A PROJECT REPORT

ON

"POCKET RECIPE"

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF

BACHELOR OF COMPUTER ENGINEERING

BY

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UNDER GUIDANCE OF

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UNIVERSITY OF MUMBAI

DEPARTMENT OF COMPUTER ENGINEERING

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AIROLI, NAVI MUMBAI

CERTIFICATE

This is to certify that the project entitled **POCKET RECIPE** is bonafide work of "**Rutik Vilas Patil, Rohit Devendra Sawant, Bhavesh Sengunthar, Sanket Srikanth Shetty**" submitted to the **University of Mumbai** in partial fulfilment of the requirement for the award of the degree of **Undergraduate in Computer Engineering.**

Dr. Chandrashekar Raut	Dr. A. P. Pande	Dr.S.D. Sawarkar
Project Guide	Head of the Department	Principal

DATTA MEGHE COLLEGE OF ENGINEERING

AIROLI, NAVI MUMBAI

PROJECT APPROVAL

This project report entitled "**POCKET RECIPE**" of the students **"Rutik Vilas Patil, Rohit Devendra Sawant, Bhavesh Sengunthar, Sanket Srikanth Shetty"** approved for the degree of Computer Engineering.

Internal Examiner	External Examiner
Date:	Date:
Place:	Place:

DECLARATION

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included; we have adequately cited and referenced the original sources. We also declare that we have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

Name of the Students	Signature
Rutik Vilas Patil	
Rohit Devendra Sawant	
Bhavesh Sengunthar	
Sanket Srikanth Shetty	

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ABSTRACT

People enjoy food photography because they appreciate food. Behind each meal there is a story described in a complex recipe and, unfortunately, by simply looking at a food image we do not have access to its preparation process. Therefore, in this paper we introduce an inverse cooking system that recreates cooking recipes given food images. Our system predicts ingredients as sets by means of a novel architecture, modeling their dependencies without imposing any order, and then generates cooking instructions by attending to both image and its inferred ingredients simultaneously. We extensively evaluate the whole system on the large-scale Recipe dataset and show that we improve performance with respect to previous baselines for ingredient prediction we are able to obtain high quality recipes by leveraging both image and ingredients our system is able to produce more compelling recipes than retrieval-based approaches according to human judgment. We make code and models publicly available.

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1. INTRODUCTION

Food is fundamental to human existence. Not only does it provide us with energy—it also defines our identity and culture. As the old saying goes, we are what we eat, and food related activities such as cooking, eating and talking about it take a significant portion of our daily life. Food culture has been spreading more than ever in the current digital era, with many people sharing pictures of food they are eating across social media. Querying Instagram for #food leads to at least 300M posts; similarly, searching for foodie results in at least 100M posts, highlighting the unquestionable value that food has in our society. Moreover, eating patterns and cooking culture have been evolving over time. In the past, food was mostly prepared at home, but nowadays we frequently consume food prepared by third parties. Thus, the access to detailed information about prepared food is limited and, therefore, it is hard to know precisely what we eat. Therefore, we argue that there is a need for inverse cooking systems, which can infer ingredients and cooking instructions from a prepared meal.

Therefore, we present a system that generates a cooking recipe containing a title, ingredients, and cooking instructions directly from an image. To the best of our knowledge, our system is the first to generate cooking recipes directly from food images. We pose the instruction generation problem as a sequence generation one conditioned on two modalities simultaneously, namely an image and its predicted ingredients. We formulate the ingredient prediction problem as a set prediction, exploiting their underlying structure. We model ingredient dependencies while not penalizing for prediction order, thus revising the question of whether order matters. We extensively evaluate our system on the large-scale Recipe1M dataset that contains images, ingredients and cooking instructions, showing satisfactory results.

1.1 Motivation

In the digital era we go across numerous amounts of photos everyday through social media or through many other resources, and if we find some food image attractive we tend to do more research about it. So, to reduce this time and giving the details regarding what the photo is all about including name of that product and how it can be made we are building this application.

