspects will give the immersive historical experience about the myth and folk tales.

5. CONCLUSION

The project titled as "Digital Storytelling on a Virtual Heritage Museum with Believable Agents" is explained in detail. At the end of the project, a virtual museum, in which a story based on the Turkish horror culture is committed, will be revealed. Our aim is to advertise Turkish culture, and by using believable agent concept is to provide realism.

This project aims to design a virtual museum based on elements of Turkish horror culture by using virtual reality,believable agents and storytelling techniques. The aim is to provide a solution to the problems of computer engineering, with the help of storytelling approaches to be a reminder to the forgotten Turkish horror culture. Virtual reality addresses a wide area and this field is continuously gaining popularity (Okita, 2004). With the addition of many innovations and creativity elements, it can easily reach the masses that it cannot reach before. Virtual museums support the development of virtual reality (Ö. Türk, 2016); It includes many new technology elements and unique experiences. It is possible to observe many concepts in culture, technology and simulation studies in virtual museums. The concept of realism is very important in reflecting the culture (White, 2018); Therefore, in our project, a form of artificial intelligence called "believable agents" is used. In this way, the culture introduced to people will be transferred more efficiently. While our project offers a unique experience, it offers a more efficient way of transferring our forgotten culture. We do not only want to use this virtual museum project, but also with to provide an framework for future virtual museum projects.

First and foremost, we have made a comprehensive literature research. Throughout our research on literature we have seen that there were not similar projects based on specific aspects that we mentioned in this document. Projects that far similar were mostly replicas of actual museums implemented in a virtual world.

After the literature research has done, we discussed and specified the requirements of the project. According to requirements, software requirements specification (SRS) has prepared. Then, software software design document (SDD) has prepared, and the design of the project has explained in the SDD.

The project will be developed with Unity3D as a VR game. Therefore, the project will provide effective visual for the users, and users can be able to have an immersive experience of the living environment in the game. At the end of the game, it is aimed to improve our heritage awareness of Turkish horror culture.

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