CS486C – Senior Capstone Design in Computer Science
Project Description

Project Title:	A mobile app to increase food bank efficacy

Sponsor Information:	
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Project Overview

The COVID-19 pandemic has created an unprecedented demand for the nation's food banks as those who have lost jobs during the pandemic struggle to feed their families. According to the Feeding America Network, almost 100% of U.S. food banks are serving more people than the previous year. St. Mary's Food Bank (SMFBA), located in Phoenix, Arizona, is the world's first food bank, the largest food bank in Arizona, and also one of the largest in the U.S. SMFBA distributes food across the Phoenix metro area in addition to Western and Northern Arizona (Figure 1), including the Navajo Nation and Hopi Tribe. Since March, SMFBA has been very active in responding to the economic hardships created by the COVID-19 pandemic, working closely with tribal government representatives to increase and improve the emergency food resources available to Navajo and Hopi communities, which have been especially hard hit by the pandemic and have some the highest food insecurity rates in the state (Figure 2).

Figure 1. St. Mary's Food Bank Distribution Area. Source: https://www.firstfoodbank.org/learn/

Even before the pressures created by the COVID-19 pandemic, suggesting and recommending healthy recipes to local distribution agencies and recipients was an on-going day-to-day challenge. SMFBA distributes a wide and ever-changing variety of foods through approximately 700 local agencies, which are charged with distributing food to recipients. This raises a number of chronic obstacles to efficient food utilization, including:

- The distribution of food products is not uniform; many of the 700 local agencies receive different food products at different amounts, making the centralized inclusion of recipes into food pallets at the warehouse a challenge.
- A push inventory management system with short lead times makes development of "recipe cards" a challenge because the goal is to move as much food as quickly as possible. Often, SMFBA doesn't know what food types will be available to clients until 24 hours before it is received and distributed.

- Due to the wide variety of produce distributed by SMFBA, a common question faced by SMFBA managers and those working in the 700 local agencies is: "I've never seen this before. What is it? What do I do with it?"

FOOD INSECURITY RATES
- 30%+
- 20-29%
- 15-19%
- 4-14%

In short, food utilization within the food bank system is non-optimal simply because the end users being served by the food bank infrastructure don't have easy, reliable access to information (recipes!) on what to do with the varying kinds of foods available. While such questions are manageable at an individual-level, having multiple versions of these questions across 700 local agencies creates logistical challenge to providing healthy recipe options and advice for preparing new foods.
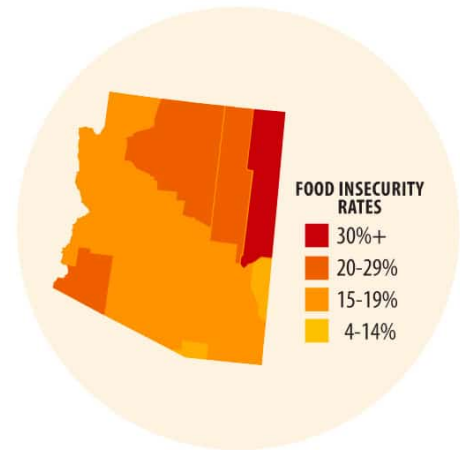
As a starting point, SMFBA has gained access to a database of recipes compiled by the Arizona Health Zone for distribution to local agencies and food recipients. SMFBA does not, however, have an efficient way to distribute these recipes to the local agencies or food recipients. In particular, agencies and food recipients need access to recipes that are healthy, easy to prepare, and don't require exotic ingredients…and, ideally, that are synchronized with the food resources that are available from the food bank at any given moment. What is needed is an easily accessible "smart" source of healthy recipes that are always tailored to the food (ingredients) currently on offer in the foodbanks.

The Envisioned Product: A smart recipe app for foodbanks

This project will provide a solution to this problem by creating a searchable, customizable recipe app for local agencies and food recipients. The app would pull in up-to-date information on what it available at the user's "home" food bank, would consult a large database of recipes to calculate which recipes can be made with the ingredients (perhaps rating recipes based on how "close" to make-able they are, i.e., allowing common cheap ingredients to be missing that could be picked up at any grocery store), and present these recipes in an easily browsable way to food bank clients. For missing recipe ingredients, the app would help users identify nearby food retailers or food pantries where these can be found. This would allow food bank clients the ability to prepare creative, healthy, nutritionally-balanced meals from food received from SMFBA, or other foodbanks, given what is in their pantry or what can be purchased nearby at convenience stores and/or other food retailers. Specifically, the envisioned app has six overall aims:

1. Allow users to search for and identify healthy, nutritionally-balanced recipes.
2. Filter recipes based on a 'digital pantry' of food items either received from SMFBA or on-hand in the home.
3. Enable users to identify food items or input items into a 'digital pantry' manually, by scanning a product UPC, or through computer vision object recognition.
4. Allow user input on the quality and popularity of distributed food items.
5. Ability to create custom printer ready, readable pdf recipe cards (4 recipes per 8.5 x 11 page).
6. Develop a mechanism for SMFBA to gather data from end-users on what food items are popular.

