

Intelligent Refrigerator to Recommend Recipes using Hybrid Approach

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ABSTRACT

A lot of times we are confused about which dish to cook and end up wasting our time on thinking about it. Thus, we need a Smart System to provide us with a solution to this problem i.e. a system to recommend us which item to prepare. Here we make a Recipe recommending fridge to reduce the human efforts and time. Our main goal here is to develop an Intelligent Refrigerator which will maintain a database containing the list of items and their amount. This data is then used to recommend a recipe to the user according to their preferences. It also consists of an option for Voice Control, a LCD screen, etc. Smart panel on the door which is nothing but a touch Enabled LCD, which provides and complete list of all the things inside the refrigerator as well as the recipes that can be prepared using those items. And various other option are made accessible to user from here. Based on the vegetables and other products, the Refrigerator is smart enough to give the recommendation on what all possible dishes can be made. The user may then select the option and whole recipe needs to be displayed or may need to be read out on demand based on voice commands.

Index Terms: Machine learning, Visual Recognition, Image Processing, Smart systems, Intelligent Systems, Human Computer Interaction, Internet of Things, Data Analytic, Classification, Regression

I. INTRODUCTION

Due to the advancements of computer technologies and the tremendous use of the Internet, intelligent systems with multimedia and smart operation capabilities have been emerging into our daily life. Kitchen is one of the places where such intelligent systems have been used a lot. Since modern life style is giving people less time because of their busy schedules, they don't get a lot of time to thinking of which recipe to cook, what are the items they have in their fridge, what else do they need to buy, etc. So, an enjoyable and healthy life style can be achieved by using an intelligent system such as a smart fridge. In this paper we introduce a novel application for a smart fridge with multiple intelligent capability. It is designed for managing items stored in it and advising its users with cooking recipes depending on what kind of food is stored. It can also perform other functions such as adding new recipe discovered, reading out the recipe for user, finding related videos online, eating habit analysis, etc. We are confident that an “Intelligent Fridge” will be an important part in future smart homes.

The Internet of Things(IoT) a technology which is a global network of machines and devices capable of interacting with each other as well as the Internet has been predicted to be a new wave of technological advancements by many academics and manufactures and will also improve, or at least change the lives from conventional to modern life. There are a lot of applications of this technology. And is used to make daily routines quicker, smarter and more efficient what were once tedious and hectic (Lee and Lee, 2015).

The idea of an Intelligent Refrigerator is the application that we will explore in this project. Already there have been some attempts of making a Smart Fridges specifically for household use. However, many thought of it as a seemingly obvious n great opportunity to introduce such technology into homes, they have failed to make an impact and have been branded as commercial flops (Kuniavsky, 2010). Here we will build our idea upon these models a[^] and try to come up with a solution to save time and money as well. We commonly have features that help track inventory, set the user preferences of recipes, get recommendation about recipes - to create a smart fridge which has the additionally functionality of helping the person to save time by not wasting their time on thinking about which recipe to make today. This additional feature is expected to increase the commercial appeal of an Intelligent Fridge, as time has become more important in the busy life of a modern person on a global scale.

Some of the initial ideas for our Intelligent Fridge system include: • LCD screen display - showing important information such as what are the items present inside, a warning of products which might expire soon, how much of a product is left • User profiles - possibly with face recognition or log-in system for multiple users such as person from different regions or to keep a record of an individual’s preferences, notifying them of their intake of calories, nutrients, alcohol and etc.

- An online recipe updating tool used to add new recipes to the main database of recipes where all the recipes are stored, and an automatic recommendation system to tell what are the possible recipes using the items currently present inside the fridge.

- Approach detection - turns on the display screen and closes the light when it has been left untouched for too long accordingly

This Fridge can also hold information on household food that doesn’t need to be kept in the refrigerator (i.e. cupboard food) by scanning an item or receipt to provide better information on recipes. It can also show and vary temperature according to the food stored inside the fridge. Warning when there is a shortage of food is also given before the items get finished. In the next chapter we will provide an evaluation of current systems which will draw upon task analysis, so that a better understanding of user requirements as well as flaws can be made.

There are also certain features which could be added to make it a better. These are, Online ordering feature based on the users average shopping of items, connected mobile app so you can track your diet and items inside the fridge anywhere, to receive notifications about what you need when you are at the store.

II. LITERATURE SURVEY

The concept of smart Homes has now become reality with the help of Internet of Things, Machine Learning, Visual recognition, Image processing and many more technological advancements. Smart refrigeration is also a part of such smart homes, which use IoT to make human life simpler by providing various control options and advanced features.

