



OralOptix

INTELLIGENT ASSESSMENT OF INTRA-ORAL RADIOGRAPH QUALITY





Problem Definition

manual review is :



time-
consuming



requires significant
expertise.



can lead to
inefficiencies



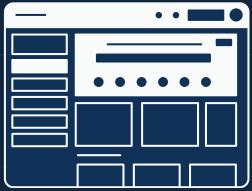
Objectives



Create a Database
of Errors



Rapid Error
Detection



Design a simple and
effective user interface



Increase the level
of diagnostic
accuracy



Educational tool
for dental
students

Aims

The project aims to create an AI-based system that automatically assess the quality of radiographic images, whether they are accepted or rejected, depending on the acceptance of intra-oral radiographs standers. In addition, it identifies the common technical errors, such as incorrect positioning, inappropriate density and contrast, and scanner-related issues.

10cm

MOTIVATION

Healthcare Improvements in Saudi Arabia

- Better outcomes, fewer complications
- Reduces human error, improves accuracy

Impact

- More efficient healthcare, reduced costs, better outcomes
- Decreased redundant radiographic exposures, improving diagnostic efficiency and patient safety.

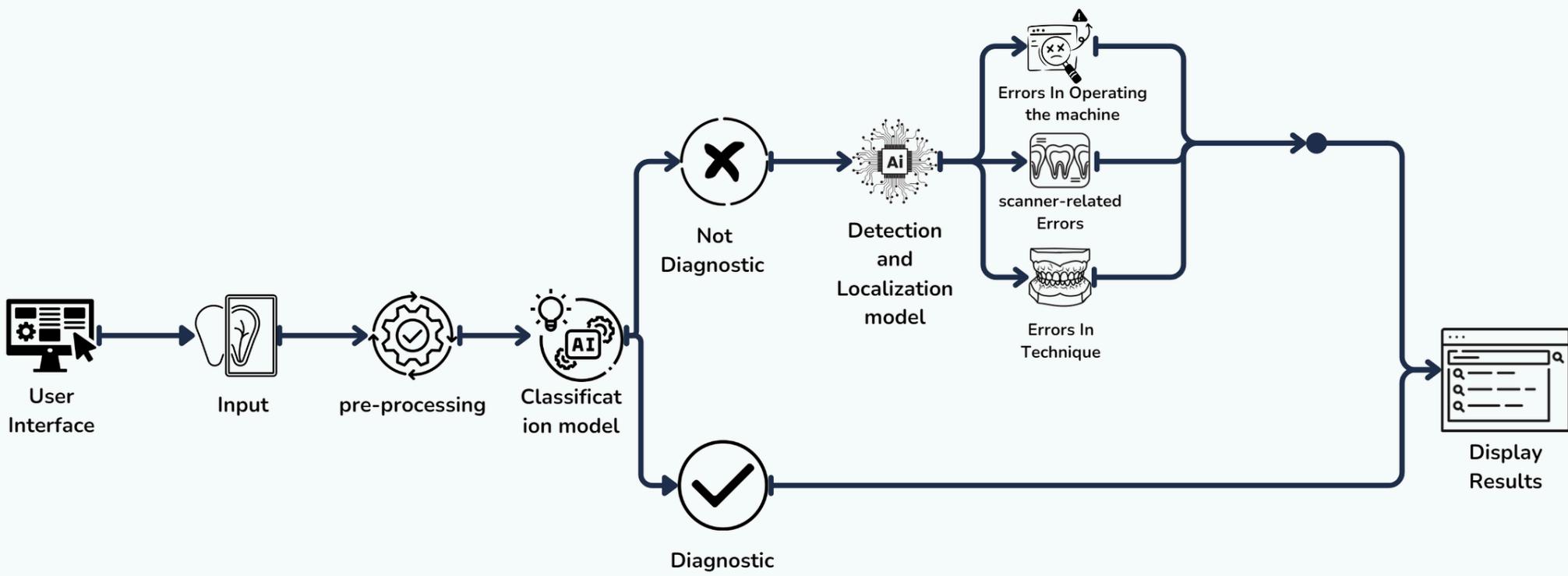
Vision 2030 Alignment

Supporting Vision 2030's focus on promoting preventive care, reducing medical errors, and utilizing advanced technologies to improve healthcare outcomes in Saudi Arabia.

