

AUTOMATIC CLASSIFICATION OF THE PRELIMINARY DIABETIC RETINOPATHY STAGES

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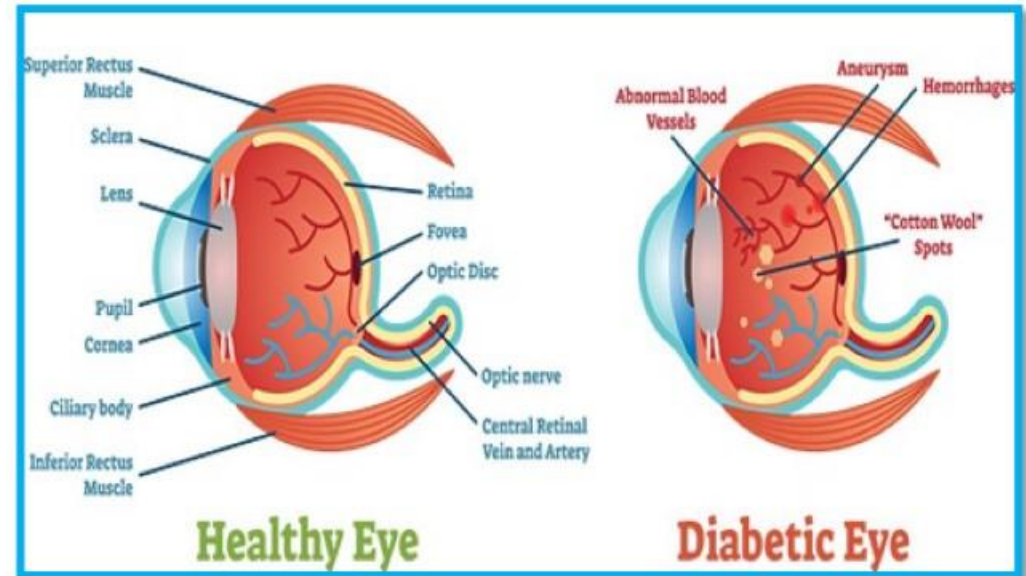
Supervised By : Dr. alaa hamdy, ENG. Yomna Ibrahim

OUTLINE

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INTRODUCTION

- **Too much sugar** in the blood, can cause damage throughout the body, including the eyes [1].
- **One third** of people suffering from Diabetes Mellitus are expected to also be diagnosed with **Diabetic Retinopathy** [2].
- **Diabetic Retinopathy** is a retinal disease that is caused by too much sugar in the blood, over an extensive period of time.



- Healthy Vs. Diabetic Eye

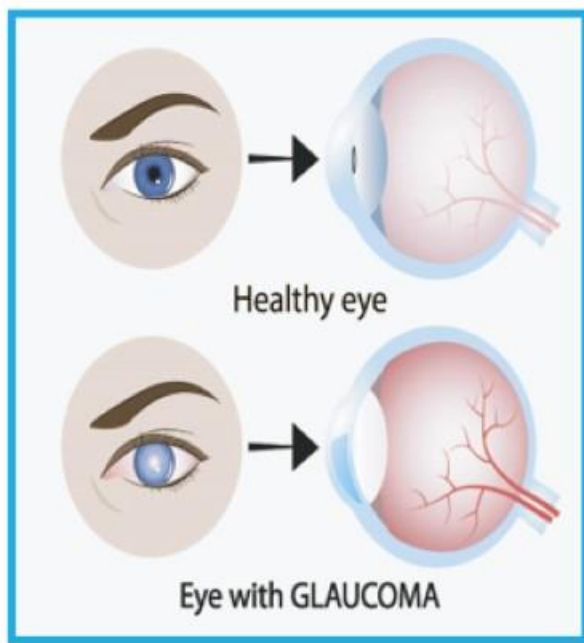
[1] "Diabetic Retinopathy." Mayo Clinic, Mayo Foundation for Medical Education and Research, 30 May 2018, <https://www.mayoclinic.org/diseases-conditions/diabetic-retinopathy/symptoms-causes/syc-20371611>. Accessed 8 Oct. 2019.

[2]- Lee, Ryan, Tien Y. Wong, and Charumathi Sabanayagam. "Epidemiology of diabetic retinopathy, diabetic macular edema and related vision loss." Eye and vision 2.1 (2015): 17.

CHALLENGES

- **Diabetic Retinopathy** can eventually evolve and lead to more severe complications, such as total **blindness** and/or **Glaucoma**.

- **Manual** Classification of (**DR**) is not always accurate.



- Eye Affected By Glaucoma



- RetCam 3

SUPPORTIVE DOCUMENT

Re: Diabetic Retinopathy project



Dina Hossam <drdhossam@yahoo.com>



10/2/2019 9:45 PM

To: Mohamed Mohamed Alaa Eldine Hanafi Mohamed

Dear Mohamed

It is my pleasure supervising your valuable project and i am willing to provide you with any information needed about Diabetic Retinopathy, which is considered one of the most prevalent preventable eye diseases in Egypt and the middle east. The success of setting a comprehensive screening and management program for Diabetic Retinopathy in Egypt will definitely have an extremely positive impact on the rates of blindness among the Egyptian population.

Good luck in your project and best wishes.

Dr. Dina Hossam Hassanein, MD, FRCS
Assistant Professor of Ophthalmology
Cairo University

OBJECTIVE

- **Automatically** Detecting the presence of Diabetic Retinopathy and **Classifying** the different **Stages** of the disease in the patient's body.
- We aim to **minimize** and reduce the **inaccurate** and erroneous diagnosis of (DR), and increase the classification **accuracy** rate among the **four** different stages of the disease.

FUNCTIONAL REQUIREMENTS 1/2



Doctor

- Login
- View/Search Patients
- Upload Images
- Classify
- Print Report
- Suggested Stage



Admin

- Login
- CRUD Users



Patient

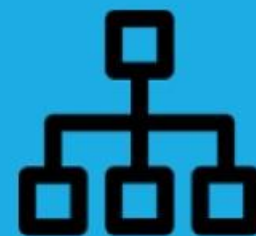
- Login
- View Reports

FUNCTIONAL REQUIREMENTS 2/2



Pre-Processing

- Normalize Images



Classification

- Classify With CNN
- Retrain Model

NON-FUNCTIONAL REQUIREMENTS



Security



- Data Stored In Database
- Encryption using (Sha1 & Md5) algorithms



Reliability



- Accuracy & Precision
- Training and Testing on a Huge dataset



Performance



- Minimal Delays
- Action-Per-Response < 1s



Maintainability



- Design Patterns (MVC, Singleton, Facade)



Usability



- Intuitive, User-Friendly View

DESIGN PATTERNS

MVC

- Separating functions and methods from layout and design, and binding them together by a single controller. (Model – View – Controller)
- Assists in implementing and applying **Maintainability**.

