

# Immersive Quiz for Spanish Learners

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# Immersive Quiz for Spanish Learners

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We recommend acceptance of this manuscript in partial fulfillment of this candidate's requirements for the degree of Master of Software Engineering in Computer Science. The candidate has completed the oral examination requirement of the capstone project for the degree.

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# Abstract

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This manuscript describes the development of a quiz creation tool combined with a virtual reality component to provide an immersive quiz taking experience for Spanish learners. The quizzes also have an orienteering course aspect as well, where each quiz is comprised of multiple timed locations where all questions must be completed correctly before continuing onto the next location.

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# Glossary

## **ANTLR**

ANother Tool for Language Recognition. Successor to the Purdue Compiler Construction Tool Set (PCCTS). Currently maintained by Terence Parr.

## **BYACC/J**

An extension of the Berkeley YACC-compatible parser generator. Can generate both C/C++ and Java parsers.

## **CUP**

Constructor of Useful Parsers. A LALR parser generator written in Java.

## **IEEE**

Institute of Electrical and Electronics Engineering. The world's largest professional association dedicated to advancing technological innovation and excellence for the benefit of humanity.

## **JFlex**

A scanner generator for Java.

## **LALR**

Look-Ahead Left to Right. LALR parsing algorithm, introduced by Frank DeRemer, provides the same high performance of LR parsing algorithm, introduced by Donald Knuth, but is more efficient in term of size.

## **LaTeX**

LaTeX is a document markup language and document preparation systems for the TeX typesetting program.

## **SUT**

System Under Test. This term refers to a system being tested for correct operation.



# 1. Introduction

## 1.1. Overview

The rise of globalism has prompted people of different cultures to increasingly work together and interact with one another. Thus, understanding other cultures and languages will become ever more important. Often times this can be hard to teach, especially in a classroom. Virtual reality can be used as a means to bridge the gap between real-world understanding and classroom knowledge. Virtual reality allows for a more immersive experience. A more immersive experience is a more effective way to engage students and promote learning.

In 2017-2018 there was an initial virtual reality project conducted by Claire Mitchell to take tours of Medellin, Colombia. This project was a success and discussions were made to expand on this initial success. In 2019, there was a grant proposal for development of a new project to further enhance experiential learning. As virtual reality is a vanguard area of development such resources don't exist yet and would require new development. The proposal also requested an orienteering component to be included. Orienteering is an activity where participants "navigate between checkpoints along an unfamiliar course" [1]. The primary purpose of adding an orienteering aspect is to add to the depth of cultural understanding, as orienteering requires the participants to have a more active role in the experience.

## **2. Requirements**

### **2.1. Overview**

The following section is on the requirements of the project and development methodology.

### **2.2. Development Methodology**

The stakeholders for this project is the project owner and sponsor, project advisor, and developer, Claire Mitchell, Elliot Forbes, and Austin Klum respectively. The end users are the students using the virtual reality tool for their learning and the instructors using the quiz management tool for assessment of student's comprehension of classroom material.

The chosen development methodology for a project is an early and influential decision made that alters the course of development. As this was a solo-developer, web, and virtual reality project with a busy project sponsor, the decision was made to make use of an iterative agile methodology. An iterative agile approach focuses on delivering value to the product in fast small increments, rather than all at once. This approach allows software developers to adjust, refine, and review the development process to better provide value and output. This approach also allows for earlier risk identification and the flexibility to easily correct course.

Traditional methodology follows the waterfall approach which “contains five phases of management, where each requires a deliverable from the previous phase to proceed” [2]. The waterfall method is more suited for projects that follow a linear path and is fixed and rigid. The project did not have this rigidity or clarity of output, hence a more Agile approach was taken. The developer also made use of a KanBan board to help keep organized.

### **2.3. Course Creator**

This tool allows the project sponsor and approved users to create orienteering courses for the students to complete. Each course is comprised of locations which has a corresponding photo to accompany the location. To help with immersion and to best utilize the capabilities of virtual reality, the uploaded photos must be 360 Photos, also known as a photo sphere. This type of photo allows for the virtual reality tool to wrap the image around the user making a sphere, such that the user is able to look around as if they were really at that location. The tool also allows for locations to be added, updated, or deleted. Each location has a list of questions. There is no limit to the number of questions per location. The tool allows for each question to be added, updated, or deleted. Each question has a list of answers which can be of one to six possibilities. The tool allows for each answer to be added, updated, or deleted.

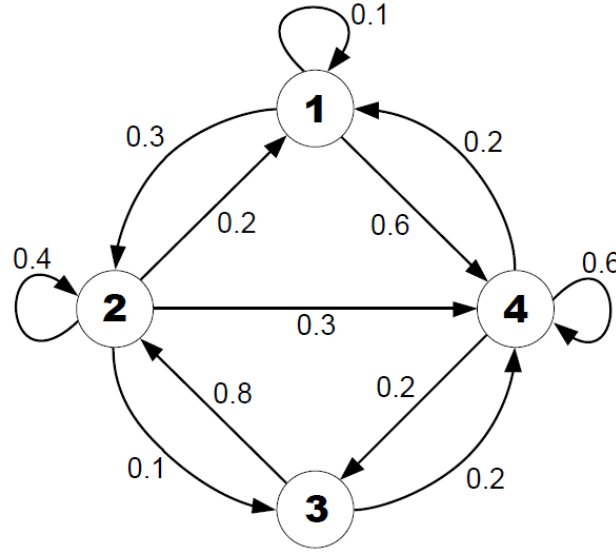
Once a course has been completed by a student, an approved user can view the results from the course main dashboard. This dashboard lists the student ID, point score, time score, and total score. As security is important, the database is encrypted and requires an authorized administrator database account to access the data outside of the tool.

