ACCRETE
Growing Together Globally

The Trend of Medical Image Work Station

Abstract

Image Work Station has rapidly improved its efficiency and its quality along the development of biomedical engineering. The quality improvement of image significantly increases the chance of curing the patients. This essay is going to give a fundamental concept of how Image Work Station works, its developing trend and it relationship with PACS (Picture Archives & Communications System).

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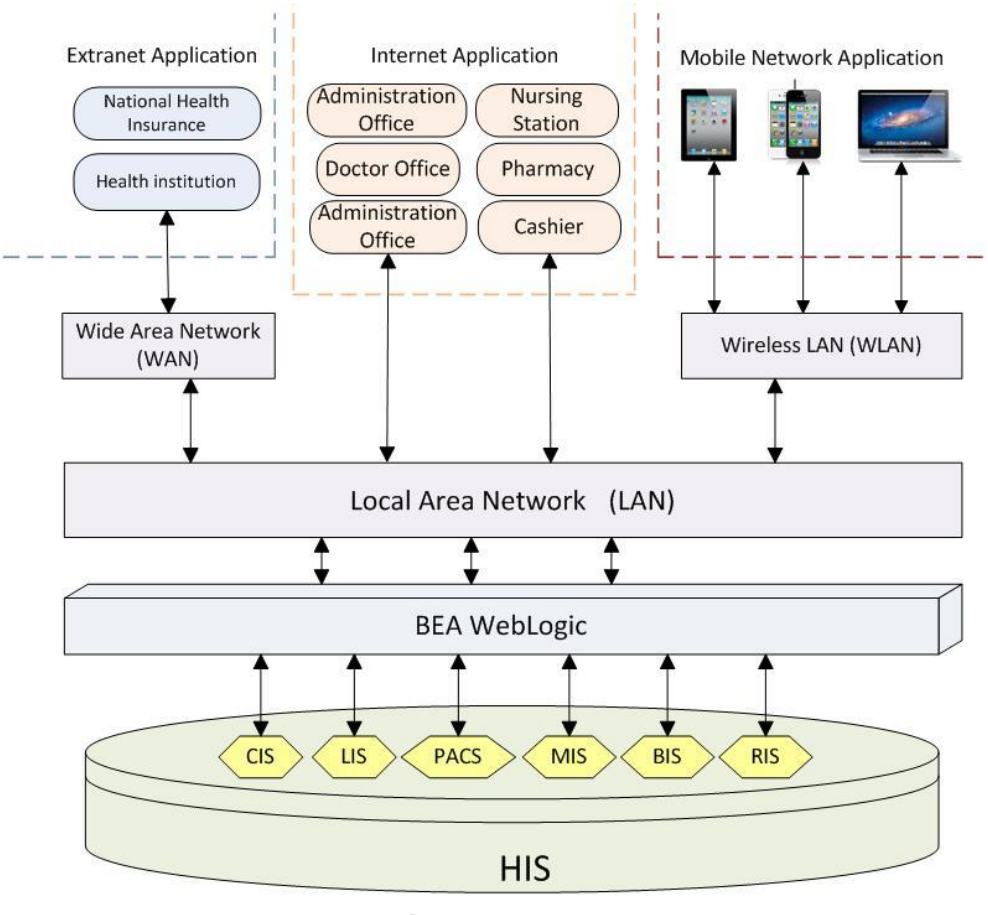
Introduction

Technology has shifted the experience dominant mode of diagnose into a more scientific, accurate and digital one. The Image Work Station is one of the examples. Digital image can eliminate the errors that observed just by human eyes. With this technology, doctors would have more objective aspects and views to treat their patients. These images can be analyzed by computers and even provided doctors morphological and metabolism information.

1.1 The Concept of Image Work Station

There are many Image Work Stations in the clinical and research purposes and here we are specifically discussing the Image Work Station that is belonging to the sub system of PACS. It's also called PACE Medical Image Work Station. It has the most advanced storage and image processing technology, its development is based on Window and Unix.(See Picture) The core of Image Processing Data Base has the capacity to improve the analyzing for medical purpose. You can also find the other similar Data Base like ITK and VTK etc.



