



Exploring Three Dimensional Environments Through The Oculus Rift

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Abstract

The research conducted for this project was done to create a more affordable alternative to the CAVE System, a computer environment using several projectors to replicate full immersion within a virtual environment. This technique costs thousands of dollars and requires extensive calibration prior to running. Our technique uses the Oculus Rift, Microsoft Kinect, and Unreal Engine for the graphical environment. This setup costs no more than \$500 to create and can be expanded and used in a much more generic location. This allows consumers to create their own CAVE system for any purpose.

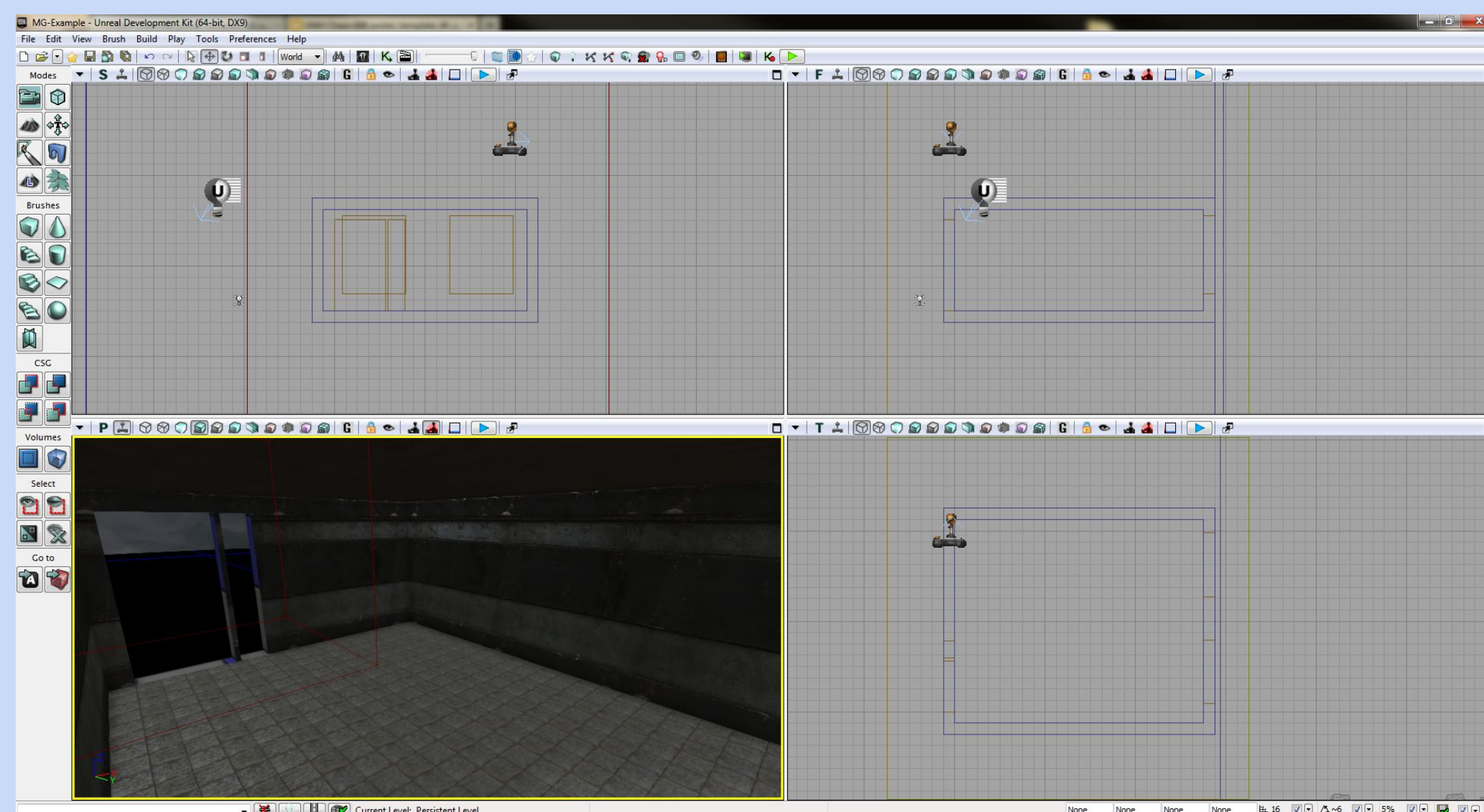


Figure 1: Unreal Development Environment Creator

Implementation

There are three main components in the implementation of this project. The location tracking, the user interface, and the 3D environment.