10cm



Problem Solution



10cm

Data

Tabular Data:

Key Label: Diagnostic Status (3 classes):

0: Poor quality (unusable).

1: Minor issues (usable).

2: Ideal quality (suitable for diagnosis).

Other Features: Region, Area of Interest (AOI) coverage, Proximal Contact, Overlaps, Occlusal Plane Centering...

Image Data: Dental X-rays (BW-Xrays).



Tabular Data:

BW-Xrays	agnostic Stat	Region	AOI covered	proximal contacts	proximal overlap	distal plane	cenone cut (OAO)	one cut (WAO)	ratches (OAC)	ratches (WAC)	exposure (O)	exposure (W)	inner error (O)	inner error (W)	density	receptor position	of plate OAOI
s	0	2	1	0	1	0	1	1	1	1	0	0	1	1	1	1	0
4	0	1	1	0	0	0	1	1	1	1	0	1	1	0	0	1	1
5	0	2	1	0	0	0	1	0	1	1	1	1	1	1	1	1	1
6	0	1	1	0	0	0	1	1	1	1	0	0	1	1	1	1	0
7	0	2	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1
8	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1
9	0	1	1	1	-	-	1	0	1	0	0	1	1	1	1	1	0
10	0	1	1	1	-	-	0	1	1	1	1	1	1	1	1	1	1
11	2	1	1	1	-	-	1	1	1	1	1	1	1	1	1	1	1
12	1	2	1	0	1	0	1	1	1	0	1	1	1	0	1	1	1
13	0	2	1	0	0	1	1	0	1	0	0	1	1	0	0	1	0
14	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1
15	0	2	1	0	0	0	1	1	1	1	1	1	1	0	1	1	1
16	0	1	1	0	0	0	1	1	1	1	1	0	1	0	0	1	1
18	2	2	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
19	2	2	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
20	0	1	1	0	0	0	1	1	1	1	1	1	1	0	0	1	1

image Data:



Processing techniques used:

Tabular Data : Handling missing values, scaling features, encoding labels

Image Data : Resizing, normalization, and augmentation.

Train-Test Splitting : 80%-20% split.

Augmentation : Rotation, shifts, shear, zoom, flips, brightness changes.

Learning Rate Scheduling : Adaptive LR reduction.

Hyperparameter Settings:

- Consistency: Ensures fair comparison across models.

Model	Learning rate	Optimizer	Batch size	Epochs	Dropout
EfficientNet -based Model	0.001	adam	16	20	0.5
Vision Transformer (ViT)	0.001	adam	16	20	0.5
MobileNet V3Small	0.001	adam	16	20	0.5

Table 5.3: Hyperparameter Settings

AI Models

- Multimodal Approach: Combines image and tabular data for improved accuracy.
- Objective: Classify X-rays into 3 categories (0, 1, 2) based on Diagnostic Status.



- EfficientNet-based Model:

Highest training accuracy (94.73%).

Generalizes well to validation data (91.67%).

- Vision Transformer (ViT):

Slight improvement in validation accuracy (91.76%) over training (88.77%).

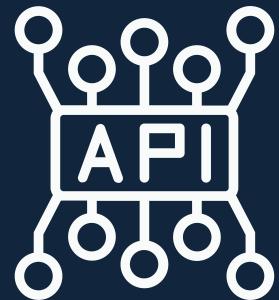
Shows robustness.

- MobileNet V3Small:

Notable drop in validation accuracy (89.25%) compared to training (93.16%).

Potential overfitting.

Back-end Implementation



API Implementation

Database Implementation



Back-end Tools

myadminphp, XAMPP



PHP



Netbeans



Database Tables

Table	Action	Rows	Type	Collation	Size	Overhead
<input type="checkbox"/> evaluation	Browse Structure Search Insert Empty Drop	5	InnoDB	utf8mb4_general_ci	32.0 KiB	-
<input type="checkbox"/> patient	Browse Structure Search Insert Empty Drop	5	InnoDB	utf8mb4_general_ci	16.0 KiB	-
<input type="checkbox"/> radiograph	Browse Structure Search Insert Empty Drop	5	InnoDB	utf8mb4_general_ci	48.0 KiB	-
<input type="checkbox"/> report	Browse Structure Search Insert Empty Drop	5	InnoDB	utf8mb4_general_ci	32.0 KiB	-
<input type="checkbox"/> user	Browse Structure Search Insert Empty Drop	6	InnoDB	utf8mb4_general_ci	16.0 KiB	-
5 tables	Sum	26	InnoDB	utf8mb4_general_ci	144.0 KiB	0 B

