FOOD ALLERGY APP WITH POWER OF AI

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1)INTRODUCTION

As of September 2021, it was estimated that around 10-30% of global population, and around 20-30% of Indian population was affected by allergies. This could include allergies to pollen, dust mites, certain food, and other allergens.

Allergies are generally not considered curable in traditional sense, but their symptoms can be often be managed effectively. The best way to prevent allergies is to avoid allergens, the best approach is to strictly eliminate those foods from your diet, carefully check the ingredient labels on food products. But it can be challenging to people manage this, so to help people manage their dietary restrictions and allergies machine learning can be useful in various ways:

- Classification of allergens
- Ingredient analysis
- Personalised allergy profiles
- Ingredients substitution
- Recipe recommendation

2)PROBLEM STATEMENT

Developing a food allergy app that address the challenges faced by individuals with food allergies, which utilize machine learning algorithm to analyse ingredient list of packed items, suggest suitable food recipes and maintain a diary of their allergen information.

3) MARKET/CUSTOMER/BUSINESS NEED ASSESSMENT

The rate of food allergies worldwide has increased from around 3% of the population in 1960 to around 7% in 2018. And it is not just the rate that has increased. The range of foods to which people are allergic has also widened.

Asthma and allergic diseases, such as allergic rhinitis (hay fever), food allergy, and eczema, are common for all age groups in the United States. Asthma affects more than 24 million people in the U.S., including more than 6 million children.

Even in India approximately 20-30% of India’s population suffers from at least one allergic disease. The commonly seen allergic disorders include asthma, allergic rhinitis, atopic dermatitis, food allergies and drug allergies.

And first and foremost, treatment is avoidance of allergens, but it

-equires careful attention, awareness, and proactive measures, like reading labels (ingredient list) carefully, understanding terms (such as “may contain”, “processed in a facility that also processes” or “shared equipment”)

In this report, I am going to emphasis on machine learning which is branch of Artificial intelligence to help people suffering from allergies, caregivers and even health care professionals, by recommending suitable food recipes, helping in understanding food labels etc.

3) TARGET SPECIFICATIONS AND CHARACTERIZATION

The proposed service/app will provide following specification:

1)Ingredient Scanning: the app will able to scan and analyse ingredients list from food items. It will identify allergens or potentially harmful ingredients that might trigger allergies.

2)Recipe analysis: It will be able to take recipe and analyse its ingredient list for potential allergens.

3)Alternate ingredients: For each identified allergens in recipe, the app can suggest suitable alternative ingredients that are safe for individuals with allergies.

4)User profiles: Each user will be able to create profile with their specific allergies. the app then can tailor its analysis and suggestion based on their allergy profile.

4) EXTERNAL SEARCH

Machine learning has several existing applications in field of allergy and immunology:

- **Diagnosis and risk prediction**: Machine learning models can analyse patients' data, such as medical histories, genetic information, and environmental factors, to predict the risk of all allergies and allergic reactions. These models can assist in identifying potential triggers and developing personalized treatment plans.
- **Allergen identification:** machine learning algorithms can analyse large dataset of allergens-related information to identify new potential allergens or cross reactivity patterns. This helps in improving allergens labelling and understanding the allergenicity of various substance.
- **Predictive modelling for pollen allergen levels:** ML models can forecast pollen and allergens levels in specific geographic regions, aiding individuals with allergies in planning their outdoor activities and managing their symptoms.
- **Drug development:** ML is used in drug discovery to identify compounds that can alleviate allergy symptoms or treat related conditions, such as asthma.
- **Medical image analysis:** ML can assist in the analysis of medical images related to allergies, such as prick test results or lung scan, to aid in diagnosis and treatment planning.
- **Allergen avoidance guidance:** ML powered apps and website can provide personalized allergens avoidance recommendation based on user's location, allergies, and environmental conditions.
- **Air quality prediction:** ML model can predict air quality and pollution levels, which are crucial for individuals with allergies, particularly those affected by airborne allergens.

These applications of machine learning in allergy and immunology are continually evolving, offering the potential to improve diagnosis, treatment, and overall management of allergic conditions.

5) BENCH MARKING ALTERNATE PRODUCTS

Artificial intelligence (AI) is rapidly becoming a valuable tool in healthcare, providing clinicians with a new AI lens perspective for patient care, diagnosis, and treatment. It has been increasingly applied in various fields of medicine, including allergy and immunology. AI chatbots have shown considerable promise in various medical domains, including radiology and dermatology, by improving patient engagement, diagnostic accuracy, and personalized treatment plans.

