HOMEMADE RECIPE BOWL

Your ingredients, Our recipes

Under the expert guidance of:
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Team:
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Problem Statement?

- Often, people get into a situation that they want to cook something delicious but are short on ingredients at home.

- Many times people see an image of a delicious looking dish, but they don't know how to cook it.

- We aim to make a user aware of the various dishes which can be cooked from available set of ingredients or an input image given by a user.

Our Contribution...

- What already exists:
  - Recipes-by-name search system
  - Recipes recommender search system
- Existing Problems:
  - No Recipes-by-Ingredients search system
  - No Recipes-by-Images search system
  - No Ingredients-Recipe and Image-Recipe datasets.
- Our Contribution:
  - Scraped Ingredients-Recipe and Image-Recipe datasets.
  - Training Image-to recipes model using Convolutional Neural Network
  - Recipe generator using character-level RNN text generation ML technique.
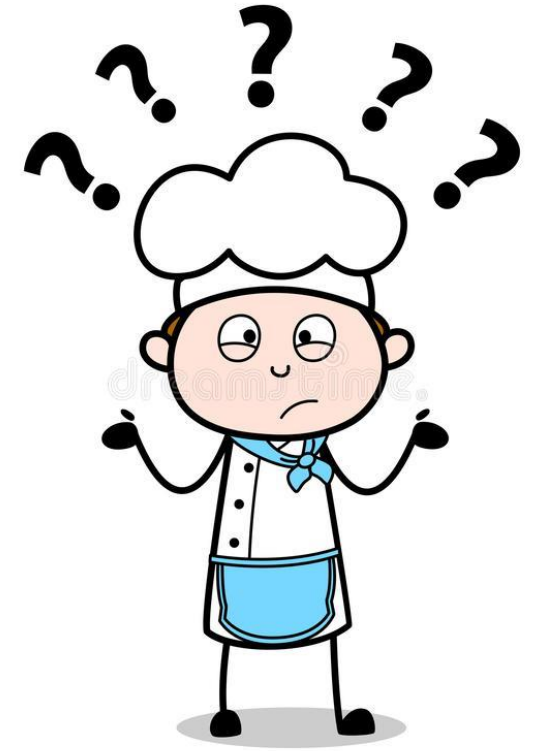
What is Homemade Recipe Bowl?

- A **dynamic website** incorporating **machine learning techniques**.
- Search options:
  - Search by Ingredients
  - Search by food image
  - Search by cuisine
- Output: self generated recipes
- It is a recipe **generator system** and not a recommender system!!!
- An additional feature for sharing food related content in the form of posts.

Technologies used...

- **Website front end:** React, CSS, HTML, Javascript, Jquery, AJAX

- **Website Back end:** Flask (Python Framework)

- **Database:** SQLite

- **Deep learning:** Tensorflow and Keras Framework

- **Web Scraping:** BeautifulSoup (Python)
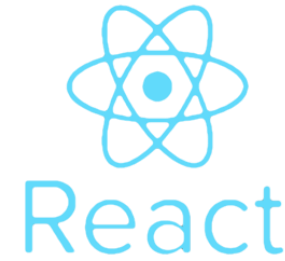
Timeline…

Week 0

(28 July 2020 - 9 August 2020)

Team formation and Mentor Selection:

- Team Member Formation.
- Choosing the field/technology of interest after a series of meetings with the team members.
- Selecting the appropriate mentor best suited for the technology to be used.

Week 1
(10 August 2020 - 16 August 2020)

Project Idea Discussion and Synopsis Drafting:

- Decided on three project ideas:
    1. A gaming project which uses physical movement detection for moves in the game. This would collaborate exercise with gaming.
    2. Personal voice assistant software and hardware for blinds to detect the objects around.
    3. Platform for generating recipes based on given set of ingredients. This was influenced by the cooking trend during lockdown situation.
- Finally, we decided to take up the third idea, as we found it to be a more practical and useful idea. And also it was feasible according to our knowledge and skill set.

Week 2

(17 August 2020 - 23 August 2020)

Discovering Project Requirements:

- Looking onto the existing work in this related field, if done.
- Deciding the further contributions we can make.
- Looking for availability of datasets for training purposes of our models to be able to predict the required output.
- Looking for platform to perform high end computations like web scraping and machine learning model training
- Developing a user interface through which the user can access all the functionality easily and innovatively.