View Samples

	<input type="button" value="←"/> <input type="button" value="→"/>	<input type="button" value="▼"/>	UserID	Password	EmailAddress	F_name	M_name	L_name
<input type="checkbox"/>	<input type="button" value="Edit"/>	<input type="button" value="Copy"/>	<input type="button" value="Delete"/>	1111 11a_11	Aa11@gmail.com	amal	mohamed	omar
<input type="checkbox"/>	<input type="button" value="Edit"/>	<input type="button" value="Copy"/>	<input type="button" value="Delete"/>	1112 11a12_2	Aa12@gmail.com	hassan	salem	alzahrani
<input type="checkbox"/>	<input type="button" value="Edit"/>	<input type="button" value="Copy"/>	<input type="button" value="Delete"/>	1113 11c1_3	Aa13@gmail.com	khalid	saad	alqahtani
<input type="checkbox"/>	<input type="button" value="Edit"/>	<input type="button" value="Copy"/>	<input type="button" value="Delete"/>	1114 11_a14	Aa14@gmail.com	rana	yasser	khan
<input type="checkbox"/>	<input type="button" value="Edit"/>	<input type="button" value="Copy"/>	<input type="button" value="Delete"/>	1115 11a15	Aa15@hotmail.com	rasha	abdul aziz	Juffali
<input type="checkbox"/>	<input type="button" value="Edit"/>	<input type="button" value="Copy"/>	<input type="button" value="Delete"/>	1234 \$2y\$10\$IVfqqEJhZUtH5jxWljwb2OMWOAKEie89FQIP4OxNh7K	ahmed@gmail.com	AHMED	Omar	basha

	<input type="button" value="←"/> <input type="button" value="→"/>	<input type="button" value="▼"/>	EvaluationID	ErrorsDetected	Suggestions	Classification	RadioID
<input type="checkbox"/>	<input type="button" value="Edit"/>	<input type="button" value="Copy"/>	<input type="button" value="Delete"/>	1	positioning error placing the receptor in the same horizontal plane ...	Not diagnosable	2
<input type="checkbox"/>	<input type="button" value="Edit"/>	<input type="button" value="Copy"/>	<input type="button" value="Delete"/>	2	receptor orientation error The receptor must be placed straight or perpendicu...	Not diagnosable	4
<input type="checkbox"/>	<input type="button" value="Edit"/>	<input type="button" value="Copy"/>	<input type="button" value="Delete"/>	3	positioning error placing the receptor in the same horizontal plane ...	diagnosable	1
<input type="checkbox"/>	<input type="button" value="Edit"/>	<input type="button" value="Copy"/>	<input type="button" value="Delete"/>	4	scanning errors the central ray must pass through the proximal sur...	Not diagnosable	3
<input type="checkbox"/>	<input type="button" value="Edit"/>	<input type="button" value="Copy"/>	<input type="button" value="Delete"/>	5	receptor orientation error Proximal overlap in the outer half of the enamel.	Diagnostic with errors	5

Front-End Implementation

A web-based system for assessing intra-oral radiographs



Key Features of the Front-End

A cartoon illustration of a doctor with purple hair and glasses, wearing a white coat and a purple bow tie. He is smiling and has a stethoscope around his neck. He is positioned in front of a dark blue background with white clouds.

01 User-Friendly Interface

Simple and easy to navigate.

02 Smooth Navigation

Guided workflow with step-by-step interactions.

03 Interactive Elements

Buttons, form validation, and dynamic UI updates.

04 Responsive Design

Works across different screen sizes.

Technologies Used



HTML

Structures content (forms, buttons, images).



JavaScript

Adds interactivity (real-time validation, smooth transitions).



CSS

Enhances the design and layout for readability.



VS Code

A code editor used for development, offering debugging tools and extension support.

