Safecopter: Developing a Collision Avoidance System Based on an Array of Time-of-Flight 3D Cameras

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Multicopters have a wide range of applications from surveillance to package delivery and medical support. Although growing in popularity, they are not yet used on an industrial scale for safety reasons. The goal of Safecopter is to develop a modular collision detection and avoidance system that would make flying a multicopter in autonomous or tele-operated mode completely safe. Integrating a system of sensors that provides 360° spherical coverage and works reliably in any light conditions opens the door to the safe use of multicopters and to an extended range of applications. Based on the research of a wide variety of sensors, I reached the conclusion that the best solution would be to use a Time of Flight 3D camera array. To be able to process the point cloud produced by the 3D cameras, I use a compact onboard computer running the Ubuntu Linux operating system. The software system is programmed in C++ using ROS (Robot Operating System) as a development platform. Data received from the 3D cameras is processed and combined into a single point cloud representing all the objects around the multicopter up to six meters away. Based on the vector of travel, if a collision is detected, a new trajectory is calculated. For visualization and debugging purposes, this cloud of points is categorized and displayed in different colors on the ground station computer. Based on testing performed, the system can reliably detect possible collisions with objects in different lighting conditions (day/night, indoor/outdoor, etc.) and reroute the multicopter to the shortest path to the target.

Awards Won:

Third Award of $1,000