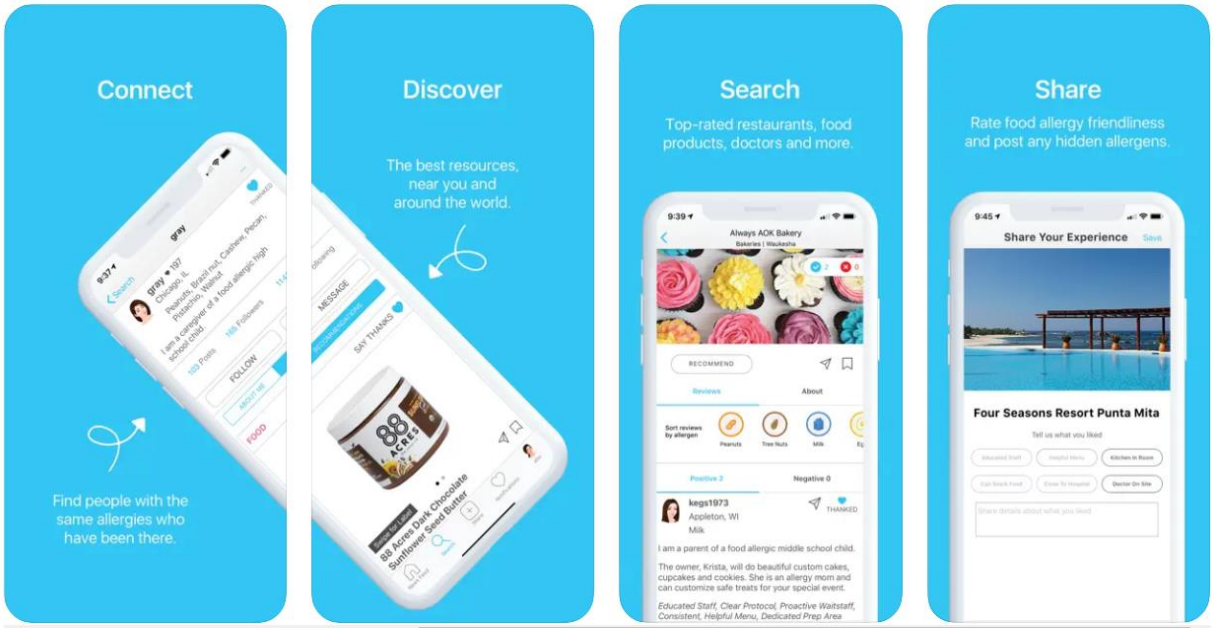
As of February 2023, the US Food & Drug Administration (FDA) has approved 521 medical applications that utilize artificial intelligence (AI) and machine learning (ML). Most of these (75%) are in radiology, followed by cardiology, haematology, and neurology. Similar trends are observed in Conformité Européene (CE)-marked medical devices incorporating AI within the European Union. Currently, no registered AI and ML-based applications are being utilized in the field of allergy. One can therefore question if this field is missing out on new research opportunities and clinical applications either because of insufficient access to AI applications or a lack of awareness of potential applications. However, given the rapid pace of technological advances, it can be anticipated that AI and ML algorithms will be increasingly employed in allergy research and applications soon.

5.1) EXISTING COMMERCIAL PRODUCTS

Over the past decade, medicine has witnessed an exponential growth of interest in AI and the yearly number of scientific articles on AI has increased tenfold since 2012.

Below is the list of some commercially available apps which can be helpful if someone are newly diagnosed, unsure of what you can eat, or living with serious food allergies.

