“TouchMe” Project

Solution for the Distribution and Management of Medical Videos within the Robert-Rössle Clinic (Berlin, Germany)

Julien Cohen-Adad was in charge of the project from 2003.04.22. until 2003.09.15. as an engineer trainee, and from 2003.10.01 until 2004.07.01 as a researcher-engineer salaried in Charité-Hospital / Humboldt University.

1 Overview of the project

1.1 Summary in English

Visual informations - like video signals - are used during surgical operations and for diagnostics more and more frequently during surgical operations. These signals are displayed on one or several screens for more convenience.

When the number of the video sources is too high, there could be a problem with the management of signals. For instance: how can we see the laparoscopic camera on screen number two? How can we switch between different sources? How can we see a 4x4 matrix of several sources? It is obvious that the more convenient this management is, the better is the environment the doctor works in.

A suitable way to solve this problem would be to integrate in the video management system some interfaces such as touch screen, vocal command, or virtual keyboard.

In OP 2000 I was involved to develop and realize the project *TouchMe*. In this project, the touch screen has been chosen. The aim is to improve the work of surgeons or doctors, allowing them to touch video(s) they want to see / analyze.

For the *TouchMe* project, I programmed a software which reads the touch screen signal and sends the appropriate commands to Barco's Hydra video management system.

Another aim of the project is the application sharing. That is to say, the user also has the opportunity to control several applications from his place, e.g. Orion, WinVicos, PACS, etc…

1.2 Résumé en français

De plus en plus, l'information visuelle, telle que les signaux vidéos, est utilisée pendant les opérations chirurgicales et pour les diagnostics. Ces signaux sont alors affichés sur un ou plusieurs écrans pour plus de convenance.

Quand le nombre de ces sources vidéos est trop élevé, il peut se poser un problème de gestion de ces signaux. Comment voir maintenant la caméra laparoscopique sur l'écran numéro deux ? Comment commuter entre différentes sources ? Comment voir une matrice 4x4 de plusieurs sources ? Il est évident que plus cette gestion est commode, meilleur est l'environnement dans lequel le médecin pourra travailler.

Une solution élégante serait d'intégrer dans le système de gestion des sources vidéo certaines interfaces telles que l'écran tactile, la commande vocale, ou le clavier virtuel.

Au sein de OP 2000, j'ai été choisi afin de réaliser et développer le projet *TouchMe*. Dans ce projet, l'écran tactile a été choisi. Le but est d'améliorer le travail des chirurgiens et médecins, en leur permettant de toucher les vidéos qu'ils souhaitent voir / analyser.

Pour le projet *TouchMe*, j'ai programmé un logiciel qui interprète le signal provenant de l'écran tactile et qui envoie au système de gestion vidéo Hydra (de la firme Barco) les commandes appropriées.

Un autre but dans ce projet est le partage d'application. A cet effet, l'utilisateur a également les possibilités de contrôler de son endroit plusieurs applications, e.g. Orion, WinVicos, PACS, etc.

1.3 Zusammenfassung auf Deutsch

Immer häufiger werden visuelle Informationen - wie zum Beispiel Videosignale - während chirurgischen Operationen und für Diagnosen benutzt. Diese Signale werden dann auf einem oder mehreren Bildschirmen angezeigt, um angenehmeres Arbeiten zu ermöglichen.

Wenn die Anzahl dieser Videoquellen zu groß ist, kann sich ein Problem mit der Verwaltung dieser Signale ergeben. Zum Beispiel: wie kann die Quelle "laparoscope" auf dem Bildschirm Nummer zwei sichtbar gemacht werden? Wie kann zwischen verschiedenen Quellen gewâhlt werden? Wie kann eine Matrize 4x4 mit mehrerer Quellen sichtbar gemacht werden? Es ist offensichtlich, dass die Umgebung, in der die Ärzte arbeiten, umso besser ist, je zweckmäßiger die Verwaltung ist.

