MOSCAP VR Experience

Kaushik Padmanabhan, Dr. Prabhakar Venkatraman, Dr. Gauri Karve, Leah Pastel, Zachary Lanahan, Lisa Sibilia, Paul Marca, John Hopkins, Carolyn Cole, Dr. DP Prakash, YOUTOPIAN
Siyun Qiao, Dhruv Srinivas, Dr. Subramanian Iyer, UCLA CHIPS

Introduction

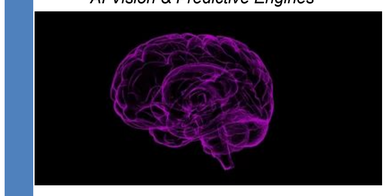
While semiconductors are fundamental to Digital Transformation across industries through exponential technologies including AI, eXtended Reality (XR), Robotic Process Automation (RPA) and 5G, semiconductor education itself need to be modernized.

Current Baseline in Pedagogy 2D based	Teaching with Metaverse tools embraces 3D
Relies on text, pictures, audio & video channels	Incorporates eXtended Reality & AI technologies
Mental models need complex imagination	3D visualization cuts through complexity
Cognitive overload limits onboarding speed	Seeing expedites understanding
Takes significant time to link concepts to applications	End to end visualization accelerates learning
Needs to be augmented to better engage NextGen	Entertains to educate with interactive experiences

YOUTOPIAN LLC

- Custom AI XR innovations for Digital Transformation in Enterprise and Education
- Led by alumni of UCLA & Stanford University

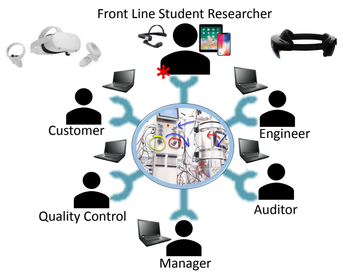
AI Vision & Predictive Engines



Digital Twins of Campuses

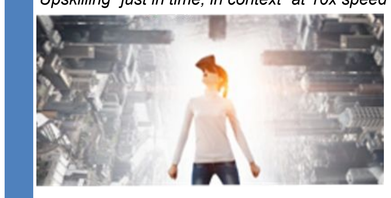
XR Visualization for Metaverse

Connected Worker Remote Collaboration



IoT AI AR integration & Predictive Maintenance

Upskilling "just in time, in context" at 10x speed



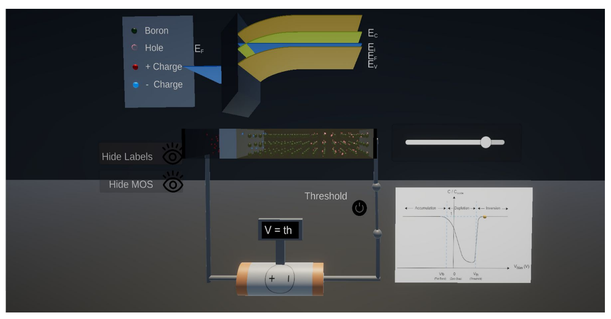
Long Life Learning

YOUTOPIAN®

MOSCAP VR Prototype

Overview of MOSCAP Model

- Built with classical physics model
- Electrons and Holes modeled as particles
- Movement of charges made clear
- Learner uses Interactive controls
- 3D Band diagrams & C-V curve in context



Prototype created with 5 PhDs, 3 Masters and 3 VR experts in ~4 months. Pipecleaned templates now enable 10x faster turnaround times.

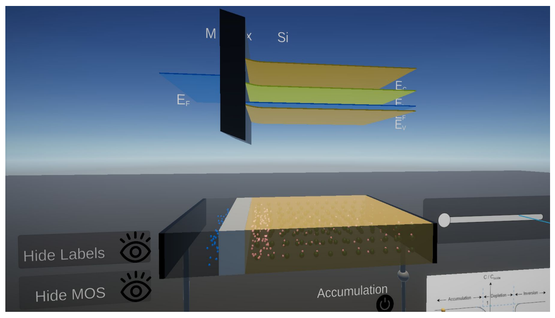
Creation Process

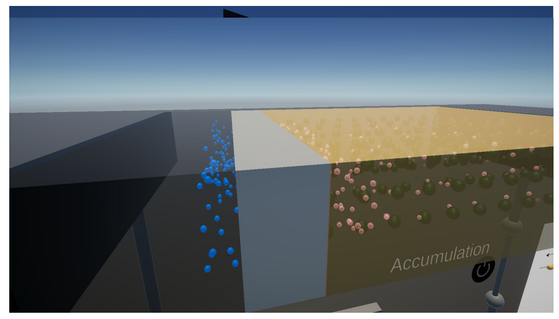
- *Discovery*
  - Define pain points & specifications
  - Identify learning behavior objectives
  - 3D/2D device types for end users
- *Design*
  - Storyboarding
  - Technology architecture
  - Assets & Data requirements
- *Develop*
  - 3D, 2D, Audio & Video assets
  - Unity Animation Interaction design
  - Static & Dynamic composition
- *Deployment*
  - User engagement & feedback
  - Iterations to improve

