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FollowCam

UNIVERSITY OF WATERLOO

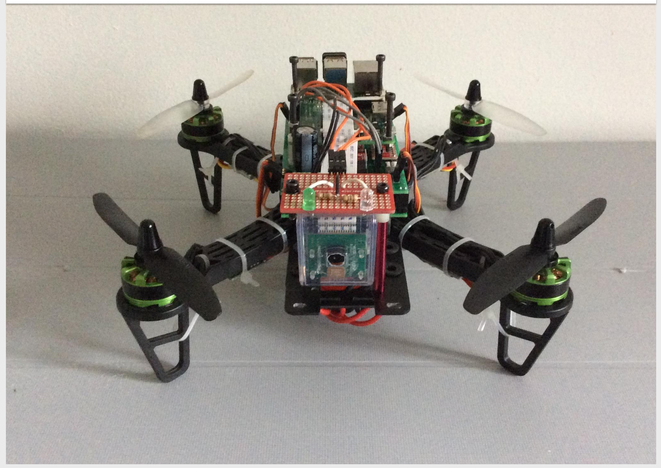
Motivation

- Currently filming oneself usually requires the camera to be operated by a third-party person or to have the recording camera positioned in a single place beforehand.
- We proposed that using image processing, control theory and multi-rotor design we could design a system that can film the user more dynamically and accurately than any human could.

Objective

- To build a UAV that will track the user through the use of image processing and control algorithms

Final Design



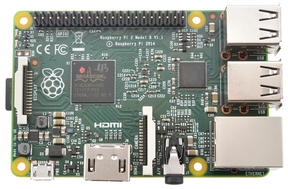
Component	Design Alternatives and Iterations		
Single Board Computer	**Raspberry Pi**	BeagleBone	Arduino
Communication Protocol	SPI	**I2C**	
Image Processing Techniques	**Human Shape-Based**	Color-Based	
Manufacturing Options	3D-Printed Frame	**Stock Frame**	
Battery Capacity	1300 mAH	**2200 mAH**	

Camera

(Image Input)

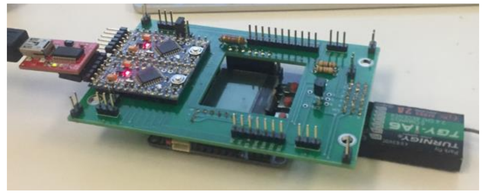
Raspberry Pi

(Image Processing Algorithms)



Control Electronics

(Control Theory Algorithms)



Electronic Speed Controllers

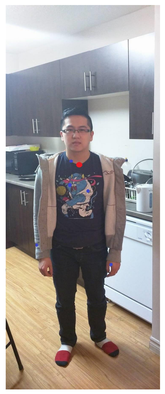
(Generate Three-Phase Power)

Brushless Motors

(Electrical to Mechanical Energy Conversion)

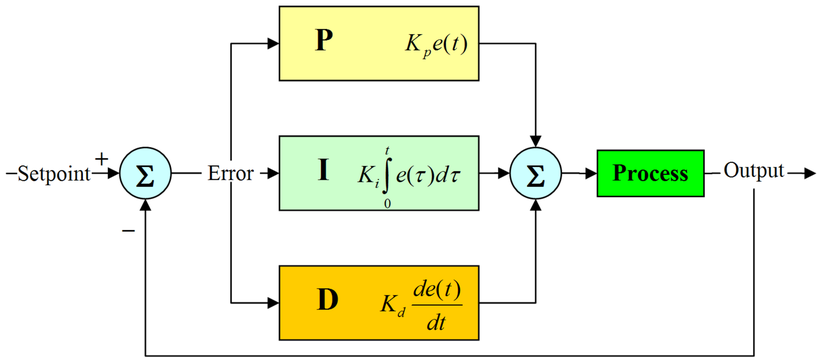
Image Processing

A HOG descriptor is used to detect a person.



The Lucas-Kanade method is used to track feature points found on the person from frame to frame.

Control Theory



PID control algorithms are applied on the input from the image processing algorithms. These control algorithms are applied on the rudder movement (to control the x position of the quadcopter) and on the throttle movement (to control the y position of the quadcopter).

Results

- We proved that Image processing and control theory could be used on a multi-rotor to produce dynamic and accurate tracking movement.
- The final system had the image processing and control algorithms implemented only in the rudder and throttle movement. Implementations on the elevator and aileron movements will be required in the future designs.
- There can be many more improvements in the frame designs, battery integration, faster microcontrollers, use of FPGAs for faster image processing, propeller guards and weight reduction.