Virtual Online Shopping

CS39440 Major Project Report

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Declaration of originality

I confirm that:

* This submission is my own work, except where clearly indicated.
* I understand that there are severe penalties for Unacceptable Academic Practice, which can lead to loss of marks or even the withholding of a degree.
* I have read the regulations on Unacceptable Academic Practice from the University’s Academic Registry (AR) and the relevant sections of the current Student Handbook of the Department of Computer Science.
* In submitting this work, I understand and agree to abide by the University’s regulations governing these issues.

Name …………………………………………

Date ……………………………………………

Consent to share this work

By including my name below, I hereby agree to this project's report and technical work being made available to other students and academic staff of the Aberystwyth Computer Science Department.

Name …………………………………………

Date ……………………………………………

Acknowledgements

I am grateful to a lot of people, starting with the staff at Aberystwyth – who have motivated me and let me achieve my potential as a programmer. I also want to say thanks to my friends who have been there through this project – helping me visualise and think through ideas, debug when issues were out of my scope and for dragging me away from my PC when I become hyper focused.

I’d like to thank…

Abstract

**During COVID19, online retail is as strong as ever. I will be exploring the use of Virtual Reality to support both retail stores and customers. The use of real-time simulation of clothing can contribute to this – customers are more likely to buy items if they can examine the goods. This will include identifying the fit and colour of selected clothing items. My aim is to simulate high street shopping but from the comfort of the customer’s home.**

**The data set will be from ASOS, I will be displaying a small selection of clothing items. A feature I will be implementing is a save feature. This will allow the user to take away the outcome of the application to then purchase the items if they so wish on the website.**

**The key features of this application are to have the ability to view clothing items in Virtual Reality. The application is going to be developed with the HTC Vive – though the application will be available on any headset compatible with SteamVR.**

**The application will have a specific area to filter down the clothing choices and an interactive area to view both the clothes and the model. The user can customise the model to match their measurements to see how the clothing looks using sliders. There is also a range of pre-set models to quickly choose from. Pre-sets are based on a range of body types and popular options, such as curvy, petite, and maternity.**

**With this application, I hope to validate Virtual Reality in this use case and produce a functional prototype to promote the use of VR in the retail sector.**

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# Background, Analysis & Process

This section should discuss your preparation for the project, including background reading, your analysis of the problem and the process or method you have followed to help structure your work. It is likely that you will reuse part of your outline project specification, but as you write this report at the end of the project you should have more to discuss.

**Notes**:

* All of the sections and text in this example are for illustration purposes. The main Chapters are a good starting point, but the content and actual sections that you include are likely to be different.
* Look at the document MMP\_SO8 Project Report and Technical Work [7] for additional guidance.

## Background

What was your background preparation for the project? What similar systems did you assess? What was your motivation and interest in this project?

**Both myself and people I know have had bad experiences with ill fitting clothes after ordering online. This could be because of several reasons – limited numbers of photographs, bad quality photos and unnatural poses for the models.**

**During the research phase, I discovered a lot of online clothing retail stores used models as images which don’t accurately represent the fit of an item. According to background research, this concept has been explored before using XR technologies. Companies such as Zara, Topshop and H&M are examples of this.**

**This dates to 2014 when Topshop hosted an exclusive VR fashion show.**

## Analysis

Taking into account the problem and what you learned from the background work, what was your analysis of the problem? How did your analysis help to decompose the problem into the main tasks that you would undertake? Were there alternative approaches? Why did you choose one approach compared to the alternatives?

There should be a clear statement of the objectives of the work, which you will evaluate at the end of the work.

**I will use VR to simulate clothes shopping – using a virtual dressing room. It fits in with the current political climate during this pandemic as people cannot physically visit stores. It will help online shopping as it can simulate the accuracy of trying on clothing items. The aim is to prove that this concept could work and be used by the public at sometime in the future.**

In most cases, the agreed objectives or requirements will be the result of a compromise between what would ideally have been produced and what was determined to be possible in the time available. A discussion of the process of arriving at the final list is usually appropriate.

