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Safety Assurance of Cyber-Physical System Control Code by Analysis of Input/Output Response and Observed Behavior

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-Background Cyber-physical systems (CPSs) involve complex interacting components including the physical environment and human participants. As such, faulty operation of any CPS sub-component presents serious safety risks. Faulty CPS operation can occur due to several reasons including differences in architectures and sub-optimal implementation. Evaluation of high-level code may not bring attention to these issues which can be missed by traditional software techniques such as static or dynamic analysis. Hence, detecting these changes in operational behavior may be improved by focusing on the CPS input/output response during deployment. Invention Description Researchers at Arizona State University have developed a data-driven framework for model extraction and validation of a CPS system, specifically to identify deviations between intended operation of the control code and observed behavior during deployment. This is achieved by deriving a hybrid system representation of the CPS operation using observed input/output traces. The result is then mapped to a finite state-machine-based expression of the CPS code. Discrepancy in operational behavior can then be explained in terms of binary or unary operations on input/output variables and the status of function call arguments. Potential Applications • Cyber-physical systems • Safety-critical systems • Medical device control • Autonomous vehicles Benefits and Advantages • Highlights changes in CPS behavior caused by bugs or patches Related Publication: FaultEx: Explaining operational changes in terms of design variables in CPS control codeResearch Homepage of Professors Sandeep Gupta and Ayan Banerjee