CollabDDS:

Network Enabled Medical Diagnosis and Education in Skeletal Imaging using X-Rays

The availability and reach of National Knowledge Network (NKN) due to high bandwidth and low latency has ensured the creation of applications which will be beneficial to all stakeholders in science, technology, governance and research & development. A model project funded by NKN and executed by NIC, New Delhi; AIIMS (Radiology and Orthodontics), New Delhi; CSIR-CSIO, Chandigarh and OrthoCAD Cell, IIT, Mumbai is an extension of CollabCAD to include medical and dental applications.

This proof-of-concept is now transformed to Collaborative Digital Diagnosis System - CollabDDS.

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BACKGROUND

The National Knowledge Network (NKN) serves as an enabler for long distance education in real time, collaborative research between different institutions and knowledge sharing among students and faculty. The model project "Network enabled Medical Diagnosis and Education in Skeletal Imaging using X-Rays" funded by NKN Model Project Executive Committee, was undertaken as proof-of-concept to provide a network based system for radiological and dental imaging using X-rays. CollabCAD's collaborative platform is used as a base for dynamic and real-time sharing of imaging data. The high bandwidth and low latency capability of the NKN would provide an ideal platform to transmit medical imaging data and make it beneficial for both patients and physicians who desire radiological consultation with experts at tertiary level health care centre. The area of study being complicated required expertise in varied domains such as but not limited to Radiology, Orthopedics, Orthodontics, Computational methods, CAD, Rapid Prototyping and Image Processing.

OBJECTIVES

- Analyze different medical imaging data formats from various imaging modalities

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CollabDDS is an advanced software system of communication and collaboration of medical and dental imaging data between two or more remote centres. This indigenous system can be used to disseminate dental education through repository of case report as well as live transmission on a collaborative mode between two remote centres. CollabDDS has varied applications in distant education and health care. Its real potential can be many, including applications in research.

- Design and develop software for visualization of 2D medical imaging data
- Bi-directional transfer of data between one or more NKN nodes
- Standardized graphical markup and annotation tools for medical/dental imaging experts
- Creation of digital content repository of teaching cases for knowledge dissemination
- Exploratory work to convert X-ray images into 3D models for

visualization, implant design and prototyping.

● 2D cephalometric analysis for orthodontic applications

TECHNOLOGY ADOPTED

CollabDDS is built using open-source development tools like Core Java, RMI, Linux, Apache SLIDE, JITSI and libraries like Swing, Graphics2D, JAI, DCM4CHE toolkit, JavaHelp.

STAKEHOLDERS

● CollabCAD Division, National Informatics Centre, New Delhi

● Dept of Radio-diagnosis, AIIMS, New Delhi

● Dept of Orthodontics, CDER, AIIMS, New Delhi

● OrthoCAD Cell, Department of Mechanical Engg., IIT, Mumbai

● Computational Instrumentation Division, CSIR-CSIO, Chandigarh

● National Knowledge Network, New Delhi

USERS

● Faculty/Students of NKN connected Medical/Dental College's

● Primary, Secondary, Tertiary Health Care Centre

● Medical/Dental Doctors

HOW IT WORKS?