2.1 An IoT-based Appliance Control System for Smart Homes

This paper describes development of home networking and its architecture which is totally wireless based in an attempt to eliminate the use of wires to control the devices completely. An IoT system[1] based on the use of 433 MHz wireless sensor along with actuators and controllers to control various things like air-condition, room lighting and their monitoring.433MHz frequency band is able to transfer data at low rate up to long distances at a very low power and it is available globally and license-free. To control all the appliances a Smart Home Information System (SHIS) [1] is proposed which can be on the management server or the user computer. SHIS [1] is nothing but a web based application that lets user to control the various appliances through a user interface.

2.2 Vegetables detection from the grocery shop for the blind

They have presented the Automatic recognition system (Vegetable vision) [2] for blind people to help them to identify vegetables at the grocery store/supermarket. An image is captured and based on the captured image various parameters like color, shape, size, density, textures are analyzed as a single parameter is not capable of identification of correct vegetable. Various methods like RGB color modelling, histogram analysis, image segmentation, textured segments are to be used but increase in the number of parameters increases the recognition time. The future work suggests the use of neural networks in recognition system to reduce latency. Vegetable vision [2] system can be used to quantify quality aspects of vegetables which can be then used as an alternative of manual sorting and grading of vegetables.

2.3 Review Paper on Vegetable Identification and Detection using Image Processing

This paper describes project to develop a vegetable detection system [3] using computer vision to identify the vegetables. It is based on image processing, which can control the classification, qualification and segmentation of images and hence recognize the vegetable. The identification of vegetables has to be done by multiple recognition clues such as color, shape, size, and texture are extracted and analyzed to classify and recognize the vegetables. They have Canny Edge Detection [3] algorithm as it is most optimal. Classification of vegetables is carried out after image detection and segmentation based on the color classification and texture classification. Image processing does not guarantee the correct identification but it can generate optimal result using above methodology as output depends upon image quality and angle also.

2.4 A Content-aware Fridge Based on RFID in Smart Home for Home-Health care

In this paper we studied about Content-aware Fridge [4] based on RFID to provide several content-aware services like creating a grocery list intelligently when the stock in the fridge is less or providing the details about what food to eat to a particular user based on their health and eating habits. The system also recommends recipes in a way such that it ensures overall nutrition of the family. The Content aware fridge uses RFID [4] to integrate item details and user information. The use of RFID [4] is also a drawback of such implementation as most of the items inside the fridge are kept after unwrapping them in other words removing the RFID [4].

2.5 Smart Fridges with Multimedia Capability for Better Nutrition and Health

The project aims at development of Smart Fridge [5] which maintains the user information weight, height, age, medical record, allergic food etc. in a database, the database also contains specific nutrition information and based upon the above data it suggests nutritional recipes. It provides all the details via a display mounted on the door. It may notify the user by audio and visual medium. It also provides multimedia cooking demonstration (requires internet connectivity) [5]. Generating store list, generating shopping list, warning on food which is going to expire, displaying calories for various foods are some of its features. But the problem with the system is that uses RFID [5] to scan the items.

2.6 IoT Based Smart Refrigerator System

They have designed a smart refrigerator [6] and an android application Which can notify the user about the contents of the fridge. Various notifications are send to user based on the condition whether the fridge is loaded or not. They have also proposed various multimedia capability [6] of the fridge and dietary control and eating routine analysis.

2.7 A scalable recipe recommendation system for mobile application

In this paper, they have proposed a hybrid recommendation system [7] for personalized recipe mobile application. The system is a combination of content-based and collaborative filtering. The hybrid recommendation algorithm [7] is designed to improve the effectiveness of recipe recommendation. They have used spark clusters to manage and process high amount of data generated from mobile application. Spark [7] clusters are the open source implementation of map-reduce Framework [7]. It maintains two type of data log data and historical data for the hybrid recommendation system.

2.8 Recipe Recommendation Considering Flavors of Regional cuisines [8]

There are variety of recipe recommendation system [8] based on user preference, content based, nutrition based or user health based, in this paper they have presented and recommendation system based on the regional cuisines preferences [8]. It is a score based system so the flavor preferred by a region is calculated from all regional recipes and

hence broken into their ingredients and scored by the TF-IDF[8] (Term frequency and inverse document frequency). Finally, the recommended recipe score is calculated by local score and the score of similar recipes.