1.2 Medical Image Work Station and PACS

PACS means the medical image technology, such as CT, MRI, US, X-ray and DSA. These machines are able to gather medical image data and analyze the data into informative image for doctor. Medical Image Work Station has come across the PACS in two aspects: Medical Image Storage and Patient's Image Processing. In another word, Medical Image Work Station is a technology that based on PACS and this technology decrease the costs of traditional PACS.

2 Developments

2.1 Development of PACS

PACS has already invested a lot of effort in the image processing and Internet transmitting. Universities, companies and hospitals are also involved in the researches which help PACS become more and more successful and mature. In 1992, America has applied PACS on medical diagnose and this project has been last for four years. During these years, PACS has been systematically formed up. The Hammersmith Hospital in London and the SMZO Hospital in Vienna are also adopted PACS since 1990s. In Japan, Image Save and Carry (ISAC) had been introduced as a concept in 1989, but ISAC is different from PACS that PACS is an online system. Japan PACS Association and Medical Information Center is in charge of ISAC system standardization and its development.

The development of PACS in our country is now at the level that compare to other countries is around 1990s. However, each medical center has established and transformed its medical execution system into Clinical Diagnosis and Treatment Information System. They commonly purchase DICOM 3.0 Interface which has a profound effect on Medical Image Management. There are some major medical centers try to cooperate purchasing PACS system, and some of them has successfully developed a small scale experimental system. Therefore, we can almost foresee the future of PACS is positive.

2.2 Developments of Medical Image Work Station

Overall, the Medical Image Work Station is on its way to catch up the foreign countries. But it's been rapid improved during these years.

2.2-1 Developments of Foreign countries

American PACS Image Work Station is financial aided by manufactures and government. PACS image workstation in Europe is support by the multinational consortia, national or regional funds. It usually cooperates with major manufacturers. The research focuses on the modeling and simulation of PACS and also image processing.

2.2-2 Development in Our Country

In order to promote the modern management of hospital and the working efficiency, we start to establish different scales of information system of hospitals since 1990s. Medical Image Work Station then has a chance to develop its researches and applications. However its overall applications haven't been able to fit the International standards. Similar to PACS, various medical image work stations like Ultrasound imaging work station endoscopic imaging work station, radiology work station, ECG workstation, high times microscope imaging workstation and etc. In 2000, China also tried to explore the medical image work station's market, Daijia Medical Imaging Systems Inc. in Shanghai learned the ADV Image Work Station Software 2.1 from Taiwan and this officially became the first and recognized as high tech achievement by Shanghai Officials. On 29 March, 2006, Will Technology and Chinese Academy of Sciences co-research on 3Dulta Issue of Three-dimensional ultrasound workstation and it has successfully passed the test by Robots of 863 Project. Meanwhile, many outstanding academic institutions are also involved in the research of Image Work Station. For example, Zhang Lipei, fellow of the Computer Application Technology Department of Zhejiang University, her master thesis" The Research and Realization of Medical Diagnose by PACS Medical Image Work Station". And the fellow of Shandong University from Signal and Information Processing Department, Chen Lihua, his thesis is "The Crucial Technical Skills and Designs of New Type Ultrasound Imaging Work Station 'DICOM'. In 2007, there are almost a hundred cooperation which professed in Medical Image Information System, such as the Integrated real-time medical diagnostic imaging workstation by Broaden technology in Beijing, All-around workstation by Aquarius and Medical imaging workstation by Compass Electronics CO. and so on.

3 The Applications and Categorizations of Medical Image Work Station

3.1 The Categorizations of Medical Image Work Station

Scholars are still arguing about the principle of categorizing Medical Image Work Stations. According to the principle of its Imaging Equipment, they can be divided as CT imaging work station, ultrasound workstation, MRI image workstation. According to the principle of department, they will be divided as Radiology radiotherapy systems, surgical navigation systems, endoscopic imaging workstation. According to the principle of usage, they will be divided into Teaching Purpose Imaging Work Station, Researching Purpose Imaging Work Station and Commercial Purpose Imaging Work Station. Of course, these are only the simple division we made here, we are still hoping there can be a better way to describe them.

