WALKTHROUGH METHODS FOR IMPROVING THE SYSTEM FIT TO THE USERS' TASKS WITHIN MANUFACTURING OPERATIONS

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Abstract: Designing an information system for manufacturing context has challenges, such as efficiency and user requirements. Therefore manufacturing systems should be evaluated with real users before their implementation. The purpose of the evaluation is to ensure that a system supports the work flows and that users are introduced to a new system in the early stages of design. Walkthrough methods provide means to simultaneously review a sequence of actions and involve the users in the design activities. In this paper, a pluralistic walkthrough method was used for evaluating a user interface of a manufacturing system. In the session, the target user groups performed predefined task scenarios with a paper prototype of the system. The results indicate that walkthrough methods could be applicable for the manufacturing systems design, and the results could improve the system design and the user acceptance.

1 INTRODUCTION

Manufacturing contexts present several challenges for systems design, such as allocation of users' tasks and functionality of technology. In order a system to be efficient and purposeful, the internal logic and the external compatibility must be ensured already in design phase. First the system has to support the work flows of users, and second the users have to accept and use the system. If these conditions are not fulfilled, the system becomes useless.

Walkthrough methods are utilized for different purposes, e.g. code review, business process review or user interface evaluation. The methods vary in their objectives, purpose and participants. Walkthrough methods usually require preparative actions like data gathering, modelling and designing a solution that is then evaluated in a walkthrough session. However, they provide an efficient and intensive way to achieve shared understanding among stakeholders, e.g. designers, users and their managers. Moreover they help to detect problems of the design before implementation phase.

In this paper, three walkthrough methods, Participatory heuristic evaluation (Muller et al. 1998), Pluralistic walkthrough (Bias 1991), and Socio-technical walkthrough (Hermann et al. 2004), are first introduced in terms of their objective, purpose and participants needed. Then a detailed case example of how to conduct a pluralistic walkthrough session in a manufacturing context is described. Finally the applicability of walkthrough methods in manufacturing controlling systems design is discussed and conclusions are drawn.

2 WALKTHROUGH METHODS

The primary criterion for selecting a walkthrough method to be applied is the objective of the walkthrough. Table 1 provides criteria for the selection of the previously introduced methods.

Participatory heuristic evaluation is best suited for inspecting interface design in a detailed level taking into account the process in which the system is used.

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Table 1: Selection criteria for a walkthrough method.

Methods	Objective	Purpose	Participants
Participatory heuristic evaluation	Interface, process scenarios	Evaluation	Experts and users
Pluralistic walkthrough	Interface, scenarios	Evaluation, design	Experts, designers and users
Socio-technical walkthrough	Process, system	Design, evaluation	Experts, designers and users

Pluralistic walkthrough is on a higher level of abstraction and concentrates on how the interface responds to the work flows in terms of scenarios. Socio-technical walkthrough on the other hand concentrates on the interaction between the social and technical system in the work process. Even though interface of the technical system might be involved, the focus is more on the work process. The purpose of the walkthrough is usually evaluation, but it always provides input to design. In pluralistic walkthrough the design may be updated in the walkthrough session, because of the presence of designers. In socio-technical walkthrough the design function is in even greater role. The participation of different roles in each of the methods is seen in the table. Expert refers to a human factors specialist.

3 APPLYING THE PLURALISTIC WALKTHROUGH METHOD TO THE SYSTEM DESIGN

The case study approach is suitable for exploring the phenomena within a limited group or organisation (Yin 1992). The aim of this case study is to explore what kind of benefits and limitations occurs when a walkthrough method is used in the design of the manufacturing control system.

3.1 The Design of the Manufacturing Control System

The current manual manufacturing system included moving physical objects i.e. cards from operator to another (Fig.1). The cards cotrolled the production, for example notified that the assembler had consumed the material produced by the manufacturer. The problems with the manual cards were e.g. lost cards, inaccurate timing, and that participant could not see the status of one another's work in real time.

Therefore, a manufacturing system was to be designed. The desired manufacturing control system is an information system that replaces the current cards (Fig. 2) The system tackles the problems with manual cards, and moreover has controlling functions such as production priorities and calculation of the material needed for current production.. The desired system also increases the visibility of the production process (Fig. 2) that also changes the social environment in a way that operators are able to see the status of the whole process.

