A Framework for Implementation of Cervical Dysplasia Prediction using Cervigram images

A Project Report Submitted to Cotton University in Partial Fulfilment of the Requirements for the Degree of
Master of Computer Application (MCA)

In the Department of Computer Science and Information Technology By

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MCA2065032

MCA 4th Sem

Under the Guidance of

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.

CERTIFICATE

This is to certify that the project entitled ***"A Framework for Implementation of Cervical Dysplasia Prediction using Cervigram images"*** submitted by **Prithwish Bhowmick** for the award of the degree of **Master of Computer Application (MCA)** in the Department of Computer Science and Information Technology is the outcome of a bona fide project work under my supervision. This work has not been submitted previously for any other degree at this or any other University. It is further certified that the candidate has complied with all the formalities as per the requirements of Cotton University, Guwahati-01. I recommend that the project report may be accepted in partial fulfilment of the requirements for the degree of MCA of this University.

Dr Himanish Shekhar Das
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CERTIFICATE

The Project Report entitled "***A Framework for Implementation of Cervical Dysplasia Prediction using Cervigram images***" submitted by **Prithwish Bhowmick (MCA2065032)** in partial fulfilment of requirements for the degree of **Master of Computer Application (MCA)** of Cotton University has been examined.

Signature of Internal Examiner
Date:
Place:

Signature of External Examiner
Date:
Place:

DECLARATION

I, **Prithwish Bhowmick**, bearing MCA Enrollment No.:***MCA2065032*** hereby declare that the subject matter of the project entitled ***"A Framework for Implementation of Cervical Dysplasia Prediction using Cervigram images"*** is the record of work done by me under the guidance of **Dr Himanish Shekhar Das**, Department of Computer Science and Information Technology, Cotton University, Guwahati-01, Assam. I further declare that the contents of this project report did not form the basis for the award of any degree to me or to anybody else to the best of my knowledge. The report has not been submitted to any other University or Institution. This report is being submitted to Cotton University, Guwahati-01 for the degree of MCA in the Department of Computer Science and Information Technology.

Place:
Date:

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I would also like to take this opportunity to thank **Elima Hussain** maam**,** Institute of Advanced Studies in Science and Technology and **RogNidaan Technologies Pvt.Ltd.** for the guidance and constant supervision as well as for providing necessary information regarding the project and also for their support in completing the project.

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I remember forever my father **Prabir Bhowmick** for all his motivation and help to reach a greater position in my life. I am also very much thankful to my mother **Namita Bhowmick** and other family members for their infinite love, motivation, suggestions and support.

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ABSTRACT OF THE PROJECT

In this project "***A Framework for Implementation of Cervical Dysplasia Prediction using Cervigram images***" I have to develop a Deep Learning model based on Image Classification. The model used, in this project is MobileNet.MobileNet is a lightweight-based deep learning CNN model.

After the Training, Validation, and Testing of the model, we have to deploy the CNN model in a server which is Django. Django is a python based framework used in the backend server. And for the frontend part, we are using Flutter, which is a Mobile Application Development framework for Android and IOS. It means using flutter we have to write one code base but it will work on two different Operating systems.

So, Now we have to create a Hospital management system to deploy the model in real-world scenarios. The hospital management system has HospitalAdmins, doctors, patients and SuperAdmin. SuperAdmin is the superuser of this system which manages HosptialAdmins. Super admin can approve, delete, update, and perform other operations to maintain the system. Hospital Admin is the admin of a particular Hospital and he manages and approves doctors through his dashboard. Doctors are the main important part of this system. Doctors can add patients, upload images of cancer-related images into the database and generate reports for the patient.

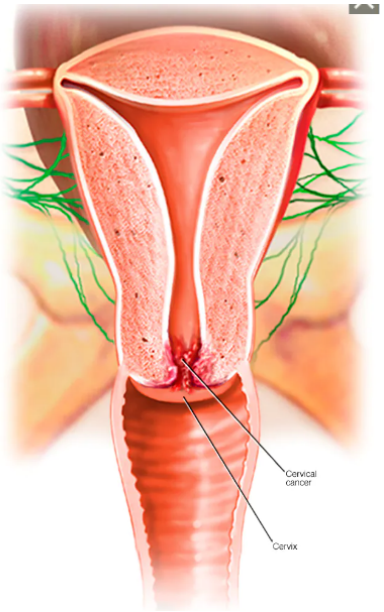
Chapter 1: Introduction

1.1 Cervical cancer and scenario in NE, India

It is a malignant tumour of the lowermost part of the uterus (womb) that can be prevented by PAP smear screening and an HPV vaccine. It's a type of cancer. Various strains of the human papillomavirus (HPV), a sexually transmitted infection, play a role in causing most cervical cancer.

Typical cervical cancer symptoms are

- Unusual bleeding, such as in between periods, after sex, or after menopause
- Vaginal discharge that looks or smells different than usual
- Pain in the pelvis
- Needing to urinate more often
- Pain during urination



Scenario in NorthEast

In India, cervical cancer contributes to approximately 6–29% of all cancers in women. The age-adjusted incidence rate of cervical cancer varies widely among registries; the highest is 23.07/100,000 in Mizoram state and the lowest is 4.91/100,000 in Dibrugarh district. The pooled estimates of sensitivity and specificity of visual inspection with acetic acid (VIA), magnified VIA, visual inspection with Lugol's iodine (VILI), cytology (Pap smear), and human papillomavirus DNA were found to be 67.65% and 84.32%, 65.36% and 85.76%, 78.27% and 87.10%, 62.11% and 93.51%, and 77.81% and 91.54%, respectively.

1.2 Early screening tests available

The best way to find cervical cancer early is to have regular screening tests. The tests for cervical cancer screening are the HPV test and the Pap test. These tests can be done alone or at the same time (called a co-test). Regular screening has been shown to prevent cervical cancers and save lives. The most important thing to remember is to get screened regularly, no matter which tests you get. Early detection greatly improves the chances of successful treatment of pre-cancers and cancer. Being aware of any signs and symptoms of cervical cancer can also help avoid delays in diagnosis.

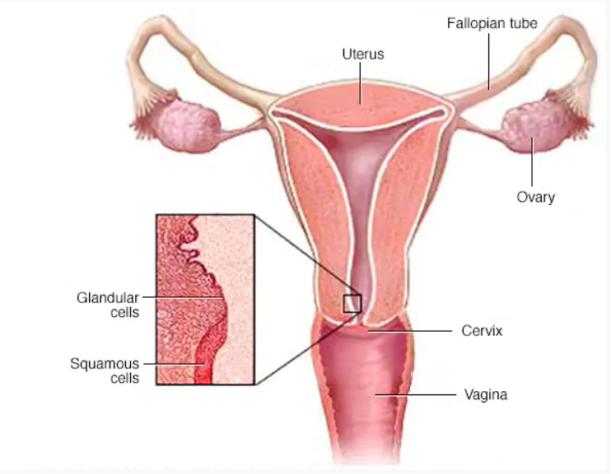
1.3 Significance of Visual inspection using acetic acid and Lugol’s iodine (VIA/VILI)

Naked-eye visual inspection of the uterine cervix, after application of 5% acetic acid (VIA) and/or of Lugol’s iodine (VILI), provides simple tests for the early detection of cervical precancerous lesions and early invasive cancer. VILI is similar to Schiller's iodine test, which was used for the early detection of cervical neoplasia in the third and fourth decades of the 20th century but was discontinued after the advent of cervical cytology testing. The potential difficulties in implementing cervical cytology-based screening in low-resource settings have prompted the investigation of the accuracy of alternative low-technology tests such as VIA and VILI in the early detection of cervical neoplasia. The results of VIA and VILI are immediately available and do not require any laboratory support. The categorization of the results of VIA or VILI depends upon the colour

changes observed on the cervix. A clear understanding of the anatomy, physiology and pathology of the cervix is absolutely essential to understanding the basics and interpreting the outcome of screening using VIA and VILI. The objective of this manual is to help a range of healthcare providers such as doctors, nurses, midwives and health workers to acquire the skills and competence in administering and reporting the results of these tests by describing their basis and practice.

1.4 Cervical intraepithelial lesion and its early diagnosis procedure

Abnormal cells are found on the surface of the cervix. Cervical intraepithelial neoplasia is usually caused by certain types of human papillomavirus (HPV) and is found when a cervical biopsy is done. Cervical intraepithelial neoplasia is not cancer, but may become cancer and spread to nearby normal tissue. It is graded on a scale of 1 to 3, based on how abnormal the cells look under a microscope and how much of the cervical tissue is affected. For example, CIN 1 has slightly abnormal cells and is less likely to become cancer than CIN 2 or CIN 3. Also called CIN. Cervical dysplasia doesn't usually cause symptoms. Instead, your healthcare provider may diagnose you with cervical dysplasia after finding abnormal cells during a routine Pap smear. Some people may have irregular vaginal spotting or spotting after intercourse.



Chapter 2: Literature review

2.1 Existing smartphone-based apps for capturing cervix images using visual inspection test

Smartphone-Based Visual Inspection with Acetic Acid: An Innovative Tool to Improve Cervical Cancer Screening in Low-Resource Setting

Visual inspection with acetic acid (VIA) is recommended by the World Health Organization for primary cervical cancer screening or triage of human papillomavirus-positive women living in low-resource settings [1]. Nonetheless, traditional VIA with the naked eye is associated with large variabilities in the detection of pre-cancer and with a lack of quality control. Digital-VIA (D-VIA), using high-definition cameras, allows magnification and zooming on transformation zones and suspicious cervical regions, as well as simultaneously comparing native and post-VIA images in real-time. In this paper, they searched MEDLINE and LILACS between January 2015 and November 2021 for relevant studies conducted in low-resource settings using a smartphone device for D-VIA. The aim of this review was to provide an evaluation of available data for smartphone use in low-resource settings in the context of D-VIA-based cervical cancer screenings. The available results to date show that the quality of D-VIA images is satisfactory and enables CIN1/CIN2+ diagnosis and that a smartphone is a promising tool for cervical cancer screening monitoring and for on- and off-site supervision, and training. The use of artificial intelligence algorithms could soon allow automated and accurate cervical lesion detection.

