

# CMPE 491

## Senior Project 1



### **“VR Project Blue” (VR Video Game)**

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# 1. Introduction

The description discusses the concept of serious games and their purpose in education, healthcare, and other fields. It then explains the benefits of VR technology in providing an immersive and interactive learning experience. The combination of serious game content with VR technology is believed to create a unique and effective learning solution, with potential applications in education and training. The article concludes by emphasizing the enormous potential of VR in the field of education.

There are some constraints about the implementation, hardware, software, health and safety, and ethical constraints for a VR serious game we will develop. The project will be managed through Github and Jira, and the game will be optimized for Steam VR Valve Index. Players need an HTC Vive, Oculus Rift, or Windows Mixed Reality glasses and up-to-date hardware. Health and safety concerns include motion sickness and risks associated with detachment from the real world. Ethical concerns include avoiding perpetuating biases and ensuring transparency about learning outcomes.

VR Project Blue will be conducted in accordance with laws, regulations and professional ethics. In addition, the project gives importance to the physical and mental health of the users. The project does not contain any elements that can create negative examples or trauma in any way. VR Project Blue cares that education is equal for all. In this context, the project provides equal benefits to everyone, regardless of gender or race, in education.

The user requirements for the VR serious game include providing an engaging and visually appealing experience for secondary education students, aligned with the computer science curriculum, with adaptive difficulty to cater to different levels of knowledge. The system requirements focus on compatibility with a range of VR hardware and minimal latency for a smooth experience. The technical requirements include using the Unity game engine with C# scripting language, interactive 3D models to demonstrate computer science concepts, and audio elements for an immersive experience. These requirements aim to create an effective and innovative learning solution using VR technology combined with serious game content.

## 1.1. Description

In our VR PROJECT BLUE project, we are planning to develop a serious game using VR technology. We aim to demonstrate the power of VR and how useful a product can be when serious games are combined with VR technology. Firstly, we will explain what a serious game is and its purpose, and then we will provide information about VR technology.

Serious games are games designed with a primary purpose other than entertainment. They are designed to educate, train, or inform players on a particular topic or subject matter. Serious games can be used for a variety of purposes, including education, healthcare, military training, and even marketing. One of the benefits of serious games is that they can make learning more engaging and interactive. Serious games can help learners develop critical thinking skills, and problem-solving skills, and improve their ability to retain information. For example, a serious game designed for healthcare professionals might simulate real-life situations to help them develop their clinical decision-making skills. Serious games can also be used for therapeutic purposes. They can help individuals learn to manage anxiety, stress, and other mental health issues. Serious games can be designed to help individuals with specific conditions, such as autism, develop social skills and improve communication. We believe that by combining the benefits of serious games with VR technology, we can create a truly unique game.

There are first serious games:

TABLE 1: Milestones in the history of serious games.

Year	Serious game	Application
1970	Serious Games book by C. Abt	Academic book
1972	Magnavox Odyssey	Education
1973	The Oregon Trail	Education
1980	BattleZone	Training
1981	The Bradley Trainer	Training
1982/1983	Pole Position/Atari VCS 2600 console	Training
1996	Marine Doom	Military
2002	America's Army	Military
2003	DARWARS	Military
2005	VBS1	Military
2006	BiLAT	Interpersonal communication
2009	VBS2/Game After Ambush	Military
2012	X-Plane 10	Training

As you can see, most of the games in this genre are military-themed, but we want to create a more educational game. Our goal is to develop a serious game that utilizes VR technology to provide a unique and engaging learning experience.

Virtual Reality (VR) is a simulated experience that can be like or completely different from the real world. It allows the user to interact with a three-dimensional environment that is generated by a computer. VR can be experienced through a variety of devices, such as head-mounted displays, motion-sensing gloves, and handheld controllers. In addition to gaming, VR has a wide range of applications in other fields such as education, training, and healthcare. For example, in education, VR can be used to provide students with a more immersive and interactive learning experience. Students can explore historical landmarks, interact with scientific simulations, and experience simulations of complex systems. In the field of training, VR can be used to simulate dangerous or high-risk scenarios, such as firefighting or military training. By using VR, trainees can experience these scenarios in a safe and controlled environment without the risk of injury or death.

“Engage's platform is used by the likes of Facebook, HTC, and the European Commission to enable remote learning, and one study published in 2019 found that medical students trained using VR were able to carry out certain procedures more quickly and accurately than peers trained using traditional methods. VR is already making great inroads into education, with a large number of startups and established companies offering packaged experiences and services aimed at schools (Greenburg, 2018).”As mentioned in the Forbes article, VR (Virtual Reality) is a big door in the field of education, and we firmly believe that by combining it with serious game content, we can create a unique experience. By combining the power of VR technology with serious game content, we believe we can create a unique educational experience. This combination allows for a more immersive and interactive way of learning, enabling users to better understand and retain information. The potential for VR in the field of education is enormous, and by leveraging the benefits of serious game design, we can create truly innovative and effective learning solutions.

## 1.2. Constraints

### 1.2.1. Implementation Constraints

- Github and Jira will be used for project management, monitoring and working together. Task distributions and task tracking will be managed via Jira, code shares and joint project file will be managed via github.
- For the project to be developed with Unity Game Engine, C# development will be done in Rider IDE and Unity's own libraries will be used.
- Non-copyrighted models and sounds will be used for assets to be used in the game. We will also use our own developed assets.
- The game will be optimized to be played on Steam VR Valve Index.

