Designing VR Systems for Semiconductor Microfabrication

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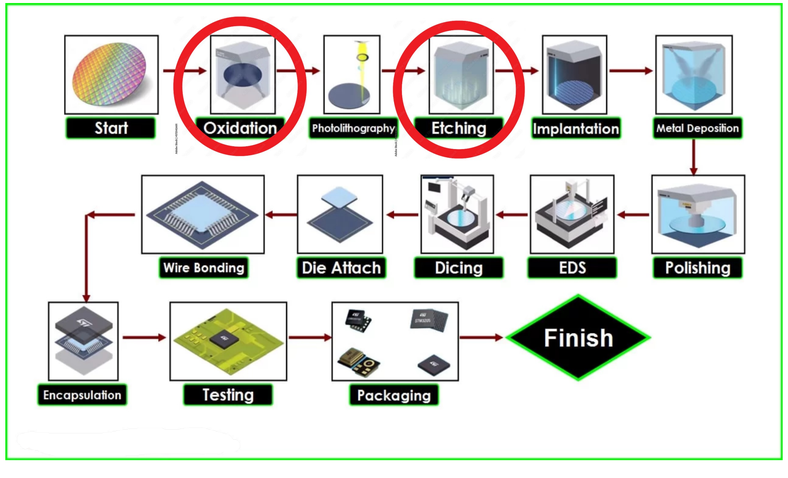
Opportunity and Significance

Both Federal and State governments are actively investing in the semiconductor industry, as the United States aims to reduce dependence on foreign chip manufacturers. Growing Michigan's semiconductor industry invites new private-sector innovation and protects existing Michigan companies from supply-chain constraints.

- Semiconductor fabrication requires specialized training in delicate and expensive cleanroom environments.
- By utilizing VR technology, larger workforces can be trained efficiently and cost-effectively.

Technical Objectives

Our goals were to simulate specific processes of semiconductor microfabrication within a virtual-reality cleanroom environment through four interactive modules:
(1)Cleanroom gowning procedure, (2)SiO_2 oxidation, (3) BHF wet etching, and (4)general dry etching.



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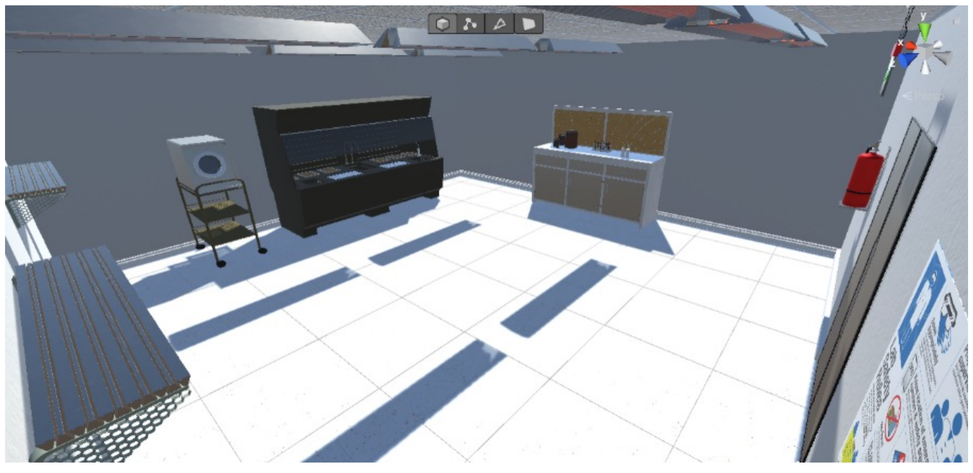
Technical Approach and Results

Key Components:

- Software: Unity 2019 - for creating and managing 3D environments
- Open-Source Libraries: SteamVR/OpenXR - for enhanced VR functionality and compatibility
- Hardware: HTC VIVE Pro v2 - for immersive VR experience, including headset, controllers, and spatial sensors

Our Virtual Reality Environment:



Related Work, State of Practice, Industry Standards

- IEEE P2048.6, Immersive User Interface: requires the complete immersion of the user by avoiding the use of non-immersive user interfaces (such as keyboards, mice, touchscreens).
- Cleanroom training durations range from a few days to several weeks, with costs per person varying from hundreds to thousands of dollars, based on the ISO level required.
- CHIPS for America Act aims to enhance educational infrastructure surrounding semiconductors. This includes facilities, online courses, and virtual learning environments.

Next Steps for Development and Test

- Create and include additional processes of semiconductor fabrication and specify them further depending on the use-case, e.g., mask design.
- Integrate more VR functionalities such as hand-recognition and further advance intractability.

Commercialization Plan & Partners

Who did you work with?

- VR design and implementation expertise provided by Dr. Sara Masoud, IE department
- Microfabrication and Semiconductor design expertise and theoretical knowledge provided by Dr. Gozde Tutuncuoglu, ECE department

Who will you work with to commercialize the product or process?

- Companies and universities seeking to train individuals to operate in industrial or academic cleanroom facilities are our target markets.

What are the main steps or hurdles to commercialization?

- Creating custom VR environments for each client's specific cleanroom may be necessary
- The need for high-end hardware by consumers can be a limiting factor to the program's accessibility
- Hosting costs would be encountered if a general-use version was marketed via the web

References: [1]: https://www.electronicsandyou.com/blog/semiconductor-manufacturing-process-steps-and-technology-used.html#google_vignette