

# A Configurator Component for End-User Defined Mobile Data Collection Processes

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**Abstract.** The widespread dissemination of smart mobile devices offers promising perspectives for collecting huge amounts of data. When realizing mobile data collection applications (e.g., to support clinical trials), challenging issues arise. For example, many real-world projects require support for heterogeneous mobile operating systems. Usually, existing data collection approaches are based on specifically tailored mobile applications. As a drawback, changes of a data collection procedure require costly code adaptations. To remedy this drawback, we implemented a model-driven approach that enables end-users to realize mobile data collection applications themselves. This paper demonstrates the developed configurator component, which enables domain experts to implement digital questionnaires. Altogether, the configurator component allows for the fast development of questionnaires and hence for collecting data in large-scale scenarios using smart mobile devices.

## 1 Introduction

In many application scenarios (e.g., clinical trials), data collection is still based on paper-based questionnaires (so-called *instruments*), which reveal many drawbacks (e.g., huge efforts for digitizing and analyzing the data collected). Using smart mobile devices with specifically tailored services offers promising perspectives in this context. The development of respective mobile services, however, is both time-consuming and costly. Furthermore, the mobile support of mobile data collection scenarios often requires profound domain-specific knowledge. Hence, a generic and flexible approach to speed up the development of mobile data collection applications is demanded by domain experts [3]. In the QuestionSys project, we developed an advanced framework for supporting the lifecycle of mobile data collection scenarios. On one hand, IT experts are relieved from costly manual tasks (e.g., deploying mobile applications to devices). On the other, domain experts (e.g., medical doctors) are empowered to create sophisticated data collection instruments following a process-centric approach for their design and enactment. This paper demonstrates the configurator component that enables domain experts to create sophisticated instruments for large-scale data collection scenarios.

The paper is organized as follows: Section 2 presents selected services of the framework. Section 3 discusses related work and Section 4 summarizes the paper.

