Requirements Index for Information Processing in Hospitals[1]

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Introduction and Objectives

Up to now reference models [1] that describe typical structures of hospital information systems rarely exist. This causes high expenses in the strategic management of hospital information systems as well as in tender processes for obtaining software application programs.

In the context of a DFG-research project we work on a requirements index for information processing in university hospitals, which should support systematic management of hospital information systems. The requirements index should turn into a reference model. Thus it is intended to find general consensus among experts of different university hospitals in Germany.

It is planned to publish the requirements index as a basis for a DFG-recommendation and through the World Wide Web. Especially the electronic version should fasten up the process of creating requirements specifications and comparing different offers of software products.

Methods

The requirements index will be developed in close cooperation with experts from different university hospitals in Germany. This will be done in a cyclic review process. On the basis of literature and existing requirements specifications we work out drafts of a structured index, which will be reviewed and discussed by the experts. A first meeting with the experts at the end of April 1999 showed, that they agreed on the need and necessity of such a requirements index. The relevant contents and structure were discussed intensely. In the following we present a structure for the requirements index based on the results of the first expert meeting.

Structure for a requirements index

Present work shows that it is not sufficient to list functions of information processing in order to model requirements. Rather concise sentences that describe the requirements which a function has to fulfill are needed. Further it is important to find an overall structure for the requirements index

[1] This Paper will be published in Proceedings GMDS/ISCB 99 (Sept. 1999, Heidelberg).

which is general enough to be adapted to different architectures and circumstance but at the same time it needs to be easy to understand and usable in practice.
The analysis of literature, existing requirement specifications and discussions with experts showed that it is necessary to distinguish between function embracing requirements and functional requirements. Under function embracing requirements we understand requirements that each software product should fulfill. Here categories as system-architecture, integration, data-security, user-interface and operation of an application system have to be considered. Examples for aspects of each category are given in figure 1. We still work on the actual requirements of these aspects.

Function embracing category	**Examples of aspects for which requirements should be formulated**
Integration	Data integration, interfacing, use of communication standards
System architecture	Client-Server Model, database scheme
Data-security	Authentification, acces control, digitale signature
User-interface	Suitability for the task, error tolerance, self descriptiveness
Operation of the application system(s)	administration, concept in case of system failure, maintenance,

Figure 1: Examples for function embracing requirement categories.

The functional requirements are structured by the functions given in figure 2. We distinguish between functions, that are directly part of patient treatment and supporting functions. The latter are divided into 3 categories: keeping up medical records and documentation, work organization and resource planning, hospital management. In order to ensure a patient centered view within the context of information processing, we highlighted the process of treating patients and stepped back from a view that focuses on different departments of a hospital. Many of the functions are used by more than one department. Of course they differ a little, e.g. a ward has to plan beds and a radiology department has to plan the use of different diagnostic devices, but both beds and medical devices are both resources that should be used to full capacity. The timeframe of planning and some other details differ, but the general requirements of organizing these resources should be the same.
Each function is systematically described using the concept of modeling requirements with the help of use cases in UML (compare to [2,3]). Although the functions given in figure 1 mostly don’t resemble use cases we think to have found a structure to model the requirements of each function systematically and in an easy to understand manner. An example of the description of the function "order-entry with appointment arrangement" is given in figure 3.
There you see that functions are described in two parts. The first part consists of a goal, critical points and persons who carry out the function. Further an indication of quantities is given. This should help to find out about how often a function is carried out and how important it is to improve or change it. In the second part the function is decomposed into its parts, which we call activities.

For each activity we formulate requirements. For the requirements it is important to build concise sentences, that can be answered clearly (see for example [4]).

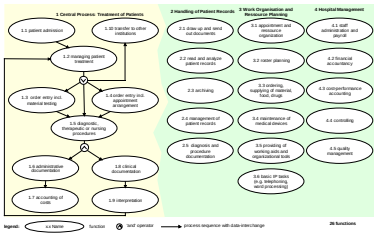

Figure 2: Collection of functions to be described in the requirements index.

1.4	**Order-entry incl. appointment arrangement**
Critical:	- Functional units often want to make the appointments. Thus a solution where the person who orders simply puts an appointment into the appointment book of the functional unit might not work.
Persons	Physicians, Nurses, Secretaries, Medical technicians
Amount/ frequency	Average number per patient and day
Activities **1.4-1**	**Fill out order form / explain order** - Already existing data should be inserted automatically. - The formulating of the clinical question and further details is supported. - It is possible to enter free text. - The requested order can be selected from a structured list: - The list contains a clear overview of all requestable orders. - Orders, that are usually requested in combination should be selected automatically together. The combination should also be adaptable. - The responsible or authorized person can sign the order.
1.4-2	**Arrange appointment** - Urgency and a preferred date can be submitted. - It is possible to look into all necessary appointment books (patient, transport, functional unit). - Planning aids for continued appointments exist. (Example: an appointment set for physiotherapy). - The fixed appointment is put into all appointment books automatically.
1.4-3	**Change already requested orders** - To support the selection of orders different overviews are needed (patientwise, orderwise, unitwise). Further the appointment books are needed in this context. - It must be possible to cancel appointments. - Appointment changes have to be communicated (e.g. if someone moves up in the waiting list)
1.4-4	**Print Out forms** (necessary, if the order-entry-process is not realized fully computer-based) - Multiple printouts appear on one button push . The needed number depends upon organizational structures.

Figure 3: Example for the description of functions.

Summary and Discussion

In the paper we presented the idea of a requirements index for information processing in hospitals to be used as a reference model that supports the systematic management of hospital information systems. Until now we primarily worked on finding an adequate structure for the requirements index. We hope that the above described structure of function embracing and functional requirements as well as the identified functions and the concept of describing them can be confirmed when more requirements are filled in.

After thorough research we decided to structure the functional part of the requirements index with functions. They seemed to be most suitable for our purpose. Since we know about the importance of looking at the processes carried out within an information system in order to understand the context and detect weak points, we tried to use processes or “real” use cases instead of the functions given in figure 2. All attempts showed too many hospital or departmental dependent details. Thus we found our attempt of using the presented functions and to structure their descriptions with a concept as use cases a good compromise.

As soon as enough requirements are filled in we want to try out, whether our requirements index can really fasten up the process of developing requirements specifications and comparing different offers. In this context we hope to find a possible candidate, who is planning to invest into a new software product. Whether and how our requirements index will support the strategic management of hospital information systems also needs exploration. We hope to support the drawing up of framework plans and carrying out state of the art analyses.

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(2) Cockburn A (1997): Structuring Use Cases with Goals, Part I and II. *Journal of Object Oriented Programming*(Sept/Oct 1997, Nov/Dec 1997). http://members.aol.com/acockburn/papers/usecases.htm.

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