Development of an Automatic Object Tracking Camera System Using Multiple Metrics

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Summer Research 2004
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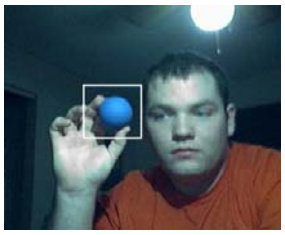
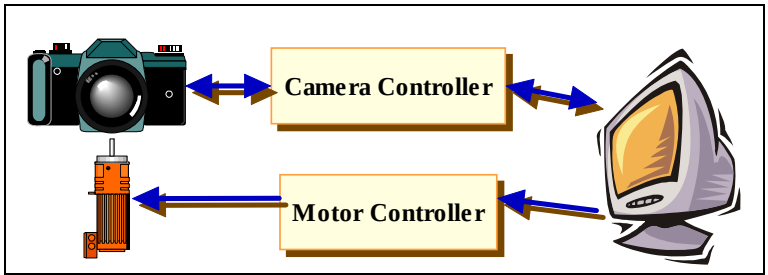
			
Image acquired from camera or storage device.	Automatically process image and find bounding region based on user input.	Region zoomed, cropped and displayed for further processing.	If region is detected within some distance from the edge of the image, then motor controller will pan/tilt camera.

Introduction:
Object segmentation separates regions of interest in image data that identify real world objects. Segmenting and tracking regions of arbitrary size within a scene allow the application to focus on more complex tasks like object recognition within a smaller spatial domain of the entire spatial scene which reduces the processing time required to identify the object of interest. Reducing the spatial domain of the image decreases the computational resources necessary for the detailed analyses required for object recognition.

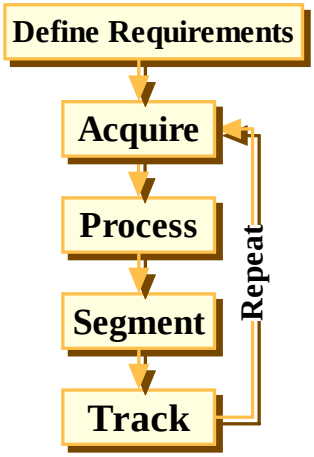
Object tracking has many applications in video and image processing systems. Robotic vision, security cameras, video editing, and smart rooms are some examples of systems that would require such an object tracking system. Segmentation and tracking object within an image enables a system to gain a higher level of comprehension from the seemly random pixel values within the image data.

Implementation:
We intend to blend many disciplines of study including software development, process control, electrical engineering and even mechanical engineering to develop an automatic motorized object tracking system. We will be developing a complete system from the ground up including the software, hardware, firmware, and device drivers.

Our aim is to develop a robust algorithm using multiple metrics to segment and track objects within a single image or a sequence of images. The solution proposed is to retrieve geometric regions by integrating multiple measurements from a single image or from a sequence of images. Measurements might include information like edges, motion vectors, threshold information, and color spaces.

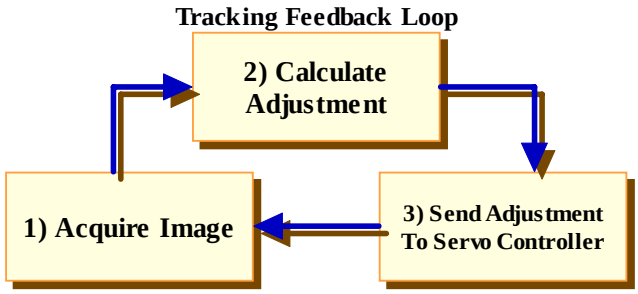


System overview

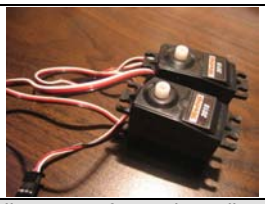


Acquisition of image content
The software will have the ability to process static images from storage as well as images captured in real-time from webcams. Because our system will be a generalized object tracking system, users will specify various constraints like color, size, and shape. Optionally, the user has the option to view the intermediate steps during image processing (enhancement, segmentation, etc).

Processing / Detection of the object
The image enhancements and object segmentation algorithms applied will be dependent upon the constraints given by the user during acquisition. Object segmentation will take place by integrating color, edge, differences, and motion information. Once the image manipulation process is complete, the system will look for connected regions and filter regions based on size.



Tracking system
The goal of the tracking system is to control the camera pan and tilt such that a detected object remains projected at the center of the image. The camera tracking system hardware will include a microcontroller based servo controller that interfaces to the software running on the computer. The servo controller will adjust the viewing field of the camera by applying the adjustment output as a pulsed width modulated signal to the servo motors. Adjustment output will be calculated by the software in the acquisition feedback loop to center the object found with the specified user constraints. A camera mount will be fabricated for the camera as well as housing for the servos this allows a range of motion for tracking moving objects.

		
Possible controller for camera pan/tilt.	Typical webcam	Controller servos for motion adjustments

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