

CS 4800

# Programming Assignment 3

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Computer graphics play a large part in the current advancement of many technologies. Virtual reality applications and drones are becoming more and more prevalent in today's technological world. Their various uses, such as recording video or exploring dangerous areas, make them a viable option for any enthusiast or professional. From military to personal to medical use, drones and virtual reality applications are wildly and increasingly popular. Exploring avenues, such as these, provides extensive applications from computer graphics.

Learning about drones from Damià Fuentes Escoté, I was able to see just how drones may be used. Damià has developed a Python interface for the drone. It allows him to view the camera feedback, as well as control the drone remotely. He provided clear instructions for how to use the program he created, which allow anyone to replicate his practices. Getting the program up and running was straight forward; download and run some setup files to automatically install the dependencies needed. Damià mentioned that the drone positions itself using the camera and sensors.

Seeing the ideas from computer graphics implemented within the drone project are quite clear. Advancement with drones using computer graphics would allow a user to think of the drone as a single 3D object, instead of worrying about controlling all the different aspects for navigating the drone and the camera. The drone could be moved along the camera's axes, which means that the drone obviously uses a local coordinate system. Thanks to computer graphics, this can be translated to the real world.

Furthermore, most drones have four separate propellers for navigation, and with computer graphics, they can be set up in such a way that allows for simplified motion. Traditionally, drones had multiple controls for navigation, but, with added ideas from computer graphics, navigation could be as simple as a single swipe on a touchscreen

device using the drone's camera. Building off the project built by Damià, another camera would need to be connected so that depth calculations could be performed. Additionally, the drone

Extending the capabilities of drones would allow for a variety of practical uses. For example, helping the disabled, such as the blind. Damià mentioned that with at least two cameras depth could be calculated. Using depth information, a drone could be programmed to fly along a predefined path while keeping track of some object, say a blind person. Helping the blind to be able to run without the use of canes or similar devices could prove a useful application of drones. The drone could be programmed to fly around a track using it as its world coordinate system, while the cameras could be programmed to track the depth of the runner. With depth information, the drone could emit some type of sound to alert the runner that they have deviated too far from the defined path. Drone applications for the capable and handi-capable could be endless.

Shifting from drones to virtual reality, virtual realities essentially create brand new interactive, immersible world. Abhishek Chepe is developing a world based on mental health applications, specifically schizophrenia. Using Unity3D to create his application, Abhishek has developed a world that allows one to understand what life is like for someone with schizophrenia. This new world provides the user with an extreme amount of feedback from the surrounding world, as well as the world inside the mind of a schizophrenic, like voices and hallucinations. The world feedback was provided with scripts. Although the scripts were short, their use proved to be much more impactful. Abhishek also showed how the user navigates about the local coordinate system of the camera. Also, since virtual reality uses a headset for immersion, two images must be produced for each eye. This means that two slightly different images must be generated

with slightly differing viewpoints. Understanding how the mind of a schizophrenic works could provide a lot of useful information for treating such a condition.

Computer graphics, in the case of virtual reality, are extensively used. From rendering images, to calculating projections, to calculating movements, there is no part of virtual reality that does not rely on advancements in computer graphics. For example, user movement within the simulated world requires global and local coordinate systems. The world exists in some space, but the user interactions, like camera movement or simulated tactile interactions, require actions to happen in the vicinity of the user. Furthermore, images may be presented in such a way that requires the worldview to be transformed in such a way that requires rotations or translations as the result of the user navigating this world.

In conclusion, computer graphics and 3D applications involving drones and virtual reality go together. Drones and virtual reality applications essentially create a new world using ideas and concepts from computer graphics. Both avenues could lead to amazing developments serving various purposes. It is essential to understand some basics of computer graphics to develop applications for either drones or virtual reality. Seeing some of the techniques in action from Damià Fuentes Escoté and Abhishek Chepe helped demonstrate what may be accomplished.