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Ontology Based Virtual Assistant for Diet Recommendation

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Abstract— A balanced diet contains nutrient rich foods from all the food groups. People are becoming very conscious about their health. People who follow a well balanced diet feel better and are in better health. Calories are an important component of the diet. Calorie needs for an individual depend on gender, age, activity level and weight. It is important to supply right amount of calories to the body to function properly. People follow different diet plans. Imbalance in the diet results in illnesses and different diseases. For recommending diet instead of manually, different approaches from computer science are used. In this project diet recommendation approaches is based on ontology used for knowledge representation method and is combined with content based filtering concept to recommend diet specific to the user preference.

Keywords— Recommendation, Ontology, Balanced Diet, Ideal Calorie Count, Content Based Filtering

I. INTRODUCTION

Diet is the sum of food consumed by a person. Dietary habits and choices play a significant role in the quality of life, health and longevity. Complete nutrition requires ingestion and absorption of vitamins, minerals, and food energy in the form of carbohydrates, proteins, and fats. Balanced diet is a diet consisting of a variety of different types of food and providing adequate amounts of the nutrients necessary for good health. Most individuals adopt unhealthy lifestyles either due to stress or lack of knowledge or not knowing the importance and impact in long term. A balanced diet means that you are combining the right fats, proteins, carbohydrates, vitamins, minerals and fibre in order to obtain all of the nutrients you need for good health. By eating the correct combination, and not too much or too little of anything, you will give your body the right fuel to grow, replenish, repair and strengthen. A recommender system or a recommendation system is a subclass of information filtering system that seeks to predict the "rating" or "preference" that a user would give to an item. When diet is recommended by considering user's body type and preference it will encourage user to follow balanced diet and become healthier.

The three main aspects of the project "Ontology Based Virtual Assistant For Diet Recommendation" are

- Balanced diet to calculate ideal calorie intake
- Ontology for knowledge representation
- Content based filtering to recommend as per user's preference

II. BALANCED DIET

A balanced diet needs to contain foods from all the main food groups in the correct proportions to provide the body with optimum nutrition. It should also be made up of the correct number of calories to maintain a healthy weight, and be low in processed foods. Every person is different and hence the correct diet for health may vary from person to person, however by following a diet that is varied, covers all foods groups and is low in undesirable nutrients such as sodium, saturated fats and sugar, you are well on your way to a healthy body. A healthy diet involves consuming appropriate amounts of all nutrients, and an adequate amount of water. Nutrients can be obtained from many different foods, so there are a wide variety of diets that may be considered healthy diets. It comprises of macronutrients like protein, carbohydrates and fat along with micronutrients which include vitamins and minerals. Each of them has a different role to play in maintaining various body functions.

These nutrients are derived through a combination of the five major food groups

- Fruits and Vegetables
- Cereals and Pulses
- Meat
- Dairy Products
- Fat and Oils

The ideal calorie intake per day is given in the below table. These values can vary depending on age, metabolism and levels of physical activity, among other things.

Gender	Age	Sedentary	Moderate	Active
Child	2-3	1000	1000	1000
Female	4-8	1200	1400	1800
	9-13	1600	1600	2200
	14-18	1800	2000	2400
	19-30	2000	2000	2200
	31-50	1800	2000	2200
	51+	1600	1800	2200
Male				
	4-8	1400	1600	2000
	9-13	1800	2200	2600
	14-18	2200	2800	3200
	19-30	2400	2800	3000
	31-50	2200	2600	3000
	51+	2000	2400	2800

Fig. 1 A sample of ideal calorie intake for an individual

III. ONTOLOGY

An ontology is a specification of a conceptualization. In the context of knowledge sharing, an ontology is a description (like a formal specification of a program) of the concepts and relationships that can exist for an agent or a community of agents. This definition is consistent with the usage of ontology as set-of-concept-definitions, but more general. And it

is certainly a different sense of the word than its use in philosophy. In Computer Science, ontology is a systematic arrangement of concepts, their properties and relations which exist in domain. Common components of ontology includes Individuals, Classes, Attributes, Relations, Function terms, Restrictions, Rules, and Axioms; for more details related to these concepts. In short, a commitment to a common ontology is a guarantee of consistency, but not completeness, with respect to queries and assertions using the vocabulary defined in the ontology.

