Group Name: SPIDER

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CECS 490A – Senior Project
Project Description – Specification
Due: Oct 22, 2014

Part I: Project Specification

Stage 1 – Refine your product description to include more details on the device functionality, user interface and packaging. So far you have presented only a brief conceptual statement. It is time to think more about the overall device you will be designing. You might find that as you think more about the details you mind want to modify your descriptions.

KEY FEATURES
- Autonomous GPS Navigation Mode
- Travel circular clockwise to take area image
- Object Collision Detection
- Custom Lightweight Frame
- Rotating Camera using Stepper Motor

Project Description:

Our project will be surveillance UAV which is a battery powered hexacopter. The hexacopter will fly autonomously to a given GPS coordinate, take aerial photos, and return to the original starting location. During the duration of the flight, the host computer will be able to view the current position and status of the hexacopter and act accordingly if there is a problem with the flight path. The hexacopter will begin executing a circular clockwise movement around the specified GPS coordinate when it is 25 feet away from reaching the GPS coordinate. As the hexacopter is moving in a circle, an auto-stabilizing camera will keep the camera's point of view locked onto the GPS coordinate and take pictures. After it has completed its mission, it will return to the starting location and the user will be able to take the MicroSD card from the hexacopter and view the pictures.

Stage 2 - Similar and Prior Technologies

1. Research the Internet, magazines and journals for prior and existing products and technologies that have functionalities similar to the device in your product description.
2. List the related devices and provide similarities, advantages, disadvantages and cost of each. Provide a summary in a table format.
3. Provide a concluding statement that specifically tells how your device will be better than those you have listed.

Devices	Similarities	Advantages	Disadvantages
 **DJI S900 Spreading Wings Hexacopter** **Foldable, lightweight hexacopter with retractable landing gear, mounting bracket that allows for a range of camera angles. ($1,489.00).**	Mounting bracket that allows for range of camera angles.	+ Retractable landing gear allows for photos to be taken without being blocked by landing gear. + hexacopter is foldable and easily transported	- Lacks intelligent capabilities such as GPS and autonomous features
 **Parrot AR Drone 2.0** **Smartphone. Table controlled hexacopter, automatic stabilization system, live video streaming and recording. ($353.44)**	On board camera features	+ WIFI video streaming capabilities	- Does not use an auto stabilizing camera - Lacks of intelligent capabilities such as GPS and autonomous features
 **Parrot MiniDrone Rolling Spider** **Quadracopter with an embedded mini-camera allowing for aerial photos, smartphone controlled via Bluetooth, performs in air flips. ($99.99)**	On board camera allowing for aerial photos	+ Bluetooth capabilities using smartphone app + Capable of operating in air or on land with use of side wheels	- Lack of intelligent such as GPS and autonomous features - Small design limits the use of additional hardware - Camera is not mounted to allow angle ranges

 **MQ-8 Fire Scout** **Unmanned Autonomous Helicopter with precious targeting system. ($18.2 mil)**	Autonomous travel to their destination with coordination given by GPS. Camera on helicopter able to move and view on different angle.	+ Highly intelligent + Situation awareness + Capable to operate in harsh environment	- Cost is too high

Research Conclusion

Unlike the systems listed above, our copter will be able to operate autonomous to travel to its destination. Most of the aerial system requires someone to operate it by using some kind of controllers. There is some of the copter able to fly autonomous; however it comes with a big price tag. The copter that we plan to create will be able to operate on its own to fly to the given location by using GPS. It will fly in circle around the location to take many photos and store them into the MicroSD card. There will be the stepper motors to control the camera rotation. This allows our copter to be able to take better photos at many different angles. While flying in the circle, the camera will be auto stabilizing to keep its point of view on the GPS coordinate and take photo of it. After complete the mission, the copter will fly back to the base. These surveillance drones usually come with the big price tags. However, our aerial devices will be able to perform many similar features with a fraction of the price.

Stage 3 -- Engineering Design Specifications

1. Provide a detailed list of the any and all design specifications
2. Examples would include but not limited to: Max current, max voltage, standby current and voltage, standby power, operating range, material case made of, max operating temperature, etc.
3. This list might be extensive and must be very detailed. Every specification must have an absolute number or a legitimate range of numbers. These numbers might change as you select different components for your design but these numbers should accurately reflect the requirements for your design.
4. These numbers are not arrived at through guessing or just pulling them out of the air. You must do your due diligence or research to come up with reasonable numbers. You must have a reasonable block diagram of your hardware requirements so you can determine size, power requirements, speed, and performance.

1. The hexacopter will fly autonomously to a given GPS coordinate and return to a chosen base location.
2. Upon arriving to given GPS location, the hexacopter will circle around the coordinate with a radius of 25 feet for 3 full rotations.
3. The hexacopter will rotate clockwise around the given GPS coordinate.
4. The hexacopter will take off and land autonomously from a flat and stable surface.
5. Photos will be taken by using an auto stabilizing camera which will maintain its point of view directly on the given GPS location.
6. Photos will be taken from a height of 20 feet
7. Photos will be stored into a MicroSD card.

Stage 4 -- Verification of Engineering Specifications
For ten of your most significant engineering specifications you must provide a method of verifying your numbers. These must be significant specifications and not weight or size.

1. A host machine will send a GPS coordinate to the hexacopter and the starting location will be set as the base location where the hexacopter must return to.
2. Hexacopter will be flown in a circle with a radius of 25 feet for several rotations to ensure a proper circular rotation around a given point.
3. Verification will be done when the hexacopter is able to move clockwise around the GPS coordinate.
4. As most of the testing will be done in CSULB soccer field, the launching and landing will have to be done on a grassy field without any problems.
5. Camera stabilization will be tested separately from hexacopter. Will be tested by walking around with camera and testing the stabilization.
6. Camera will be mounted on hexacopter and pictures will be taken to test the image clarity from the given height.
7. When pictures are taken, the MicroSD will be removed in which the pictures will be verified.