World Academy of Science, Engineering and Technology
International Journal of Computer and Systems Engineering
Vol:11, No:05, 2017

Autonomic Sonar Sensor Fault Manager for Mobile Robots

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Abstract : NASA, ESA, and NSSC space agencies have plans to put planetary rovers on Mars in 2020. For these future planetary rovers to succeed, they will heavily depend on sensors to detect obstacles. This will also become of vital importance in the future, if rovers become less dependent on commands received from earth-based control and more dependent on self-configuration and self-decision making. These planetary rovers will face harsh environments and the possibility of hardware failure is high, as seen in missions from the past. In this paper, we focus on using Autonomic principles where self-healing, self-optimization, and self-adaption are explored using the MAPE-K model and expanding this model to encapsulate the attributes such as Awareness, Analysis, and Adjustment (AAA-3). In the experimentation, a Pioneer P3-DX research robot is used to simulate a planetary rover. The sonar sensors on the P3-DX robot are used to simulate the sensors on a planetary rover (even though in reality, sonar sensors cannot operate in a vacuum). Experiments using the P3-DX robot focus on how our software system can be adapted with the loss of sonar sensor functionality. The autonomic manager system is responsible for the decision making on how to make use of remaining ‘enabled’ sonars sensors to compensate for those sonar sensors that are ‘disabled’. The key to this research is that the robot can still detect objects even with reduced sonar sensor capability.

Keywords : autonomic, self-adaption, self-healing, self-optimization
Conference Title : ICACCE 2017 : International Conference on Autonomic Computing and Computer Engineering
Conference Location : London, United Kingdom
Conference Dates : May 25-26, 2017