System Workflow

Sign-Up & Login



OralOptix

Full Name

Email

Password

Confirm Password

Sign Up

Already have an account?
Log In



OralOptix

User ID or Email

Password

Log In

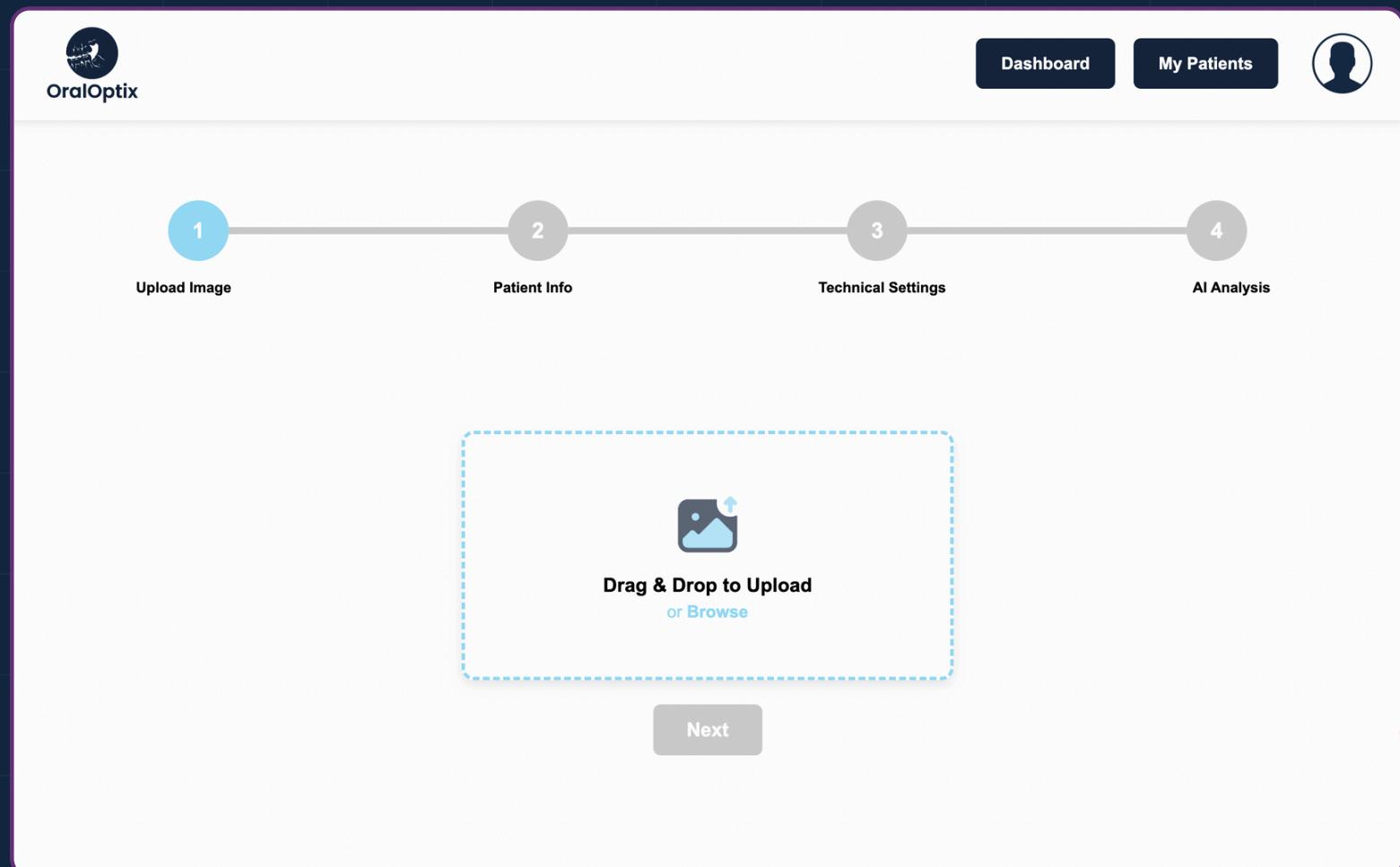
Forgot Password?