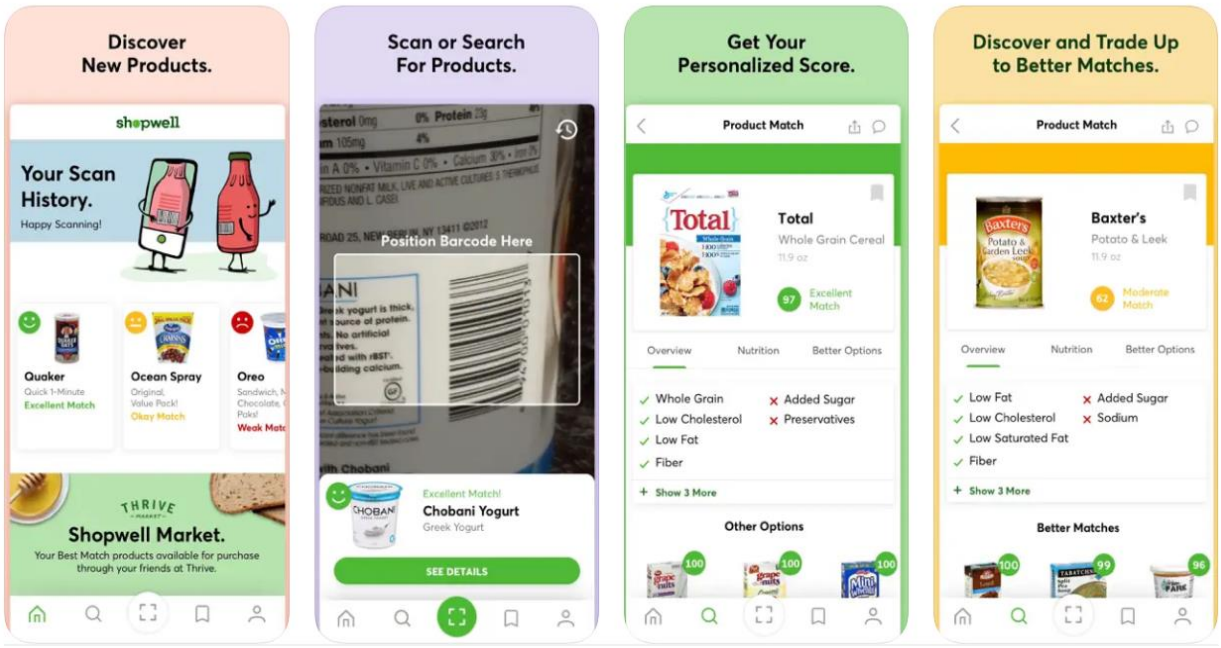
1)**SPOKIN**



In the Spokin app, you can find reviews on restaurants and products from other food allergic individuals – and you can leave your own reviews, too. They also give information about food allergy-friendly camps, hotels and more.

2) SHOP WELL

In the ShopWell app, create your own food profile, listing what foods you need to avoid. Then, scan the barcode of different products and you'll be alerted if they're safe or not safe for you to consume. They even provide alternative options if the product you scanned isn't safe.

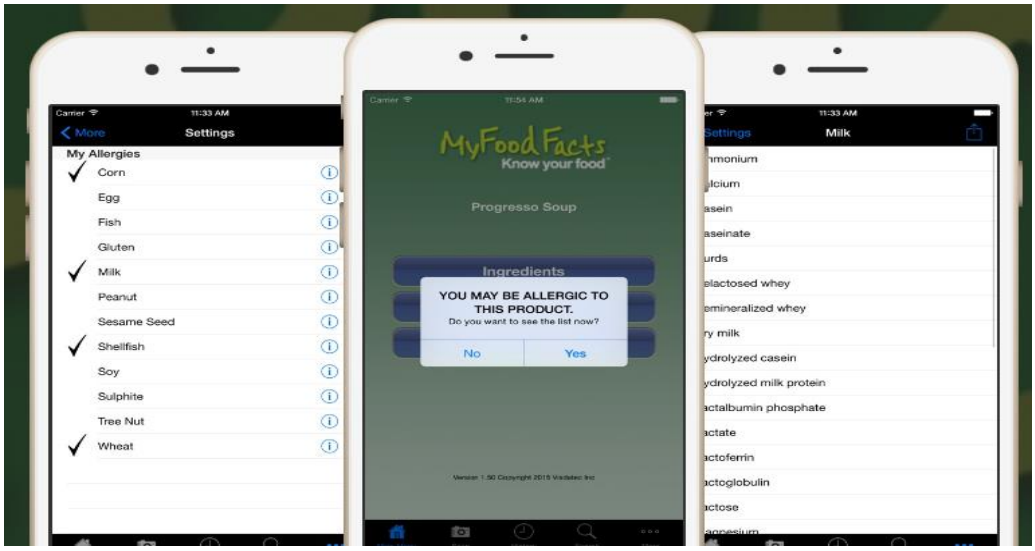


The Shop Well app helps users grocery shop with the knowledge of a personal nutrition expert; the app can help you match foods to your dietary needs, including avoiding ingredients you don't want such as added sugar, trans fat, and allergens like gluten and lactose. The app has a barcode scanner (or search directly on the app) and will tell you if the food is a good match to your settings; which includes a variety of options from avoiding gluten to minimizing artificial sweeteners. Want to know more? The app tells you why the product is a "strong," "medium," or "weak" match for you – as well as ingredients and the nutrition facts panel. The app even has a grocery list feature, which is great for those who want to streamline their shop.

3) OPEN FOOD FACTS

Open Food Facts lets you scan products' barcodes to check for allergens—14 different potential allergens in all.

