

Abstract: Impaired Pilot/Operator Detection and Response System

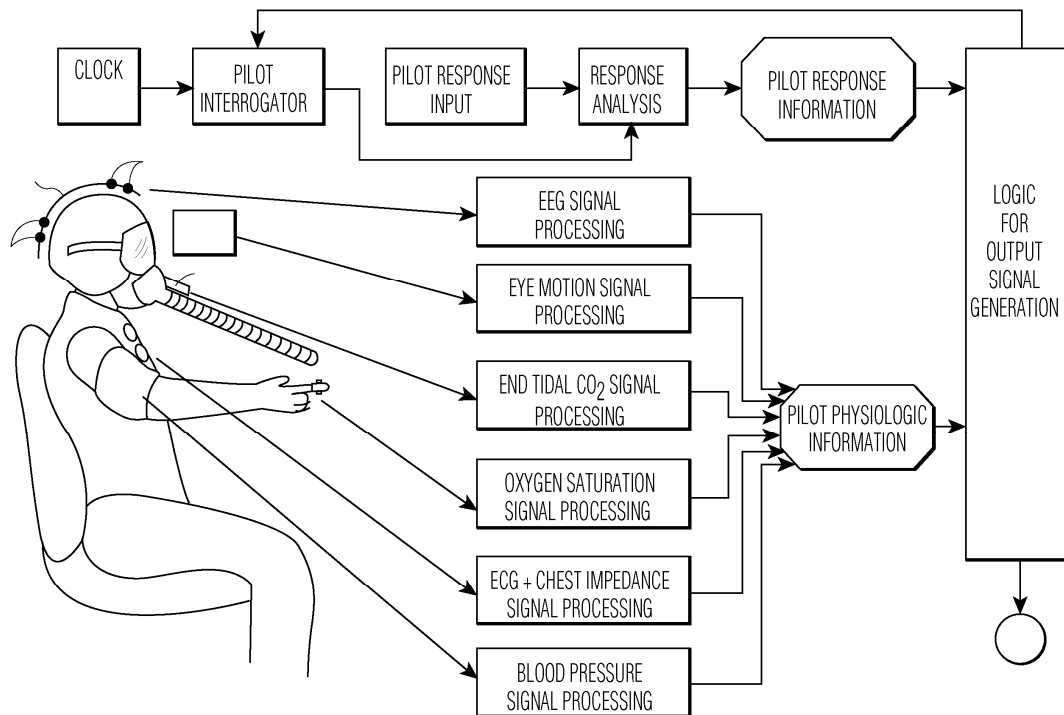
Dr. Jeffrey Matos, Mr. Karl Milde
M&M Technologies

BACKGROUND: The foundation for the impaired pilot protection system is an invention intended to neutralize a terrorist attempt to hijack an aircraft. This was presented at the First Human Factors of UAVs Workshop and is the subject of U.S. Patent No. 6,917,863 and of U.S. Patent Application No. US2006/0032978. The invention allows control of a hijacked aircraft to be taken away from the pilot (and all onboard persons) and transferred to an alternate pilot. The alternate pilot may at times be the autopilot/ flight management computer system and may at times be a remote, off-aircraft pilot. The off-aircraft pilot may be in the vicinity of the threatened aircraft, or may be remotely located. The alternate pilots fly the aircraft to a secure airfield and land the aircraft.

THE IMPAIRED PILOT/OPERATOR DETECTION AND RESPONSE SYSTEM: The impaired pilot management system utilizes the aforementioned hijacking neutralization platform, with its triggering inputs modified to monitor and react to changes in pilot status. Detection of an impaired pilot triggers the transfer of control of the aircraft from the impaired pilot to an alternate pilot. A modified form to the system may be used to deal with an impaired UAV/UGV/UUV operator.

Impaired pilot detection is triggered by one of three types of event:

- (a) the detection of an inappropriate value of a pilot physiologic parameter (e.g. a very low blood pressure),
- (b) the detection of an inappropriate response to a pilot cue, and
- (c) the determination that the aircraft position (or a measure derived from the position) is inappropriate.



