Kennesaw State University

DigitalCommons@Kennesaw State University

Actively Guided CanSats for Assisting Localization and Mapping in Unstructured and Unknown Environments

Cary Chun

M. Hassan Tanveer
Kennesaw State University

Title: Actively Guided CanSats for Assisting Localization and Mapping in Unstructured and Unknown Environments

Graduate Student: Cary Chun

Research Mentor: Muhammad Hassan Tanveer

When navigating in unknown and unstructured environments, Unmanned Arial Vehicles (UAVs) can struggle when attempting to preform Simultaneous Localization and Mapping (SLAM) operations. Particularly challenging circumstance arise when an UAV may need to land or otherwise navigate through treacherous environments. As the primary UAV may be too large and unwieldly to safely investigate in these types of situations, this research effort proposes the use of actively guided CanSats for assisting in localization and mapping of unstructured environments. A complex UAV could carry multiple of these SLAM capable CanSats, and when additional mapping and localization capabilities where required, the CanSat would be ejected from the UAV to perform an unpowered but guided descent through the obstructed space. The CanSat's sensors would then generate SLAM data, which would be concurrently communicated back to the primary UAV while also being used by the CanSat to navigate in the unknown environment. The successful mapping and navigation of the CanSat during descent could supply the UAV with adequate data to execute a more efficient and safe navigation across previously uncharted space. Potential uses of this technology include agricultural surveys, in which UAVs would launch SLAM capable CanSats to map the whole tree canopy of an orchard. Similar obstacles and opportunities may exist beyond Earth, with scientists becoming increasingly interested in the possibility for UAVs to serve as helpful pathfinders on distant planets. Many of the suggested scientific vehicles, however, will be too large and unwieldy to navigate in the narrow and enclosed regions that could be suitable for future manned habitats. The development of low-cost SLAM competent CanSats may therefore establish the technological foundation for enhanced sensory systems that could be deployed from large-scale interplanetary explorers to map unknown and unstructured environments on alien worlds.

Keywords: Robotics, Mapping, SLAM, CanSat, Guidance Control, UAV, Localization