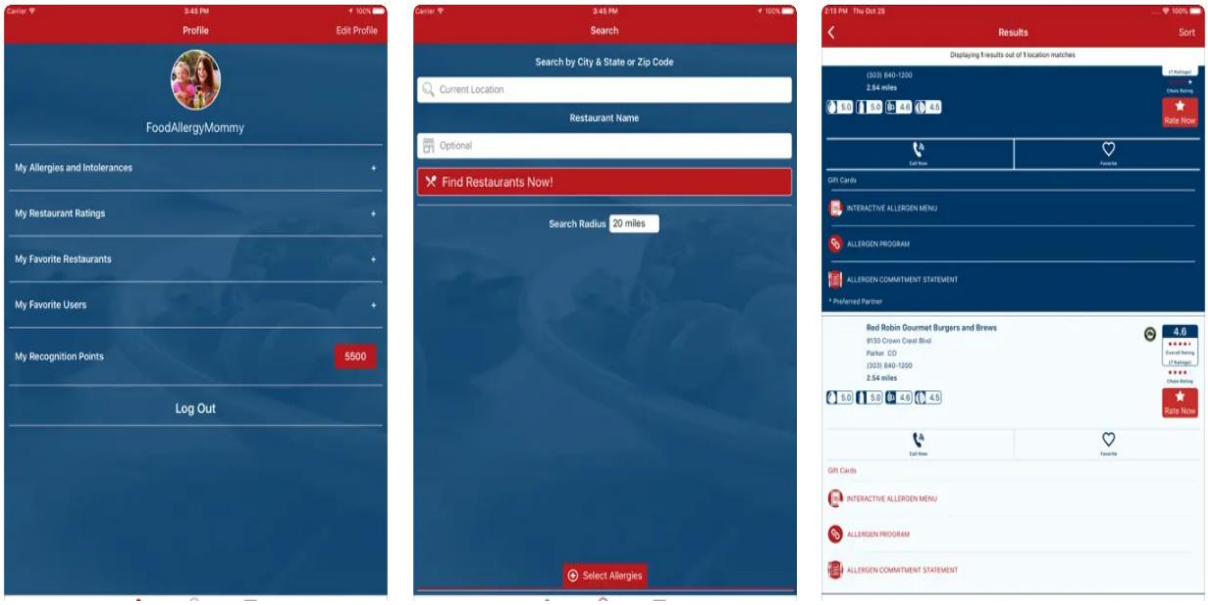
You enter your family's list of allergens into the app, and once it scans a bar code, it provides you with an easy-to-read list of ingredients (in a large font, unlike most ingredient lists), plus pop-up allergy warnings.



The app also can tell you whether products include a particular ingredient.

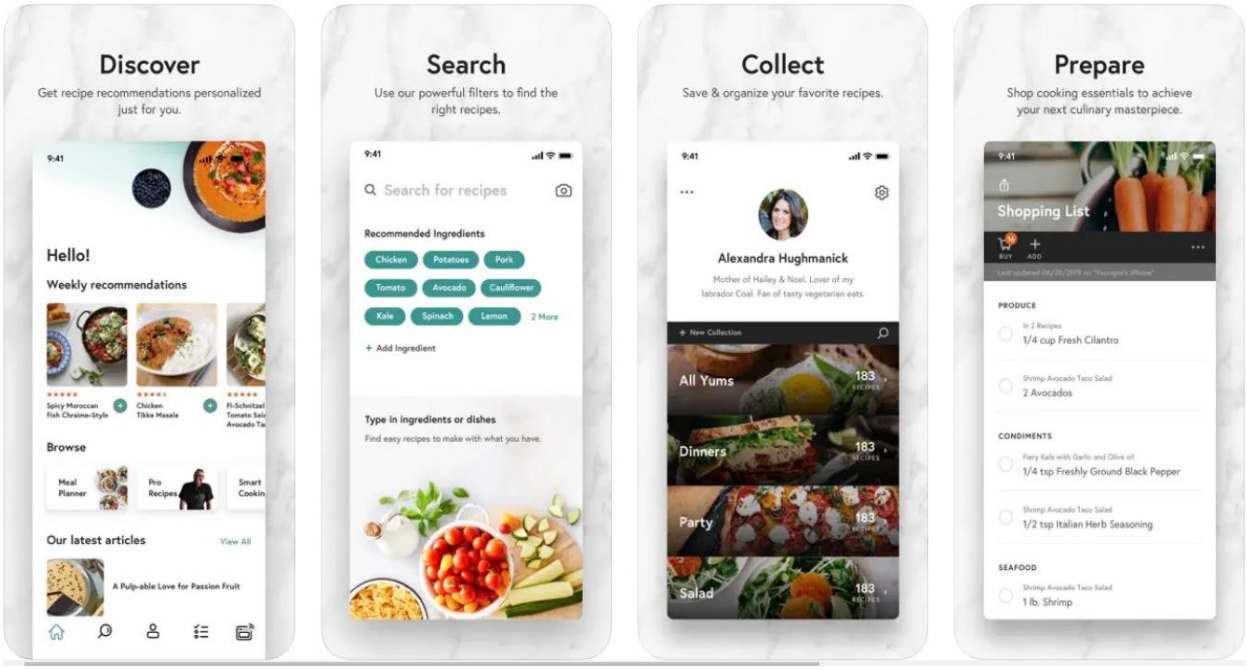
4) ALLERGYEATS

AllergyEats allows you to use a "find near me" search for restaurants and returns a list ranked by allergy-friendly rating. If you're traveling to a new city, you can use the app to search for convenient, allergy-friendly restaurants. AllergyEats also includes places to eat within Disney parks through AllergyEats Disney World.