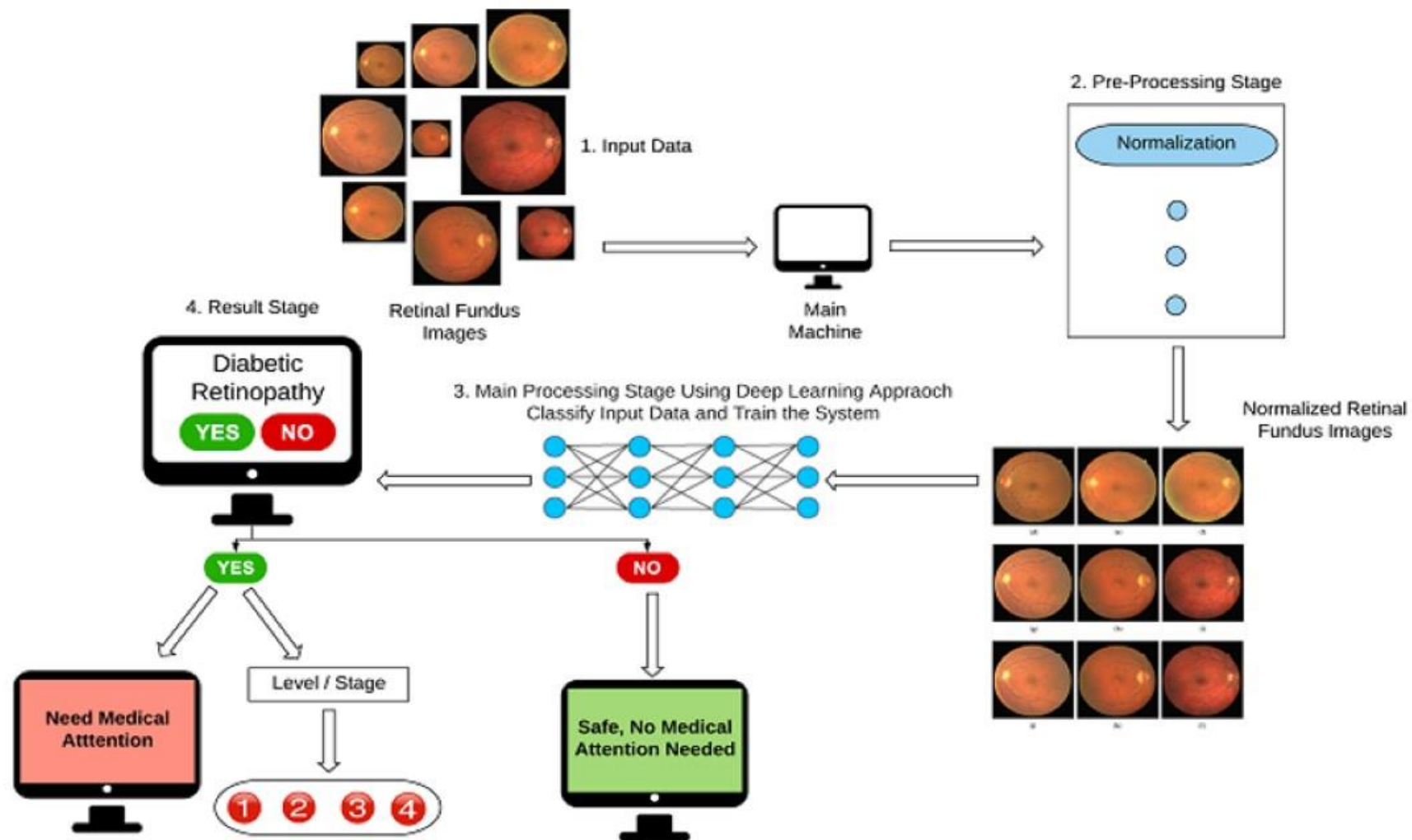
Singleton

- Allowing only a **single** connection to the database, and closing all other connections.
- Assists in implementing and applying **Performance**.

