Task and Process Support in ERP Systems

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Abstract. We present a proof-of-concept prototype that demonstrates novel collaborative features for supporting enterprise system users. The purpose of the prototype is to illustrate the implementation of design principles derived from field studies of Enterprise Resource Planning system (ERP) users. Its novel features are designed to improve the users' understanding of the business context of their interactions with the system and help them learn to operate it by viewing how tasks have been performed in the past.

1   Introduction and motivation

Enterprise Resource Planning systems (ERPs) are widely used for automating business processes, yet they are notorious for their complex and unintuitive user interfaces. The generic design of those interfaces, which support a broad variety of business practices, makes them inordinately complex for users to master on their own. We have developed a set of design principles [3], models, and algorithms [1,2,4,5] for building enterprise systems using the human-computer collaboration paradigm [3]. These principles grew out of field research investigating and documenting the usability issues experienced by ERP system users [3]. The development of these design principles was guided by collaboration theory.

In this paper, we present an integrated proof-of-concept prototype that implements some of these design principles. A relatively small number of tasks have been implemented when compared to a real ERP system. Our goal, however, is to demonstrate a novel design approach and illustrate the principles from [3] with concrete implementations. Since the design features require real-time logging of interactions and access to the Task-Interface-Logging (TIL) framework [1,4] underlying our implementation, it is not currently possible to integrate these features into an existing ERP system.

The functionality of an enterprise system traditionally lies within the set of business tasks and processes that it implements. Although individual users are typically exposed to a small subset of tasks, successful operation of the system requires a broader understanding of how individual tasks are related. The relationships between tasks and processes, their associated business contexts, and the flow of business data through them are largely hidden behind opaque interfaces. This creates huge obstacles to the users' understanding of where their responsibilities fit in, how to identify and

complete related tasks, and where to look for data that is pertinent to their tasks. Users are also intimidated by the enormity of organizational data that is often presented to them in an unfiltered, un-optimized manner, thereby discouraging independent exploration of the rich informational and operational resources offered by the system.

In adopting the human-computer collaboration paradigm, we recognize that the user alone cannot handle the cognitive load associated with learning and utilizing such a complex system. The system must include features that will educate and guide users so that they can achieve greater effectiveness in performing their tasks. To that extent, we have designed and implemented the TIL [1,4] framework in which an ERP system's tasks, task interfaces, task composition into processes, and the history of all system-user interactions, are embedded in the system's data model. Using the information in TIL, our prototype implements the following features:

- Interactive visualizations of the process currently being performed, and
- On-demand, automated demonstrations of how to execute a task.

We describe these features in the next section.

2 Task and Process Support in ERP Prototype

The overarching design goal of this project is to provide a mechanism by which the system can provide the user with useful guidance and assistance in:

- learning or recalling how to perform a specific task or process,
- understanding the task context and the flow of business data through tasks and processes, and
- reviewing the detailed history of tasks and documents related to the task that is currently being performed by the user.

These goals are supported by two features, an Interactive Process and Process Instance Visualization and an Automated Task Playback. Before presenting them, we provide some definitions regarding the TIL model (see [1,4] for a full description), which serves as a supporting infrastructure to our implementation. In the TIL framework, a process is a predefined set of tasks. Two tasks are connected when an output of one is used as an input to another; thus, the flow of data objects links the tasks within a process. A process instance is defined as a set of concrete instances of the tasks comprising a process that are executed by a user. Task and process descriptions are a part of the TIL model. Process instances are automatically reconstructed from the Log portion of the model in real time, using algorithms presented in [4].

2.1 Interactive Process and Process Instance Visualization

Figures 1 and 2 show our Prototype ERP window as it appears when a user is working on *Add Goods Receipt* task. The left pane of the window presents a traditional form-based page for entering data. The right pane contains the tabs that display information

about the business process (*Purchasing*) encompassing the *Add Goods Receipt* task currently being performed by the user. The top white rectangle presents a choice of two tabs: Process Graph and Process Instance Graph. The **Process Graph** view (Fig. 1) displays information about the Purchasing process in general, including individual tasks and data flow between them. The **Process Instance Graph** view (Fig 2.) presents information about the current task instance being worked on as well as the other related task instances within the same process. The rectangular pane on the bottom of the right side shows process details that are displayed when a user clicks on the components of a graph. Below we discuss the details of each view.
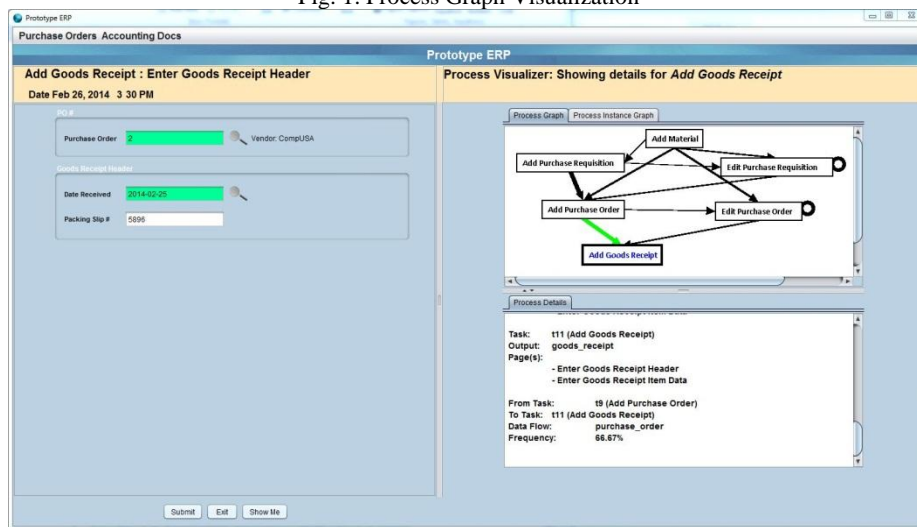
Fig. 1. Process Graph Visualization

