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A Human Activity based Operational Knowledge Elicitation Method

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Abstract

For managing information systems operation, it is necessary to clearly describe not only dynamic interactions between subjects and target operations on the information systems, but also their environmental context. In this paper, a method to elicit and design systems operation knowledge is proposed based on the structural model of human activities. An example of the proposed method is provided how to elicit and revise the operational knowledge by using an incident management guideline.

The practical application is also described to show the effectiveness, critical issues and limitations of the proposed method.

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1. Introduction

It has been reported that approximately 40% of damage to critical infrastructure is caused by the system operation [1]. The fact that problems with infrastructure damage occurs frequently due to system operations means that critical infrastructure systems are being operated with insufficient systems operation knowledge. There is a need to establish a method to clearly define system operation knowledge. Despite the existence of situation-dependent interactions between the actor and object, conventional system operation process manuals contain only the operational process,

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and do not clearly define these dynamic interactions.

In order to reduce the damage to critical infrastructure, it is necessary to record operating knowledge considering these dynamic interactions with the operating actor based on this essential characteristic of operating systems. One method that has been proposed to record these dynamic interactions with the actor in the operating the system is the system operation knowledge elicitation method [2]. This paper describes the points to note related to the introduction of this system operation knowledge elicitation method in an operating worksite, as well as the effectiveness and limitations of this method based on the experience applying it to an actual system in operation. The rest of the paper is as follows. Section 2 describes the system operation knowledge elicitation method. Example application of the proposed approach is explained in section 3. Evaluation of the application is described in section 4. Related work is shown in section 5. Section 6 summarizes this paper.

2. System operation knowledge elicitation method

2.1. Human Activity Model

The system operation knowledge elicitation method is a method proposed in which operational activities are recorded based on a) the operating actor, b) pre-conditions, c) system that is the object of operation, d) post-conditions, f) events, g) responses, h) operation process, i) inputs, j) outputs, k) operation rules, l) stakeholders, and m) roles. This method can be used to manage system operations by matching the actor and object with the operation process. The content of the operation process can be described in terms of the operating event, response, input and output, operation rules, the operating stakeholders and their roles, and is thus characterized by the capacity to clarify the operation rules and roles, which tended to be vague in the past. Thus this method can be used to clarify not just the interactions between the operating actor and system, but also the interactions between the operating actor and stakeholders. The operating rules are related to all of these classes and are not shown. The activity actors, activity objects, and stakeholders shown in these concept classes also have pre-conditions and post-conditions, and the actor that generalizes these have been defined as having these pre-conditions and post-conditions, with the activity actor, activity object, and stakeholders all shown as subordinate concepts.

2.2. Operational activity definition card

The operational activity model can be described using an existing diagram format such as UML. However, there is a significant possibility that in the system operation worksite has few engineers well-versed in UML. On the other hand, a form is sufficient for describing these 12 items. Also, a form requires no knowledge of UML. A form designed so that these 12 items can be directly recorded is shown in Fig. 1 below. Of course, a UML can be used to create diagrams based on the information in this form such as use case diagrams and activity diagrams.

When completing an operational activity definition card, one issue is the granularity required for the information entered. This is covered in Section 4.3.

2.3. Operation knowledge elicitation mode

Eliciting operation knowledge means not only analyzing operation knowledge, but also finding deficiencies through the analysis process and designing future operation knowledge. When the suitability of operation knowledge that has been designed has been validated, operation can take place based on this operation knowledge, which is analyzed in the next generation of operation knowledge analysis.

The process of eliciting operation knowledge involves repeatedly iterating through the following four modes: (1) Analysis, (2) Design, (3) Validation, and (4) Implementation. At the implementation stage of operations, the operational activity definition card can be used to visualize operational activities.

2.4. Example of a completed operational activity definition

Figure 1 shows an example of an operational activity definition card that was completed based on the description of incident management for ITILV3 [3]. The figure shows an operational activity definition card that was filled in