Khulna University of Engineering & Technology

খুলনা প্রকৌশল ও প্রযুক্তি বিশ্ববিদ্যালয়

Project Name

PLANT'S DOCTOR

Project Supervisor

Dr. Sk. Mohammad Masudul Ahsan
Professor
Department of Computer Science & Engineering
Khulna University of Engineering & Technology (KUET)
Khulna

Project By

Md. Azizul Hakim
Roll : 1707104
Department of Computer Science & Engineering
Khulna University of Engineering & Technology
Khulna

Md. Saidul Islam Akib
Roll : 1707119
Department of Computer Science & Engineering
Khulna University of Engineering & Technology
Khulna

Approval

This project report based on CSE-3200 has been submitted for examination with the approval of our supervisor.

Supervisor's Signature

Dr. Sk. Mohammad Masudul Ahsan
Professor
Department of Computer Science & Engineering
Khulna University of Engineering & Technology (KUET)
Khulna

Acknowledgment

With immense please, We, Md. Azizul Hakim and Md. Saidul Islam Akib presenting
project report of “Plant’s Doctor” as part of the curriculum of “CSE 3200: System Development Project”. We wish to thank all the people who gave us unending support.

We are thankful to our supervisor sir, **Dr. Sk. Mohammad Masudul Ahsan** who helped and guided us to complete project successfully.
We are thankful to **Jakaria Rabbi** sir who guided and inspired us.
thankful to our some of the classmates and family.

1 Introduction:

1.1 Motivation:

Bangladesh is an agricultural country. Almost eighty percent of rural people earn their livelihood by farming. As the science progressed , farming also developed in various sector like increasing production, protecting from fatal diseases. For example, Japan uses all modern technologies in farming and their net production is larger compared to our production in same area of land. Because most of our farmers are illiterate and they are deprived of the modern knowledge of agriculture. Our main crops are rice, jute, potato and vegetables like tomato. But all of these have fatal diseases that can cause huge loss in final production. What if they can know about their crops diseases and take action before it becomes dangerous. As the internet and smartphone are available in almost every area of our country, it is feasible to utilize this opportunity to reduce their damage by creating a website that can easily predict the diseases from a single picture and give them solution instantly.

A user friendly website (putting instructions in bengali) that can predict all the fatal diseases can reduce this severe problem of farming and help the farmers to get more production. Again with the ability of detecting diseases and check whether the crops are healthy or not can bring a lot of changes of farming in rural areas of Bangladesh.

1.2 Scope:

Mainly the website is designed for Bangladeshi people as the crops are chosen here are the main crops in Bangladesh. The instructions are given both in bengali and english language so that it can be upgraded as an international website as well as work for specific region too. There are many projects available on specific crops like for rice , for potato, for apple etc. The project is inspired from kaggle notebook [1]. But our project will provide solution for all the possible diseases in bangladesh, So one website and one click is enough to find out the diseases no matter which crops you choose.

After comparing to the previous projects available online we have used inceptionv3{2] model of keras, as this model gave more accurate results than the projects we are inspired from.

2 Objective:

The goal of this project is to build an user friendly website for our Bangladeshi people to check the health of their crops by simply uploading a picture of their crops leafs. And as the website will detect the diseases it will also provide the solution of the particular disease. The main target is to find out the crops diseases and their solutions by simply taking its picture. The targeted user of this website are the farmers of Bangladesh, so the user interface is very easy for understand and check the diseases.

3 Analysis and Design:

The main crops of Bangladesh are Rice, Jute, Potato, Tomato etc. We had taken Rice and potato as our main priority as these two are the most planted crops. Our websites can predict their diseases as well as for tomato and apple. Other crops are available in bangladesh but the datasets of those crops aren't resourceful enough to predict successfully.

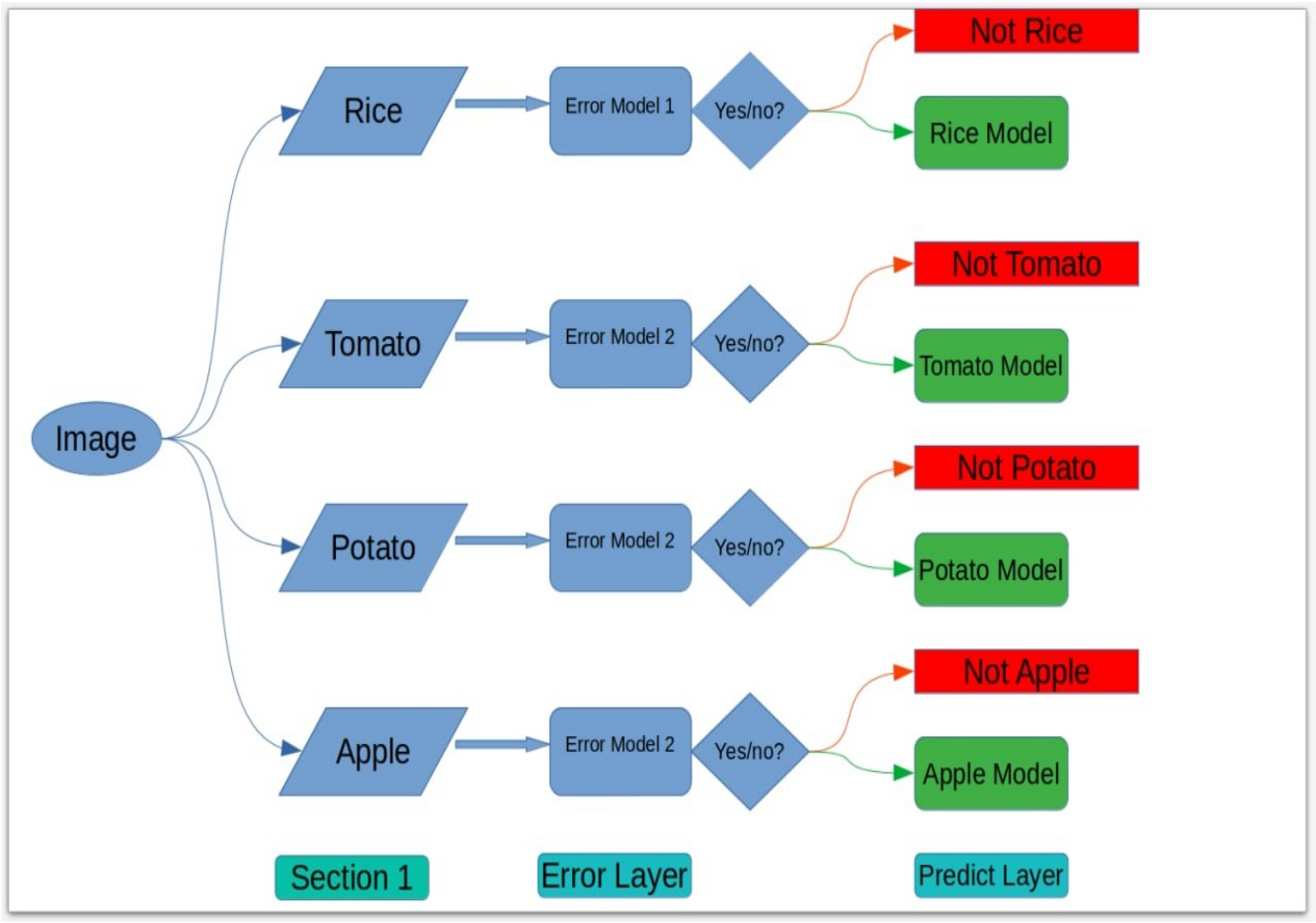


Figure1 : Figure shows the structure of the operation of website.