Figure 1 shows the Process Graph and the Process Detail panes on the right side of the window. The user can interact with the Process Graph by clicking on tasks and arrows, with the latter representing the flow of a data object between tasks. Clicking on a task causes the Process Detail window to display detailed information on the task, including its name, id, and the number and names of the interface pages associated with it. Clicking on an arrow displays information on the data object that is passed between the two tasks and the frequency of this transition. For example, the highlighted link from *Add Purchase Order* to *Add Goods Receipt* represents a *purchase_order* object that is created by the former task and used by the latter. This information and statistics on how frequently a completed *purchase_order* object is passed by an *Add Purchase Order* task to an *Add Goods Receipt* task is displayed in the Process Detail pane. The thickness of the arrow is proportional to that frequency.

The Interactive Process Instance Visualization shown in the right pane in Figure 2 provides information on the concrete task instance of the Purchasing process that the user is working on in the left pane. Note that the Process Instance Graph shows a subset of tasks from the Purchasing process displayed in Figure 1, including only tasks that have already been completed or are in progress. Clicking on a box repre-

senting a task instance causes the window to display information on the users who executed the task, task time stamps, completion status, and the output data object produced by the task. The Interactive Process Instance Visualization allows a user to trace back through the entire process chain from the document that is currently being worked on to all other related data objects, find the task instances that were enacted to produce those related objects, and identify the users who performed those tasks.

Fig. 2. Process Instance Graph Visualization
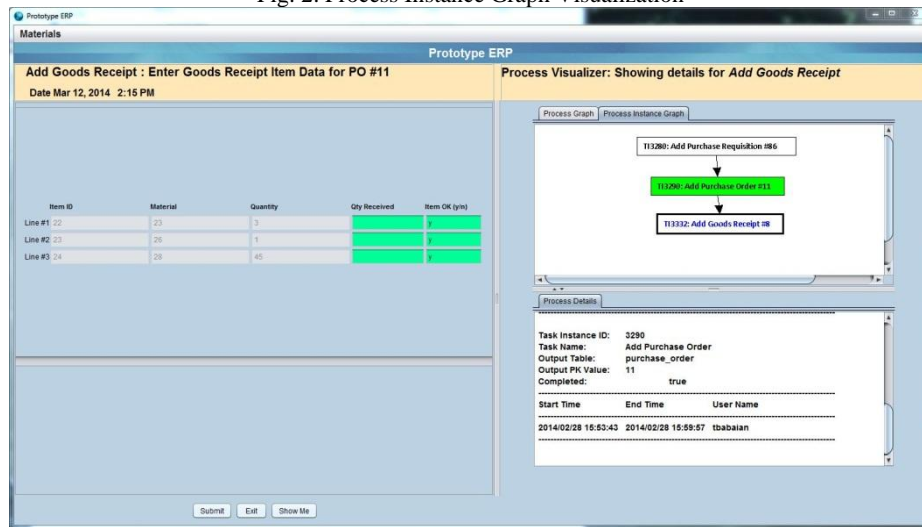
2.2   Automated Task Playback

ERP users often consult a colleague, a help desk, or their own notes when experiencing difficulty with some part of a task or learning how to do it for the first time. User difficulties stem from not knowing which fields to fill in, what data to enter and in what order or format, and how to access a related task [3]. We have implemented the system capability of replaying a prior system-user interaction, which serves as a tutorial demonstration of a task interface. These demonstrations are generated in real time based on the usage Log data collected and stored within the TIL data model [2].

To enact the Playback feature, a *ShowMe* button is included in each task interface. Upon clicking it, the system displays a page that asks the user to provide optional parameters for selecting a past execution of the task for playback. The parameters include the user whose interaction will be visualized, the beginning and end dates defining the interval in which the task instance occurred, the type of document produced by the task, a specific document number, and the process within which the task occurred. These parameters are used by the system to identify the corresponding task instances, which are then presented in a list to the user. If no parameters are entered by the user, the system presents only the task instances corresponding to the user's current task. The user picks a particular task instance and the system dynamically creates a script, based on the interaction data in the Log, and plays it as an animation in a separate Playback window.

3 Discussion

Significance to research. Due to space limitations, we refer the reader to [2,3,5] for a review of the related literature and a discussion of how the presented features differ from the existing approaches reported in research and implemented commercially. The presented prototype makes the following research contributions:

- it illustrates the use of collaboration theory in guiding the design and implementation of large organizational systems,
- it validates the suitability of the TIL framework as a supporting infrastructure to the system-partner approach to interface design, and
- it presents novel types of user support, namely interactive process and task visualizations and on-demand task tutorials that are dynamically generated based on the automatic logging of user interaction data within the TIL framework.

Significance to practice. This approach addresses common concerns of ERP users regarding the opacity of the business processes, which significantly impairs the users' ability to operate the system. The presented prototype demonstrates low-cost alternatives to time- and labor-intensive approaches to educating and supporting users via training seminars, help desks, and peer-to-peer communication.

Evaluation of the artifact. We are planning a laboratory study for evaluating the usefulness of the Process Visualizations. An empirical evaluation of the asymptotic time complexity of the algorithms is also underway. Finally, we are planning on discussing the features presented here with field users in order to assess their usefulness.

Acknowledgement

References

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