Use of Smartphones for the Detection of Uterine Cervical Cancer: A Systematic Review

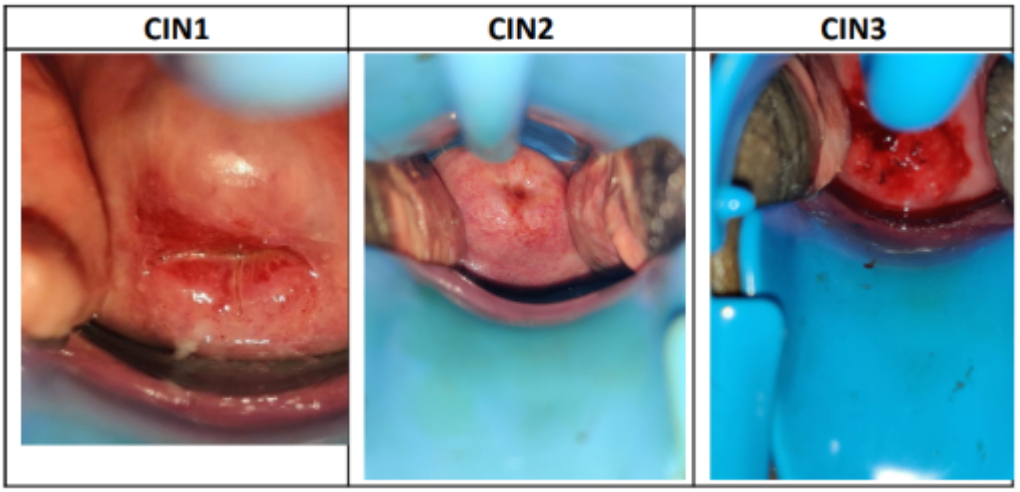
Little is known regarding the usefulness of the smartphone in the detection of uterine cervical lesions or uterine cervical cancer. Therefore, In this paper, they evaluated the usefulness of the smartphone in the detection of uterine cervical lesions and measured its diagnostic accuracy by comparing its findings with histological findings. Then conducted a systematic review to identify studies on the usefulness of the smartphone in detecting uterine cervical lesions indexed in SCOPUS, MEDLINE/PubMed, Cochrane, OVID, Web of Science, and SciELO until November 2020. The risk of bias and applicability was assessed using the Quality Assessment of Diagnostic Accuracy Studies-2 tool. A total of 16 studies evaluated the usefulness of the smartphone in the detection of uterine cervical lesions based on the images clicked after visual inspection with acetic acid (VIA), Lugol's iodine (VILI), or VIA/VILI combination were included in the study. Five studies estimated diagnostic sensitivity and specificity, nine described diagnostic concordance, and five described the usefulness of mobile technology. Among the five first studies, the sensitivity ranged between 66.7% (95% confidence interval (CI); 30.0–90.3%) and 94.1% (95% CI; 81.6–98.3%), and the specificity ranged between 24.0% (95% CI; 9.0–45.0%) and 85.7% (95% CI; 76.7–91.6%). The risk of bias was low (20%), and the applicability was high. In conclusion, the smartphone images clicked after a VIA were found to be more sensitive than those following the VILI method or the VIA/VILI combination and naked-eye techniques in detecting uterine cervical lesions. Thus, a smartphone may be useful in the detection of uterine cervical lesions; however, its sensitivity and specificity are still limited.

Chapter 3: Database design

3.1 Data collection

We have collected the images from Institute of Advanced Study in Science and Technology (IASST) Guwahati. We received the images labelled as CIN1, CIN2 and CIN3. After that, we cropped the raw images for achieving the region of interest.

Here is an example of labelled images after cropping-



Chapter 4: Study design

4.1 Overall study methodology

Following is the main steps under the methodology section:

1. Data preparation.
2. Data Augmentation.
3. Image training for Multiclass classification using CNN classifiers: mobile net_V1
4. Testing and validation of all the models with graphical outputs.

1. Data Preparation

We have collected the images from IASST Guwahati. We received the images labelled as CIN1 , CIN2 and CIN3. After that, we cropped the raw images for achieving the region of interest.

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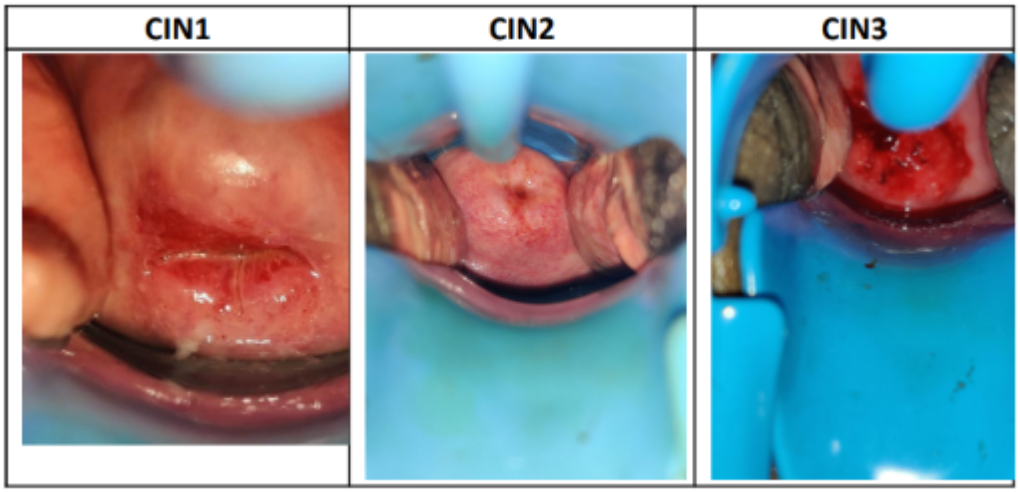


Example of images after cropping

2. Data Augmentation

Data augmentation is a set of techniques to artificially increase the amount of data by generating new data points from the original data set. Classic image processing activities for data augmentation are:

- padding
- random rotating
- re-scaling
- vertical and horizontal flipping
- translation (image is moved along X, Y direction)
- cropping
- zooming
- darkening & brightening/colour modification
- grayscaling
- changing contrast
- adding noise
- random erasing

The techniques we have used to augment our dataset are-

```
rotation_range = 40,
width_shift_range = 0.2,
height_shift_range = 0.2,
shear_range = 0.2,
zoom_range = 0.2,
horizontal_flip = True,
fill_mode = 'nearest'
```

Database details:

Per class total images before augmentation

CIN1	CIN2	CIN3
117	35	32

Per class total images after equalising the dataset using image augmentation techniques.

CIN1	CIN2	CIN3
117	**117**	**117**

Per class total images after splitting the images into three sets as training, testing, and validation into 7:2:1 respectively.

Trian			**Validation**			**Test**		
CIN1	CIN2	CIN3	CIN1	CIN2	CIN3	CIN1	CIN2	CIN3
82	**82**	**82**	**24**	**24**	**24**	**11**	**11**	**11**

1. **Image training for Multiclass classification using CNN classifiers: mobile net_V1,** After splitting the dataset into Training, testing and validation set, we have trained all the images for Multiclass classification using three CNN models namely mobileNet_V1,

Training of mobileNet : MobileNet-v1 is a convolutional neural network that is 53 layers deep that seeks to perform well on mobile devices. It is

based on an inverted residual structure where the residual connections are between the bottleneck layers.

1st iteration (version= mobilenet_1.00_224

epochs = 200
Activation = relu
Optimizer = Adam
Learning rate= 0.0001
Loss = categorical_crossentropy
Metrices = accuracy)

2. Testing and validation of all the models with graphical outputs.

For evaluating the performance of the trained models, we have used classification evaluation techniques like confusion matrix, accuracy-loss graph, F1 score, etc. Here I am giving some detailed explanation of all evaluation techniques.

Confusion Matrix: A Confusion matrix is an N x N matrix used for evaluating the performance of a classification model**,** where **N** is the number of target classes. The matrix compares the actual target values with those predicted by the machine learning model.

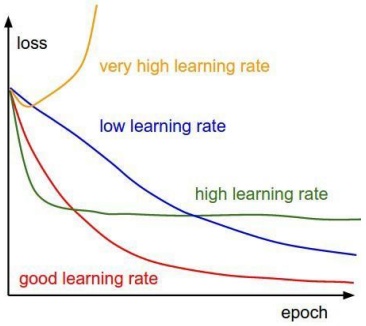
The characteristics of a good confusion matrix are-

- A good model is one which has high TP and TN rates, while low FP and FN rates.
- If you have an imbalanced dataset to work with, it's always better to use confusion matrix as your evaluation criteria for your machine learning model.

		Predicted Class: Positive	Predicted Class: Negative	
Actual Class	Positive	True Positive (TP)	False Negative (FN) **Type II Error**	**Sensitivity** $\frac{TP}{(TP+FN)}$
	Negative	False Positive (FP) **Type I Error**	True Negative (TN)	**Specificity** $\frac{TN}{(TN+FP)}$
		Precision $\frac{TP}{(TP+FP)}$	**Negative Predictive Value** $\frac{TN}{(TN+FN)}$	**Accuracy** $\frac{TP+TN}{(TP+TN+FP+FN)}$

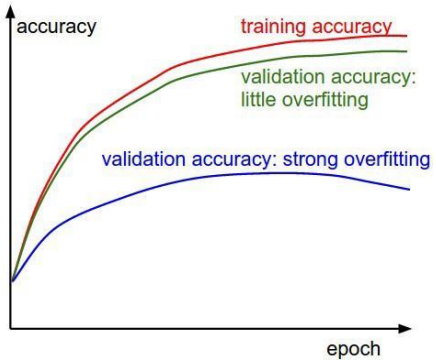
4.2 Confusion Matrix

Loss Curve: One of the most used plots to debug a neural network is a Loss curve during training. It gives us a snapshot of the training process and the direction in which the network learns. An awesome explanation is from the image is pretty much self-explanatory.



4.3 Loss graph

Accuracy Curve: Another most used curve to understand the progress of Neural Networks is an Accuracy curve. For anyone who has some experience in Deep Learning, using accuracy and loss curves is obvious. A more important curve is the one with both training and validation accuracy.



4.4 Accuracy Graph

Accuracy: Accuracy simply measures how often the classifier makes the correct prediction. It's the ratio between the number of correct predictions and the total number of predictions.

The formula for calculating accuracy is-

$$\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN} = \frac{\text{Correct Predictions}}{\text{Total Predictions}}$$

F1- Score: F1 score gives the combined result of Precision and Recall. It is a Harmonic Mean of Precision and Recall.

$$\text{F1 Score} = \frac{2}{(1/\text{Recall}) + (1/\text{Precision})}$$

Precision: Precision is no more than the ratio of True Positive and the sum of True Positive and False Positive. If the ratio of Precision is 50%, then the predicted output values of our model are 50% correct.

$$\text{Precision} = \frac{TP}{TP + FP}$$

Recall: The recall is none other than the ratio of True Positive and the sum of True Positive and False Negative.

$$\text{Recall} = \frac{TP}{TP + FN}$$

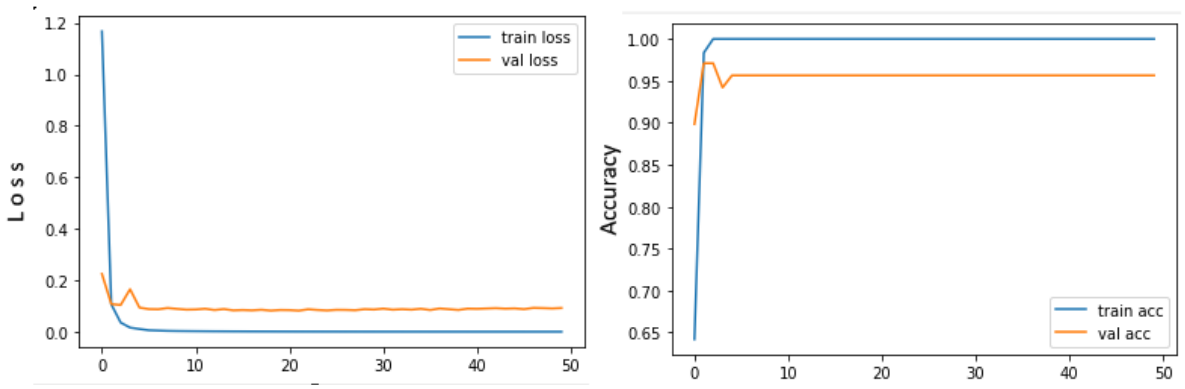
MobileNet Evaluation:

loss: 1.6688e-04

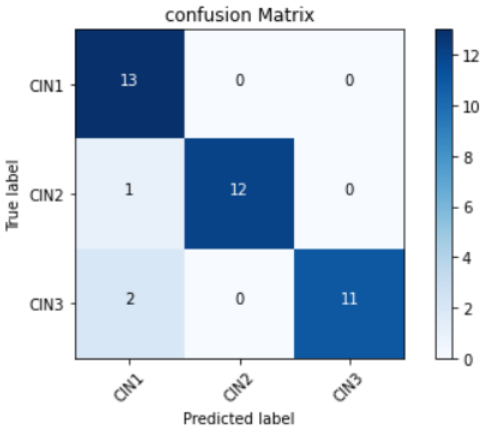
Training_accuracy: 1.0000

validation loss: 0.08

validation accuracy: 0.96



Accuracy loss graph of MobileNet evaluation



	precision	recall	f1-score	support
0	0.81	1.00	0.90	13
1	1.00	0.92	0.96	13
2	1.00	0.85	0.92	13
accuracy			0.92	39
macro avg	0.94	0.92	0.92	39
weighted avg	0.94	0.92	0.92	39