First of all any of section 1 option should be chosen. After the successful upload, it will check whether it is match with the option or not. If the option is chosen Rice and the uploaded picture is of potato it will show wrong picture warning because of error layer. If the picture passed the stage of error layer then it will jump into its own model like rice picture will run through rice model and show the result.

3.1 User Activity:

The website is simple and easy to use. All the button have english and bengali name simultaneously, so that any native bengali speaker can easily understand what to do. Again a dedicated menu is also added for those who doesn't understand what to do to get prediction.
At first the user need to sign in or register to get the access. Then he home page of the website has four dedicated options for four crops. Each option provides same interface and instruct the user to upload a picture of leaf of his crops. And by clicking on the "Predict" button , an user can know about the diseases and if the leaf has not any diseases then it will show healthy. If the leaf has disease, then another button will appear to show the solutions of the particular diseases if the user is interested.
So the steps for users are:-

3.1.1 Sign In/ Register (if new user)

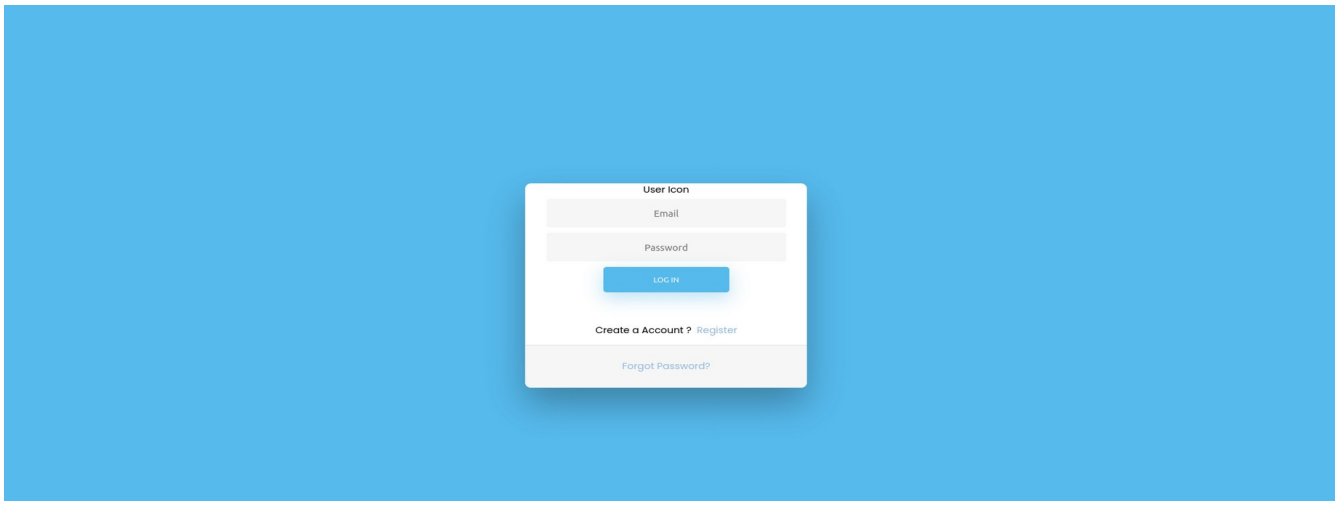
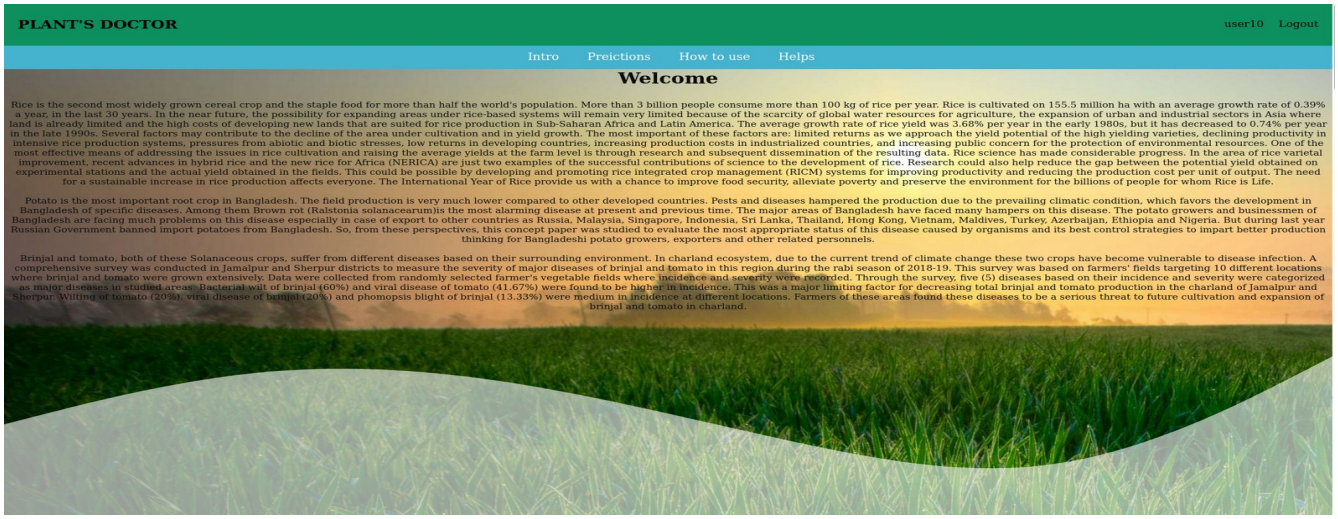


Figure2 : Figure shows the login page of the website.

