ARTEMIS Call 2008 Project
100008

CAMMI

Cognitive Adaptive Man-Machine Interface

EXECUTIVE *summary*

CAMMI aims to develop a joint-cognitive system that will balance and optimise operators' workload and thus improve the safety of complex systems such as industrial plants, airplanes or cars operated by people under demanding conditions. Mitigation strategies that balance operator workload based on the operators' situational awareness and working environment will be developed.

CONTRIBUTION *to SRA*

CAMMI will contribute to reference designs and architectures with a closed-loop control system, where embedded computers adaptively present information, accept commands and automate tasks, according to the cognitive state of the operator (pilot/driver/controller). CAMMI targets the "Industrial systems" application context of the ARTEMIS SRA.

The objective is to demonstrate a joint-cognitive approach, where workload that exceeds the operator's capability should result in offloading non-critical, time-consuming tasks to autonomous controllers (software, artificial-intelligence agents) thereby allowing the operator to focus on the critical tasks.

Platform independent models are used to introduce a common and cross-domain approach to workload mitigation techniques, while platform specific models are then applied to the implementation of the embedded control system.

MARKET INNOVATION *& impact*

Many industrial and transport accidents are attributed to operator error, often because the interface provides them too much or even irrelevant information at critical times. CAMMI will improve the way operators are monitored by developing an innovative, adaptive, "human-in-the-loop" system to assess their situational awareness. CAMMI will develop technologies for intelligent, multi-modal, interactive systems addressing especially user interaction with complex machines. This cognitive state assessment will be used to drive a dynamic, context-aware human-machine interface that enables the operator to focus on his primary control tasks in the most efficient way, thereby improving safety in human operated machines. CAMMI addresses a broad range of applications within the aviation, automotive, agricultural and civil security domains. Non-invasive techniques are being investigated, based on both a multi-camera, low-cost sensor system and advanced processing pipeline. CAMMI will take this technology forward by developing a multi-camera prototype able to capture the pilot/driver/operator's face from different angles and to synthesize a 3D face alteration metric.

RELEVANCE & CONTRIBUTIONS *to Call 2008 Objectives*

CAMMI addresses the priorities detailed in the Human-Centric Design sub-programme of the ARTEMIS AWP. It will provide solutions for intelligent multi-modal interactive systems specifically addressing user interaction with adaptive context-aware systems. In line with Sub-programme 8 objectives, CAMMI will consider how the macroscopic effects of stressful situations, like high workload scenarios, can have an influence on the physiological and psychological state of the user.

Human-centered computing is closely related to interdisciplinary fields such as human-computer interaction and information science. CAMMI has identified a core of cooperative work among different domains including workload mitigation strategies, common architectures and articulation. The CAMMI concept is to establish a closed-loop architecture, where embedded computers of the HMI (Human Machine Interface) adaptively present information, accept commands and automatically execute tasks, according to the cognitive state of the user. This is achieved by adopting specific strategies tailored around the operator's workload and the specific context in which he/she works, reproducing and testing them in a Virtual Reality environment.

The CAMMI project contributes to defining methods to prioritize the flow of information that has to reach the operator's attention.

R&D INNOVATION *and technical excellence*

Compared to traditional HMI design, CAMMI introduces a third functional block, the so-called Cognitive Supervisor Agent (CSA) composed of two main subsystems: the Cognitive Monitor and the Workload Mitigator. The Cognitive Monitor is responsible for the continuous assessment of the operator's psycho-physiological state, by monitoring quantities related to the physiological activity, environmental parameters as well as stress and task-performance indices. The Workload Mitigator role is to take the updated information on the state of the operator, as classified by the Cognitive Monitor and trigger automation strategies, as appropriate, that might be reflected either in the machine operation (automation) or in the information presented to the operator (adaptation), or both. The action taken will depend on the classified input, the state of the machine condition and any other factor found to be needed or informative for reducing the mental and cognitive load to the operator. This reduces the likelihood of human error and impaired performance and so contributes to safer operation. CAMMI modeling and testing methods are supported by a Virtual Reality environment based on high quality digital terrain models and high resolution orthophotography.

PROJECT *partners*

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GOBIERNO DE ESPAÑA · MINISTERIO DE INDUSTRIA, TURISMO Y COMERCIO

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START
December 2008

DURATION
36 months

TOTAL INVESTMENT
€7.3 M

PARTICIPATING ORGANISATIONS
12

NUMBER OF COUNTRIES
6