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Workout and Wellness Wizard Diet and Workout Recommendation Using Classification and Regression Tree

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Abstract
In the current scenario, it has become difficult to maintain a healthy lifestyle while meeting our health and diet requirements. It is really important to have proper food intake along with the correct exercises to move towards our health goals. Most of the people are running behind a single fitness plan that is expected to fit for all age groups and all body types. What works for a 25-year-old won't fit for a 45-year-old. Hence, it is the need of the hour to have an application that can help us in getting recommendations according to our age and health conditions and also to track our progress throughout the fitness journey. This is where the Workout and Wellness Wizard steps into picture.
This document outlines the essential requirements for the fitness guide. It portrays both functional and non-functional aspects of the software including its constraints and assumptions influencing its development. This document serves as a medium of communication between various stakeholders such as business analysts, project managers, and technical and non-technical team members. By projecting the requirements of its stakeholders, it gives us an opportunity to make informed decisions while the system's design and development is in progress. The mentioned requirements enable the development team to create a more robust solution that addresses the main objective that is to create an application which recommends diet and workout plans to the users.

Keywords: Personalized Diet, Workout, Recommendation, Classification, Regression Tree.

1. INTRODUCTION

In the modern age where we deal with automation, and screen-stuck lifestyles, health and fitness have been the subjects under utmost concern. People suffer because of unhealthy lifestyle, irregular eating habits leading to poor nutrition, and chronic stress. All these issues surge a need for the awareness about the importance of fitness and personalized nutrition. However, most people are choosing the path of generic exercises and vague dietary suggestions which are not tailored according to their unique health conditions, preferences or physiology.
While there exist huge number of diet and fitness apps in the market, most of them fail to address the main need of the user that is personalized recommendations according to their body type and health. A plan that works efficiently for a young person who is a fitness junkie will not be suitable for an older person managing diabetes or someone who has just recovered from a surgery.
The workout and wellness wizard (WWW) is an online platform that enables customers to get their

recommendation for diet and exercises, based on the assessment on their health conditions and various other inputs. The health assessment is done based on the user's inputs. In this user-centric fitness assessment system, individuals input key metrics, including age, weight, height, and detailed exercise-related information. The software system includes a website and a mobile application which will be developed for iOS and Android platforms. Both of the platforms include similar functionality and features, making it easy for the users to make use of the application, regardless of the device.
Backed by interpretable machine learning algorithms like classification and regression trees, and powered by food analysis based on correlation, this application ensures that the recommendations are adjustable, explainable and designed by keeping user's needs in mind.

1.2 Scope of the project

The WWW is an online platform designed to provide customers with personalized health and wellness recommendations based on their health conditions and preferences. The system will be developed to offer a seamless user experience, allowing customers to easily input their health data, receive personalized recommendations, and track their progress.

It includes the following key features:

Customer account management: Customers can sign up when they're new to the application and once they sign up, they can login to access the application. Within the application, they can manage their account by tracking the exercises they've done so far, the diet they have taken and keep updating the health details to vary the recommendations.

Health assessment section: Customers initially need to input their current health conditions which are asked. Based on the information they provide the health will be assessed and a proper diet and exercise recommendation can be made.

Diet and Exercise tracking: Customers, once started with a diet and exercise plan, can track their progress in the progress section. They can make a day-wise checklist which has the total number of days the plan needs to be followed, based on which the current progress percentage will be displayed.

Diet and Exercise recommendation system: Once the user inputted the data for health assessment, the model understands the user's health condition. Next step for the user is to get a relevant diet and exercises recommended for them. So, once the user clicks on respective buttons of diet and exercise, the corresponding content should be displayed.

Premium content payment: Once the user's health is assessed, few top recommendations will be displayed. The top recommendation which is predicted to be the most effective one is locked and the users need to pay a certain amount to access it. So, the payment gateway portal's button should be attached to that content.

