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HEALTH AND USAGE MONITORING SYSTEMS (HUMS) OF UNPILOTED AERIAL VEHICLES - A LITERATURE REVIEW

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ABSTRACT

With the global drone market projected to reach USD 40.9 billion by 2027, the need for higher system reliability has become a matter of utmost concern, not only to protect public safety and ensure mission success, but also for demonstrating risk controls as part of licensing. Health and Usage Monitoring Systems (HUMS) were primarily developed for real-time structural health monitoring and machinery diagnostics of aircraft, naval vessels, and other civilian and military systems. HUMS on lightweight and low-cost Unpiloted Aerial Vehicles (drones) is a comparatively new phenomenon. Incorporating existing HUMS used for other aircrafts directly into UAVs is very challenging, as the size, mass, and cost of such systems often do not match the capabilities of traditional drone structures, nor can they be easily integrated. Several health monitoring technologies geared specifically for UAVs have been developed, including optical fiber sensors, piezoelectric (PZT) sensors and ultrasonic propagation imaging sensors; however, the use of fiber optic sensors, specifically fiber Bragg grating (FBG) optical sensors, seems to be favored by many, due to their high sensitivity to mechanical strain, small size, low mass, long life, immunity to electrical interference, durability in extreme weather conditions, and high-speed. This paper discusses and evaluates the recent research on different health and usage monitoring systems for UAVs currently in use; and investigate which system may be most suitable for broad applications. After making a comparative analysis of these systems and identifying their limitations, we conclude with several promising directions for future research and prototype evaluation for different classes of small to midsize UAVs.

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