Ideally, the app will be developed using a multi-platform framework like Ionic or React Native that allows generation of both Android and iOS versions of the app. Some specific features envisioned for the mobile app version of TFD include:

Basic, minimum viable product:
- A simple Android mobile application that allow proof of the basic concept.
- Searchable recipe database, based on both food bank ingredients and those commonly available for cheap locally.
- A 'digital pantry' where users can input food items in their house
- Digital pantry food entry by manual input, scanning product UPC, or object recognition.
- Select recipes that can be made with ingredients on hand, one ingredient missing, two ingredients missing, etc.
- Display recipes as interactive, intuitive recipe step-by-step instructions
- Sensitive to the user's location, i.e., can search for nearby food retailers.
- Can click to get further information on any nearby food retail locations; provides directions to nearby food retailers.
- An administrative interface (likely a simple back-end web app) that allows administrators to review/edit the recipe database, create/edit/delete food distribution sites, and allows specification of foods available at each site.
- SMFBA version of the app that allows users to create simple recipe cards (4 recipes per 8.5 x 11 page) that are easily readable and distributable.

A complete, well-appointed product: usable for testing and further development
- Improvements to the basic GUI to create an attractive, and smoothly working product, truly ready for deployment and further development.
- Easy support for multiple sites; administrators can create/edit/delete distribution sites, each stocked with different supplies.
- Compact, information-packed "dashboard views". For users, these easily overview available supplies at any of their "favorite" distribution sites. For admins, they can easily view the status of all sites, and also able to "click in" to examine any one site in more detail.
- Generation and testing/validation of an iOS version.
- The ability for app admins to run analytics on various statistics (users data, preferences, foods utilized, user feedback) using a simple graphical analysis interface (graphing).
- Supports searching the archive of foodbank data for certain datasets (e.g., data for some time span); allows export of any dataset for further external analysis.
- Ingredient and recipe rating and comment system accessible to end users; the recipe presentation function supports filtering based on user ratings.
- Functions to allow utilization feedback from users, e.g., surveys send in the week after a foodbank visit that ask users to rate utilization of various ingredients.
- Admins can see how many other users are visiting a site/have visited a site

Stretch goals
- Digital pantry food entry by scanning product UPC or object recognition in addition to manual input.
- Development of customized recipe recommender system based on user input and preferences
- Allows sharing of recipes: users can share recipes (email, text, social media) they like.

If successful, this mobile app framework would have immediate uses within SMFBA and within communities across Arizona, and could serve as the basis for developing a nationwide foodbank management network.

The NAU sponsor will serve as the primary point-of-contact on the project. Additionally, the student team will have periodic feedback meetings with Ceara Chirovsky at SMFBA and Sean Ryan at the

Center for Science Teaching and Learning at NAU. Upon completion, the team will demonstrate the mobile app to SMFBA and statewide food bank stakeholders in a webinar.

Knowledge, skills, and expertise required for this project:
- Basic knowledge of data processing and statistics. Willingness to learn programming tools for data processing and statistical computation. The student team will determine programming language(s) and tool(s).
- Programming and software development skills for modern web interfaces and databases.
- Ability to analyze end-user needs and wishes and incorporate them into product design.
- Interest/experience in web app and mobile app frameworks, especially in the use of cross-platform frameworks that support both Android and iOS apps.

Equipment Requirements:
- No equipment or software is required other than a development platform and software/tools freely available online.
- Sponsors will work to provide some sort of hosting solution (likely NAU server).

Software and other Deliverables:
- A fully-functioning mobile application for either Android/iOS platforms, as well as administrative back-end web app.
- Manual for the mobile app written for non-technical users; could be a web-based document.
- A "system administrator" manual that details with detailed instructions on installation, configuration, and maintenance.
- As-built report that carefully documents requirements, design decisions, and implementation details.
- Professionally documented source code in a GitHub repository.