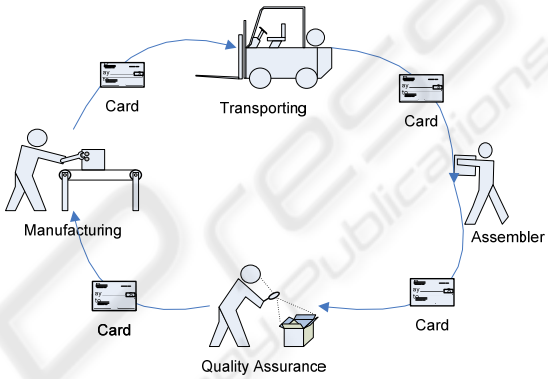

Figure 1: An illustration of the current manual system in use.

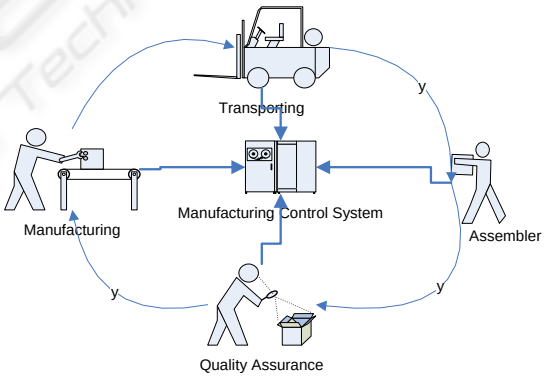

Figure 2: An illustration of the desired manufacturing control system in use.

The overall designing process of this system is presented by Salmimaa and Vilpola (2007), but the focus in here is limited to the walkthrough session and its contribution to the design. Also the practicalities of how to conduct a walkthrough session are revealed in this case.

3.2 The Walkthrough Session

During the pluralistic walkthrough session, each primary user i.e. operator (Fig. 3) worked as a

partner with some other primary user or with a human factor professional or a designer. The partners representing different aspects were expected to create more versatile comments on the functionality, the scenarios and the UI design. Each scenario was presented on first the slide show and walked through with the paper prototype. The responsible role that also performed the task in real context, had an opportunity to start commenting. Other users could comment afterwards.

The paper prototypes are based on the predefined task sequences created from the notes of the observations in the real context of use. In this case, with the aid of the walkthrough session, the system functionality can be double-checked with the end users, because the paper prototypes and scenario descriptions work as a stimulus for the participants.

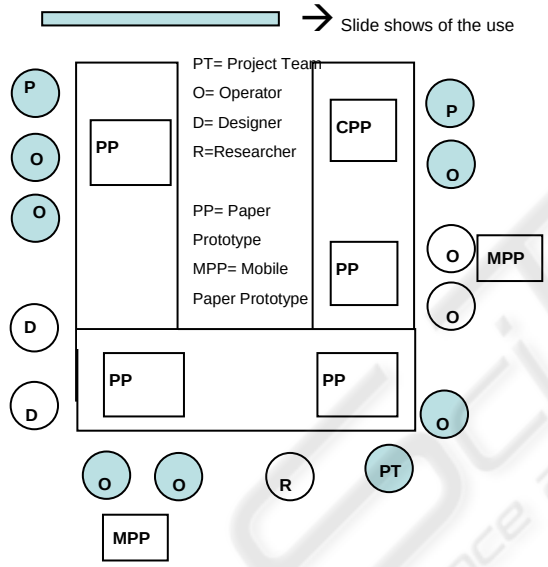

Figure 3: The seats of the participants and the location of the paper prototypes in the room.

The paper prototypes were distributed to the participants, one for several participants As designed so far, every user should have own device but only few users have hand terminal (MPP in Fig. 3) in the shop floor. The amount of hand terminals were kept limited for a purpose that the real situation can be simulated.

Fast moving steps on the user interfaces were presented by using power point slide shows (Figure 3). Thus, the simulation was quite close to reality. Also the comments from the participants can be captured on the paper prototype UIs to appropriate locations. The developers may browse through the corrections before illustrating the UI sketches into the requirement specification. Most of the development ideas collected in the session concerned improvements on UIs.

3.3 Results

The table 2 presents the user roles and use scenarios that have been gone through in more detail in the walkthrough session.

Table 2: User roles and Use scenarios with the number of the notes emerged during the walkthrough session.

User	Scenarios	Notes
Operator A in the component line	1. Booking a material and a product type for preparing the components at the line.	4
Operator B in the component line	2. Registration at the intermediate storage	2
Truck driver	3. Transporting units on the truck	2
Production controller	4. Updating the product information	2
All Users	5. Registration of a defective product	3
Production manager	6. Updating the manufacturing order list at the component line	2

The development ideas emerged mostly at the first use case “Booking a material and a product prepared for preparing the component at the line” (Table 2). The list of works designed for Operator A was quite usable and simple to use from users’ standpoint. Some corrections are needed, e.g. how to present the highest priority on the list. Also some additional information was missing on the view, e.g. product information on the manufacturing order list.

