



Teleradiology at Military Medical Academy: present and future

Bogdan PUTNIK
Goran PETKOVIĆ
Miodrag VUKOBRATOVIĆ
Dorđe JELIĆ

Development of teleradiology in the Institute of Radiology, Military Medical Academy (MMA) started in the late nineties. Leading aims of this project were the reduction of working expenses and improvement of educational system. Radiological information system (RIS) was based on our software and much more sophisticated network than previous one of Hospital information system (HIS). The quality of this network enabled original solution to the problem of image acquisition. In the Institute of Radiology, MMA, this process was performed with frame grabber card, made for the use on both high-resolution radiological machines and real-time image machines (cine mod) In this way we connected five machines in a network with two of them in dynamic code. It is very important to emphasize that the whole system works without server application, which means in Windows frames. This provides simple approach to the database by PC work station. Acquisitive image is then processed by our software. The combination of hardware and software that we use fulfills all accepted standards in this area. Images that are standardized in this way, can be stored and analyzed in data base or can be manipulated by the means of digital communications such as e-mail, Internet, intranet and telemedicine. What we always have to bear in mind is the protection of data base, especially when we know that PC workstations are used in intranet as well as in Internet.

KEY WORDS: Radiology Information System; Teleradiology; Image Processing, Computer-Assisted

INSTITUTE OF RADIOLOGY, MILITARY MEDICAL
ACADEMY, BELGRADE, YUGOSLAVIA

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INTRODUCTION

The development of telemedicine at the Military Medical Academy (MMA) started at the end of the 90's. Technical characteristics of information systems that had previously existed at the MMA could not meet the needs of modern technologies. Prior to all problems was the problem of the old fashioned informative and cable network, common in such circumstances. It was not possible to use old equipment for the qualitative functioning of telemedicine. Due to all of this the new network was placed independently from the previous Hospital Information System (HIS) (1,2). In this way, all potential users of telemedicine, first of all the institutes of pathology and radiology, can be

attached to such a network.

MATERIALS AND METHODS

Different approaches and attitudes were expressed during the elaboration of a project for telemedicine and the ways for its realization. It was necessary to promote the issue of telemedicine, introduce the professional public and potential users with its characteristics and values. It was very difficult to promote such ideas, especially during sanctions. The main consideration was to spend as little as possible during the realization of teleradiology, and to use of already existing radiological devices as much as possible.

The leading goals of this project were the saving and progress in the sense of education.

The radiological information system (RIS) was based on the software of home production and significantly sophisticated network that the existing network of the HIS. The quality of the set network enabled the characteristic solution of taking over images from the

Address correspondence to:

Dr. Goran Petković, Medical Military Academy, Institute of Radiology, Crnotravska
17, 11000 Belgrade, Yugoslavia

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device. The acquisition was performed with the assistance of the frame grabber card made exclusively for the use on radiological devices of high resolution and devices that produce image in the real time (cine mode). The modern X-ray devices with the digital acquisition produce images of high resolution (3). With that characteristics they imposed high standards while purchasing an equipment and an adequate technical approach during the transfer or storage to various media (film, magnetic optical disc, hard disc and others). The first problem we were faced with was how to put the image from the x-ray device into a classical PC and at the same time (data) the image to fulfill all medical-technical standards which had already been set in the field (5,6,7). On the basis of hardware possibilities of X-ray devices, "taking off" the image - acquisition was performed with the help of the appropriate "frame grabber" card (4). This was the unpopular way of obtaining the acquisition from the X-ray device or from the working station, all until the recent appearance of frame grabber card made exclusively for the needs of radiological devices of high resolution. The technical characteristics of the used card are given in the Table 1:

Table 1. Technical characteristics of the used card

MEDICAL Accura: 150 MHz, 8/10 bit, PCI bus	
The key features of MEDICAL Accura include: <O:P</O:P	
Extreme Accuracy	±0.5 ns pixel jitter; 8 or 10 bit acquisition
High Performance	Up to 132 MB/sec PCI transfers
Flexibility	Up to 4,000 x 4,000 pixel input
Programmability	Up to 75 MHz single pass and 150 MHz dual pass pixel r
Multiple Inputs	Up to four inputs
Ease of Use	Auto-SYNC performs automatic configuration and setup
Stability	Auto-TEMP for consistent and repeatable results

Five X-ray devices are connected in this way, and two with pictures in dynamic mode.

