TEXAS SPACE GRANT CONSORTIUM
DESIGN CHALLENGE

TOPIC # - TDC-45-F17

VEHICLE INTERCHANGEABLE ELECTRONIC CONTROLLER(VIEC) NETWORK SYSTEM

BACKGROUND

As humans push their exploration further into space, logistical aspects of providing spare spacecraft components becomes critical. Traveling a great distance from earth makes it difficult in terms of obtaining timely replacements. Solutions such as flying many unique spare components is costly in terms of dollars, mass and volume. The cost aspects of including many unique spares on a vehicle competes against achieving primary mission objectives. Is there a better way? Is it possible there is another approach would not only reduce the logistical cost of spare components while potentially increasing mission flexibility and interoperability?

One approach to consider is a system that permits interchangeability vehicle controllers based on the controller's interfaces to the vehicle. For example, one controller performing a function could be used as a spare to replace a failed controller performing a different function occupying a different location on a vehicle. The behavior for the controller in its new location is defined via networked interactions with other controllers (providing a server function) on the same vehicle. The results are that a common controller could be swapped around to different locations on the vehicle. This approach reduces controller sparing requirements for a vehicle, reduces aforementioned costs that compete against primary mission objectives and increases the probability of achieving long duration mission goals.

PROJECT DESCRIPTION

Develop a system of interchangeable controllers (ICs) configured via an interaction with a network server providing definition of controller behavior via network server downloading the program implementing appropriate behavior to the IC based upon the IC's reporting of a positional identifier supplied by the act of interfacing the IC to the vehicle. For this technology demonstration, the vehicle's positional identification (I am an engine controller, or I am a pressure vessel controller, etc.,) can be implemented through a variety of means such as an IC connector plug with a configured discrete code (ex: I am a lighting controller) or other means. The IC should be capable of interfacing to two more different physical simulated vehicle system applications containing both effectors (accepts digital or analog) and sensors that monitor the system. An example could be such as a vehicles lighting controller that controls the brightness of a solid state lighting module and that monitors lighting intensity or light emitter temperature. Another example could be an IC operating a simulated vehicles valves and sensors measuring pressure inside a simulated chamber (not suggesting a real life pressure vessel is required). There are other potential creative examples that are left up to the implementer. Key to the successful demonstration will be the IC should take every opportunity to utilize common serial interfaces as SPI or I2C for controlling simulated vehicle system. The application is not as important as demonstrating the interchangeable aspect of the IC and its interaction with the vehicle's positional identifier and the server that supplies the appropriated behavior. In addition, the IC should have a common interface connector for receiving for power, and interfacing to the vehicle (including the positional identifier). The network connection can be a separate interface or wireless.

DELIVERABLES

Hardware, Software for the IC, Software for the Server Application, Software defining positional behavior, Operations manual, Schematics, Bill of materials, List of any known issues/bugs.

DESIGN TEAM PROFILE

NASA MENTOR:	George Salazar
LEVEL:	Upper Division Students [JR/SR]
MAJOR / DISCIPLINES:	Electrical Engineering, Chemical Engineering or Mechanical Engineering
TEAMS:	One team
DURATION:	Two-Semester Project

Design Project Topic Offered By:
NASA JSC, EV/Human Interface Branch