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***End-User eX-Ray Teleradiology System
Implementation Guide***

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1. Introduction

Radiology is part of the service industry, and as a service provider, one needs to understand quality and delivery of service [1]. However, accessibility to radiology services is not always an easy task for patients who live a great distance from the hospital, together with the limited healthcare professionals in the field [2]. As a result, ensuring patient satisfaction is still a challenging task for most healthcare organizations. Patient satisfaction is one of the main components of quality of care and is a crucial phenomenon for the overall health care delivery system [3, 4]. Various factors were mentioned as contributors to patients' being dissatisfied with the radiology service. Of these, waiting time is considered the top contributing factor that adversely affects patient satisfaction [5].

However, teleradiology is considered a suitable solution to reach underserved areas with limited health professionals as the technology allows the transmission of images in difficult cases to those members of a group who are best trained to interpret the image [6]. It is often defined as the electronic transmission of radiographic images from one geographical location to another for the purposes of interpretation and consultation [7].

2. Benefits of the system

A number of advantages are mentioned for both the patient and providers. Such as:

- It allows end-users get the chance to upload patient radiology images and remotely access radiologists' interpretation and consultation services
- It helps clinicians can receive feedback from radiologists through the system.
- The system facilitates the sharing of knowledge among radiologists for the purpose of consulting with clinicians
- Consulting clinicians can make timely decisions and provide optimal treatment for their patients with the assistance of the system.

3. eX-Ray Teleradiology Workflow

The web-based eX-Ray teleradiology system is depicted in this diagram. The process begins with patients receiving image requests from referring hospitals. They then proceed to the X-Ray imaging room to have the requested image captured. The captured x-ray image is subsequently transferred by the radiographer (imaging technician) back to the requesting physician through the local area network.

Upon receiving the X-ray image, the requesting physician promptly logs into the system using their username and password. They then proceed to upload the X-ray image to the central server, seeking consultation from senior radiologists. Before submitting the image to the central server, the physician must fill in essential information, including the patients' demographic and clinical details, as well as upload the image itself. Once submitted, the image and accompanying information are made available to the radiologists on the central server. The radiologists, using their own username and password, log in to the system and access the uploaded image along with the provided basic information. They then generate the radiology report, including their comments, and submit it back to the central computer. Finally, the referring clinician logs into the central server, gaining access to the clinical report. Additionally, they have the option to download the report as a PDF file.