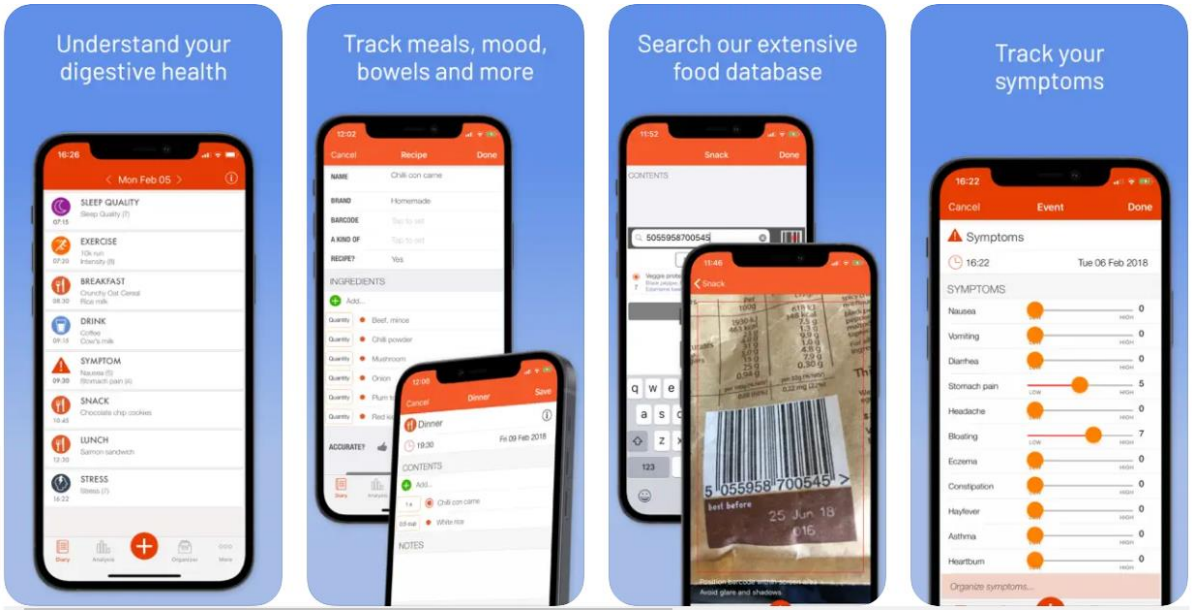
5) YUMMLY RECIPES + SHOPPING LIST

Yummly features more than 2 million recipes that you can personalize to your tastes and dietary needs. Just plug in your allergies and preferences, and it will dish up recipes you will love. Follow the step-by-step guided recipes, collect and save your favourites, and even find recipes you can make with ingredients on hand.



6) MYSYMPTOMS FOOD DIARY & SYMPTOM TRACKER

This app helps you track your symptoms, allergy episodes, bowel movements, and any other major events. It can help you better understand the patterns of your allergies and what diet, lifestyle, or exercise routines may trigger your worst symptoms and how to manage them.



5.2) POTENTIAL ISSUE WHILE CATERING INDIAN AUDIENCE

1)Limited Indian food databases: these Apps are designed mainly for American /European audience. Theses food allergy apps reply on databases of common allergens and ingredients ,which may not adequate cover wide variety of Indian foods and regional information. This can lead to inaccuracies in allergy information.

2)Reginal & cultural differences: India is known for its diverse culinary traditions and regional variations in ingredients and cooking methods.

3)Lack of awareness: Food allergies and intolerance are not widely recognized In India as in some western countries .Apps may need to focus on raising awareness and education about food allergies in addition to providing information

4)Lack of integration with local healthcare system: Apps not always integrate seamlessly with Indian healthcare system, making it challenging for users to connect with healthcare profession.

To address these issue, food allergy apps targeting Indian audience should considering collaborating with local experts, including dietitians and allergist, and invest in a comprehensive and accurate databases of Indian foods and ingredients .They should also prioritize user-friendly interfaces and multilingual support to ensure widespread adoption

6) APPLICABLE REGULATIONS

Here are some regulation and consideration that may apply in India(September 2021) :

1)Drug and Cosmetics Act, 1940: If app provides information related to pharmaceuticals or medical treatments, it may need to comply with the regulations under this act, which governs the manufacturing, sale, and distribution of drugs and cosmetics in India.

2)Medical Device Rules, 2017: If app includes diagnostic features or is considered a medical device, it may need to comply with the Medical Device Rules, which regulate the import, manufacture, distribution, and sale of medical devices in India.

3)IT Act, 2000: Ensure that app complies with the Information Technology Act, which addresses electronic commerce, data protection, and cybersecurity issues in India.

4)Data Protection Laws: If app collects and processes personal or health-related data, you should consider compliance with India's data protection laws, such as the Personal Data Protection Bill, 2019 (as of last update).

5)Advertising Standards: Advertisements within app must adhere to the Advertising Standards Council of India (ASCI) guidelines to ensure they are not misleading or deceptive.

6)Telemedicine Guidelines: If app offers telemedicine services, you should follow the Telemedicine Practice Guidelines issued by the Board of Governors in Supersession of the Medical Council of India.

