Efficient Data Validation for Geographical Interlocking Systems

In this paper, an efficient approach to data validation of geographical interlocking systems (IXLs) is presented. It is explained how configuration rules for IXLs can be specified by temporal logic formulas interpreted on Kripke structure representations of the IXL. Violations of configuration rules can be specified using formulas from a well-defined subset of LTL. By decomposing the complete configuration model into sub-models corresponding to routes through the model, the LTL model checking problem can be transformed into a CTL checking problem for which highly efficient algorithms exist. Specialised rule violation queries that are hard to express in LTL can be simplified and checked faster by performing sub-model transformations adding auxiliary variables to the states of the underlying Kripke structures. Further performance enhancements are achieved by checking each sub-model concurrently. The approach presented here has been implemented in a model checking tool which is applied by Siemens for data validation of geographical IXLs.

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