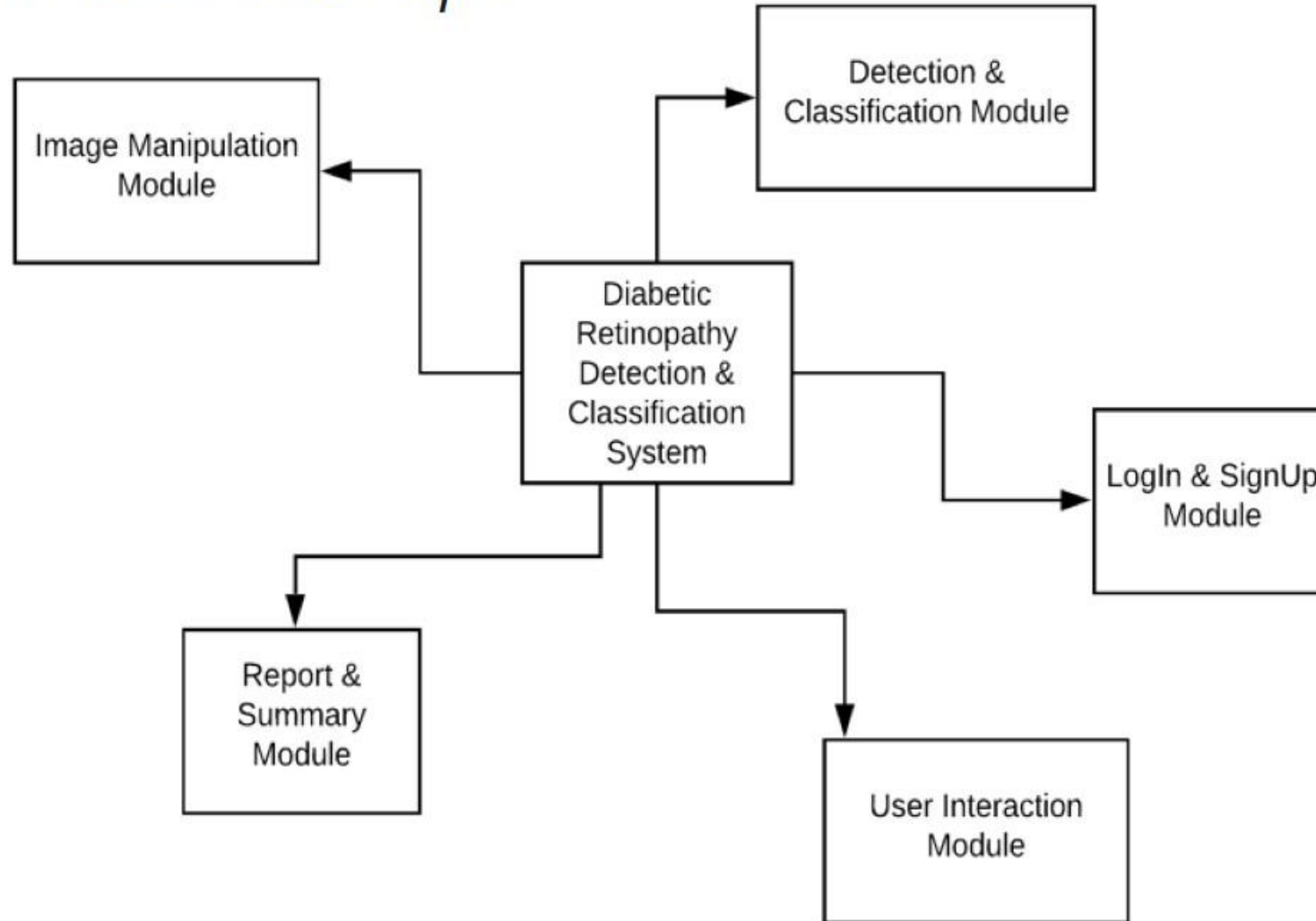
Facade

- Simplifying complex systems, such as PHPMailer, so as to be able to send notifications to the patients, via Email.
- Assists in implementing and applying **Maintainability**.

SYSTEM OVERVIEW

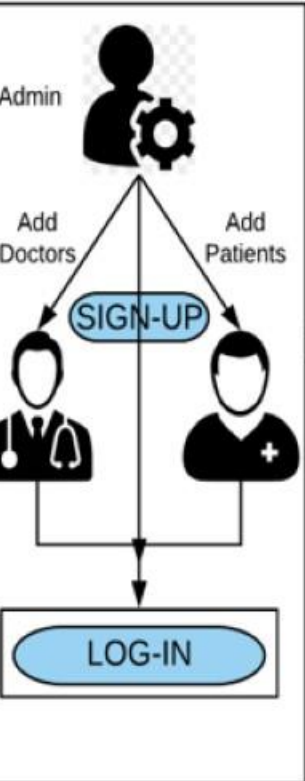


BLOCK DIAGRAM 1/2



BLOCK DIAGRAM 2/2 (EXTENDED)

LogIn & SignUp Module



Data Acquisition Module

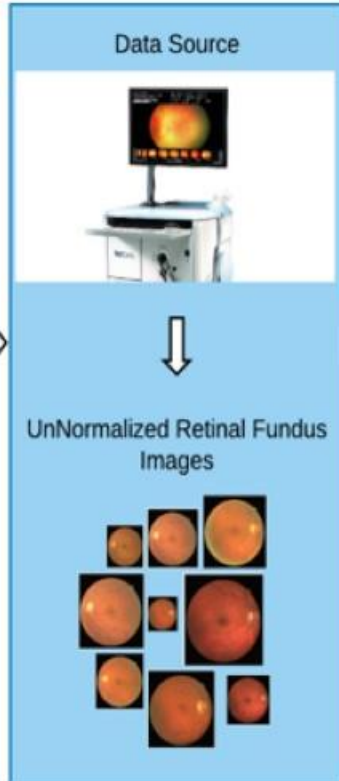
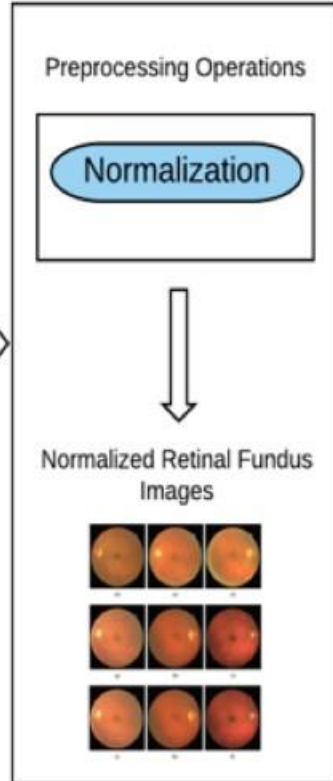
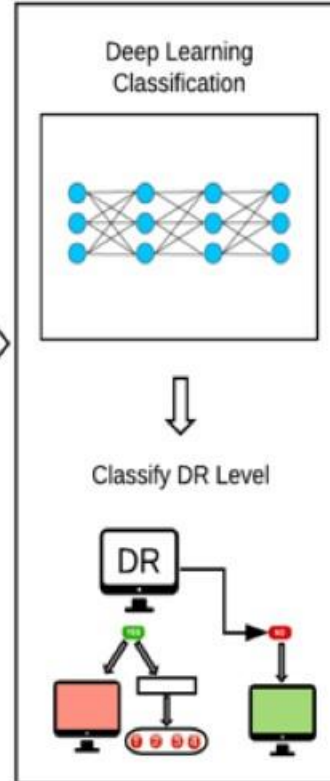


