**Module One Assignment**

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The following paper summarizes a real-world problem that would benefit from the application of artificial intelligence (AI). A solution will be proposed to the real-world problem by describing applicable AI techniques, identifying necessary system components, such as hardware or services, needed for the solution, and potential ethical concerns with the solution will be identified.

The real-world problem that would benefit from the application of AI is that in today’s growing and fast-paced environment, many people find it difficult to find time to cook their own meals, and many others lack the necessary skills in the kitchen to do so. Because of this, it could be beneficial to many people to have smart kitchen technology, such as a smart refrigerator, smart pantry, and a smart device, such as a tablet, that is dedicated to the kitchen, and would all work in conjunction with each other to assist in teaching an adult how to cook a whole meal from start to finish. This smart kitchen technology would recommend easy-to-follow recipes, help coordinate cooking times for multiple dishes, and select recipes that can be made with the ingredients that the user already has, or ingredients that can be ordered and delivered to the user’s home by the time they get home from work.

To incorporate such an intelligent system in a home, a system would need to be developed that utilizes machine learning to keep track of the ingredients the user already has in the home. This would include various sensors and cameras so that the system would know precisely what is and is not in the fridge/pantry and how much of each item there is. Machine learning is the subset of artificial intelligence that "typically pertains to computer programs that can detect and exploit patterns in data" (Goel & Davies, 2019). Its foundation is based on statistics, which is a subdiscipline of AI that seeks to develop programs that use data to create new beliefs based on limited previous beliefs (Goel & Davies, 2019). The kitchen’s intelligent system would begin with data that can be used to classify the existing ingredients in the kitchen. As ingredients are either used or introduced to the kitchen as new items, the machine learning model would learn what is being used and what each of the new items are that are introduced to the kitchen environment. This form of machine learning is considered unsupervised learning, which is a type of learning process consisting of grouping input automatically, finding patterns in the input, and interpreting data based on that input and only on the input. (Narayanan, 2019). This type of machine learning is also called clustering (Narayanan, 2019). Based on the available ingredients, the system can recommend meals that the user would like to make, and the system can purchase new ingredients to have delivered when the user arrives home for the day, as needed when the user is missing ingredients or does not have a sufficient amount of a particular ingredient. Also, a benefit of the machine-learning smart kitchen is that the system will continue to improve over time as the machine-learning model is exposed to more and more ingredients in the kitchen. The smart refrigerator and pantry would be capable of classifying ingredients for recognition. For example, if a gallon of milk was purchased from one location, it might have a label that is specific to that location. If a second gallon of milk were purchased from a different location, that gallon of milk would likely have a different label than the first gallon of milk (unless items were purchased brand-specifically). The refrigerator will be able to learn that while the two items look different because of their labels, it is still the same item. However, the system would also be able to differentiate between various types of similar items. For example, the refrigerator would know if the gallon of milk was either whole milk, 2%, 1%, etc.

The components necessary for this smart kitchen technology to work adequately would be a central device or smart hub, such as a tablet, that is dedicated to the kitchen for keeping track of all of the ingredients available (an inventory of ingredients). The device should also be capable of both audio and video for providing instructions for preparing meals in the kitchen from start to finish, coordinating with the user and scheduling meals, and for the automation of ingredient ordering/purchasing. The smart kitchen would include a smart refrigerator (for cold storage) and a smart pantry (for dry storage), which would make use of sensors, such as scales and cameras, that are capable of reading/measuring the ingredients that are either removed or introduced. Shelves would be capable of measuring the volume of ingredients, and cameras would be used for ingredient identification purposes. These smart appliances would constantly update ingredient data with the kitchen’s smart hub. Therefore, the kitchen smart hub would always be learning about the use of ingredients in the kitchen and when new ingredients are introduced or depleted. Additionally, the devices would need to be able to communicate with each other which could be done via wired or wireless connectivity methods. The smart hub would need access to an internet connection to learn new recipes and be able to communicate with online services such as companies that ingredients can be ordered and delivered from. The user would also need a mobile application that they can access on the go to make decisions about what the smart kitchen’s hub suggests for meal planning. Also, the user’s schedule would need to be synchronized with the kitchen’s smart hub so that deliveries of ingredients are aligned with the time when the user gets home to prevent spoilage of delivered ingredients. The system’s success is also based on whether or not the user has all the cooking utensils necessary to prepare each meal. The user must consider this when meals are selected. The system should also be capable of purchasing new cooking utensils as needed if the user allows it.

Many people could benefit from the use of this type of technology, however, it should not go unnoticed that with its use does come potential ethical concerns. Ethical concerns include security risks, privacy violations, the types of decisions these systems should be allowed to make (especially when considering safety), and economic concerns (Sorbello, 2023, Potential Challenges and Opportunities). While the type of data collected about users of this potential product may not be significant to some, others may disagree. Some people may not want others to know information about their diet and what they are or are not consuming. It is essential that companies prioritize security and that they are transparent with consumers about what data is collected about them, how they are collecting the data, and for what purposes the data is being collected (Sorbello, 2023, Potential Challenges and Opportunities). It can also be concerning when considering the decisions this type of product will be making. Will the product always know whether the ingredients in the kitchen are safe to consume? Perhaps not in all situations. When dealing with food, there must be some precautions in place that enable the intelligent system to make appropriate or rational decisions based on whether or not each ingredient is safe to consume. Another ethical concern is the economic impact on society. It should also be considered whether or not the benefits of having this type of product (increased efficiency and cost savings by reduced energy use) outweigh the potential for job loss as automation continues to grow in society (Sorbello, 2023, Potential Challenges and Opportunities).

**References**

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