Koray Celik
PhD
CprE
Major Professor: Arun Somani

"This thesis presents a novel robotic navigation strategy by using a conventional tactical monocular camera, proving the feasibility of using a monocular camera as the sole proximity sensing, object avoidance, mapping, and path-planning mechanism to fly and navigate small to medium scale unmanned rotary-wing aircraft in an autonomous manner. The range measurement strategy is scalable, self-calibrating, indoor-outdoor capable, and has been biologically inspired by the key adaptive mechanisms for depth perception and pattern recognition found in humans and bats, designed to assume operations in previously unknown, GPS-denied environments. Novel aircraft systems have been developed to demonstrate how these procedures and algorithms come together to form airborne measurement of absolute ranges from a monocular camera via passive photometry, and use it to mimic that of a simple human-pilot like judgement. The research is intended to bridge the gap between practical GPS coverage and precision localization and mapping problem in a small aircraft. For broader experimental validation, non-aerial robotic platforms have also been developed, some of which have been integrated in field trials. Albeit the emphasis on miniature robotic aircraft, the research has been tested and found to augment the reliability of many other types of robots and next generation tactical vests and helmets to assist military, emergency response personnel, as well as disabled people."