

A web-based approach to HIS with Handhelds

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Abstract: We introduce an approach that allows the use of mobile devices as an extension to an already existing HIS providing the full range of functions of the system. GSD has developed an extension to its product IS-H*MED (SAP R/3 based) using mobile devices, WirelessLAN and Web technology, which allows synchronised access to IS-H*MED functions and data likewise.

The most important functions provided by the application are synchronised worklists, the presentation of service requests and findings, case histories and patient information as well as bed scheduling. Added features include SMS and access to the clinic Intranet.

The substantial advantages of our approach lies in the rapid and simple feasibility to user-specific and practice-orientated solutions for handhelds using established technology like HTML and scripting. Extensions to and adaptation of an existing application are easy to realise by adding and linking further HTML-pages.

Keywords: mobile computing, IS-H*MED , mySAP healthcare, online application, web technology

1 Introduction

Clinical requirements like bedside patient data capture and access in healthcare bring up new demands to Hospital Information Systems (HIS). The most suitable solutions are applications for mobile devices. The technological basis (PDA, WebPad, Wireless LAN, Bluetooth) of Mobile Computing in healthcare has developed rapidly over the past years. This stimulated the development of numerous applications suitable for the different fields of medicine.

Mobile devices used in healthcare can basically divided into two groups: firstly offline-applications running autonomously on a mobile device. The second group comprises online-applications, loading up data via different hardware interfaces, and after processing loading them down back to the leading application.

Most offline-applications are solely information systems using databases (i.e. medication, dictionaries, catalogues) or small applications as for example formula calculators. In general this allows only a restricted use in special fields and yields limited benefits in clinical routine.

Online applications on the other hand are able to upload data or applications from an al-

ready existing systems using hardware interfaces (docking cradle, infrared, bluetooth or wireless LAN). After processing or simply presenting the data the results are then downloaded back to the leading application. However, this approach often requires the implementation of additional features, or the re-implementation of existing ones, in order to make the feature suitable for a new device. In both cases data are provided by an software interface, which requires the additional implementation of an import/export interface in the non-mobile application.

In the following we will introduce an extended approach that allows the use of mobile devices as an extension to an already existing HIS providing the full range of functions of the system. GSD developed a mobile information system supporting the work of a surgical consultant using IS-H*MED functions and data, which are part of the mySAP Healthcare solution.

2 The Basis

IS-H*MED made by GSD Berlin is an SAP R/3 based Hospital Information system providing a broad range of functions. The solution supports the administration and medical treatment of indoor and outdoor patients. It comprises basic medical services like medical documentation, service requests and findings communication as well as a number of specific modules supporting e.g. nursing, pre- and post OP treatment and radiology departments. IS-H*MED is fully integrated into SAP Patient Management, the administrative component of the mySAP healthcare solution.

Moreover IS-H*MED includes numerous options for customizing, a user-definable medical documentation and program segments, which can readily be modified and enlarged by trained users. This makes IS-H*MED a powerful support instrument for clinical stuff in their daily routine.

While originally designed for use in large clinical fixed networks, IS-H*MED also provides the technical requirements for use on Pocket PCs or WebPads in wireless environments.

3 The System Architecture

Three essential aspects of IS-H*MED's architecture allow extension into the field of mobile applications:

So-called Remote Function Calls (RFC) and Business Application Programming Interfaces (BAPI) enable application developers to use existing IS-H*MED functions without understanding the underlying transactions. These interface is fit for use by external systems or non- IS-H*MED applications. Complex operations may thus be called from external applications, and results may be returned to the calling system.

The basis of IS-H*MED is an advanced n-tier architecture separating data, application

and presentation layers. This architecture combined with further SAP components allow a web-based user interface (GUI) instead of the standard desktop presentation.

The central component is the Internet Transaction Server (ITS), which connects the application layer of IS-H*MED with a standard web server. Requests from web sites are sent to the ITS by the web server, which calls IS-H*MED transactions via RFCs or BAPIs. The results are then returned to the ITS using the same interfaces. Using pre-defined templates, ITS generates HTML-pages, which are made available at the web server for browser presentation.