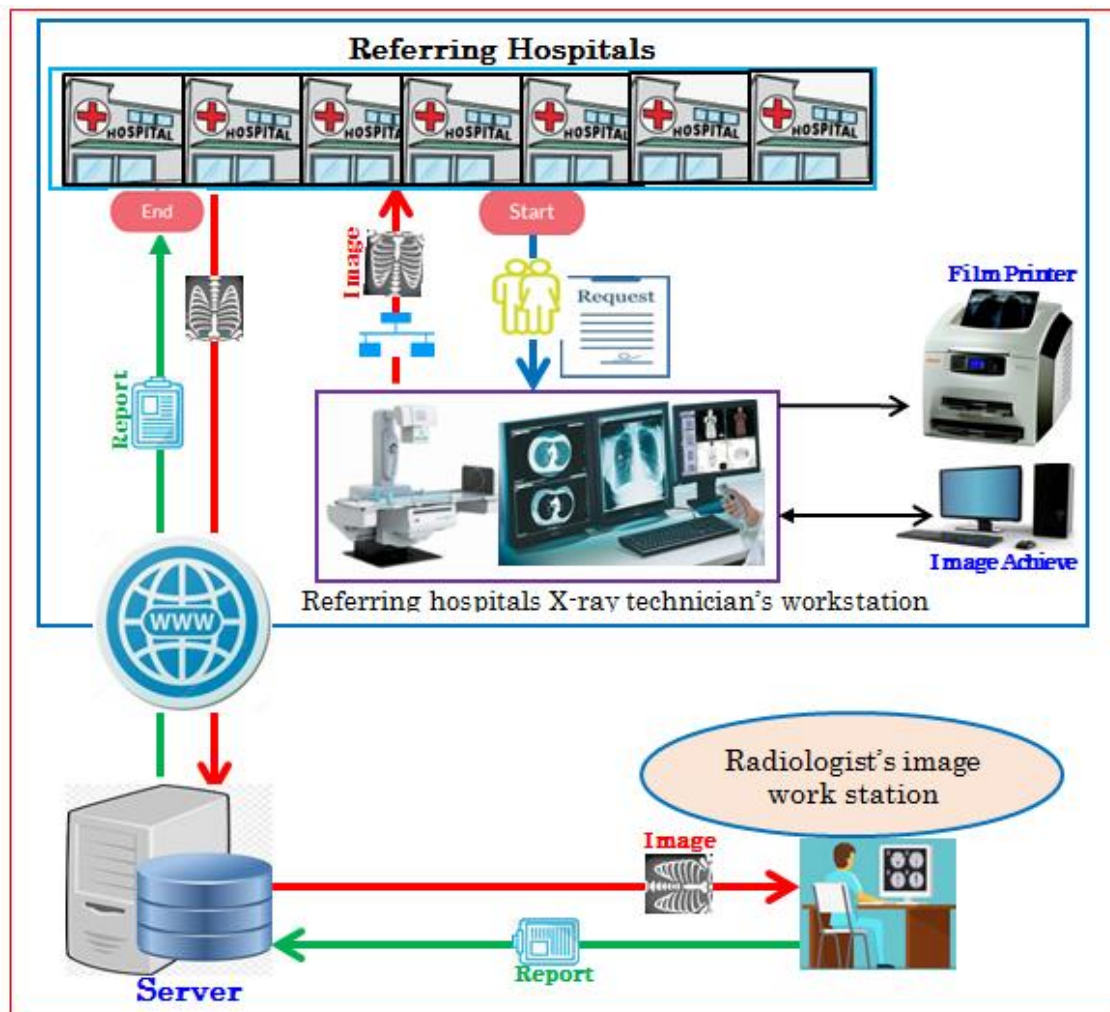


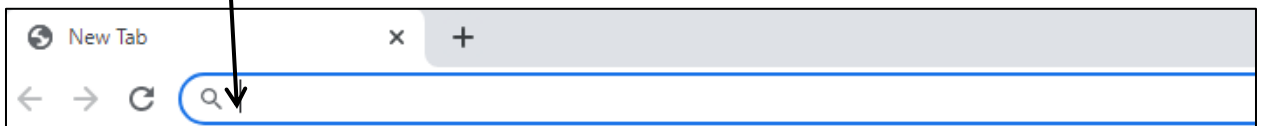
Figure 1: eX-Ray web-based teleradiology system workflow

- 4. Login page:** This page serves as the login portal for users to access the eX-Ray teleradiology system. Users must enter their designated username and password to proceed. It is crucial to maintain the confidentiality of your username and password. Please follow the steps below to access the system:

Steps to use the system

- Open browser [*Chrome is preferable* 

Type the (<http://telerad.uog.edu.et>) you have given at the **URL address** (*the address used to access the web-based eX-Ray teleradiology system*) **you have given** (at the address bar of the browser and **press enter key**