1.2 Problem Statement

Problem statement: Recipe generation from food images using deep learning is a challenging task that involves developing an intelligent system capable of recognizing food items and ingredients from images and generating a recipe based on the recognized food items. The goal of this project is to build an end-to-end system that takes an input image of a dish as input and generates a list of ingredients and cooking instructions that can be used to prepare the dish. The system should be able to recognize various food items, handle variations in cooking techniques, and generate recipes that are both accurate and easy to follow. The project involves developing deep learning models for image recognition, natural language processing, and recipe generation, as well as integrating these models into a cohesive system that can be deployed on the cloud or mobile devices.

1.3 Aim

Pocket recipe is an application which generates detailed recipe by processing food image. The application takes food image as input and provides its recipe, step by step procedure to user by using image processing and deep learning.

Objectives

1. Many times we see a picture of food items and want to know the recipe or we order something from third parties and interested about its recipe but it is hard to know what we eat.

2. Or sometimes we don’t remember what ingredients was used previously in some recipe.

3. The pocket recipe application takes a food image as an input and outputs a sequence of cooking instructions.

4. The objective of the system will be trying to deal with image and textual data associated with food dishes to provide the best match with maximum accuracy.

2. LITERATURE REVIEW

2.1 Literature Review

Sr. No.	Name of paper	Published By	Conclusion
1.	Inverse Cooking: Recipe Generation from Food Images (2019)	Amaia Salvador, Michal Drozdzal Xavier Giro-i-Nieto, Adriana Romero	In this paper, we introduced an image-to-recipe generation system, which takes a food image and produces a recipe consisting of a title, ingredients and sequence of cooking instructions. We first predicted sets of ingredients from food images, showing that modeling dependencies matters. Then, we explored instruction generation conditioned on images and inferred ingredients, highlighting the importance of reasoning about both modalities at the same time. Finally, user study results confirm the difficulty of the task, and demonstrate the superiority of our system against state-of-art image-to-recipe retrieval approaches.
2.	Food Image to Cooking Instructions Conversion Through Compressed Embeddings Using Deep Learning (2020)	Madhu Kulkarni, Tajinder Singh, ShaitansinghRajpurohit	They have proposed a unique way to model recipe cooking instruction in to order preserving compressed embeddings which can handle variable length (words) of instructions and variable number of instructions(steps). Experiments and results clearly indicates the the suitability of the proposed scheme for the reduction sparsity of the embedding with good similarity to the original recipe instructions. It is yet to be tested on decoding efficiency and larger intercontinental recipe data sets.
3.	Identification and prediction of recipe using deep learning model	K Ranjith Reddy, Jogi Krishna Mohan, Jayanth, Sagar	The contributions of this paper can be summarized as: We present an inverse cooking system, which generates cooking instructions conditioned on an image and its ingredients, exploring different attention strategies to reason about both modalities simultaneously. We exhaustively study

			ingredients as both a list and a set, and propose a new architecture for ingredient prediction that exploits co-dependencies among ingredients without imposing order. By means of a user study we show that ingredient prediction is indeed a difficult task and demonstrate the superiority of our proposed system against image-to recipe retrieval approaches.

2.2 Summarized findings of literature survey

Traditionally, the image-to-recipe problem has been formulated as a retrieval task where a recipe is retrieved from a fixed dataset based on the image similarity score in an embedding space. The performance of such systems highly depends on the dataset size and diversity, as well as on the quality of the learned embedding. Not surprisingly, these systems fail when a matching recipe for the image query does not exist in the static dataset.
A system for comprehensive visual food recognition should not only be able to recognize the type of meal or its ingredients, but also understand its preparation process. In this project we are training CNN with recipe details and images and this model can be used to predict recipe by uploading related images and we used 1 million recipe dataset and from this dataset we used 1000 recipes as training entire dataset with images will take lots of memory and hours of time train CNN model.

2.3 Existing System

- The existing system processes the image as a whole without extracting the ingredients.
- The system uses LSTM architecture which processes and makes predictions according to given sequence of data.
- This system can't distinguish between similar images.
- This system has less decoding efficiency.

3. REQUIREMENT ANALYSIS

This chapter states the minimum requirement that a system should have to make the software run properly. This software can work in any operating system in which the developer or user tools are installed.