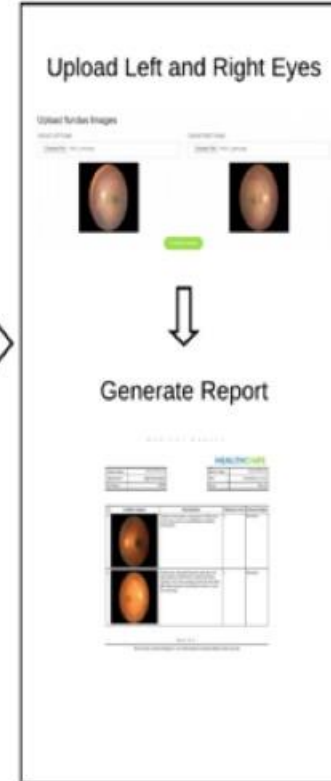
Image Manipulation Module



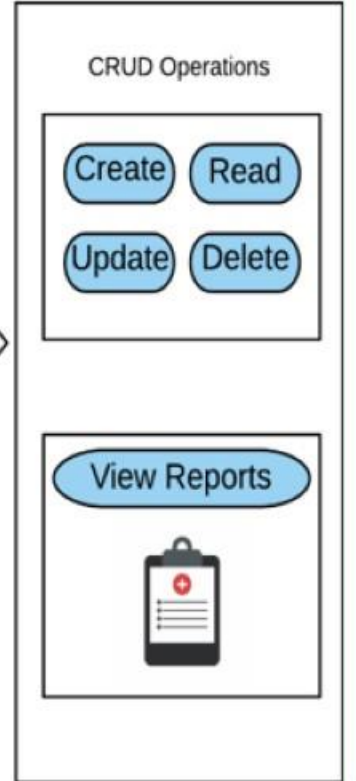
Detection & Classification Module



Report & Summary Module

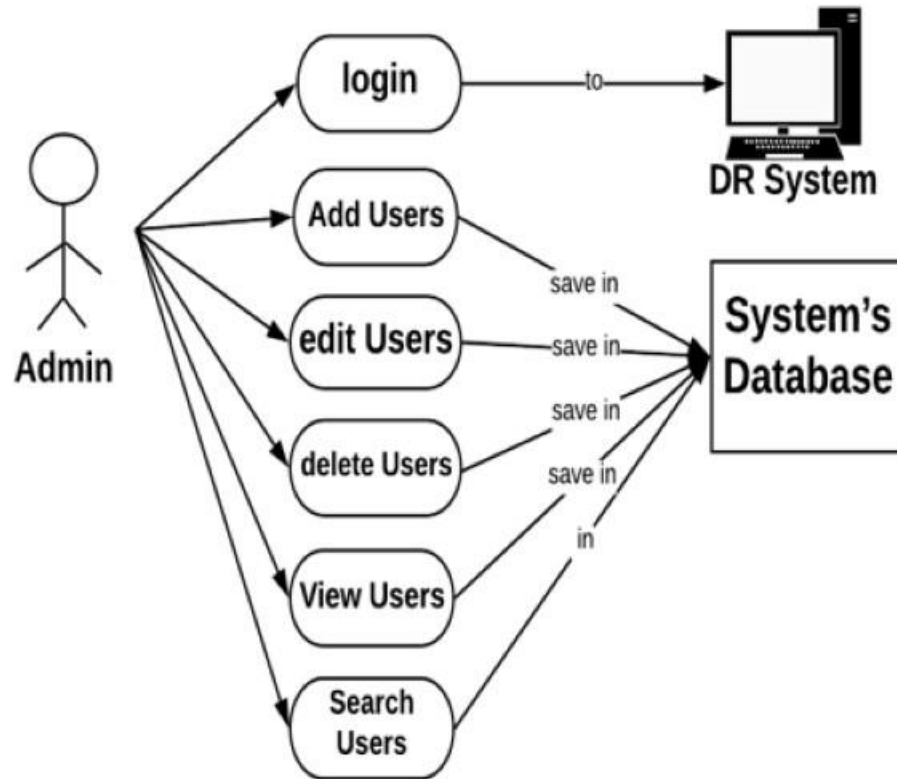