3.1.2 After Successful signing in would take the user to a homepage



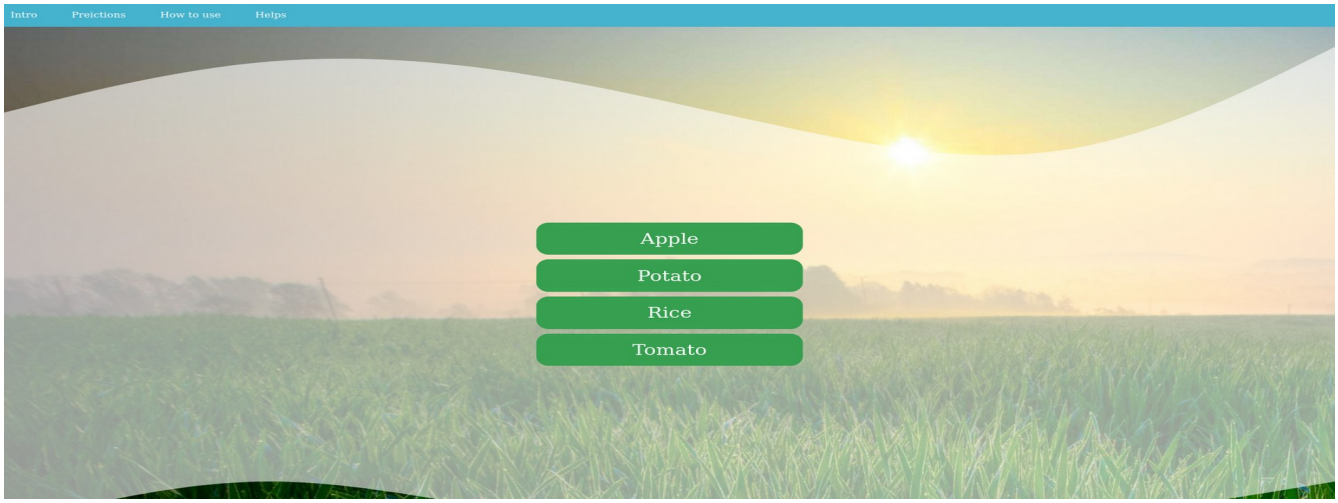


Figure 3 & 4 : Figure the home page and predictions options.

3.1.3 Choose the option for your crops

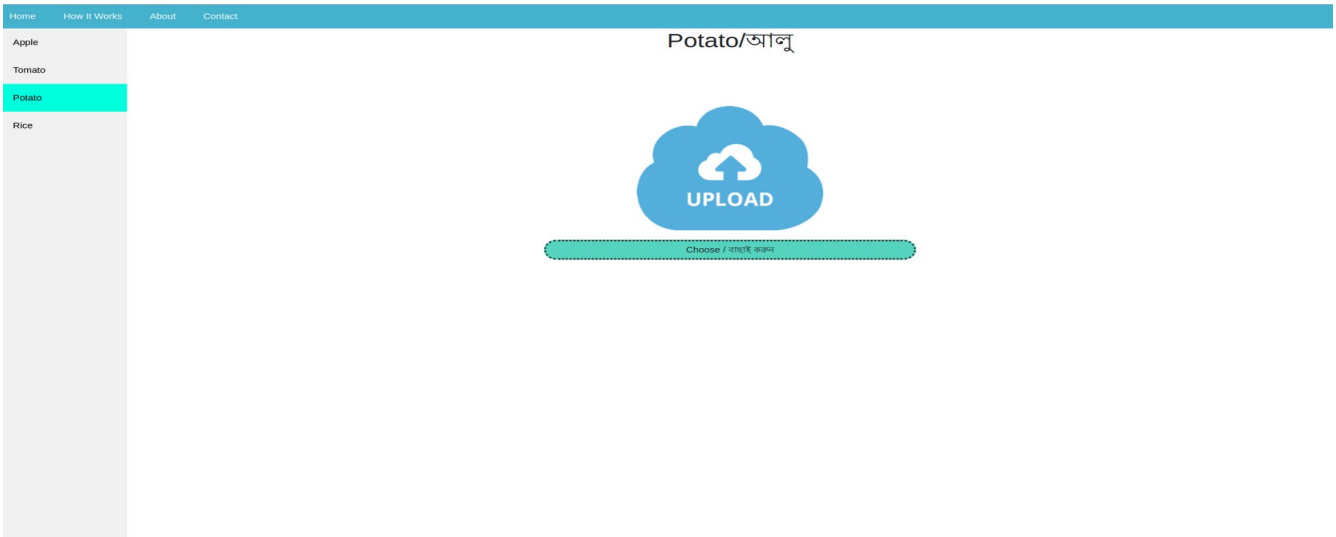


Figure 5 : Figure shows the predictions page for Potato.

Here, after choosing the ‘Potato’ option it is showing the page dedicated for this option.

3.1.4 Upload a picture of leafs

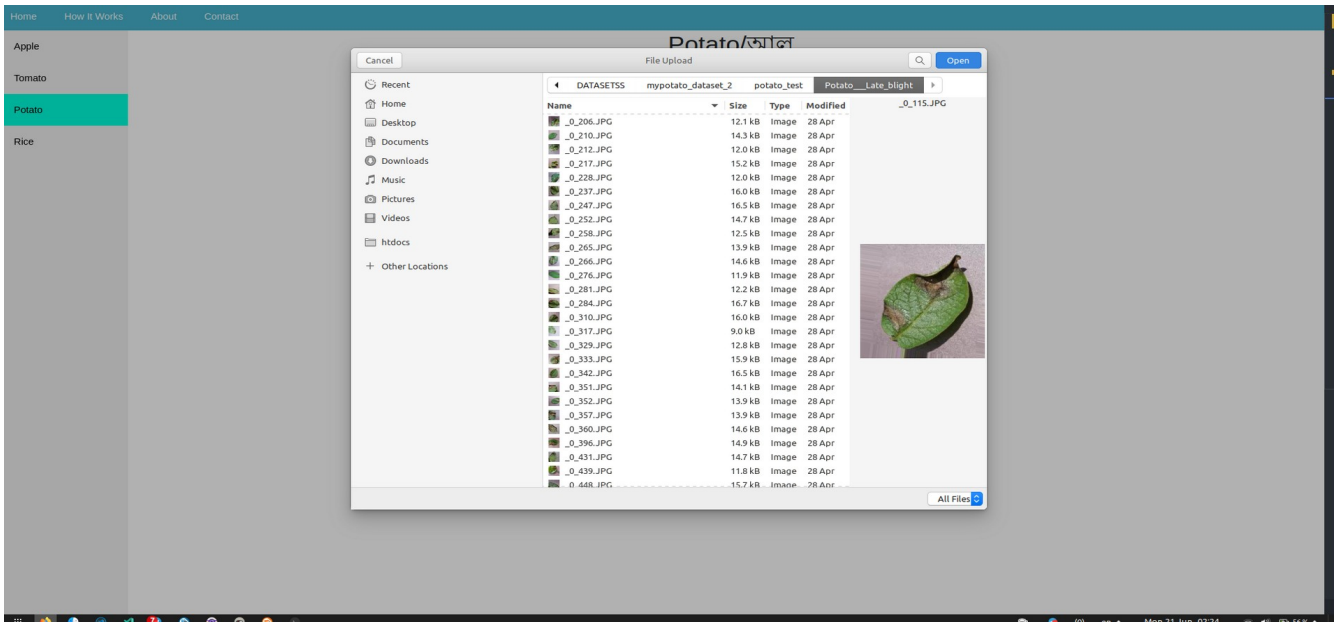


Figure 6 : Figure shows the feature for selecting images.