3.1 Functional Requirements

User Authentication: User authentication is a process that allows a device to verify the identity of someone who connects to a network resource. There are many technologies currently available to a network administrator to authenticate users. System will authenticate users based on providing unique usernames and passwords for a user session.

Availability: The system should be available to the end user for use all the time. Specific technology/domain requirements listed in the system should be available and accessible to the end user. Availability of a system may also be increased by the strategy of focusing on increasing testability, diagnostics, and maintainability.

3.2 Non-Functional Requirements

Portability: Portability is a characteristic attributed to a computer program if it can be used in an operating system other than the one in which it was created without requiring major rework. Porting is the task of doing any work necessary to make the computer programrun in the new environment.

Performance: System should be well optimized to exhibit high performance. Performance is a degree which explains the responsiveness and stability of a system under a particular workload. It can also serve to investigate, measure, validate or verify other quality attributes of the system, such as scalability, reliability, and resource usage.

Usability: Usability is the degree to which a software can be used by specified consumers to achieve quantified objectives with effectiveness, efficiency, and satisfaction in a quantified context of use.

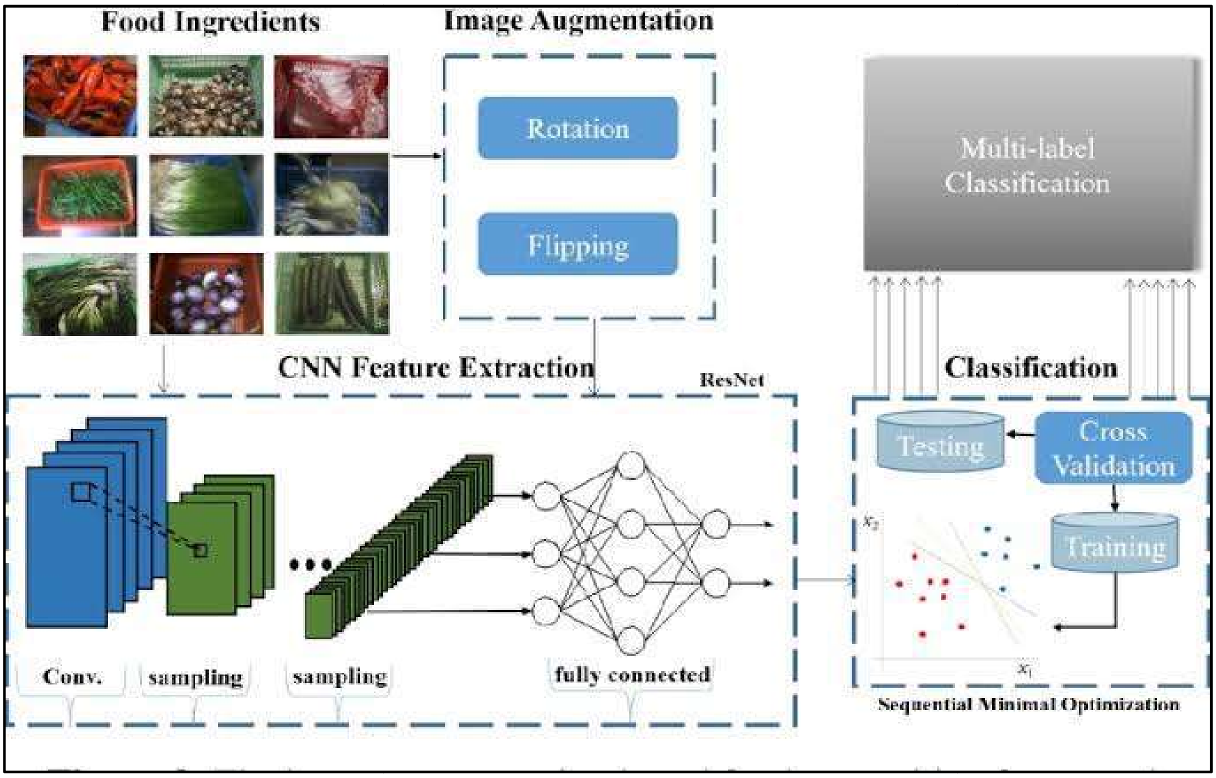
Dependency: The entire system should be put together as a whole package and should work without requiring any additional dependencies. It is a state in which one object uses a function of another object. It describes a dependence relation between statements in a program.