Software Requirements Specification (SRS)

- **Purpose:** to develop a system which primarily is capable of generating extensive recipes out of given set of ingredients.

- **Intended Audience:**
  - Any person of any age group, any region and any profession who loves exploring food.
  - A very large size audience!!!

- **Scope:**
  - Fetch/Scrap relevant dataset
  - Decide upon apt deep learning technique for text generation
  - Train the ML Model on variations of hyper parameters
  - Develop hitech and easy-to-use user interface system

- **Product Features:**
  - Ingredients-to-recipe feature
  - Image-to-recipe feature
  - Nutritional analysis for every recipe

- **User Interface Requirements:**
  - Easy to use dynamic website which runs on exhaustive set of devices and which is capable of handling heavy user load.

- **Hardware Requirements:**
  - High end computational machine required for Web Scraping and ML Model training if required.

- **Software Requirements:**
  - 3rd Party dependencies required for Web Scraping (like BeautifulSoup, JSoup), Model Training script (like Tensorflow, Keras, Pytorch) and Web interfaces (React or Vue for frontend, Flask, Express or Django for backend).

Week 3
(24 August 2020 - 30 August 2020)

Exploring datasets and websites for scrapping (if required):

- Looked up for the existing datasets on the internet.
- Found one nearly exhaustive dataset by MIT, but the access was not public, wasn't accessible.
- Could not find any other dataset related to the Recipe name along with ingredients and instructions.
- Created the Github Repository for the project - Homemade Recipebowl (Currently the repository is private)

Week 4
(31 August 2020 - 6 September 2020)

Scraping Websites:

- Shortlisted three websites suitable for ingredient-recipe dataset:
  - Epicurious
  - All Recipes
  - Food Network
- Developed the code for scraping in python.
- Scraped the websites using the **BeautifulSoup** module in python.

Week 5
(7 September 2020 - 13 September 2020)

Designing UML Diagrams:

- Use Case Diagram
- Class Diagram
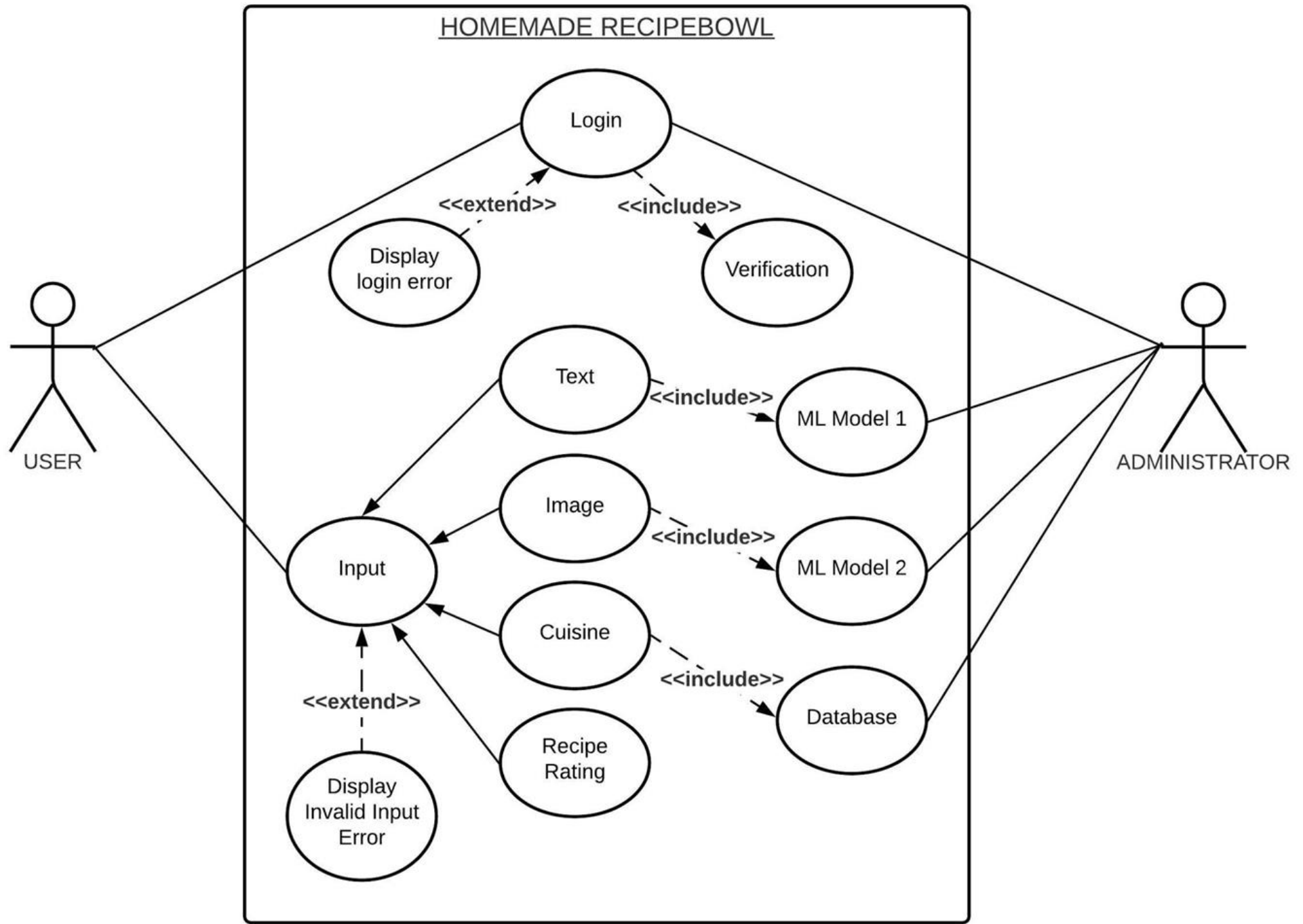- Sequence Diagram
- Activity Diagram
- Statechart Diagram

