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Patent

From applied experiment to ownership.

Ducted rotor unmanned aerial vehicles

Aug 22, 2016

Systems and methods in accordance with various embodiments of the invention can be utilized to implement unmanned aerial vehicles ("UAVs") designed for autonomous operation in cluttered environments, indoor environments and/or as photography drones. One embodiment includes: launching an unmanned aerial vehicle (UAV); performing in flight path planning to scan an area for people using the UAV; detecting the presence of at least one subject by processing image data captured by at least one camera on the UAV; determining at least one pose from which to capture images of detected at least one subject using the UAV; performing path planning to navigate the UAV to the determined at least one pose; and capturing images of the detected at least one subject using at least one camera on the UAV when the UAV is posed in one of the determined at least one pose.

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

The current application claims priority under 35 U.S.C. § 119(e) to U.S. Provisional Patent Application Ser. No. 62/208,408 entitled "Ducted Rotor Unmanned Aerial Vehicles" to Tseng et al., filed Aug. 21, 2015. The disclosure of U.S. Provisional Patent Application Ser. No. 62/208,408 is hereby incorporated by reference in its entirety.

FIELD OF THE INVENTION

The present invention relates to unmanned aerial vehicles and more specifically to unmanned aerial vehicles configured to operate in cluttered environments.

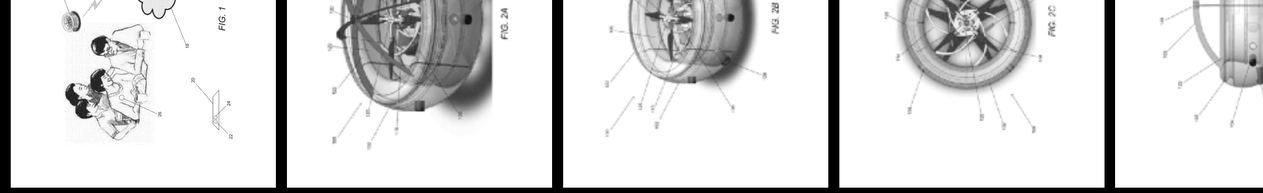
BACKGROUND

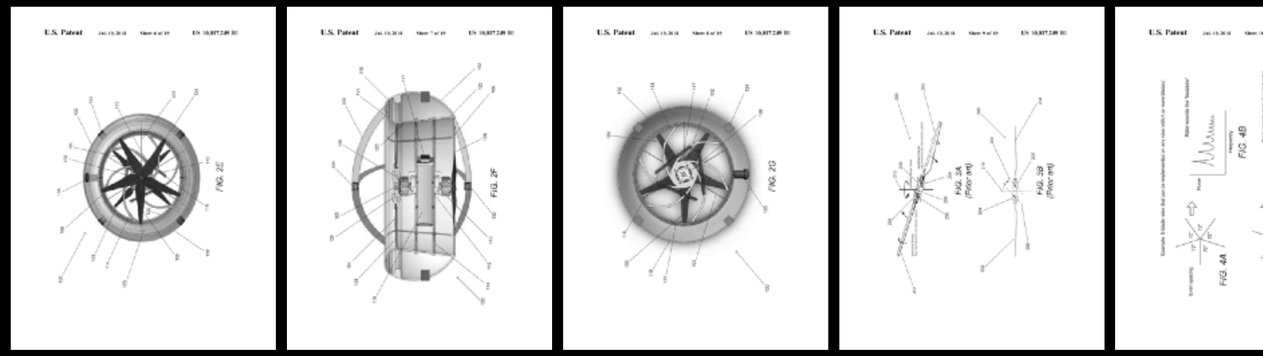
Unmanned or uninhabited aerial vehicles ("UAVs"), commonly referred to as drones, are aircraft without a human pilot aboard. UAVs may be remotely piloted and/or can navigate autonomously. A variety of propulsion technologies are currently utilized. UAVs that are in use today vary in size from Micro Air Vehicles ("MAVs") having no dimension larger than 15 cm to UAVs with wingspans of several tens of feet. Depending upon the application, UAVs can carry cameras, sensors, communications equipment, and/or other payloads.

