3D HARDTISSUE DATABASE

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Abstract

This research focuses on the development of a 3D hardtissue database for craniofacial. This database is being developed to assist the medical profession to provide better health services to the public. 3 software are used in this research, i.e. 3D SLICER, RAPIDFORM2004 and MYSQL 4.1. 3D SLICER software is used for image-processing of Computed Tomography (CT) scanned data to get 3D computer model of human skulls. Then RAPIDFORM2004 software is used to identify and measure the landmarks on the 3D skulls. After 3D skulls were processed and landmarks were identified, the 3D hardtissue database is designed and developed to store the data. The database is developed using MYSQL 4.1 software for later retrieval.

1.0 INTRODUCTION

With the rapid advances in the computerization of medical data, the question of the protection of medical records privacy has begun to arise. Storing a large amount of sensitive information in a database could open the door to "invasion of privacy" issues that were not as common as with the keeping of paper files. Medical records contain some sensitive information, such as past drug use or genetic predisposition to various diseases, it's important to keep this information truly "private". Health records use to be considered a private matter between doctor and patient. Thus, development of medical database is very important to assist the medical profession to provide better health services to the public. In a typical teaching hospital, many people can have access to medical reports. Anyone from the nursing staff to the x-ray technician can have a look at patient’s records. As hospitals begin to computerize their medical records, there is a legitimate fear that more people will have even more access to the medical records.

2.0 CURRENT MEDICAL DATABASE

An ideal hospital information system design should be focused on integration of clinical as well as financial and administrative applications. At present time, most systems are Financial Information Systems (FIS), some are Management Information Systems (MIS), and some Hospital Information Systems combine FIS and MIS. In order to improve hospital services in a time-efficient and cost-effective manner, both FIS and MIS must be linked to a Clinical Information Systems (CIS). This system is centered around patients and clinical processes and consists of: ward-related Nursing Information Systems (NIS), and the non-ward Departmental Information Systems (DIS). Examples of DIS are Radiology Information Systems (RIS), and Pharmacy Information Systems (PIS). With such synergy, the key issue is the integration of digital data so that the authorized personnel can retrieve necessary information anywhere and anytime they need it. The required data are usually different in nature and are called multimedia data. To review a patient's record the healthcare provider may need to look at radiographic images, listen to voice data with video sequence and live signals (intensive care scenario), and read the notes of other physicians. It is in this context when there is also a need for integration of HIS with Integrated Digital Medical Records (IDMR) and other advance information systems such as Picture

Archiving Communication System (PACS) and Document Information Systems (Doc IS) to handle massive amounts of multimedia data. In Summary, in an ideal situation IDMR would be the center of Hospital Information System, and the presentation of various categories of essential data would be an automatic function geared to the needs of an authorizes user.

3.0 METHOD

For this research, the method are used is Computed Tomography (CT) scanning for data captured (Figure 1). Computed tomography (CT), sometimes called CAT scan, uses special x-ray equipment to obtain many images from different angles, and then join them together to show a cross-section of body tissues and organs. CT scanner is a special kind of X-ray machine. Instead of sending out a single X-ray through your body as with ordinary X-rays, several beams are sent simultaneously from different angles.

The X-rays from the beams are detected after they have passed through the body and their strength is measured. Beams that have passed through less dense tissue such as the lungs will be stronger, whereas beams that have passed through denser tissue such as bone will be weaker. A computer can use this information to work out the relative density of the tissues examined. Each set of measurements made by the scanner is, in effect, a cross-section through the body. The computer processes the results, displaying them as a two-dimensional picture shown on a monitor.

CT scanning provides more detailed information on head injuries, brain tumors, and other brain diseases than do regular radiographs (plain x-ray films). It also can show bone, soft tissues and blood vessels in the same images. CT of the head and brain is a patient-friendly exam that involves radiation exposure.

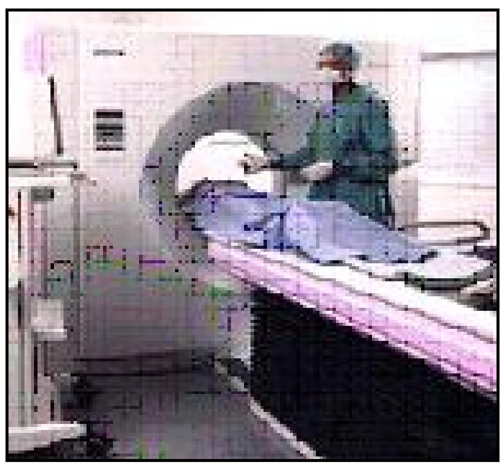
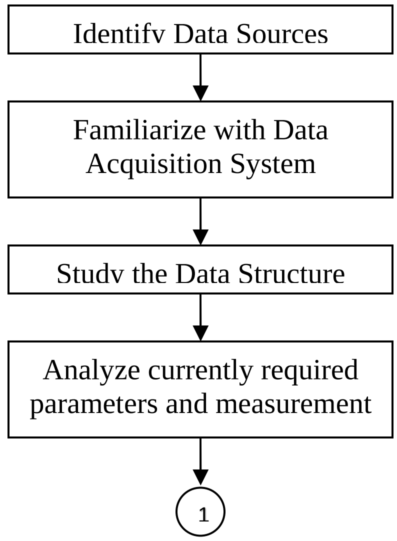