7)Pharmacy Regulations: If app facilitates the sale or delivery of pharmaceuticals, it may need to comply with the pharmacy regulations set by the respective state pharmacy councils.

8)Consumer Protection Laws: Ensure your app adheres to consumer protection laws to protect users' rights and interests.

9)Cybersecurity Measures: Implement robust cybersecurity measures to protect user data and privacy, as outlined by the Indian Computer Emergency Response Team (CERT-In).

10)Informed Consent: Provide clear and informed consent processes, especially when collecting sensitive health data or offering telemedicine services.

NOTE : *Please note that regulations can change over time.*

7) APPLICABLE CONSTRAINTS

Developing a food allergy app in India comes with several constraints and considerations, including:

1)Diverse Food Culture: India has a vast and diverse food culture with regional variations. Ensuring comprehensive coverage of allergens and dietary preferences can be challenging.

2)Language Diversity: India has multiple languages and dialects. Translating and localizing your app's content to cater to a broader audience can be a complex task.

3)Allergen Labelling Standards: Allergen labelling standards and practices may not be consistent across all food products in India, making it difficult to provide accurate information.

4)Data Accuracy: Ensuring the accuracy of allergen information and cross-contamination risks in Indian food products can be challenging due to limited standardized data sources.

5)Regulatory Compliance: Complying with the various regulations related to food labeling and safety can be complex, as India's food regulations are evolving.

6)Ingredient Complexity: Indian cuisine often includes complex spice blends and ingredients, which can make it challenging to identify specific allergens.

7)Food Handling Practices: Variations in food handling practices and hygiene standards across different regions can impact the accuracy of allergy information.

8)User Education: Users may have varying levels of awareness and education about food allergies and dietary restrictions. App may need to provide educational resources.

9)Access to Healthcare: Access to healthcare services and allergy specialists may vary across different parts of India, affecting the ability to receive professional medical guidance.

10)Data Privacy: Complying with India's data protection laws and ensuring the privacy of users' health-related data is essential.

11)Technical Infrastructure: Consider the varying levels of access to smartphones and the internet in different regions of India when designing app.

12)User Engagement: Encouraging user engagement and ensuring the app remains useful and relevant can be a challenge in a diverse and dynamic market.

13)Monetization: Identifying a sustainable monetization strategy that aligns with the Indian market's preferences and affordability can be a constraint.

To address these constraints, it's essential to conduct thorough market research, collaborate with local experts, and stay informed about the evolving regulatory landscape. Additionally, user feedback and iterative development can help tailor food allergy app to meet the specific needs and challenges of the Indian market.

9. BUSINESS MODEL

Creating a business model for a food allergy app in India can be a promising venture.

1)Identify Your Target Audience:

- Determine whether the app will cater to individuals with food allergies, parents of children with allergies, or both.

2)App Features:

- Offering allergen detection tools, ingredient analysis, and customizable allergy profiles.
- Providing a recipe database with allergy-friendly options.
- Including restaurant and product scanning capabilities.

3)Monetization Strategies:

- Freemium Model: Offering basic features for free and charge for premium features like personalized allergy tracking or ad-free usage.
- Subscription Model: Charging a monthly or annual fee for full access to all features.
- In-App Advertising: Partner with relevant food brands or health-related advertisers.
- Affiliate Marketing: Earn commissions by recommending allergy-friendly products or restaurants.

4)Data Partnerships:

- Collaborate with food manufacturers to access ingredient information.
- Partner with restaurants for menu data integration.
- Offer an API for other health and wellness apps to integrate your allergy data.

5)User Engagement and Retention:

- Implement gamification elements to encourage regular usage.
- Provide timely allergy-related content and updates.
- Enable community features for users to share tips and experiences.

6)Compliance and Safety:

- Ensuring the app complies with Indian food safety regulations.
- Partnering with healthcare professionals for accuracy and safety.

7)Marketing and Outreach:

- Utilizing social media, content marketing, and SEO to reach target audience.
- Collaborating with allergy support groups and healthcare organizations.
- Considering local partnerships with Indian restaurants and food manufacturers.

8)Feedback and Improvement:

- Continuously update and improve app based on user feedback.
- Stay updated on emerging allergens and dietary trends.

9)Data Security and Privacy:

- Prioritize user data protection and comply with Indian data privacy laws.

10)Scaling and Expansion:

- Expanding to neighbouring countries if successful in India.
- Exploring opportunities for international partnerships.

10) CONCEPT GENERATION

1)Regional Allergen Database:

- Create a database specific to Indian cuisine that highlights common allergens found in traditional dishes.
- Offer detailed ingredient information and allergy warnings for regional foods.

2)Language Localization:

- Ensuring the app supports multiple Indian languages to reach a wider audience.
- Providing translations for ingredient lists and allergy-related content.

3)Restaurant Allergy Reviews:

- Allowing users to rate and review restaurants based on their allergy-friendly offerings.
- Including a feature for users to share their dining experiences and precautions taken by restaurants.
- Collaborating with allergy-friendly restaurant.

