Project Proposal – Team The Fridge Bros

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Project/Team Title: Smart Fridge/The Fridge Bros

Introduction / Problem Statement:

Smart home devices are becoming increasingly popular in homes around the world. Data from the Statista Technology Market Outlook estimates that over 73.1 million households are home to at least one smart big appliance such as refrigerators, for example, and this figure is expected to grow to as many as 177.6 million in the next 5 years.

It is easy to see why smart home devices are getting popular, as they offer many quality of life improvements to users. For example, smart fridges allow us to monitor stock levels in real-time from anywhere. This can be convenient when used remotely, from a grocery store. However, having more features comes at a cost. Smart fridges like Samsung's offerings cost around 2000 dollars for the most basic model. Therefore, we plan to explore the creation of a smart fridge that only has the most essential features such as real-time stock level monitoring, making it more affordable.

Proposed IoT Solution:

Our proposed IoT system is a smart fridge that is able to:

1. Monitor food stock levels in real-time and predict the demand for products based on consumption patterns of the user
2. Inform the user if the fridge door is left open or if abnormal conditions are detected.

This will allow users to efficiently grocery shop by only buying what they need and reduce food waste and energy waste. Better for the environment, and better for the wallet!

Sensors used: Temperature and Humidity sensor (to monitor fridge conditions), photoresistor (to detect if the fridge door is open) and smartphone camera (to take pictures of the inventory) will be connected to the WeMOS in the fridge. LED (to notify the user) will be connected to the other WeMOS.

Number of IoT Devices: Two. One in or near the fridge to monitor stock levels and conditions and one in a convenient location to notify the user if there is some action to be taken.

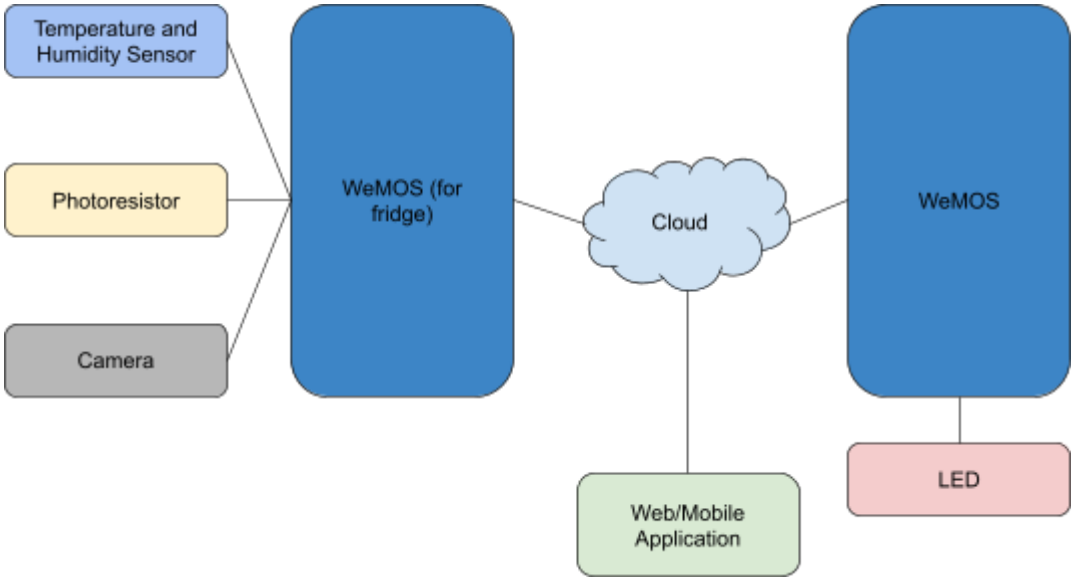
Other hardware used: Smartphone for connecting to the cloud and viewing the data sent by the IoT system.

Machine Learning Models:

The data we are collecting is long-term food consumption patterns. By predicting the future consumption, the user is not only able to plan their grocery shopping better (for example, buying grocery only on the weekends based on the following week's consumption predictions), they are also able to use it to adjust their diets. We plan to use time-series forecasting models such as ARIMA(autoregressive integrated moving average), as they are widely used for predicting future values based on previously observed values and have shown success in predicting demand and consumption patterns.

To monitor the stock levels, the camera takes a picture of the inventory which is passed into a pre-trained You Only Look Once (YOLO) model that detects the items.

System Architecture:



Other Cool Features:

We plan to make a model representing the smart fridge with real food items inside to make it more realistic. Push notifications will also be sent to the user's phone to alert them of conditions such as low stock or high temperature.

Progress so far:

We have read papers on similar projects to examine the feasibility and tested the sensors we plan to use. We also read up on the ARIMA and YOLO models.

Possible Limitations or Challenges:

It may be difficult to detect stock levels if the fridge is cluttered and disorganised, or if there are too many different food items. Therefore, we aim to start with a simpler situation, placing food items in specific spots and using a few common food items such as eggs and milk. It may be difficult to obtain datasets on an individual or a home's consumption patterns, therefore, we plan to generate realistic custom datasets to do so.

Timeline:

Week 8: Create custom dataset for consumption patterns, train with ARIMA model. Test and retrain YOLO model if required. Hardware setup and find a suitable fridge or box to use.
Week 9: Decide on database and cloud to use and create a simple backend to test data collection and model.
Week 10: Develop a simple user interface for the web application.
Week 11: Prepare for Check In 2 demonstration, improve UI and add in other features such as a mobile application if time allows.
Week 12: Prepare scripts for presentation, run through demonstration to ensure it is working properly.
Week 13: Demo and presentation. Prepare the final report.

References:

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