Confusion matrix and testing accuracy of MobileNet evaluation

4.2 Hardware System requirements:

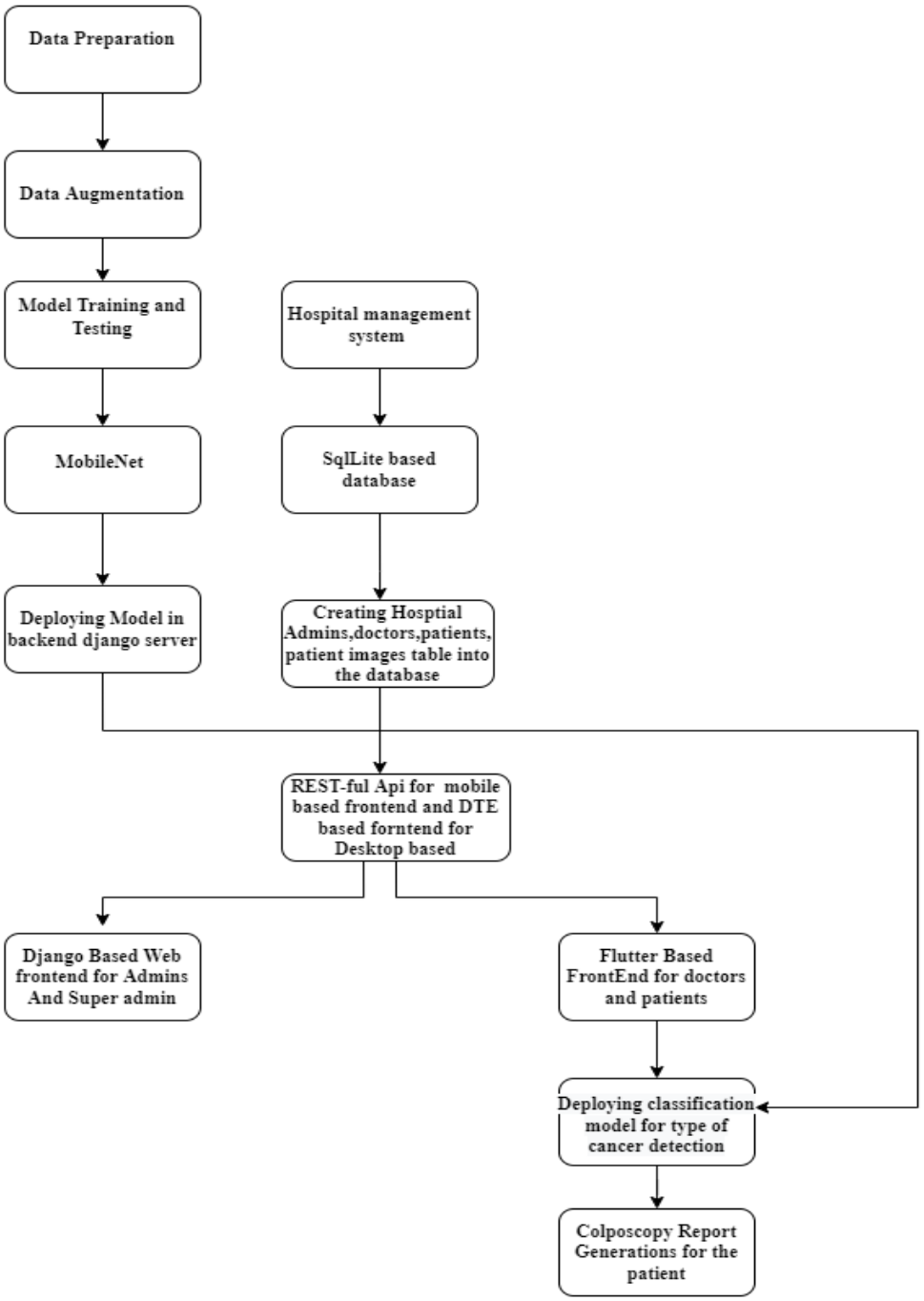
- RAM – 1 GB +
- PROCESSOR – 1 GHz +

4.3 Software System requirements:

- Web Browser – Chrome, Brave, Mozilla, etc
- Android version 4.4 or later handset
- iPhone Requires iOS 11.0 or later handset

Chapter 5: Multiclass classification of CIN lesions using deep learning techniques

5.1 Proposed methodology



5. 2 Results and discussion

1. From the model evaluation techniques, we can see that the mobile is giving 92% accuracy,
2. So, we choose mobileNet because of its lightweight architecture as compared to other CNN models.
3. The deployment of mobileNet in real-world applications is more practical, user-friendly and efficient in terms of Space(storage) as compared to Vgg16.
4. mobileNet performance is not as good as Vgg16 because the number of CNN and other layers in mobileNet is very very less as compared to Vgg16 but performance wise it's very minute.

Chapter 6: FEASIBILITY STUDY

TECHNICAL FEASIBILITY

Technical feasibility is the process of figuring out how the product or service is to be produced to determine whether it's possible for development. The technical requirements for the project are technically feasible as there is only a need for a laptop or a smartphone - which is carried by everyone at the present day, to access the web application. There is no need to install any other software application on that device. The web application can be run through any web browser. The applications require no extra expertise to use.

ECONOMICAL FEASIBILITY

It is evaluating the effectiveness of a system by using the cost/benefit analysis method. The project is economically feasible as there is no cost included in running/ designing the frontend. Every component used in designing and running is free of cost and open-source.

BEHAVIOURAL FEASIBILITY

It evaluates and estimates the user attitude or behaviour towards the development of the new system. The application is easy to use and requires no extra effort. There is no hidden implementation that would have any ill effects on the users of the application.

Chapter 7: TOOLS AND TECHNOLOGIES USED

Django

Django is an advanced Web framework written in Python that makes use of the model view controller (MVC) architectural pattern. Django was created in a fast-moving newsroom environment, and its key objective is to ease the development of complicated, database-driven websites. This Web framework was initially developed for The World Company for managing some of their news-oriented sites. In July 2005, it was publicly released under a BSD licence.

Flutter

Flutter is an open-source UI software development kit created by Google. It is used to develop cross-platform applications for Android, iOS, Linux, macOS, Windows, Google Fuchsia, and the web from a single codebase. First described in 2015, Flutter was released in May 2017.

Python

Python is a high-level, interpreted, general-purpose programming language. Its design philosophy emphasises code readability with the use of significant indentation. Python is dynamically-typed and garbage-collected.

Dart

Dart is a programming language designed for client development, such as for the web and mobile apps. It is developed by Google and can also be used to build server and desktop applications. It is an object-oriented, class-based, garbage-collected language with C-style syntax.

JSON

JSON or JavaScript Object Notation is a lightweight text-based open standard designed for human-readable data interchange. The JSON format was originally

specified by Douglas Crockford, and is described in RFC 4627. The official Internet media type for JSON is application/JSON. The JSON filename extension is **.json**.

TensorFlow

TensorFlow is a free and open-source software library for machine learning and artificial intelligence. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks

VS Code Editor

Visual Studio Code, also commonly referred to as VS Code, is a source-code editor made by Microsoft for Windows, Linux and macOS. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git.

Postman

is an API platform for building and using APIs. Postman simplifies each step of the API lifecycle and streamlines collaboration so you can create better APIs—faster.

Jupyter Notebook

The Jupyter Notebook App is a server-client application that allows editing and running notebook documents via a web browser. The Jupyter Notebook App can be executed on a local desktop requiring no internet access (as described in this document) or can be installed on a remote server and accessed through the internet.

SQLite

SQLite is a database engine written in the C programming language. It is not a standalone app; rather, it is a library that software developers embed in their apps. As such, it belongs to the family of embedded databases.

APIs (Application Programming Interfaces)

API is a software intermediary that allows two applications to talk to each other. When an application is used, the application connects to the Internet and sends data to a server. The server then retrieves that data, interprets it, performs the necessary actions and sends it back. The application then interprets that data and presents the information wanted in a readable way. This is what an API is - all of this happens via API.

HTML/ CSS

The HyperText Markup Language or HTML is the standard markup language for documents designed to be displayed in a web browser It is assisted by the use of Cascading Style Sheets (CSS) to provide an elegant feel to the structure through different styles. Web Browsers receive HTML documents from a web server or from local storage and render the documents into multimedia web pages. HTML describes the structure of a web page semantically and originally included cues for the appearance of the document.

Chapter 8: Designing mobile application for multiclass classification of CIN lesion

The system analysis phase is a detailed appraisal of the existing system. It includes how the system works and what it does. The following tools and methodology are adopted in our system analysis:

● Entity Relationship Diagram (ERD)

● Data Flow Diagram (DFD)

8.1 SQL database and tables:

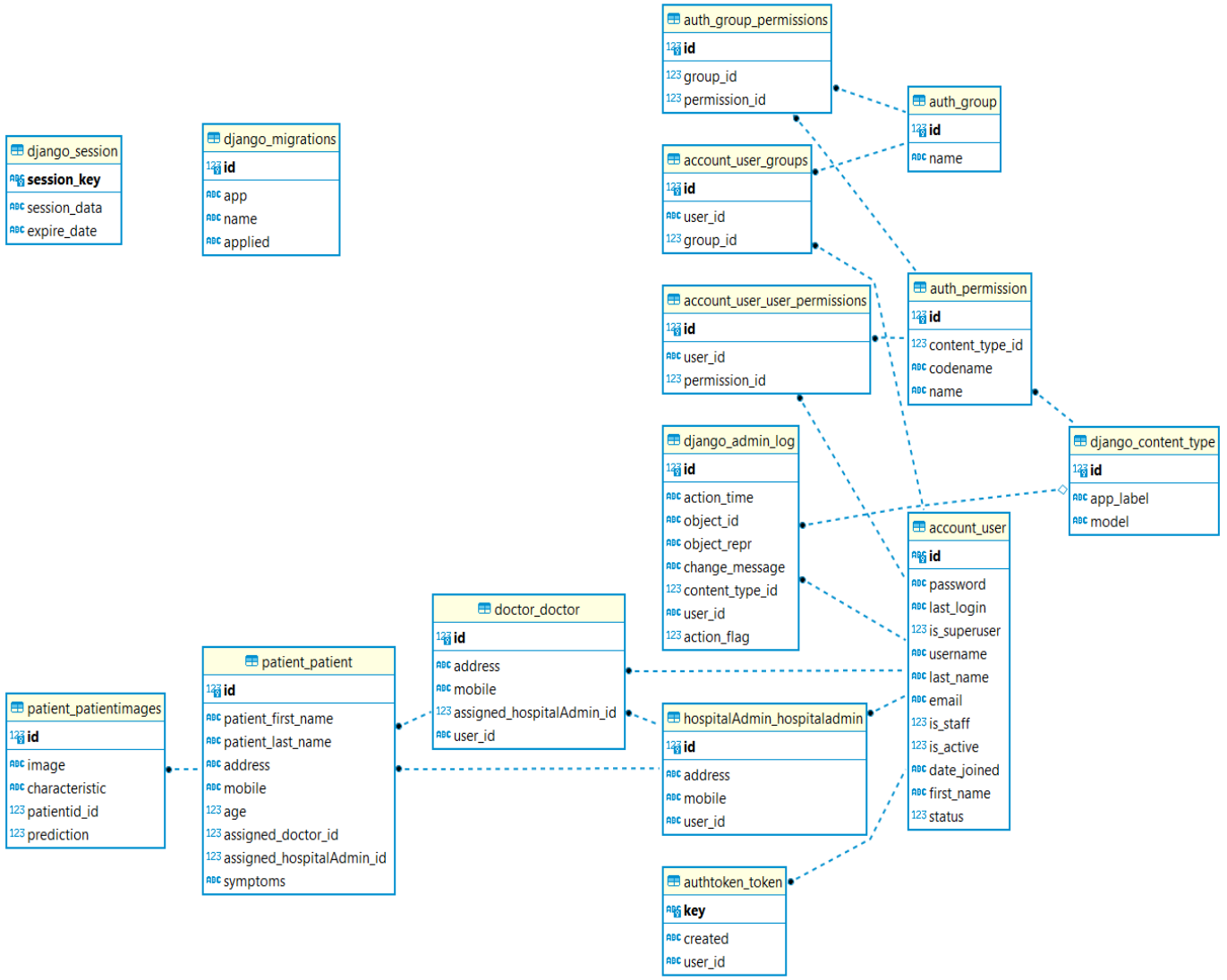
CONTEXT DIAGRAM

It is designed to be an abstraction view, showing the system as a single process with its relationship to external entities. It represents the entire system as a single bubble

