FDIR development practices based on a probabilistic reasoning approach

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FDIR functionalities are investigated since the very beginning of a mission and play a relevant role in the definition of its autonomy, reliability and availability objectives. An attentive FDIR analysis is necessary since it impacts the overall mission specification, design and operation.

Currently, the lack of a strong analytical methodology supporting system-level conception and implementation of diagnostic procedures causes serious discontinuities throughout all the project phases and hampers the process of a stable and consistent FDIR design.

In this paper, an analytical methodology derived from the Bayesian Networks is proposed. By doing so, FDIR process can be driven by probabilistic reasoning. Faults, actions and observations are represented by the Bayesian network nodes, whereas their mutual relationships are associated with their conditional probabilities. The path leading to the fault recovery can be modified by tuning the Bayesian network structure. The proposed methodology has proved to be very useful in the context of the trouble identification & shooting of complex industrial equipment.

The main aim is to propose a single methodology (or offshoots) at whatsoever perspective, which can support the FDIR analysis, specification, design, implementation and verification. To bear out this challenging objective, the implementation of a bayesian-based SW tool assisting system engineers in the definition of a mission FDIR specification is hereby proposed. In particular, it has been shown how to represent and reproduce diagnostics procedures of a specific satellite subsystem, how to tune them by updating the Bayesian structure and how to integrate diagnostics procedures involving different sub-systems.