User Interaction Module

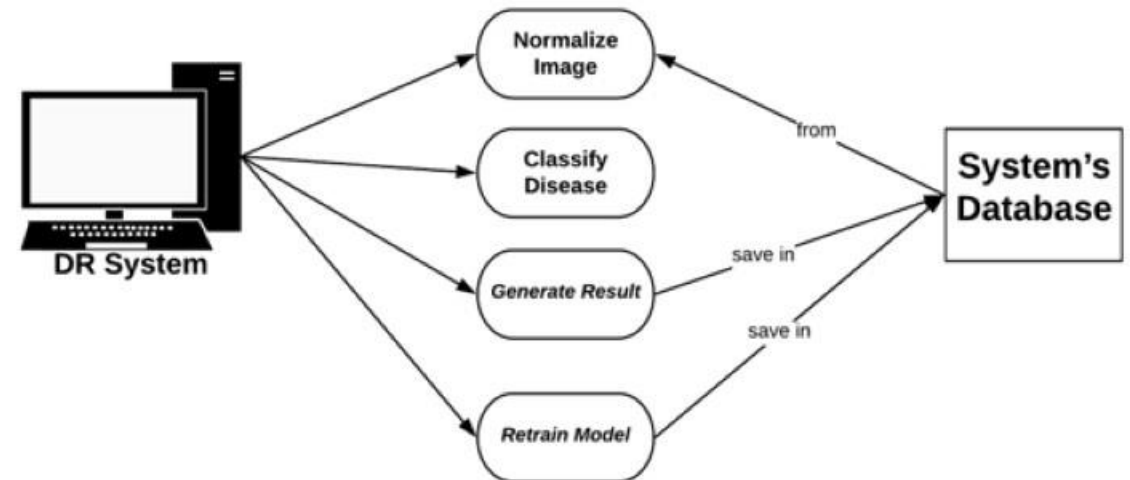


USE CASES 1/2

Admin Scenario

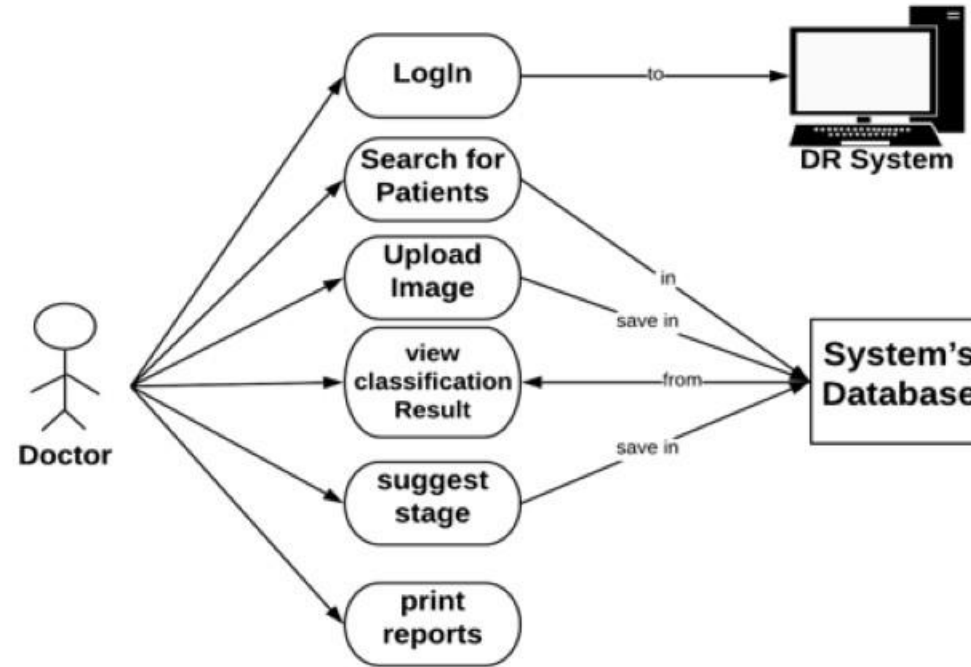


DR System Scenario

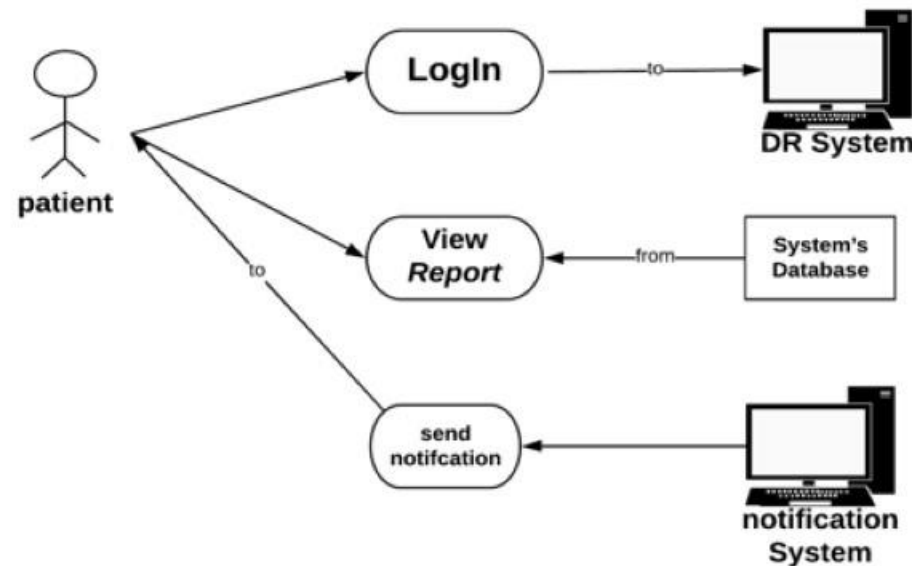


USE CASES 2/2