Moreover, ITS provides a gateway which checks access authorization based on the IS-H*MED's security settings. This secures exclusive access to IS-H*MED data and functions via web applications for authorized users only. This guarantees a secure access to IS-H*MED data and functions using any common web browser.

4 The Development of an Application

In cooperation with T-Systems (Vienna) and SAP AG (Walldorf) we developed an application, in order to exemplify optimal support of clinical staff using the technology described above combined with wireless LAN. This was specified for a surgical consultation service enabling full access to a HIS using a pocket PC.

The first step was to analyze the typical workflow of a surgical consultant, which allowed us to identify information and function required for the specific clinical situation. On this basis we defined suitable HTML-Pages, which served as prototype for the verification of the design model for data presentation and navigation.

The application is implemented in the integrated development environment of IS-H*MED, the so called Workbench.

The following services should be offered to the surgical consultant:

- An easy personalized authorisation
- Task lists
- Work lists
- Current consultation request
- Patients and case information
- Medical documents as findings and reports
- Plain bed scheduling
- Standard services, e.g. SMS
- Exemplary access to Internet and Intranet



Figure 1: personalized authorisation

Before starting the application the user needs to login. The proof of authorization is based on IS-H*MED customizing and thus on SAP security (fig. 1). After successful login the user sees his current task list, e.g. consultation appointments. When choosing this item, the surgeon gets a list of currently registered consultations with additional more general information on the requests (fig. 2). This survey helps the doctor plan his route across the hospital premises according to the severity of patients disease, the priority of the request or the position of the requesting ward in the premises. By refreshing the worklist new requests are instantly visible and can be integrated into his planning. In front of the patients room the consultant can look up details via his worklist, particularly information on the request (e.g. the medical problem or a brief medical history), on the patient (e.g. personal data, attending doctors) or on the case (e.g. admission or transfer data, prior cases). Additional medical documents can be displayed, if available in IS-H*MED or any other connected source. Exemplarily this is implemented for laboratory findings. Firstly the doctor gets a list of existing laboratory finding documents, which he can look up in detail on a tip (fig. 3). This provides the surgeon with all necessary - and moreover up-to-date - information for the consultation. Frequently the situation demands a transfer to the consultant's department for further diagnosis or treatment. Therefore the application includes a plain bed scheduling service, which supplies a current list of available beds in the consultants department. Detailed information on the respective bed can be obtained and preservations can be made by tipping a button (fig. 4). The upcoming transfer of a patient is announced instantly to the receiving ward, thus reducing organisational expenses. Finally the doctor can finish the consultation, which is then removed from his



Figure 2: Consultation worklist



Figure 3: Laboratory findings



Figure 4: Bed scheduling

current worklist.

5 The Experiences

When planning and implementing web-based applications, we think the most promising approach is to develop small, reusable, role-based and task-orientated modules. This allows readily the connection of single modules, the adaptation and enlargement of existing applications by inserting further hyperlinks. Browser-based presentation of the application came out on top, for its far-reaching independency from operating systems and hardware.

The limited display size and the unfamiliar use of touchscreen as input device demand particular accuracy on designing the respective HTML-pages and the navigation model. From our point of view it makes more sense to distribute large amounts of information on several pages and linking them, in order to avoid uncomfortable scrolling on long pages.

At present the entry of large data sets on mobile devices via touchscreen proves to be the main problem. Even when using current operating systems for PDA, the input of long texts with handwriting recognition or emulated keyboard on display is not workable in clinical use. Simple voice recording tools are only insufficiently integrated into the clinical application, thus interrupting the documentation workflow.

Feasible for touchscreens is a structured documentation, which allows quick data entries

using small option lists, checkboxes and radio buttons via tip pen. However, this approach is presently limited by very little standardized and mostly non-structured medical documentation. Current improvements in the fields of mobile speech recording and recognition as well as flexible structured documentation (e.g. XML) might soon overcome these restrictions in comfortable use of mobile applications.

6 Summary

SAP's open architecture allows easy implementation and online availability of IS-H*MED functions and data on mobile devices. The use of web technologies enables the developer to build optimised applications for different mobile devices, which present the well-known HIS functions combined with a modern user interface.

This approach allows the development of standard as well as customer-specific applications at a moderate operate expense.