As mentioned in the lectures, think about possible security issues for the project topic. Whilst these might not be relevant for all projects, do consider if there are relevant for your project. Where there are relevant security issues, discuss how they will this affect the work that you are doing. Carry forward this discussion into relevant areas for design, implementation, and testing.

**There are minor security challenges expected as the application will be offline based, any saved preferences of clothing will be on the local system and the main data pull from the ASOS API must only be done once.**

## Process

You need to describe briefly the life cycle model or research method that you used. You do not need to write about all of the different process models that you are aware of. Focus on the process model that you have used. It is possible that you needed to adapt an existing process model to suit your project; clearly identify what you used and how you adapted it for your needs.

**For the project, I used a Kanban board hosted on GitHub. This will take full advantage of milestones by cross referencing notes from the weekly group meetings, ensuring I hit my minimum weekly goals. Weekly goals are agreed upon and documented in my blog.**

**The blog link is: https://lwilkinson.dev/vosBlog.html**

**In my process, I break down features into multiple components – Research, Implementation, and Testing. After all these parts are committed, then the pull request is closed and merged. When designing new features, I draw them out visually along with alternate designs. These are photographed and added into the project.**

# Design

You should concentrate on the more important aspects of the design. It is essential that an overview is presented before going into detail. As well as describing the design adopted it must also explain what other designs were considered and why they were rejected.

The design should describe what you expected to do and might also explain areas that you had to revise after some investigation.

Typically, for an object-oriented design, the discussion will focus on the choice of objects and classes and the allocation of methods to classes. The use made of reusable components should be described and their source referenced. Particularly important decisions concerning data structures usually affect the architecture of a system and so should be described here.

How much material you include on detailed design and implementation will depend very much on the nature of the project. It should not be padded out. Think about the significant aspects of your system. For example, describe the design of the user interface if it is a critical aspect of your system, or provide detail about methods and data structures that are not trivial. Do not spend time on long lists of trivial items and repetitive descriptions. If in doubt about what is appropriate, speak to your supervisor.

You should also identify any support tools that you used. You should discuss your choice of implementation tools - programming language, compilers, database management system, program development environment, etc.

**Add sketches and images in as figures.**

**Add all the separate class diagrams**

## Overall Architecture

### Model Adjustment Levers

**The Model Adjustment Levers control the dimensions of the body parts including waist, hip, neck, shoulders and bust. The script is simple as it uses an algorithm to calculate the levers range and assigns appropriate values from only the minimum and maximum. This object is referenced in the model to have a similar algorithm which assigns and scales the model.**

**I made the script attached to the model sliders as re-usable as possible, by reducing the amount public dependencies and iterating through a hardcoded list of strings instead to find the game objects. That both reduces de-referencing issues when it comes to game objects during development and makes the code clearer to any future developers.**

### Model

**I created a script which allows the user to change the individual body parts. The individual body parts are scaled according to the relative position of the lever. However, through research and finding implementation issues – I adapted the transform of the shoulders by changing the x value instead. The outcome of scaling them up is deforming the model in an inhumane way.**

### Information Filtering

### Clothing

## Detailed Design

## User Interface Design

**My aim is to utilise as many VR design aspects as possible, making sure all controls and UI are intuitive and clear to use.**

**This includes certain interactions:**

* **Sliders**
* **Physical push buttons**
* **Scroll Bars**
* **Click buttons**
* **Teleportation**

**I decided against adding highlights on the physical 3D model for multiple reasons. The player should have a minimum number of concentration points, because that increases the complexity of the singular task – making it harder for first time users.**

### Teleportation

### Clothes

**Clothing user interface – which shows errors when the items of clothing don’t fit. The UI for the clothing has a small tag attached as both a way of expanding on details and aestically. These are physically distanced from the model as to not cause any interaction conflicts.**

### Model Adjustment Levers

**The User Interface on the model slider panel has multiple images attached via planes – which show the body part that would be affected.**

### Information Filtering

**To filter information, I have created a scrolling panel on the wall next to the clothing items. This can open another scrolling panel which shows a more detailed list of options.**

## Other Relevant Sections

# Implementation

The implementation should discuss any issues you encountered as you tried to implement your design. During the work, you might have found that elements of your design were unnecessary or overly complex; perhaps third-party libraries were available that simplified some of the functions that you intended to implement. If things were easier in some areas, then how did you adapt your project to take account of your findings?