2.9 Intelligent Food Planning - Personalized Recipe Recommendation

This paper describes use of content based recommendation system[9] for recommending recipes. It has high coverage[9] and reasonable accuracy[9]. It uses content based strategies with break down and construction to establish relationship between food items and recipes. There was only a marginal improvement in the accuracy when collaborative filtering was deployed. It does not use collaborative filtering[9] based on user preferences and other eating habits.

2.10 Implementation of a Goal-Oriented Recipe Recommendation Providing Nutrition Information

In this paper they have proposed a recommendation System Providing Nutrition Information [10] this paper they have proposed a recommendation system that suggests recipes to user based on nutritional information [10] on the Internet but the end user gets the recommendation based on simple natural language input like want to cure acne [10]. They have maintained a cooccurrence database that maintains nutrients and their nouns associated with along with this they had ingredients database with the amount of nutrition they have and database which contained all recipes. Using above databases [10] nutrition value of each dish was calculated and then recommended dishes were then compared to manually recommended dishes and overall system performance is evaluated.

III. PROJECT IDEA

The main idea of the project is to make a system that recommends the recipe according to the items present inside the refrigerator. The system maintains a table for keeping the records of items. The table has two things one is the item name and the other is the weight of the item. The system has two options, one is for adding an item in the list and another is for removing it.

There are mainly 3 options available on the Dashboard:

- User Related Functions
- Item Related Functions
- Getting Recommendation

Firstly, the User Related Functions need to create a profile where they save their name and their preferences for the recipes. There is also an option for updating the user profile which lets the user to update their details. Secondly, the user has options for updating the list of items in the fridge. The user can add the item or take out an item. If the user wants to add an item then the user needs to place it on the weighing pan where the weighing pan measures the weight and the camera scans the item. The list is updated with the weight and the name of the item. Suppose, the user wants to remove an item then the item is kept on the weighing machine and then the item is scanned as well. Then, the weight of the item is subtracted from the previous weight and it is then updated also it checks if the weight of the item is 0 after updating it. If it is 0 then the item is removed from the list else the updated value is shown. Finally, we have an option which performs the main task of the system i.e. Recommending Recipe based on items present. Here, the system first analyses the list of items and then uses it to recommend the possible number of recipes.

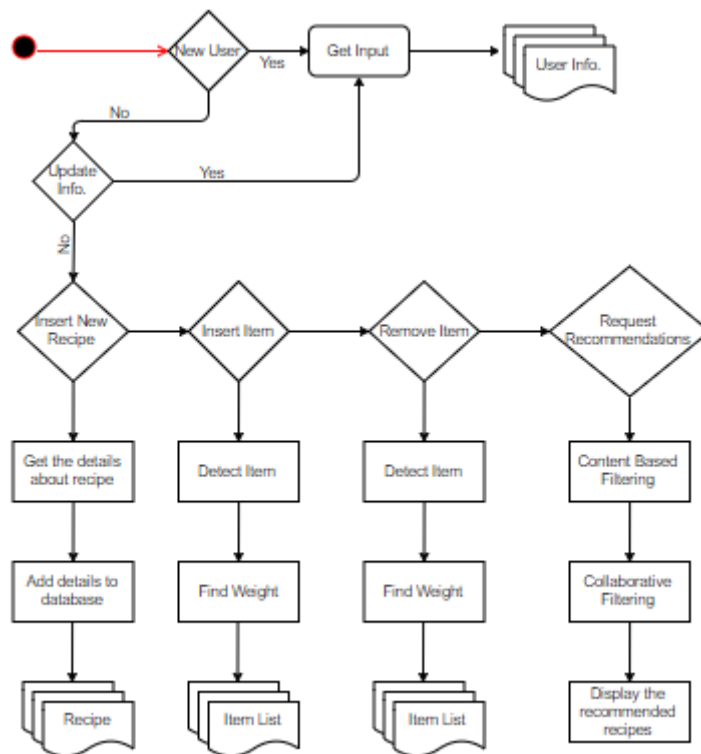


Fig. 1 : Activity Diagram

IV. CONCLUSION

From the above research we can conclude that, there have been a lot of attempts to make a Smart Refrigerator but all of them had a few disadvantages. The system which is proposed here tries to overcome those disadvantages as well as also some of its own disadvantages like accuracy of Visual Recognition, accuracy of weighing pan, connections to the internet and many more. But, the system proposed here very well solves the problem statement.

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