**Proposal**

**Motivation and rationale – 10%**

* **Why is the project worth doing?**

There is an impetus to undertake this project that I am proposing because Newcastle University possesses both a highly valuable and massively useful piece of equipment in the CAVE virtual reality suite, however its use is presently being disadvantaged by certain features of the current system. Developing a new system would allow the suite to be used to its fullest potential, maximising the investment that the University has made in acquiring the suite.

* **What is the problem it is trying to solve?**

The main problem with the current system is that most users of the suite find it very difficult to operate. This can often lead to problems, rendering the hardware unusable until a technician is available to attempt to resolve these difficulties. In the event of this, it can be particularly awkward to determine the fault given that there are simply so many possible features or elements that could have malfunctioned and consequently this can be a very time-consuming job.

Many of these issues are caused by the proprietary tracking system that is currently used, as there is the potential for the license files to be lost, at which point they must be retrieved from the server before the system can proceed. I intend on using an Open Source tracking system, which will remove this risk of license files being lost and ensure that the system is more reliable.

Likewise, the current system is somewhat complex to develop for, too. As such this project also attempts to solve this problem by simplifying the development pipeline in use.

* **Which need is being addressed?**

The overall need that is being addressed by this proposal is the necessity for a single, unified and easy-to-use system.

* **Who will benefit?**

By implementing this it will not only be the commonplace users that will benefit, but also the technicians that overlook its use, as well as developers creating content for the suite. This is because an easier to use system will lead to fewer problems arising and thus fewer cases where a technician is required to restore use of the system. Similarly, a streamlined development pipeline will, in turn, make it easier to develop models and environments for use within the CAVE.

* **Also identify specific points where the proposed project will go beyond existing work, and discuss the reasons why this is desirable**

Another motivation for this project is that it will give me the opportunity to develop a system with certain capabilities that are beyond those of the existing one. If it is conceivable for my system to work through a web browser then that will simplify the pipeline even further; developers will require no knowledge of memory allocation or C/C++ in order to create content for the suite

This is desirable as it will make the technology much more accessible for those who may wish to create something for the suite but simply don’t have the knowledge, resources or time with which to do so. By creating a system capable of working through a web browser I would be giving these users a simpler alternative with which to create their desired content.

* **You can include some personal motivation (why this project is attractive to you) but focus on the wider benefits.**

This particular project is attractive to me as it will give me a substantial insight into the sector of virtual reality, allow me to develop my understanding of graphics and also give me knowledge and use of several technologies that are paramount for a career related to video games.

**Aim and objectives – 20%**

* **Should be a list of bullet points concisely and precisely identifying the overall aim or hypothesis and resulting objectives of the project.**
* **Objectives can include both technical and (at most two) personal objectives, and if all achieved, should result in the overall aim being realised.**
* **Define objectives fully and sensibly, identifying success criteria that are measurable as well as clearly linking objectives to the overall aim and the project.**
* **Ideally your objectives should be “SMART”, although it is not essential that all of them are.**
* **Avoid listing tasks, but focus on what you want to achieve. For example, instead of saying that you will “research into X”, state that you will “identify six main attributes of X from the literature” (if that is a desirable outcome of the research).**
* **Your objectives will form the criteria for success for your project. It is therefore essential that you can measure the extent to which you have satisfied them. If your objectives are clear and measurable then you will be able to scope and focus your project and it will make your evaluation much easier to define. In contrast a poorly defined aim and objectives often lead to a poor project outcome.**
* **What will the project try to accomplish?**
* Through this project I aim to develop a toolset for the CAVE virtual reality suite, in order to run projects and studies easily
* **Which key objectives will need to be achieved in order to realise the overall aim or prove/disprove your hypothesis?**
  + Create 3D architectural visualizations that can be navigated and explored using the VR suite
  + Increase the share-ability of the CAVE through the use of the web and open source technologies
  + Integrate head-tracking and collision detection when available in order to provide an immersive experience
  + Support the loading of 3D models of various types to ensure that the toolset is widely useable
  + Provide logging of user interaction so that the suite can be a suitable location for psych studies and demos