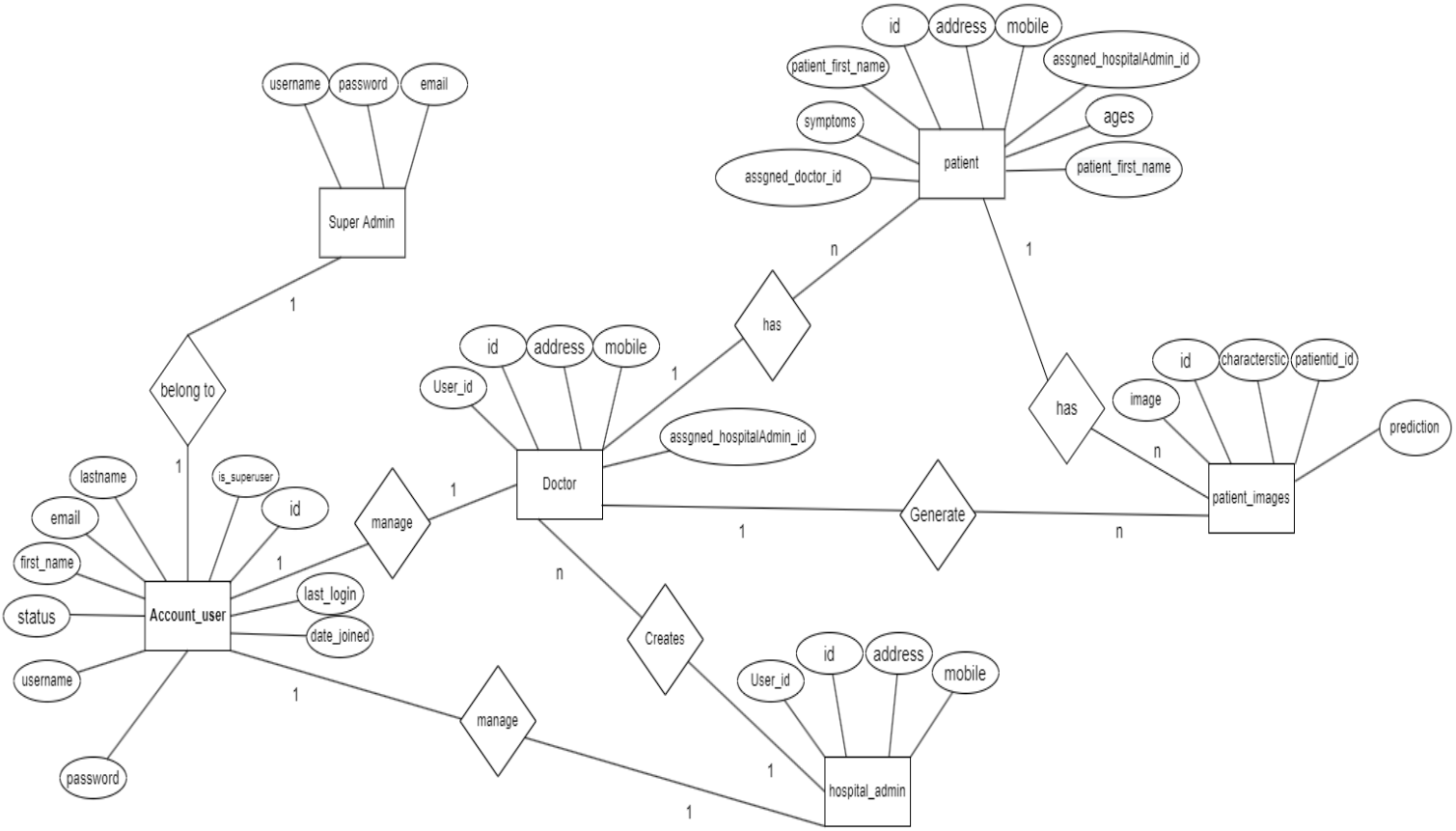
Entities used in the ER-diagram

- **Account_user**(status, first_name, email, last_name, username, is_superuser, last_name, email, status,last_login)
- **Doctor** (address, mobile, assigned_hosptial_id,user_id)
- **Patient** (patient_first_name, patient_last_name, address,mobile, age,assigned_hosptial_id,assigned_doctor_id,symtoms)
- **Patient_images**(image,characterstic,patient_id,prediction)
- **hospital_admin**(id,mobile,user_id)

Schema diagram



ER- Diagram


username
password
email
Super Admin
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first_name
status
username
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is_superuser
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patient_first_name
patient
1
has
n
id
characterstic
patientid_id
image
prediction
patient_images
Generate
1
n
n
Creates
1
manage
1
1
id
address
mobile
User_id
hospital_admin

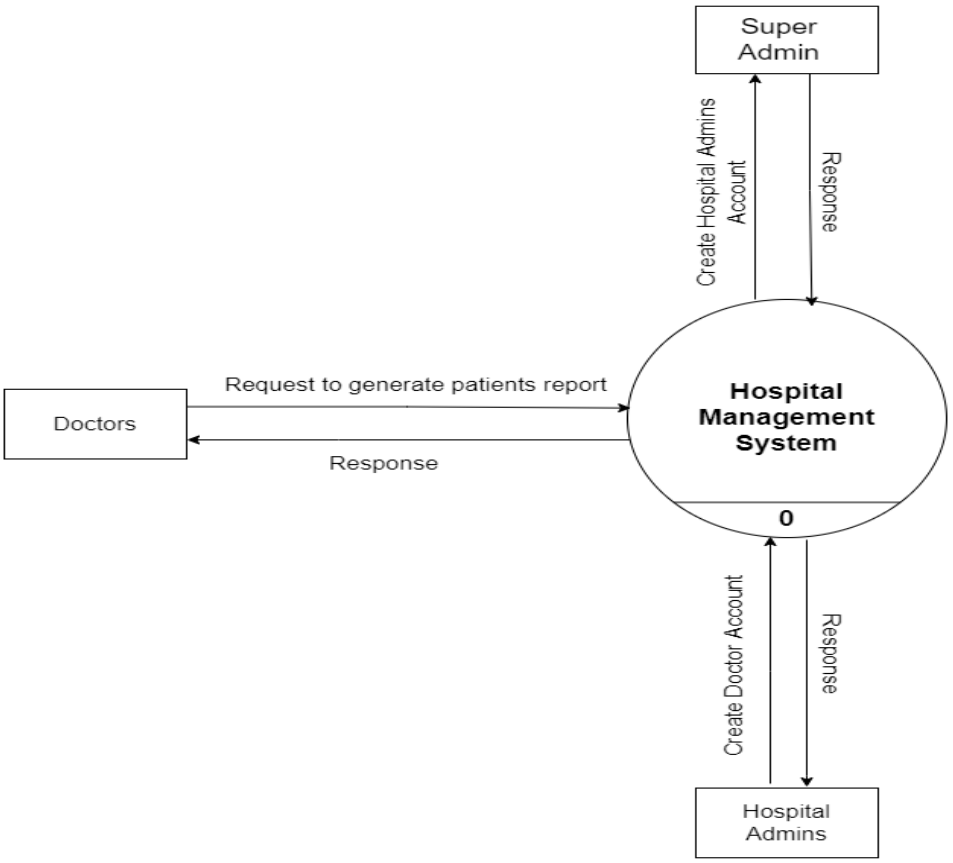
8.2 Data Flow Diagram for the mobile application:

DATA FLOW DIAGRAM:

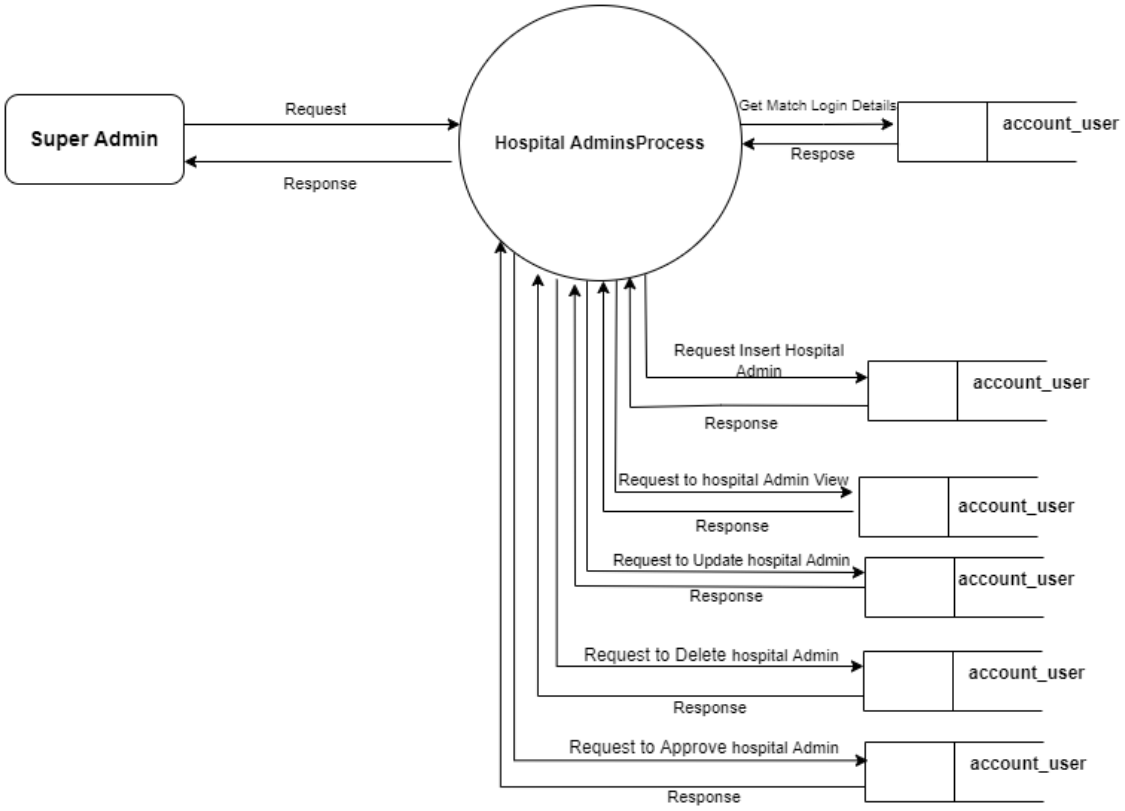
A DFD, also known as a “Bubble chart”, has the purpose of clarifying system requirements and identifying major transformations that will become programs in system design. So, it is the starting point of the design phase that functionally decomposes the requirement specification down to the lowest level of details.

