

An Indian-Australian research partnership

Project Title:	Design and Assessment of Virtual Environments in Technological Applications	
Project Number	ID00712	
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Research Clusters:

Research Themes:

Highlight which of the Academy's CLUSTERS this project will address? <i>(Please nominate JUST one. For more information, see www.iitbmonash.org)</i>		Highlight which of the Academy's Theme(s) this project will address? <i>(Feel free to nominate more than one. For more information, see www.iitbmonash.org)</i>	
1	Material Science/Engineering (including Nano, Metallurgy)	1	Advanced computational engineering, simulation and manufacture
2	Energy, Green Chem, Chemistry, Catalysis, Reaction Eng	2	Infrastructure Engineering
3	Math, CFD, Modelling, Manufacturing	3	Clean Energy
4	CSE, IT, Optimisation, Data, Sensors, Systems, Signal Processing, Control	4	Water
5	Earth Sciences and Civil Engineering (Geo, Water, Climate)	5	Nanotechnology
6	Bio, Stem Cells, Bio Chem, Pharma, Food	6	Biotechnology and Stem Cell Research
7	Semi-Conductors, Optics, Photonics, Networks, Telecomm, Power Eng		
8	HSS, Design, Management		

The Research Problem

Virtual Reality (VR) has immense prospective for application in multidisciplinary fields. Using VR, we can transport ourselves to different worlds as well as simulate existing physical environments where controlled testing and training can be conducted. VR systems that evoke compelling experiences rely on advanced technical expertise. However, designing content for simulating realistic interactions in a VR environment is as imperative as the technical precision of the system, in order to create quality user-experience.

Some of the areas that would gain significantly from development of such methodologies as part of VR research and development include - Architecture and Design (Industrial Design, Automotive Design), Engineering and Construction, Healthcare and Rehabilitation, Education and Training, Gaming and Entertainment, Human Computer Interaction and AI, Distant Collaboration and Communication.

As a starting point, the project would explore the potential of VR from the context of mining applications. Any physical damage in the mining space affects land as well as people. This demands sustainable approaches for assessing mining environments. Simulated environments in VR would help the mining industry by aiding evaluation of on-site dangers and training of prospective personnel in a safer space, in turn saving lives and money. Understanding such physical environments, design of corresponding virtual spaces, visualizing potential scenarios for testing and assessment of various conditions requires research in the area of 3D space and content design in Virtual Reality.

Project aims

The primary aim of the project would be:

To design and develop a methodology to simulate virtual environments for visualization, testing and training in VR. The strategies developed may include approaches to using 3D scan or 360 video data of existing physical locations to recreate the spaces virtually and analyze the simulated conditions, as well as methods to develop new virtual spaces based on the existing data. The methodology and setup developed would help visualize and test any real-world situation, especially hazardous environments in a safer and controlled virtual space.

As an example case, the mining application project would primarily explore two areas:

- (1) To simulate existing geology, geography or mining environment that can be experienced as a real-time 3D virtual space to test and predict conditions.
- (2) To visualize probable scenarios in which one can step in for training purpose; so that we could foresee different conditions one may encounter if physically present in that scenario and explore the decisions one would accordingly make.

Expected outcomes

The project will deal with development of strategies and guidelines to create virtual environments from real-world scenarios as well as visualize virtual surroundings for immersive testing and training purpose. The methodology would explore approaches to using data from existing physical locations and to analyze the simulate conditions as well as methods to develop new virtual spaces based on existing data.

Mining Context:

Design of contextual interactions in such simulated spaces is crucial especially in training as it must eventually help the users when they are at the physical site. The study would not only enhance research on mining applications, but also lead to a repository of potential mining conditions that would help future mining engineers, geologists, researchers and students have a realistic experience of the mining spaces as part of their learning.

Potential Domains of Application:

Virtual reality being relevant in multi-disciplinary fields, the strategies developed could be studied in order to be adopted by or extended to applications in multiple domains, viz: Design, Architecture, Engineering, Healthcare and Education.

How will the project address the Goals of the above Themes?

Although this particular research would be a collaborative project between Design and Earth Sciences, virtual reality being relevant in multi-disciplinary fields, the strategies developed could be studied in order to be adopted by or extended to applications in multiple domains. The most relevant areas have been highlighted above.

Capabilities and Degrees Required

A background in design or architecture; with preferable focus on interaction design, visual communication, 3D gaming or virtual reality is desired.

Potential Collaborators

- Tata Group of Companies (TCS, Tata Steel, Tata Elxsi)
- Unity Technologies, 3D and 2D game development and visualization platform
- Arts et Métiers ParisTech, Presence & Innovation VR Lab, Laval France
- ISE-NET, Politecnico di Torino, Italy
- SensiLab at Monash University through IITB-Monash Collaboration

Keywords

Design, Virtual Reality, Computer Simulation, Gaming, Visualization, Interaction Design