The patient gets a conventional (film) x-ray done on the recommendation of the treating physician. A medical grade digitizer (in this case, Medi6000) easily transfers the X-ray film and patient meta data into digital format at a high resolution. The data is saved locally at the remote health centre in various image formats (TIFF, BMP, JPG, GIF) and there is an option to save in DICOM file format.
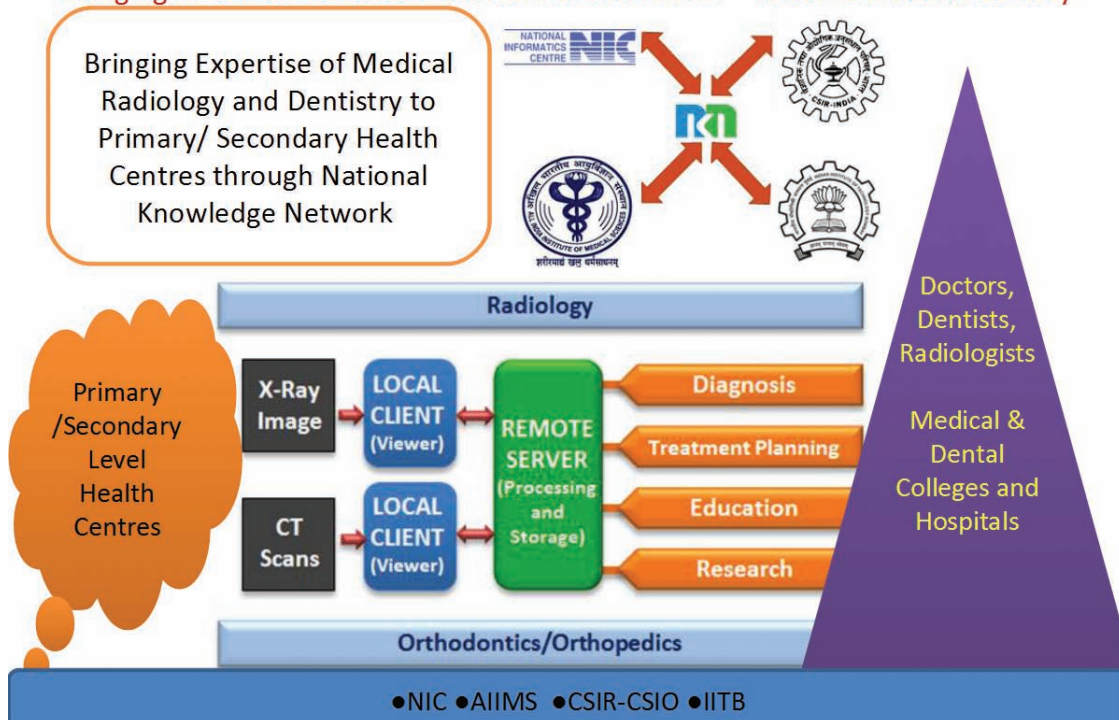
Dr. ARUN KUMAR GUPTA
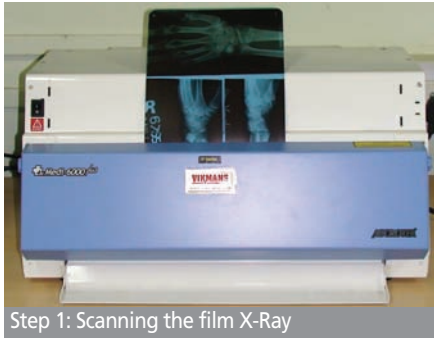Head, Department of Radio-diagnosis, AIIMS, New Delhi

CollabDDS is unique and indigenously developed software for medical images which allows sharing, viewing and real time collaboration. It has the potential of taking medical expertise available in tertiary medical centres right up to the PHC level. It can also be applied to the field of medical education and research.

The CollabDDS server is started and the clients (authorized user's) having access to the server use the CollabDDS client at the remote centre to open the digitized image, and shares the data with the client application at the tertiary health care centre. Regions on the images can be marked by doctors/specialists with annotations for interaction and effective diagnosis. This collaborative sharing is real-time as both the physician and the radiological/dental expert will view the same image and annotations simultaneously. The image along with

NKN-CollabDDS: Collaborative Digital Diagnosis System
Bridging the divide between Rural and Urban Health – Towards Inclusive Society

Bringing Expertise of Medical Radiology and Dentistry to Primary/ Secondary Health Centres through National Knowledge Network

Primary/Secondary Level Health Centres

X-Ray Image → LOCAL CLIENT (Viewer)
CT Scans → LOCAL CLIENT (Viewer)

REMOTE SERVER (Processing and Storage)

Radiology

Diagnosis
Treatment Planning
Education
Research

Orthodontics/Orthopedics

Doctors, Dentists, Radiologists

Medical & Dental Colleges and Hospitals
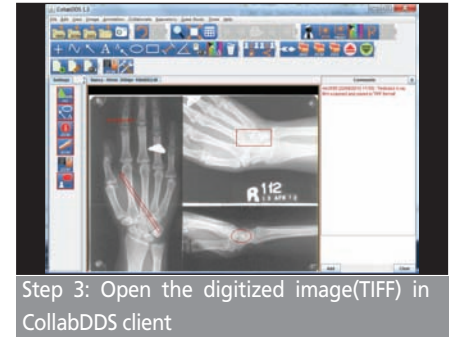
●NIC ●AIIMS ●CSIR-CSIO ●IITB