- Type the your **username**, **password** and finally click on **login button**

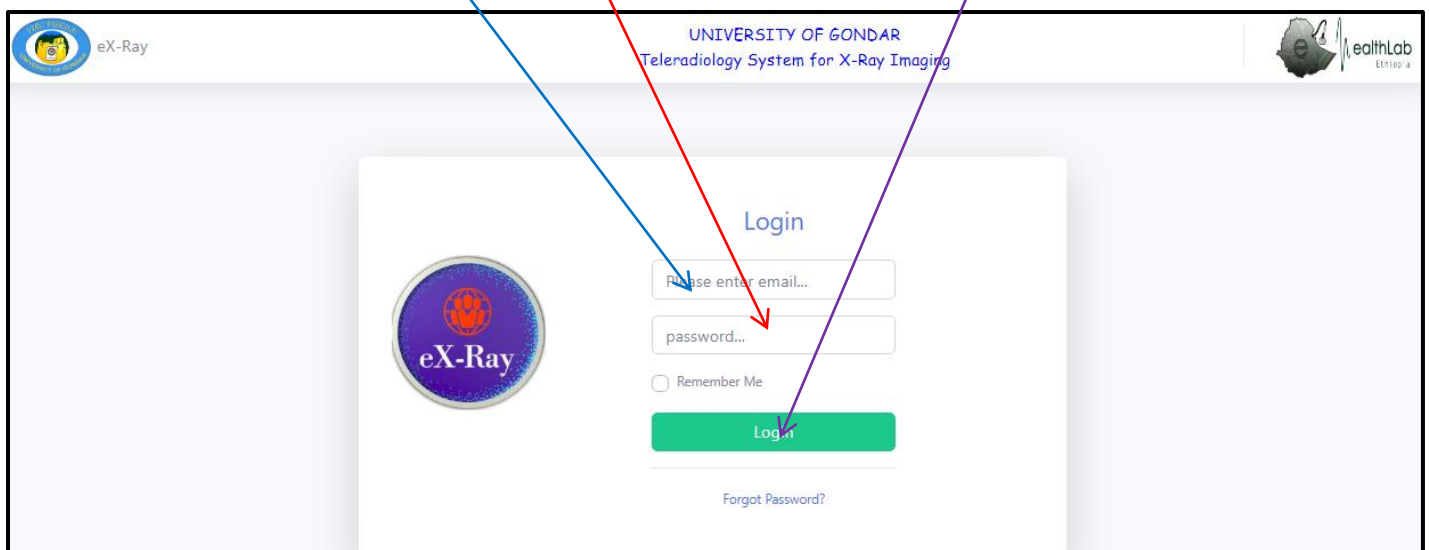
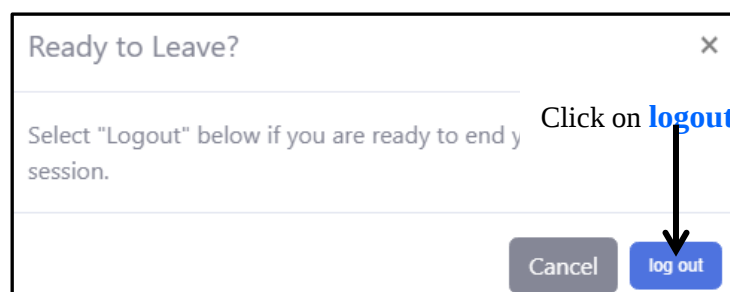
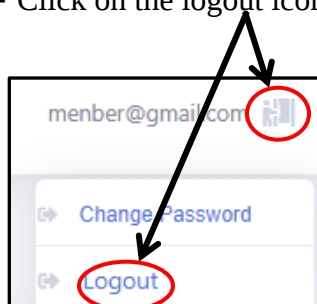


Figure 2: The eX-Ray teleradiology login page

- 5. The logout button:** This tab is used to log out when you finish your activity.