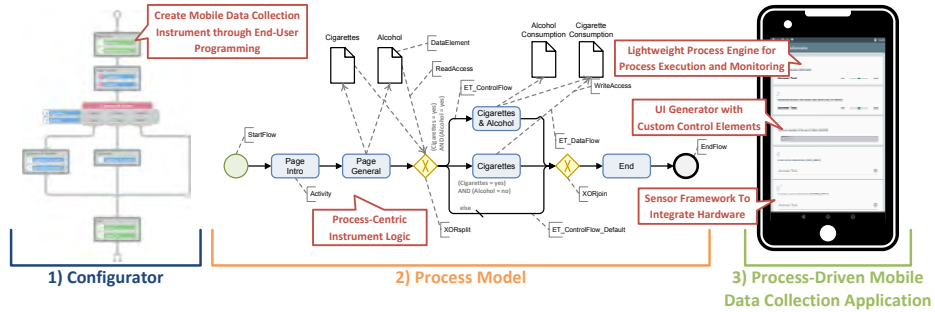


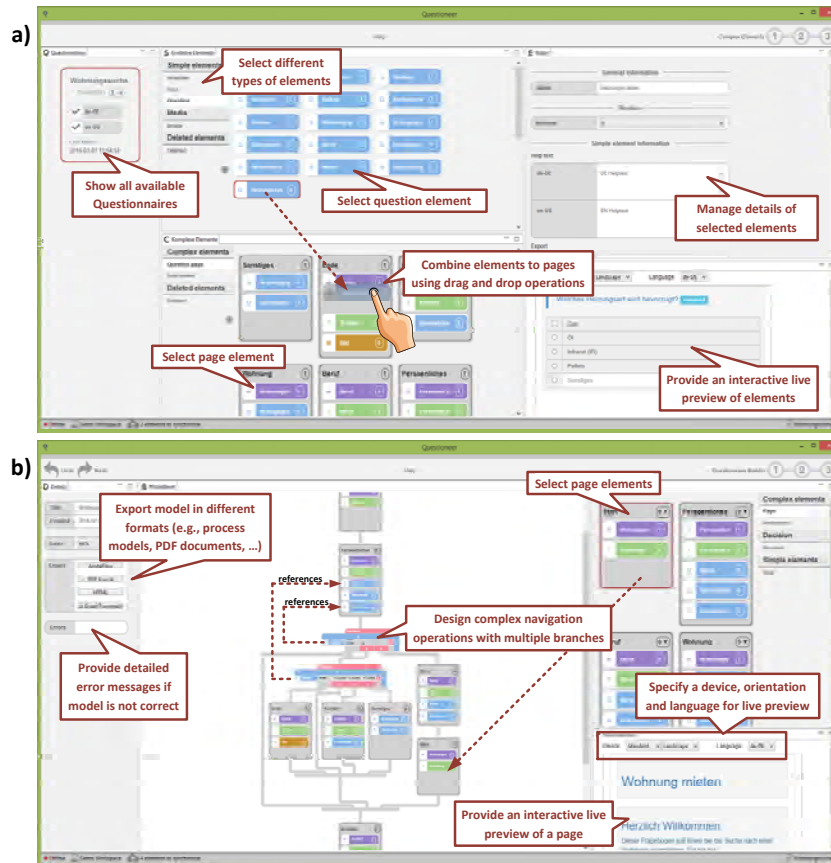
Fig. 1. QuestionSys Approach

## 2 The QuestionSys Framework

This section introduces the QuestionSys framework (cf. Fig. 1) and its underlying mobile data collection lifecycle: The *Design & Modeling* phase allows domain experts to create an instrument by applying a graphical questionnaire definition tool. The resulting specification is then transformed into an executable process model based on a well-defined mapping. The *Deployment* phase then handles the installation on smart mobile devices. During the *Execution* phase, multiple instances of the instrument may be started. In order to allow for a robust but still flexible enactment, a mobile process engine is used. During the *Analysis* phase collected data may be evaluated in real-time in order to provide immediate feedback if needed. Finally, the *Versioning* phase deals with release management of the created instruments and collected data respectively. This paper focuses on the configurator component. However, more details regarding the other components of the QuestionSys architecture and the mobile data collection lifecycle are provided in [4].

Fig. 2 (a) shows the *element creation* view of the QuestionSys configurator (cf. Fig. 1, ①). First, the domain expert (i.e., end-user) chooses the respective questionnaire from the left. Then, elements of different types (e.g., *Headlines* or *Questions*) may be selected. In the rightmost part, the content of an element may be edited. In particular, the configurator allows versioning and handling multiple languages. To enable an immediate feedback when editing elements, an *interactive preview* is provided. The feature further allows simulating different devices and switching between languages. The most important function allows combining elements to *pages* using a drag & drop approach.

Fig. 2 (b) illustrates the modeling perspective. Domain experts may use the created pages and drag them to the model depicted in the center view. Furthermore, the modeling component allows creating sophisticated navigation operations to guide interviewers through the process of data collection. Note that the modeling editor follows a *correctness-by-construction* approach; e.g., it is not possible to create a *non-executable* model. Finally, the questionnaire model is mapped to an executable process model (cf. Fig. 1, ②).



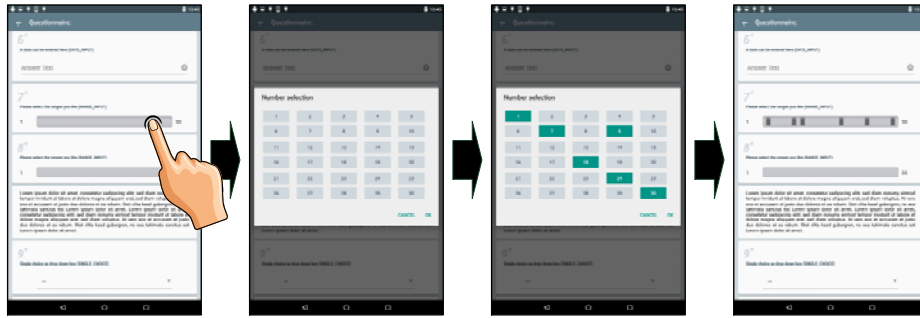
**Fig. 2.** QuestionSys Configurator: (a) Combining elements to pages; (b) Modeling a data collection instrument

The configurator component and its model-driven approach allows domain experts to visually define executable instruments. In turn, it contributes to reduce costs and increase productivity regarding mobile application development.

To validate the approach, a mobile application (cf. Fig. 1, ③) supporting scientists during data collection was realized and applied in large-scale trials. More details regarding the mobile process engine, capable of executing data collection instruments, are discussed in [5]. Fig. 3 presents impressions of the developed mobile data collection application.

### 3 Related Work

There exist various approaches supporting non-programmers in creating software. Their feasibility and applicability were proven in several studies. [2] pro-



**Fig. 3.** QuestionSys Mobile Data Collection Application Impressions

vides a tool assisting administrators in their daily routines, allowing them to visually model scripts. In turn, [1] presents a graphical notation for implementing block-structured programs. Evaluations showed that subjects prefer this approach compared to text-based programming. Due to their limitations, however, these approaches cannot be applied for more complex data collection scenarios.

## 4 Summary and Outlook

The paper presented two components of the QuestionSys framework. In particular, we demonstrated the configurator component enabling domain experts to create instrument themselves. In addition, the mobile application was discussed. Currently, we are conducting a study evaluating the usability of the configurator component. Information regarding the process of creating elements and combining them to instruments are of particular interest in this context.

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