2. Related Work

1. The system uses Pearson Correlation Coefficient to compare food nutrients and recommend alternative food items.
2. The idea behind using K-means clustering is to group patients based on their health status computed according to their inputs in the health assessment, with K-means Clustering.
3. There's research on including social media platforms to the tracking part, where the social platforms provide daily related news, quotations, success stories for motivation, so that out of the overall motivation from the device and tracking, the chance of maintaining the consistency might increase.

4. In the fast-growing world, wearable devices can also be integrated with such applications, as a future scope.
5. The system continuously learns from user interactions to improve the accuracy and relevance of recommendations over time.
6. The research mainly focuses on the application of machine learning techniques to personalize diet and workout plans. It involves the development of an Android-based mobile application which can be used to generate health recommendations for users.
7. The system mainly depends on three ontologies—nutrition, sports medicine, and runner profiles—which structure data for efficient querying and adaptability. The Map-Reduce model is used for scalability. [8] Unlike traditional recommendation systems, this particular system doesn't focus on user preferences, instead it takes the health needs of the users into consideration and provides the recommendations.
8. The "Iworkout" application was developed using the Waterfall Software Development Life Cycle (SDLC) methodology, ideal for this small-scale project with a limited developer team.
9. The comparison of different algorithms has been done using e Watson Analytics Sales Database, for various algorithms showed in the plots.

Table 1: Accuracy Scores (Using Accuracy and Kappa Metrics)

Algorithm	Accuracy Range (%)	Kappa Range
Random Forest (RF)	83.3 – 91.6	0.750 – 0.877
Support Vector Machine (SVM)	70.6 – 82.9	0.536 - 0.747
Classification and Regression Tree (CART)	72.7 – 81.3	0.573 - 0.711
K-Nearest Neighbors (KNN)	34.0 – 50.0	-0.014 - 0.224
Naïve Bayes (NB)	40.0 – 45.5	0.000 - 0.115

Table 2: Interpretability of Different Algorithms

Algorithm	Interpretability
Random Forest (RF)	High
Support Vector Machine (SVM)	Moderate
Classification and Regression Tree (CART)	Low
K-Nearest Neighbors (KNN)	Moderate
Naïve Bayes (NB)	High

Figure 1: Accuracy comparison for various algorithms, with Random Forest being the most accurate.

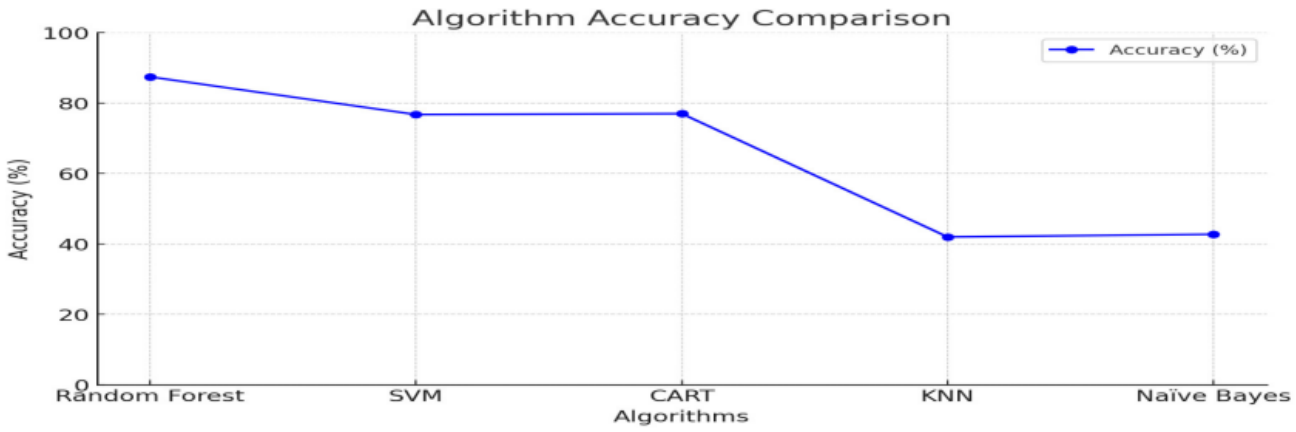
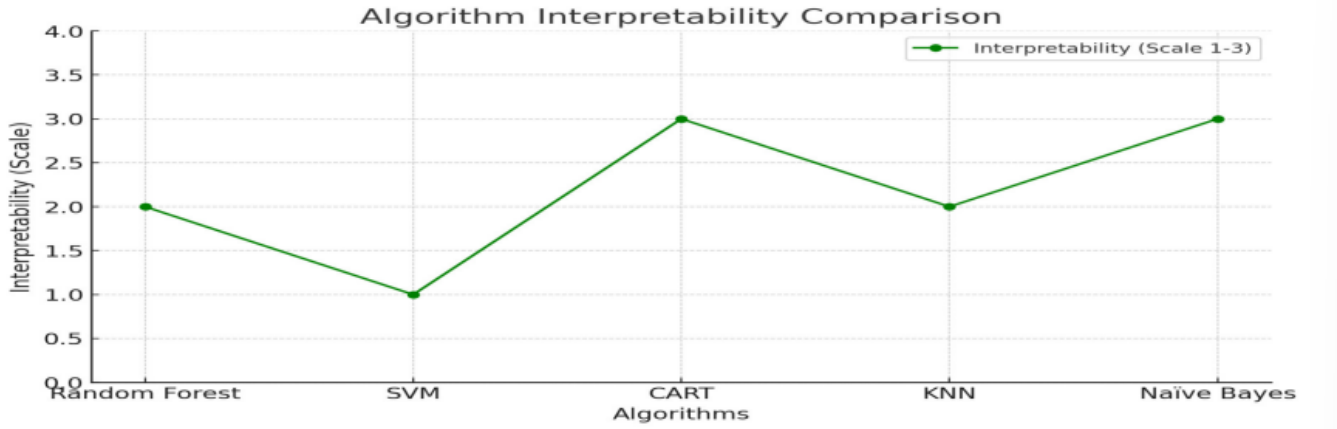