Ontology can be domain-specific or generic; the former means ontology concepts are defined with reference to the specific domain whereas the later means the concepts are defined in general (i.e. the meaning / relationship of these concepts are already defined by English language). The implementation of ontology is generally a hierarchal representation defining concepts and their relationships. Three kind of relationships namely is-a, instance-of and part-of are generally used in the ontology; for more information. Ontology are usually develop to share common understanding of information among entities or software where each node in the ontology is a concept containing set of attributes and relationships.

There is no clear division between what is referred to as vocabularies and ontologies. On the Semantic Web, vocabularies define the concepts and relationships used to describe and represent an area of concern. Vocabularies are used to classify the terms that can be used in a particular application, characterize possible relationships, and define possible constraints on using those terms. The role of vocabularies on the Semantic Web are to help data integration when, for example, ambiguities may exist on the terms used in the different data sets, or when a bit of extra knowledge may lead to the discovery of new relationships. Consider, for example, the application of ontologies in the field of health care. Medical professionals use them to represent knowledge about symptoms, diseases, and treatments. Pharmaceutical companies use them to represent information about drugs, dosages, and allergies. Combining this knowledge from the medical and pharmaceutical communities with patient data enables a whole range of intelligent applications such as decision support tools that search for possible treatments; systems that monitor drug efficacy and possible side effects; and tools that support epidemiological research. In the last decade, Ontologies have been widely used for knowledge representation and sharing.

The project “Ontology Based Virtual Assistant For Diet Recommendation“ contains ontology file which defines classes based food type like beverage, raw, dishes etc. It defines object properties like isHighInSugar, isLowFat, isVeg etc. Also contains data properties like hasCalories, hasFeature etc. Sample ontology file is shown in the below diagram. *Protégé* is a free, open-source platform that provides a growing user community with a suite of tools to construct domain models and knowledge-based applications with ontologies. Reasoners should play a vital role in developing and using an ontology written in OWL. Automated reasonser “HerMit” is used to check for any inconsistency in the data created. The inputs for ontologies queries are based upon the user profile which contains age, gender, type and lifestyle like active, moderately active or sedentary.

