**Overview (100 words):** *This should be a summary of what the project will be.*

This project is a Virtual Reality (VR) software system to be utilised by site based project management teams in their day to day operations. This software will allow the project management team to create 3D virtual models of the construction site, identify potential risks, hazards, defects or buildability concerns and raise them effectively to the relevant stakeholders.

Integrated effectively, this software in combination with other standalone software packages will allow real time scanning of a construction site and produce accurate models of the site throughout the build phase of the project.

Project Name: KaneVR – Named after my current employer, KANE Constructions.

**Motivation (100 words):** *This should be a description of why the project will be interesting or useful.*

VR and Augmented Reality (AR) are not new technologies, more commonly associated to videogames or movies. In the construction industry, VR is more likely seen during pre-construction than anywhere else.

Commercial builds are represented by high-value contracts between multiple stakeholders; each with their own varying levels of project & design knowledge. The introduction of a robust VR application to the Site Team (the Builder-Side project management team based on site) would increase efficiency -time equals money- and decrease overheads by allowing clients and contractors to conceptualise onsite issues before they arise.

**Description (500 words):** *Detailed description of the features of the product or service.*

**Development**

Firstly, the application would require development of a proprietary software system capable of reading Autodesk©’s .RVT, .NWD and/or .DWG file types, in addition to .IFC file types (which are vendor-neutral files that are not specific to the Autodesk© suite). These files are readable by BIM software and would assist in the creation of the virtual environment.

Once the file type has been uploaded, extraction of the BIM data will commence and be converted into a 3D model using basic BIM principles.

**User** **Experience**

Beyond the intent of this tool, what must also be considered is the users experience (UX) as well as the interface (UI) that the team member is displayed with. The UI/UX would be simple in nature, menus would always be minimized to not cloud the user’s vision, and adequate frame rates ensured thus to not make the user feel nauseas and provide an unpleasant experience.

Finally, The BIM data extracted (user created layers, objects, lighting etc.) will be presented within the VR headset and allow the user to navigate around the construction site, turning off layers such as walls and structures, as well as set the time of day so to determine if lighting is sufficient for their space. Immersed in the VR environment, the user would have the functionality to tag, mark up and comment on the 3D model which would be saved to the environment. This would allow future user’s to see previous concerns, close out open issues or understand concerns raised from previous walkthroughs.

**Conflict Resolution**

No construction project is without its faults due to errors in documentation, miscommunication or lack of detail. The inception of 3D visualization tools to the site team (Site Managers, Foreman and the project management team) would allow immediate attention and clarification of issues that occur on site.

The purpose of this tool is to provide a virtual environment of the project to allow the relevant parties to review, document and provide further instruction on how to proceed following the discovery of an issue on site.

**Health & Safety**

Sometimes unforeseen risks or hazards appear on site. By utilizing the VR system in the site office in conjunction with the programme of works; the site team can visualize the site, perform walkthroughs and anticipate high risk activities that might not always be obvious when reviewed against 2D drawings.

**Collaboration through Simulation**

The VR system would allow construction meetings with stakeholders to be held, even when not on site. Functionality would be considered to host multiple users at a single moment and perform walkthroughs or communicate design concerns from comfort of their respective offices.

**Integration of Existing Software**

Skycatch© develop software for drones that autonomously captures hundreds of photos of a construction site then ‘stitches’ them together to create a 3D model. Known as Real-Time Kinematic (RTK), it utilizes GPS to extract distances and positions within the photos taken from the drone and provide an accurate representation of the site.

Integrated with this tool, Skycatch© would allow for real-time mapping of a site and assist in creating 3D models of up to date site conditions. This feature would allow contractors such as Quantity Surveyors to review the project and pay monthly progress claims accordingly.

**Tools and Technologies (100 words):** *Describe the software, hardware and/or other equipment needed. Include any relevant open source tools as appropriate.*

The best chance this tool has at succeeding is if it can be established using general consumer products. Moving away to specific or custom built hardware would eliminate the ease of accessibility and therefore isolate the tool from the industry.

A VR Headset – Any off-the-shelf VR headset such as HTC© Vive or Oculus© Rift for desktop applications, or else Google© Cardboard or Microsoft© Hololens for wireless solutions. These headsets create a stereoscopic display (two images displayed to each eye respectively) as well as encompass tracking sensors to assist in the immersion. Some of these headsets come with accessories such as the Oculus Touch Controllers that give the user the ability to navigate around the environment through the press of a button.

VR Engine – ‘Unity’ and ‘Unreal Engine 4 (UE4)’ are the most common VR development software tools available online. Originally, they both started as videogame engines. Both Unity and UE4 are programmed using C# and C++. Within the UNITY asset store is an asset called ‘Adventure Creator’ which allows beginners to create VR environments without writing a single line of code. This asset could be considered an excellent learning tool to train staff in the core of VR. There are also multiple Software Development Kits (SDK’s) available online that could have potential to open this tool to other devices such as mobile phones and tablets.

**Skills Required (100 words):** *List the skills required for your project, including software that needs to be written, and special hardware (if any). How feasible will it be to find the skills, software and hardware required?*

Site-based Computer: To be able to utilize this tool on site, there must be a capable system available on site to ‘power’ the VR system. According to the Oculus© website, minimum PC requirements include a NVIDIA© GTX 1050Ti graphics card, Intel© i3-6100 or AMD© Ryzen 3 1200 CPU, at least 8GB of RAM, DisplayPort 1.2 for video output as well as a single 3.0 USB port.

Software engineering/programming – Knowledge of the C# and/or C++ language, although getting into coding is easy as there are plenty of beginner resources available online.

3D Design & Building Information Modeling (BIM) – Used in the construction industry, BIM is a 3D modeling process used to design and document the life cycle of a construction project from conception to handover. Experience in the software such as Autodesk© BIM360 or PlanGrid© would be greatly beneficial.

Industry knowledge – Previous experience within the construction industry is not a necessity but would be highly advantageous. To understand the day to day operations of a construction build would assist in the development of this tool.

**Outcome (100 words):** *If the project is successful, what will be the outcome? How will the original problem be solved? What impact will this development have?*

Like most inventions, they stem from a need to solve a problem. As a construction builder, I can easily isolate the cause of my problem to a lack of client and architect communication.

I believe this tool would have an overwhelmingly positive impact on today’s construction industry. This problem is a daily pain point for me and others within my occupation. A site team with an asset like this that can be used to present an instant solution to onsite disputes would save countless hours of unnecessary phone calls, emails as well as save a lot of money. Ultimately, this tool provides a virtual environment to assess the conditions of a construction site and alleviate issues immediately as they arise.