3.1.5 Click predict [If wrong leaf is uploaded it will show error message]

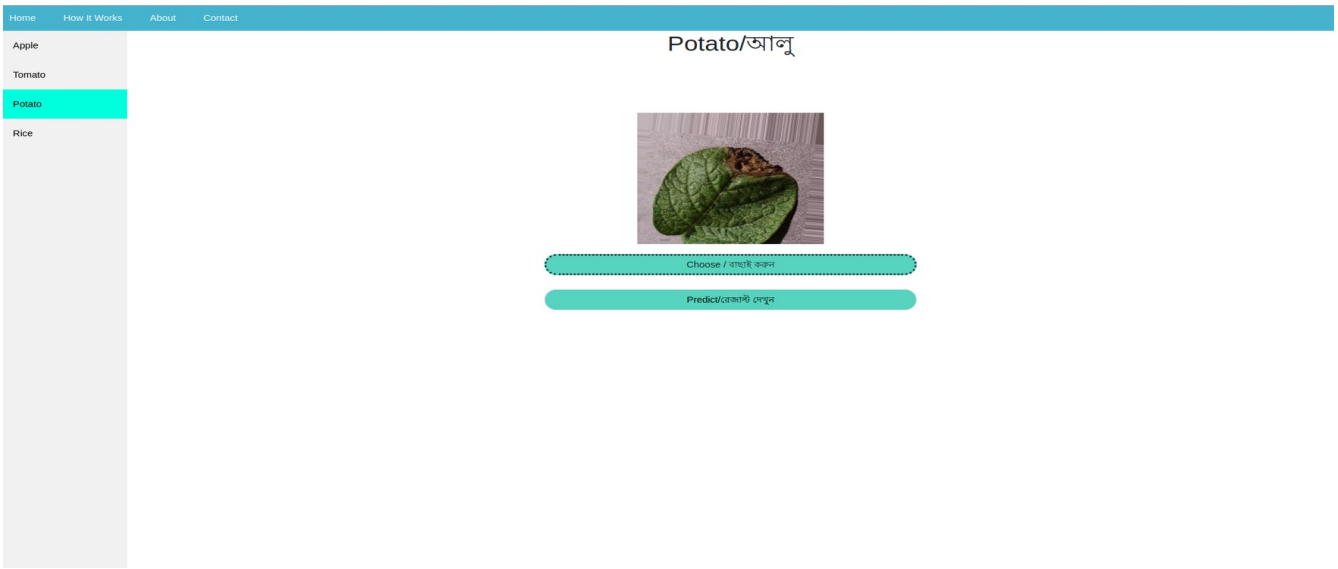


Figure 7 : Figure shows the prediction button options.

3.1.6 Show option to get to know about the solution:

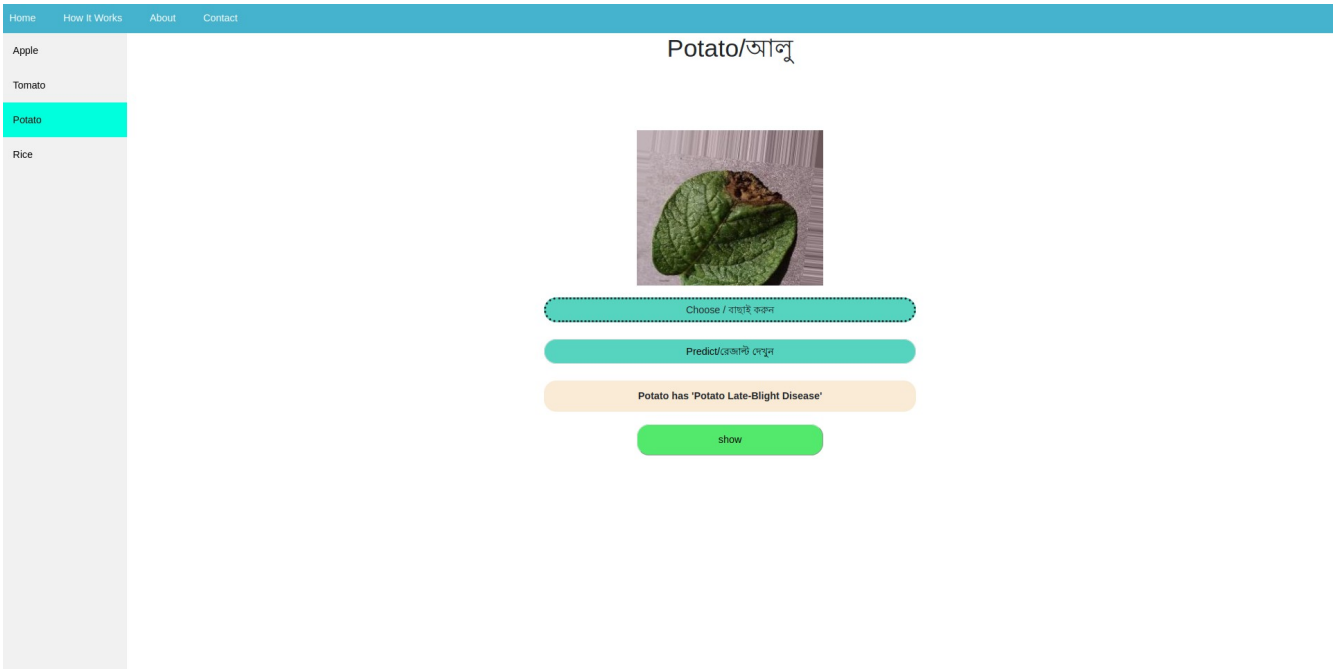


Figure 8 : Figure shows the feature for soltuion.

3.1.7 Token's For User:

Upon successful registration each user will get 20 tokens, each token will be used for each prediction. If the user is also interested after using 20 tokens, a menu for getting token is created. After applying for token each user will get 1000 token which can be activated from the token code sent to his mail, which he used for registration.