Figure 1: CT scan

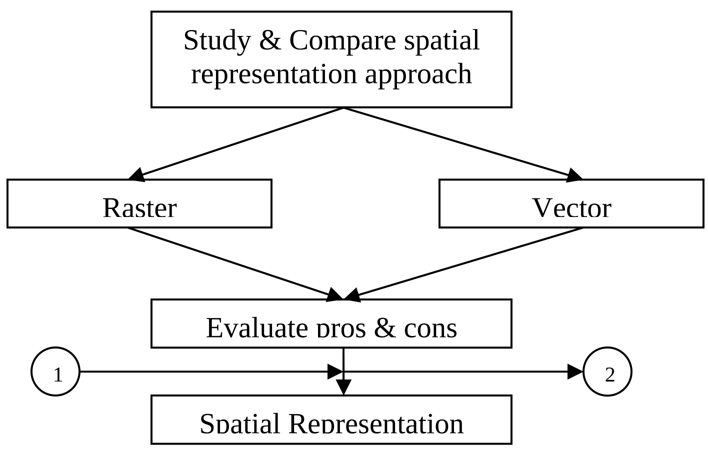
4.0 DATABASE DESIGN

This research is divided into 4 phases. There are user requirement analysis, data structure and design, database design and database population and design.

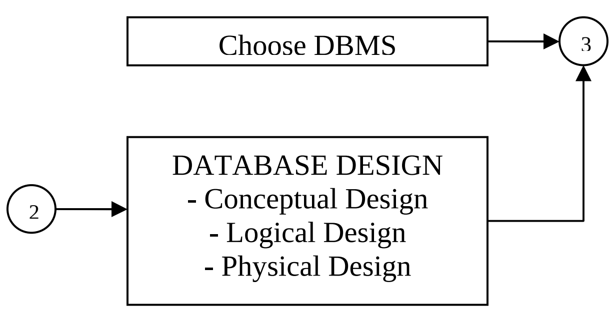
Phase 1: User Requirement Analysis



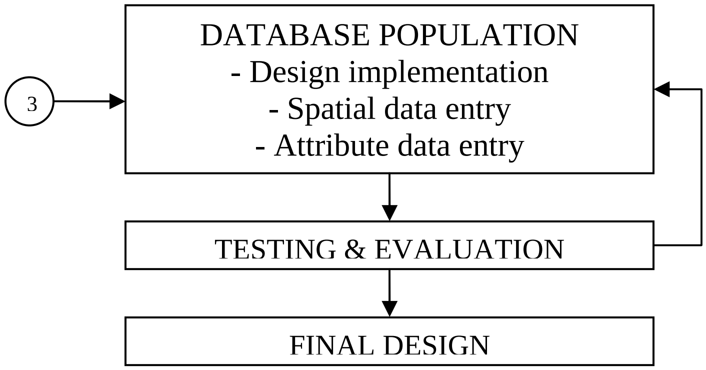
Phase 2: Data Structure Design



Phase 3: Database Design



Phase 4: Database Development & Testing



5.0 PRELIMINARY RESULT

For data acquisition, CT scanner used to get CT scan data in DICOM format. The data processing used 3D Slicer software to get 3D model of human skull (Figure 2). RapidForm2004 also used in this research for editing, landmark identification and measurement for the human skull. For database design, Rational Rose software is used and MYSQL 4.1 used for Database Management System (DBMS).

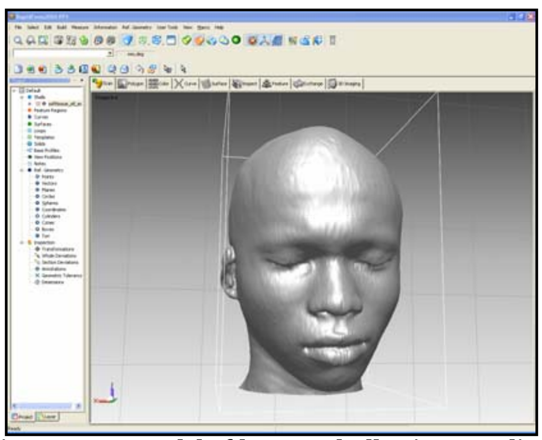


Figure 2: 3D model of human skull using 3D Slicer

For image processing, there are 8 steps to construct 3D model from CT scan data using 3D Slicer (Figure 3).

