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Raspberry Pi Car Following Object

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Semester Project: Part 3 Report

The first part of our project was to set up our Raspberry Pi with the display, configure the camera, and download the necessary software such as Raspbian, VSCode, OpenCV, and PiCamera. Second, the methods that we're using for data processing are detecting lower and upper HSV values to create a mask through the inRange function, erode, dilate, and bitwise_and operation. We played around with different combinations of these methods and their iterations on our training data since we had used them in class and we have found that the parameters we have set now through trial and error to be the best. We then convert the image into gray scale since it simplifies the algorithm and reduces unnecessary computations. Once we apply those methods, we can detect the exact outline of tennis balls with the camera on our Raspberry pi using the following feature extraction steps: we chose to use Hough transform to identify the shape of the tennis ball in the video. We chose Hough transform as our feature extraction method because it's commonly used for circular objects and it excels in detecting them when there is a sharp contrast between the pixel colors along the detected edges. We can use a modified version of this method called HoughCircles which takes a grayscale image and multiple other parameters that we were able to set based on trial and error with our training data of tennis ball pictures and live video capture. The parameters we set for the function are Hough Gradient (detection method), inverse ratio of the accumulator resolution, the minimum distance between the centers of the detected circles (to avoid overlap but this doesn't apply here), accumulator threshold, minimum circle radius, and maximum circle radius. Also, while Hough Transform can have its limitations such as not performing well under noisy images, we don't expect there to be excess noise in our testing environment. Canny edge detection is already

used implicitly by Hough Transform and Hough transform uses only 3 simple hyper parameters in its voting algorithm to detect circles that are in contrast with the surrounding pixels.
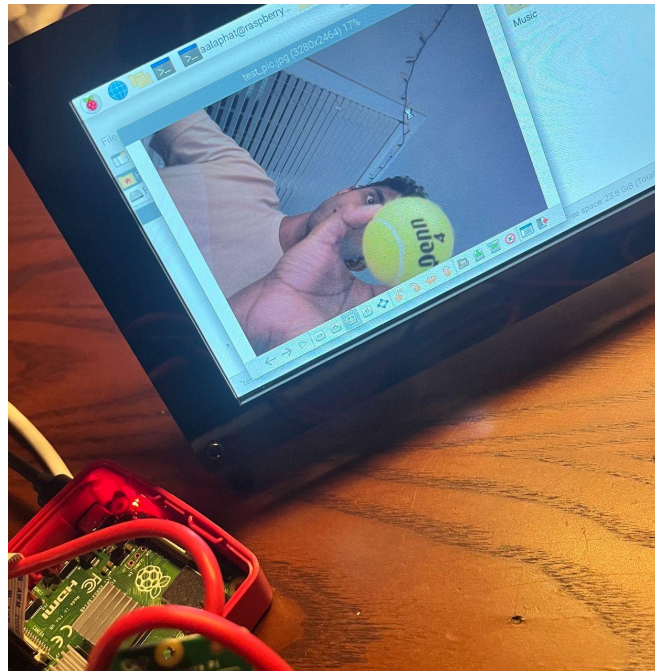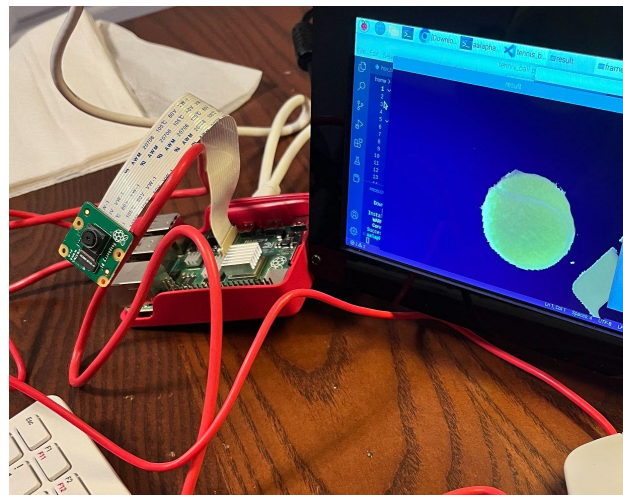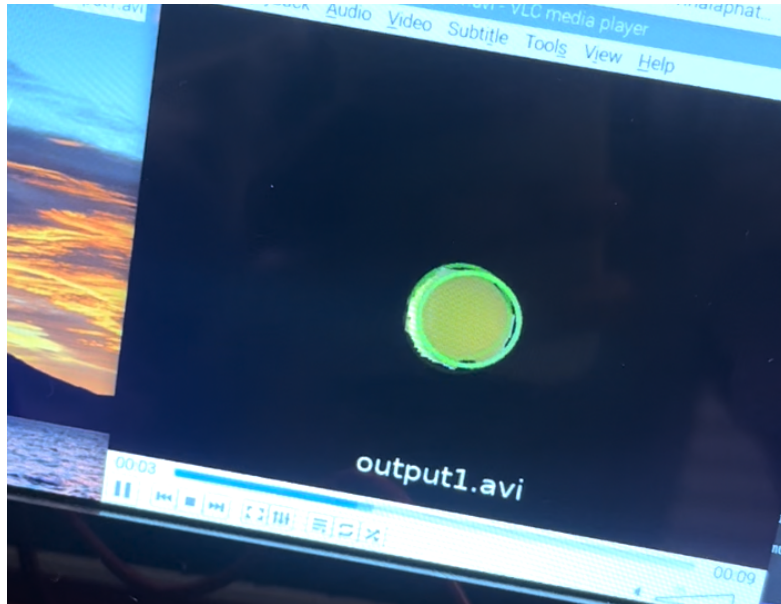

Figure A. Raspberry Pi Camera

Figure B. Result After Data Pre-Processing

Figure C. Hough Transform in Action