

The Internet of Skills: Online Virtual Simulators For Skilled Trades

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The nature of emerging virtual reality and augmented reality systems, of low-cost Cloud-based ultra high-performance simulation, of low-latency high-bandwidth 5G networks, ubiquitous local machine-to-machine wireless networks, along with prospects for phenomenological step-function improvements in both sensors and truly 'natural' haptic technologies means we now have in sight the potential to build realistic skills simulators. This will enable, first, virtual and thus online apprenticeship for many skilled trades (the focus of this Abstract), followed by real-time man-machine interfaces enabling continuous on-the-job and process improvements in manufacturing, and then the realization of the broader Tactile Internet.

Online virtual simulators for the skilled trades and apprenticeships will constitute a revolutionary advancement that will radically lower costs and improve the efficacy of training thereby enhancing a vital part of the manufacturing ecosystem, especially for small and mid-sized firms.

Edwin Link's idea, and his 1929 launch of a realistic aircraft simulator revolutionized the skilled trade of flying. While physical hands-on training remains essential, the simulator improves and accelerates both acquiring and continually refining skills. Other trades are more challenging to simulate than flying, but foreseeable technologies now make the vision of an Online Virtual Simulator (OVS) imaginable for many skills. Odds are good we will achieve that goal well before the 100th anniversary of the first flight simulator.

The roadmap of key enabling technologies that will make the OVS realizable is inherently multidisciplinary. It starts with materials sciences that underlie gains needed in sensors and actuators (e.g., programmable materials for virtual skin, high-performance MEMs devices, high-resolution low-power nanosensors). OVS system design also requires advances in ergonomics and psychology of man-machine interfaces, a deeper understanding the physiology of human tactile sensing, as well as behavioral and neurological features of skills development.

Radically improving skilled-trade training comes at a pivot in history. As manufacturing machines become ever more sophisticated—from cobots and 3D printers to anthropomorphic robots—the need for skilled trades rises both to manufacture such machines, and to operate and maintain them. But, as is well known, there is a wide and growing “skills gap” with far more openings for skilled trades than candidates for those high-paying jobs.

And the industrial and manufacturing sectors now face a “silver tsunami” with the near-term aging-out of a majority of today's trade-skilled employees that are bunched into the older end of the age spectrum. Meanwhile, the rate at which young people are entering trade apprenticeships in America is a fraction of that in European nations where there is also a widening skills gap. Proposals to deal with this include restoring vocational classes in high schools, supporting or subsidizing institutional trade training, popularizing apprenticeships, and expanding corporate in-house training.

While all such initiatives are important, they won't be sufficient. It bears noting that the last option, in-house training, is non-viable for small and mid-sized enterprises that utterly dominate the manufacturing landscape. Online virtual simulators offer a path to radically better, faster, less expensive and more appealing ways to train people, especially the rising Millennial generation and their progeny. Finally, entertainment industries will embrace generation 1.0 online virtual simulators as the technology follows the inevitable downward cost curve, followed by healthcare embracing generation 2.0 OVS as enabling technologies follow the upwards curve of greater performance.

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