CONTEXT DIAGRAM

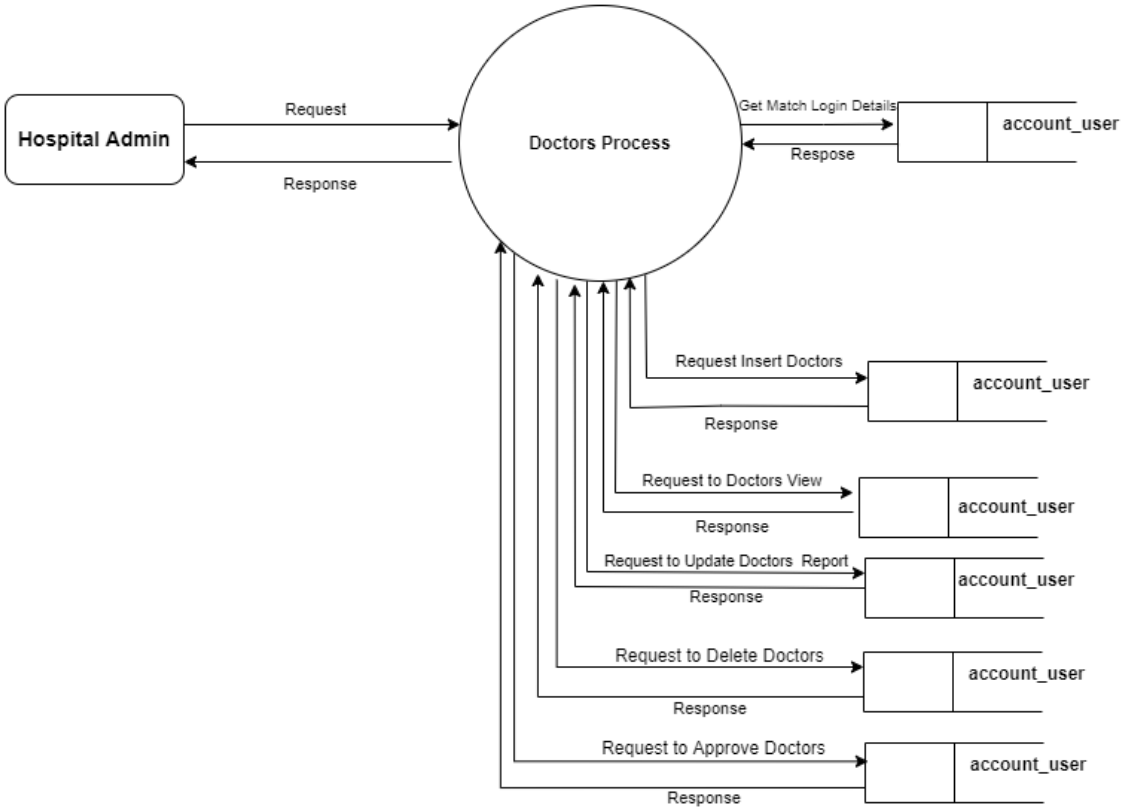
It is designed to be an abstraction view, showing the system as a single process with its relationship to external entities. It represents the entire system as a single bubble.



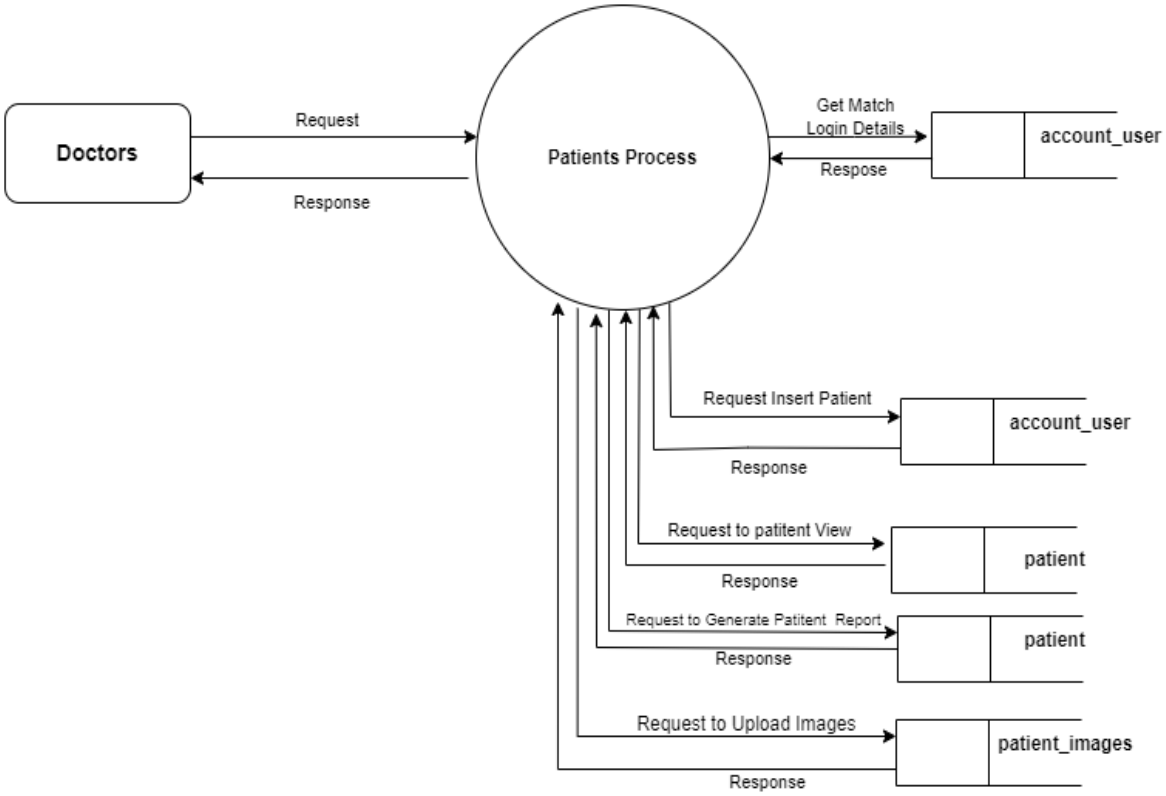
0-level DFD:


Super Admin
Request
Response
Hospital AdminsProcess
Get Match Login Details
Respose
account_user
Request Insert Hospital Admin
Response
account_user
Request to hospital Admin View
Response
account_user
Request to Update hospital Admin
Response
account_user
Request to Delete hospital Admin
Response
account_user
Request to Approve hospital Admin
Response
account_user

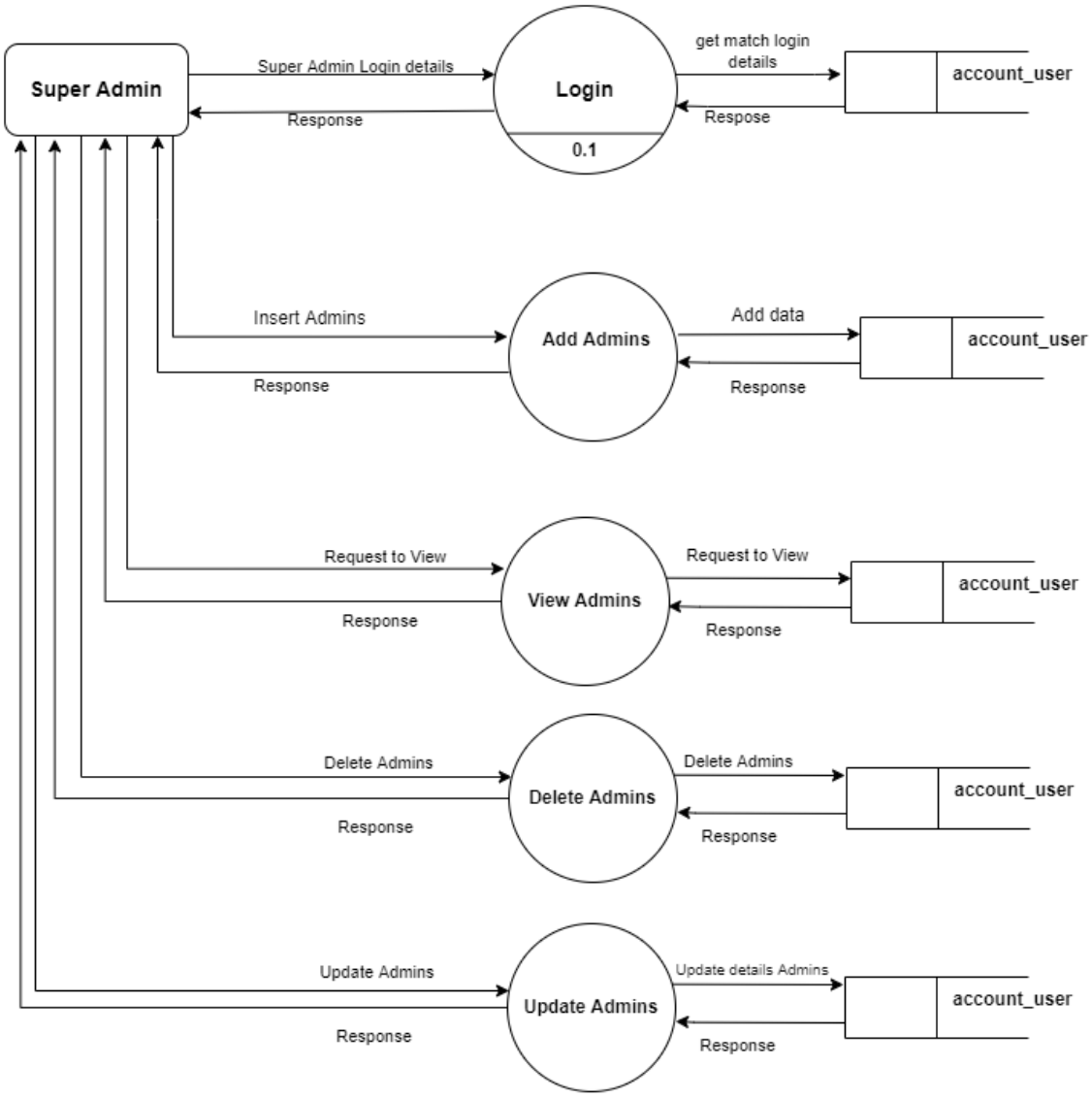
1-level DFD:


Hospital Admin
Request
Response
Doctors Process
Get Match Login Details
Respose
account_user
Request Insert Doctors
Response
account_user
Request to Doctors View
Response
account_user
Request to Update Doctors Report
Response
account_user
Request to Delete Doctors
Response
account_user
Request to Approve Doctors
Response
account_user

