

6.111 Abstract: FPGA Ray Tracer

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The goal of this final project is to implement a ray tracer. A scene will be spatially subdivided into octants recursively, with the “leaf” nodes representing some cube of space (either empty or containing some material). This project has many challenging aspects such as creating and implementing efficient ray tracing algorithms and scattering. More subtle aspects such as balancing memory usage, throughput, and latency across devices with different requirements (ie ray tracing units, display, and other peripherals) and creating an efficient bus architecture will also provide challenges. Our most basic goal would be to display a static scene with only simple reflections from configurable camera angles, with externally provided scene information. The user will be able to control the camera angle and position using buttons/an IMU. Once this part is working, we would like to add diffuse and volumetric scattering to create more realistic/interesting images. An additional goal would be adding the ability to dynamically change the rendered scene which would involve recomputing the octree on the fly – this could potentially be done through a USB connection to a laptop or more ambitiously by implementing a CPU on the FPGA.