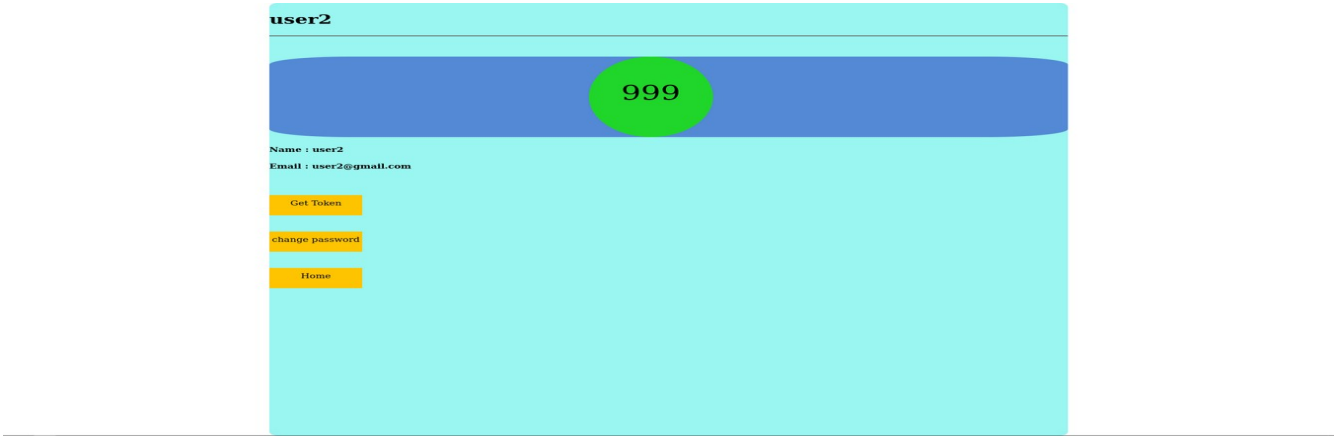


Figure 9 : Figure shows the user profile.

3.2 ADMIN ACTIVITY :

After successful login as administrator, the admin would see different layout than the user ones.

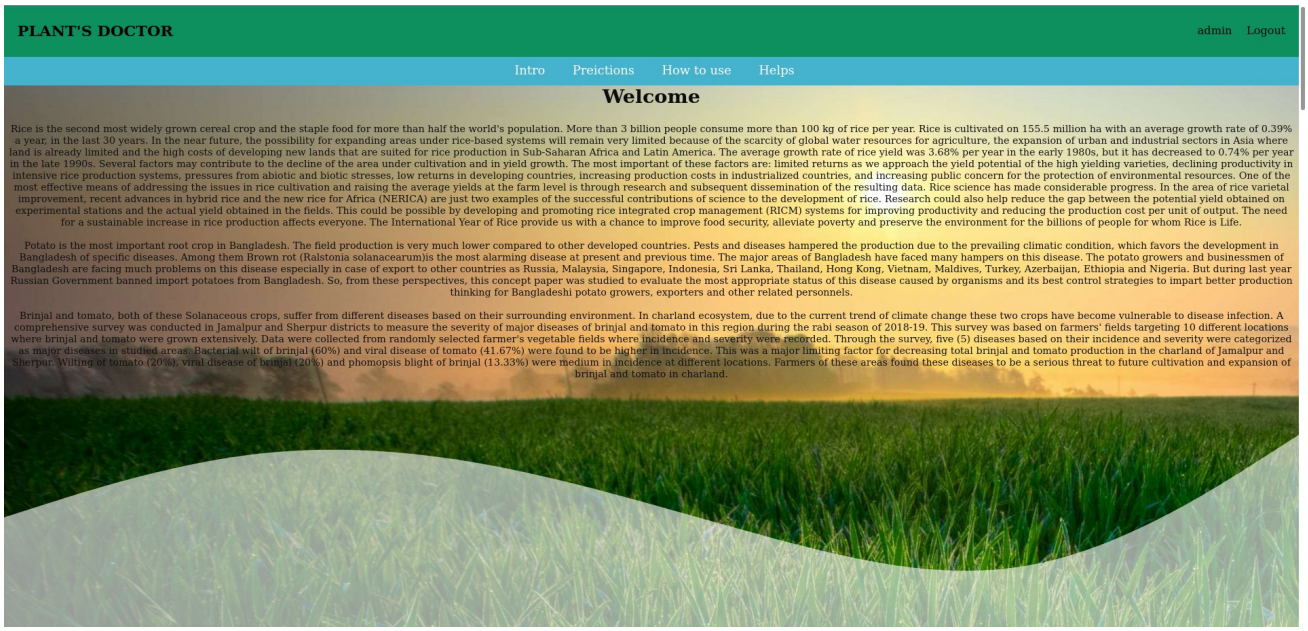


Figure 10 : Figure shows the admin home page.

The right corner is showing successful admin login .
The admin can give input multiple leafs at a time to know the accuracy of the specific diseases. And get the total accuracy based on the input.

Figure 11 : Figure shows the prediction result for admin.

3.3 Database:

For Database we have used mysql database. We have 7 column in our database.
They are describe below :

1) user_id:

- Datatype : int
- Auto Increment Enable

this column is used as the key of the table. Each user id is different and can identify any user with the help of this user_id

2) name:
Datatype is set VARCHAR
This column is used for storing the name of the user.

3) email:
Datatype is set VARCHAR
This column is used for storing the email address of the user

4) token:
Datatype is set VARCHAR
This column is used for generate and storing token when user do forgot password operation.

5) password:
Datatype is set VARCHAR
This column is user for storing the password of the user

6) count:
Datatype is set INT
This column is used for storing the number of prediction operations left for the user.

7) count_token:
Datatype is set VARCHAR
This column is used for generate and storing the token for getting ‘premium package’ of the user.

A overview of the database is given below :

	user_id	name	email	token	password	count	count_token
Edit Copy Delete	1	user1	user1@gmail.com	77fb91cc-0b5a-492c-89b6-7b5f00f3ac4c	1212	20	111
Edit Copy Delete	2	user2	user2@gmail.com	none	user2_pass_2	999	88a3a44d-164f-4c1e-8b68-5ad86f1e6d5e
Edit Copy Delete	5	user4	user4@gmail.com	none	user4_pass	20	NULL
Edit Copy Delete	6	user5	user5@gmail.com	none	user5_pass	20	NULL
Edit Copy Delete	8	user6	user6@gmail.com	1c4e08c2-23d9-4956-9f5e-0f613181007d	user6_pass	20	NULL

Figure 12 : Figure shows the database contents.

4 Implementation Section:

4.1 Libraries:

4.1.1 Numpy:

NumPy is a Python library used for working with arrays.

It also has functions for working in domain of linear algebra, fourier transform, and matrices.In Python we have lists that serve the purpose of arrays, but they are slow to process.

NumPy aims to provide an array object that is up to 50x faster than traditional Python lists.

Here in this project this library is used to make images as array dimension.

4.1.2 Tensorflow:

TensorFlow is a Python library for fast numerical computing created and released by Google.
It is a foundation library that can be used to create Deep Learning models directly or by using wrapper libraries that simplify the process built on top of TensorFlow. In this project it is used to import different types of keras model.

4.1.3 CV2:

OpenCV-Python is a library of Python bindings designed to solve computer vision problems. cv2.imread() method loads an image from the specified file. If the image cannot be read (because of missing file, improper permissions, unsupported or invalid format) then this method returns an empty matrix.

4.1.4 glob:

Glob is a general term used to define techniques to match specified patterns according to rules related to Unix shell. Linux and Unix systems and shells also support glob and also provide function glob() in system libraries.
In Python, the glob module is used to retrieve files/path-names matching a specified pattern. The pattern rules of glob follow standard Unix path expansion rules. It is also predicted that according to benchmarks it is faster than other methods to match path-names in directories. With glob, we can also use wildcards ("*, ?, [ranges]) apart from exact string search to make path retrieval more simple and convenient.