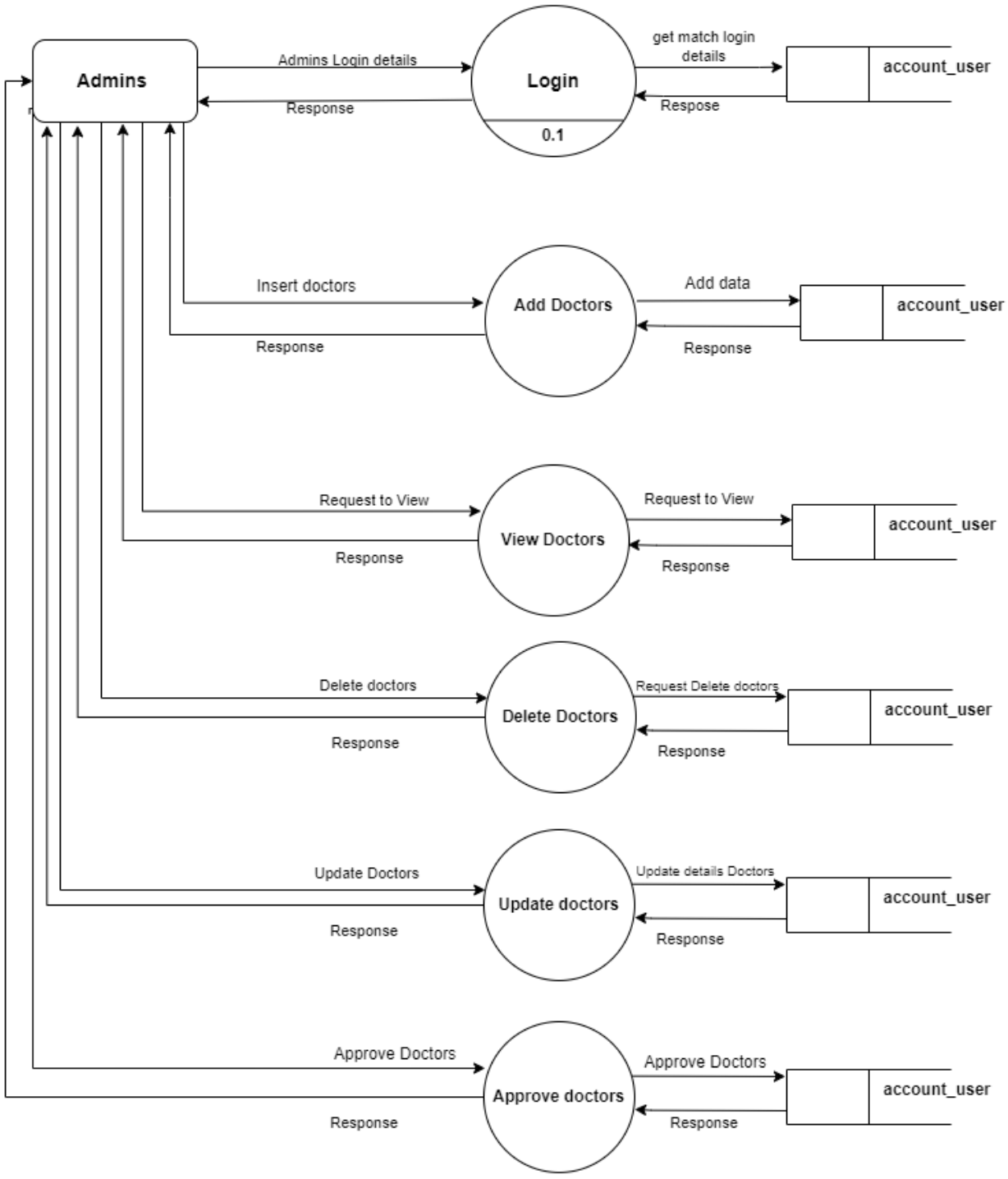
1-level DFD:


Doctors
Request
Response
Patients Process
Get Match
Login Details
Respose
account_user
Request Insert Patient
Response
account_user
Request to patitent View
Response
patient
Request to Generate Patitent Report
Response
patient
Request to Upload Images
Response
patient_images

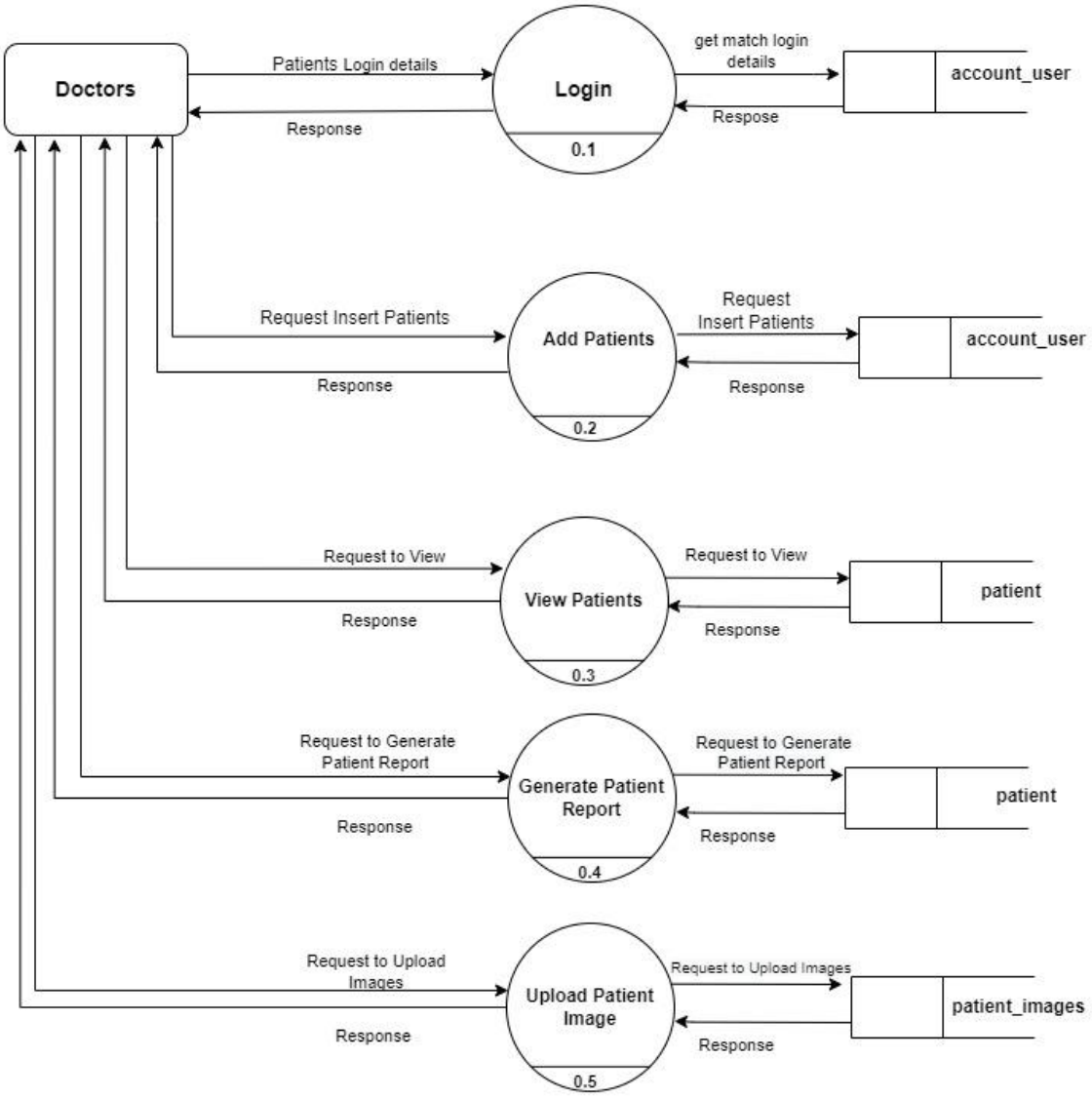
1-level DFD:


Super Admin
Super Admin Login details
Response
Login
0.1
get match login details
Respose
account_user
Insert Admins
Response
Add Admins
Add data
Response
account_user
Request to View
Response
View Admins
Request to View
Response
account_user
Delete Admins
Response
Delete Admins
Delete Admins
Response
account_user
Update Admins
Response
Update Admins
Update details Admins
Response
account_user

2-level DFD:

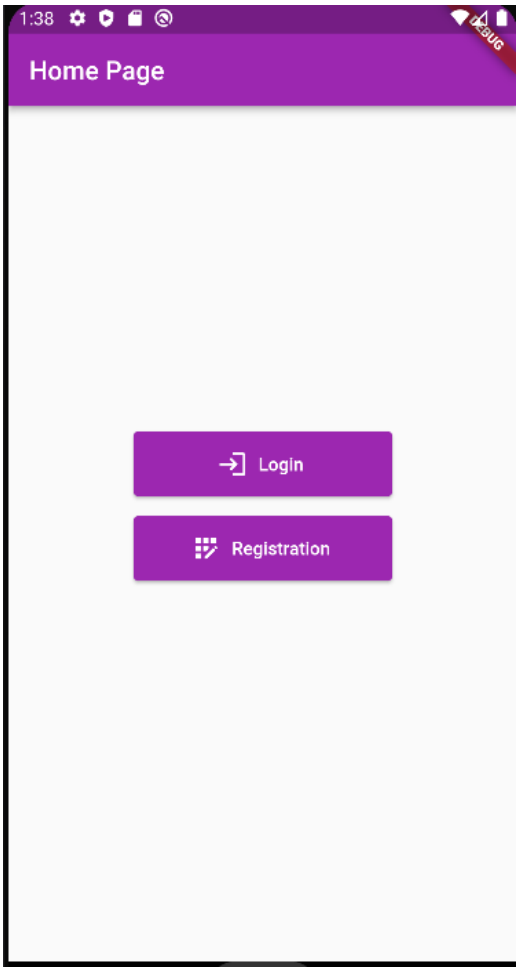

Admins
Admins Login details
Response
Login
0.1
get match login details
Respose
account_user
Insert doctors
Response
Add Doctors
Add data
Response
account_user
Request to View
Response
View Doctors
Request to View
Response
account_user
Delete doctors
Response
Delete Doctors
Request Delete doctors
Response
account_user
Update Doctors
Response
Update doctors
Update details Doctors
Response
account_user
Approve Doctors
Response
Approve doctors
Approve Doctors
Response
account_user

2-level DFD:


Doctors
Patients Login details
Response
Login
0.1
get match login details
Respose
account_user
Request Insert Patients
Response
Add Patients
0.2
Request Insert Patients
Response
account_user
Request to View
Response
View Patients
0.3
Request to View
Response
patient
Request to Generate Patient Report
Response
Generate Patient Report
0.4
Request to Generate Patient Report
Response
patient
Request to Upload Images
Response
Upload Patient Image
0.5
Request to Upload Images
Response
patient_images

2-level DFD:

8.3 Building the app using flutter: explain here the GUI



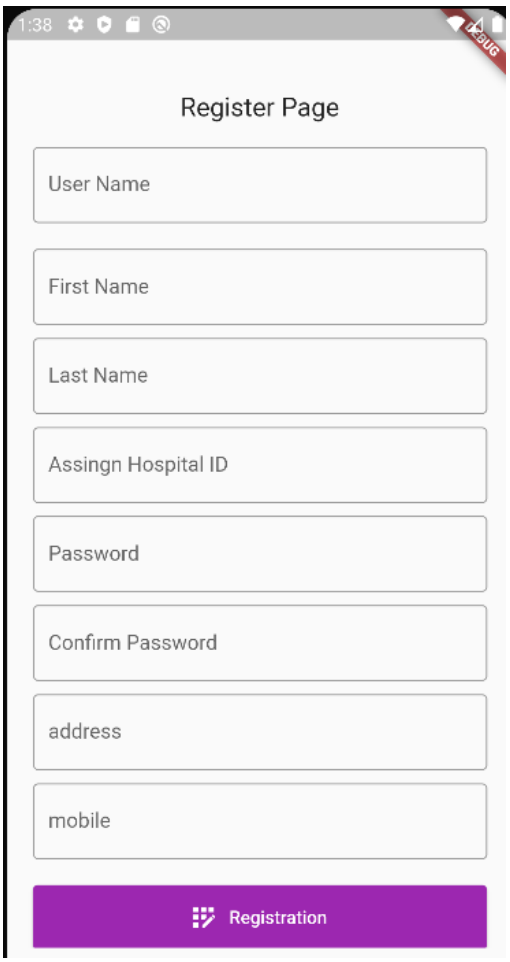
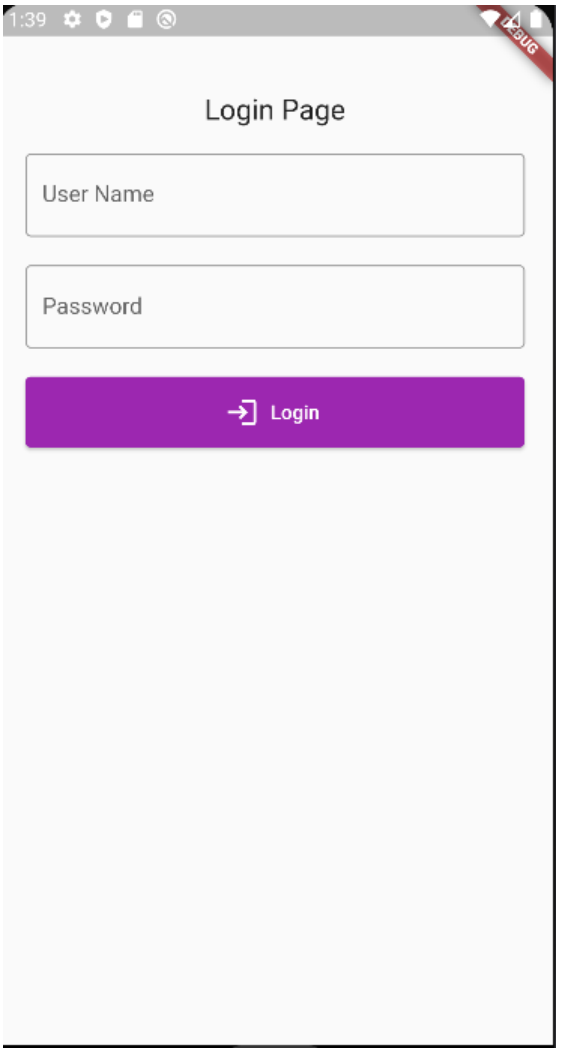


