



Building Virtual World in Second Life for MEMS Education (update)

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BCC, FCC and HCP Unit Crystal Cells in Second Life



SCME Pressure Sensor & me

Abstract

Since last year the Ivy Tech Engineering Island in Second Life has been used in nearly all of the Electrical Engineering Technology classes at Ivy Tech – Fort Wayne. Students have presented posters, designed and built structures and used gamification to explore engineering concepts in VR. MEMS devices such as the SCME Pressure Sensor and unit cell crystal models have been built using Solidworks, Blender and Second Life. Techniques have been developed to create detailed mesh models, mimic past animated and controllable DC Motor models and enhance the modality of learning and access to virtual learning environments in Second Life and Opensim. In addition, some of the Maya models created for the SCME virtual cleanroom that was presented in AltSpace have been converted in Blender and uploaded to Second Life. This poster will discuss the current state of our efforts to build virtual environments for engineering education and our plans to build the virtual cleanroom in Second Life.

Posters - Status

Since last year we have continued to use Second Life to supplement engineering education. This has included student poster presentations. These posters are created by the students and presented in-world by students either as a team or individually. Currently, there are over 50 semi-permanent student posters that are spread around the IvyTech Engineering Island. These posters help to generate pride in student work and provide educational examples for future students. Multiple YouTube videos have been created from Zoom and Second Life presentations which highlight the efforts of faculty and staff to use virtual reality for education.



Second Life Presentations - <https://www.youtube.com/watch?v=o3S8sou4oUQ>

Posters - Plan

All engineering students and faculty will continue to use Second Life for student poster presentations for all courses in the 2022/23 school year at Ivy Tech – Fort Wayne. Students have typically had a favorable response to this assignment.

- Add new buildings to house posters.
- Create a library of posters for student reference.
- Add linkage to posters from the www.ivytechengineering.com webpage

Posters – Method Used

- Students create poster using a standard poster template
- Poster converted to an image (typically jpeg)
- Image uploaded to www.ivytechengineering.com webpage
- Create or use a Multimedia Poster Object used in Second Life
- Add URL link to poster location on the web
- Poster renders in-world and is ready to go
- Also, have the ability to display alternative poster sizes and multiple page presentations (uses a javascript for paging).

Building - Status

Building in Second Life is essential to add object and content that will engage the students and provide new VR growth to the learning environment. Things need to evolve and change to enhance student learning. A slow or no growth real world learning environment must be challenged in the ever-evolving VR environment. Growth is achieved by adding content by faculty or students:

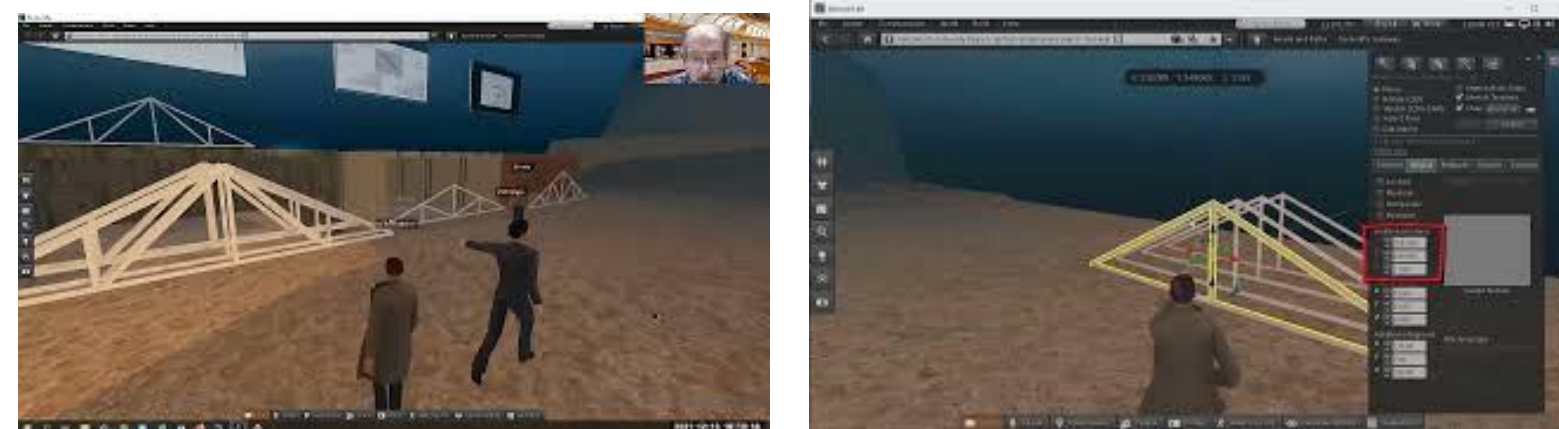
- New Buildings – purchased or built (in-world, with Blender or Solidworks)
- New Objects – purchased or built (in-world, with Blender or Solidworks)
- Your own Avatar
- Exploration