4)Community Support:

- Developing a community forum or chat feature for users to connect with others facing similar allergy challenges.
- Hosting virtual support groups and webinars with allergy experts.

5)Ingredient Scanner:

- Implementing a barcode scanner that can identify allergens in packaged Indian food products.
- Providing alternatives and safe options for allergic individuals.

6)Customized Meal Planning:

- Offering personalized meal planning tools based on users' specific allergies and dietary preferences.
- Suggesting allergy-friendly recipes and create shopping lists.
- Food/Recipe analysing system according to user allergy.

6)Healthcare Professional Integration:

- Allowing users to connect with allergists and dietitians virtually for personalized advice and consultations.
- Maintaining a directory of allergists and clinics specializing in food allergies in India.

7)Food Label Analysis Tool:

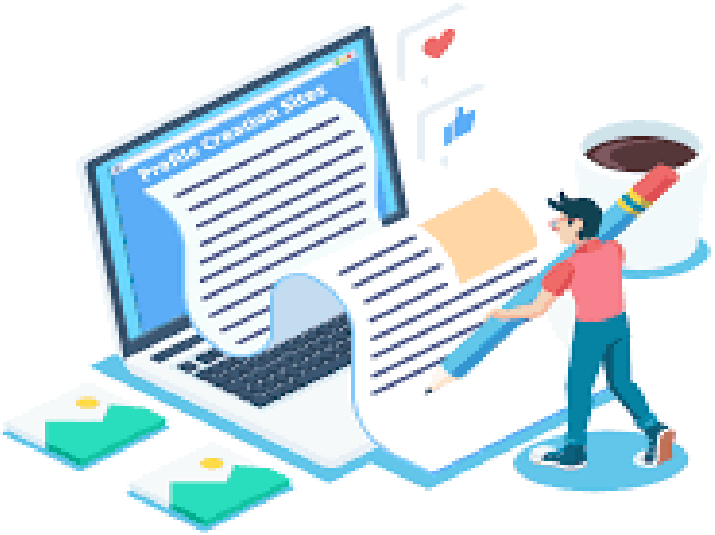
- Developing a feature that interprets food labels, especially those in regional languages, to help users quickly identify allergens.

11)FINAL PRODUCT PROTOTYPE

Some of the key feature's functionalities of app :

1)Onboarding:

- Users can create an account or log in.
- A brief tutorial explains how to use the app.
- Identifying user's allergies.



2)Home Screen:

- Displaying user's profile picture, name, and allergies.
- Options for scanning, searching, and accessing user settings.

3)Allergen Scanner:

- Users can scan barcodes or take photos of food products.
- The app identifies allergens and provides safety information.
- User can take scan picture of ingredient list of food product.

4)Search for Allergen-Free Foods:

- Allowing users to search for allergen-free products or recipes.
- Filters for specific allergens and dietary preferences.
- User can copy paste recipes to check if recipe contains any allergen.
- App can suggest alternate ingredient for recipe.

5)My Allergies:

- Users can view and edit their allergy profiles.
- Add or remove allergens, set allergen severity levels.
- User can maintain a allergy diary.
- They can make a list of their favourite food products

6)Emergency Contacts:

- Users can input emergency contact information.
- A quick call button for emergencies.

7)Notifications:

- Alerts for product recalls or allergen-related news.

8)Settings:

- Customize app preferences and notifications.
- Privacy and security options.

9)Allergen Database:

- Comprehensive database of allergens with detailed information.

10)Recipes and Meal Plans:

- Access to allergen-free recipes and meal plans.
- Personalize based on dietary restrictions.

11)Community Forum:

- Users can join discussions, share experiences, and ask questions.
- Moderation and reporting features.
- User can write about restaurants they visited and their experience.

12)Feedback and Support:

- Contact customer support or provide feedback on the app.
- FAQs and user guides.

13)Accessibility Features:

- Voice-over support and customizable font sizes for accessibility.

14)Legal and Compliance:

- Information about app compliance with relevant regulations.

15)Logout:

- Users can log out of their accounts.

12) PRODUCT DETAILS

12.1) How does it work?

- **User Input:** The app allows users to input their food allergies, sensitivities, and dietary preferences.
- **Database:** The app will contain database containing information about various food products, ingredients, and allergens. This database can be extensive and regularly updated.

