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Title:	Authoring Augmented Reality Work Instructions by Expert Demonstration
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Problem:

The challenge of maintaining the flexibility of human workers with the efficiency and quality necessary to compete globally is exacerbated by the archaic nature of work instruction delivery, which has not changed substantially in more than a century. Workers conducting manual processes on the shop floor still typically refer to written instructions, which sometimes include reference drawings. Whether delivered on paper or a computer monitor, this method induces a substantial cognitive load on the worker. In an assembly process, for example, a worker is required to read an instruction, remember part numbers, retrieve necessary parts, position them properly, and finally conduct the assembly operation. Depending on the complexity of the task and their familiarity with it, a worker may feel compelled to refer to work instructions numerous times throughout the process. This can lead to increased completion time and assembly errors.

Summary:

A promising solution to these challenges is the adoption of augmented reality (AR) technology for work instruction delivery. For an assembly operation an AR application can be used to superimpose video of work area with computer-generated visual features that provide instructions on assembly operations, such as which part to pick next, where to assemble a particular part, or which tool to use. However, despite promising AR research results, the broad adoption of AR in manufacturing industries has been hampered by a procedural technology gap, namely: how to facilitate the authoring of AR content.

The goal of this project was to develop the Augmented Reality Expert Demonstration Authoring (AREDA) product to provide a simple and intuitive method for rapidly authoring AR work instructions. This was achieved through tracking and recording the actual part manipulations of an expert using 3D depth cameras with advanced image processing, computer vision and point cloud matching algorithms. The system was based on existing successful research results from the proposers. Through cost-sharing partnership with aerospace (Boeing) and heavy equipment (Deere) sectors, functional requirements for AREDA were developed. Product requirements based on market opportunities were gathered from other project partners (DAQRI and Design Mill). Inter University collaboration (Purdue) afforded the opportunity to implement cutting edge depth camera sensors for use within AREDA.

AREDA was developed at a level commensurate with TRL 6 in an attempt to bring these new methods to commercialization faster. This is a key innovation that will accelerate AR adoption in manufacturing, which in turn will reduce time to author work instructions, enhance their communication to the shop floor, reduce process errors, and decrease manual process time – all of which will substantially improve US manufacturing productivity and competitiveness.