- The location tracking.
 - Performed with a Microsoft Kinect and the OpenCV (computer vision) library.
 - Frames are captured with the Kinect and passed to OpenCV for processing.
 - The image is thresholded to find a unique object in the environment (Figure 3).
 - The dimensions of this object are used to find X, Y, and Z coordinates.
- The Oculus Rift, an advanced head mounted display.
 - Implemented into the design to control the camera's orientation.
 - The Oculus Rift's sensors adjust to the headsets orientation (yaw, pitch and roll).
 - It then applies the orientation and displays the environment.
- The virtual world, the room seen in Figure 1.
 - Created using the Unreal Engine.
 - Environment makes calls to our location tracking software
 - The software then uses transformations to apply the data to the world's camera position.

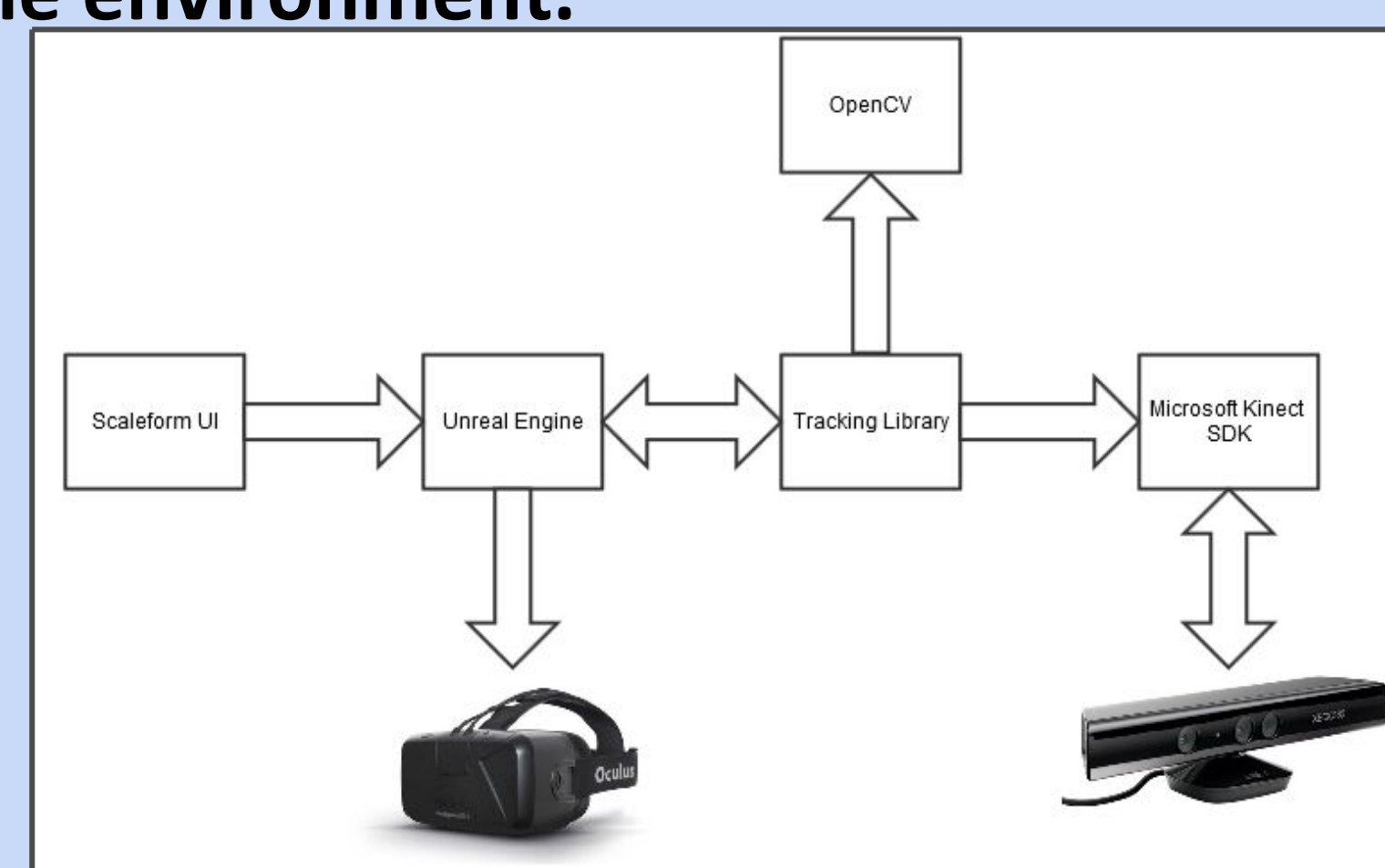


Figure 2: Flowchart describing the data flow

Future Work

- User end customization.
 - Ability to import and select from multiple environments and models.
 - Ability to give world coordinates to placeable models.
 - Parametrize the area for the camera to capture.
- Continue to increase the stability of tracking in all three dimensions.
 - Reduce camera stutter.
- Multiple cameras to increase area of motion capture.
- New version of Oculus Rift (1920 x 1080 HD).
- Remove Kinect specific camera dependencies.
 - Allow any industry standard camera to be integrated.

