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Batch: C1	**Roll No.: 16010122323**
Experiment No: 06	
Group No: G4	

Title: Chapter 06 Result and discussion

Expected Outcome of Experiment:

CO4: Design of test cases to meet the desired specifications.

Books/ Journals/ Websites referred:

[Students can mention websites/ books used in their project implementation]

This write-up will expect students to prepare chapter no 6 in the format given below

Chapter 6

Result and discussion

This chapter presents the results obtained from the implementation of the prototype/application and provides an in-depth analysis of its performance. The findings are evaluated based on predefined metrics, including accuracy, efficiency, usability, and reliability. A comparative analysis with existing systems or methodologies is conducted to assess improvements and innovations introduced by the proposed approach. Additionally, key observations, challenges encountered during testing, and their implications are discussed. The insights gained from the results are critically examined to validate the effectiveness of the system and highlight areas for further improvement.

Result and Discussion of the Prototype

This chapter presents the results obtained from the implementation of the **Bytes Recommendation System** prototype. The findings are analyzed based on key performance metrics such as accuracy, usability, and efficiency. Additionally, comparative evaluations, encountered challenges, and key insights are discussed to assess the effectiveness of the developed system.

6.1 Implementation Results

The prototype of the Bytes system was successfully implemented with the following core features:

- **User Authentication**: Users can sign up and log in to the platform.
- **Food Logging via Image Upload**: Users upload food images labeled with the respective meal time (e.g., breakfast).

- **Food Identification**: A CNN model (ResNet-50) trained on the Food-101 dataset (11,000 images) identifies food items.

- **Macro & Calorie Analysis**: Nutritional data (calories, protein, carbs, fats) is retrieved using an external food nutrition API.

- **Meal Summary**: Users receive a comprehensive breakdown of their daily intake through a summary page.

- **Custom Meal Plan Generator**: Based on the user's physical profile and calculated BMR and TDEE, a personalized meal plan is generated using KNN (for cluster classification) and Random Forest (to segment meals into breakfast, lunch, snacks, and dinner).

- **Seasonal and Allergy-Based Filtering**: Meal plans consider seasonal food recommendations, allergies, cuisine preferences, and vegetarian options.

- **Downloadable Meal Plan**: Users can print or download their personalized meal plan for daily use.

6.2 Performance Evaluation

- **Accuracy**: The ResNet-50 model achieved a food classification accuracy of approximately **83%** on validation images from Food-101, providing a reliable baseline for identifying food items.

- **Efficiency**: Meal plans are generated in under 5 seconds after user input. Food logging and image processing also take less than 5 seconds on average.

- **Usability**: The application provides an intuitive flow—from logging food to generating meal plans—with minimal user effort, enhancing user engagement.

- **Reliability**: The system has shown consistent performance across multiple user tests with different food inputs, accurately reflecting macros and calories.

6.3 Comparative Analysis

When compared to existing meal planning apps and calorie tracking systems:

- **Most apps use manual input** of food names; Bytes automates this with food image classification.
- **Generic meal plans** are common; Bytes uses ML models (KNN and Random Forest) to provide **tailored meal suggestions** based on a user's nutrition cluster.
- Bytes incorporates **seasonal recommendations** and **allergy filtering**, which many apps overlook.

This makes the Bytes system more adaptable and user-centric.

6.4 Challenges Encountered

- **Image Quality Variability**: Inconsistent lighting and camera quality sometimes reduced food classification accuracy.
- **API Limitations**: Nutritional API calls were limited by usage quotas, which required caching mechanisms.
- **Balancing Customization**: Ensuring meal plan diversity while adhering strictly to nutritional needs and user preferences was challenging during ML model tuning.

6.5 Key Observations

- Users appreciated the automation in logging food through images instead of manual input.
- Including **seasonal and cultural food recommendations** increased user satisfaction and relevance.

- The combination of KNN for clustering and Random Forest for meal segmentation proved efficient and interpretable.

6.6 Conclusion of Findings

By taking the following steps:

- Using a **ResNet-50 CNN** model for accurate food detection,
- Applying **KNN and Random Forest** for personalized meal generation,
- Integrating **nutritional APIs** for real-time macro tracking,
- and incorporating **user-centric filters** (cuisine, allergies, veg/non-veg, seasons),

the Bytes system effectively meets the expected outcome of designing a system that recommends personalized meals and tracks daily nutrition with high accuracy and usability. These results validate the approach and provide a foundation for future enhancements like real-time dietary feedback or integration with fitness trackers.