

# DRONE PRODUCT DESCRIPTION AND SPECIFICATION

*2/7/16*

*REVISION 3.0*

## PRODUCT DESCRIPTION

Our smart drone will be able to track any object in an open field autonomously. It could be your best friend when you want to do outdoor activities. It will capture your moment when you go down a ski slope, or when you make a fancy move while dirt biking. Show off your skills and our smart drone will record it.

### MUST

- Our drone must autonomously follow an object in an open field with image processing software on board.
- Our drone must track an object based off of image processing techniques rather than tracking a device located on the object
  - The image processing techniques will be used to process an image of the object uploaded to the drone via the user.
  - Image processing and tracking will be done using OpenCV library. There are a variety of image processing and tracking techniques and algorithm in the OpenCV library that we can utilize to accomplish our goals.
    - SURF (Speeded Up Robust Features) is an image processing technique that uses key feature identifiers for object recognition.
    - Distances from the point of the captured image of an object can be measured with Triangle Similarity and knowing the intrinsic parameters of the camera (focal length, sensor height, etc.). The approximate true height of the object may be needed as well.
    - OpenCV can differentiate objects based off of color differences among other algorithms and functions provided by OpenCV.
- Objects traveling only in a straight line will be followed directly behind in the direction of the travel greater than 10 feet distance. The object must not accelerate or decelerate faster than approximately 3 mph (average walking speed of a person). The drone will fly at a height just greater than the height of the object (approximately 7 ft from the ground) to ensure optimal view of the object.
- The drone must have the ability to follow an object on clear or slightly cloudy days
  - As it stands, the electrical components and circuitry are exposed to the elements. Protective casing is not a prerequisite for us and will be handled if time allows.

### SHOULD

- Our drone should implement GPS onboard and transmit GPS coordinate information to our microcontroller.
- Objects will be followed directly behind in the direction of travel at greater than 10 feet distance from the object with the object traveling in straight lines and turns no greater than 45 degrees. The object must not turn in the same direction twice. Thus, the drone can follow the object primarily by strafing. The object must not accelerate or decelerate faster than a rate of approximately 20 mph.

- Our drone should have a minimum flight time of 30 minutes under the condition that all four motors are running at full throttle and all electrical components are actively computing (scenario with greatest power draw)
- Our drone should track and differentiate unique, specific object among a collection of possible similar objects using OpenCV's image processing techniques
- If the drone loses track of an object, the drone will go back to it's initial starting position defined by the user who activates the tracking sequence

## MAY

- Objects will be followed directly behind in the direction of travel at greater than 10 feet distance from the object with the object traveling in any direction at anytime. The object must not accelerate or decelerate faster than a rate of approximately 20 mph
- The drone may have Implemented WiFi onboard to assist with the transferring of image and video captures between the drone and the user while the drone is within wifi proximity with the user
- An application with a rudimentary gui may be developed to assist the user in interfacing between their image uploading device and the drone. The application may also assist in storing and/or retrieving saved video/image captures.
- The drone may store any relevant information that the user may find useful on an SD card such as, but not limited to, image and video captures
- The drone may have a protective casing or cover to protect the electrical components from the environment
- The drone may have additional servos to allow for greater degrees of freedom for camera movement as opposed to the camera being fixed to a single viewing position
- The drone may scan an object to captures multiple images from various angles of the object that is to be tracked as opposed to a single image of the object being tracked
- Status LEDS may be implemented to provide the user with potentially relevant information such as battery life, on/off, etc.
- The drone may be able to be thrown into the air for launch as opposed to having to be launched from a launching pad or with the landing gear attached