**Spring 2014, Capstone Project Proposals from MESA Lab @ School of Engineering @ UC Merced. (Last updated: 12/03/2014)**

**Project-1: Vegetation Spectral Indices from High Resolution Multispectral Aerial Imagery**

* Applications - Decision Support for Precision Ag, Conservation Efforts
* Scope of Work - Most vegetation indices were developed for satellite imagery, but with new high resolution images available, there is an opportunity to identify and develop vegetation indices that can show more information and provide better analysis results. Spatial identification through innovative variability analysis.
* Requirements - Identify and develop low-cost way of mapping visual-based vegetation indices. Develop an innovative method to analyze spatial and temporal variability.

**Project-2: Small, Lightweight, Precision Sprayer Design and Prototype for Mobile Robots**

* Applications- Precision Ag, Conservation Efforts, Pest Control
* Scope of Work - There is a need for using small mobile robots (including ground mobile robots and unmanned aircrafts (UASs)) to precisely spray a small amount of liquid at a small targeted areas.  This project will be responsible for developing an easy-to-integrate spraying system. The project does not require to be integrated with a UAS, but should be tested on a mobile robot controlled by an Arduino.
* Requirements- Must demonstrate a sprayer that can target and spray a 5cmx5cm target. Additionally, maximize the amount that is carried by the mechanism. Design and develop a completely modular payload enclosure.

**Project-3: Height Programmable Field Sensor Pod (HPFSP)**

* Applications - LiDAR, Communication Relays, High Precision Photogrammetry
* Scope of Work - Minimal autonomy of vehicle will be required of the team, simply altitude holding and GPS lock. The team will need to integrate dGPS into an autonomous system, calculate max payload, identify payload precision, and identify power necessary. A “dummy-payload” will be utilized to validate the project’s results.
* Requirements - Lift a predetermined payload for several hours consistently while utilizing a multi-rotor vehicle that is tethered to an external power source on the ground below.

**Project-4: Low-Cost Autonomous Unmanned Surface Vehicle (USV)**

* Applications - Conservation, Water Sampling, Bathymetry, Canal Inspection
* Scope of Work - There is a need for a small autonomous watercraft capable of mapping out river banks and depths for a variety of restoration projects.  A range of 50 meters as a minimum radius is sufficient for the scope of this project. The vehicle would be outfitted with an autopilot, GPS and sensors for navigation and a variety of environmental sensors and mapping systems for the payload. Low cost is defined as under $500 based on an RC boat. Designed for the small creeks common to the Central Valley, it should be capable of avoiding obstacles and debris, as well. (based on: <http://www.eswusa.org/drupal/2014-inter-chapter-challenge>)
* Requirements - Modify an R/C boat to perform autonomous navigation. Commercially of the shelf (COTS) autopilots are encouraged to be utilized and modified. Propose collision avoidance methods for future teams to extrapolate upon.