Step 1: Scanning the film X-Ray

Step 2: Scanner settings for digitization

Step 3: Open the digitized image(TIFF) in CollabDDS client

conversations can be saved locally either in DICOM or XML, and also be stored in the digital repository at the server for future reference and teaching. Reports can be generated for viewing and printing. It runs as desktop and client-server mode on Wndows or Linux OS.

SALIENT FEATURES AND KEY DELIVERABLES

● 2D Visualization (X-ray images in JPEG, GIF, TIFF, PNG, DICOM)

● Post-processing DICOM images (single, multiple, series from CT/MRI)

● Image manipulation (Window level/width, Rotate, Zoom in/out, Pan)

● Dicomization (conversion of JPEG to DICOM)

● Annotation (Graphical and text)

● Measurements (linear, angular) and Region-of-interest tools(rectangle, ellipse)

● Collaboration (Sharing images, comments, recordable , audio-video)

● Repository (HTTP based, upload/retrieval, access/security control)

● Education (Clinical case study generation, feedback and modification)

● Documentation (HTML, context-sensitive search, indexing, glossary)

BENEFITS

● Efficient digital work-flow of Medical Imaging data

● Improved diagnosis and treatment

by Collaborative consultations

● Enhanced quality of public health care ICT infrastructure

● Reliability, security and accessibility of medical and dental imaging records

● Knowledge exchange via teaching cases

CURRENT STATUS & FUTURE PROSPECTS

● Knowledge partners on NKN for use of CollabDDS for medical & dental education

● Implementation of CollabDDS at primary/secondary health centres and hospitals

● Feedback and testing from AIIMS/CSIO on system enhancements and bug fixing

● Digital signatures for medical imaging data and reports with anonymization

● Re-construction of 3D volumetric data and surface images

● 2D Cephalometric orthodontic analysis (CSIO AutoCEPH) module development

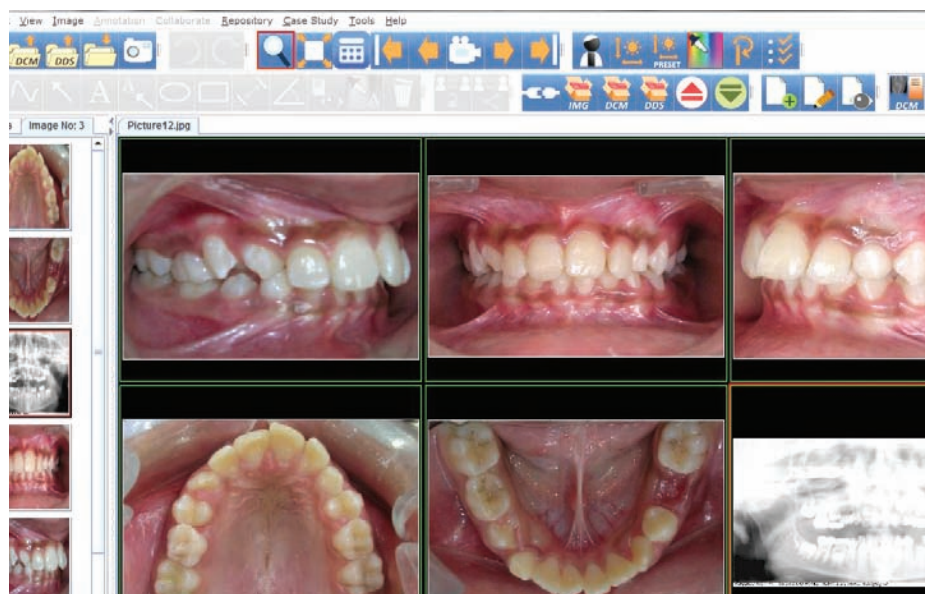● Designing and prototyping customized dental implants and instruments

Fig. 1: Dental Case Study for Teaching