Omni-Directional Vision System for Mobile Robots

Biweekly Report

Presented to Professor Ricardo Gutierrez-Osuna
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by
The A Team

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The omnivisional group surpassed several milestones in the past two weeks. Previously we had implemented the hardware necessary to allow the camera to communicate directly with a PC via a serial connection, but despite all our efforts to get the camera working, we still could not establish communication. We solved the mystery surrounding this challenge and made significant progress towards completing our project goals.

Camera Success

After much testing and correspondence with Parallax and Carnegie Mellon about the CMUcam that refused to communicate, we began rechecking our hardware connections again. On a whim, we reversed the order in which we had the serial pins connected, and the camera worked. We do not know if the pin-out in the documentation from Parallax was backwards or if we were supposed to know that it was a mirror image. We were so happy to be able to see what the camera was seeing that we did not even think about wasting more time trying to figure out who was to blame for our delay. Please see Figure 1 for the first image we captured with the CMUcam.

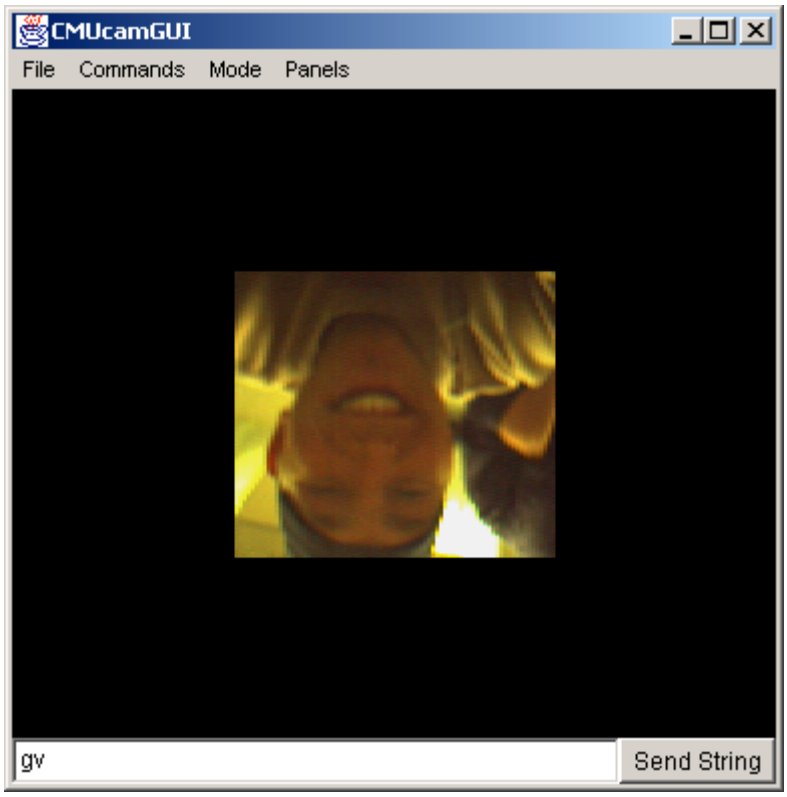

Figure 1 - First picture captured with CMUcam.

We moved on to mounting the light bulb at the correct height above the camera to maximize the amount of the camera's viewing window that is taken up by the mirror image. When we found the perfect spot, we hot-glued the light bulb fixture to our clear acrylic housing. As it turns out, our estimate of where the light bulb should be placed was very close to its final location.

Because we could display the image that the camera sees on our monitor, we were also able to focus the camera lens to sharpen the image. It might seem like a small formality, but being able to focus the lens was a crucial step in continuing our project. We also

experimented to see how far away the robot could see an object. Please see Figures 2, 3, and 4 to see the robot's view of a book at one, two, and three feet respectively.

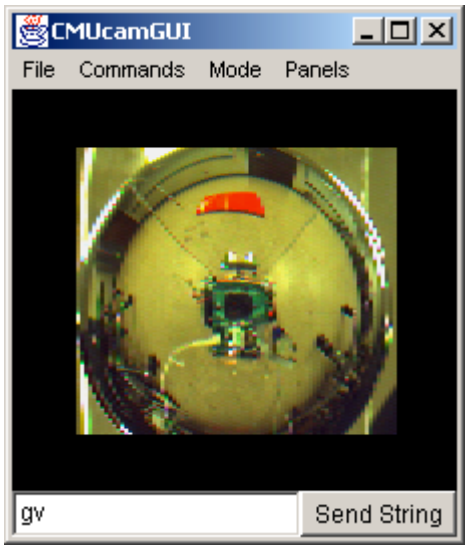

Figure 2 – Object one foot away.

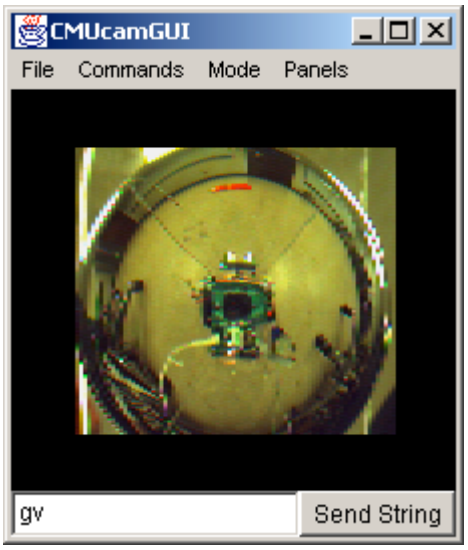

Figure 3 – Object two feet away.

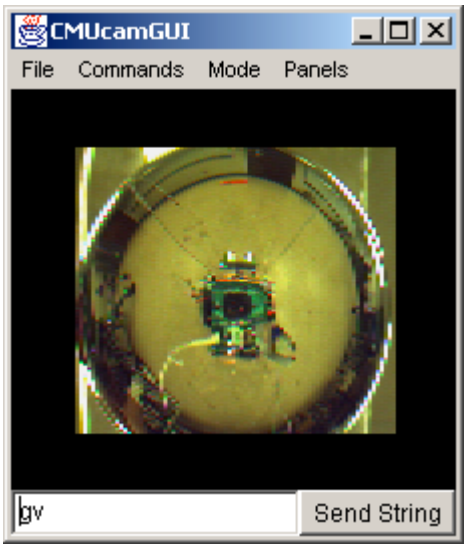

Figure 4 – Object three feet away.

Color Tracking Success

With our omni-directional mirror in place, we were ready to try to track a color in all directions. We implemented code to track a bright color and spin in place to face it. The camera locks onto a color during its initialization routine, and when placed on the floor the robot turns to face the color. The distance the robot turns is determined by the location of the color that the camera sees. After finding the color, a command is issued for the robot to turn to the color. It does not search for the color again until it has completed its movement to face the location it last saw the color. This is one serious limitation of the BASIC stamp: we can only do one thing at a time. We cannot poll the camera to see if the object has moved while the servos are moving. It is an inconvenience that we cannot overcome, and it will prevent us from attaining the ideal, smooth motions we had envisioned from our robot.

Current Work

Currently, we are integrating the obstacle avoidance, tracking, and movement algorithms into one program to achieve our final task. We know that the robot can perform each individual task successfully; now we are working on putting all the pieces of our puzzle together. We experienced several unavoidable delays due to the power outage on Tuesday, April 15, everyone going home for the long Easter weekend from April 18-20, and network problems that would not allow us to log on to the computers in the lab on Tuesday, April 22. We do not foresee any other major difficulties and feel that we will complete our project successfully by the end of the semester.