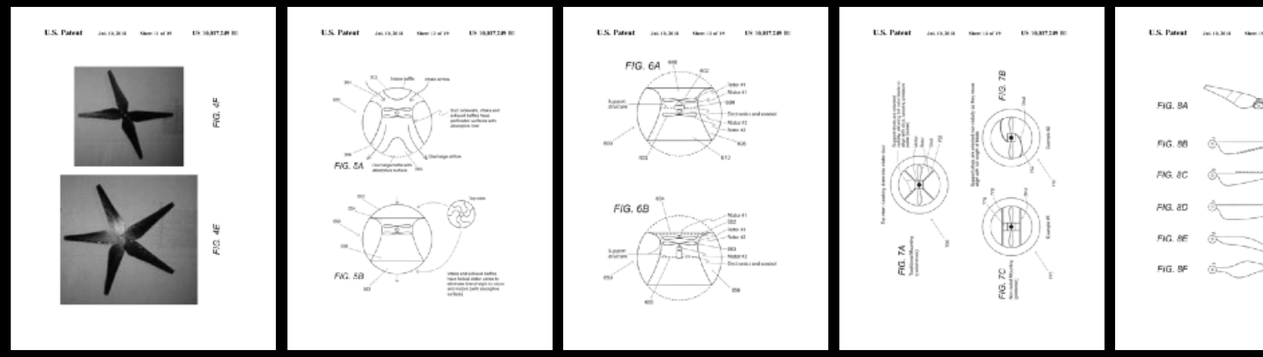
For operation in highly-congested, highly cluttered environments like urbanized areas, whether indoors or outdoors, UAVs are typically required to be able to have high maneuverability at low speeds, and the capability of hovering. UAVs that have these capabilities are typically regarded to fall within three classes: rotating-wing configurations, like helicopters and tilt-rotors; flapping-wing configurations (emulating birds or insects); and fixed wing configurations with powered-lift capability. For any aircraft, low-speed flight and hovering flight are inherently power-hungry and rotary-wing aircraft tend to exhibit the highest efficiency in hover and low-speed flight relative to other propulsion systems.

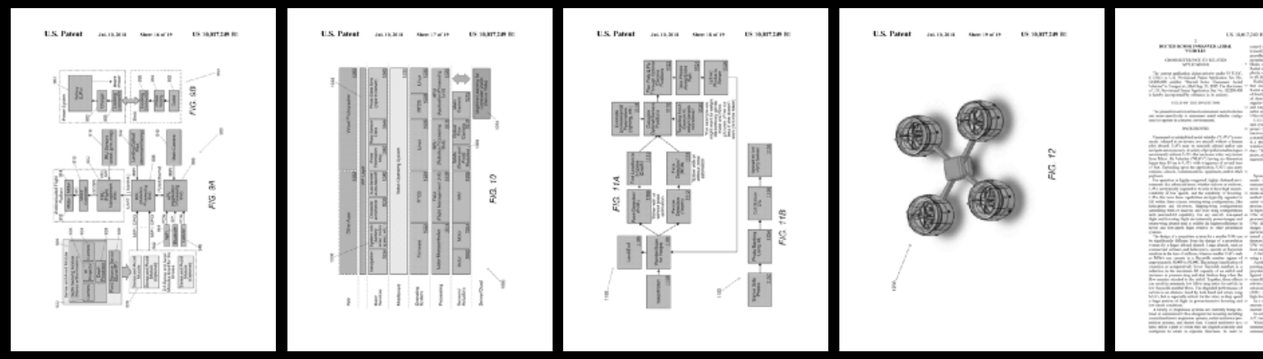
The design of a propulsion system for a smaller UAV can be significantly different from the design of a propulsion system for a larger piloted aircraft. Large aircraft, such as commercial airliners and helicopters, operate at Reynolds numbers in the tens of millions, whereas smaller UAVs such as MAVs can operate in a Reynolds number regime of approximately 10,000 to 50,000. The primary implication of operation at comparatively lower Reynolds numbers is a reduction in the maximum lift capacity of an airfoil and increases in pressure drag and skin friction drag when the flow remains attached to the airfoil. Together, these effects can result in extremely low lift-to-drag ratios for airfoils in low Reynolds number flows. The degraded performance of airfoils is an obstacle faced by both fixed and rotary wing MAVs, but is especially critical for the latter, as they spend a large portion of flight in power-intensive hovering and low-speed conditions.

A variety of propulsion systems are currently being utilized in commercial UAVs designed for hovering including coaxial multirotor propulsion systems, radial multirotor propulsion systems, and ducted fans. Coaxial multirotor systems utilize a pair of rotors that are aligned coaxially and configured to rotate in opposite directions. In order to control pitch, yaw, and roll, a coaxial multirotor system typically includes a mechanism that adjusts the pitch of the propeller blades. Usually the pitch change is achieved by mounting servos with mechanical linkages to the propeller









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Design : Technical

An array of tools and technical geekout.

But, we needed to look beyond 'specs'…