Revolutionizing Nutritional Management Through Food Scanning And Object Detection: A New Android Application For Adults

[*] *Healthpad*: A Healthcare Application

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***Abstract*—The proliferation of mobile technology has led to the development of numerous applications aimed at promoting a healthy lifestyle, such as monitoring food intake and providing suggestions for a healthy diet. However, many of these apps require significant time and effort to manually input food items. To address this issue, we present the development of a new machine learning-based Android application that simplifies food management for adults, especially those in rural environments or with limited technical knowledge. The proposed application uses AWS Rekognition to scan food items and obtain nutritional information, such as the percentage of diabetes, cholesterol, and other key factors affecting health. The app also utilizes image recognition to detect fruits and vegetables, providing their nutritional contents. Additionally, for packed food items, the app scans the ingredients list to predict vital information regarding the user's health. The machine learning algorithm in the application helps in improving the accuracy of the scanned information and provides better nutritional recommendations. The application is designed to have a simple and user-friendly interface, providing a convenient solution for managing food intake.**

***Keywords*—** diet, scan, detection, machine learning

I. Introduction

A healthy diet is essential for maintaining good health and preventing chronic diseases[1]. It is a balanced diet that provides the body with all the necessary nutrients and energy while avoiding excessive intake of harmful substances[2]. Eating a healthy diet has numerous benefits, including weight management, increased energy levels, improved mental and emotional well-being, and a reduced risk of developing chronic diseases such as diabetes, cholesterol, etc. However, for many people, making healthy food choices can be challenging. The abundance of fast food, processed foods, and convenience meals has made it easy to choose unhealthy options[3]. In addition, busy schedules, limited access to fresh and healthy foods, and a lack of nutritional education can make it difficult for individuals to maintain a healthy diet[4]. To address these challenges, numerous tools and resources are available to help individuals make informed choices about their diets. These include nutritional guidelines, meal planning resources, and mobile applications that provide nutritional information and recommendations. Advances in technology have also made it possible to use machine learning and artificial intelligence to analyze food and provide personalized recommendations[5]. This paper will explore the importance of a healthy diet and the challenges that individuals face in maintaining one. It will also discuss the various tools and resources available to support healthy eating habits, including mobile applications that use machine learning and artificial intelligence to provide nutritional recommendations. The paper will highlight the benefits and limitations of these tools and their potential impact on promoting healthy eating habits and improving health outcomes.

II. Existing System

There are several existing systems and tools for diet prediction, some of which use machine learning and artificial intelligence techniques to provide personalized recommendations.

A. MyFitnessPal

MyFitnessPal is a popular mobile application that helps users track their calorie intake, macronutrients, and exercise. The app has a database of over 6 million foods, and users can scan barcodes or search for foods to add to their daily logs. The app provides personalized recommendations based on the user's goals and dietary preferences.

B. NutriGenie

NutriGenie is a desktop software that uses machine learning to create personalized meal plans based on the user's age, gender, height,

weight, activity level, and dietary preferences. The software provides daily and weekly meal plans with recipes and shopping lists.

C. MealGenius

MealGenius is a mobile application that uses artificial intelligence to provide personalized meal plans based on the user's dietary preferences, health goals, and food allergies. The app also provides nutritional information for each meal and allows users to customize their meal plans.

D. Foodvisor

Foodvisor is a mobile application that uses artificial intelligence to analyze food images and provide nutritional information. Users can take a photo of their meal, and the app will recognize the food and provide information about its macronutrient content.

E. Nutrient Optimiser

Nutrient Optimiser is a web-based tool that uses machine learning to create personalized meal plans based on the user's nutrient needs. The tool provides recommendations for nutrient-dense foods and allows users to track their progress towards their goals.

III. PROPOSED SYSTEM

The purpose of the project entitled "*Healtpad*: Health Care Application" is aim at adult people to manage their food from the items that appear in their grocery stores and generate recommendations. This is done by predicting the number of lifestyle diseases[6]. Lifestyle diseases depend on various parameters that are to be included in the dataset. The value of parameters varies from person to person. The project predicts the number of food items consumed according to the user's health by scanning the packet foods or by detecting the fruits and vegetables. This is a system that involves object detection and recognition, text scanning, dataset creation, model training, and model testing. The phone camera is used to capture the packet of food or fruits and vegetables. Fruits and vegetables are detected using the AWS Rekognition[7]. The packet foods are scanned using OCR technology. The OCR approach is used to identify the nutrient facts on the packed food items. With the help of AWS Rekognition, we can easily and accurately identify the text. This nutrient facts information is an important element of the project. The application was built using the AWS Amplify Studio tool that is available in AWS free tier plan. AWS Amplify CLI was installed locally in the system. AWS Amplify will provide the authentication of the application[8]. The dataset is created for the purpose of machine learning. The data required to create the dataset are collected from the lab reports of friends and relatives and from the clinics as well. The dataset has multiple parameters that vary depending on the patient. Using the dataset we first need to train our model using a machine algorithm. The parameters that are taken into account are age, gender, RBS, FBS, and HbA1C[9]. After the training is complete, we need to test with new data in order to monitor the accuracy of the model. After all, we need to integrate all these operations into one mobile application.