Figure 2: Interpretability plot for various algorithms, with Classification and Regression Tree being the most interpretable.



3. Methodology

Among Random Forest and CART, the algorithm CART is chosen because interpretability of CART is more, enabling us to analyze and explain the recommendations easily based on health inputs like BMI, weight, allergies, and diseases. Even though Random Forest has more accuracy, it has less interpretability, but CART has a significant amount of accuracy, even though it's less than Random Forest, overall score of CART is higher for this problem statement. Initially, we collect the data and preprocess it. CART is the underlying algorithm for the Decision Tree Classifier or Decision Tree Regressor from the scikit-learn library. After preprocessing it, use the scikit-learn library to transform the data and then split it to train and test data. Then we can perform hyper parameter tuning to increase the score of the model. This will give the prediction output as high protein data , carbohydrates and other specifications. Our system will exclusively maintain a database with these tags. All the foods with those tags, will be clubbed and a diet is recommended to the user. From them the user can also get an alternative food recommended, by comparing the food items with other food items available. This is done using Pearson Correlation Coefficient. It gives the measure of the strength of the linear relationship between two variables.

Consider a set of items which are recommended in the first go ,represented as represented as

x=x1,x2,. . . ,xn, where each xi the nutrient value of the ith food item and the food items remaining in the dataset as a second set, represented as y = y1, y2, . . ., yn The Pearson Correlation Coefficient (r) quantifies how strongly these two sets are related. It can be calculated with the help of the following formula:

$$r = \frac{\sum(x_i-\bar{x})(y_i-\bar{y})}{\sqrt{\sum(x_i-\bar{x})^2}\cdot\sqrt{\sum(y_i-\bar{y})^2}} \quad (1)$$

Where:

- r : Pearson correlation coefficient
- xi : each value in set x
- yi : each value in set y
- $\bar{x}$: mean of set x
- $\bar{y}$: mean of set y

After calculation of PCC, we identify foods with high correlation values. A high r value indicates that the alternative food item has a nutrient profile similar to the user's current food choices. We retrieve these food items as well, and present them as alternative foods to the user. For grouping the data, we take the present user data, dynamically and then give in the number of clusters that we decided on earlier. We store the recommended diet plans and their corresponding customers in a database. After grouping is done, the diet plan of the customers in the same group is checked and then retrieve their diet plans for the present customer. This way the redundant computations of the system, making it efficient. Making use of all these algorithms together, aids in running the system smoothly.