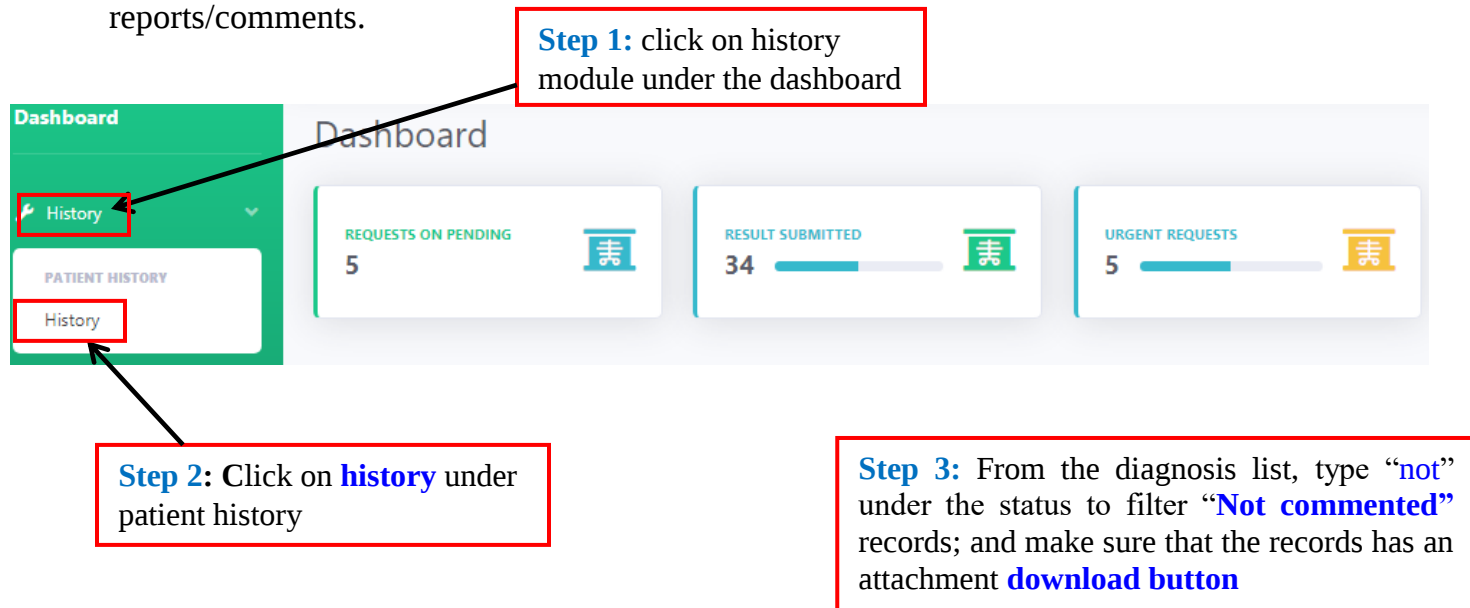
- Click on the logout icon



Click on **logout** button

Figure 3: steps how to logout from the web-based eX-Ray teleradiology system

6. Dashboard: The dashboard provides referring clinicians with valuable features to access summarized reports related to patient registration, pending images, and radiology results. It consists of two modules, namely the patient module and the history module. Similarly, the dashboard is beneficial for radiologists as it allows them to access summarized reports regarding pending requests, submitted results, and urgent requests. Within the dashboard, the history module enables radiologists to download patient-uploaded images requiring comments and write their final radiology reports/comments.



7. Steps to register patients

The patient registering page is utilized to collect and store demographic information pertaining to patients, while the history page is applicable to document the patient's medical history. To register patients' demographic details, medical history, and submit images, please follow the steps outlined below.