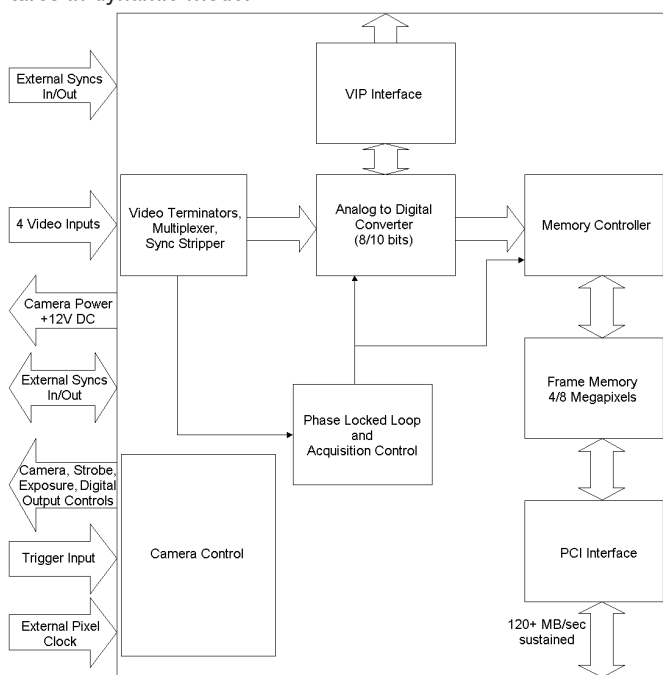


Figure 2. I-Series Block Diagram

It is very important to mention that the whole system is working without the server application, i.e. under Windows. Such a solution enables the simple approach to data processing through PC working station. The image taken from the x-ray device and transferred to PC we process with the help of homemade software. The hardware-software combination we use meets the world standards from this field.

In this way, we can save standardized images along with the sound color Doppler and textual record in the multimedia data base or through the digital communication such as e-mail, Internet, intranet and telemedicine, and we manipulate with them. This comprehensive informative process will be completed with the settings of Picture Archiving and Communication System (PACS) (8).

DISCUSSION

The realization of this type of information system is comprehensive and long lasting work that demands the multidisciplinary approach. It includes the close co-operation of physicians and electronics of informatics especially in the realization of software component that has to support maximally the technology of the working process. The institutions that plan to form the radiological information system (RIS) need to have at their disposal two possibilities: taking over the complete final solutions, which requires great financial funds, and gradual forming of all elements of the network in accordance with the needs but also with the present possibilities. Such an approach is easier because of the accessibility of technical and software solutions, and their prices which are in the constant decrease. It is necessary to take care about the compatibility of chosen components and their functioning at the moment when the process is finalized.

HIS at MMA was formed at the end of 1980. After the purchase of contemporary digital radiological equipment, at the beginning of 1990, it was possible to establish the RIS.

The application of frame grabber card for the acquisition of the radiological image is one of the original solutions applied at the Institute for Radiology of MMA. It proved as a very successful in many aspects, including financial, time and organizational. The quality of the signal is at the level of the possibility of the very device and the outcome formats allow the manipulation and transfer of images by any electronic way.

The X-ray devices we used to perform the acquisition i.e. the transfer of the image to PC had been far less demanding than the frame grabber card and the possibilities it had. The next step was to make the software that would be easy to handle (easy manipulation) and which would process data automatically from the card and give it all the attributes according to the standard for the radiological image (DICOM 3). The process of the raw data

should be performed because of the existing demands in the field of transfer and storage of radiological image. In this way, the transfer of image was possible to the radiological information system (RIS) .

CONCLUSION

The forming of RIS at the MMA is a continuation of the work that was started a decade before. The present level of organization is nearly to be finalized but it does not mean that its forming will be completely finished. The system is opened to further expanding according to needs and possibilities. It should be emphasized that with the purchase of the equipment it is necessary to proceed with the further education of the staff.

The current problem is a protection of data base because the working stations to which data are transferred are attached to PC network, and in this way to the Internet network and that leaves the possibility of an unauthorized access to data base.

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