Eine elegante Lösung für dieses Problem bestünde darin, ins System der Verwaltung der Videoquellen einige Schnittstellen wie den Touchscreen, den Stimmauftrag oder die virtuelle Tastatur zu integrieren.

In OP 2000 wurde ich damit beauftragt, das Projekt *TouchMe* zu entwickeln und zu verwirklichen. Dafür ist der Touchscreen gewählt worden. Das Ziel besteht darin, die Arbeit der Chirurgen oder der Ärzte zu verbessern, indem es ihnen ermöglicht wird, die Videos zu berühren, die sie zu sehen oder zu analysieren wünschen.

Zu diesem Zweck habe ich eine Software programmiert, die das Tastsignal interpretiert, welches vom Touchscreen ausgeht, und die entsprechenden Aufträge an Hydra sendet.

Ein anderes Ziel dieses Projektes ist „application sharing“. Das heißt, der Benutzer hat die Möglichkeit, von seinem Standort aus mehrere Anwendungen zu kontrollieren, z.B. Orion, WinVicos, PACS, usw.

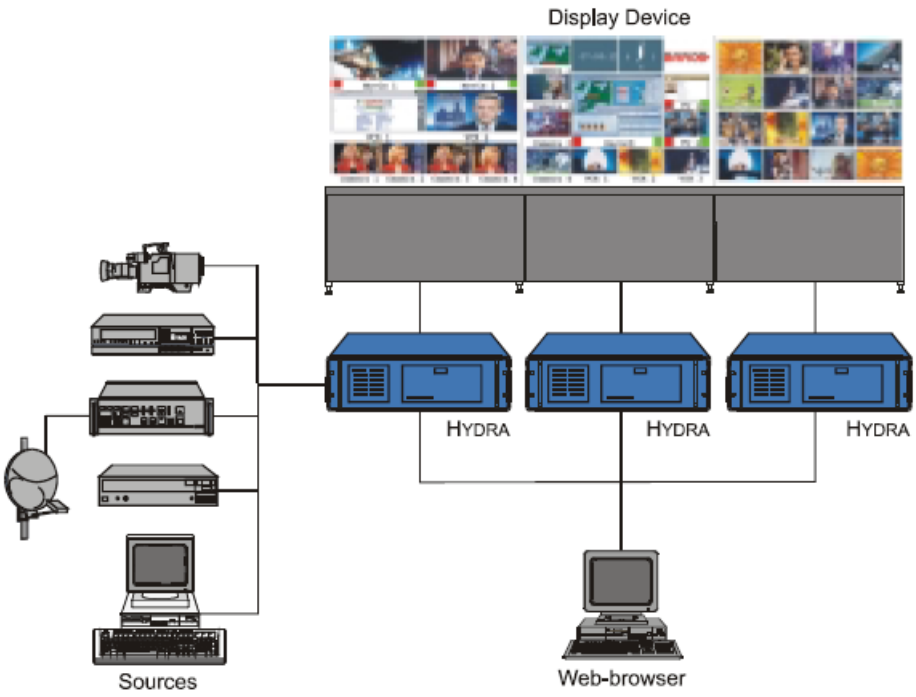
2 What is a HYDRA?

HYDRA is a hardware system developed by the firm Barco. Different video signals (analog or SDI) as well as audio sources (analog, digital or embedded) can be connected to a HYDRA module. Then up to 2 VGA outputs display the different sources in a pre-defined way.

Depending on the configuration each HYDRA monitors up to 30 video sources and up to 112 audio sources (56 stereo pair or 112 mono channels) and displays them on an analog (RGB) or digital (PanelLink) visualization system.

HYDRA is controlled via PC with a standard up to date web browser. The PC is connected to the HYDRA via LAN. If more sources shall be monitored or if the sources shall be displayed on a bigger display, multiple HYDRAS can be connected to multiple projection modules of a display-wall.

