Urban Air Mobility Traffic Analysis Tool

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Growing complexity of advanced aviation systems brings new threats to safety and security and poses several regulatory and technical challenges. As Advanced Air Mobility (AAM), including Urban Air Mobility (UAM) and Unmanned Aircraft Systems (UAS), air traffic increases, it is important to ensure safe integration into an air traffic management system initially designed to support manned aircraft. The main challenge of integrating UAS into urban settings is that these environments are already densely used by ground traffic, people, and manned aircraft. Growing use of UAS in urban environments will increase the risks of potential collisions, various incidents and accidents that can result in serious losses or injury. Since the uses and applications of UAS are increasing and diversifying it is necessary to develop effective risk management practices, methodologies, and processes to ensure safety of operations. Identifying and understanding risk factors is a key step in developing risk mitigation and response measures for UAS operating in urban environments.

The purpose of this paper is to examine the most critical issues and challenges related to the rapid growth in UAS operations in urban environments. The goal of the research is to identify potential hazards and determine which safety regulations and procedures applied in manned aviation are scalable and can be implemented in the UAS domain. The paper will include analysis of existing risk prediction and mitigation technology, currently used in traditional aviation operations which can be used to develop in-time system-wide safety assurance of autonomous systems. However, special attention will be given to the challenges that are unique to the UAS domain for which new mitigation solutions need to be created.

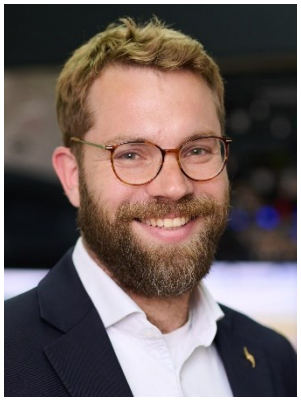
This paper focuses on UAS integration in urban environments where their operations are currently greatly restricted by safety regulations. UAS are increasingly applied in other areas, such as international border patrol, forest surveillance, or precision farming. These missions are performed in non-urbanized areas and are less affected by the most challenging urban-related risks. In such applications the operations are safe, and UAS can be freely used and provide enhanced efficiency, major cost savings, and increased profitability. Even though, in most cases drone implementation and technological development relates to UAS operations and does not have a direct translation to UAM development, the applicable lessons learned and risk identification and mitigations capabilities will be discussed.

The Urban Air Mobility Traffic Analysis Tool was created in order to help with answering these questions. The dedicated software specifically for UAM solutions was developed. It is capable of simulating air traffic over specified area of interest, accounting for real population density data, airspace restrictions and daily traffic distribution. Aircraft population is generated considering vehicles' parameters such as

speed, ceiling, and range, as well as various levels of autonomy and cases of aircrafts' malfunctions. Both cargo- and passenger-oriented applications such as taxis and deliveries in point-to-point, hub-to-point and multipoint trips are considered. The infrastructure (airports, zones, corridors etc.) is unready to gather such a high volume of UAS (commercial, private-use, service, etc.). Some of the adapted/proposed solution from commercial aviation in above mentioned reports seems to be inadequate and it is highly possible so they are not assuring sufficient safety. Thus, the novel approaches such as AI/ML in UAS traffic management seems to be a promising direction

Biography

Speaker Antoni Kopyt



Antoni Kopyt is an Assistant Professor at Warsaw University of Technology, Poland. Received a PhD diploma with honors in 2016 in Automatics and Robotics. During studies, he spent one year at the L'Institut Polytechnique des Sciences Avancées, Paris, France. In 2013, he went to NASA Langley Research Center, VA, USA, for a scholarship, researching Adaptive automation. His professional interests are computer simulations, automation, human–operator modeling, biofeedback, human-in-the-loop, UAV, and UAM. Dr. Kopyt participated in several projects funded by the European Commission, such as ACROSS, TALOS, NEFS, NICETRIP, and several nationally funded projects. He is strongly engaged in numerous R&D projects in Urban Air Mobility (UAM) that focus on the area of multi-variate sensor data. He also received a faculty grant for a young scientist to research his PhD thesis. He supported the teaching process at FPAE in several subjects at the Bachelor's and Master's levels. He published several papers in scientific and technical journals and actively presented multiple speeches at international and national conferences. Currently, he is a subcontractor for NASA LaRC in the System Wide Safety program, researching Urban Air Mobility. The study's primary goal is to develop a simulator of an urban area and test various methods and risks in ATM. AIAA SSIF TC member, DASC TC member.