It is more likely that things were more complex than you first thought. In particular, were there any problems or difficulties that you found during implementation that you had to address? Did such problems simply delay you or were they more significant?

You can conclude this section by reviewing the end of the implementation stage against the planned requirements.

**Issues with implementation:**

**SteamVR updating and hardware disconnecting**

**Using new package (EZ soft bones) with little documentation**

**Clothes physics and rigid bodies**

**Transformations of armature**

# Testing

Detailed descriptions of every test case are definitely not what is required in this section; the place for detailed lists of tests cases is in an appendix. In this section, it is more important to show that you adopted a sensible strategy that was, in principle, capable of testing the system adequately even if you did not have the time to test the system fully.

Provide information in the body of your report and the appendix to explain the testing that has been performed. How does this testing address the requirements and design for the project?

How comprehensive is the testing within the constraints of the project? Are you testing the normal working behaviour? Are you testing the exceptional behaviour, e.g. error conditions? Are you testing security issues if they are relevant for your project?

Have you tested your system on “real users”? For example, if your system is supposed to solve a problem for a business, then it would be appropriate to present your approach to involve the users in the testing process and to record the results that you obtained. Depending on the level of detail, it is likely that you would put any detailed results in an appendix.

Whilst testing with “real users” can be useful, don't see it as a way to shortcut detailed testing of your own. Think about issues discussed in the lectures about until testing, integration testing, etc. User testing without sensible testing of your own is not a useful activity.

The following sections indicate some areas you might include. Other sections may be more appropriate to your project.

## Overall Approach to Testing

## Automated Testing

### Unit Tests

### User Interface Testing

### Stress Testing

### Other Types of Testing

## Integration Testing

## User Testing

# Critical Evaluation

Examiners expect to find a section addressing questions such as:

* Were the requirements correctly identified?
* Were the design decisions correct?
* Could a more suitable set of tools have been chosen?
* How well did the software meet the needs of those who were expecting to use it?
* How well were any other project aims achieved?
* If you were starting again, what would you do differently?

Other questions can be addressed as appropriate for a project.

The questions are an indication of issues you should consider. They are not intended as a specification of a list of sections.

The evaluation is regarded as an important part of the project report; it should demonstrate that you are capable not only of carrying out a piece of work but also of thinking critically about how you did it and how you might have done it better. This is seen as an important part of an honours degree.

There will be good things in the work and aspects of the work that could be improved. As you write this section, identify and discuss the parts of the work that went well and also consider ways in which the work could be improved.

In the latter stages of the module, we will discuss the evaluation. That will probably be around week 9, although that differs each year.

# Annotated Bibliography

This final section should list all relevant resources that you have consulted in researching your project. Each reference should also include a brief annotation.

1. Sylvia Duckworth. A picture of a kitten at Hellifield Peel. <http://www.geograph.org.uk/photo/640959>, 2007. Copyright Sylvia Duckworth and licensed for reuse under a Creative Commons Attribution-Share Alike 2.0 Generic Licence. Accessed August 2011.

This is my annotation. I should add in a description here.

1. Mark Neal, Jan Feyereisl, Rosario Rascunà, and Xiaolei Wang. Don’t touch me, I’m fine: Robot autonomy using an artificial innate immune system. In *Proceedings of the 5th International Conference on Artificial Immune Systems*, pages 349–361. Springer, 2006.