IV. WORKING PRINCIPLE

The *Healtpad* mobile application is aimed at adult people for recommending diets and also lifestyle disease level predictions. The application is planned to design in a way that can be used by people with limited technical knowledge. The application runs by integrating different machine learning algorithms and approaches. The application is hosted on the cloud using AWS Amplify.

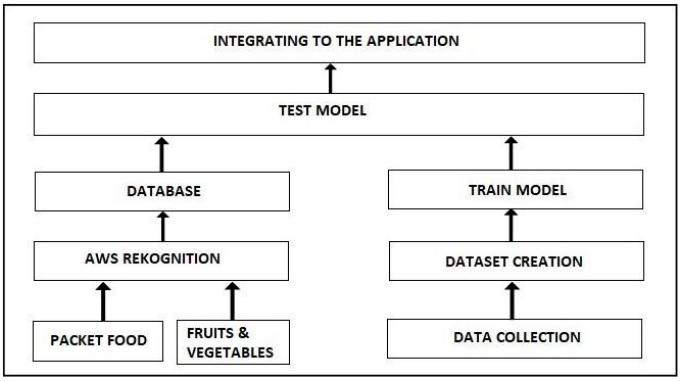

Fig. 1. Design of *Healtpad*

A. Machine Learning

Machine learning is a growing technology which enables computers to learn automatically from past data. Machine learning uses various algorithms for building mathematical models and making predictions using historical data or information[10]. Machine Learning is said as a subset of artificial intelligence that is mainly concerned with the development of algorithms which allow a computer to learn from the data and past experiences on its own. Machine learning can be classified into three types: Supervised learning, Unsupervised learning and Reinforcement learning.

B. AWS Rekognition

Amazon Rekognition is a cloud-based service provided by Amazon Web Services (AWS) that offers image and video analysis capabilities using deep learning technologies. With Amazon Rekognition, you can easily integrate image and video analysis into your applications without having to develop and train machine learning models from scratch. Some of the key features of Amazon Rekognition include:

- Object and scene detection:

Amazon Rekognition can identify and label objects within an image or video frame, as well as recognize and describe scenes.

- Facial analysis:

Amazon Rekognition can detect and analyze faces within an image or video frame, as well as identify facial features such as emotions, age range, and gender.

- Text recognition:

Amazon Rekognition can detect and recognize text within images and videos, and can even identify the language and font used.

- Custom labels:

You can also train Amazon Rekognition to recognize custom labels or objects specific to your use case.

Overall, Amazon Rekognition is a powerful tool for developers and businesses looking to integrate advanced image and video analysis capabilities into their applications.

C. AWS amplify

Amazon Web Services is the world's biggest cloud platform, and businesses of all shapes and sizes use it every day to run their businesses. It includes a wide variety of open-source libraries and drag-and-drop UI components developers can use as building blocks for their apps. It can also include code libraries, ready-to-use components, and a built-in CLI. The Health care application for this project is also hosted using AWS Amplify.

D. AWS Lambda

AWS Lambda is a serverless computing service provided by Amazon Web Services (AWS). With AWS Lambda, you can run your code without the need to provision or manage servers[11]. You simply upload your code to AWS Lambda and it automatically scales and runs your code in response to triggers such as API calls, file uploads, or scheduled events. It can be easily integrated with other AWS services such as Amazon S3, Amazon DynamoDB, and Amazon API Gateway. It automatically scales your code to meet the demand, so you only pay for the computing time that your code actually uses. With AWS Lambda, you only pay for the compute time that your code actually uses, rounded up to the nearest 100ms. It is a serverless computing service, which means you don't have to worry about managing servers or infrastructure.

