

ENSC 481: Computational Dynamics

Program Proposal Memo V2

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General Idea: We want to take what we can from senior design and continue to explore photogrammetry and image processing. Potentially surrounding insects or more general depending on how easy it will be to gather clear footage of insects flying.

Progress so far: Considering what we had done for Senior Design up to this point.

- Video Processing
 - Input: Video from Camera
 - Output: Images Files “Light values”
- Camera Calibration
 - Using MATLAB toolbox to gather extrinsic properties
 - Input: Camera images of checkerboard, dimension of checkerboard squares
 - Output: Estimated distance of camera to object, origin and coordinate system on checkerboard

WIP/Goals:

- Photogrammetry Steps:
 - Establishing a global origin by using the calibrated images
 - Reading through techniques and equations within “Close-Range Photogrammetry and 3D Imagery”
 - There are also sections in here about feature detection and they provide a few methods to do so!
 - Giving coordinate point locations to objects we take pictures of/insects if we find good footage
- Image Processing:
 - Edge Detection
 - Using MATLAB Methods to start creating edge detection code
 - Gaussian noise reduction
 - Built-in MATLAB commands
 - Research into MATLAB(/Python?) Image Processing Libraries
 - Feature Detection
 - Learning methods in the book we have or using resources online
 - Checking the image processing libraries and detect basic objects from different views

Main Deliverables: What is accomplishable from all of this?

- Photogrammetry Code:

- Can establish a global origin
- Project coordinate points from multiple views
- Image Processing:
 - Edge detection
 - Object detection (simple objects/different insects?)
 - Basic feature detection
- Combining the two:
 - Giving specific objects or features of an object coordinate positions
- Stretch Goals:
 - Analyzing moving insects akin to our original project
 - Complicated feature detection (different insects but detecting the same types of body parts: wings, body, antennae)

Process:

- Research time (03/27/20 – 04/03/20):
 - Gathering information, libraries, and exploring the book we just got to flesh out our work and goals
- Writing pseudo-code, documenting current files, preparing instructions (03/27/20-04/03/20):
 - Writing explanation and instruction for bugs, containment cube, lasergates, cameras, Arduino, lights, etc. This way whoever takes over the project can pick up where we left off and something to add to the final report.
 - Deciding on a standard way of code delivery (github) and formatting (consistency and organization is important)
 - Organizing teams and sources/information we have gathered so far (this will be all semester long as we will hopefully gather more resources)
- Focusing on photogrammetry (04/04/20-04/10/20):
 - Establishing the code outlined above for photogrammetry
- Focusing on image processing (04/11/20-04/17/20):
 - Establishing the code outlined above for image processing
- Evaluating stretch goal feasibility and creating the podcast (04/18/20-04/24/20):
- Wrapping up the project (04/25/20 – Final Date):
 - Organizing deliverables and creating presentation to deliver the final results (this will most likely be a modified version of our final oral presentation in senior design)