Functionality: System should be capable of running on machines with both low and high configuration. Functionality is the sum or any aspect of what a product, such as a software application or computing device, can do for a user. Thus, we have studied and analyzed all the requirements of our system. All the stated requirements are clear, complete, consistent, and unambiguous. This will help us in the successful development of our project.

4. PROJECT DESIGN

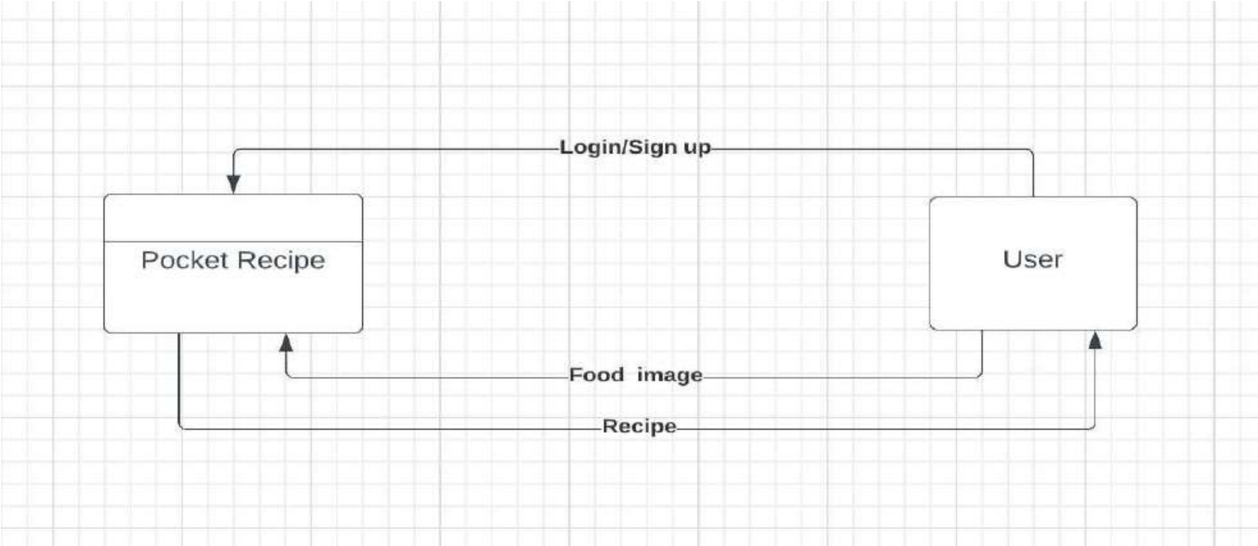
4.1 Algorithm and process design

1) When user open the app user can login if they have account or they can register themselves if they do not have an account.
2) Once login user can view its saved recipes if any. Or they can search new recipe by uploading a picture of food.
3) User can like the Recipe to store them in Saved recipe. The data about these recipe gets stored in the Database.
4) User can also add their recipe in the app. Authorized users can upload a image of food items along with detailed recipe, Procedure of the same.

