MyMeals: Intelligent Healthy Meal Planning Assistant During COVID-19

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Abstract
Due to the decreasing food during the quarantine, how to utilize available limited food resources to make healthy meal plans quickly has recently become the main concern of many people. To address the challenges that people are facing in maintaining healthy eating routines during the COVID-19 period, we prototyped an app called MyMeals, which functioned in three core parts: intelligent ingredient inventory tracking, recipe recommendation, and meal planning. It aimed at identifying the current problems for people to cook and further providing solutions to reduce users' workload of meal planning in order to facilitate convenient and healthy lives. In this position paper, we present the design of MyMeals and lay out future directions.

Keywords
Meal planning, COVID-19, Artificial intelligence (AI), Visual Recognition

Introduction
COVID-19 has impacted every aspect of our lives. Most of the world population is sheltering in place or staying at home to contain the spread of the Coronavirus. Statista conducted a survey of 2,129 respondents. The survey disclosed that 80% of the Americans stayed home and around 70% of Americans avoided public places like bars and restaurants [1]. Due to the shelter

Figure 1: Intelligent Inventory Tracking Feature in MyMeals using IBM Watson Visual Recognition

in place order during this difficult time, people are forced to cook more often at home.

Takeout and delivery are still the most available and convenient option for those who would rather not cook during the coronavirus pandemic [2]. However, the risks coming out of the food delivery are still under concern. Besides that, the security of delivery food itself still needed great considerations. Even before the pandemic, food insecurity and the lack of consistent access to enough food for a healthy life were also major problems that people commonly consider. The World Food Program estimated that the number of people facing severe food insecurity worldwide could double to 265 million due to the economic impact of COVID-19 [3]. In particular, with the limited access and flexibility to food and ingredients during COVID-19, it is inconvenient and time-consuming to cook tasty meals and eat healthy.

Related Work

The impetus for AI technology always derives from the idea of resolving the inconvenience in life. As one type of AI technology, visual recognition technology has started to grow in popularity on various industrial platforms. Due to its convenient ability to quickly and accurately tag, classify and search visual content, visual recognition helps the technician identify unfamiliar parts and pinpoint the problem such as robotic manipulation of complex parts, and helps determine possible solutions to reduce instability caused by objective conditions [4, 5]. In the business world, many companies such as Coca-Cola also started to drive their brand performance by leveraging image recognition technology to target potential customers and advertise specific products catering to their drink preferences [6]. Looking beyond the visual identification function, the technology contributes to research fields such as pulsar candidate screening, fostering a better interpretation as well as improving the recognition speed [7].

Prior work also explored the benefits of AI tools or data-driven approaches in recipe recommendation. Yanai's team has proposed a cooking recipe recommendation system that suggests related cooking recipes based on the real-time visual object recognition of food ingredients to assist people in determining the diets [8]. A similar idea has been conducted in Ueda's research that employs a more statistical method of scoring recipes by extracting the user's food preferences related to his/her recipe browsing and cooking history [9]. In general, Watson Visual Recognition might make different aspects of life more convenient. However, how to recommend meals based on the limited food storage using Visual Recognition with meal-planning feature is understudied.

We aim at leveraging visual recognition to assist in recipe recommendation as well as designing a more customized meal plan to help more people cook and derive fun in the kitchen, especially amidst the Coronavirus outbreak period.

Design Rationale

MyMeals was originally developed to appease the stresses that come with cooking good-tasting, healthy meals at home. With COVID-19 keeping people at home during quarantine, it is healthier and more cost-saving to cook their meals at home rather than eating out. With this in mind, we wanted to help people cook healthy meals with the food they already had at home. This would help people minimize the risk of contracting the virus by encouraging them not to eat out and go to the

