State Machine Generation from Structured Natural Language Requirements

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Abstract: State of the art in (automotive) system development are system specifications in form of natural language descriptions. Specification patterns are often used to avoid ambiguous and inconsistent expressions. Yet, neither natural language nor specification patterns provide sufficient overview about inner system dependencies and architectural structure. Requirements in form of finite state machines are suited for that but are often not accepted as sufficient exclusive form of documentation. To assure consistency when combining both approaches, it seems practical to derive one representation form from the other. We did not find a general formal method that solves this problem. We therefore propose a method that formally derives a finite state machine system representation from structured textual system specification by converting structured textual requirements into linear temporal logic expressions and map these into a state based representation form. This approach enables engineers to specify systems in (structured) natural language while having the ability to derive a structured, state based system overview any time during the specification process. We use an industrial system to evaluate the derived system state machine against the provided system test cases. This allows us to show correctness of the generated state machine and indicate usefulness of the proposed method.