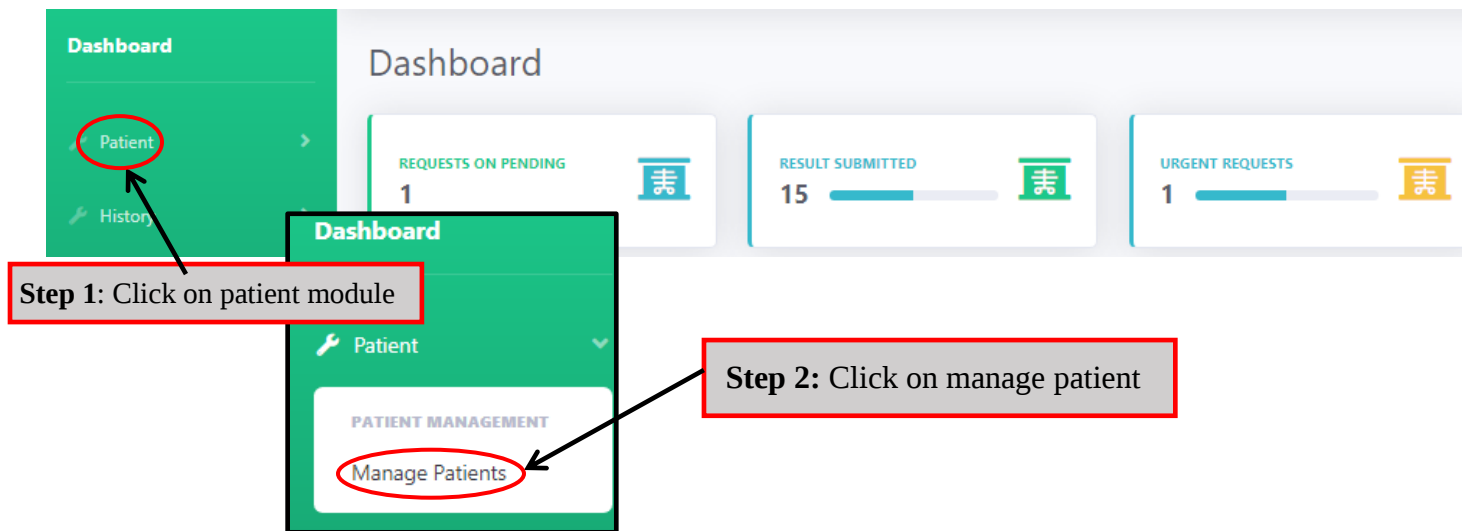


Figure: The web-based eX-Ray teleradiology system dashboard

- **Patient module:** is the module that helps the referring clinician to record patients underwent X-ray service

Step 3: Click create button to register patients

Steps 4: Fill the patient demographic information

Step 5: Click here to save the information

Figure 5: eX-Ray teleradiology patient registration window

Note: Make sure all the required fields (i.e. fields with *) are properly filed

- **History module:** This is the module in which referring clinicians are expected to fill in the patient history.

+ Create								
<< 1 >> 10								
Mrn	Patient	Sex	Age	MaritalStatus	Woreda	Kebele	PatientCase	Operations
Nef-233456		Female	34	Single			New	+ Diagnose Edit Delete
Nef-273652		Female	24	Single			New	+ Diagnose Edit

Step 2: Fill the chief compliant, treatment and clinical impression boxes with the appropriate information

Step 1: Click on diagnose to fill the patient history

Note: This box filled only by radiologists to write their radiology comment

Chief Compliant *

Treatment

Relevant Lab Information

Previous Image Finding

StudyRequested *

Case Level

Date of Image Upload(Consulted)

Upload X-Ray Image *

Radiologist_Comment

Clinician_Impression *

☐ Yes
☐ No

☐ Yes
☐ No

☐ Chest (PA or AP)
☐ KUB
☐ Skull,(two views)
☐ Cervical spine,(two views)
☐ Thoracolumbar spine,(two views)
☐ Elbow,(two views)
☐ knee joint,(two views)
☐ Forearm,(two views)
☐ Leg, (two views)

☐ Chest Lateral
☐ Pelvic
☐ Neck,(two views)
☐ Thoracic spine,(two views)
☐ Lumbar spine,(two views)
☐ Wrist Joint,(two views)
☐ Ankle Joint,(two views)
☐ Finger,(two views)
☐ Calcaneus,(two views)

☐ Plain abdominal
☐ Nasal bone
☐ Mandible,(two views)
☐ Lumbar spine,(two views)
☐ Shoulder joint,(two views)
☐ Hip joint,(two views)
☐ Upper arm,(two views)
☐ Hand,(two views)
☐ Foot ,(two views)

Regular

+ CHOOSE

Upload

Cancel

Date of Image Taken

Step 3: Provide previous lab and image finding information: If yes, type the finding from the popup text boxes

Step 4: Choose study requested by clicking the check box (more than one possible if any)

Step 5: Click the case level box to select the case level either **Regular/Emergency**

Step 7: Click the date of image upload box to adjust **date/time of image while uploading**

