TRADEmark – Using Location Data for Mobile Distributed Processes in BPM (Extended Abstract)

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Abstract

The combination of IoT and BPM enables new possibilities for the utilization of contextual information during the modeling and execution of process models. This paper presents a novel approach to using mobile devices for process execution, opening new avenues for harnessing IoT devices and data to create value in businesses.

We address shortcomings in current BPM tool support by providing a method to directly model spatial information into BPMN models, thus coupling mobile interactive interfaces with the dynamic structure of business processes, utilizing inherent location data from said devices.

Keywords

Business Process Management, Location-Awareness, Distributed processes

1. Introduction

Business processes are a series of actions taken to achieve specific business outcomes [1]. They can be represented by business process models consisting of instructions on how the encompassed activities should be executed. The combination of the Internet of Things (IoT) and Business Process Management (BPM) can lead to new possibilities for value creation [2], supporting actors during the execution of activities by providing additional information and automating non-value-adding tasks.

Distributed mobile processes involve multiple participants engaged in sequential tasks at various locations, their execution being inherently linked to specific contexts [3]. Compared to classical IT environments, this brings new challenges to the forefront, and spatial dependency necessitates a greater focus on the process participants and their orchestration.

To address the representation of location-specific concerns in the de-facto standard Business Process Model and Notation (BPMN), we introduced various modeling elements as part of the BPMN extension LABPMN [4]. These elements include location data objects, support for location events, and the automatic allocation and assignment of one or multiple tasks to a specific actor based on their current location.

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This paper presents our tool *TRADEmark* for utilizing location data in BPM[1]. Leveraging the BPMN extension for location-awareness, we introduce comprehensive tool support for modeling and executing processes with a strong emphasis on location information. Our tool facilitates process execution, backed by mobile devices used by actors as sources of location data and by providing information about current tasks for execution. Additionally, it incorporates a back-office application that provides valuable contextual information about actors, customers, and other process resources. The presented tool serves as an initial approach to dynamically adjusting mobile applications for actors working at different locations, solely based on the modeled and executed business process.

The remainder of this introduction is structured as follows: In section 2 we give a short overview of the system architecture and the included parts, followed by a concise description of the different parts of the tool in section 3. Finally, section 4 describes a currently running use case, followed by current shortcomings and future implementation tasks.

2. System Overview

The tool at hand adheres to a standard web-based approach and consists of the location-aware modeler, a backend including a database and the Business Process Management System (BPMS), as well as the back-office web-application and the mobile application (see fig. 1).

The backend employs a conventional layered MVC (Model-View-Controller) architecture with Spring Boot[2] as its technological framework. It provides a REST interface for the mobile application and HTML web pages for human users. These interfaces enable common use cases, such as the storage and querying of tools, locations, or projects, and the handling of user tasks. We employ a SQL database (PostgreSQL[3]) with an extension for geographic data (PostGIS[4]) for data storage. To accommodate a wide array of mobile devices (Android and iOS, with the possibility to also deploy as a web application) and enable access to native device features, such as Bluetooth communication or location services, we have selected Flutter[5] as the mobile development framework.

3. *TRADEmark* – Innovations and Features

As previously mentioned, *TRADEmark* currently comprises different components primarily focused on the modeling and execution of business processes. In line with the architecture presented earlier, we divide the tool into three main parts: Modeler, Mobile Application and Backend with Web application (see fig. 2). This also shows the approach of moving BPMS functionality like the tasklist and different needed forms from static web applications towards dynamic mobile approaches, suiting the actors' needs.

[1] A demonstration environment can be accessed via https://pcinf00037.uni-regensburg.de:8443 (User: `test`, Password: `Test!2023`). Supplementary information, including a brief demonstration video, is accessible on GitHub at https://github.com/LeoPoss/demo-trademark.