4. Data Flow Diagrams

Figure 3: Users and admin are main stakeholders, interacting with the system for various purposes.

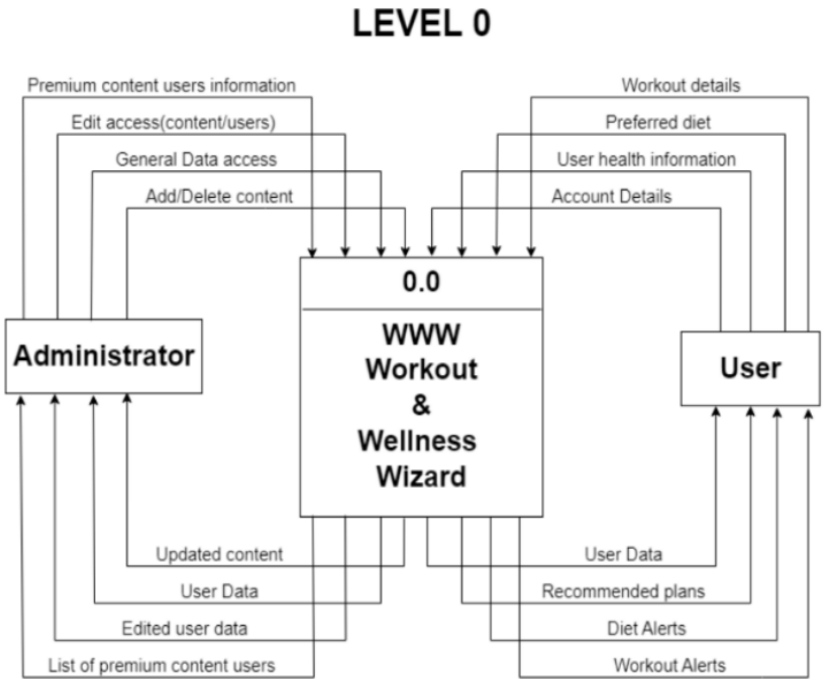


Figure 4: Progress tracking helps users monitor their workout and diet plan adherence.