The HYDRA uses a quad module hot swap power supply with 2 different power inputs. Each power input can be connected to a different power net. Like that the failing of one power net or power supply module will not shut off the HYDRA. Depending on the system configuration, several SDI video input cards, analog video input cards, digital audio cards, analog audio cards and output cards can be plugged into the box.



2.1 *Managing the HYDRA*

The web-browser station has to dialogue with the HYDRA in order to manage all the video screens.

Two message protocols can be used for this purpose: XML and a private scripting language. The last one has been chosen because it allows many more functionalities.

Messages are achieved via LAN. HYDRA has its own IP address so that a standard TCP protocol can be used between the web-browser and HYDRA.

N.B.: HYDRA has its own management software which is called iStudio. The aim of *TouchMe* is to replace iStudio in a more specific medical orientated way with a friendly interface.
HYDRA also has a Samba server which allows uploading layouts and/or pictures on the Hardware.

2.2 HYDRA with TouchMe

I opted for an interface which has 2 video screens in each user's room (each video per HYDRA's VGA output).

The first one called "Matrix view" displays an overview of all sources that are available in the clinic. A touchscreen which allows selecting video sources is mounted on this screen.

The second one named "Main view" displays up to 4 selected videos on a dedicated screen. It can also be a projector for conferences or education programs. It has already been tested for such purposes (see chapter 4: Implementation and Validation).

3 Integration of a KVM solution into the system

3.1 Objectives

KVM stands for Keyboard-Video-Mouse. Indeed, with such a hardware the user can navigate through several "video providers" (e.g. Barco's Hydra, WinVicos[1] workstation, Orion[2], PACS server, …).

The idea is now to allow the user to switch between several VGA-PS2 sources, using a friendly interface. This interface is basically the software *TouchMe*, which integrates this functionality.

For instance, let's imagine this scenario:
A surgeon in Berlin is operating, viewing several sources from one Hydra (laparoscopy, microscope, stereoscopic camera…). He suddenly wants to ask a colleague in Paris for his opinion about a particular point. So he selects on the touch-monitor the WinVicos videoconference system, discusses the problem with his colleague and then returns to his patient.
This situation – or similar ones – could be part of the everyday life in a clinic with the help of *TouchMe*.