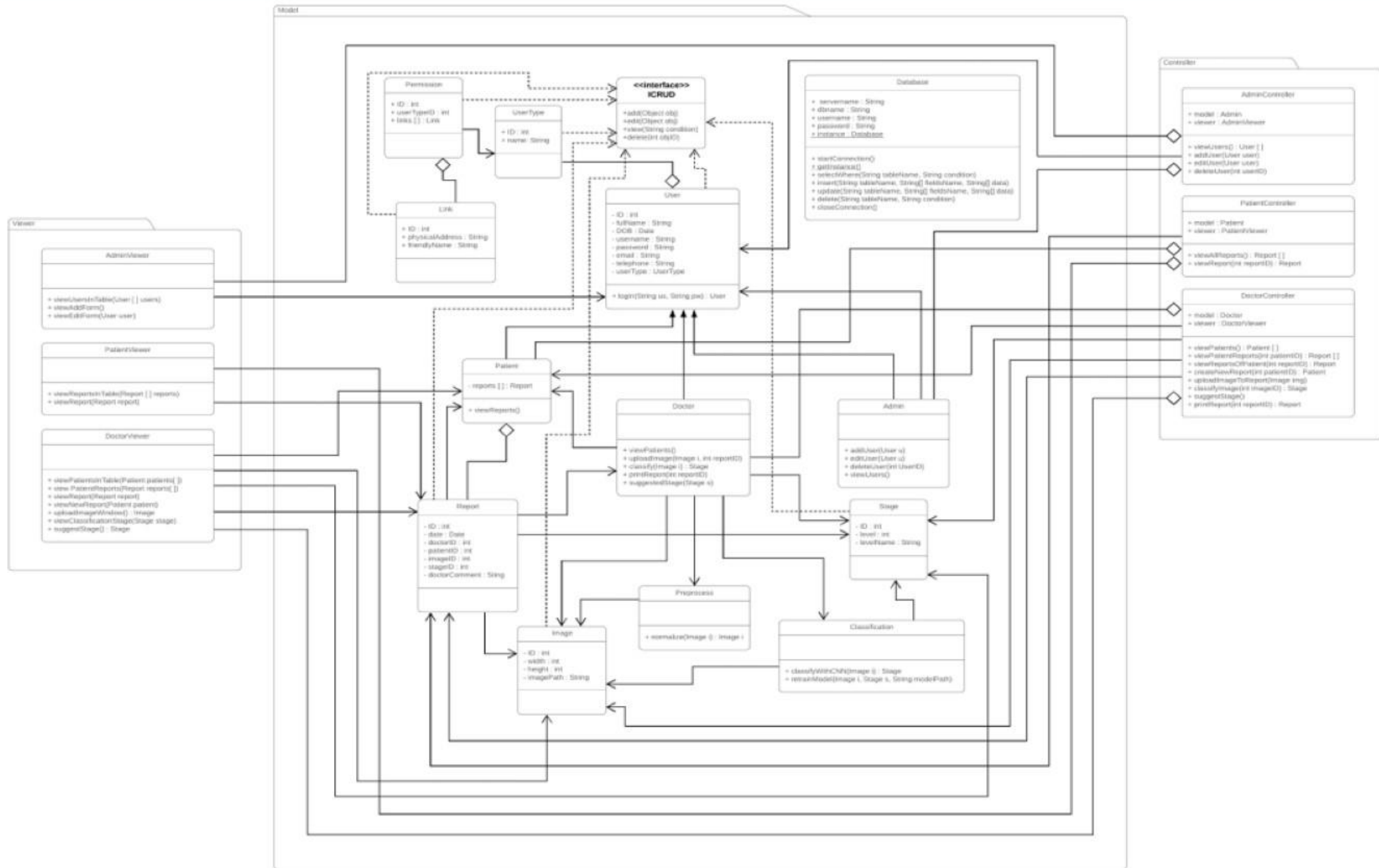
Doctor Scenario



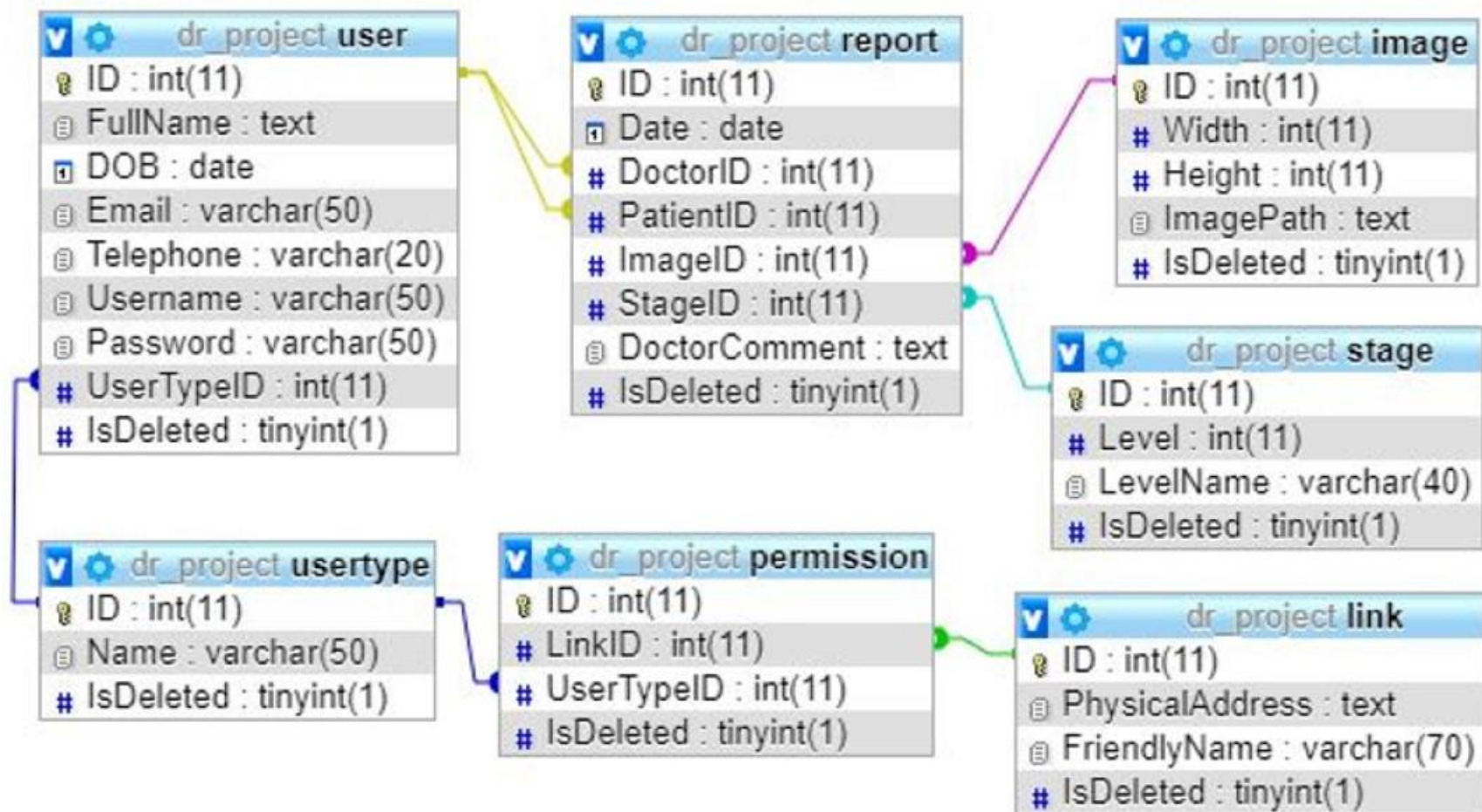
Patient Scenario



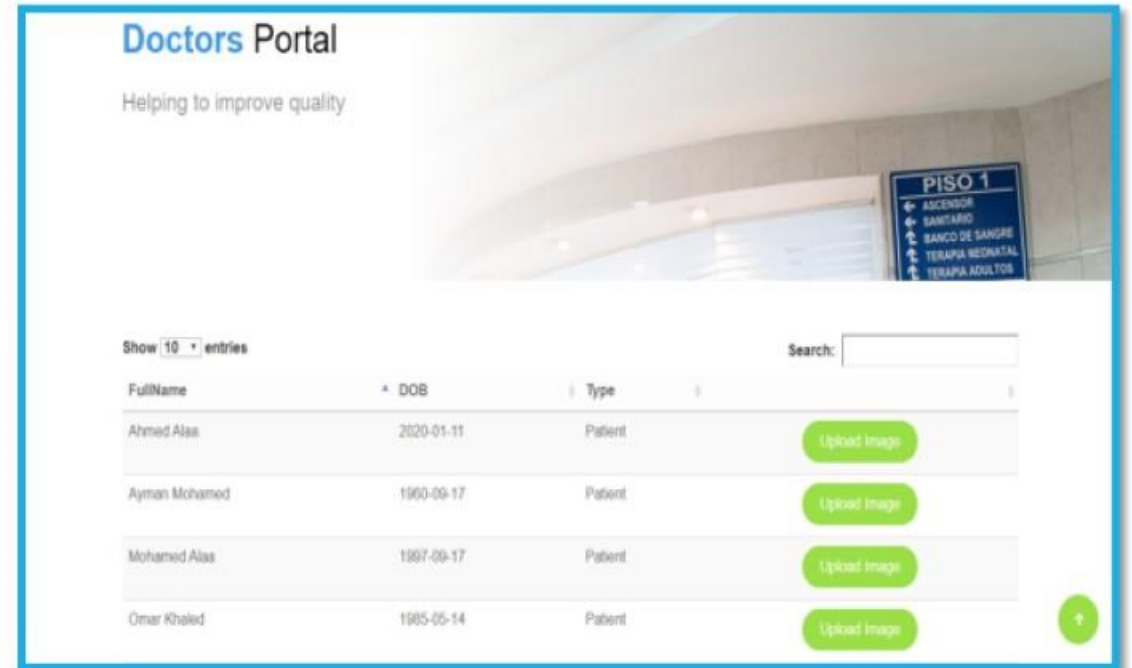
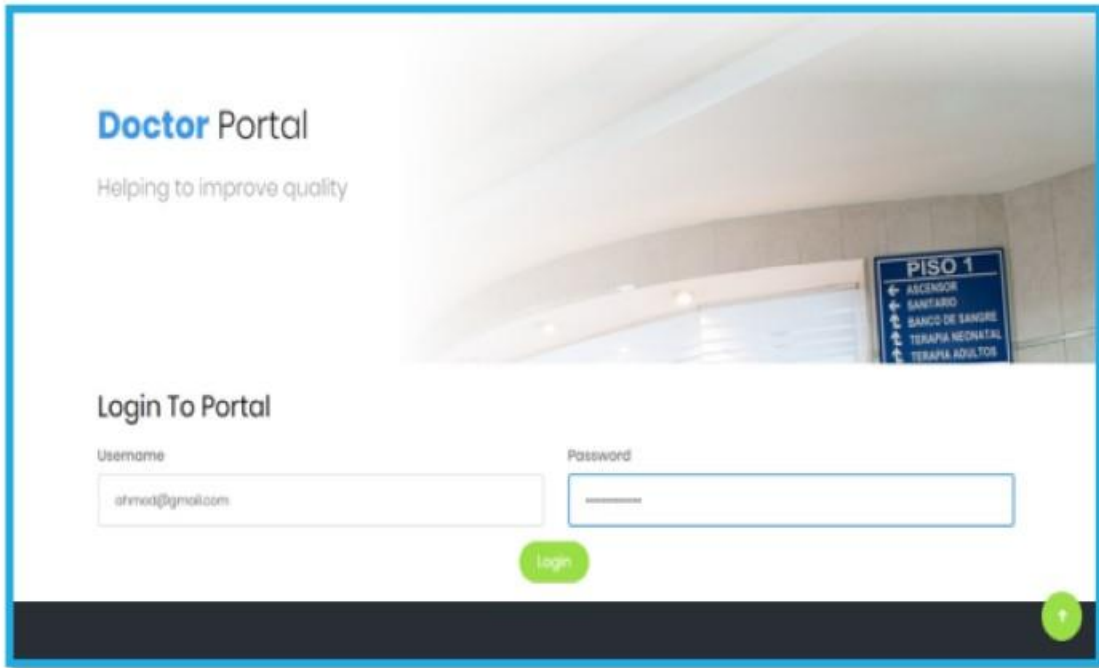
CLASS DIAGRAM