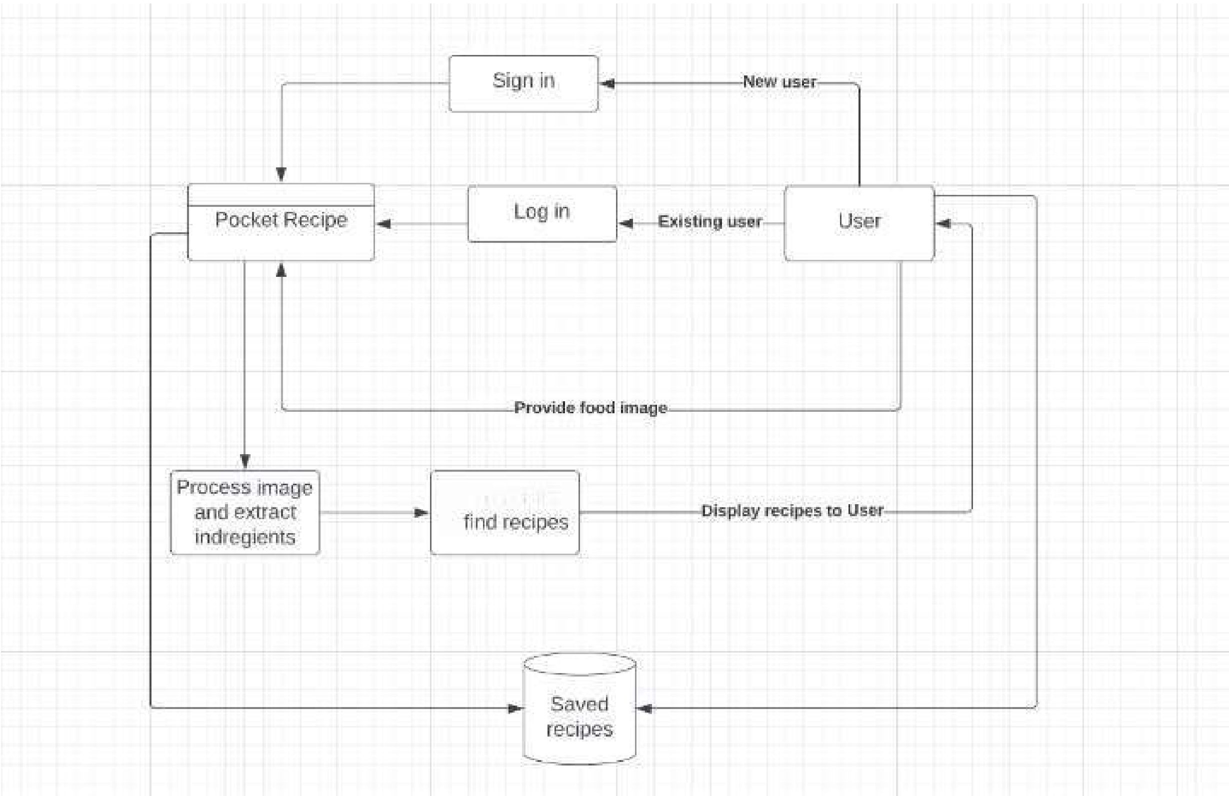


Above image describes the detailed overview of application workflow

4.2 Data flow diagram



Level-0 DFD



Level-1 DFD

5. TECHNOLOGY USED

5.1 Front End:

[I] **Flutter** - Flutter is an open-source mobile application development framework created by Google. It allows developers to build cross-platform mobile applications for iOS and Android with a single codebase using the Dart programming language. Flutter provides a rich set of pre-built widgets and tools that make it easy to build beautiful and responsive user interfaces. It also includes a fast development cycle with hot reload, which allows developers to see changes made in the code immediately on the emulator or device.

[II] **Dart** - Dart is particularly well-suited for building high-performance, reactive user interfaces, thanks to its reactive programming model and support for asynchronous programming using the async/await syntax. Dart also includes several features that make it easy to write modular, reusable code, such as mixins, abstract classes, and interfaces.

5.2 Backend:

[I] **Flask REST framework -** Flask-RESTful is a popular Python framework for building RESTful APIs. It is built on top of the Flask micro-framework and provides an easy-to-use interface for building RESTful APIs with minimal code.

[II] **Firebase** - Firebase is a mobile and web application development platform owned by Google. It provides a set of tools and services to help developers build, manage, and grow their apps.

Deep learning model:

[I] Convolutional Neural Network (CNN) –

- Convolutional neural network, or CNN, is a deep learning neural network sketched for processing structured arrays of data such as portrayals.CNN are very satisfactory at picking up on design in the input image, such as lines, gradients, circles, or even eyes and faces.