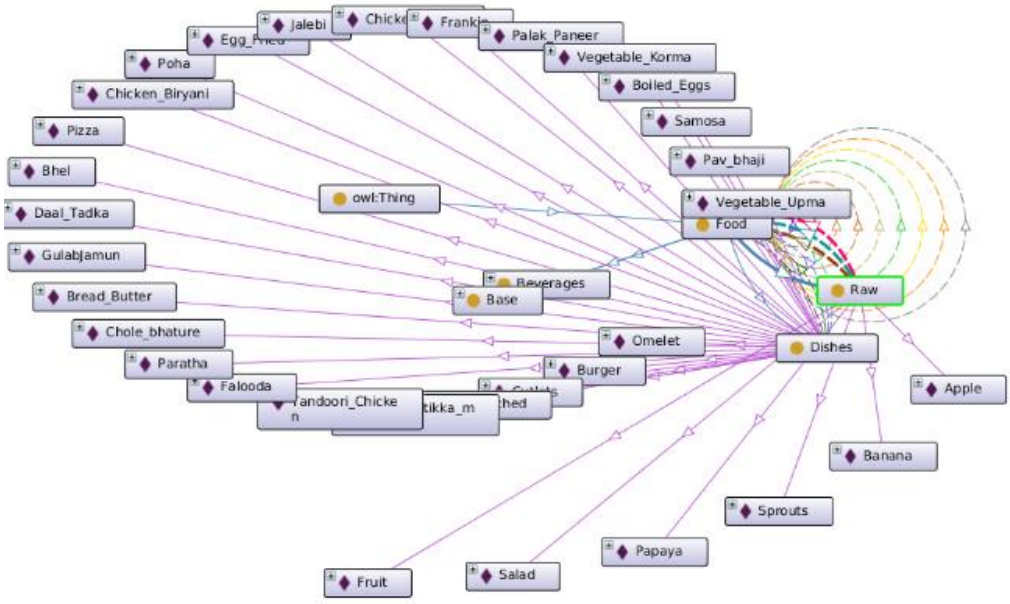

Fig. 2 OWL file containing classes and properties

IV. RECOMMENDATION SYSTEM

Recommender systems have become increasingly popular in recent years, and are utilized in a variety of areas including movies, music, news, books, research articles, search queries, social tags, and products in general. Recommendation engines now power most of the popular social and commerce websites. They provide tremendous value to the site's owners and to its users but also have some downsides. This article explored some of the ideas behind recommendation systems and the algorithms that power them. There are also recommender systems for experts, collaborators, jokes, restaurants, garments, financial services, life insurance and Twitter pages. A recommendation engine, also known as a recommender system, is software that analyses available data to make suggestions for something that a website user might be interested in, such as a book, a video or a job, among other possibilities. Recommender systems typically produce a list of recommendations in one of the following approach

- Collaborative
- Content-based filtering
- Hybrid Recommender Systems

Collaborative filtering approaches building a model from a user's past behaviour (items previously purchased or selected and/or numerical ratings given to those items) as well as similar decisions made by other users. This model is then used to predict items (or ratings for items) that the user may have an interest in. Content-based filtering approaches utilize a series of discrete characteristics of an item in order to recommend additional items with similar properties. These approaches are often combined known as Hybrid Recommender Systems.

Collaborative filtering arrives at a recommendation that's based on a model of prior user behaviour. The model can be constructed solely from a single user's behaviour or more effectively also from the behaviour of other users who have similar traits. When it takes other

users' behaviour into account, collaborative filtering uses group knowledge to form a recommendation based on like users. In essence, recommendations are based on an automatic collaboration of multiple users and filtered on those who exhibit similar preferences or behaviors. For example, suppose you're building a website to recommend blogs. By using the information from many users who subscribe to and read blogs, you can group those users based on their preferences. For example, you can group together users who read several of the same blogs. From this information, you identify the most popular blogs that are read by that group. Then for a particular user in the group you recommend the most popular blog that he or she neither reads nor subscribes to.

Content-based filtering constructs a recommendation on the basis of a user's behavior. For example, this approach might use historical browsing information, such as which blogs the user reads and the characteristics of those blogs. If a user commonly reads articles about Linux or is likely to leave comments on blogs about software engineering, content-based filtering can use this history to identify and recommend similar content (articles on Linux or other blogs about software engineering). This content can be manually defined or automatically extracted based on other similarity methods.

Hybrid approaches that combine collaborative and content-based filtering are also increasing the efficiency (and complexity) of recommender systems. A simple example of a hybrid system could use the approaches shown in Figure 1 and Figure 3. Incorporating the results of collaborative and content-based filtering creates the potential for a more accurate recommendation. The hybrid approach could also be used to address collaborative filtering that starts with sparse data known as cold start by enabling the results to be weighted initially toward content-based filtering, then shifting the weight toward collaborative filtering as the available user data set matures.

V. CONCLUSIONS

The project is designed to use the advantages like consistency of the data provided by ontology and improving user experience by recommending diet based on feedback which is content based filtering. The data for the user is retrieved from the ontology based on the rules and queries. This data is reordered to present the recommendation to the user based on the tags used for each items and rating or feedback user has provided. This will make sure the user gets the ideal diet based on his body conditions and his preference.

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