The consensus among the participants prevailed in terms of the main view in which the status of the whole production process and demand of a critical component should be presented. General comments on the feedback or error messages presented on the screen were raised up by some operators and system developers. Concerning the location information of the truck, the updating in any case (also overwriting) has to be possible.

Trolleys, which are used for moving the material in the process, without any identification label have to be registered into the system in some way because these are not registered into the system at all. Each trolley in the system needed to be identified and traced. The identification needs to be double-checked. If the server of the system is fallen down, the trolleys have to be taken an inventory. The most important thing is that the production is not

interrupted if the system would be down. The status view and logs have to be maintained. The production parameters have to be easily modified.

Defective product can be easily returned to the production. The location information of the defective product is very important so that it can be transported as soon as possible to the unburden area. There are several reasons for the defective products. In the current manual system, the operator has to call to a team responsible person before implying the defective product. Some discussions have emerged from the reasons for the failures on the process.

Breakdowns occur in the process. Thus, the messages about the breakdowns have to be registered to the system in real-time in order to share the information in the whole process. A responsible primary user argued that they need as accurate information about the consuming rate of units as possible. It is a significant trigger to the component line and should be updated in real-time to the system. The assembly machine can also register the information about each unit running in the machine.

4 CONCLUSIONS

Manufacturing control systems are designed according to the manufacturing logic of increasing company productivity. Designing such a system includes planning how the system will support the tasks of end users. In this paper, a pluralistic walkthrough method is used for evaluating a system design from users' perspective. The primary users, e.g. the main operators in the system, were using a paper prototype of the system according to predefined scenarios of use. As a result their comments were considered for the requirement specification of the system.

Walkthrough methods provide an intensive way to "walk through" the functionality of system design, and iterate the design solution at the early stage of the design process. Thus, the requirements for system functionality can be verified before any function is implemented. Moreover, using walkthrough methods in the design phase may ease the adoption stage as the users' are already introduced to the system.

The system designers may not be fully aware of the everyday possibilities and practical restrictions, such as breakdowns or product changes. The communication ability between designers and users help to avoid misunderstandings of the design objectives.

Organisational change issues, such as job redesign and changes of the individuals' tasks, may pose a threat to shop floor level workers. However, in the walkthrough session the workers conduct their tasks with the prototype of the new system. Therefore, the workers are able to experience how the new system will affect their work flows. The issues that are raised during the session can be taken into account also in the training plan for the new system. The user acceptance and user satisfaction are hard to measure, but users' understanding of the benefits of the system for their work can be clarified in the walkthrough session.

The results of this paper affect the requirement analysis and design process of the manufacturing control system. In addition the walkthrough session allowed communication between users and designers, and introduced the users to the new system in the early stages of design process.

REFERENCES

Bias, R., 1991. Interface-Walkthroughs: Efficient Collaborative Testing. IEEE Software, Vol. 8, No. 5, pp. 94-95.

Bias R., 1994. The Pluralistic Usability Walkthrough: Coordinated Empathies, in Nielsen J. and Mack R. L (Eds) Usability Inspection Methods. New York: Wiley & Sons Inc.

Hermann, T., Kunau G., Loser K., Menold N., 2004. 'Socio-Technical Walkthrough: Designing technology along Work Processes', Proceedings of the eighth conference on Participatory design: Artful integration: interweaving media, materials and practices - Volume 1, Participatory Design, Toronto, Ontario, Canada, July 27-31, 2004, New York, NY, United States, ACM Press, pp. 132-141.

Muller M. J., Matheson L., Page C., Gallup R., 1998. Methods & tools: Participatory heuristic evaluation. Interactions. Vol. 5, No. 5, pp. 13-18.

Nielsen J., 1994. Heuristic Evaluation, in Nielsen J. and Mack R. L (Eds) Usability Inspection Methods. New York: Wiley & Sons Inc.

Salmimaa, T., Vilpola, I., 2007. How to Design an Efficient Electronic Kanban System – A Case Study of Sociotechnical Design Process. The 11th International Conference on Human Aspects of Advanced Manufacturing Agility and Hybrid Automation.

Yin, Robert K., 2002. Case Study Research: Design and Methods.