Data Analytics Enforced Content-Based Fitness Recommender System for Individuals without Allergies and Ailments

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Abstract—The society these days is bounded with inactive and unhealthy lifestyle. According to the recent studies, there is a rapid increase of individuals suffering and dying from diseases caused by poor diet and unhealthy lifestyle. In view of this, knowing the right kind of food to eat, and the appropriate exercise is essential in achieving good health. Being fit relates to good health, and healthy living makes life longer and happier. The objective of this study is to develop a system that will recommend its users the appropriate exercise and diet for their daily activities. Exercise and diet plans were gathered and were validated by experts to ensure utmost level of effectiveness and safety among users. Linear regression with passive monitoring of user activities was used to estimate and forecast future fitness states of the users.

Keywords—Content-Based Recommender System; Health and Fitness Systems; Diet and Exercise; Health.

I. INTRODUCTION

The progress of information technology has served as gateway to a lot of new services in different fields and disciplines. Computers connect to the telephone and mobile network to exchange messages and communicate [1-2]. Radio-TV transmission, World Wide Web, and social media [3] like Facebook, Instagram, Twitter, Tumblr, and the like, have also been made possible with these communication technologies. Educational sites [4] were also been made available for information, collaboration and learning such as Moodle and Edmodo among others. There was also an increase in online businesses such as online shopping and banking [5].

Despite these advancements in Information Technology (IT), there were also consequences that were introduced. According to recent studies, these can greatly affect people’s lifestyle and would later lead to high mortality rates [6-7]. One particular example is unhealthy diet, and lack of exercise which may lead to plethora of physical and health problems. These two factors are the primary predictors to obesity as they are linked to risk in many diseases.

The latest data from World Health Organization as of January 2015 says that the worldwide obesity has more than doubled between 1980 and 2014. In 2014, about 13% of the overall world’s adult population (11% of men and 15% of women) was obese. More than 1.9 billion adults, 18 years and older, were overweight and over 600 million of these were obese. It was reported that the causes of this problem are the increased intake of energy-dense foods that are high in fat; and increased in physical inactivity due to the increasingly sedentary nature of many forms of work, changing modes of transportation, and increasing urbanization [8].

The consequences of ignoring the importance of nutrition and fitness are not difficult to see and how large their role is in our health as shown by the recent studies [9-22]. Eating properly allows us to maintain a healthy weight and keep excessive stress off. A person has energy when he eats right, and when he has energy, he burns fat. Most importantly, good nutrition keeps a person’s body stocked with antioxidants that fight off a
wide range of illnesses including cancer. Regular exercise on the other hand is one of the requirements necessary to address health and fitness issues. The types of exercise that will improve and strengthen the heart muscles are highly recommended such as recreational activities like sports and physical exercises [23].

Centers for Disease Control and Prevention [24] says that both diet and physical activity play a critical role in controlling your weight. You gain weight when the calories you burn, including those burned during physical activity, are less than the calories you eat or drink [25-32]. People vary greatly in how much physical activity they need in terms of weight management. You may need to be more active than others to achieve or maintain a healthy weight. Hence, getting to and staying at a healthy weight requires both regular physical activity and a healthy eating plan.

This study generally intends to develop a content-based recommender system that will help people in maintaining and improving their health through exercise and balance diet. A recommender system is a subclass of information filtering system that seek to predict the ‘rating’ or ‘preference’ that a user would give to an item [34]. The system serves as a fitness kit that guides and advice users on their fitness programs in order to achieve good health.

Specifically, this study is aimed to accomplish the following activities: collect data about exercise routines, and diet plans; classify diet plans according to exercise routines; validate exercise routines with a professional gym instructor; and validate diet to exercise routines with a licensed nutritionist.

This study is focused on the development of a web application for fitness which is applicable to individuals who do not have allergies and ailments, and individuals from ages 12 and above. Also, since experts are from the Philippines, diets and food recommendations are also localized to this area.

II. RELATED WORK

The MyFitnessPal [42] is an android based application that log’s user calories. It features personalized calorie intake calculations, nutritional value breakdown, recipes and foods, community, progress tracking and notifications. This app is also similar to Meal Snap [43] and Lose It [43] as to functionalities and activity tracking however, since they only provide calorie calculators, the activities may not complement the diet and may also miss nutrients to heavy activities.

Activities including exercise is an important aspect as to controlling calorie levels. The Sworkit [42] by Nexercise is focused on this aspect. The app has a number of built-in exercise regimens, including yoga, which will cater to what you need. It has over 160 exercises and provides no-gym approach to exercise as demonstrated by professional personal trainers. Though this app provides a lot of exercise to choose from, there is always a question on how suited these are to users since inappropriate exercise may have more negative effects than otherwise.

Motivation is also a common component in achieving your fitness goals, apps like Seven [42] and Diet Coach [44] uses this feature to push users to complete exercise challenges, and combat laziness and food temptations. The interesting feature in this app is that they provide a scheme of monitoring to check on the progress of their users. Like in the MyFitnessPal app, the only missing component here is bridging the user activities to the things they eat to ensure they get proper nutrition. Also, the motivation done here are alarms or reminders that are triggered when users get out to their threshold. This may be insufficient since a view of today’s routine may not encompass the whole lifestyle of the users [38-39]. The researchers wanted to create a scheme with analytics that would intelligently allow the system to predict future fitness states of the users based on user data along with giving recommendations of appropriate diet to exercise routines. These combined may strengthen and improve our typical ways on how we deal with health and fitness.