Building - Plans

Building a new world, a new learning environment in Second Life is the goal. How do we grow and evolve to meet the needs of students and maintain educational integrity? From an “object” standpoint Second Life allows for the transformation of 3D models created in Solidworks or other CAD programs to be converted into Second Life objects which can be uploaded and used in-world. This is typically done using a program called Blender. A free, extremely popular program that can be used for: animation, mesh reductions, 3D drawing, texturing and graphics to name a few. It can also be used to support other VR environments such as Unity and Opensim.

Building – Method Used (Student)

Offering this option to students has been a little challenging because a “sandbox” must be setup in your space that allows students to build. In a recent experiment, students were instructed to design a single roof truss for a 28-foot-wide garage in Solidworks. A 28 by 28 garage was created in-world and the converted roof trusses models were placed in front of the garages and students were instructed to “build the roof” using their roof trusses and present their designs in Second Life.



Building Roof Truss in Second Life https://www.youtube.com/watch?v=9CiQ6_zmeIQ
METC 111 Roof Truss Second Life <https://www.youtube.com/watch?v=6yF-zeuzHfo>

Building – Method Used (Faculty)

By far there has been more building in Second Life by faculty than anyone else primarily because of the learning curve and domain ownership. Blender has a very steep learning curve and drawing objects in Second Life is difficult due to the fluidity of your object view and point of reference as well as the limited number of primitive objects available. However, if you do create something in Second Life you can download it, save it and edit it in Blender using the Firestorm viewer. For additional info see:

Virtual Reality for MEMS Material in Second Life - <https://www.youtube.com/watch?v=CA7QwplqxXU>

VRBPE Conference 2022 Virtual Reality and its use in education - <https://www.youtube.com/watch?v=mvEIRoO4fCO>