### 1.2.2. Hardware Constraints

- The game requires one of HTC Vive, Oculus Rift or Windows Mixed Reality virtual reality glasses and a computer with up-to-date hardware in order to play the game.

### 1.2.3. Software Constraints

- Since the game will be developed to be played through Steam VR, a computer with Windows 7 SP1, Windows 8.1, Windows 10 or newer operating system is required. You must also have Steam and Steam VR installed.

### 1.2.4. Health and Safety Constraints

- One of the most significant challenges is the potential for motion sickness, which can result from the disconnect between the player's visual and physical experiences. Other potential risks include tripping or colliding with objects in the real world, eye strain or fatigue from prolonged use, and neck and back strain from prolonged periods of standing or sitting in one position.
- In addition, since the player will be detached from the real world in terms of hearing and vision, it is necessary to be alert in order to be protected from injuries caused by the objects around and to react in possible danger situations.

### 1.2.5. Ethical Constraints

- One of the main concerns is the potential for these games to perpetuate biases or stereotypes that could have real-world consequences. Additionally, VR serious games used for education must be transparent about the learning outcomes and not misrepresent the skills or knowledge that students will gain. It's also important for developers to ensure that the game does not become a substitute for real-world training or interactions, and that the limitations of VR technology are clearly communicated to users. All ethical details are explained in detail in item 1.3.

### 1.3. Professional and Ethical Issues

VR Project Blue will be conducted in accordance with laws, regulations, IEEE Code of Ethics and ACM Code of Ethics and Professional Conduct. In this context, the project complies with the Personal Data Protection Authority and the data received from the user will not be used in any way without the consent of the users. VR Project Blue does not contain any negative elements that may threaten the virtual security of users. APIs and software development tools to be used in the project will be licensed.

VR Project Blue cares about the physical and mental health of users. In this direction, the project does not contain any negative elements that may cause trauma to people. Since our project is a serious game for educational purposes, children and young people form a part of the target part of our project. For this reason, there will not be any negative elements in our project that are not suitable for the age of the user. In addition, VR Project Blue will remind users that the virtual world is not real, so as not to damage the users' perception of reality. There will be no negative elements in the project that can harm the users themselves.

VR Project Blue will encourage the user to learn and will not violate the educational ethics. The project will attach importance to equal education for everyone. VR Project Blue will benefit everyone equally, regardless of any ethnicity or gender.

## 2. Requirements

### 2.1. User Requirements

**Engaging experience:** The VR serious game shall provide a compelling and engaging experience for students aged 14-18, designed to be immersive, interactive, and visually appealing to keep students engaged and motivated to learn.

**Aligned with curriculum:** The VR serious game shall include content that aligns with the computer science curriculum for secondary education, covering topics such as programming concepts, web development, databases, and networking.

**Adaptive difficulty:** The VR serious game shall provide a challenging yet achievable learning experience for students of different skill levels, with the game being designed to cater to students with different levels of computer science knowledge.

### 2.2. System Requirements

**Hardware compatibility:** The VR serious game shall be compatible with a range of VR hardware, including headsets and motion controllers, to ensure that students can use the hardware they have access to.

**Desktop compatibility:** The VR serious game shall be able to run on mid-range desktop computers, to ensure that students can play the game without requiring expensive hardware.

**Minimal latency:** The VR serious game shall have minimal latency to avoid motion sickness in users, with the VR experience being smooth and responsive.

**Network connectivity:** The VR serious game shall have network connectivity to allow for multiplayer and collaborative features.

### 2.3. Technical Requirements

**Unity game engine:** The VR serious game shall be developed using the Unity game engine, a reliable and widely used game engine that can handle the 3D graphics and interactions needed for the game.

**C# scripting:** The VR serious game shall use a C# scripting language for programming, a popular and easy-to-learn language that is widely used in game development.

**Interactive 3D models:** The VR serious game shall include interactive 3D models to demonstrate computer science concepts, such as algorithms and data structures, to help students visualize and understand these concepts.

**Audio:** The VR serious game shall include audio elements to enhance the immersive experience for students, such as background music, sound effects, and voiceovers to provide instructions and guidance.



## 2.4. Educational Requirements

**Five computer science topics:** The VR serious game shall include at least five different computer science topics that are commonly taught in secondary education, such as programming concepts, web development, and databases.

**Immediate feedback:** The VR serious game shall provide immediate feedback to the student on their performance and progress, so that they can identify areas where they need improvement and take corrective action.

**Reinforcement of concepts:** The VR serious game shall be designed to reinforce key computer science concepts and principles, helping students better understand the fundamental concepts and principles of computer science.

## 2.5. Assessment Requirements

**Assessment system:** The VR serious game shall include a system for assessing the student's performance and understanding of the computer science concepts taught in the game, so that students can measure their progress and identify areas that need more work.

**Feedback system:** The assessment system shall provide feedback to the student on their strengths and weaknesses, helping them understand their performance and identify areas where they need to improve.

## 2.6. Game Design Requirements

**Intuitive user interface:** The VR serious game shall have an intuitive user interface that is easy to use and understand, with clear instructions and a simple menu system.

**Realistic environments:** The VR serious game shall use realistic environments and objects to create an immersive experience for students, with detailed and accurate representations of computer science concepts.

**Interactive gameplay:** The VR serious game shall provide interactive gameplay elements, such as puzzles, challenges, and simulations, to engage students and promote learning.

**Storyline:** The VR serious game shall have a storyline that ties the different computer science concepts together into a cohesive narrative, providing context and motivation for the student to learn.

### 3. References

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