

Institute of Robotics, University of Innopolis

Sensors and Sensing Homework 02

April 4, 2022

Attention

This is valid for the each and every lab class, you can do your lab tasks with the most preferred language but these standards need to be fulfilled.

- C++ 11
- C 99
- Python 2.7.x or 3.6.x
- Matlab 17a onwards

You need to submit your source code along with a clear description of how to run your implementation.

Task One

Case 1

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UAV flies through the strong wind and begins to oscillate. The pitch angle change was measured with the gyro during a few seconds. Estimate proper trajectory for the pitch angle while considering the gyro reading are normally distributed by using Kalman filter.

Case 2

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UAV flies through the strong wind and begins to oscillate. The roll angle change was measured with the gyro during a few seconds. Estimate proper trajectory for the roll angle while considering the gyro reading are normally distributed by using Kalman filter.

Case 3

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UAV performs loop-the-loop. The pitch angle change was measured with the gyro during a few seconds. Estimate proper trajectory for the pitch angle while considering the gyro reading are normally distributed by using Kalman filter.

Case 4

Email
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The human CoM (center of mass) during the walking has been measured with Kinect sensors. Estimate proper trajectory for the human CoM movement while considering reading are normally distributed by using Kalman filter.

Case 5

Select this dataset if your name is not listed any of cases

Inside the right hand of the AR-601 robot there is an accelerometer. Engineers fixed the robot on the crane and went for a lunch. Robot was swinging by inertia for a few minutes. Engineers came back after lunch and read the data from accelerometer. Help them to understand what they measured. Estimate proper trajectory for the accelerometer reading while considering reading are normally distributed by using Kalman filter.

Note: Kalman filter is needed to be implemented by yourself. You may have to make some assumptions while implementing it. Please comment on it, if you want take 100 consecutive points form the given dataset and apply the Kalman filter.

Task Two

Calibrate a camera (e.g., your phone) using the chessboard pattern. It's logical to switch off the auto focus mode of the camera, if it is enabled. The number of images should be at least 30 (with different chessboard positions). Obtain the intrinsic and extrinsic parameters. Once you have

calibrated your camera, store intrinsic and extrinsic parameters. Then take a photo of some object (for example, a cup) using the calibrated camera, estimate the height and width of the selected object using both a ruler and an image from the calibrated camera. Calculate the distance between the camera image plane and the selected object, if possible.

Submit

Please upload the single zip file which includes your source code and the report. The report should include what you did and why you did it.

Deadline

The deadline: April 16, 23:59:59 GMT+3.