[2] https://spring.io/projects/spring-boot

[3] https://www.postgresql.org/

[4] https://postgis.net/

[5] https://flutter.dev/

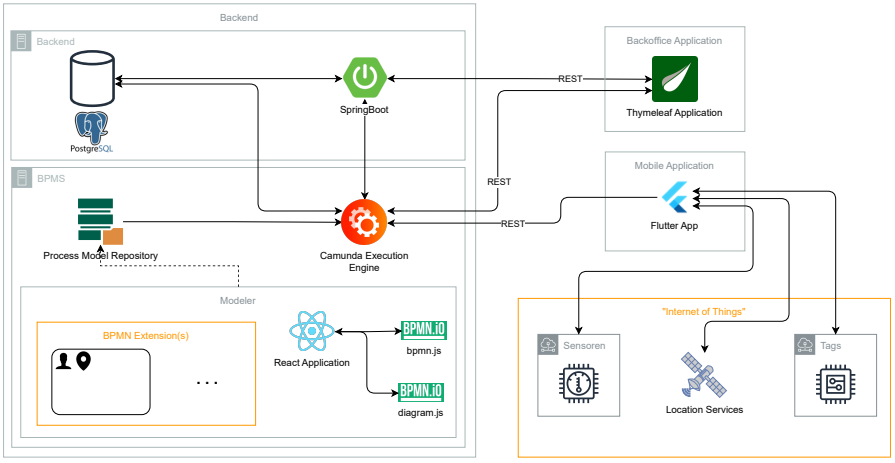

Figure 1: Software architecture of *TRADEmark*

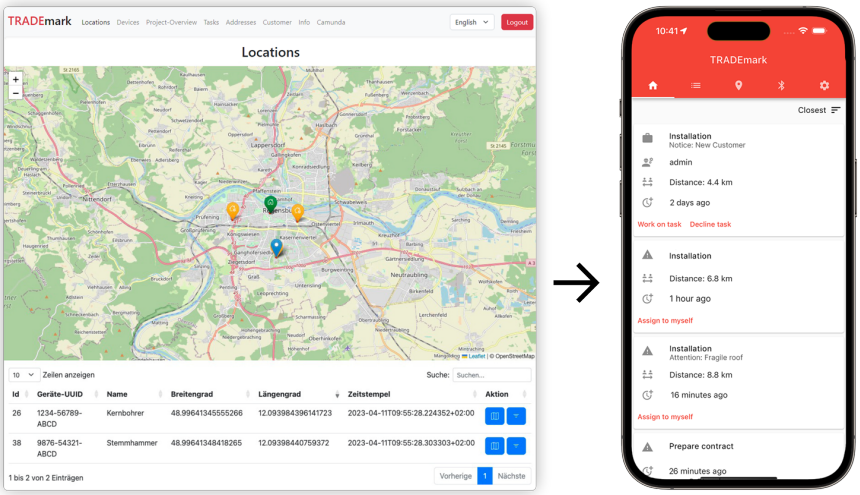

Figure 2: *TRADEmark* – Combining IoT and BPM to leverage the use of location information for mobile distributed processes

LABPMN – Location-aware Process Modeling The first appliance is based on the BPMN extension published in [4]. The implementation of the modeling aspect of the extension is built upon the open-source implementation bpmn.js[6], which integrates well into the BPMS.

The various introduced elements can be selected either directly from the context menu or after assigning a specific location-aware event type or distance type to the element within the properties panel.

[6]https://bpmn.io/toolkit/bpmn-js/

***TRADEmark* – Mobile Application for BPM with Location Information** To enhance efficiency and effectiveness in process execution, we also offer a mobile application for actors responsible for carrying out the tasks of the business process. This application includes functionalities such as accessing current tasks (both assigned and unassigned), initiating and completing tasks, accessing attached forms, and working with them. It also supports the initiation of process instances and provides easy access to the actor's current location via the mobile device's geolocation services. Additionally, it can connect to other IoT devices, such as reading sensor values or accessing Bluetooth Low Energy (BLE) tags.

Backend and Web Application – Further Leveraging Location Data The backend comprises the BPMS (in this case, Camunda[7]), a SpringBoot application that integrates and manages all components, and the mandatory database. This component not only provides access to all standard BPMS features but also extends its functionality with location-specific features. This includes displaying customer locations and the current locations of items such as tools on a map. It also supports the incorporation of additional contextual information for existing customers.

4. Maturity

The tool we are introducing is a part of a larger ongoing research project. While it's still actively in development, the individual components we've presented can be used separately or combined to facilitate the utilization of IoT data, primarily location data, in BPM. To support seamless development progress, we adhere to best practices, including the integration of unit tests that are automatically executed in our CI/CD pipeline.

Conversely, to facilitate feedback and the actual use of the tool from our application partners, we place a significant emphasis on UI and UX. This includes providing localization in both English and German, ensuring accessibility and user-friendliness through simplicity.

User Study To present the current status of our tool, we provide a real-world example that initially motivated its development. The business process for this demonstration is outlined in fig. 3 and incorporates the BPMN extension elements for location from [4]. The process initiates with an incoming order, whereupon a worker is promptly assigned to the task, proceeds to the customer's location, performs the required work, and subsequently returns. Following the creation of an invoice, the job is marked as completed, thereby concluding the process instance.

An adapted version of this process and our tool are currently undergoing testing at a research partner's company, evaluating the interaction between the various tool components that support the use of location in different phases of the BPM lifecycle.

Future Work As previously mentioned, *TRADEmark* is an integral part of an ongoing research project, and our development efforts continue. From a technical standpoint, our future tasks encompass several key aspects: *(i)* Monitoring and DevOps: We recognize the need for robust

[7] https://camunda.com

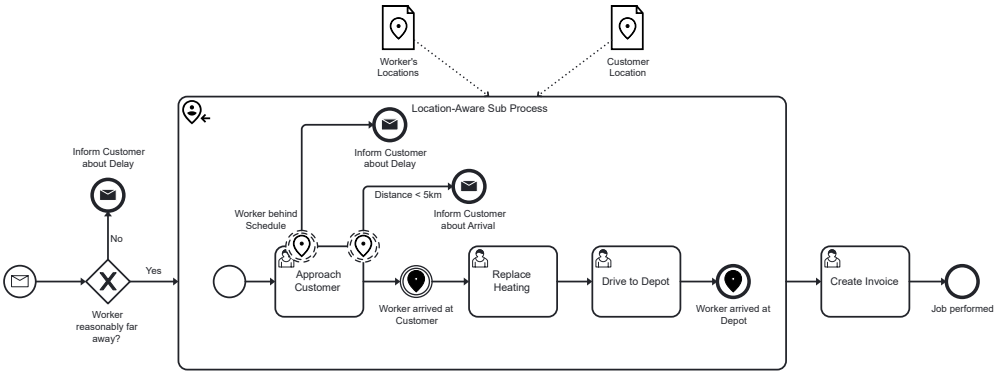

Figure 3: Simplified real-world process using LABPMN

monitoring features for the deployed software, as well as the integration of various DevOps tasks such as CI/CD, *(ii)* Standardizing BPM Forms: We are actively working on standardizing the BPM forms used for activities or developing the capability to parse standard Camunda forms. This will ensure compatibility for both the web and mobile applications.

Conceptually, we are focused on enhancing contextual information usage. We are actively exploring additional methods to incorporate contextual information into BPM processes. We are also committed to addressing ethical considerations and adhering to regulatory conditions related to the use of actors' locations.

These efforts reflect our dedication to advancing the capabilities of *TRADEmark* while also ensuring its alignment with evolving technical and ethical standards.

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