



CENTRE FOR TECHNOLOGY INFUSION

Multifunctional MEMS sensors for improved autonomous vehicle avionics

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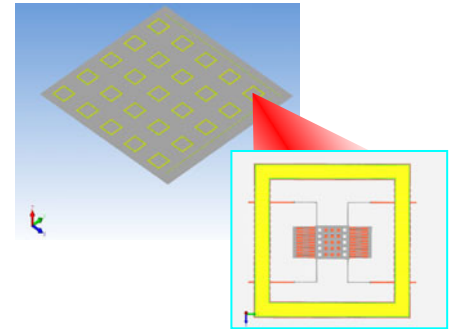
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OVERVIEW

Uninhabited Aerial Vehicle (UAV) technology is at a key stage of its development with the introduction of autonomous operations. While many technologies for UAVs can be adapted from manned aircraft, cost, weight, and size constraints have prevented mini/micro UAVs from including many of the robustness mechanisms common to larger aircraft.

Traditional sensing approaches for avionics, in mini/micro UAVs, have difficulty implementing redundancy due to the tight design constraints and the demanding computational requirements of arbitrating between multiple sensors of different types.

An UAV may be equipped with multiple MSRN nodes. Each MSRN is an inherent array of elements with a regular information exchange framework. This framework is also able to be extended to include elements on other nodes. Such an arrangement allows using the spatial separation to enhance available information. It also improves robustness, and accuracy of the UAV. An additional feature is potential for multiple processing engines and algorithms based on both local and global knowledge to maximise the probability of mission success.



Multi Sensitivity Redundant Node

Intelligent Agent reasoning on the information provided making pilot-like appropriate actions including team management

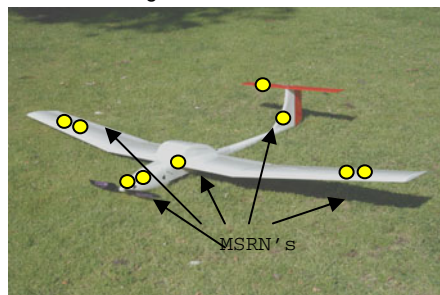
Path planning, modelling environment, aircraft status – energy, health monitoring

Stability & Control, sensors for environmental and health monitoring

UAV Control Pyramid

PROJECT DESCRIPTIONS

This project involves the design and implementation of an array of identical multifunction sensors, which is named a Multi Sensitivity Redundant Node (MSRN), for the control system of UAVs. Each MSRN consists of several MEMS structures on a single substrate, that are sensitive to some or all of the followings; acceleration, angular velocity, temperature, pressure, IR intensity, magnetic flux (by implication electric current) and fluid flow. It also incorporates the mechanisms for deriving estimates, with an indication of their quality, of the required parameters. This quality indication may be used as a basis for robust estimate amalgamation.



Multi Sensitivity Redundant Nodes on a UAV

APPLICATION IN UAVS

Many existing UAV control systems base their control surface and throttle settings on measurements of pressure (altitude and airspeed), acceleration and velocity. Where multiple data sources (or actuation mechanisms) are available some form of arbitration or amalgamation is often employed to maximise value of data streams. Commonly these can be some combination of static pre-canned decision tree/s and/or linear equations, static artificial intelligence structures or learning type structures. The rich information flow from such an array enables the system designer to have a reasonable chance of succeeding with any of these approaches, (providing they are skilfully employed). Any of these approaches appropriately implemented could reasonably be expected to deliver superior performance to the existing architectures when the system suffers some kind of damage. This MSRN based technology will enable integration of more functionality on less pieces of silicon (or whatever material) this would reasonably be expected to improve both cost vs. performance, mean time between failure and weight vs. performance ratios.

FURTHER INFORMATION

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