Towards Decision Management for Robotic Process Automation

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Abstract. Robotic process automation (RPA) is a rapidly growing technology for automating digital processes. While RPA allows the automation of common tasks performed on a computer, there are only rudimentary possibilities to represent decisions in RPA models. Especially workflows that involve more than simple yes-no questions quickly result in confusing models, which are difficult to understand and maintain. To overcome these issues, an integration of an established decision management approach, Decision Model and Notation (DMN), into RPA is proposed and motivated in this paper.

Keywords: Robotic Process Automation, RPA Lifecycle, Decision Management

1 Introduction

Automation based on process models has long been an area of interest in business process management (BPM), for both the research and the enterprise world [13]. Robotic process automation (RPA) is a novel automation approach employing software robots to automate undemanding tasks on the computer, that recently gained more attention in research [2]. Whereas BPM systems target organization-wide processes, RPA automates sequences of tasks that employees perform locally on their computers by imitating the employee's behavior on the graphical user interface level [6, 12], making it a useful addition to BPM [14].

To enable business users and employees to create their own automations, many current RPA vendors focus on the visual representation and modeling of RPA robots [3]. However, a preliminary analysis of different RPA products (UIPath, Blue Prism, Automation Anywhere, and Automagica) revealed disadvantages of these approaches, especially with respect to the design of decisions. A majority of the representation types examined only supported simple $if/else$- or $switch/case$ constructs to model decisions. Since each decision branch must be represented explicitly, the RPA models become complex, especially for more elaborate decisions. This may lead to decision-intensive processes being discarded for automation using RPA due to the excessive modeling effort and decreased maintainability, although they might be well suited for automation.

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This paper outlines a possible solution to overcome the issue of representing complex decisions in RPA models. Based on the mature standard for decision management, DMN [11], a way of integrating decisions in RPA robots is delineated, maintaining the focus on business users and intuitive usability.

2 Related Work

In BPM, similar problems regarding the modeling of decisions in workflows have been reported, such as complex, nested structures which are hard to maintain and understand [1]. For one of the associated modeling notations, BPMN [10], the problem was addressed by separating the decision logic and the control flow using DMN (Decision Model and Notation) [5, 7]. DMN allows the modeling of decision requirements and the specification of the underlying decision logic in the form of a decision table [11]. In BPMN models, DMN is used to encapsulate the previously branched and nested decisions into a single new decision activity. This allows decision-intensive business process models to be presented in a clear and compact way. Even approaches to extract the decision logic from process models and replace it with DMN have been proposed [4].

However, although current graphical RPA approaches suffer the same problem, it has, to the best of our knowledge, not yet been addressed in research. Nevertheless, since RPA software is known to be highly rule-based [12], it is expected to benefit from the integration of a proven technique for data-based and rule-based decisions, such as DMN.

3 Motivation

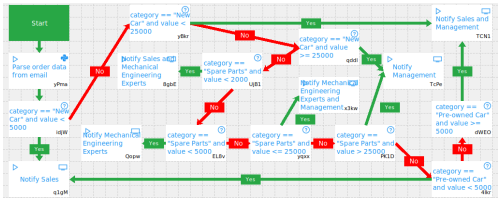

Fig. 1. Scenario implemented with explicitly modeled decisions (intentionally not readable)

Consider the following scenario: In a car dealership, orders placed by employees for the company are to be released. To do this, they send their orders to a secretary, who decides which departments in the company are eligible to approve an order. Since orders can have different costs and categories (such as 'New Car' or 'Spare Parts'), and depending on this can have one or more parties in the company authorized to review them (e.g., 'Management' or 'Sales Department'), the decision has a certain degree of complexity.

Implementing the scenario with RPA is a viable option here, as the costs and category extraction, the decision, and the email notifications can be automated using common RPA features. Figure 1 shows a possible implementation with

the open source version of the RPA software Automagica[1], demonstrating that explicit decision modeling can lead to an unreadable spaghetti-like model.

Here, the explicit but necessary modeling of the decision with the different options of responsibility to decide on orders as well as the different combinations of the input variables 'cost' and 'order category' leads to a nested decision tree that is difficult to understand.

4 Integrating RPA with DMN

The research proposal is to apply elements from decision management of BPM to the modeling and implementation of RPA systems. Hiding the complexity of a decision using a decision engine makes the RPA process model more understandable. For example, Figure 2 shows a prototypical implementation of a software robot that executes the same program logic as the model in Figure 1, but requires much less modeling elements as the decision resides in a decision table that is evaluated by a decision engine in the task "Decide on responsible party". The

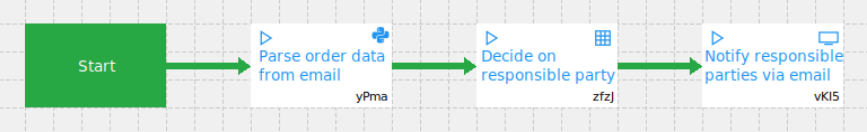

Fig. 2. Order review scenario modeled with RPA and DMN

decision takes place within a DMN decision table, which is not shown here. To create the decision table, however, further modeling effort is necessary, especially for users who are not familiar with DMN. Thus, two different modeling languages have to be learned to create RPA process models.

The research approach is to investigate for all phases of the RPA lifecycle, as defined by König et al. [9] and Jimenez-Ramirez et al. [8], how decisions in RPA bots can be supported by DMN and how each lifecycle phase needs to be adapted compared to existing approaches. The selection of suitable business processes for automation, necessary capabilities of modeling tools and requirements for RPA architectures (e.g., local decision engine versus external decision service) as well as their implementation will be compared and discussed. Communication flows between individual software components, verification of correct behavior and efficient operation are also to be considered. In order to demonstrate the feasibility and to evaluate the benefits of integrating DMN in robotic process automation, several prototypes addressing the different architecture types (e.g.,

[1] `https://github.com/automagica/automagica/tree/ae8a1846f23df6497e725c8db198b4420da82f12` (latest open source version)

decision engine embedded in the RPA robot or connection to an external decision engine) will be implemented and compared.

5 Conclusion

The proposed introduction of a dedicated decision component for RPA is applicable for rule-based and data-focused RPA processes. Although the decision component should not and cannot be applied to every decision in RPA processes (simple decisions can still be mapped using conventional means such as $if-else$), more complex and data-driven processes are expected to benefit from the use of more sophisticated decision management. Overall, it may lead to better monitoring, easier updating, and higher overall comprehensibility of RPA models and executions compared to explicitly modeled decision trees, which highlights the need for further research in this direction. Future work could analyze whether and how DMN in RPA could benefit from the integration of machine learning technologies and conduct a user study to analyze the trade-off between reduced model complexity and additional effort due to an additional modeling language.

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