DB SCHEMA



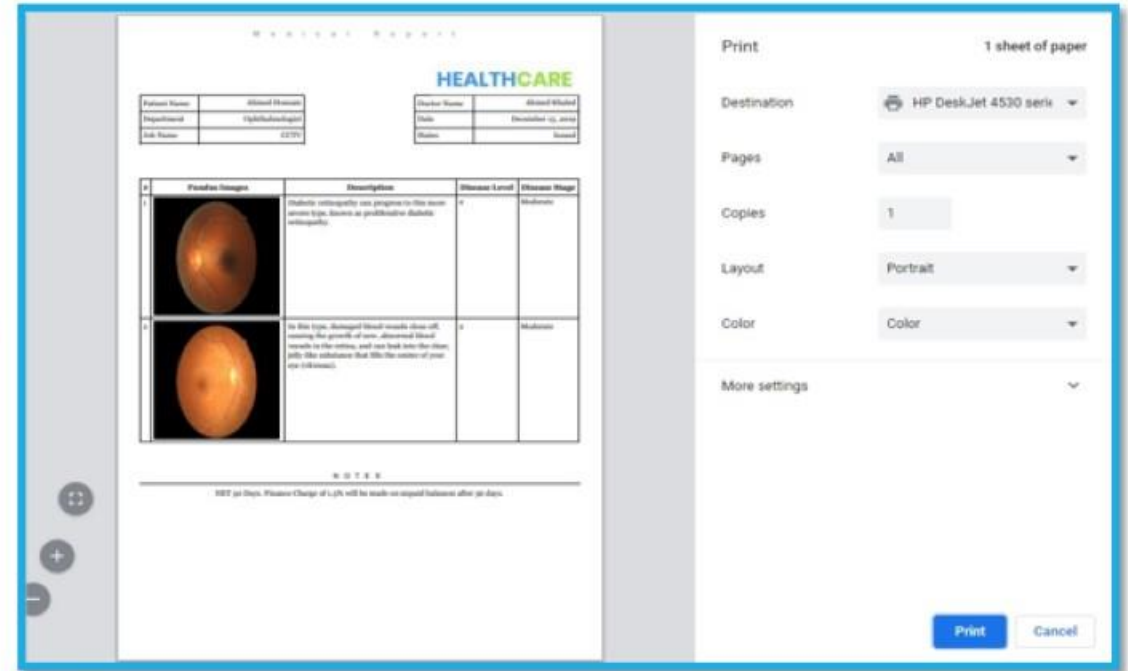
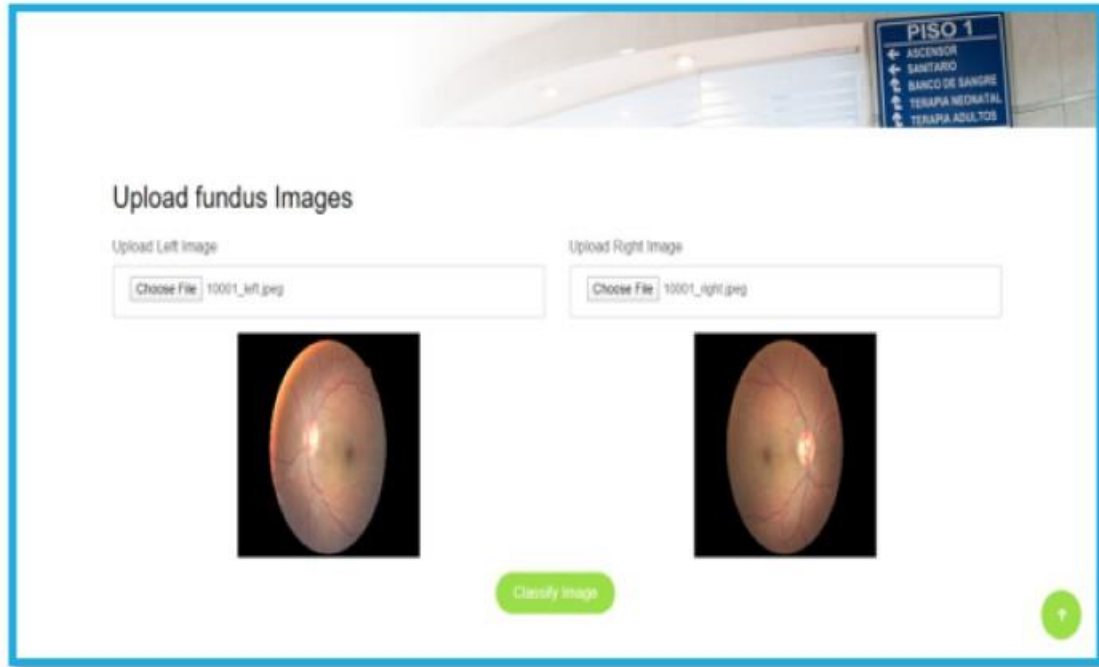
WIREFRAMES (GUI) 1/3