V. IMPLEMENTATION

A. Authentication

A new app was created in AWS Amplify. AWS deployed the app successfully. After initializing the app, inside AWS, inside the section Setup, in the section Authentication, the authentication methods were specified. For Sign in, 3 methods were given

- Email and Password
- Social Sign In
  - Google
  - Facebook

Both App id and App secret were provided in the Amplify Studio Interface itself.
For Sign up, the details to create an account are,

- Name
- Email
- Password

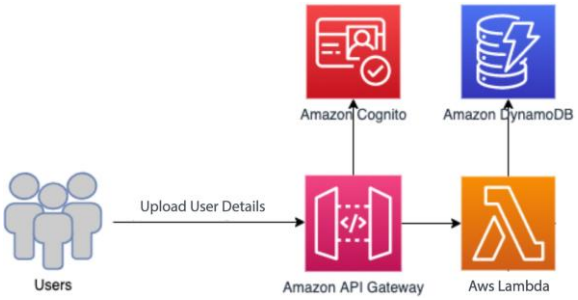

Fig. 2. User authentication block diagram

The app was deployed in AWS Amplify. The deployed app was then pulled to the local system in the folder containing the react native application using the command provided by the Amplify software and Amplify CLI. After signing in to the application using Google/Facebook the user has to be redirected to the app again. React native linking was used for this purpose. Through this method, a URL was created for the profile page to which the user has to be redirected. This URL is then provided in the redirection URL of amplify studio.

B. Dataset creation

The dataset is created for the purpose of machine learning. The dataset has multiple parameters that vary depending on the patient. We have consulted an expert dietitian to get information regarding the data to be collected. The data were collected from colleagues and other connections. A total of 500 entries have been included in this dataset. The parameters that are taken into account are

1. Age
2. Gender
3. RBS
4. FBS
5. HbA1c

Parameters	User1	User2	User3	User4	User5
Pregnancies	6	1	8	1	0
Glucose	148	85	183	89	137
BloodPressure	72	66	64	66	40
SkinThickness	35	29	0	23	35
Insulin	0	0	0	94	168
BMI	33.6	26.6	23.3	28.1	43.1
DiabetesPedigreeFunction	0.627	0.351	0.672	0.167	2.288
Age	50	31	32	31	33
FBS	125	86	120	82	126
RBS	206	110	186	92	174
HbA1c	6.3	4.2	6.2	4.4	6.2
Fiber	4	9.7	5.4	5.32	4.3
Carbohydrate	30	46.36	27.7	49.65	30.2
Calorie	145	339	224.5	235.88	143.4
Fat	2.8	7.4	10.6	0.62	1.1
Outcome	1	0	1	0	1

Fig. 3. Dataset (cropped image)

C. Profile Creation

A profile creation page in a diet application would typically allow users to create a personal profile with information relevant to their dietary goals and needs. The user's name, age, gender, weight, and height can be collected to calculate their Body Mass Index (BMI) and determine their recommended caloric intake. The user can indicate their food preferences such as vegan, vegetarian, gluten-free, or dairy-free. The user can indicate any allergies or intolerances they have to certain foods. The user can select their physical activity level, which can be used to calculate their recommended caloric intake.

Fig. 4. Image uploading block diagram

D. Fruits and Vegetable Detection

Amazon Rekognition can be used to detect and label objects within an image or video frame, including fruits and vegetables. Here are the steps to detect fruits and vegetables using Amazon Rekognition:

- Upload the image: First, you need to upload the image to Amazon S3 or provide the image as input to the Amazon Rekognition API.
- Detect labels: Use the Amazon Rekognition API to detect labels within the image. The API will return a list of labels with associated confidence scores.
- Filter for fruits and vegetables: Parse through the list of labels and filter for labels that correspond to fruits and vegetables. This can be done by comparing the label names with a pre-defined list of fruits and vegetables.
- Display the results: Finally, display the list of detected fruits and vegetables along with their corresponding confidence scores.

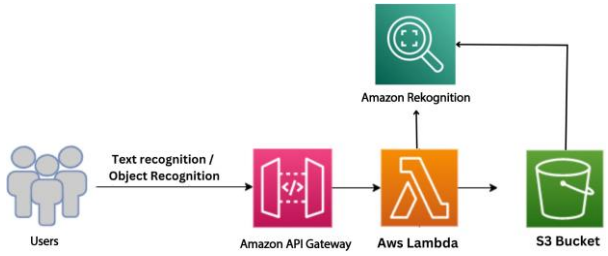

Fig. 5. AWS Rekognition block diagaram

It's worth noting that the accuracy of the detection will depend on the quality of the image and the training data used by Amazon Rekognition.

