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Title and acronym: Development of estimation algorithms for navigation of unmanned aerial vehicles
(UAV-NAV)

Keywords: Estimation algorithms, Filtering, Kalman filter, Neural networks, Quadcopters, Unmanned aerial vehicles

Necessary Background: Linear algebra, Signal processing, Object-oriented programming, Solid C++ and/or Python programming, Familiarity with Linux-like operating systems

Aim: Operation of an autonomous unmanned aerial vehicle (UAV) system requires the cooperation and execution in real-time of proper algorithms that are responsible for implementing specific procedures, like for example estimation of system orientation (roll-pitch-yaw angles), processing of measurements collected by the onboard sensors etc. The aim of this Thesis is the development of estimation algorithms to be used in a real quadcopter platform. To be more specific, the developed algorithms will used for estimating orientation (complementary filter, extended Kalman filter, mahony orientation filter etc.), processing of sensor measurements (lowpass filters, analog filters, digital filters) along with certain control algorithms, like for instance a PID controller. An additional objective is to investigate the integration of machine learning techniques like neural networks, for further improving the performance of the developed techniques.

Possible research questions:

- How can estimation algorithms be used to improve navigation of UAVs?
- What types of filtering algorithms are more appropriate for estimating UAV sensor measurements?
- How to develop more efficient estimation algorithms?
- How can machine learning techniques be integrated with estimation algorithms?

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Additional Support: Any student undertaking this Thesis will also collaborate with PhD candidate Teo Protoulis at the University of West Attica, Dept. of Electrical & Electronic Engineering

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Indicative Literature:

https://arxiv.org/pdf/1809.00037.pdf
https://books.google.gr/books?id=6dHEojwXU6MC
https://ieeexplore.ieee.org/document/1643403
https://ieeexplore.ieee.org/document/1310010
https://www.sciencedirect.com/science/article/abs/pii/S0924424707003834

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