**Background – 30%**

* **A table summarising key background sources and identifying their relationship to the project at hand**
* **Each entry in the table should consist of three elements: a citation of the source (which will be included in detail in the list of references), a sentence or two summarising the source, and a brief explanation why this source is relevant to the project.**
* **should contain a sufficient number of sources from all areas relevant to the project**
* **provide summaries for each that clearly state the key point of the source**
* **A concise explanation of how it is relevant in the context of the project.**
* **Do not include so many sources that you have to reduce content to fit them in. A general guideline would be at least 4 but no more than 8. The emphasis should be on the quality of explanation, not the quantity of sources.**

|  |  |  |
| --- | --- | --- |
| Source | Summary | Explanation |
| Phil Heslop | The senior technician who oversees use of Newcastle University’s CAVE virtual reality suite. | As it is Phil who is in contact with the CAVE suite most of the time, I intend on consulting with him at regular intervals throughout my project in order to ensure that my solution is meeting the requirements for the system. I also anticipate discussing the success of my solution with Phil with regards to him giving his opinion on the share-ability and usability of the system, as they are relatively subjective characteristics and so the impression from someone with a detailed knowledge of the current system will be highly valuable. |
| CQ3A (Cave Quake III Arena) | A Quake3 renderer developed specifically for the CAVE. | Commonly known as the “Hello World” of virtual reality, this is the engine currently in use within the University’s CAVE. It is sufficient for producing 3D models, however it is also commercial software that is now relatively dated and restricted. |
| CAVELib™ | A virtual reality software API that provides a platform for creating interactive three-dimensional environments for use within a CAVE. | This is proprietary software that is currently used within the CAVE. It governs the task of ensuring that all of the images rendered are stereoscopic and also that these graphics are displayed correctly across each of the CAVE’s screens. My project will essentially involve me re-writing this API for a modern system. |
| WebGL | A JavaScript API that can be used to render both two and three-dimensional graphics within a web browser. | This is the web equivalent of OpenGL that makes it possible to render graphics on the web without the requirement for any plug-ins. Also, like OpenGL, it is open source meaning that it is highly accessible and documented. It’s likely that I will be using WebGL in order to implement my solution as it contains the features that will allow me to create a toolset meeting the requirements for this project. |
| three.js | A JavaScript library that can be used to create and display three-dimensional graphics within a web browser. | I intend on using this library in conjunction with WebGL as it is lightweight and also open source. Again, this means it is extensively documented and supported, ensuring that it is both future proof and can be understood by those without any advanced programming or graphical knowledge. |

**Diagrammatic work plan – 15%**

* **A diagram (e.g. Gantt chart) detailing how the project will be carried out, e.g. which activities/tasks will be carried out when**

Tasks

* Decide which technologies I’ll be using (likely three.js/WebGL)
* three.js profiling
* Simple C++ stereo version profiling
* Compare and evaluate results
* Begin development

**Explanation of work plan – 10%**

* **What has been done so far?**

In order to get a more concrete understanding of the features and requirements of the toolset that I will be creating, I have conducted a semi-structured interview with Phil Heslop to determine how the current system functions and also any improvements that could be made. As Phil has a lot of experience with the suite and the technology used he has a detailed knowledge of what the end solution should comprise.

* **Why is the plan structured as it is?**

Throughout my project I intend on using an agile software process model. This is because I will be implementing various features into the toolset one at a time and certain tasks have the potential to take less or more time than initially planned, due to any issues that I may run into during development. A process model such as SCRUM allows change with ease and will ensure that my project can be organised and sufficiently planned.

Another benefit of using an iteration and sprint focussed cycle is that I can constantly have a working prototype available and frequently demonstrate this to Phil in order to receive feedback, like a sprint review meeting. In that sense, I am seeing Phil as the product owner with this toolset. We will also be able to discuss any impediments that may have arisen during the iterations work.

**References – 10%**

* **a list of references that were used so far (which must include all sources used in the background section), correctly cited**

<http://www.iri-vr.ncl.ac.uk/> - Newcastle VR suite

<http://www.visbox.com/cq3a/> - CQ3A

<http://www.mechdyne.com/cavelib.aspx> - CAVELib

<http://threejs.org/> - three.js

<http://www.khronos.org/webgl/> - WebGL