Fig - 1 **Fig - 2**

Fig 1 - Home page of the app

Fig 2 - Registration page for the Doctor



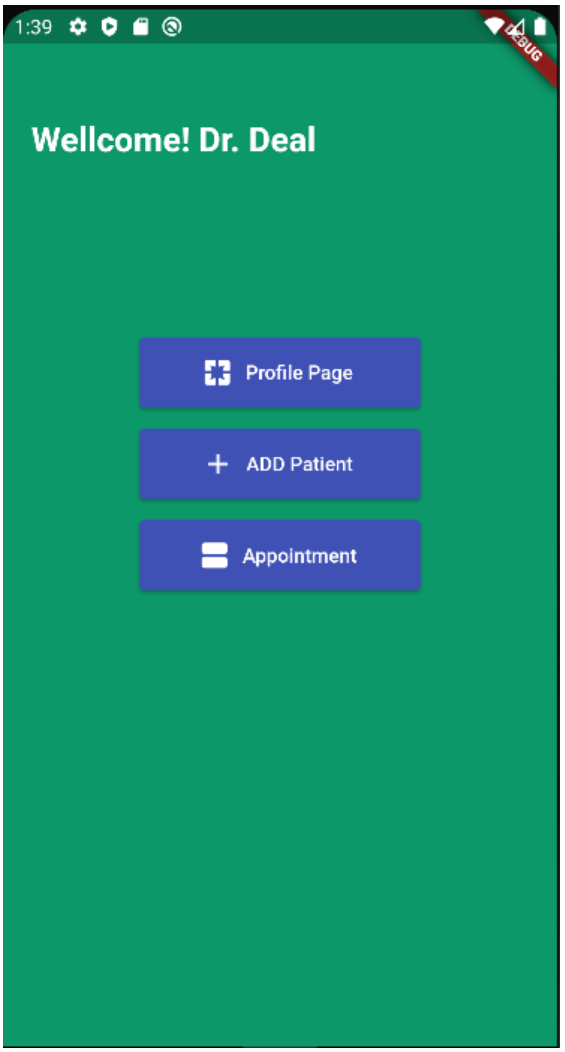
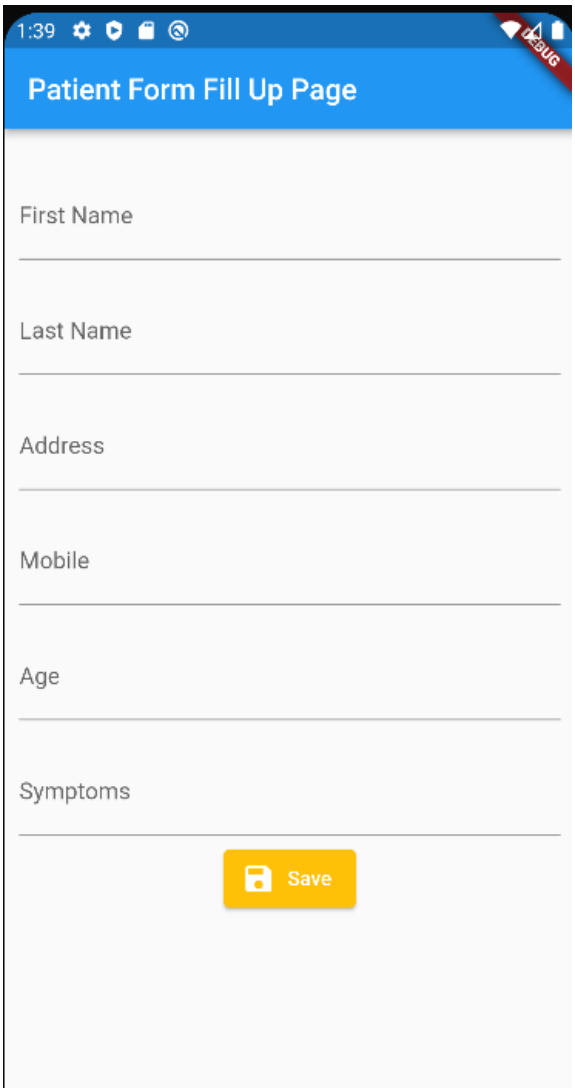


Fig - 3

Fig - 4

Fig 3 - Login Page for Doctor

Fig 4 - Doctor's home Page



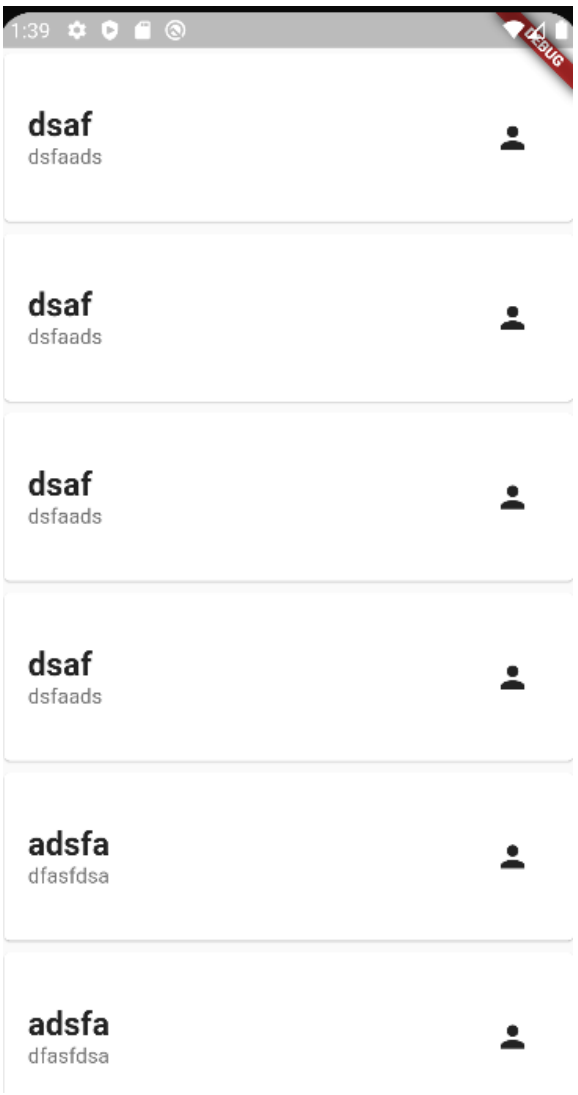
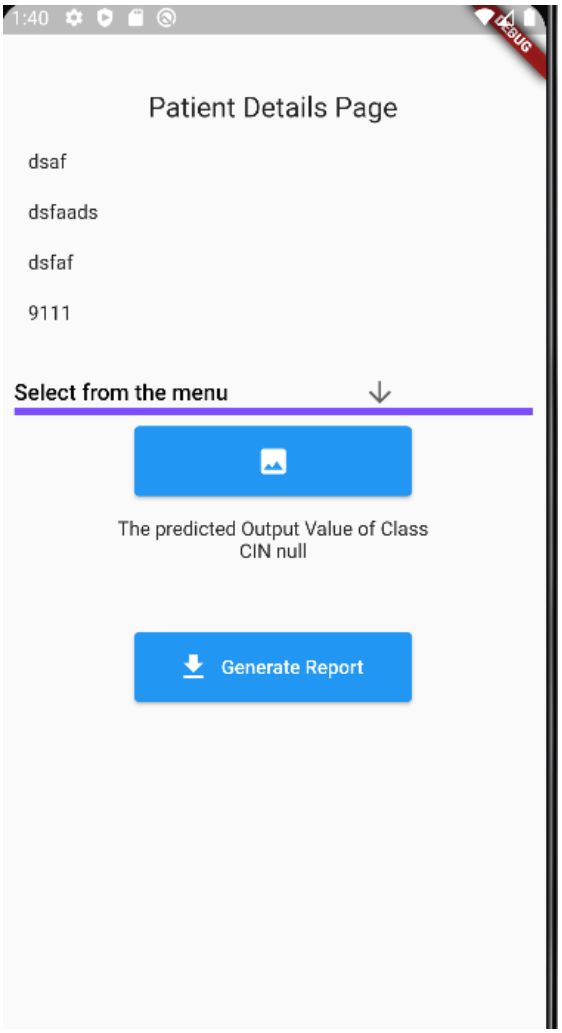


