NRI: FND: Flying Swarm for Safe Human Interaction in Unstructured Environments

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Motivation:
• Relates to the NRI because it uses novel flying robots for safe human-robot interaction with swarms.
• Research is motivated by enabling humans to interact safely with flying swarms in a wide range of environments.
• Critical gap to be addressed is onboard sensing and communication of miniature flyers, power endurance, and downwash mitigation.
• Vertically advances the field because of onboard only sensing and novel approach to swarm endurance
• Transformative because it develops hardware for a small flying swarm and allows it to safely interact with humans.

Objective: We will design and create a swarm of 200 flying robots that are safe to operate around people. They will use only on-board sensing to interact with each other and humans, which can "sculpt" the shape of the conglomerate form.

Technical Approach:
Based on a single motor, underactuated flyer, where the spinning body can be used to scan sensors and transmitters for both localization and communication. Power will be maintained by a rapid charging base station

Outreach and Broader Impacts Plan:
• Robot design and control will be open-source.
• Improve on safe interaction between humans and flying robots
• Research and Education are integrated by incorporating flyers into classroom activity, public presentations to K-12 and science fairs.

Prior Results, Deliverables:
• Piccolissimo flyer at 38mm is the worlds smallest self-powered flying robot.
• Create small autonomous flyer which only uses onboard robot-to-robot sensing and communication
• We will demonstrate 200 robots in a swarm forming shapes controlled by a human closely interacting with the swarm

Schedule:
Year 1: Robot design for flight time, control and charging system. Develop sense/comm. test rig, and simulators.
Year 2 : Producing the full swarm and the full charging pad. Path-based and Gnat inspired flight controllers. Planning and swarm level control algorithm implementation
Year 3: Sensor optimization and 200 swarm demonstration

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