MOSCAP VR Module - **First of its kind demonstration**

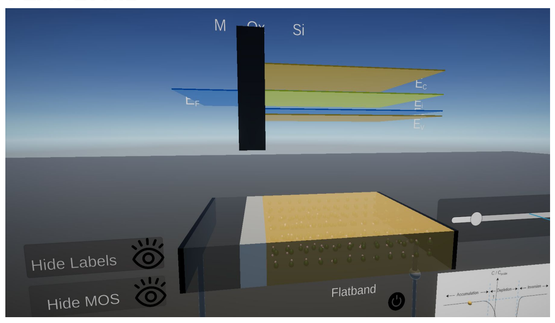
Various Operation Regimes

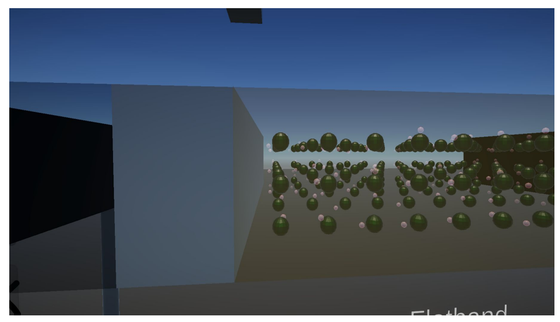
ACCUMULATION



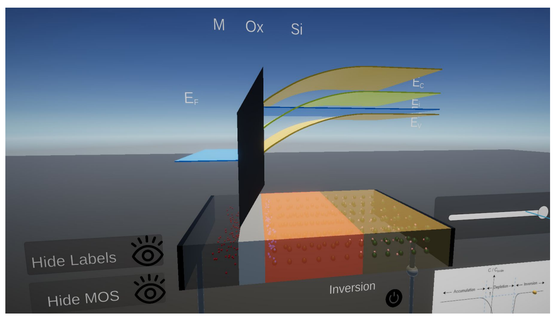


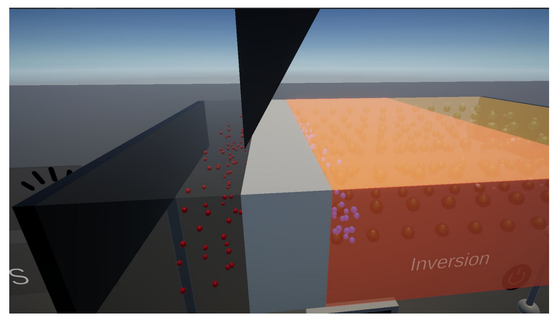
FLAT BAND





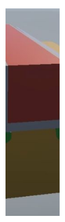
INVERSION

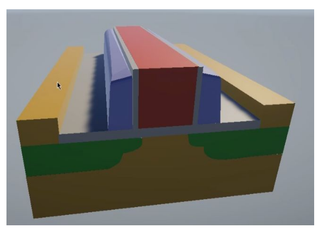


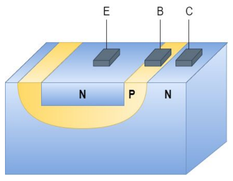


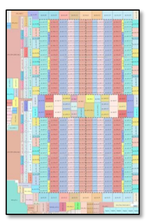
Future Plan (MOSCAP -> PN/MOSFET/BJT)

MOSCAP *PN Junction* *MOSFET* *BJT* *Chip*

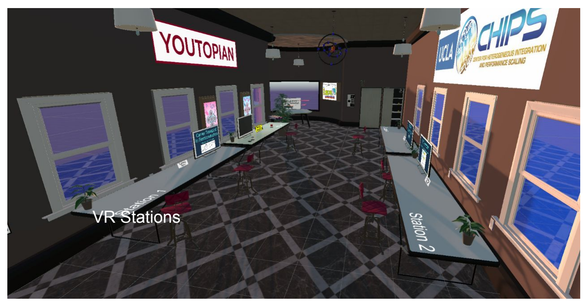








- Students can experience VR modules at different stations in the UCLA CHIPS Metaverse
- Interactive knobs include voltage, doping type, doping level and oxide thickness



Conclusions

- Interactive experiences to intrigue and engage millennial age students
- MOSCAP VR experience guided by "Entertain to Educate" principle
- Detailed visualization of device operating principles achieved
- Visual cues reducing cognitive load and enabling learning ~10x faster
- End-to-end visualization of *devices, circuits, chips and applications* planned

We are grateful to the pioneering influence of Prof. CR Viswanathan whose teaching of semiconductor courses laid the foundation for generations of semiconductor engineers from UCLA EE Department.