III. METHODOLOGY

In this section, the researchers present the methodology used in this research. To ensure safety of the users, diet and exercise data were gathered and validated by experts. These were used as baseline information for the recommender engine.

A. Data Gathering

To have a baseline fitness data to work with, the researchers surveyed existing systems to identify potential features of the target application. Health, fitness, and diet routines were also surveyed to compliment such features and to ensure every component has basis.

The researchers also gathered fitness and exercise data on printed and electronic books, health journals and articles. The objective of this is to gather information regarding fitness and its relationship to health status, and to know the available techniques of determining and improving fitness.

Videos for exercises were also collected online to have an overview on how the exercise is to be done and in order to classify them according to fitness levels [8]. Fitness levels are used to classify users. These are used as baseline information for diet and exercise recommendations. Fitness levels are computed based on the Body Mass Index (BMI) [8] of the users.
B. Diet and Exercise Validation

Recommending diets for a specific exercise routine is critical when done only by computers. In order to ensure safety, the researchers needed to validate their data to ensure that system recommendations are effective and safe. To put everything in place, series of interviews and diet-to-exercise data validation were conducted with a nutritionist and a gym instructor to know the factors and ways of achieving good health and fitness, and to ensure the accuracy and integrity of the data to be used. In here the fitness levels: underweight, normal, overweight, and obese, were defined and user clusters were put into place. Appropriate diet and exercise routines were also defined to capture routines that are particular to certain fitness levels or conditions. Exercise routine levels: beginner, intermediate and advance, were made to capture the initial capability of the users. These specifications combined will serve as baseline dataset for the recommender system.

C. System Development

The system development life cycle [33-37] was used in this research. The baseline dataset was standardized to accommodate future data to be incorporated in the system. Series of user validations were done to ensure that the system is user friendly and to ensure utmost level of user experience. In this stage, low fidelity (LowFi) user interface (UI) were made. This user interface is the initial sketch of the overall UI of the system. Ten users validated this to ensure that there is a high confidence that they will accept such UI operations.

After the LoFi UI construction, High Fidelity (HiFi) UI is established. In this stage, working UI is created. This is also validated by the abovementioned users to ensure that all suggestions and comments were incorporated.

The system modules on the other hand were simultaneously made with the UI development. Initial tests were done to ensure that the system recommends diet-to-exercise plans as intended. Integration is done to fuse everything together and the minimum viable product (MVP) was made. This will be the target initial system to be delivered to the users.

D. Post Expert Validation

Since every recommendation is critical the researchers also conducted post expert validation to ensure that the recommendations are well suited for every fitness level. Rigorous checking of BMI computations and diet-to-exercise recommendation were done by the experts. In here, both dietician and gym instructors validated the generated results.

IV. MAIN RESULTS

In this section, the researchers present the results of this research. This covers the whole system description and the integration of data analytics in the user monitoring module.

A. The EatNForm Recommender System

There are several modules in the EatNForm web app. The first one is the BMI monitoring module. This is used to compute the user’s BMI to sense user improvements. In the system, calorie is the unit used to estimate the initial fitness level of the user. In the calorie counter module, the calorie intake is calculated based from the food that the user has taken while calorie burned is calculated from the routines that the user has done. Based from these user inputs, the calorie burned is computed. These computed values are displayed in the profile of the user for monitorial and motivational purposes. In the planner module, food diet and exercise routines are provided by the system based on the current BMI state of the user. Using this index, various food plans, in the food planner module, are generated that the user can choose from. Also in the exercise planner, recommendations are also generated based on the health status of the user. Each user starts on the beginner level exercise plans and this will gradually change as the user completes the given plans. Just like other health and fitness applications, the exercises are given in video clips to be easily followed by users. Figure 1 and 2 show the web app icon and the system home page respectively.

Figure 1. EatNForm Web App Icon.
motivation to the user allowing them to push further and to achieve their fitness goals. All these processes combined encompass the entire system, from recommendations to monitoring, a complete suite for good health and healthy lifestyle.

The following formula was used to compute Body Mass Index (BMI) and Calorie Residual (r):

\[
BMI = \frac{weight}{height^2} \quad (1)
\]
\[
r = i - b \quad (2)
\]

For the BMI, the weight should be in kilograms and the height should be in meters. The calorie residual \( r \) is the difference of the calorie intake \( i \) and the calorie burned \( b \).

V. CONCLUSION

In this study, the researchers presented a system that will help people in maintaining and improving their health. To facilitate this, not only diet-to-exercise recommendations were included but intensive level of monitoring as well. In this way, the application may be able to predict possibilities that will happen in the fitness level of the user. This is based on calorie consumed and burned strategy where daily activities are recorded to make the estimate closer to reality.

Recommendations from diet to exercise routines were validated by experts to ensure high level of integrity and to ensure everything is safe during the use of the application. EatNForm is not just a health app but it ensures the best fitness advice and information for a healthy and better life.

REFERENCES


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