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DICOM in Dart Background Reading

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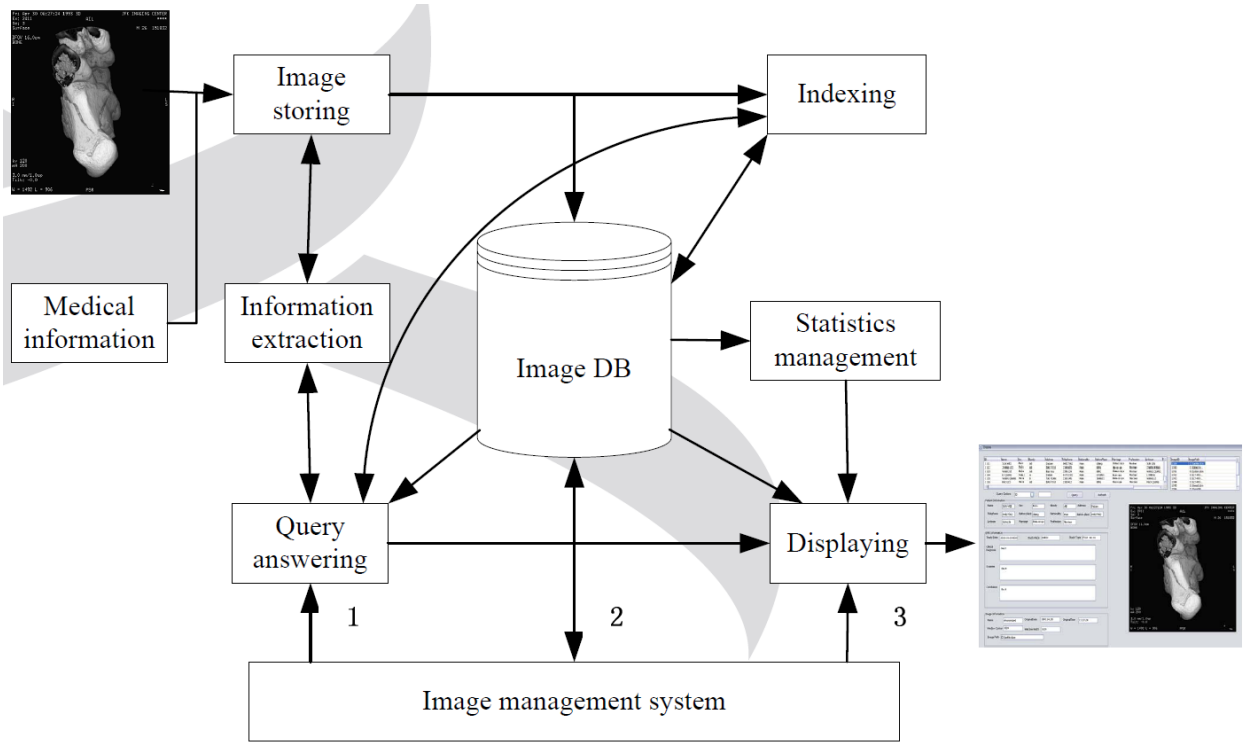
Research and Implementation of Medical Images Management System Based on DICOM Standard

The main purpose of this journal article was to propose a novel medical images and management system based on the DICOM standard. Medical imaging data has become central to patient diagnosis, therapy, surgical planning, medical reference, and medical training. Along with this, medical imaging data is mostly digitized which has caused an increased need for fast management systems that utilize the DICOM standard by which they are stored and transmitted in an efficient. DICOM image studies are stored as lists of attributes called datasets. Entire DICOM files are stored as binary and in order to make them readable to humans management systems are created that allow efficient parsing. While traditional medical image management systems only manage image information, the authors wanted to implement a novel method based on the DICOM standard to store both the image files and patient medical records information into the database together. Specifically the authors created a new semantic image retrieval method and incorporated it into a system that could parse DICOM data. The authors concluded that their results met the current demands of picture archiving and communication systems for mass data storage. These results also validated the presented methods.

The authors begin by stating that they chose to store their medical images in a separate file rather than on the same file. I interpreted this to mean that the Bulkdata is being stored independent from the actual DICOM file that the program is reading, but this was not explained very well and remains unclear. They mention that since there is a large amount of incoming medical image data that needs to be archived daily for average hospitals they chose to store the medical images in a separate file. I assume this means that it is simpler to store the images separately rather than updating the entire

DICOM file, but it seems that this would need to be done anyways to catalog the new images. This reasoning didn't seem explained well to me.

The database structure the authors created was mirrored after the DICOM standard, namely in that it was organized into a hierarchy with four layers, namely Patient, Study, Series, and Images. They organized their system into five tables, one for each level of the DICOM hierarchy and one being a medical records table. The general architecture of the management system includes six modules: Image storing, information extraction, query answering, image displaying, and statistics management. There were also three main points of internal interaction: through the database, the application programming interface (API) of the query answering module, and finally through the API of the displaying module. The authors mention these modules and interactions, but don't go into much detail about the internal workings or events of each, which I would have liked to read. The interactions and system modules are outlined in the following schematic representation of the system architecture:



The authors proceed to give a summary of how DICOM files are stored in a series of datasets, which are in turn lists of attributes containing values. The authors also include a short table describing the different types of DICOM attributes and their potential values. They mention that their design extracts the information through the DCMTK toolkit, but don't really mention much else about how it's done. The authors do a very good job of explaining what a DICOM file looks like and the importance of its structure to their management system. Transmission of the DICOM file was done to the specifications outlined in the DICOM standard. The authors explain in great detail their transfer protocols and this will likely be very useful to our project since we will need to communicate files between servers and end point users. The authors mention that the system design also includes two kinds of search methods one for patient identifications numbers and one for patient names. The transmission of the returned queries was conducted by the previously defined protocols. Once again the technical details of how the query methods work is left out, which is unfortunate since we may eventually need to implement our own search methods in our project.

The authors then list the advantages they believe their management system offer to the development of medical imaging technology. First, the image data is stored in a convenient and reliable way by the archiving module. They claim it can be permanently preserved and not lost, damaged, or incorrectly filed. This is more than likely a byproduct of the construction of the files by the DICOM standard and not necessarily by the management system. The DICOM standard specifies that each level of the hierarchy contains specifications of the previous levels. Storing medical imaging data on a complete system that can be accessed on various workstations also creates a fast and effective way of working for healthcare providers. The system also provides an efficient way to search and access patient data. Finally, the authors claim that the hospital's expenses will be reduced through their system. This would be simply because actual filing and physical image copies could be eliminated. For the most part, the authors make an excellent case for the use of digital medical imaging systems software.

The article gave an excellent overview of the basic structure the authors used and how it used the structure provided in the DICOM standard to achieve an efficient management system. This is likely to be the most useful in our project. Unfortunately, one very large critique is that there was not any more technical specification in the research paper, but this is likely to be found in a software guide or API for the actual programs that they designed. I could conclude easily from the article that the system that was designed was clearly functional for all DICOM formats and could easily and securely display and save DICOM imaging studies.