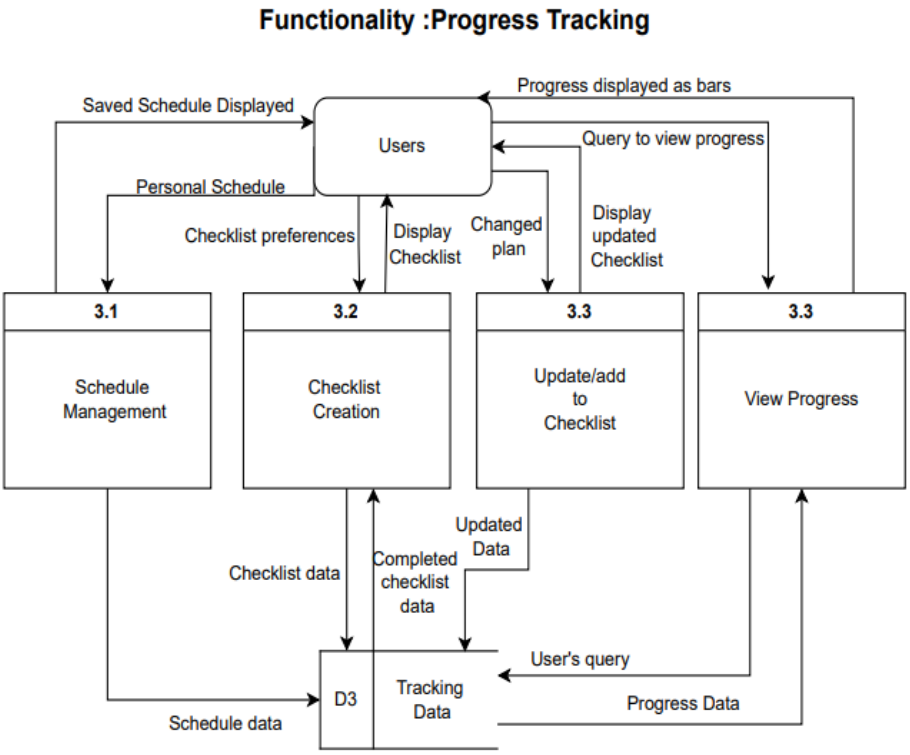


Figure 5: Users can manage accounts, with login, signup, and update functionalities.

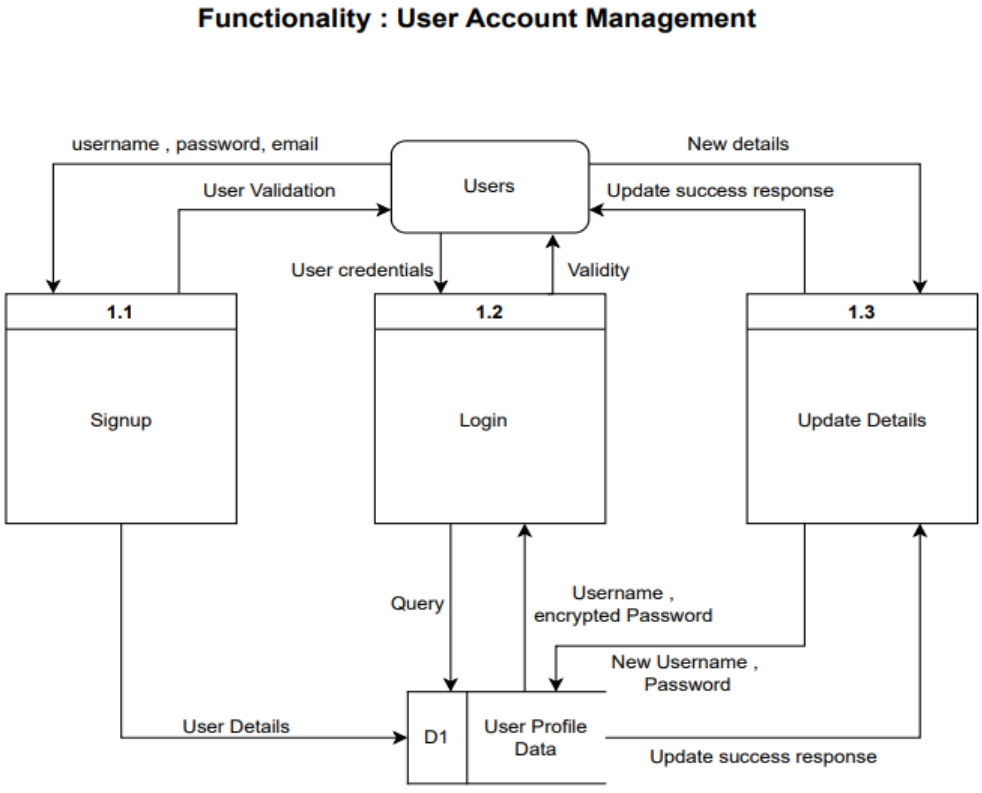


Figure 6: Feedback is stored in the database and retrieved by admin for response.