4.1.5 re:

This module provides regular expression matching operations similar to those found in Perl. Both patterns and strings to be searched can be Unicode strings (str) as well as 8-bit strings (bytes). However, Unicode strings and 8-bit strings cannot be mixed: that is, you cannot match a Unicode string with a byte pattern or vice-versa; similarly, when asking for a substitution, the replacement string must be of the same type as both the pattern and the search string.

4.1.6 os:

The OS module in Python provides functions for interacting with the operating system. OS comes under Python's standard utility modules. This module provides a portable way of using operating system dependent functionality. The *os* and *os.path* modules include many functions to interact filesystem.

To get the location of the current working directory os.getcwd() is used.

4.1.7 sys:

The sys module in Python provides various functions and variables that are used to manipulate different parts of the Python runtime environment. It allows operating on the interpreter as it provides access to the variables and functions that interact strongly with the interpreter.
The sys modules provide variables for better control over input or output. We can even redirect the input and output to other devices. This can be done using three variables –

- stdin
- stdout
- stderr

4.1.8 mysql.connector :

The mysql.connector library provide the functions to connect our flask application with mysql database. So all the 4 operation on database can be done using the attributes of this library.

4.1.9 Flask :

The 'flask' provides Flask function in out project. Flask is a micro web framework written in Python. It is classified as a microframework because it does not require particular tools or libraries. All the API for out web application are implemented using flask.

We have used "Flask", "redirect", "url_for", "request", "render_template", "jsonify", "session" library from flask to implement different functionalities.

4.1.10 UUID :

Universal Unique Identifier, is a python library which helps to make random objects/numbers of 128 bits as ids. This library is used to generate token for ‘forgot password’ and ‘premium version’ feature.

5 Methodology:

5.1 Error-Prediction for Rice :

This is the initial stage for predict Rice Images. The input images first feed into in this stage. This stage predict if the image is Rice image or not. If the Image is a Rice leaf image then the image is sent to the next stage where the image is used for predicting Rice leaf diseases. If the image is not rice leaf image then a output is shown that that image is not rice leaf image.

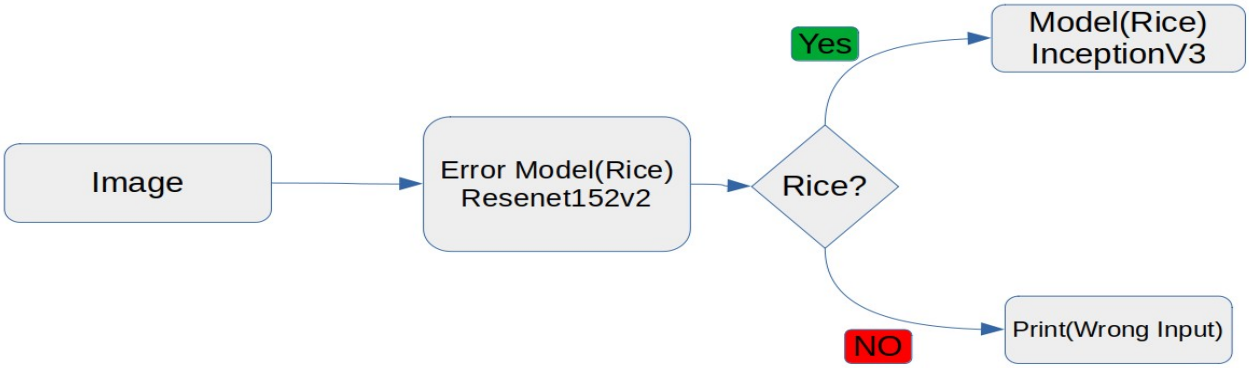


Figure 13 : Figure shows the prediction process for Error model 1.

To build this process we used Resnet152V2 architecture transfer learning model from Keras python library. A diagram of it’s working process is given below :

If the image is rice leaf image it is sent to the rice model. Which is based on InceptionV3 architect model.

5.2 Error-Prediction for Apple,Potato,Tomato:

This is the initial stage for apple,potato and tomato prediction. The input from user is given as input in this stage. The model used in this stage is InceptionV3 architecture model from Keras with transfer learning approach. The model take image from user input and process the image to detect 3 classes.

The classes are :

- Apple
- Tomato
- Potato

The predicted is compared with the input section. If the image is predicted ‘tomato’ image and the user section is also ‘tomato’ then the image is send to the next stage for that section. For tomato it is sent to ‘Model(Tomato)’ stage. For potato and apple the operation process is same.

A diagram of the operation process of this stage is given below :

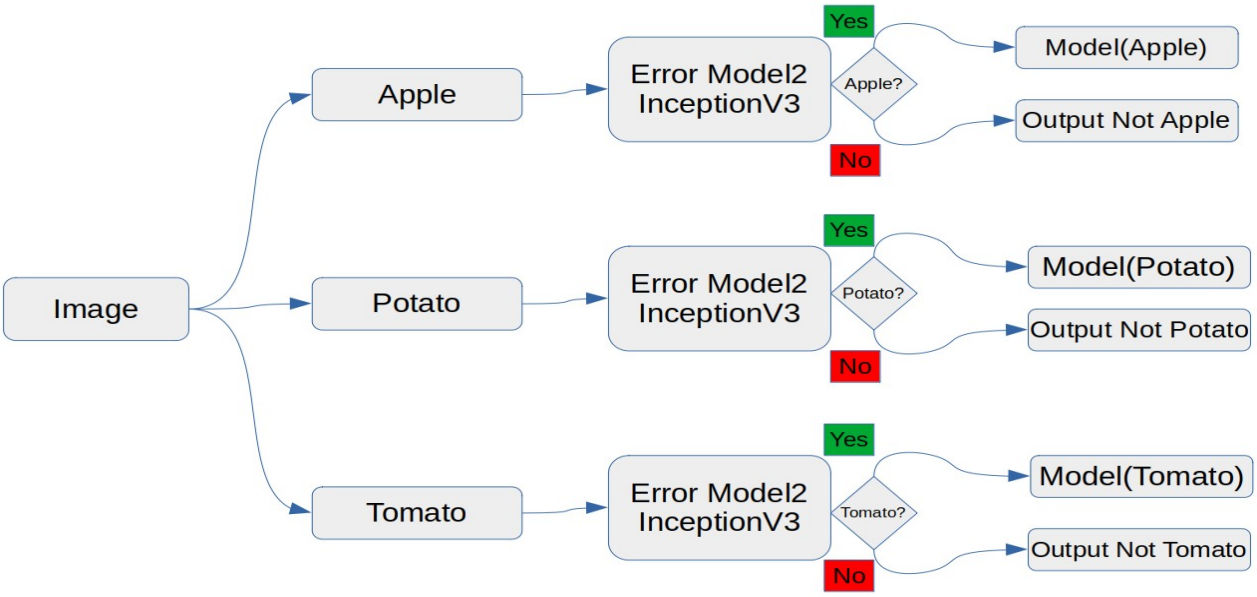


Figure 14 : Figure shows the error prediction process for Apple,Tomato & Potato.