Deep Learning Course:
- Took a brief overview of the deep learning specialisation on Coursera by Andrew NG.
- Also referred to some online articles and tutorials regarding NLP.

USE CASE DIAGRAM

HOMEMADE RECIPEBOWL

USER

ADMINISTRATOR

Login

Display login error

<<extend>>

<<include>>

Verification

Text

<<include>>

ML Model 1

Image

<<include>>

ML Model 2

Input

Cuisine

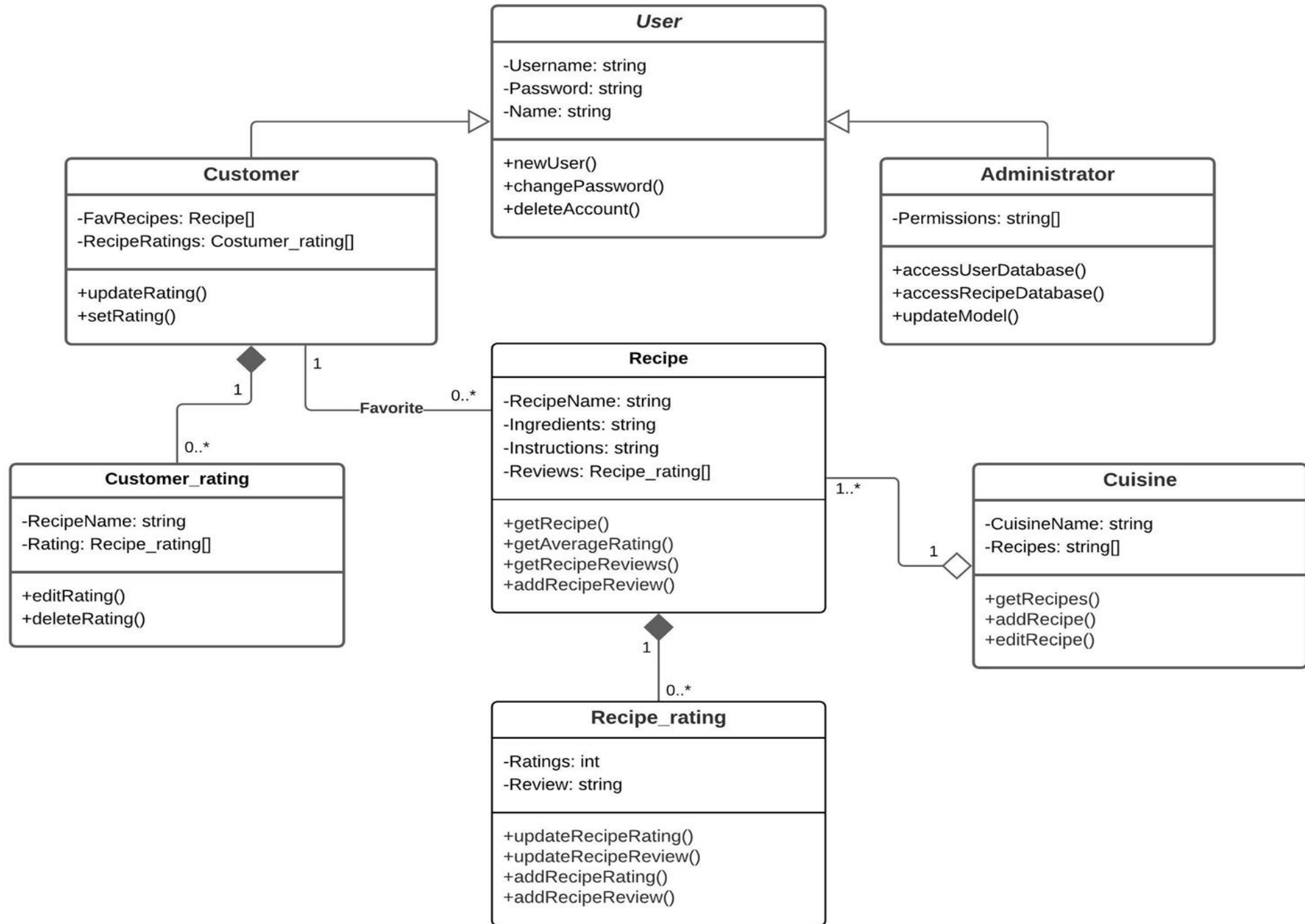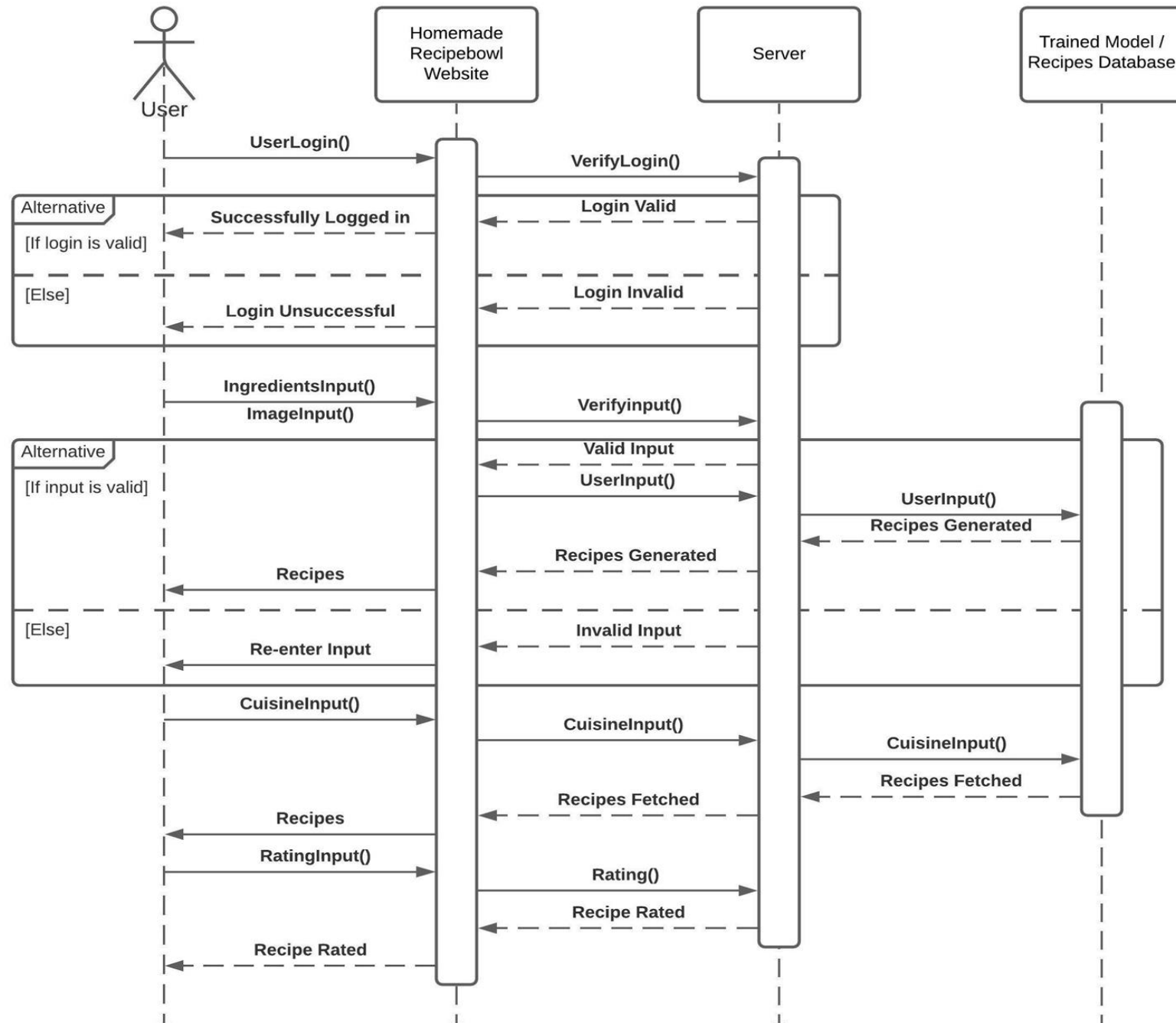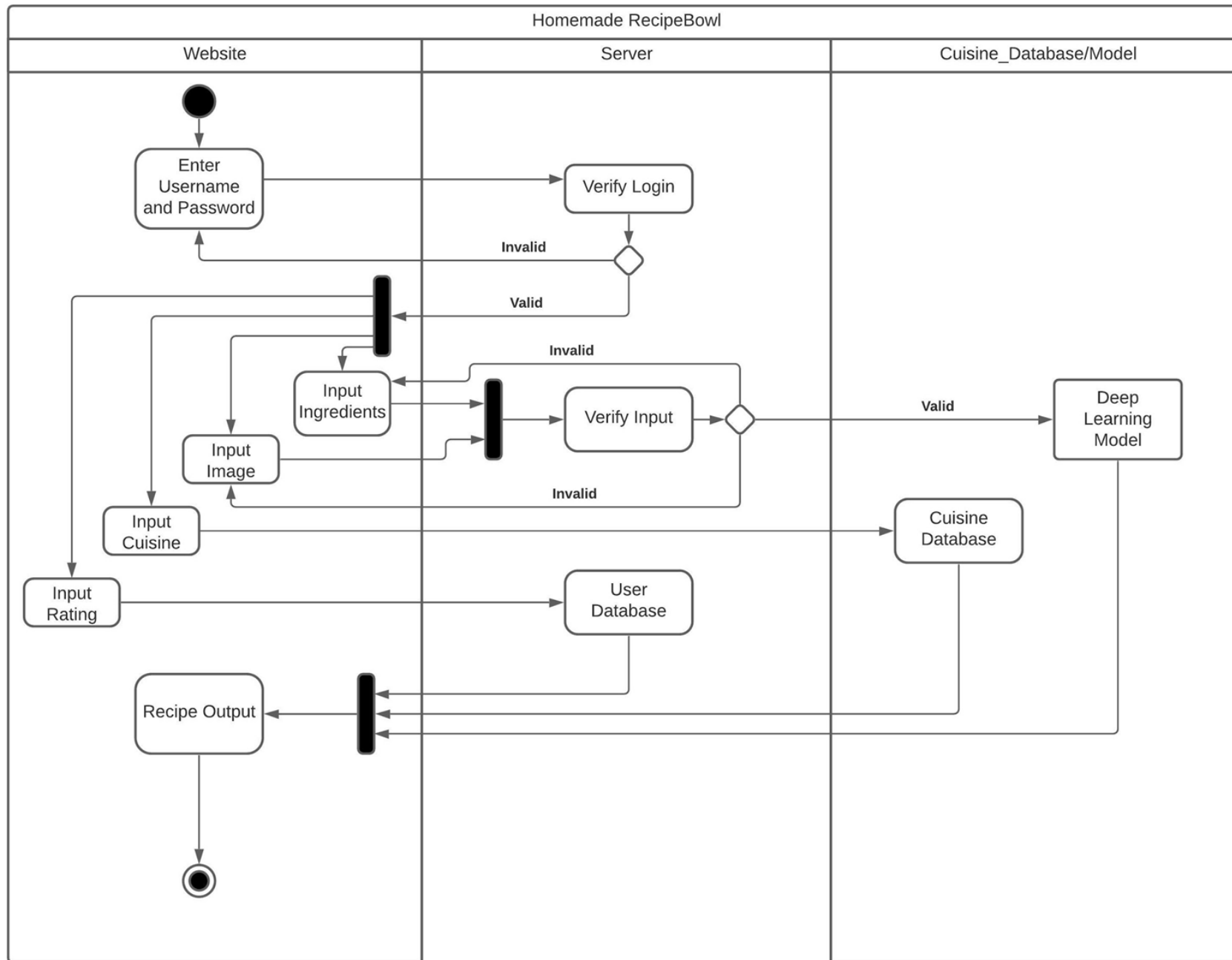<<include>>

