SMARTPHONE-BASED MOBILE HEALTH TECHNOLOGIES FOR CHILDREN EATING WELL (CHEW)
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### 1. MOTIVATION

**WIC: Women, Infants, & Children**
- USDA's federal supplemental program
- Provides vouchers to get supplemental nutritious foods for low-income population, consisting of:
  - Pregnant women
  - Women with infants
  - Infants
  - Children up to 5 years old

**CHEW: Nashville Children Eating Well for Health**
- This program addresses childhood obesity prevention through research, extension & education

**Problems**
- Paper vouchers excessively complicate the shopping experience of WIC mothers
- There are plenty of available foods, but vouchers give constraints on the types of foods & their amounts => mothers have to keep track of that while shopping

### 2. PURPOSE

**Ease the shopping experience through a smartphone App:**
- WIC mothers can scan items => automatically identify whether a product is a WIC product or not
- Provide a calculator for buying produce

**Provide nutrition education through the app**
- Give healthy tips, customized for different target populations
- Expose children to healthy snack recipes that are easy to fix
- Analyze shopping data to provide custom nutritional advice for each user

### 3. ARCHITECTURE

- **Android CHEW App**
  - The app has a copy of server’s data, as well as voucher’s & family members’ data in a Content Provider, which encapsulates data & manages its access
  - When the app runs for the first time, it pulls the data from a server that contains WIC-approved items from food stores
  - The app sends purchased food items back to the server for future analysis
- **Cloud-based Server**
  - The cloud-based server runs Open mHealth, which provides APIs that provide a uniform means to access data
  - The server stores data in a mongoDB database, which interfaces easily with Open mHealth
- **SQLite**
  - Android’s Database
    - Content Provider stores data in an SQLite database
- **Open mHealth**
  - The server sends shopping data to the server for future analysis
  - The server stores data in a mongoDB database, which interfaces easily with Open mHealth

### 4. APP USER INTERFACE

- **App’s Main Screen**
  - Scan the barcode
  - View Recipes
  - View Healthy Recipe Videos
- **View Selected Items**
  - View Healthy Snacks Recipes
  - View Allowed Products & Quantities

### 5. ONGOING & FUTURE WORK: NUTRITION PART

- Allow WIC mothers to select healthy snack recipes before each shopping trip
- Snacks’ ingredients will be saved into the shopping list
- Remind mothers to shop for healthy snacks ingredients during the shopping trip
- Remind mothers to fix healthy snacks after the shopping trip
- Provide nutrition education through healthy tips, implemented as Android “push notifications”

### 6. ONGOING & FUTURE WORK: DATA ANALYSIS

- Our database will store items bought during each trip
- We will analyze the purchase data to provide custom tips & advices for each user
- We will analyze the purchase data to evaluate the impact of nutrition education

### 7. LESSONS LEARNED

Dealing with lots of data:
- The app required a great amount of data preprocessing
- Data was normalized into 3NF (third normal form) to store the complicated vouchers’ description & to simplify possible future data updates
- Required complicated queries

Additional challenges occurred due to the need for the app to be Wi-Fi connectivity independent, as many users may have limited or no access to Wi-Fi:
- Had to account for the fact that WIC mothers will not always be able to watch recipes videos
- The app may not be able to load images from a remote address & cache them whenever they are needed => it must store small size images in the system