This paper…

1. W.H. Press et al. *Numerical recipes in C*. Cambridge University Press Cambridge, 1992.

This is my annotation. I can add in comments that are in **bold** and *italics*and then further content.

1. Various. Fail blog. <http://www.failblog.org/>, August 2011. Accessed August 2011.  
     
   This is my annotation. I should add in a description here.
2. Apache Software Foundation (2014) “*Apache POI - the Java API for Microsoft Documents*” (Online) Available at: <http://poi.apache.org> Accessed: 14th March 2014.

This is my annotation. I should add in a description here.

1. Apache Software Foundation (2004) “Apache License, Version 2.0” (Online) Available at: <http://www.apache.org/licenses/LICENSE-2.0> Accessed: 14th March 2014.

This is my annotation. I should add in a description here.

1. Neil Taylor, “MMP\_S08 Project Report and Technical Work”, 2019 (Online) Available at: <http://blackboard.aber.ac.uk/> Accessed 19th February 2019.

A document that outlines information about the marking guide for the Project Report and Technical Work. This is published in the Resources folder on Blackboard.

# Appendices

The appendices are for additional content that is useful to support the discussion in the report. It is material that is not necessarily needed in the body of the report, but its inclusion in the appendices makes it easy to access.

For example, if you have developed a Design Specification document as part of a plan-driven approach for the project, then it would be appropriate to include that document as an appendix. In the body of your report you would highlight the most interesting aspects of the design, referring your reader to the full specification for further detail.

If you have taken an agile approach to developing the project, then you may be less likely to have developed a full requirements specification. Perhaps you use stories to keep track of the functionality and the ’future conversations’. It might not be relevant to include all of those in the body of your report. Instead, you might include those in an appendix.

There is a balance to be struck between what is relevant to include in the body of your report and whether additional supporting evidence is appropriate in the appendices. Speak to your supervisor or the module coordinator if you have questions about this.

* 1. Third-Party Code and Libraries

If you have made use of any third-party code or software libraries, i.e. any code that you have not designed and written yourself, then you must include this appendix.

As has been said in lectures, it is acceptable and likely that you will make use of third-party code and software libraries. If third-party code or libraries are used, your work will build on that to produce notable new work. The key requirement is that we understand what your original work is and what work is based on that of other people.

Therefore, you need to clearly state what you have used and where the original material can be found. Also, if you have made any changes to the original versions, you must explain what you have changed.

The following is an example of what you might say.

**Apache POI library** – The project has been used to read and write Microsoft Excel files (XLS) as part of the interaction with the client’s existing system for processing data. Version 3.10-FINAL was used. The library is open source and it is available from the Apache Software Foundation [5]. The library is released using the Apache License [6]. This library was used without modification.

Include as many declarations as appropriate for your work. The specific wording is less important than the fact that you are declaring the relevant work.

* 1. Ethics Submission

This appendix includes a copy of the ethics submission for the project. After you have completed your Ethics submission, you will receive a PDF with a summary of the comments. That document should be embedded in this report, either as images, an embedded PDF or as copied text. The content should also include the Ethics Application Number that you receive.

* 1. Code Samples

This is an example appendix. Include as many appendices as you need. The appendices do not count towards the overall word count for the report.

For some projects, it might be relevant to include some code extracts in an appendix. You are not expected to put all of your code here - the correct place for all of your code is in the technical submission that is made in addition to the Project Report. However, if there are some notable aspects of the code that you discuss, including that in an appendix might be useful to make it easier for your readers to access.

As a general guide, if you are discussing short extracts of code then you are advised to include such code in the body of the report. If there is a longer extract that is relevant, then you might include it as shown in the following section.

Only include code in the appendix if that code is discussed and referred to in the body of the report.

Random Number Generator

The Bayes Durham Shuffle ensures that the pseudo random numbers used in the simulation are further shuffled, ensuring minimal correlation between subsequent random outputs.

// Some example code here…