System Design

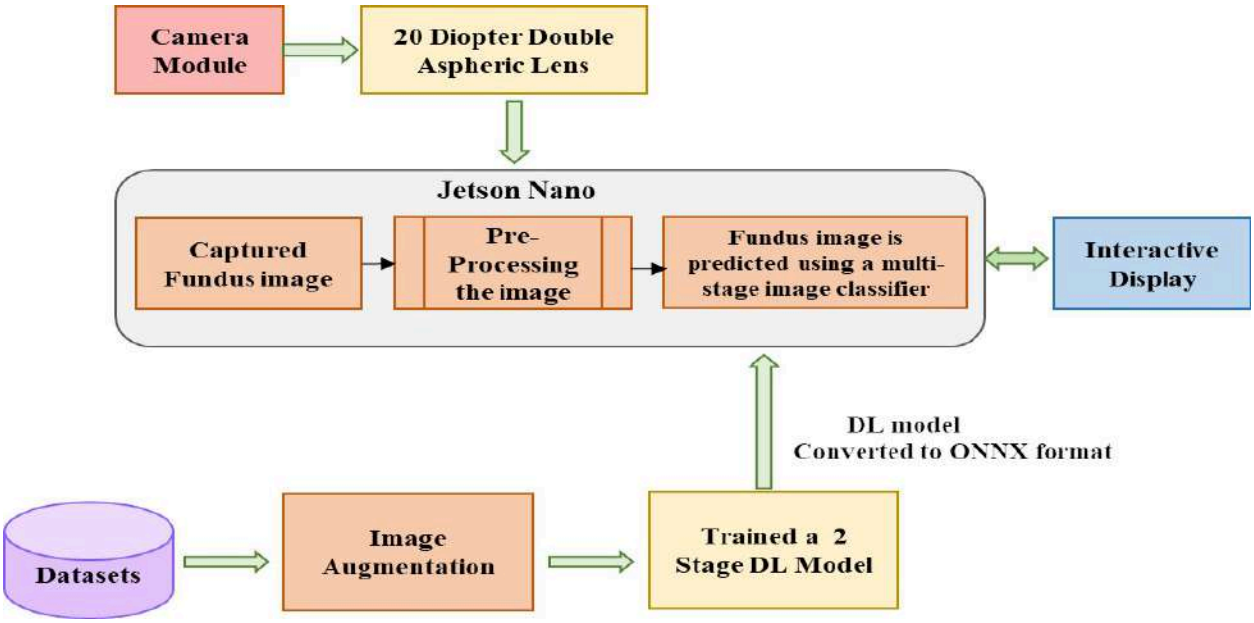

Fig 1. Overview of the proposed solution

The above figure 1 shows the overview of the proposed solution of our point of care device.

The architecture of the solution is based on a deep convolutional neural network (CNN) model designed to classify retinal fundus images as either diseased or healthy. This solution leverages a stacked ensemble classifier, which integrates multiple models to improve classification performance.

- **Model A**: Trained on the Viet Ai Dataset, which includes 7 distinct classes.
- **Model B**: Trained on a different retinal fundus image dataset, encompassing 11 classes.

The features extracted by Models A and B are then combined and fed into **Model C**, which serves as an aggregator. Model C consolidates these features into a binary classification system, distinguishing between normal and abnormal fundus images.

For abnormal fundus images identified by Model C, **Model D** is employed to perform further classification into 10 specific categories.

- Before model D classifies the image the pipeline casts it to a low resolution 128x128 image to ease computation on edge devices.
- Input Layer: The model accepts the low resolution retinal images, both in color and red-free formats.

- Convolutional Layers: These layers extract features from the images using filters, identifying patterns that indicate disease, such as lesions or hemorrhages.
- Max-Pooling Layer: This down-samples the data, reducing computational overhead while retaining important features.
- Fully Connected Layers (Dense Layers): These layers take the output of the convolutional layers and map them to the final binary classification (diseased or healthy).
- Output Layer: The output is a binary classification with a threshold (e.g., 0.85), indicating whether the image is more likely to belong to the diseased or healthy class.

The two stage deep learning model as shown in Figure 2 is designed to be efficient in both training and inference phases, leveraging GPU acceleration for faster processing.

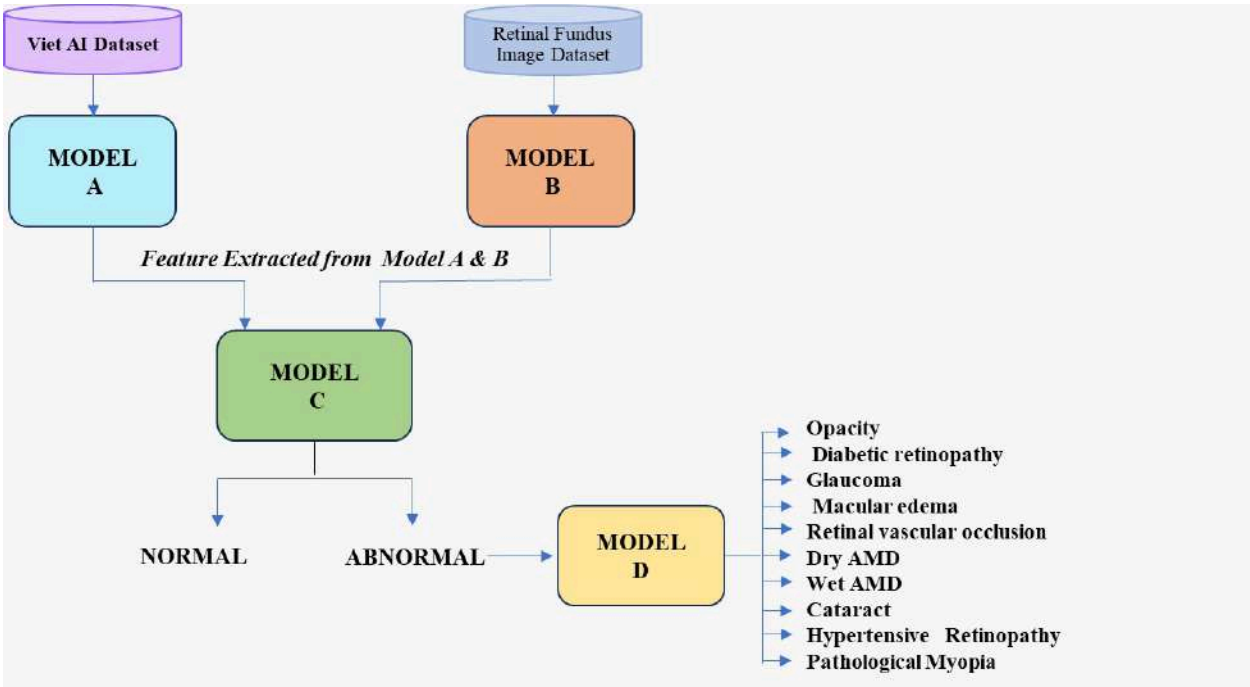

Fig 2. Two stage deep learning architecture