Database

Recipe Rating

Display Invalid Input Error

<<extend>>

CLASS DIAGRAM

SEQUENCE DIAGRAM

ACTIVITY DIAGRAM

Homemade RecipeBowl

Website	Server	Cuisine_Database/Model

Enter Username and Password

Verify Login

Invalid

Valid

Input Ingredients

Verify Input

Invalid

Valid

Deep Learning Model

Input Image

Invalid

Input Cuisine

Cuisine Database

Input Rating

User Database

Recipe Output
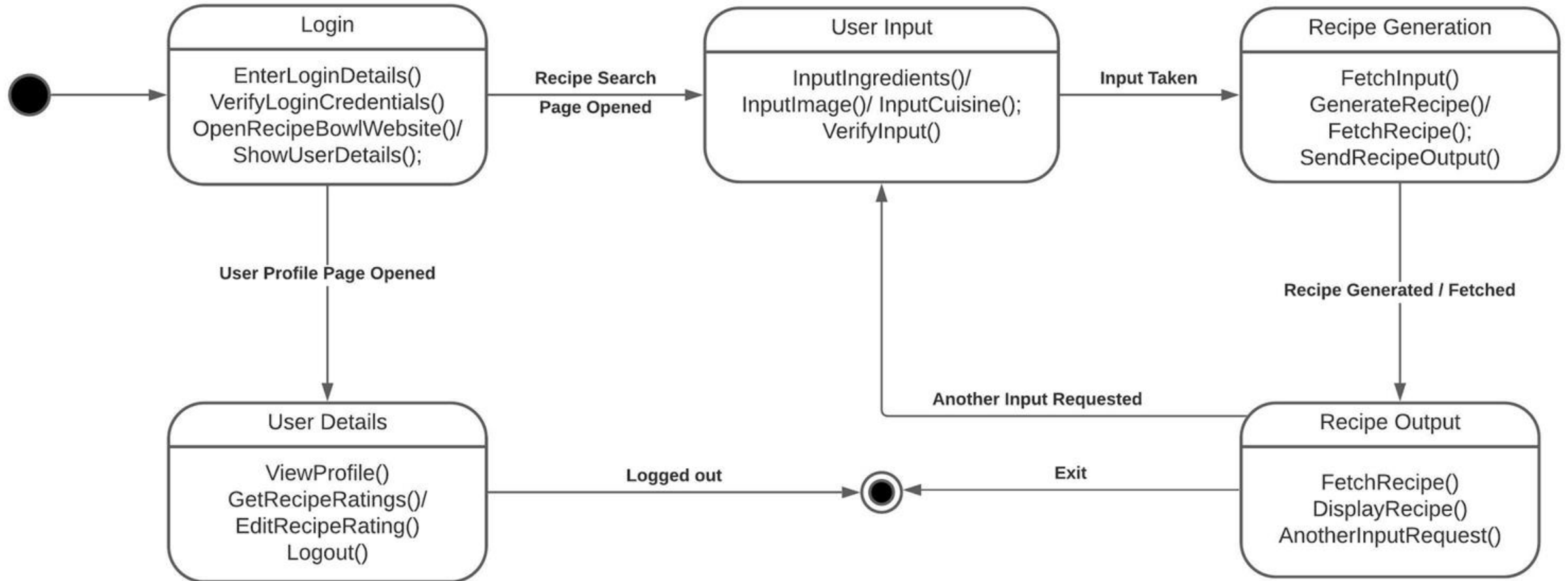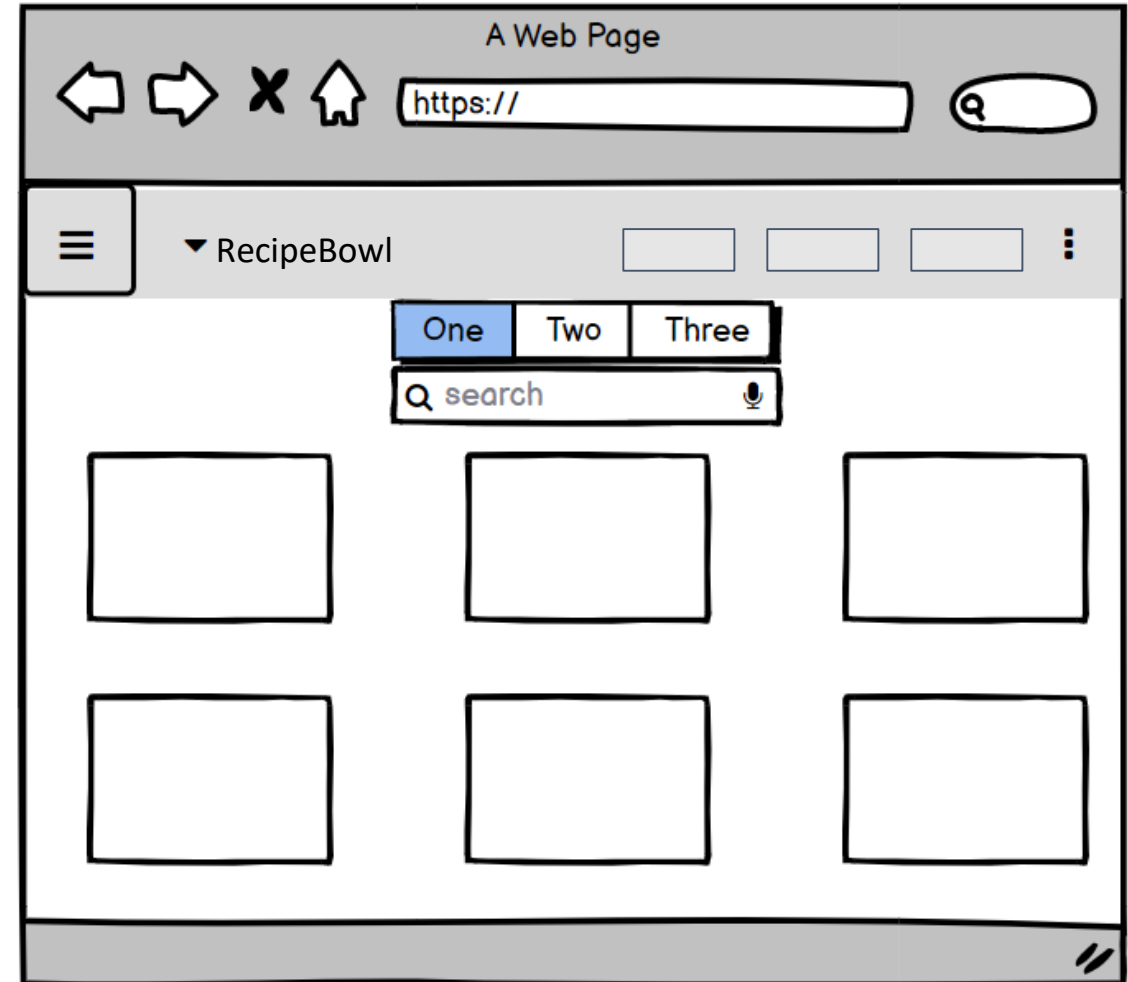
STATE
DIAGRAM