Step 8: Click choose to select the **patient image** to be uploaded

Step 6: Click on date of image taken box to set the **date/time when image was taken**

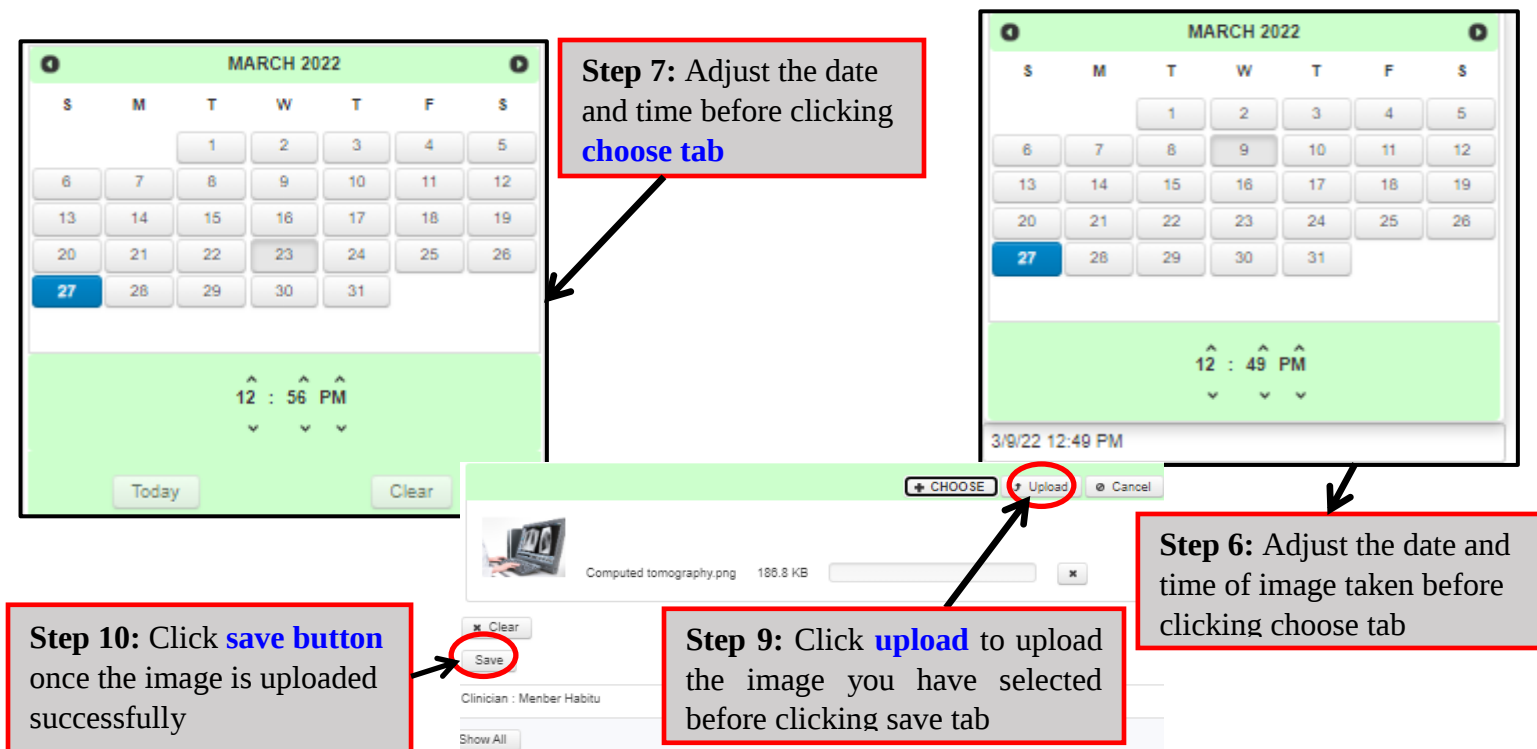


Figure 6: eX-Ray teleradiology patient history window

NB: Make sure to you properly filled the required fields. In addition, make sure that you have adjusted the date/time of image taken before the date and time of image uploaded/consulted