5.3 For Apple :

To implement this section, we used transfer learning method. Here the model we used for transfer learning is InceptionV3 from python library Keras. Here our dataset of Apple is divided into 4 classes. And we trained the model to predict these 4 classes.
The 4 classes are :

- Apple Scab Disease
- Apple Black-Rot Disease
- Cedar-Apple-Rust Disease
- Healthy Apple leaf

Images are given as input and output is an array of predictions of each of the four classes. And the index of the maximum prediction are taken and transfer it to desired result.

A diagram of this prediction process is given below :

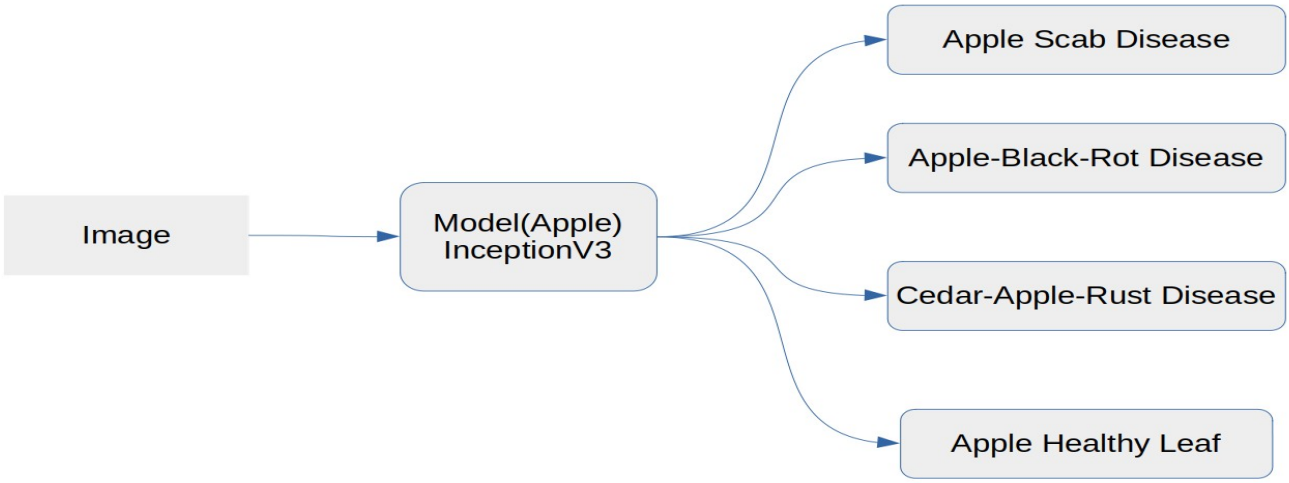


Figure 15 : Figure shows the prediction process for Apple Diseases.

5.4 For Rice

In Rice, Potato and Apple we used the same transfer learning process with the help of the InceptionV3 model from Keras. For rice the model is trained for prediction of 4 classes.
The 4 classes are :

- Brown Spot Disease
- Healthy Rice
- Hispa Disease
- Leaf Blast Disease

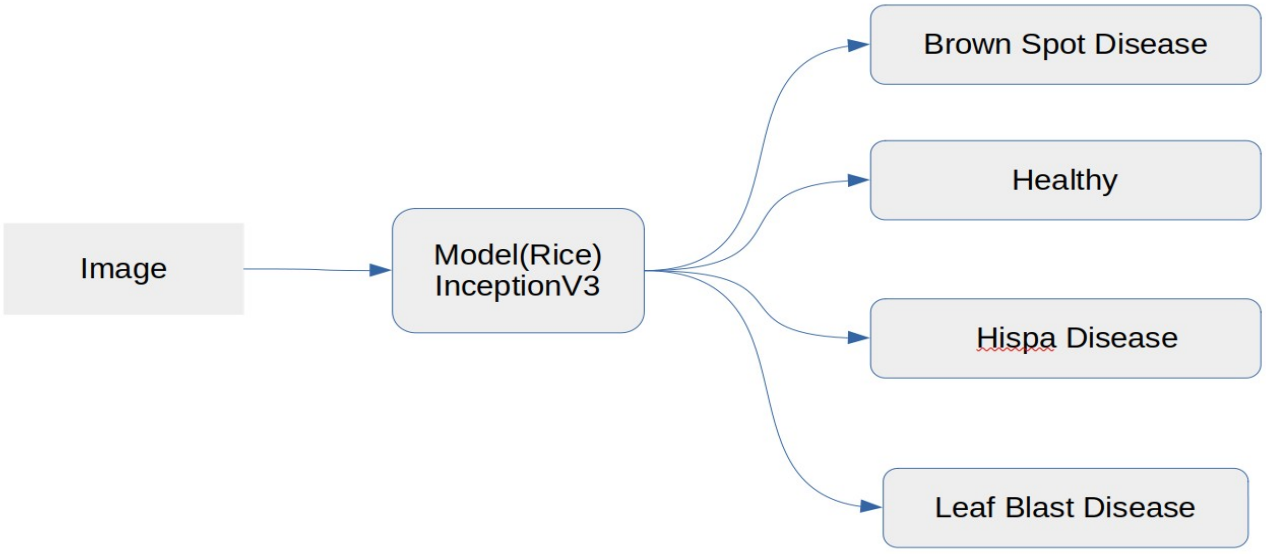


Figure 16 : Figure shows the prediction process for Rice Diseases.

5.5 For Potato

In potato we trained the model to predict 3 classes. And we used InceptionV3 here also. The classes 3 are :