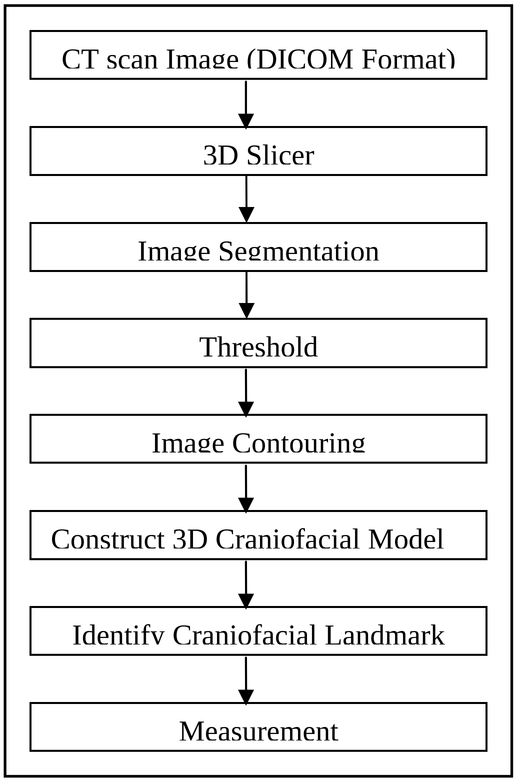


Figure 3: Flowchart to construct 3D Model from CT scan data

There are 21 craniofacial landmarks (Table 1) and 18 craniofacial measurements (Table 2) identified as needed by the user.

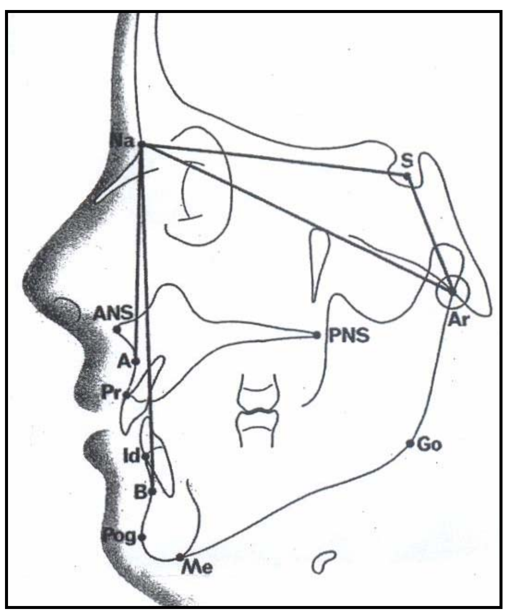


Figure 4: Landmark identify

Table 1: Craniofacial Landmark

Landmark	Name	Definition
Ba	Basion	The median point of the anterior margin of the foreman magnum
S	Sella	The midpoint of the cavity of sella turcica
Na	Nasion	The intersection of nasal septum and anterior cranial base.
G	Glabella	The most prominent point in the median median sagittal plane between the supraorbital ridges
Op	Opisthion	The median point of the posterior margin of the foreman magnum
Eu	Eurion	The most lateral point on the head
Co	Condylion	The superior most point on the head on the condylar head.
Po	Porion	The most superior point on the upper margin of the external auditory meatus with the head in the Frankfort horizontal plane.
B	Point B	The innermost point of the contour of the mandible between the incisor tooth and the bony chin
Or	Orbitale	The most inferior point of the bony orbit
N	Nasion	The midpoint of the nasafrontal suture
Me	Menton	The inferior most midline point on the mandibular symphysis
V	Vertex	The highest point on the head with the head in the Frankfort horizontal plane
Pr	Prosthion	Most anterior inferior point on maxilla
A	Point A	The innermost point of the contour of the premaxilla between the anterior nasal spine (ANS) and the incisor tooth
Pog	Pogonion	The anterior most point of the body chin in the median plane
Ar	Articulare	Intersection of cranial base and posterior surface of mandibular condyle.
PNS	Posterior Nasal Spine	The intersection of a continuation of the anterior wall of the Pterygopalatine fossa and the floor of the nose, mark dorsal limit of the maxilla.
ANS	Anterior Nasal Spine	Tip of the bony anterior nasal spine
Id	Infradentale	Most anterior superior point on mandible
Go	Gonion	The point at which the jaw angle is the most inferiorly, posteriorly and outward directed (bilateral)

Table 2: Craniofacial Measurement

Measurement	Definition
Ba – S	Basion to center of sella
Na – S	Nasion to center of sella
Ba – Na	Basion to Nasion
G – Op	Maximum cranial length
Eu – Eu	Maximum cranial breadth
Co – Co	Maximum frontal breadth
Po – B	Auriculo bregmatic height
Ek – Ek	Biorbitale breadth
B – N	Basion to Nasion (linear)
B – P	Basion to prosthion (linear)
Me – V	Menton to vertex
N – P	Nasion to Prosthion
Pr – Point A	Prosthion to inferior alveolar point

Pr – Me	Prosthion to Menton
Pr – Ba – Na	Gnatik angle
B – S – Na	Craniofacial angle
Pr – N – A	Angle 1
Pog – Ar – Pr	Angle 2

6.0 CONCLUSION

It is believed that this database design will help in providing information for expertise in craniofacial reconstruction to improve the health status. In the future, we plan to develop this database completely using MYSQL 4.1 software.

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