Drone Defense System: Detection, Tracking, Classification and Targeting of Flight Objects in 3D and Real Time

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The number of small, commercially available drones (multicopters) has continued to increase for the last few years. Apart from useful applications, they are used to invade critical infrastructures like prisons or airports and can even be used for acts of terrorism, making it necessary to provide detection of and defence against them. Detecting these small drones is a particular challenge for airspace monitoring because they are small, mostly out of plastic, relatively quiet and do not generate any significant radio or thermal emissions that could be used to detect and track them. The project's objective is to build a system to detect drones, determine their position (with methods from computer vision) in real time and point at them. The result is a robust system that uses two simple webcams to detect flying objects reliably in real time, then tracks them and, in the process, determines the position and speed in R3. It works robust both at daylight and night. Analysing flight pattern as well as sound, recorded by a directional microphone, allows a clear and unambiguous classification between drones and non-drones. In addition, the user has the possibility to mount a tool onto a pan-tilt unit that is pointed at the drones. The algorithms developed for detection, position determination, tracking and classification use complex elements from the field of computer vision. They are executed in a highly parallelized threading model on the CPU as well as the GPU in order to accelerate processing and to provide real time surveillance capabilities.

Awards Won:

Intel ISEF Best of Category Award of $5,000

Intel Foundation Cultural and Scientific Visit to China Award

American Institute of Aeronautics &amp

Astronautics: First Award of $2000.00

Patent and Trademark Office Society: Second Award of $500

National Security Agency Research Directorate : Honorable Mention in Mathematics

International Council on Systems Engineering - INCOSE: Certificate of Honorable Mention