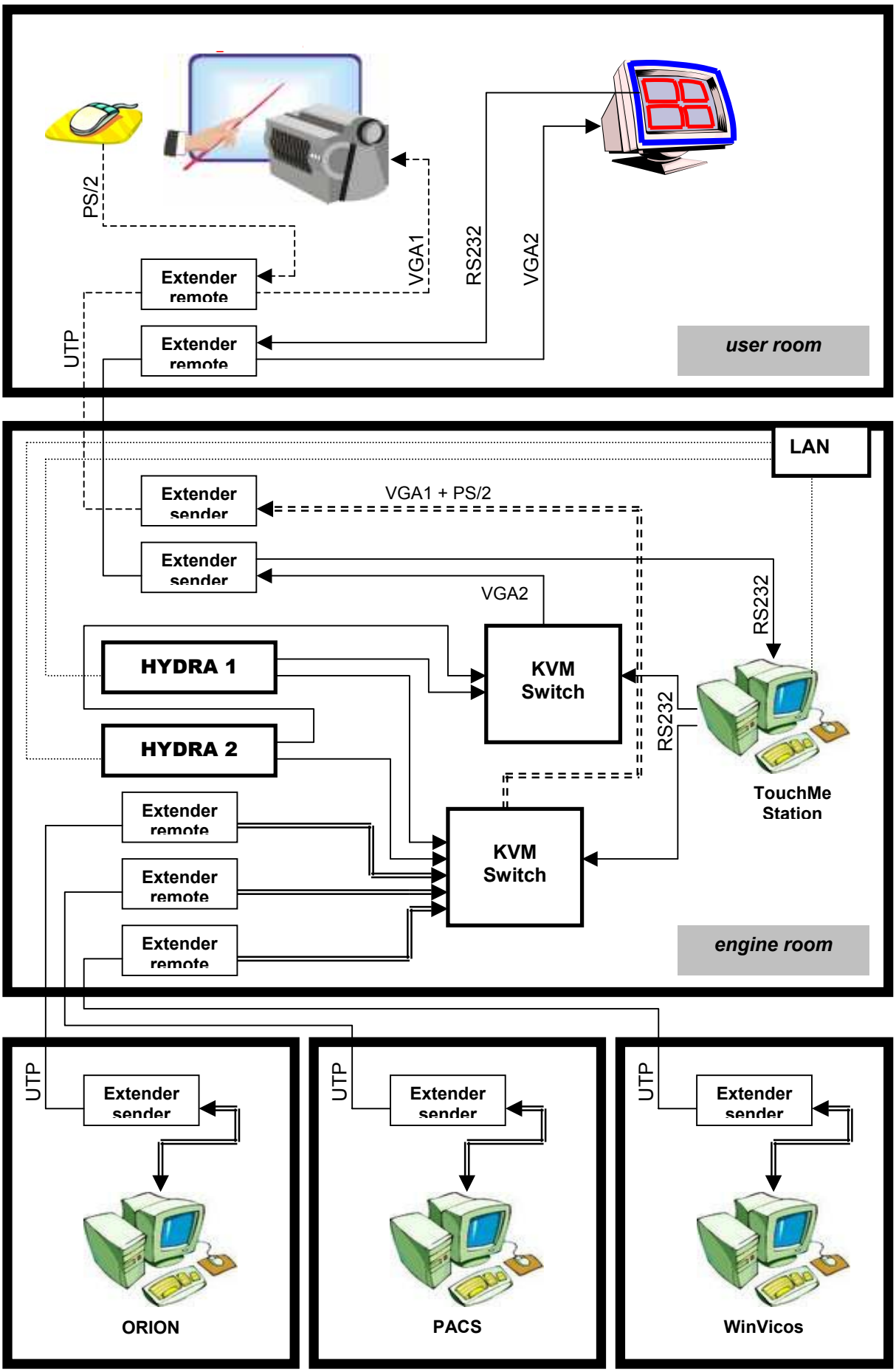
As you can see, the idea of *TouchMe* is the optimization of the workflow concerning the communication within a clinic or between several clinics. Furthermore it creates interface facilities for a surgical environment while saving space in the OP room. Indeed an important aim was to concentrate most hardwares in a therefore dedicated engine room.

3.2 Overview of the system

This following synopsis is not exhaustive because of the complexity of the system. However it gives an overall idea of the concept.

[1] Wavelet based interactive video communication system developed by SRU OP 2000
[2] PC based system which manage a stereoscopic camera

Figure 1 : Integration of a KVM solution



4 Implementation and Validation

4.1 Ways of using this system

Two different ways have already been tested for more than one year and a half half now. These are the educational oriented way and the clinical use.

4.1.1 Educational use

Several medical students have regularly come into the conference room of the clinic to assist a live operation.

While the surgeon was operating, it was very efficient to switch between different views by touching them on the “Matrix view”. For instance, when the surgeon wanted to show something we displayed a full screen video of the laparoscopic camera. When a student had a question, we chose to have both - the laparoscopic camera and the room camera from the operating room – on the screen.

4.1.2 Clinical use

For more than one year the system has been implemented in several rooms of the Robert-Rössle clinic (Berlin, Germany): three of the four operating rooms, the endoscopy room, the pathology room, the director’s room, the conference-radiology room, the OP 2000’s presentation room, and of course the engine room where the main control is based.

Nowadays, the use of the system has become a daily task and the staff quickly picked up the habit of using it.

4.2 Pictures of the system

Here is a picture from OP 2000’s laboratory (note the “Matrix view” on the left, next to the “Main view”)

And here is the system integrated into one of the operating rooms of the Robert-Rössle clinic. It is used during a surgery:

5 Contact

SRU OP 2000: op2000@rrk-berlin.de