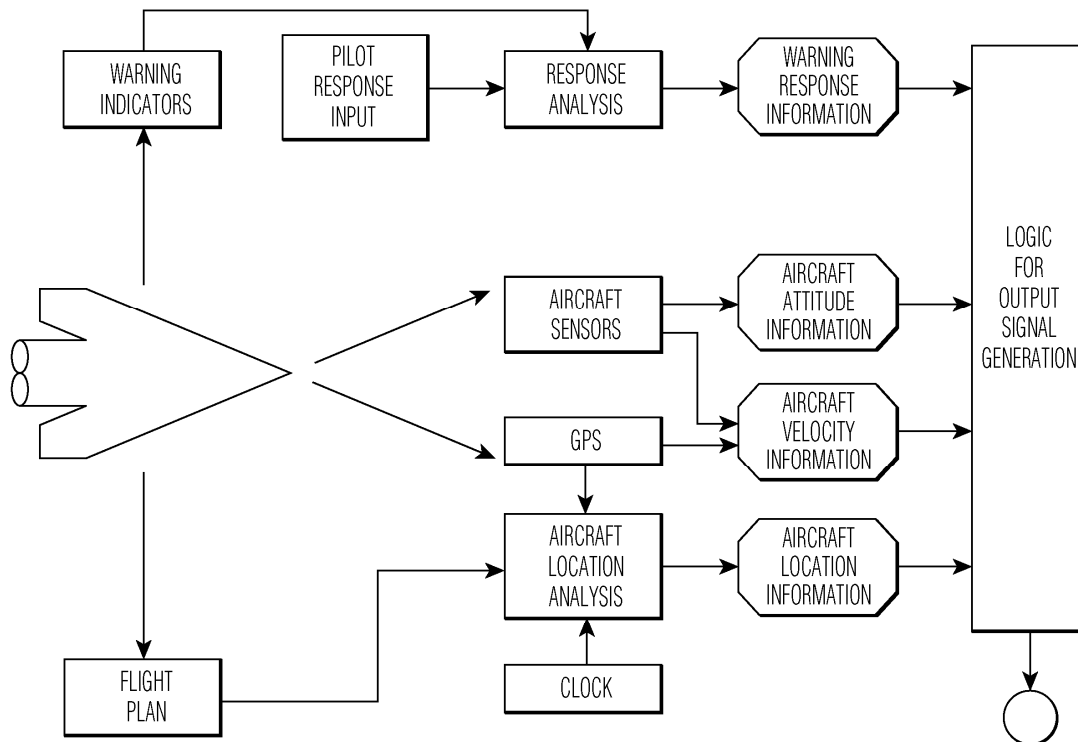
(a) Physiologic parameters which may be monitored (see figure above) include the electrocardiogram, blood pressure, heart rate, respiratory rate, blood oxygen content, exhaled

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carbon dioxide content, the electroencephalogram, eye motion, and eyelid motion. The determination to transfer control to the alternate pilot may be based on an extremely abnormal value of any one of these, or a combination of less abnormal values of more than one of these.

(b) There are two types of pilot cues which may be monitored (see figure below) for inappropriate response or non-response. One is the pilot's response to aircraft system indicator lights or signals, which indicate a need for pilot action. The other is an explicit pilot test (e.g. a verbal question, or a screen text message) requiring a response. Non-responses or entirely inappropriate responses may trigger a transfer of control. Less abnormal responses may trigger additional test cues.



(c) The detection of inappropriate aircraft location, attitude, velocity, acceleration or roll (see figure above) may be an indicator of an impaired pilot and may be used as the triggering event for the transfer of control.

Combinations of the aforementioned three types of events may serve as the transfer control trigger. For example, a systolic blood pressure of 75 and a moderately prolonged indicator response time may trigger a transfer of control, whereas the same blood pressure reading with a normal response would not serve as a trigger.

The system may be used aboard (1) solo pilot aircraft, and (2) aircraft with multiple pilots, for the detection of a condition in which all pilots are impaired. The system may be modified to detect an impaired UAV/UGV/UUV operator, with a detection resulting in the triggering of an alarm or the handoff of control to an alternate operator.