

Week 6 homework

Due date reminder

Please email your completed assignment to the course TAs (mch6@illinois.edu and jjc11@illinois.edu cc rlongo@illinois.edu, subject: '[PHYS371]: Week 6 Homework, Your Group Number') by Thursday, 5 pm of week 5 (03/01/2023). Homework that includes only group work should be submitted by one group member, rigorously copying all the other members, the instructor and the TAs.

Each day of delay in turning in the assignment will result in a grade reduction of 10%. We will not grade anything submitted more than one week late. A group member can use their wildcard to delay the homework turn-in to the beginning of the class on Friday (e.g. not to the next week anymore, since the assigned tasks are now time-sensitive). The use of the wildcard should be communicated to the instructor and the TAs before the deadline to turn in the homework.

Quote the main authors of different parts of the code you develop. **Keep the code up-to-date on the GitLab repository.**

Please compress all the material related to the homework into a .zip or .tar file. If you have questions or points you need to address, please do not wait until the last day to ask for office hours since it may be impossible to accommodate all the requests on short notice.

Problem 1

At this stage, groups that have not yet finalized the breadboard layout should make an effort to accomplish the step this week and walk-in on Friday ready to sit with the instructor and the TAs to finalize the PCB design. Groups that have already reached this stage should focus on data analysis.

Group 1: Finalize hardware setup with the ArduCam and all the other sensors needed. Provide proof of operation of all the components to meet the project requirements. If any of the components is found to be not adequate, provide a backup solution. Be ready for final PCB design on Friday.

Group 2: Take data with the Arducam in 432 and finally test the initial version of the ML analysis with the outcome of the data-taking. Proof that ML can be sufficient to measure velocity or provide an alternative solution. Set up various sensors on the actual perimeter of the colliding field. Be ready for final PCB design on Friday.

Group 3: Prepare an analysis teaser presentation (~10 minutes). See the end of this document for details about the requirements for this task. Provide a report on the final conclusions about the dead-time related to the camera and how this affects data taking strategy (can be discussed in the presentation).

Group 4: Sort out the issue with the Plantower setup. Cross-check implementation with Group 7 and nail down once per all the issues observed during HW5. Layout the setup for measurement (including a support structure for the PCB, e.g. not only the external 3D-printed case). Make requests for material to be used to implement the setup.

Group 5: Prepare an analysis teaser presentation (~10 minutes). See the end of this document for details about the requirements for this task. Test the new material provided by the instructor on Friday vs the bathtub cover.

Group 6: Provide finalized PCB schematics to the instructor (better if before Thursday). Repeat previous analyses in python, or c++ or Origin (e.g. migrate away from Excel). Carry out one test measurement in the FORGE lab with the fully assembled breadboard.

Group 7: Nail down issues with the communication between different sensors and make the breadboard functional. Provide a short written report about the problem and the solution found.

Group 8: Work with the plumber to get the T installed (or to schedule that intervention). Start taking test data with the different flow meters through Loomis and provide a short summary of the first preliminary results. Show potential locations for long-term measurements with the pressure sensor.

Note on analysis “teaser” presentations

Your presentation should include: an overview of test data taken to validate your setup, a first look to test data, data analysis techniques (to be) used for the final analysis, and plans for data taking and analysis once the PCB is assembled. Please note that the first look at the data should be based on a significant sample, e.g. not on a handful of a few acquisitions. The latter can apply only to complex data samples (e.g. Machine Learning analysis of images) that may not be ready and not trivial to establish properly during the next week. You are strongly encouraged to analyze your data via python or c++. Specific data analysis software like Origin or Mathematica will also be accepted. Data analyses carried out with Excel will not receive full evaluation. Other discriminants for the final grading of the presentation will be related to the fair share of the presentation (please avoid evident unbalance in the presenting time between different group members, e.g. 30 seconds vs 4 minutes), quality of the slides, quality and readability of the plots, timing of the presentation and so on.