Doctor / Patient - Log-In Portal

Doctor - Main Homepage

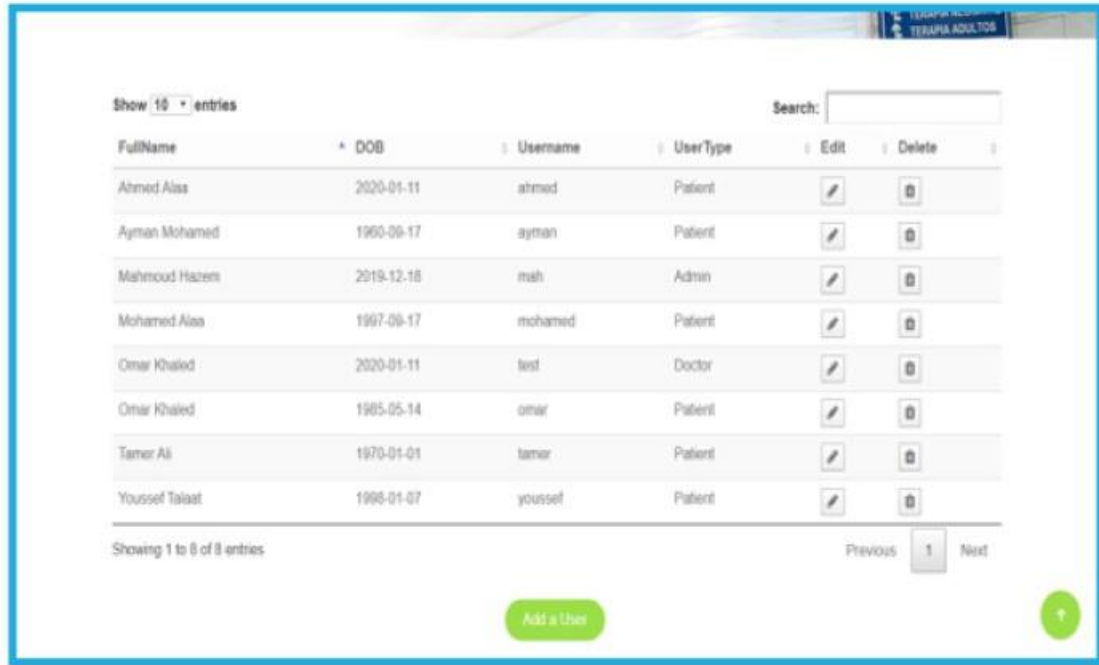
WIREFRAMES (GUI) 2/3



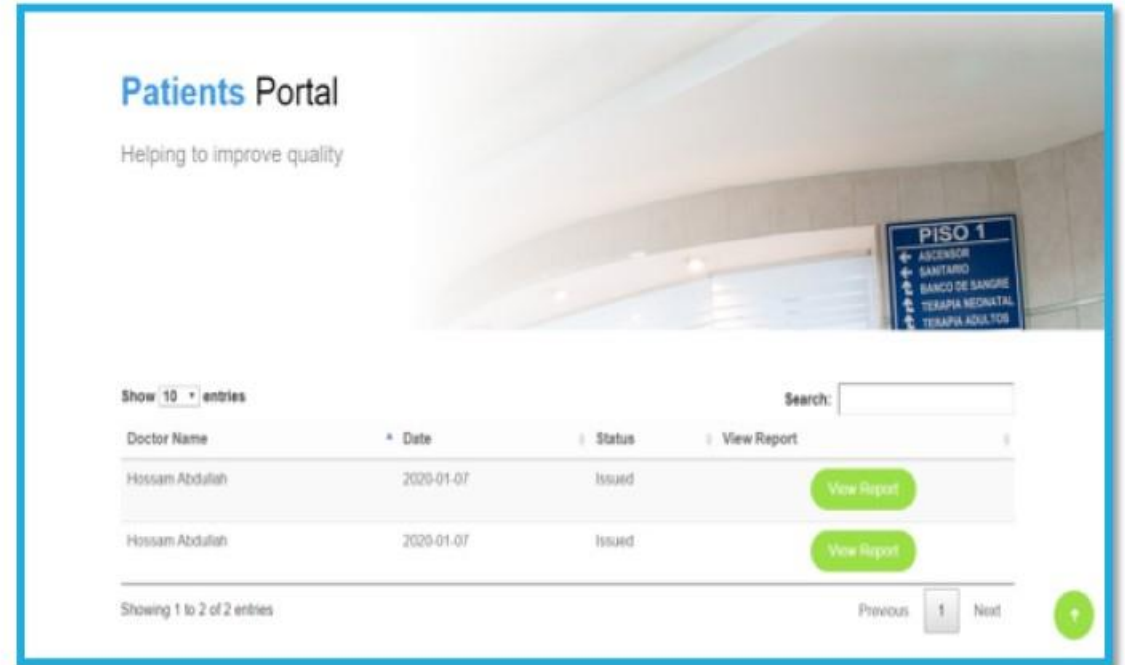
Doctor – Upload Retinal Fundus Images (L/R)

Doctor – Generate Report

WIREFRAMES (GUI) 3/3



Admin – Main Homepage



Patient – Main Homepage

RESEARCH PAPER

2020 9th International Conference on
Software and Information
Engineering
(ICSIE 2020)

ICSIE  **2020**

DEMO



Guaranteed **safe & potent** Medicine

Separated they live in Bookmarksgrove right at the coast of the Semantics, a large language ocean.

RESULTS 1/2

Imbalanced Dataset

Class 0	65,343
Class 1	6,205
Class 2	13,153
Class 3	2,087
Class 4	1,914
Total	88,702

Balanced Dataset

Class 0	1,914
Class 1	1,914
Class 2	1,914
Class 3	1,914
Class 4	1,914
Total	9,570

Balanced Dataset (Augmented)

Class 0	7,656
Class 1	7,656
Class 2	7,656
Class 3	7,656
Class 4	7,656
Total	38,280

Images used from dataset = 25,518 image.

Total Images after Augmentation = 38,280 image.

RESULTS 2/2

		True Labels				
		Class 0	Class 1	Class 2	Class 3	Class 4
Predicted Labels	Class 0	43%	31%	25%	1%	0%
	Class 1	30%	47%	22%	1%	0%
	Class 2	30%	22%	46%	2%	0%
	Class 3	3%	8%	16%	25%	48%
	Class 4	0%	0%	0%	0%	100%

Overall Accuracy = 52.2%

A complex network diagram with various sized nodes in blue, black, and grey, connected by thin grey lines. Some nodes are highlighted with larger circles. The background is light grey with faint circular patterns.

ANY QUESTIONS ?

A complex network diagram with various sized nodes in blue, black, and grey, connected by thin grey lines. The nodes are scattered across the page, with some larger nodes having smaller nodes connected to them, creating a web-like structure. The background is white with some faint, larger circular shapes in light blue and grey.

THANK YOU