Project Drone Pet

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Project Charter:

Project Overview:
Throughout this quarter, we'll be building a drone/quadcopter that has the capability to fly itself (is completely autonomous), and can follow people around recording their activities. We'll be using an off the shelf drone, and run our own software on it, that can run it autonomously. We have identified the parrot AR drone as our starting point, as it affordable enough for most people.

Project Approach:
We want to do multiple things on our quadcopter. One of them is using OpenCV to recognize an object, or tag onto it. We have found many videos showing how you can use OpenCV for object recognition.
We also want to implement SLAM (Simultaneous localization and Mapping), an algorithm that will help the quadcopter recognize where it is in a small subset of an environment.
Lastly, if we successfully get indoor autonomous quadcopter working, we will want to move outside, and use a GPS module to help guide the quadcopter.

Project Objectives, Milestones and Major Deliverables:

Milestone 1: Get the Drone Flying autonomously, without any video streaming or external output. EvEn if it's as simple as :Take off, Make a round circle, and drop off.
Due - End of Week 3

Milestone 2:
Use OpenCV or something to detect a tag.
DUE : End of week 4.

Milestone 3:
Move the quadcopter to follow the tag. Whilst constantly monitoring it. Even if its at a slow speed.
DUE: End of Week 6

Milestone 4:
Brush out details and proof the code so the quad doesn't make mistakes.
DUE: End of Week 8.

Milestone 5:

Demonstrate that your drone can follow tags/people.
DUE: End of Week 10/Finals Week.

Potential Long Term Goal: Use a GPS for outdoor autonomous navigation.

Constraints, Risk and Feasibility:
Realistically, 8-10 weeks is not a lot of time. We definitely want to complete the indoor autonomous following portion, and also the SLAM portion. If we get the time, we'll move on to the GPS part.
Other risks involve breaking/losing the quadcopter and delaying the project by a few days. I've already almost broken my quadcopter, and have had to get a new one. It's not like a Robotic Car that crashes, the crashes are generally much more severe on a flying object.
We'll try to avoid this by flying on as low of a height as possible, and being as safe as possible while tinkering with it.
We'll also fly the drone in a controlled environment, so it doesn't fly off. Possibly only indoor.

Group Management:

What are the major roles in your group's management?
Both of us will work together. Both of us are engineers and will share responsibility.

How will decisions be made? By leader, consensus?
By consensus. If we really can't agree on some issue, Aditya will take over.

How will you communicate? Email, meetings in the lab, discussion board?
In person, and Instant Messaging. We live close by.

How will you know when you're off schedule, and how will you deal with schedule slips?
We'll try to finish our work before time, so when there is an emergency, we have time to cover up.

Who is responsible for which deliverables and milestones?
Both of us are responsible. Small Team.

Who will produce the weekly group status reports?
We'll alternate, starting with Dhruv.

Project Development:

What are the development roles and who will handle them?
We have a small team, so both of us will have to share responsibilities. Both of us are engineers, and have prior experience in Robotics.

What hardware/software will you use? What do you have available? What do you need?
We just received a quadcopter. We'll be using our laptops to code in ROS or Javascript to create a flight controller. We'll also be using OpenCV for image recognition. We probably will not need anything else.

If there is software/hardware that is needed, provide a justification for its cost. Where will you order it? When will it arrive?
We ordered a Parrot AR Drone. It already arrived. It cost around $260. We wouldn't have been able to move forward without a quadcopter.

How will you do testing?
Live Testing and Some Simulation if possible on ROS.

How will you do documentation?
We'd use github to host our code and documentation.

Project Schedule

- Define a set of milestones with a specific definition of what each milestone is, what it means to complete each milestone, and when you expect to complete them. Define the milestones at two scales, a high level set of key milestones, and a low level set of weekly milestones. Also prioritize them. Some that are necessary, others that are useful, some are hopeful if time permits, etc. Gantt charts are often helpful to better visualize the milestones and understand their dependencies.

Milestone 1:
Get the drone to fly autonomously in simple paths like going around in circles, flying in a straight line, etc.
Due - End of Week 3
Milestone 1.1: Setting up the ROS nodes and interfacing with the drone.
Milestone 1.2: Testing accuracy of drone in relation to the ROS feed and fine tune it.

Milestone 2:
Using OpenCV to detect a 'tag' which the drone would follow when fully functional.

Due: End of week 4.

Milestone 2.1: Look into object classifiers and initially choose objects with the best pre trained classifier.

Milestone 2.2: Try to train our own classifier that detects an object of our choice (if time permits).

Milestone 3:

Make the quadcopter follow the tag.

DUE: End of Week 7

Milestone 3.1: Have the quadcopter move slowly towards the tag

Milestone 3.2: Fine tune the tracking algorithm to account for changes in directions, sudden movements and loss of sight of the tag (Necessary but the complexity of the algorithm would be proportional to the amount of time we put in).

Milestone 4:

Bug fixes and final touches. Try not to test new things at this point as it'll be too late to implement them with all the necessary testing required.

DUE: End of Week 8.

Milestone 5:

Demonstrate the capabilities of our drone- It's ability to track tags and capture and store the video.

DUE: End of Week 10/Finals Week.