Virtual Cleanroom - Status

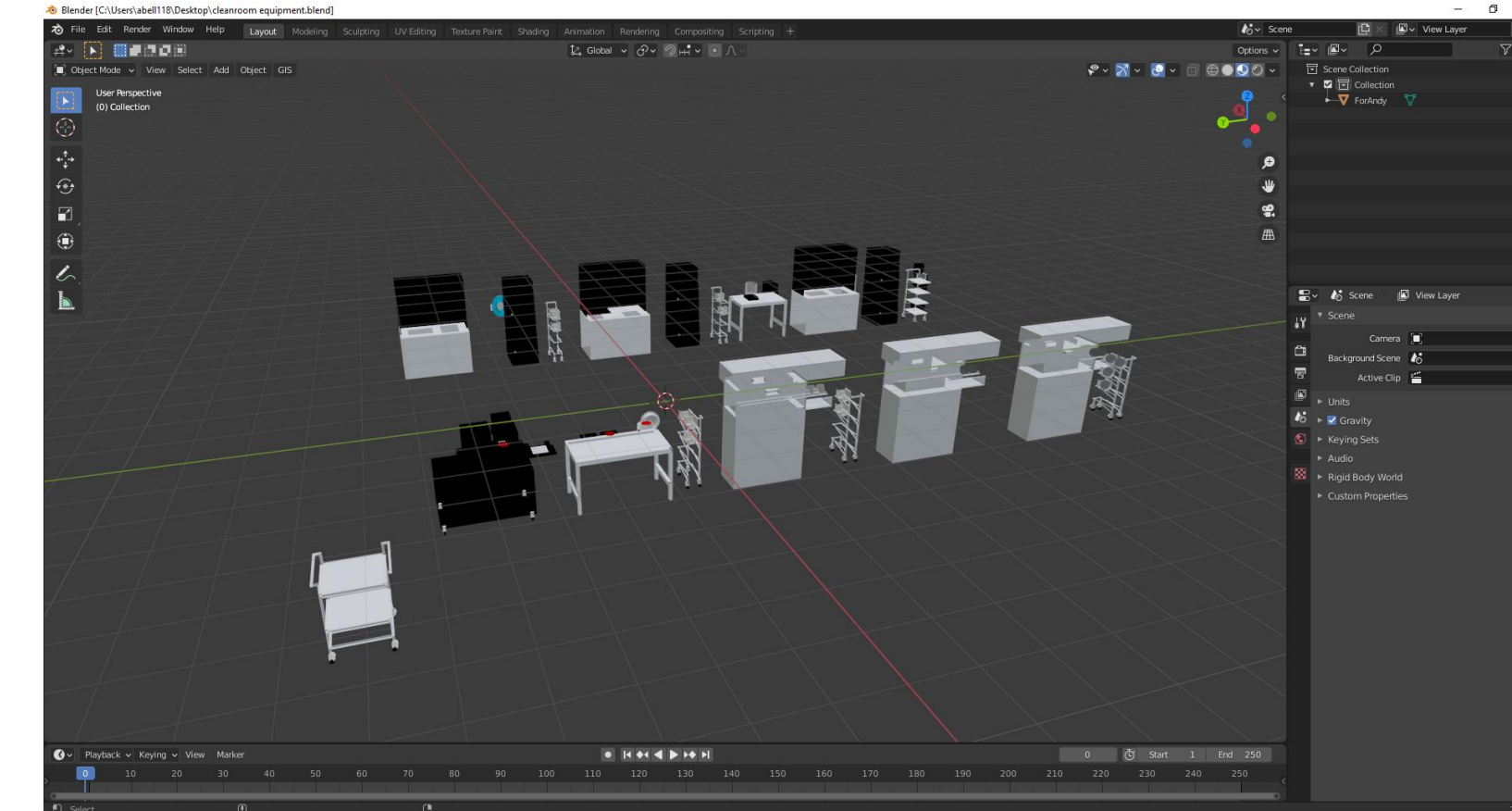
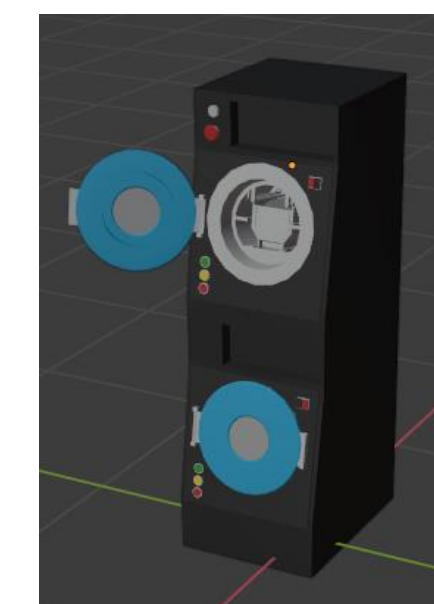
It has been my desired to build a virtual cleanroom for our students that would allow all students to gain “some” level of the experience of working in a cleanroom. SCME has created many of the cleanroom 3D equipment models and some of these have been successfully converted in Blender and added to Second Life. The process includes:

- Import STL, FBX or OBJ file from Maya or Solidworks into Blender
- Scale and reduce mesh model if required
- Save Blender file and export as DAE file
- Upload into Second Life making sure to check model parameters and include
 - Texture (image on object)
 - Size
 - Upload fee
 - Land Impact
 - Number of triangles and vertices
 - Download Physics
 - Server
 - LODs

Virtual Cleanroom - Plan

Initially, had wanted to take 360-degree pictures of cleanroom equipment or drawn 3D model based on equipment documents of the SCME Cleanroom but this has not been possible since I don't have access. Current plan is to convert all the models that UNM has already created in Maya. This includes all the equipment used in the Pressure Sensor Workshop:

- HMDS
- Hot Plate
- QDR
- SDR
- UV Station
- Wafer Box Cart
- Wafer Cart
- Wafer Oven
- Wafer Spinner



2021 SCME Cleanroom Equipment for Second Life

- 2022 SCME Cleanroom Equipment will be requested

Virtual Cleanroom – Method Used

Each object is converted into a DAE model file which is usable in Second Life or Unity. This can be a very quick effort or if the model is complicated enough it may take more time to edit the model to reduce the mesh, add texture and materials to maintain the graphical integrity but still provide a model which can be viewed and rendered in-world. Only additional step is the need to add Physics models to the equipment models. Physics model govern how Avatars can interface with the models. This can be easily drawn in Blender.