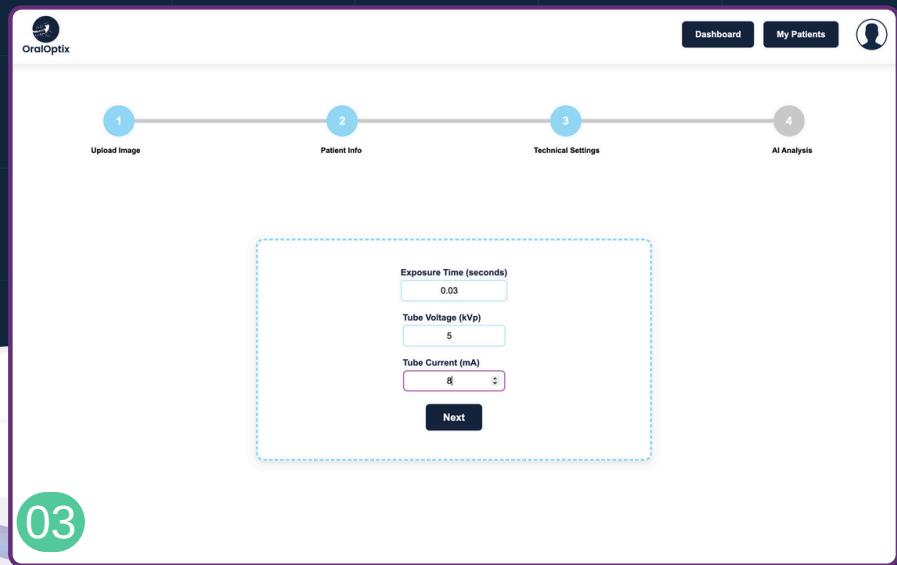
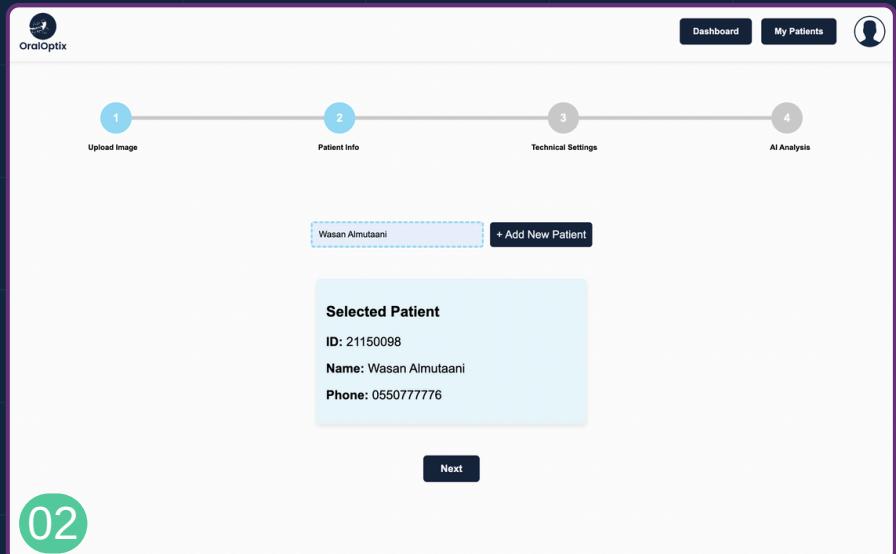
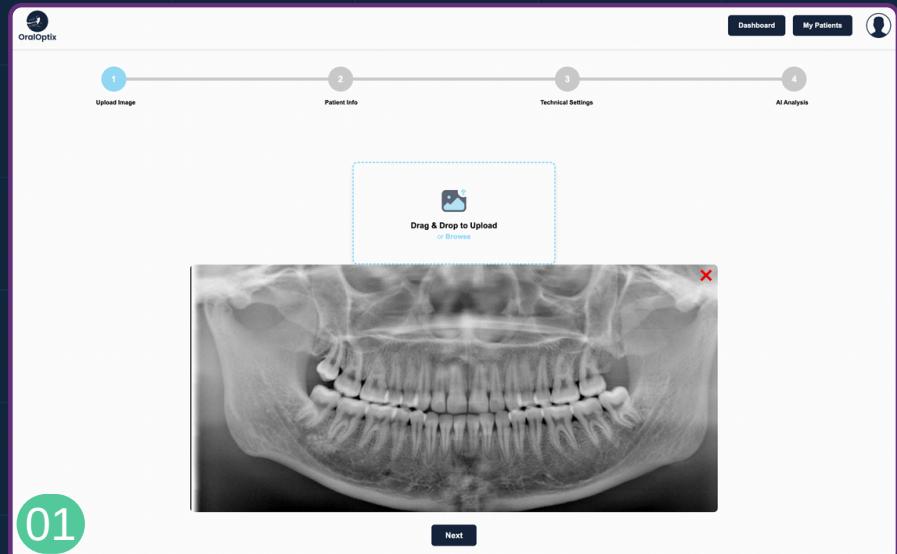
Don't have an account? [Sign Up](#)