3.2 Ultrasound and Treatment Planning Systems

3.2-1 The Ultrasound Image Work Station

Applications: Basic information setting, thesaurus editing, report editing, image parameter settings, video setting, query, statistics, processing of image gathering.

Disadvantages: 1. the software of Work Stations are composed recently, therefore the capacity and stability are still in questions. 2. the image that produced by the Image Capturing function in Ultrasound System is black-and-white which cannot clearly show the lesion on the

image and because of the black background, it will waste a lot of ink. 3. Image Processing is still not good enough for doctors to make an efficient diagnose.

Aspect: Ultrasound Image Work Station increases the efficiency and reduces the error that might occur while in manual operation. It also digitalizes the patients' data which make doctors easier to compare patient's status. In terms of paper information processing, we have reach the International Standards, however the Algorithmic processing still has a long way to go.

3.2-2 Treatment Planning System，TPS

Applications:

TPS realize the three Dimensions Re-Construction of CT, MRI and PET which allows doctors to distinguish the normal tissue and target the tumor on the CT image. And finally doctors will calculate the most appropriate amount of radiation dose to treat the patient. The typical Radiation treatment of Three Dimensions Re-Constructing has following features:

1. a three dimensions descriptive location of the lesion.

2. 3D locating frame will mark a certain area and get CT and MRI images.

3. The area which received radiation and the position of radiation will all have a 3D descriptive location.

4. Dose calculation should be carried out in three-dimensional dose grid, the dose grid should include the region that doctors are targeted.

5. It is able to simulate the area that has been radiated.

6. Reverse Plan Function. In China, including Beijing, Shanghai, Guangzhou and Hangzhou, a statistic shows that among these patients who has tumor, there are 65-75% receive radiation treatment. Only 45% of tumor patients can be treated and 18% of them are treated with radiation. In America, there are 60% of tumor patients receive radiation treatment.

Disadvantages:

1. TPS is very expensive. For example, TPS by GE or Siemens cost over hundreds of million, even it's produced by domestic factory it's still cost almost 800 thousands.

2. Our algorithm skill is not advanced enough to up-grate the products and the domestic skill level cannot catch up with international level yet.

3. TPS' interfaces are mostly adopted UNIX operation system, which is not friendly enough for now learners.

4. TPS takes a rather long time to calculate the correct dose of radiation, which is less efficient.

Aspect:

High efficiency, high quality, high accuracy, detailed treatment and precise planning are going to be the future trend of medical care. TPS can combine images and optimize planning which will help doctor lay out a more precise radiation treatment.

Conclusion

On a conference of Radiological Society of North America (RSNA2007) people were highly interested in domestic image center, three dimensions re-construction, CAD with computer diagnose assistance, Dispersion technology and medical images combination. This tells us the possible areas that Image Work Station may have the further development:

1. Increase the quality of specific area in order to identify any significant clue of the tumor. Feature collecting and identifying will be more and more important in data processing.

2. Increase the accuracy of PACS by permitting it more authority to exam the image.

3. Develop a function model that can reduce the research time of Medical Image Work Station and by expanding its function mode we are going to have a universal image work station. This universal image work station can operate in different department. For example, the visual endoscope function of PACS is combined with visual endoscope function of Viatronix.

4. Integration. Apply the image work station software into the existing image equipment. This would reduce the image transmitting distance and realize the dynamic testing.

5. Combine the medical professions and information with clinical image work station in order to build a professional medical work station.

This article simply introduces the overall status of image work station's development and trend. This article doesn't mention image work station's internet structure and image processing. We must try to sync the medical knowledge with the medical image. This is what PACS is aiming to accomplish in 21st century,