So far so good! Thanks to Junifer Nez from SCME.



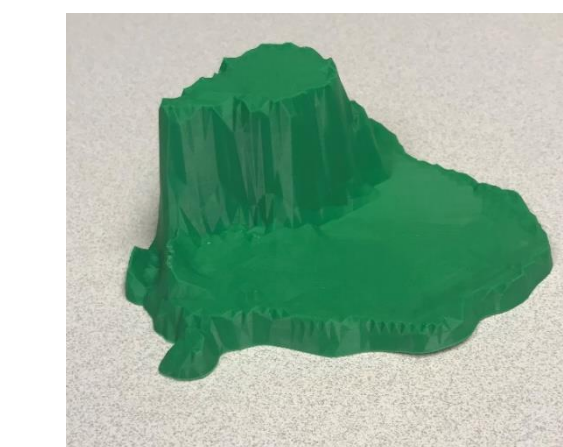
SCME Hotplate in Second Life

Virtual Cleanroom – Future Efforts

- Convert all cleanroom equipment to DAE files and upload to Second Life
- Build or purchase a cleanroom building and place on the IvyTech Engineering Island. Currently, we are moving a mountain to make the space available and using an Old West theme for part of the new buildings we are adding.
- Move the equipment into the virtual cleanroom. It will probably mimic the placement that currently exists in the SCME AltSpace VR. However, we may opt to mimic one of the real SCME Cleanroom chases (like the one for the 2022 MNTeSIG AltSpace VR environment).
- Add instructional content to all the equipment that describes theory of operation.
- Build a free Second Life Marketplace store and provide all the cleanroom equipment, crystal unit cells, SCME Pressure Sensor, etc. for others to use.
- Buy or create PPE gear for Cleanroom. Some items can be readily purchased others are unique enough that new items need to be created from scratch. Creating something that an avatar can wear requires another whole new skill set because the items need to conform to the shape of the avatar.
- Create a “safety game” that can be used to teach cleanroom safety. This could be fun!
- Add instructional content that includes readily available material that can be linked to external URLs.
- Get more student involvement to building the Virtual Cleanroom.



In Second Life



3D Printed

Next Step

- Update the IvyTech Engineering Island to include the “new” Virtual Cleanroom when completed. Some changes to the landscape are needed to make this possible.
- Present at HI-TEC, MNTeSIG, ATMAE, ASEE, VWBPE what we are doing in Second Life to promote engineering and MEMS education.
- Continue to use Second Life to capture student posters, add gamification, and point of need or interest education resources for our students.
- Continue to collaborate with other schools and organization on using virtual reality for education.
- Continue to build and share equipment models to include other equipment used in cleanroom and engineering labs.
- May move island to new the VWEC Eduverse location to improve collaboration with other schools.
- Create STL models that can be 3D printed of objects and equipment created in Blender. This could be used by younger students that desire more tactile interactions to the learning material.

Conclusion

Using Second Life has opened up many possibilities for teaching and learning. Instructors can add graphical course content that allows for user interaction with models. The models can be built by students and uploaded to SL for a very small cost. Scripts can be added to models to enhanced learning interactions. No VR headsets are required and most school PCs should be able to run the SL Viewer. And Students can present posters, interact with models, create and discover as they learn about MEMS. The goal is to build a virtual cleanroom that will allow students to interact with the cleanroom equipment and environment. Second Life also allows for access to web-based material in-world so this should enhance student learning because the course material can be integrated with the visual environment. Also, gamification can be added to SL to further engage students in learning.

Acknowledgements and References

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- 2 - Explore Virtual World Meeting Spaces <https://www.connect.secondlife.com/explore>
- 3 - Destination Guide>Education>University <https://secondlife.com/destinations/learning/universities>
- 4 - Second Life Education Directory http://wiki.secondlife.com/wiki/Second_Life_Education_Directory
- 5 - **Virtual Worlds Teaching Manual** by Gregory Perrier, August 2020, <https://online.nvcc.edu/it/docs/sl/Virtual-Worlds-Teaching-Manual.pdf>
- 6 – Second Life Download - <https://secondlife.com/support/downloads/>
- 7 – Second Life System Requirements - <https://secondlife.com/support/system-requirements/>
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- 10 - How To Get Started in Second Life - New User Tutorial <https://www.youtube.com/watch?v=4Y26VOR3ksU>
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