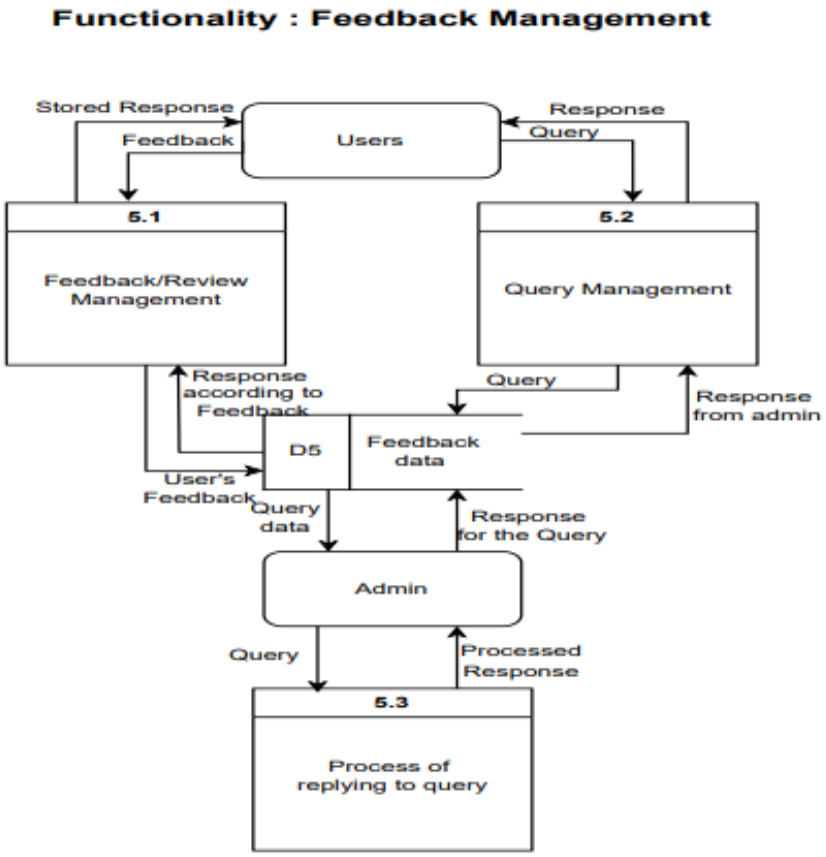


Figure 9: The various functionalities included in this use case diagram are plans, diet and workout recommendations, account management, track progress and sending feedback.