For a user to be created, they must create an account with an email and password. Once

the account is created, the user is immediately able to login, but will be unable to access any of the course creation or course results pages, limited only to the homepage and user settings. Each approved user has the capability to approve other users. In the user settings page, there exists a link to approve users. The approve users page list all users and their status of approved or not approved. From here an approved user can approve or un-approve other users by selecting the corresponding checkbox and saving.

### 2.3.1. Users

Figure 1 explains the use case diagram.



**Figure 1.** Course Creator Use Case Diagram

### 2.3.2. Create Course Flow

This section will include photos and written steps on how to use the course creator.

## 2.4. Virtual Reality Orienteering

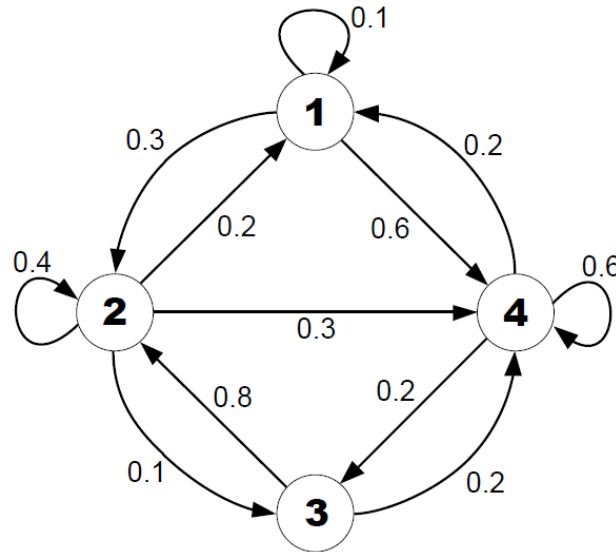
This tool is used by the students to complete the created orienteering courses that the project sponsor or approved user(s) created. Upon starting the program the user is prompted to enter their student ID using a "mallet" and tap virtual keyboard. Once the student has entered their student ID, they then select the course via a select list with a point and trigger arrow pointers buttons. After hitting the start button the student begins the course. The first location is loaded up and the student can look around the location. Upon touching the touch pad the first question and corresponding possible answers appears in the world view. As part of the orienteering spirit each question must be answered correctly to continue on to the next question. When a student answers incorrectly the button turns red and is disabled. When answered correctly the button flashes green and the next question and corresponding

possible answers load. The student is graded on how quickly they came to the correct answer and, with the orienteering aspect in mind, the time to completely answer all the questions in a location. Each question is worth one point and each location time is worth one point. The score point is awarded divided by the number of attempts. This means that a question with four possible answers the following outcomes are possible: answered correctly has one point awarded, one incorrect attempt has .75 points awarded, two incorrect attempts has .5 points awarded, and three incorrect attempts has .25 points awarded. For the time aspect of the grade, the student has 100 seconds to complete the location, where each second is worth .01 points. This means if the student took 30 seconds to answer the questions and complete the location, they are awarded with .70 points. A time of 45 seconds is awarded .65 points.

Upon answering all the questions for a location, the next location is loaded and the timer is reset. Once all locations have been completed a game over screen appears stating the student's point score, time score, total score, and what the maximum points awarded could be.

#### 2.4.1. Users

Figure 2 explains the use case diagram.



**Figure 2.** Virtual Reality Orienteering Use Case Diagram

#### 2.4.2. Virtual Reality Orienteering Flow

This section will include photos and written steps on the experience of the student completing a course.

## **3. Design**

### **3.1. Overview**

This section discusses the design of the project including technologies used, classes, database schema, and user interface.

### **3.2. Technologies**

This project uses a combination of ASP.NET Core MVC and Unity Virtual Reality. The Course Creator was developed with the former and the Virtual Reality Orienteering was developed with the latter. ASP.NET Core MVC “is a lightweight, open source, highly testable presentation framework optimized for use with ASP.NET Core.” [3] ASP.NET Core is the underlying framework that enables development. ASP.NET Core “is a cross-platform, high-performance, open-source framework for building modern, cloud-enabled, Internet-connected apps.” [4].

The MVC in ASP.NET Core MVC stands for Model-View-Controller. MVC is an architectural pattern which separates an application into three main components: Models, Views, and Controllers. This separation helps achieve a “separation of concerns”, which asserts “that software should be separated based on the kinds of work it performs” [5]. Models represent the data structure, independent of the user interface. It’s responsible for data, logic, and rules of the application. Views represent the user interface and information. Views are responsible for presenting content with minimal logic. Controllers represent the logic and actions for models and views. Controllers are responsible for responding to user input and performing operations. In summary, models are what it is, views are for what it looks like, and controllers are for how it behaves.

### **3.3. Point 2**

This gives Point 2

## **4. Testing**

### **4.1. Overview**

This gives a brief overview of this section.

### **4.2. Point 1**

This subsection gives a great deal of precise description supporting point 1. For example,

### **4.3. Point 2**

This gives Point 2

### **4.4. Point 3**

This gives Point 3

## **5. Conclusion**

### **5.1. Overview**

This gives a brief overview of this section.

### **5.2. Point 1**

This subsection gives a great deal of precise description supporting point 1. For example,

### **5.3. Point 2**

This gives Point 2

An article [6]  
A book [7]  
A series [8]  
Someone's thesis [9]  
Some technical report [10]  
A collection [11]  
Visited website [12]  
Accepted for publication [13]  
Submitted for publication [14]  
Not published [15]  
Conversation [16]



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