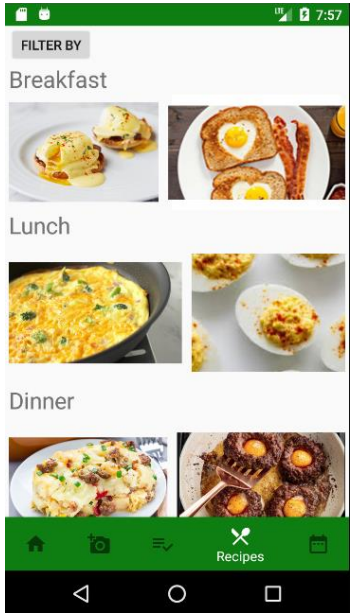

Figure 2: Recipe Recommendation Feature in MyMeals

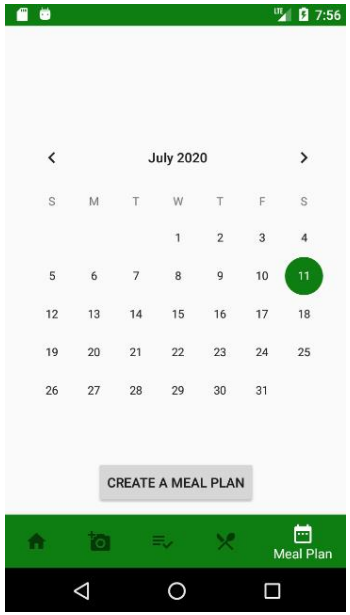

Figure 3: Meal Planning Feature in MyMeals

grocery stores less. The primary features were designed to simplify the cooking process and reduce people's workload of cooking while remaining useful and beneficial for the user.

Based on our understanding of users' needs, we chose to integrate some AI technology into our app design. Because it may be less efficient to let the user type in the recipes they want. Besides, considering that people always have no idea of what they are going to cook for meals in real life, we applied visual recognition to bring more convenience to meal planning. It is user-friendly because it makes cooking easier. The only thing people need to do is taking a picture of food (in our demo, we showed a picture of the food in the refrigerator), based on the picture, our app can identify food, analyze out the ingredient, and recommend accordingly recipes for users.

Building off of our choice to use visual recognition technology, we looked at other meal planning apps for some inspiration. We found two appealing apps for meal planning: ChefBytes and SideChef. From these two apps, we loved the idea of allowing users to put a meal on their calendar so that they could see what and when exactly they were going to eat. Hence, we arrived at the idea of implementing a calendar for the user to plan out their chosen meals. The accessibility of various recipes gives users many options as to what they would like to cook. Furthermore, the app lays out all the ingredients and cooking instructions needed to cook the selected meal. However, the visual recognition technology differentiates our app from these two apps and make ours more outstanding.

MyMeals: A Healthy Meal Planning

The core functions of MyMeals include 1). intelligent ingredient inventory tracking and digital pantry (Figure 1); 2). recipe recommendation (Figure 2), and 3). meal planning (Figure 3). MyMeals seeks to address limited food accessibility problems by making at-home cooking easy and convenient. IBM Watson Visual Recognition was utilized to allow users to identify ingredients in their refrigerator and pantry to address the issue of having no idea of recipes. Furthermore, the COVID-19 pandemic left grocery stores facing inventory deficits and communities grew concerned over low food supplies. By incorporating IBM Watson Visual Recogniton into MyMeals, the application works to help users create a digital pantry that quickly captures what food products they have in their home.

The intelligent inventory tracking and digital pantry is supported with Visual Recognition (see Figure 1) technology that identifies and adds items to the digital pantry. The result is fed into the next main feature: recommended recipes (see Figure 2). These recipes are suggested to users based on what they have in their digital pantry. MyMeals provides recommended recipes created from ingredients specified by the user. A filter option gives the user flexibility to filter out personalized recipes based on any desired cuisine, diet, or food restrictions. Listing out healthy, delicious recipes to users based on ingredients they already have on hand helps make mealtime simpler and stress-free. This is especially important during the COVID-19 pandemic as it has magnified concerns around financial insecurity and limited resources. The recommended recipes function allows users to better utilize the ingredients they have in their home and maximize their resources. The final main feature of MyMeals is the meal planning functionality.

This feature helps users place any recipes of their choice onto a calendar, allowing them to schedule their meals. Many people struggle with eating healthy on a daily basis (see Figure 3). Now, the global pandemic has introduced new worries, and maintaining a healthy diet may not be a top priority anymore. The meal plan feature allows users to create a customized meal plan from their recommended recipes so when it comes to mealtime, users have to put in minimal thought or effort into determining what to eat and whether it is healthy or not.

Conclusions

The pandemic brings much inconvenience to our lives, such as limiting people's food choices and the feasibility to eat healthy. To address the issue of healthy eating and meal planning, we developed a prototype called MyMeals that integrated Visual Recognition technology to provide intelligent inventory tracking, a digital pantry, and meal planning functions to simplify meal procedures and design personalized cost-saving meals during the quarantine. In the next step, we are going to further develop it as a more applicable app, evaluate with users, and scale the usage to help people not only amidst the pandemic outbreak but also in in the post-pandemic future.

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