- This characteristic that makes convolutional neural network so robust for computer vision.CNN can run directly on a underdone image and do not need any pre-processing.
- A convolutional neural network is a feed forward neural network, seldom with up to 20.The strength of a convolutional neural network comes from a particular kind of layer called the convolutional layer.
- CNN contains many convolutional layers assembled on top of each other, each one competent of recognizing more sophisticated shapes. With three or four convolutional layers it is viable to recognize handwritten digits and with 25 layers it is possible to differentiate human faces.
- The agenda for this sphere is to activate machines to view the world as humans do, perceive it in a alike fashion and even use the knowledge for a multitude of duty such as image and video recognition, image inspection and classification, media recreation, recommendation systems, natural language processing, etc.

5.3 Details of Hardware and Software

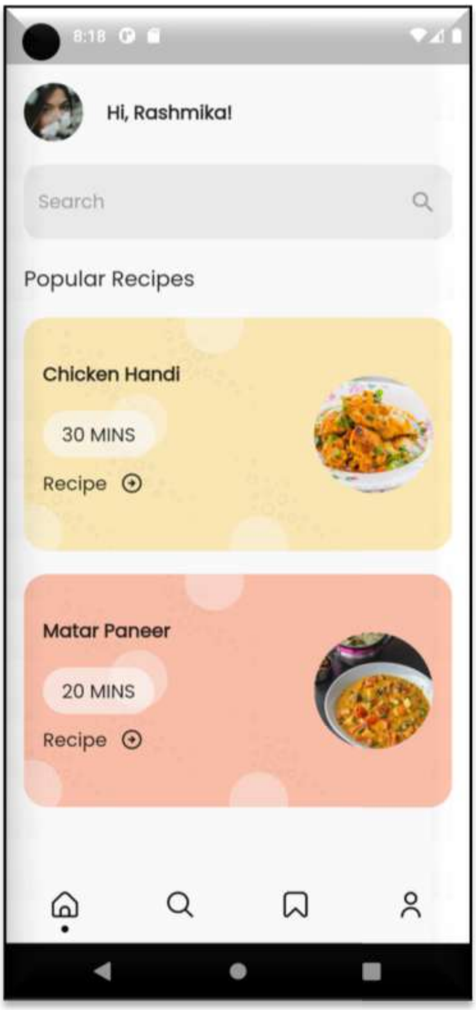
Hardware Requirements :

- **Operating System :**Android
- **Ram :**1GB
- **Memory :**20 MB (Approx)
- **Camera/WebCam**

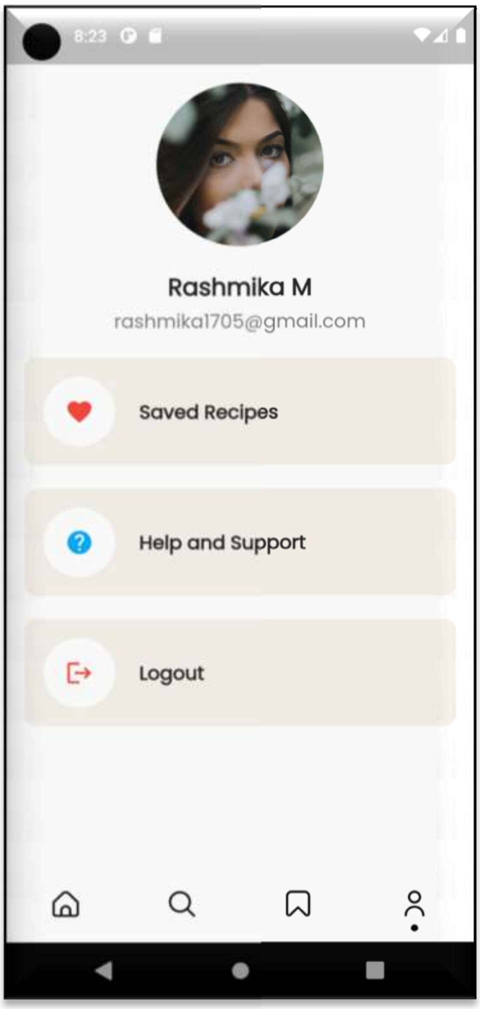
Software Requirements:

- Visual Studio
- Firebase
- Git/GitHub

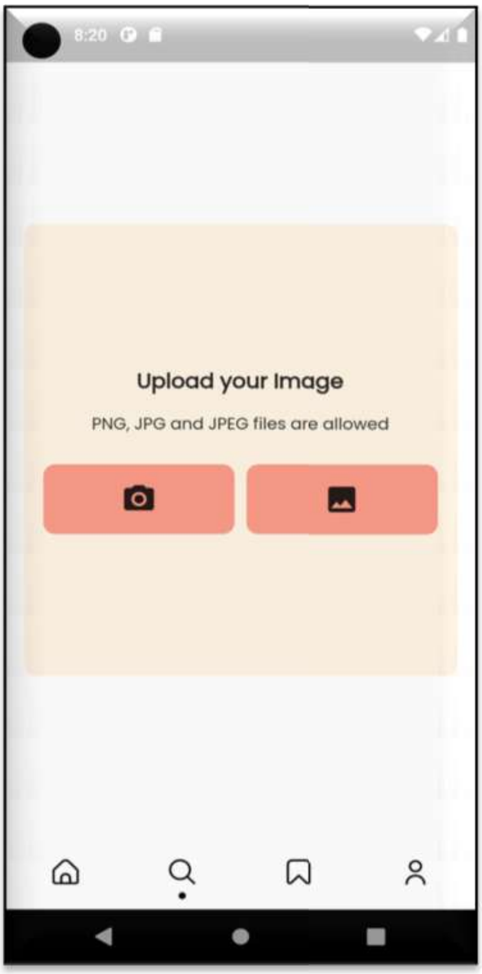
6. RESULTS AND DISCUSSION

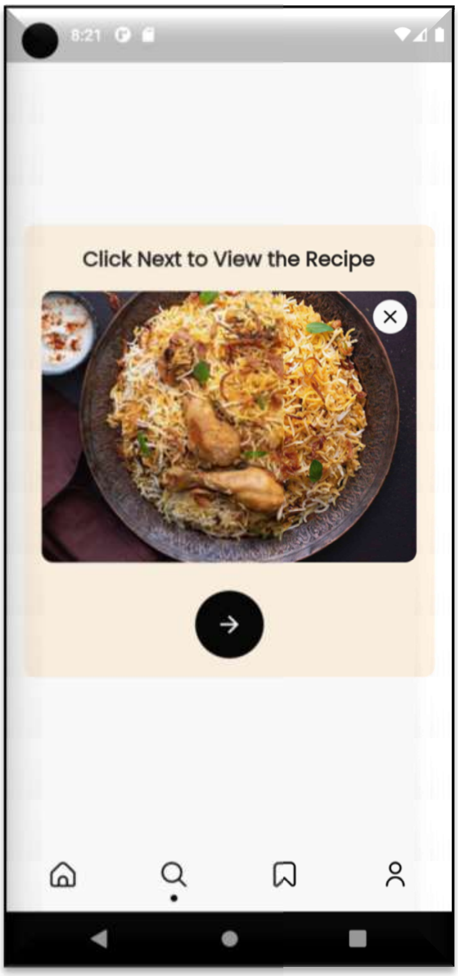


Home page of the Pocket Recipe App



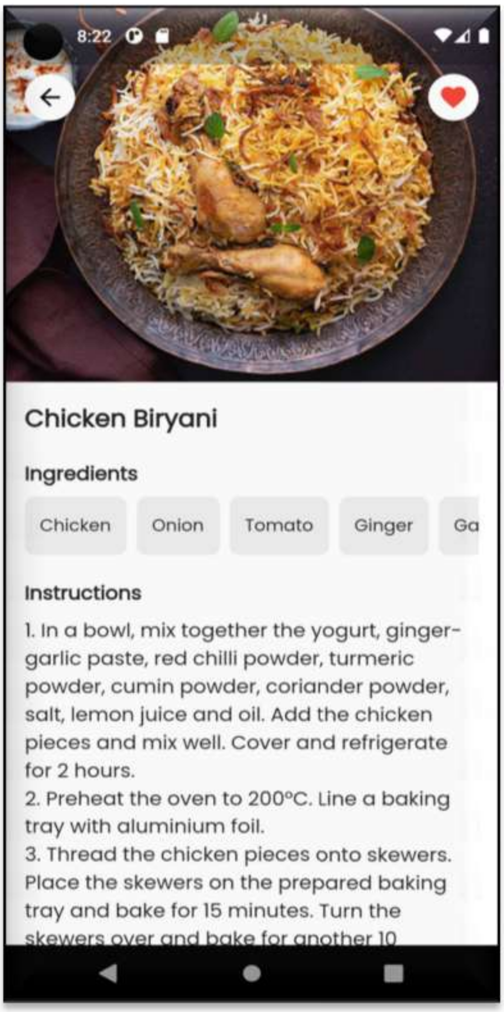
Profile Page

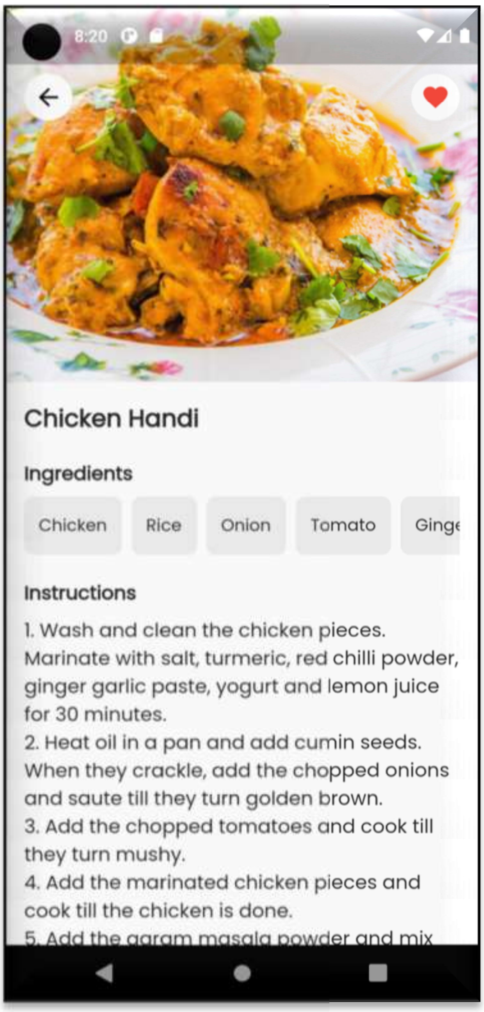




User can upload the image here **Sample Image**

Uploaded





Recipe Generated of image given **Popular Recipes**

7. CONCLUSION AND FUTURE SCOPE

7.1 Conclusion - We introduced an image-to-recipe generation system, which takes a food image and produces a recipe consisting of a title, ingredients, and sequence of cooking instructions. We first predicted sets of ingredients from food images, showing that modeling dependencies matters. Then, we explored instruction generation conditioned on images and inferred ingredients, highlighting the importance of reasoning about both modalities at the same time. We have also incorporated contextual information to improve the categorization accuracy of the model over similar ingredients and image of the food platter.

7.2 Future Scope –

- Incorporating user feedback and preferences: Future work can involve incorporating user feedback and preferences to generate personalized recipes that cater to the user's dietary restrictions, taste preferences, and cooking skill level.
- Multi-modal recipe generation: Future work can involve integrating additional modalities such as video, audio, and text to generate more informative and engaging recipes.
- Cross-cultural recipe generation: Future work can involve extending the system to support the generation of recipes for different cultures, including modifications to the recipe ingredients and cooking techniques to suit different taste preferences and cultural norms.
- Ingredient substitution and adaptation: Future work can involve developing a system that can suggest ingredient substitutions and adaptations for a given recipe based on ingredient availability and dietary preferences.
- Recipe search and recommendation: Future work can involve developing a system that can search and recommend recipes based on user preferences and search queries.
- Integration with food delivery platforms: Future work can involve integrating the system with food delivery platforms to allow users to order the ingredients required for a recipe directly from the app.

8. REFERENCES

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4. Madhu Kumari, Tajinder Singh Food Image to Cooking Instructions Conversion Through Compressed Embeddings Using Deep Learning-2019