ADVANCED VIRTUAL REALITY (VR) –BASED ONLINE LEARNING & TRAINING TECHNOLOGY FOR STEM

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Industry Sector(s): Services

Product Category: Education & Training Services, Online Education

Opportunity Overview

The current research aims at developing effective, high-fidelity and comprehensive platform and tools for educating and training tomorrow’s workforce in STEM, including advanced manufacturing and Engineering. The online environment closely and realistically emulates the classroom by incorporating natural-language human-like intelligent virtual tutors and unstructured knowledge base for instruction delivery. It accurately supports experimentation and training/practice through the use of textured 3D photo-realistic interactive and dynamic virtual models of physical components and systems as well as their operation environments, and a hierarchical knowledge base for process training. The resulting technology, platform and tool allow for effective, safe, and highly accessible online STEM training and education of high quality. In fact, the synergistic integration of high end multimedia lecture with 2D/3D interactive simulations with advanced near-realistic physics-based virtual models of the application, together with the use of multiple means of instruction delivery to accommodate different types of learners, provide an online experience that surpasses the physical one.

Markets & Applications

The new technology opens the door for effective distance education in disciplines that were traditionally confined to live teaching, including engineering, physics, and science. It is expected to be a major tool for training of Indiana's workforce in advanced manufacturing and attracting talented students to engineering and technology directly from high schools.

Competitive Advantage/Value Propositions

The technology used derives from the extensive experience of Dr. El-Mounayri & Dr. Wasfy in developing the Advanced Virtual Manufacturing Laboratory (AVML), which was developed with industrial partner Advanced Science and Automation Corp.. The AVML provides virtual training and education on high-tech Computer
Numerically Controlled (CNC) machines. It enables colleges to easily and inexpensively provide students with effective, safe, and highly accessible web-based training on advanced machining tools, equipment and processes.

**Researcher Biographies**

**Tamer Wasfy, Ph.D.**

Dr. Tamer Wasfy received a B.S. (1989) in Mechanical Engineering and an M.S. (1990) in Materials Engineering from the American University in Cairo, and an M.Phil. (1993) and Ph.D. (1994) in Mechanical Engineering from Columbia University. He worked as a research scientist at the department of mechanical engineering, Columbia University (1994-1995) and at the University of Virginia at NASA Langley Research Center (1995-1998). Dr. Wasfy is an associate professor at the Mechanical Engineering Department at Indiana University-Purdue University Indianapolis (IUPUI). Dr. Wasfy is also the founder and chairman of Advanced Science and Automation Corp. (founded in 1998) and AscienceTutor (founded in 2007). Dr. Wasfy's research and development areas include: flexible multibody dynamics, finite element modeling of solids and fluids, fluid-structure interaction, belt-drive dynamics, tires mechanics/dynamics, ground vehicle dynamics, visualization of numerical simulation results, engineering applications of virtual-reality and artificial intelligence. He authored and co-authored over 80 peer-reviewed publications and gave over 65 presentations at international conferences and invited lectures in those areas. He received two ASME best conference paper awards as first author. He is the software architect for the DIS, IVRESS and LEA software systems, which are used by industry, government agencies, and academic institutions. Dr. Wasfy is a member of ASME, AIAA, SAE and ASEE.

**Hazim El-Mounayri, Ph.D.**

Dr. El-Mounayri received his PhD in 1997 from McMaster University (in Canada) in Mechanical Engineering. He is currently an associate professor of Mechanical Engineering, the co-director of the Advanced Engineering and Manufacturing Laboratory (AEML) at IUPUI, and a senior scientist for manufacturing applications at Advanced Science and Automation Corp. He co-developed the Advanced Virtual Manufacturing Laboratory for Training, Education and Research (AVML), an innovative e-learning tool for educating students and training the next generation workforce in sophisticated technology and its underlying theory. Dr. El-Mounayri’s research focus is in advanced manufacturing, including nanomachining modeling using techniques such molecular dynamics and multiscale simulations, and realization using AFM. Dr. El-Mounayri has worked as consultant for and conducted R&D for a number of local companies in the areas of CAD/CAM, CNC machining, and process development/improvement. Dr. El-Mounayri is a member of ASME, ASEE, and SME. He has published over 60 technical papers in renowned peer-reviewed journals and technical conferences in his field and gave presentations at various national and international conferences.

**Development Plans/Needs**

1. Identifying potential partners for testing and/or commercial development.

2. Explore new directions for development and application of the online tools.