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Flow Visualization

MCEN 4151-001

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Team Second Project Report

For this first group assignment, a group member had discussed using a imaging technique called Schlieren Imaging. Schlieren Imaging is a way to view disturbances in air by highlighting high and low densities of particles. A disturbance causes that air to form areas of higher and lower densities. When a light is passed through these areas, the denser areas will let less light pass while the less dense areas let more light pass.

Chris Davidoff and I went to Matthew Davis’ house next to the Engineering Center for the photo shoot. We used Chris’ camera for all the images. We had borrowed a high end four-inch elliptical camera from Professor Hertzburg to create the Schlieren image. We set up the camera, mirror, and a razor as shown in Figure 1. We found the focal length of the camera by shining a phone light at the mirror and moving back until the reflected light from the mirror formed the smallest point of light possible on the phone back.

A candle was lit under the mirror and the heat from the candle started to cause disturbances in the air around the mirror. We began to take images with the camera with a steady burning flame. When we had captured plenty of images with a steady burning candle, we began to place objects on top of the candle to see how the hot rising air would react to objects.

Razor

Camera Lens

Point Source of Light

Mirror

**Figure 1**

As an attempt to allow clearer visualization, the walls of the vase were cleaned. To focus and place the camera at the right location, we investigated the barrel of the lens to see where the reflected light was hitting the lens. We kept the camera on a tripod and did not move it so that the focus would stay in the center of the light. The only sources of light were from the single point source.

The photo was taken on a DSLR camera. The shutter speed was at 1/500 of a second to clearly capture the flow without blur. The aperture was held at f/3.2 to allow the flame to be bright enough without catching light from outside of the experiment. The picture was taken at a portrait angle with fixed 50 mm lens from about two feet. The image was cropped to center the mirror and to remove unnecessary space and areas of the vase were painted black to remove glare and reflection in the image. The contrast was turned up slightly and so was the saturation to enhance the colors of the image. Finally, a black padding was added to the sides of the image to make the image landscape.

The final image captures Schlieren image well and it is easy to see the disturbances in the air above the flame. The final image does however is slightly blurry and had the bottom of the mirror cropped. I like the symmetry of the disturbance and how it forms a dome at the top. To improve this image, I could use a larger mirror and replace the razor to remove the doubled image.