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Formally Verifying Organizational Structures of Decentralized Autonomous Organizations For the Promotion of Local Tourism: A Case Study

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Abstract. Decentralized Autonomous Organizations (DAOs) promise to transform human coordination. However, their development poses significant software engineering challenges compared to other types of decentralized applications. This is primarily due to the complexity involved in specifying, implementing, and verifying the smart contracts that support suitable governance processes tailored for the needs of the organizations. Model-Driven Development (MDD) methods exist that facilitate the specification and verification of smart contracts for non-technical users. Yet, these approaches lack suitability for the specification and verification of governance properties, which limits their suitability for DAO design. Languages exist that support the visual specification of decentralized governance systems, including DAO-ML. This facilitates the design and documentation of DAO projects and interaction with non-technical stakeholders. However, such approaches currently lack support for the implementation and verification of smart contracts reflecting the elicited requirements, which limits the utility of these approaches. For this reason, we propose a method that integrates code generation based on visual specifications and formal verification based on Abstract State Machines. The approach is evaluated in the context of an *in vivo* case study focused on a real-world DAO development project. This applies the proposed approach to visually specify, formally verify and generate the code of a DAO that manages the governance of destination management organizations tasked to promote tourism in a local area. Unlike existing solutions, the proposed approach provides increased security guarantees for the end-users and stakeholders of the system.

Keywords: Decentralized Autonomous Organization · Blockchain · Formal Verification · Model-Driven Engineering