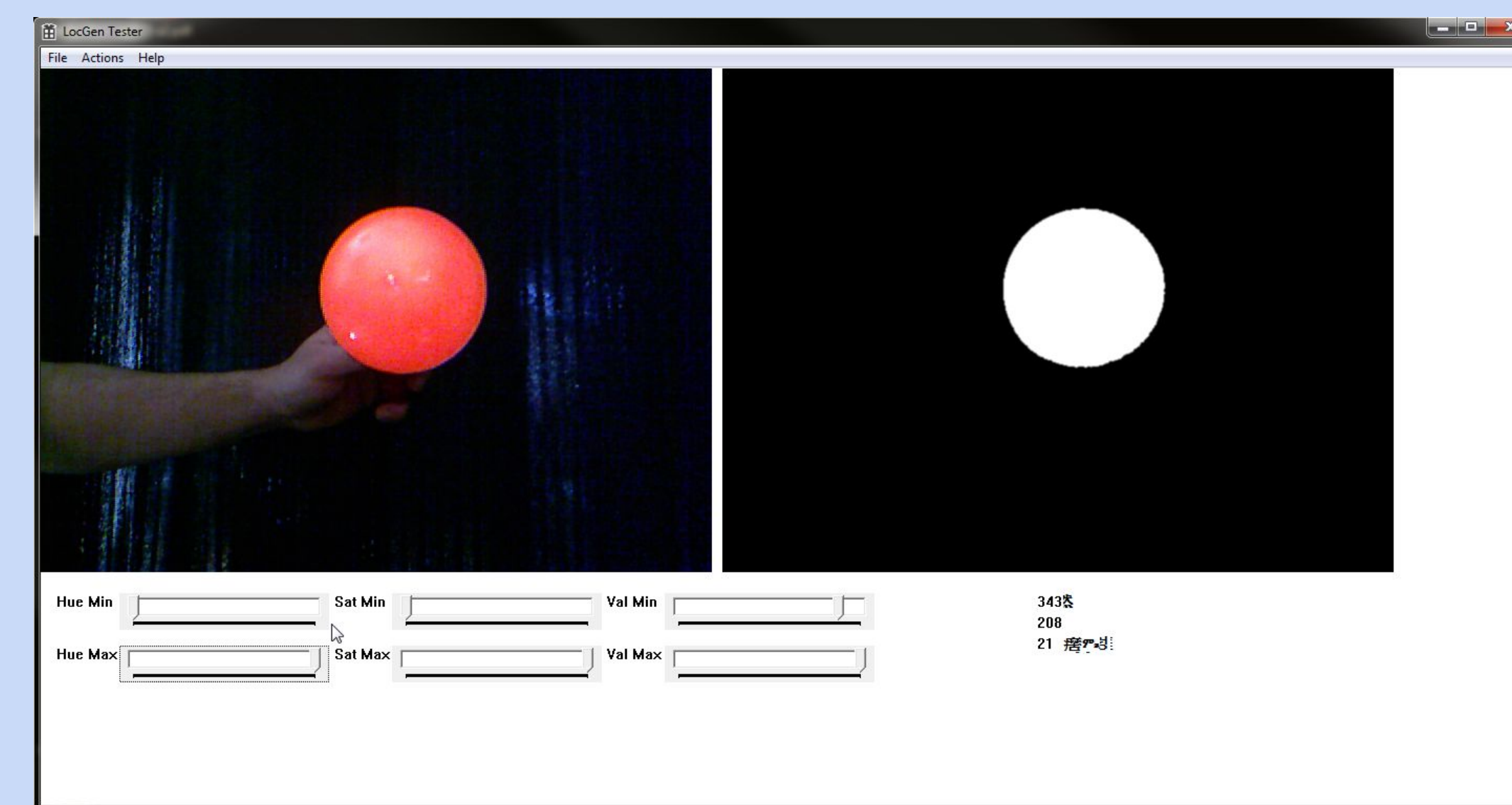


Figure 3: Kinect Tracking Debug Tool

Conclusions

Overall this project demonstrates the ability to implement a CAVE system in a more generalized and affordable way. The described features within our “future work” section allows for an even greater generalization by enabling the consumer to setup their own system with any number of commercially available cameras. Lowering the cost and increasing the efficiency and availability of these type of systems allows for an increase in the research capabilities of the many fields of study that are supported, this includes fields such as military, medical, architectural, and entertainment.

Acknowledgments

We would like to thank the UNH Computer Science department along with Professor R. Daniel Bergeron for allowing us to pursue and develop this project.

References

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