- **Scanning or Search:** Users can either scan barcodes of food products using their device's camera or search for specific products within the app.
- **Data Retrieval:** When a user scans a barcode or searches for a product, the app retrieves data from its database regarding the ingredients and potential allergens in that product.
- **Allergen Detection:** The app checks the retrieved information against the user's allergy profile to determine if the product contains any ingredients to which the user is allergic.
- **Alerts and Recommendations:** If a potential allergen is detected, the app alerts the user with a warning. It may also provide alternative product recommendations that are safe for the user based on their allergies and preferences.
- **User Feedback:** Users can provide feedback on the accuracy of allergen information or share their experiences with certain products, contributing to the app's database.
- **Updates:** The app regularly updates its database with new products and ingredient information to ensure accuracy.
- **Education:** Some apps include educational resources about food allergies, cross-contamination, and safe food handling practices to help users make informed decisions.
- **Accessibility:** Many food allergy apps are designed to be user-friendly and accessible to individuals with various levels of technical expertise.
- **Alerts and Reminders:** Some apps may offer features like allergen-specific alerts, reminders for expiration dates, and personalized shopping lists.

12.2) Data Sources

Creating a food allergy app for India would require specific data sources relevant to the Indian context. Here are some potential data sources for allergen information in Indian food products:

- **FSSAI (Food Safety and Standards Authority of India):** The FSSAI may have data or regulations related to allergen labelling requirements in Indian food products. They also have guidelines for food businesses regarding allergens.
- **Indian Food Product Packaging:** Gathering allergen information from the labels of Indian food products available in the market. This data can be collected manually or through image recognition technology.
- **Food Allergy Organizations:** Collaborating with Indian food allergy organizations or support groups. They might have resources and data related to common allergens in Indian foods.
- **Local Food Manufacturers:** Reaching out to Indian food manufacturers to obtain allergen information for their products. Some companies may be willing to share this data for app.
- **User Contributions:** Allow users to contribute allergen information and reviews for Indian food products. User-generated content can be valuable for keeping app's data up-to-date.
- **APIs from Indian Health Agencies:** Explore the possibility of using APIs from Indian health agencies or organizations that may provide allergen-related data.

- **Indian Nutrition Databases:** Access nutrition databases specific to Indian foods that may include allergen information. Y

12.3) Algorithms, frameworks, software etc. needed

-ALGORITHMS / TECHNIQUES

- C**ollaborative Filtering**: This approach analyses user preferences and recommends foods based on the preferences of users with similar tastes.
- **Content-Based Filtering:** This method recommends foods based on their attributes and characteristics, such as ingredients and nutritional information, matching them with the user's dietary restrictions and allergies.
- **Hybrid Models:** Combining collaborative and content-based filtering can provide more accurate recommendations by leveraging both user behaviour and food attributes.
- **Decision Trees and Random Forests**: These algorithms can help classify foods into categories that are safe or not safe for individuals with specific allergies.
- **Neural Networks:** Deep learning models, such as neural networks, can be used to process and analyse large amounts of food-related data, helping to make personalized recommendations based on a user's allergy profile.
- **Natural Language Processing (NLP):** NLP techniques can extract information from food descriptions, reviews, or ingredient lists to make recommendations.
- **Clustering Algorithms:** Techniques like K-Means clustering can group foods with similar characteristics, making it easier to recommend alternatives for allergy sufferers.

LIBRARIES/SOFTWARES/FRAMEWORK

- **Pandas-**Pandas is a Python library used for working with data sets. It has functions for analyzing, cleaning, exploring, and manipulating data.
- **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.
- **Seaborn-**Seaborn helps you explore and understand your data. Its plotting functions operate on data frames and arrays containing whole datasets and internally perform the necessary semantic mapping and statistical aggregation to produce informative plots.
- **OpenCv-OpenCV** (Open-source computer vision) is a library of programming functions mainly aimed at real-time computer vision.
- **Pytersseract**- Python-tesseract is a wrapper for Google’s Tesseract-OCR Engine which is used to recognize text from images.
- **NLTK**-The Natural Language Tool Kit is one of the best-known and most-used NLP libraries, useful for all sorts of tasks from t tokenization, stemming, tagging, parsing, and beyond
- **RegEx-**A Regular Expressions (Reg Ex) is a special sequence of characters that uses a search pattern to find a string or set of strings. It can detect the presence or absence of a text by matching it with a particular pattern, and can split a pattern into one or more sub-patterns.
- **pyzbar** - For making Barcode Reader in Python we are using pyzbar library.
- **BeautifulSoup**-Library for extracting data from HTML and XML documents

- **Scikitlearn**- Scikit-learn is focused on machine learning tools including mathematical, statistical and general-purpose algorithms that form the basis for many machine learning technologies.

12.4) Team required to develop.

- App/Mobile developer
- Computer vision specialist/engineer
- Data annotator / labeller
- Machine learning engineer/specialist
- UI/UX developer
- Cloud engineer
- Deep learning engineer

13)CONCLUSION

In conclusion, this Food Allergy App represents a valuable tool for individuals with food allergies. It empowers users to make informed choices about their food consumption, thereby reducing the risk of allergic reactions. The app also fosters a supportive community by allowing users to share experiences and find allergy-friendly restaurants. While there may be room for further improvements, such as expanding the allergen database and enhancing integration with wearable devices, the app's current capabilities make it a valuable asset in managing food allergies and improving overall quality of life for those affected.

14)REFRENCES

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world heath organisation

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