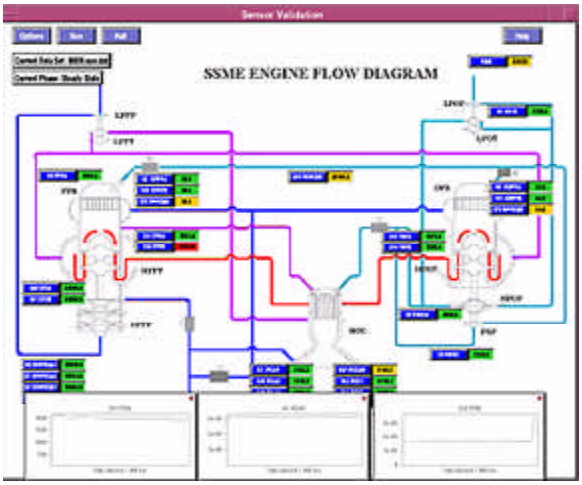
Real-Time Sensor Validation System Developed

Real-time sensor validation improves process monitoring and control system dependability by ensuring data integrity through automated detection of sensor data failures. The NASA Lewis Research Center, Expert Microsystems, and Intelligent Software Associates have developed an innovative sensor validation system that can automatically detect automated sensor failures in real-time for all types of mission-critical systems. This system consists of a sensor validation network development system and a real-time kernel. The network development system provides tools that enable systems engineers to automatically generate software that can be embedded within an application. The sensor validation methodology captured by these tools can be scaled to validate any number of sensors, and permits users to specify system sensitivity. The resulting software reliably detects all types of sensor data failures.

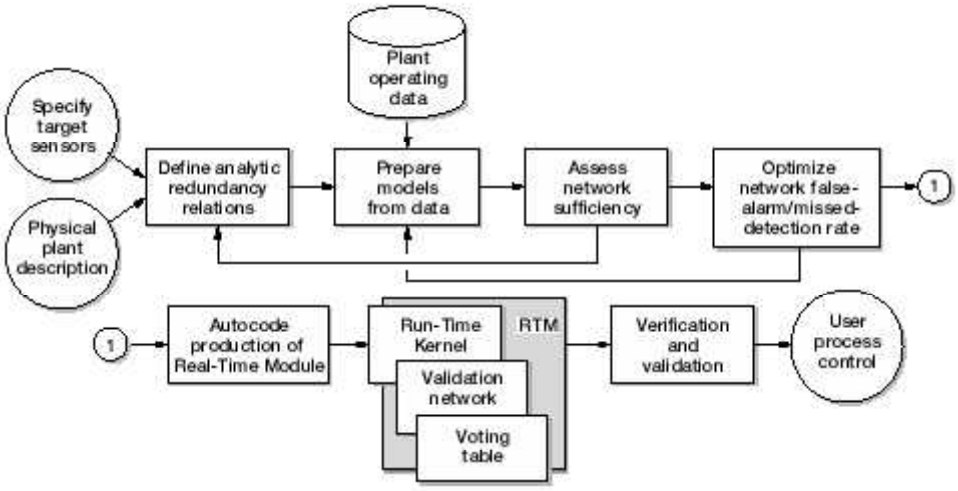
A data failure is defined as any failure that corrupts the sensor signal and provides erroneous information to a process control or monitoring system. To identify these failures in real-time, we combined system design relationships, which are captured within individual models, and Bayesian probability theory. A set of sensor readings and the set of system models form a network of cross-checks that validate all the sensors within the network. The development system provides the workstation-based tools that define these analytically redundant models and the decision strategy used by the real-time kernel to detect the sensor failures.



The sensor validation system automates the development and maintenance of an embeddable run-time sensor validation system.

The sensor validation system was applied to the Space Shuttle Main Engine, verifying that these sensor validation algorithms enable highly reliable data validation for critical sensors. Using these tools, we completed a prototype sensor validation network to validate the 22 Space Shuttle Main Engine sensors. This network was embedded in two different controllers and successfully tested at the NASA Marshall Space Flight Center's Simulation

Testbed. Current efforts are focused on extending and applying the tools to generate a larger sensor validation network for the Space Shuttle Main Engine.



User interface for the Space Shuttle Main Engine application of the sensor validation system was developed to view sensor failures in real-time.

Bibliography

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