- Potato Early-Blight Disease
- Healthy
- Potato Late-Blight Disease

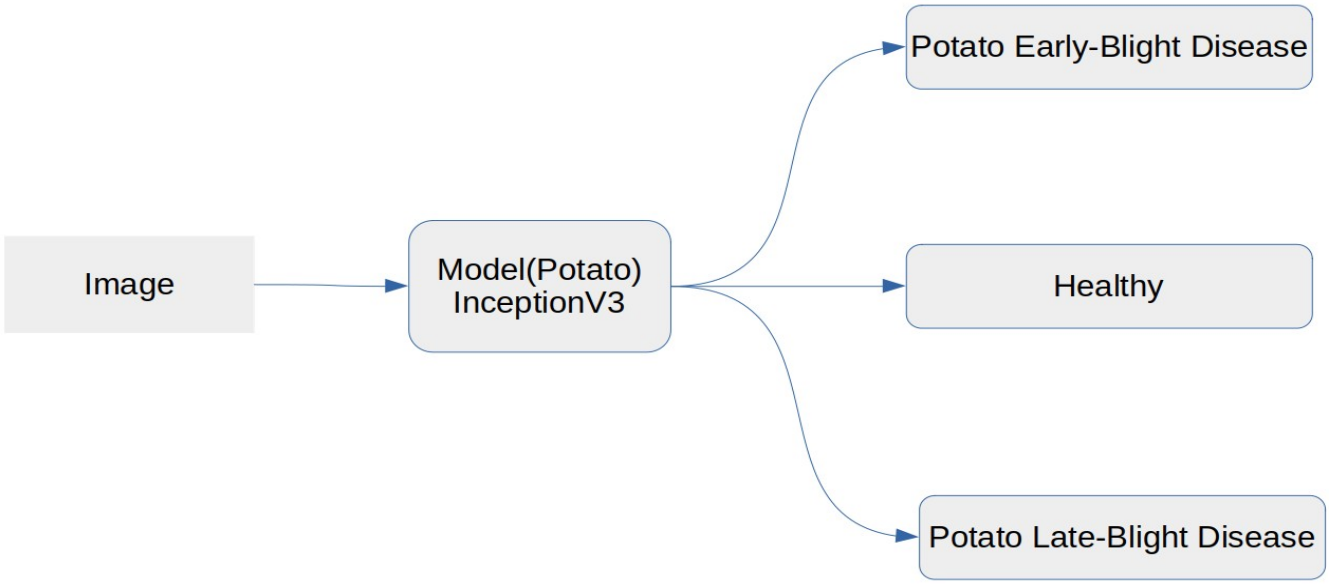


Figure 17 : Figure shows the prediction process for Potato Diseases.

5.6 For Tomato

To predict tomato classes we used transfer learning approach. And the model we used was resnet152v2 architecture. For tomato we predicted 10 classes. Because of this many classes from our finding we found that InceptionV3 is not giving good accuracy for our test data where resnet152v2 gives comparatively a better accuracy.

The 10 classes are:

- Tomato Bacterial-Spot Disease
- Tomato Early-Blight Disease
- Tomato Late-Bligh Disease
- Tomato Leaf Mold Disease
- Tomato Septoria Leaf Disease
- Tomato Two Spotted Spider Mite Disease
- Tomato Target Spot Disease
- Tomato Yellow Curl Virus
- Tomato Mosaic Virus
- Tomato Healthy

A diagram for prediction architecture is given below:

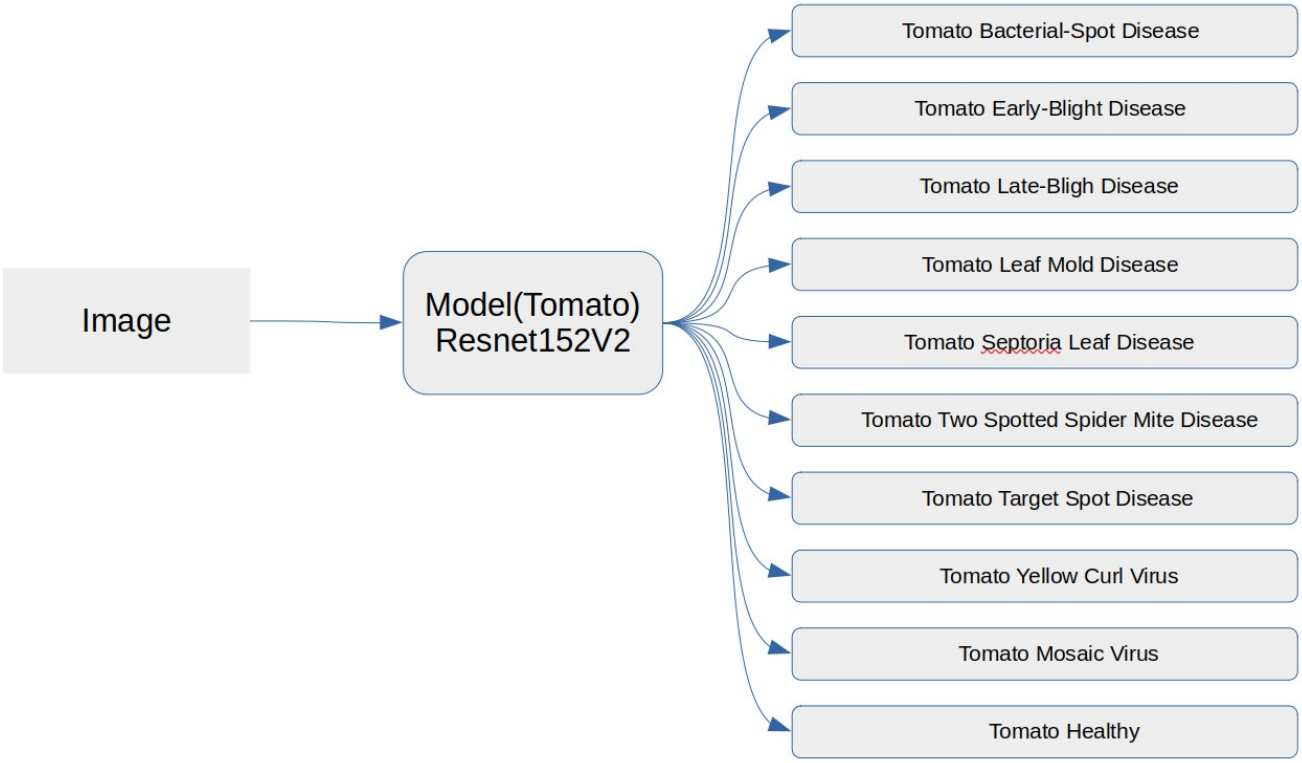


Figure 18 : Figure shows the prediction process for Tomato Diseases.

6 Limitation and Future Activities:

This project is only limited for Bangladeshi people and diseases for main Bangladeshi crops. The following feature will be added in the next version:

1. It can't detect a single leaf from multiple leafs so it should be improved
2. An app version would reach to more rural people
3. All the possible diseases of farming plants to make it as international and regional platform.
4. Option for live-chat with the specialist.

As the targeted audience is Bengali speaking, a full fledged Bangla version website and app should be developed. And for different region it should have different specific language option to make it easy to use.

7 Conclusion:

It would be more useful if we could develop an app version of this project. As well as implement all the diseases of popular crops around the world based on which country has infrastructure similar to ours and need these type of websites and app. Again some popular crops of Bangladesh aren't available right now due to shortage of datasets. A campaign can be started to collect the datasets for this website and thus make this website useful for all types of farmers.
The project is determined for the users who are mainly farmers. Its soul purpose to reduce the losses of farmers and utilize all the modern day treatment for the plants to keep them healthy.

References:

1. https://www.kaggle.com/vipoooool/new-plant-diseases-dataset
2. https://keras.io/api/applications/inceptionv3/
3. https://keras.io/api/applications/resnet/#resnet152v2-function