Week 6
(14 September 2020 - 20 September 2020)

Started developing the RecipeBowl Website:

- Started developing the website's front end using the React Framework

- Website Layout designed before the start of actual implementation by team discussions and brainstorming.

Wireframing done on https://balsamiq.com/

Week 7
(21 September 2020 - 27 September 2020)

Writing code for training the model:
- Drafted code in python using Google Colab for model training on input ingredients and giving recipes as the output.

Week 8

(28 September 2020 - 4 October 2020)

Training and Testing of the Model:
- Trained the deep learning model over 20 epochs on Google Colab.
- Tested the model and retrieved the output from the model.
- Requested Prof. Poonam Saini for PEC's DGX GPU access for further training as it was not feasible on Google Colab due to limited resources(13 GB RAM).

Week 9
(5 October 2020 - 11 October 2020)

Training the model on DGX's GPU:

- Trained and tested our model on DGX GPU using docker and Teamviewer and extracted the following models:

Optimizer	Epochs	Early Stopping	No. of Steps	Learning Rate	Accuracy (*100 %)	Loss
Adam	20	-	1500	0.001	-	0.24
RMSProp*	20	18	700	0.001	0.93	0.19
RMSProp	500	21	1500	0.001	0.927	0.225
Adam	500	41	1500	0.001	0.9296	0.2201
Adam	20	-	1500	0.0005	0.9249	0.2367
Adam	500	45	1500	0.0005	0.9311	0.2156
RMSProp	20	-	1500	0.0005	0.9275	0.2278
RMSProp	500	44	1500	0.0005	0.9320	0.2128
SGD	Model didn't learn, very high loss, very less accuracy(<60%)					

- Batch Size = 64
- Loss Function = sparse_categorical_crossentropy

RMSProp*
VERY LARGE FLUCTUATIONS IN THE LOSS OVER CONSECUTIVE EPOCHS, SO NOT PREFERABLE

Week 10

(12 October 2020 - 18 October 2020)

Developing the RecipeBowl Website backend and Integrating with front end:

- Developing the website's backend using the Flask framework of python.
- Started integrating the frontend and the backend.
- Continued with the frontend of the website.
- Updated the Project SRS according to further scope of the project.

Updated Software Requirements Specification (SRS)

- **Purpose:** to develop a system which primarily is capable of generating extensive recipes out of given set of ingredients.
- **Intended Audience:**
  - Any person of any age group, any region and any profession who loves exploring food.
  - A very large size audience!!!
- **Scope:**
  - Fetch/Scrap relevant dataset.
  - Decide upon apt deep learning technique for text generation.
  - Train the ML Model by varying hyper parameters.
  - Develop hitech and easy-to-use user interface system.

- **Product Features:**
  - Ingredients-to-recipe feature
  - Image-to-recipe feature

Nutritional analysis for every recipe (relevant dataset was not available and web scraping was not feasible)

  - Cuisine and corresponding recipes feature.
  - A feature to share food related content via posts.
  - Adding few other features to improve user experience.
- **User Interface Requirements:**
  - Easy to use dynamic website which runs on exhaustive set of devices and which is capable of handling heavy user load.

- **Hardware Requirements:**
  - High end computational machine required for Web Scraping and ML Model training if required.
  - Used DGX GPU using docker and Teamviewer for training ML Models.

- **Software Requirements:**
  - 3rd Party dependencies required for Web Scraping (like BeautifulSoup, JSoup), Model Training script (like Tensorflow, Keras, Pytorch) and Web interfaces (React or Vue for frontend, Flask, Express or Django for backend).

Week 11
(19 October 2020 - 25 October 2020)

Exploring Image-to-Recipe datasets and websites for scrapping (if required):

- Could not get the most diverse MIT dataset from the given portal (portal wasn't working).
- Tried exploring some other websites which could help us with the Image to Recipes training process.
  - Chefkoch (has multiple images for many single recipes)
- Started the scraping of the dataset.

Week 12
(26 October 2020 - 1 November 2020)

Completed scrapping and started preparing model training code:

- Completed the scrapping process of ChefKoch website.
- Started development of the model training code using Convolutional Neural Networks(CNNs).
- Continued development of the website by adding new features.
- Started scraping websites to get dataset for Cuisine-to-Recipe.

Week 13-14
(2 November 2020 - 15 November 2020)

Added features like Login page and user dashboard:

- Developed the website's front end using the React framework.
- Added additional features like login page & user dashboard.
- Integrated front end components with each other.
- Integrated front end with image-to-recipe and cuisine-to-recipe feature.

Week 15-16
(16 November 2020 - 29 November 2020)

Added User Favourite Recipes feature and fixed some minor bugs:

- Developed the website's front end using the React framework.
- Added features like favourite recipe bookmark and about us section.
- Fixed minor bugs like automatic page refreshing in Image-to-recipe feature, state update in the React component and many more.

Week 17-18
(30 November 2020 - 13 December 2020)

Developed the feed feature which contains self and other user's posts:

- Created a left panel having shortcuts to jump to components like My Posts, My Favorites, My Dashboard and Change Password.

- Designed the right panel of the feed which contains the posts of the other users along with the current user.

- Added the facility to upload a relevant image along with the text.

- Added a feature to comment on the posts.

Further Scope Of The Project…

CURRENT CHALLENGES:

- The Ingredients-to-Recipe generator produces some irrelevant outputs sometimes.

FURTHER SCOPE:

- Getting access of MIT dataset and training the Ingredients-to-Recipe generator to improve it further.
- The Post's feed can be further developed to recommend posts based on user's choices.
- Discussion forum for Q/A among the users.
- Peer to peer direct chat communication.