➤ To check your registered patient information

Step 1: Search the patient from lists by writing some initials of the patient name at the patient search box

Step 2: Click on **edit** button to access the patient detail

Step 3: Click **download** button to download the uploaded image if you wish (optional)

In	Patient	Study_Req	DateOfImag	DateOfCon	DateOfView	Date of Read	Date Difference	Status	Physician	Radiologist	X-ray Image	Operation
1	Kelem Asnakel Getu	[Pelvic]	03/23/2022 14:05:00	03/29/2022 14:06			-	Not-Read	Member Habitu		download	View Delete Edit

N:B:

- ✓ Select your record from the patient list
- ✓ Make sure that the fields/columns such as: Patient, Study requested, Date of image taken, Date of image uploaded, status and X-Ray image columns are filed. (N.B: if **download**

button is not present under the X-Ray column. It means that you haven't uploaded the image)

- ✓ In addition, if you want to **download** your uploaded image, click the **download** button
- ✓ In case you missed some of the history of that particular patient, you can click **edit button** to include the information and finally click on save button under that dialog box.

Diagnosis page: This page helps to check the status of the images uploaded.

Diagnosis List

LIST OF CUSTOMERS Enter keyword

Columns

Index	Mrm	Patient	Study_R	Urgency Level	Date of Image Taken	Date of Image Upload	Date of Image Downloa	Date of Image Commer	Date Difference	Status	Clinician	Radiologist	X-ray Image	Operation
1	And-543366		[Pelvic]	Regular	03/16/2010 08:00	03/18/2010 00:00			-	Not-Comment	Maritu Sintayehu		download	Radiology Result
2	Ebn-965520		[Neck, (two views)]	Regular	03/15/2010 10:12:00	03/16/2010 00:00			-	Not-Comment	Sisay Maru		download	+ Radiology Result
3	Dr-1760		[Leg, (two views)]	Emergen	03/25/2010 10:26:00	03/25/2010 00:00			-	Not-Comment	Senait Yirdaw		download	+ Radiology Result
4	And-765423		[Chest (PA or AP)]	Emergen	04/19/2010 04:53:00	04/20/2010 00:00			-	Not-Comment	Maritu Sintayehu		download	+ Radiology Result

Step 4: Select the record you want to give comment. For example, if you want record identified by **index number 1**, select it

Step 5: Click on **download button** under X-ray image column.

Step 6: Click **refresh button** before opening the image to mark the **download time**

Step 7: Click on **radiology result tab** to write your final radiology **report/comment**

← → ↻ ⚠ Not secure

Figure: Web-based eX-Ray teleradiology system diagnosis list page

Note: The different colors indicated at *Figure-5* tells you different meanings

- ✓ The **orange color** indicates that the patient image is **not commented** and the **case level is regular**. However, when the case level is **emergency** and the record is represented by **red color**.
- ✓ The **gray color** indicates that the patient image is **commented** and the case is **regular**, where as those **emergency** case records remains red despite they are **commented**.
- ✓ The red color indicates both the commented and not commented records where the case is emergency

RADIOLOGIST COMMENT AND FEED BACK

Radiologist_Comment *

No radiographic evidence of disease

GeneralFeedback

Try to improve the quality of the image when capturing

Submit

Radiology Result Submitted Successfully.

Radiologist : UoG1 UoG2

Show All

Step 8: Write the radiology report under the radiologist comment box (e.g. No radiographic evidence of disease)

Step 9: Write the feedback here if any. (E.g. try to improve the quality of the image while capturing)

Step 10: Click on submit button to **submit** your **report**

Step 11: Click on **Show All** to return back to **diagnostic list window**

Figure: web-based eX-Ray teleradiology system comment and feedback submission page

➤ To check your commented image

- Click on history and **search** the record you have given a **comment** from the diagnosis list
- Check that **date of image download**, **date of image taken** and **date difference** columns are filled properly
- In addition, make sure that particular patient status column is changed from “**Not commented**” to “**commented**”

8. Reference

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