Fig - 5 **Fig - 6**

Fig 5 - Patient Admission page

Fig 6 - List of patient Under the Doctor's supervision



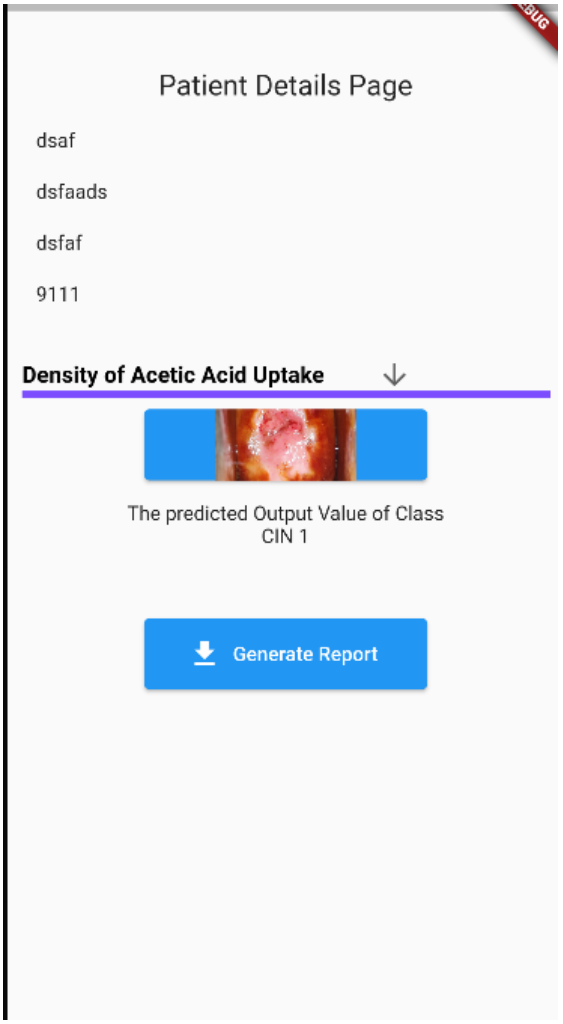
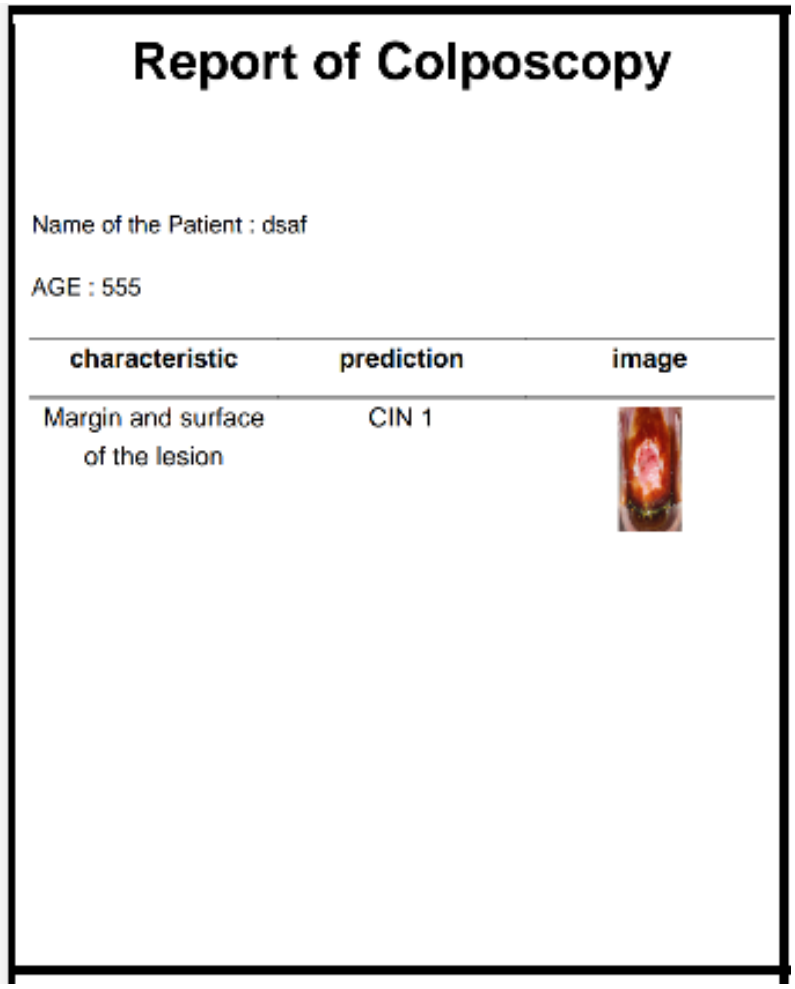


Fig - 7.1 **Fig - 7.2**

Fig 7.1,7.2 Patient page where we upload Cervical Cancer image and get Patient report



Report of Colposcopy

Name of the Patient : dsaf

AGE : 555

characteristic	prediction	image
Margin and surface of the lesion	CIN 1	

Fig 8

Fig 8 - Pdf Report of Colposcopy

8.5 Connecting the flutter API

DESIGN

Project Modules

The backend of the Hospital Management System API is divided into multiple modules to make development easier, scalable and maintainable.

SuperAdmin API

This module handles the CRUD and other types of operation for the Hospital Management System. Only SuperAdmin Api has the privilege to add hospital Admin to the system. The Hospital Admin that are present in the system can log in to their respective dashboard of the system.

Endpoint	Access	Description
api/SuperAdmin/login	Super Admin only	Used to login to the system with respective credentials.
api/SuperAdmin/admin/ registration/	Super Admin only	Used to Register Hospital Admin into the system
api/SuperAdmin/admin	Super Admin only	Used to display All the Approved Admins into the system

Table 1.1: SuperAdmin endpoint table

HospitalAdmin API

Endpoint	Access	Description
api/hospitalAdmin/login	hospitalAdmin only	Used to login to the system with respective credentials.
api/hospitalAdmin/doctor/registration/	hospitalAdmin only	Used to Register doctors into the system
api/hospitalAdmin/doctor	hospitalAdmin only	Used to display All the Approved Doctors in the system

Table 1.1: HospitalAdmin endpoint table

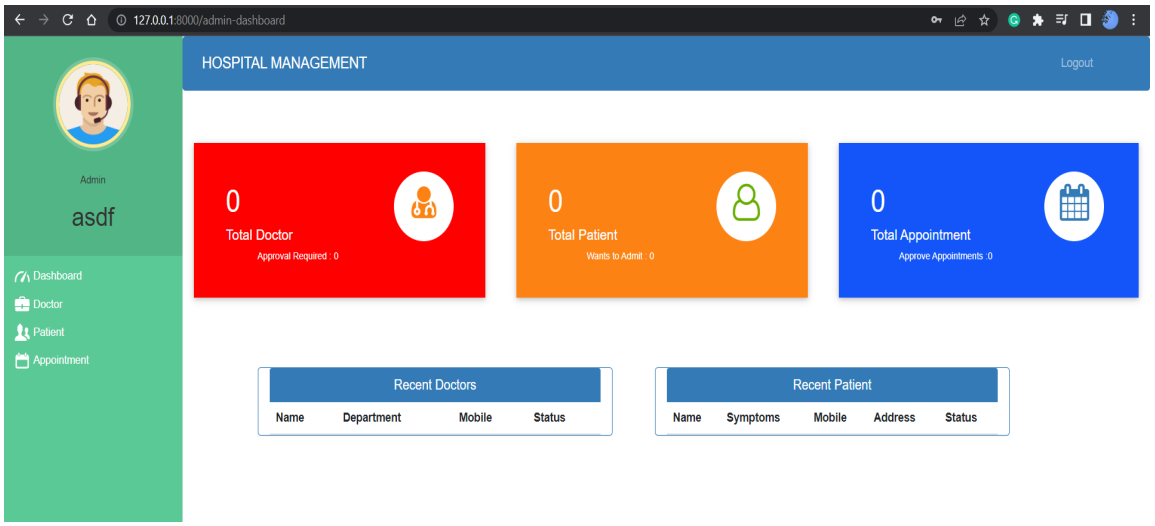
Doctor API

Endpoint	Access	Description
api/doctor/login	doctor only	Used to login to the system with respective credentials.
api/doctor/registration/	doctor only	Used to Request to Register doctor into the system

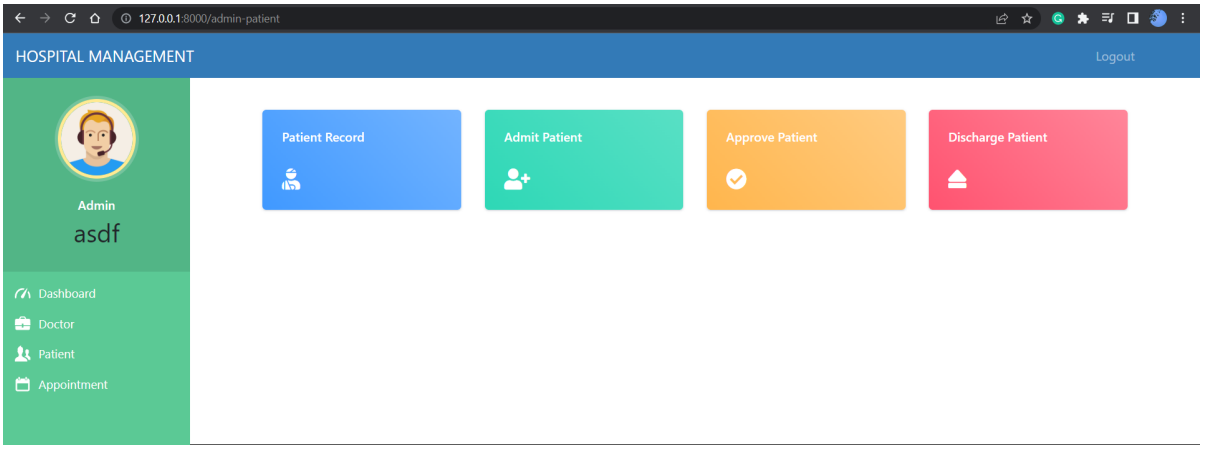
api/doctor/profile	doctor only	Used to display Doctor profile
api/doctor/patient/registration/	doctor only	Used to Register patient into the system
api/doctor/patient/all/	doctor only	Used to show all patient according to Doctor profile
api/doctor/patient/images/	Doctor only	Used to upload the cancer image
api/doctor/demo	Doctor only	Used to generate the patient report

Table 1.1: Doctors endpoint table

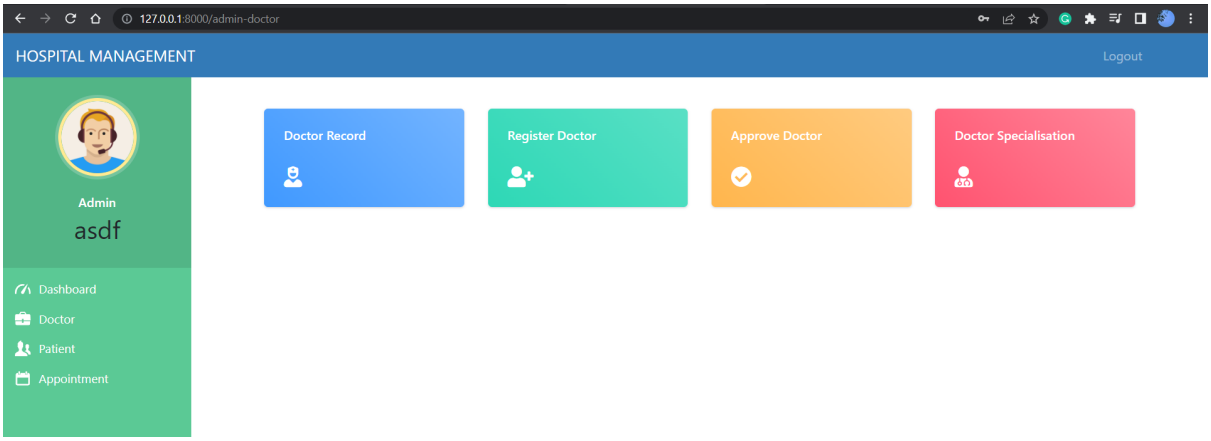
8.3 Building the Web DashBoard using Django template language



Admin DashBord



Admin Patient Section



Admin Doctor Section

Chapter 9: Conclusion and Future work

Colposcopes are expensive, heavy, and need specialised technical service, which may outreach the capacity of low-resource settings. Therefore, we evaluated the usefulness of the smartphone in the detection of uterine cervical lesions and measured its diagnostic accuracy by comparing its accuracy with colposcopy findings.

Mobile application using the trained MobileNet in the backend, which can only take an image from the file system or camera and show the predicted result

We have also developed Hospital Magement System to intrigate with MobileNet model and help in image Classiffication in different usecases.

The remaining future work are Developement of Token based authentication system, UI changes , Overlay Box in camera app.

Reference

- https://medium.com/@nutanbhogendrasharma/image-classification-model-mobilenet-v2-from-tensorflow-hub-8191b28a202a

- https://www.researchgate.net/publication/316184205_MobileNets_Efficient_Convolutional_Neural_Networks_for_Mobile_Vision_Applications

- https://www.tensorflow.org/api_docs

- https://docs.djangoproject.com/en/4.1/

- https://docs.flutter.dev/

- https://www.mayoclinic.org/diseases-conditions/cervical-cancer/symptoms-causes/syc-20352501#:~:text=Cervical%20cancer%20is%20a%20type,in%20causing%20most%20cervical%20cancer.