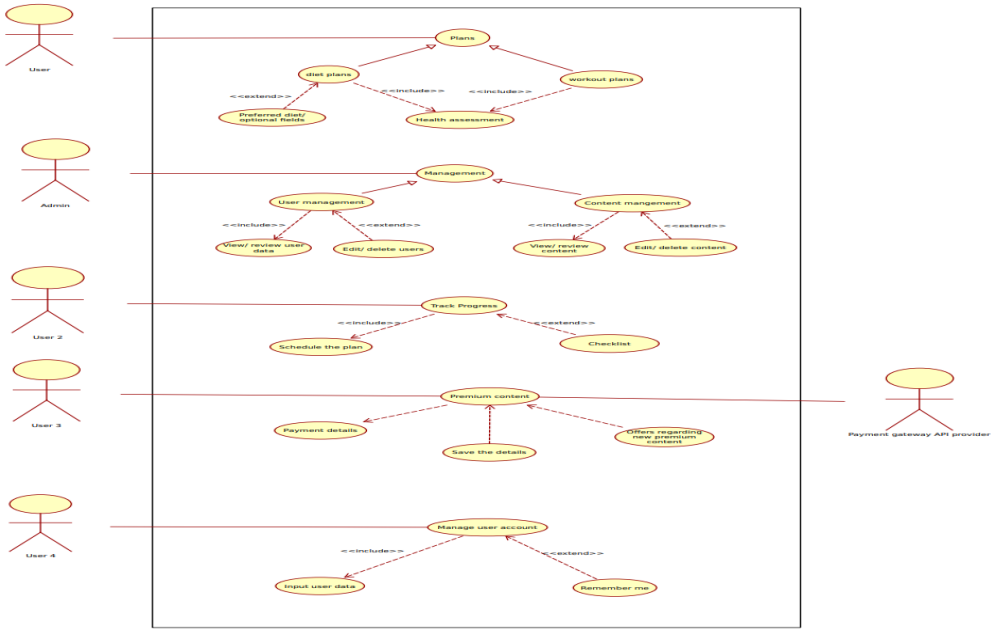
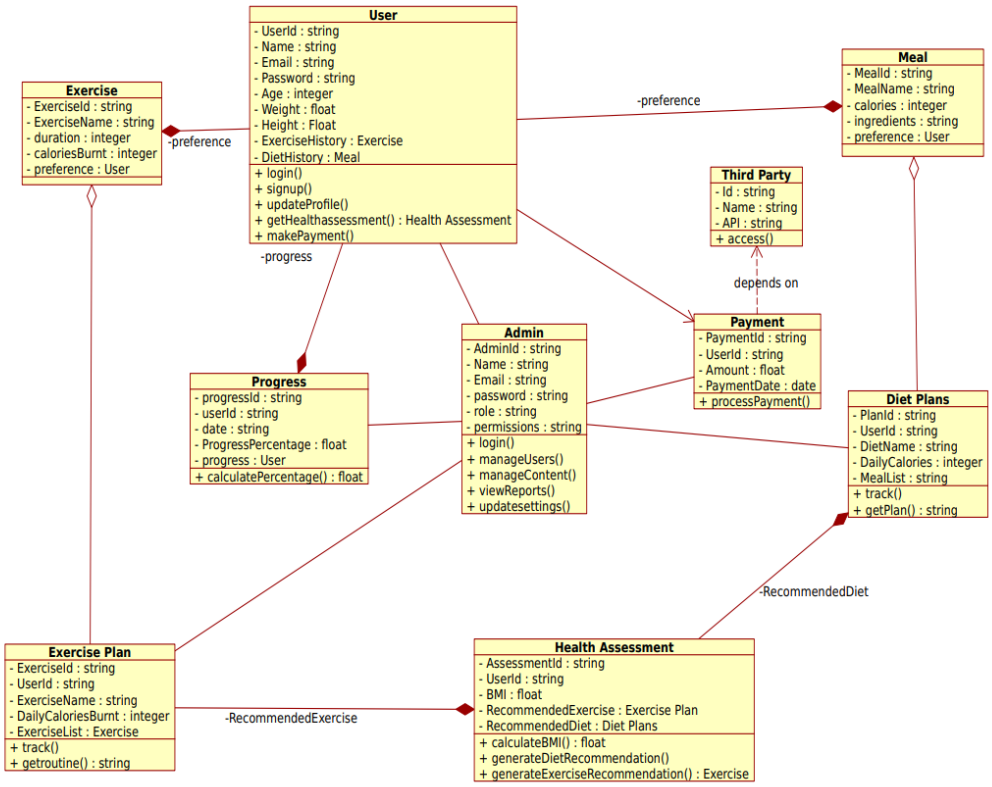


Figure 10: The class diagram illustrates all the classes and their associated objects, including variables and methods which are functionalities of user and admin.



5. Future Scope

The "Workout and Wellness Wizard" has a lot of potential for growth in the near future. This application harnesses artificial intelligence along with ever growing technology. In the future, personalization based on the emerging AI related technology can help improve the standard of recommendations given to the users. This helps in providing the users with tailored diet and workout recommendations which fit their lifestyle. In the future, the diet and health patterns keep changing from time to time hence it is important that the system recognizes these changes and provides the recommendations accordingly. Furthermore, incorporating real-time health data from devices (like heart rate, sleep patterns, and daily steps) would refine the recommendations and help in improving the system by adding additional features related to the new health data. With these upgrades, users could receive real-time feedback on their goals and adjustments to their routines, boosting motivation and engagement through a data-driven approach.

6. Conclusion

In conclusion, the “Wellness and Workout Wizard” is an application that is designed to provide the most accurate and tailored diet and workout recommendations. These recommendations are personalized so that they meet the users’ needs. By leveraging the appropriate technology for health assessment, recommendations and real-time progress tracking, the application serves as a n all-in-one tool for its users. Future enhancements such as AI-driven adjustments, integration with hardware and new up to date content will increase the usability and functionality of the system. All the enhancements will create a holistic solution for the physical and hence the mental well-being. With increasing innovation, the "Workout and Wellness Wizard" has the potential to significantly impact users’ health and lifestyle, empowering them to make informed, sustainable choices for lifelong wellness.

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