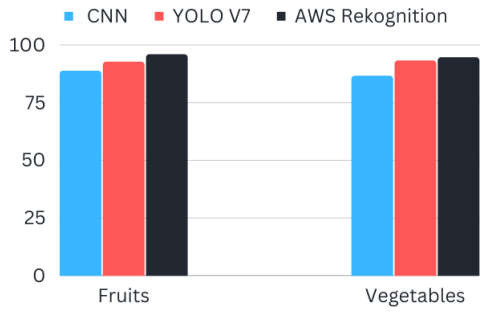

Fig. 6. Accuracy for fruits and vegetable detection

E. Text Recognition

Amazon Rekognition can be used to perform text recognition (also known as optical character recognition or OCR) on images and video frames. Here are the steps to perform text recognition using Amazon Rekognition:

- Upload the image: First, you need to upload the image to Amazon S3 or provide the image as input to the Amazon Rekognition API.
- Start text detection: Use the Amazon Rekognition API to start text detection on the image. The API will return a job ID that you can use to retrieve the results of the text detection.
- Retrieve the results: Poll the Amazon Rekognition API using the job ID to retrieve the results of the text detection. The API will return a list of detected text elements along with their locations within the image.
- Process the results: Parse through the list of detected text elements and extract the text that you're interested in. You can also use the locations of the text elements to crop the original image and obtain a clearer view of the text.
- Display or use the results: Finally, you can display the extracted text or use it for further analysis or processing.

The accuracy of the text recognition will depend on the quality of the image and the font used in the text.

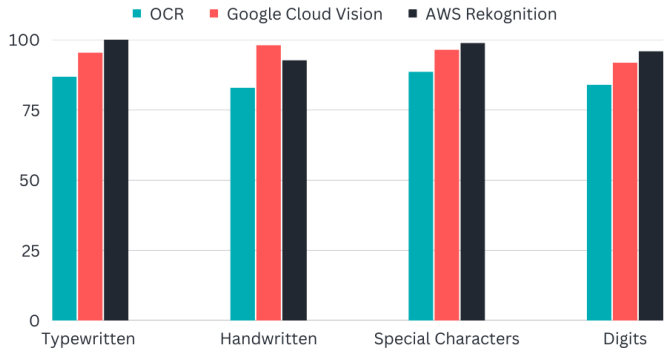

Fig. 7. Accuracy for text recognition

F. Diet Recommendations

Diet recommendations can be made based on the retrieved data from a user's profile in a diet application. Retrieves the user's age, gender, weight, height, physical activity level, dietary goals, food preferences, allergies, and intolerances to gain a better understanding of their nutritional needs[11]. User data has been taken to calculate their recommended daily caloric intake based on their age, gender, weight, and physical activity level. Uses the user's dietary goals and physical activity level to determine the ideal ratio of macronutrients (carbohydrates, protein, and fat) in their diet. Based on the user's food preferences, allergies, and intolerances, provide a list of recommended foods that fit within their caloric and macronutrient goals. Provide guidance on how to structure meals to meet the user's caloric and macronutrient goals. This can include tips on portion control, meal timing, and snack choices. Monitor the user's progress over time and make adjustments to their diet recommendations as needed.

G. Statitics

In a diet application, providing statistics can help users track their progress, set goals, and stay motivated. Show users the number of calories they have consumed each day and their progress towards their daily caloric goal. Display the percentage of calories consumed from carbohydrates, protein, and fat, and track progress towards macronutrient goals. Allow

users to log their weight over time and display their progress towards their weight loss or weight gain goals. Allow users to track their body measurements, such as waist circumference and body fat percentage, and display their progress over time. Allow users to log their exercise activities and track their progress towards their fitness goals. Display the number of essential nutrients, such as vitamins and minerals, users have consumed each day and track their progress towards their nutrient intake goals. By providing these statistics, users can get a clear picture of their progress and make adjustments to their diet and exercise habits as needed. Additionally, the ability to track progress and set goals can help users stay motivated and engaged with the application.

VI. OBSERVATION

Using the proposed system user will be able to register to this application, henceforth creating a profile page which collects all the necessary data required for the application. The user can scan the raw food or packet of food, then the user will get a notification regarding the percentage of measurement values related to the diseases after consuming that food. Diet recommendations are also provided within the application. The user has the option to view the statistics which help users track their progress, and set goals. It has also a provision for consulting doctors, online medicine shops and customer care too.

VII. CONCLUSION

The Health Care Application is useful and easily manageable by elderly people. This app helps to control the diet and helps to lead a healthy life. Elderly people are consuming food without considering their lifestyle diseases. This app manages the food from the items that appear in their grocery stores and generate recommendations. By scanning the food items or detecting the fruits and vegetables, we will get information about the percentage of sugar, cholesterol, etc that we could acquire by consuming it. The elderly, or the people in their care, can control how they are consuming. This helps to control lifestyle diseases and also can understand the diseases. Mobile Health applications and internet resources have the potential to play a significant role in health education and disease management by providing easy tracking, motivational sophistication and improved adherence.

VIII. ACKNOWLWDGEMENT

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