Sensors and Sensing Strategies: Introduction

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Sensors and Sensing Strategies enable an unmanned aircraft to "sense," "see," "hear," and "understand" the world around it so that it may function intelligently in an unknown and cluttered environment and in the absence of an onboard pilot. In essence, sensors and sensing strategies are crucial since they provide the technologies that will result in "unmanned aircraft operating as if there were a human pilot onboard."

►Sensors for Missions by Mejias, Lai, and Bruggemann sets the tone for sensors used on UAVs that are assigned complex missions. The sensor suite onboard a UAV is tightly coupled with payload capabilities, as payload dictates UAV usability and market value. However, advances in miniaturization of electronics are enabling replacement of multiprocessing, power-hungry general-purpose processors with more integrated and compact electronics that contribute to more onboard sensors. Several common payload sensors are described along with their usefulness to solve real-world problems.

►Inertial Sensor-Based Simultaneous Localisation and Mapping for UAVs by Bryson and Sukkarieh provides an overview of algorithms for inertial sensor-based simultaneous localization and mapping (SLAM) within the context of UAVs, using the extended Kalman filter (EKF) and the extended information filter (EIF) due to their ease of understanding, applicability to online implementation, and prevalence in airborne localization applications outside of SLAM.

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►UAV Localisation Using Inertial Sensors and Satellite Positioning Systems by Bryson and Sukkarieh provides an overview of UAV localization with a focus on aided inertial localization, that is, algorithms for fusing data from, for example, satellite positioning systems, barometric sensors, and magnetometers with inertial sensors to provide real-time position and orientation. An example implementation of aided inertial localization on a UAV is presented as a tutorial to understand key concepts in airborne localization and as a basic guide toward more complicated implementations.

►Data Fusion and Tracking with Multiple UAVs by Ridley, Upcroft, and Sukkarieh describes decentralized data fusion (DDF) algorithms for a team of multiple autonomous platforms. It is shown how through the DDF algorithms each platform can maintain a consistent global solution from which decisions may be made. The overall system design is detailed, providing insight into the overall complexity of implementing a robust DDF system for use in information-gathering tasks in outdoor UAV applications.

Collectively, after reading and understanding the first four sections of the handbook, the reader, novice, or expert will be ready to continue with the actual control of UAVs and all other more advanced technical aspects.