System Workflow

Dashboard





System Workflow

Results Page

OralOptix

1 Upload Image 2 Patient Info 3 Technical Settings 4 AI Analysis

Dashboard My Patients



Classification

Non-Diagnostic

Errors Detected

- Technique Errors Receptor orientation Suggested Ignore
- Machine Operation Errors Inappropriate kVp/mA settings Suggested Ignore
- Scanning Errors Artifacts from Removable Suggested Ignore

Technical Settings

- mA setting 1
- kVp setting 1
- Exposure time 0.02

Generate Report



System Workflow

Report Page

REP-75676.pdf
Page 1 of 2

REP-75676.pdf

1

2

Medical Imaging Center
Department of Radiology
Radiograph Quality Assessment Report
Report ID: REP-75676 | Date: 2/23/2025, 11:53:45 PM

1. Patient Information

Attribute	Details
Patient Name	Wasan Almuttaani
Patient ID	21150098
Radiograph ID	RAD-6856
Radiograph Type	Bitewing
Examined by	Dr. John Smith

2. Radiograph Classification

Classification Status	Result
Diagnostic Status	Non-Diagnostic

3. Technical Imaging Parameters

Parameter	Value
Exposure Time (ms)	0.03
Kilovolt Peak (kVp)	4
Milliamperere (mA)	3

4. AI-Generated Corrective Actions

Suggested Correction
Optimize exposure time to recommended levels.
Ensure correct patient positioning.



System Workflow

Report Page

Medical Imaging Center
Department of Radiology
Radiograph Quality Assessment Report
Report ID: REP-33083 | Date: 2/25/2025, 1:50:12 AM

1. Patient Information

Attribute	Details
Patient Name	Wasan Almutaani
Patient ID	21150098
Radiograph ID	RAD-1607
Radiograph Type	Bitewing
Examined by	Dr. John Smith

2. Radiograph Classification

Classification Status	Result
Diagnostic Status	Non-Diagnostic

3. Technical Imaging Parameters

Parameter	Value
Exposure Time (ms)	0.02
Kilovolt Peak (kVp)	2
Milliampere (mA)	1

4. AI-Generated Corrective Actions

Suggested Correction
Optimize exposure time to recommended levels.
Ensure correct patient positioning.

- Patient Information
- Classification Results
- Technical Parameters
- Detected Errors
- AI-Suggested Corrections
- Save, Share, and Print

System Workflow

Patient Management Page



All Patients

Show 10 entries

ID	First Name	Last Name	Mobile No.	Sex	Action
11234567	Airi	Satou	658543469	Male	
11234567	Angelica	Ramos	658543469	Female	
11234567	Ashton	Cox	658543469	Male	
11234567	Bradley	Greer	658543469	Male	
11234567	Brenden	Wagner	658543469	Male	
11234567	Brielle	Williamson	658543469	Female	
11234567	Bruno	Nash	658543469	Male	
11234567	Caesar	Vance	658543469	Male	
11234567	Cara	Stevens	658543469	Female	
11234567	Cedric	Kelly	658543469	Male	

Previous

Showing 1 to 10 of 20 entries

Next

Dashboard My Patients

New Patient

Search: Type to search...

ID First Name

Middle Name Last Name

Gender Age

Phone Number

Upload a file or enter patient medical details here.

Upload File

Save



System Workflow

Patient
Management Page



System Workflow

User Profile Page



OralOptix

Dashboard My Patients 



User Profile

ID

Middle Name

Email Address

First Name

Last Name

Password

Save



Future Work

Enhance

AI model

Complete

the back-end

Test

and evaluate the system



Thanks

Do you have any questions ?