Mobile and Ubiquitous Computing Project Proposal

NutriSeeON

virtual eyes to consume healthy groceries

Team 3

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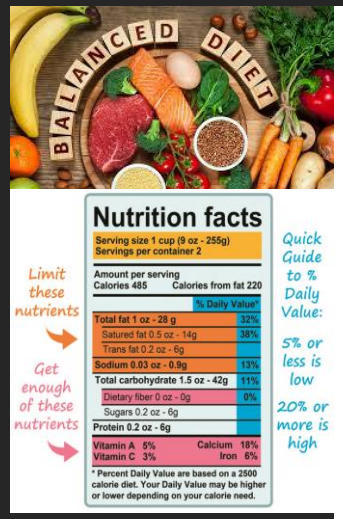
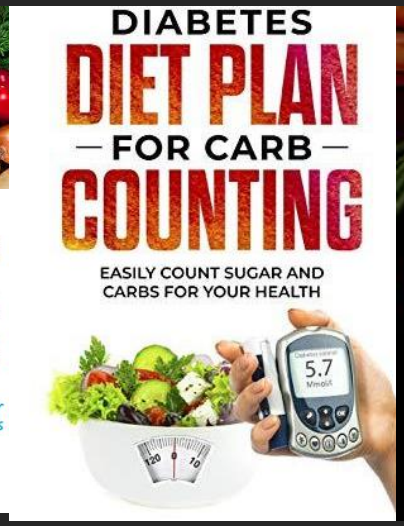
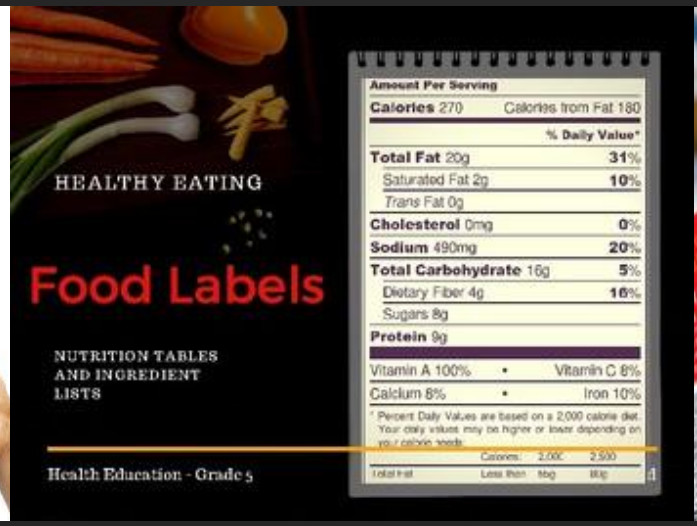
Motivation

Motivation

- Trends of consumption after identification of nutrition facts for health
  - Many modern people care about food intake due to their **health issues** such as weight control, disease(diabetes, high blood pressure), allergies.
  - They buy groceries after checking **the nutritional facts or contents** following their needs. (ingredients to be avoided or increased, serving size and calories)


BALANCED DIET
Nutrition facts
Serving size 1 cup (9 oz - 255g)
Servings per container 2
Amount per serving
Calories 485 Calories from fat 220
% Daily Value*
Total fat 1 oz - 28 g 32%
Satured fat 0.5 oz - 14g 38%
Trans fat 0.2 oz - 6g
Sodium 0.03 oz - 0.9g 13%
Total carbohydrate 1.5 oz - 42g 11%
Dietary fiber 0 oz - 0g 0%
Sugars 0.2 oz - 6g
Protein 0.2 oz - 6g
Vitamin A 5% Calcium 18%
Vitamin C 3% Iron 6%
* Percent Daily Value are based on a 2500 calorie diet. Your Daily Value may be higher or lower depending on your calorie need.
Limit these nutrients
Get enough of these nutrients
Quick Guide to % Daily Value:
5% or less is low
20% or more is high


DIABETES
DIET PLAN
FOR CARB
COUNTING
EASILY COUNT SUGAR AND CARBS FOR YOUR HEALTH
5.7


HEALTHY EATING
Food Labels
NUTRITION TABLES AND INGREDIENT LISTS
Health Education - Grade 5
Amount Per Serving
Calories 270 Calories from Fat 180
% Daily Value*
Total Fat 20g 31%
Saturated Fat 2g 10%
Trans Fat 0g
Cholesterol 0mg 0%
Sodium 490mg 20%
Total Carbohydrate 16g 5%
Dietary Fiber 4g 16%
Sugars 8g
Protein 9g
Vitamin A 100% • Vitamin C 8%
Calcium 8% • Iron 10%


Pocky

Motivation

- This trend has allowed the most of consumers to check and choose the food product considering their conditions.
  - Improvement of guidelines for nutrition facts label
  - Increased release of health food products that emphasize good nutritional composition


A makeover for food labels
The 20-year-old nutrition facts label shifts focus from fat to overall calorie consumption. Here is the new look and what you need to know.
Current label
Proposed label
More realistic serving size
Calories bolder
Added sugars displayed
So, why the change?
Calories more of a concern
Serving sizes are misleading
When will this happen?
Likely several years away
Anything else I should know?
Serving sizes to be based on actual consumption, not ideal consumption
Will cost companies around $2 billion to change labels
Source: Food and Drug Administration


think!
HIGH PROTEIN BAR
Brownie Crunch
20g PROTEIN
0g SUGAR
SPAM
50% LESS SODIUM
340g
Amul
LACTOSE FREE
MILK

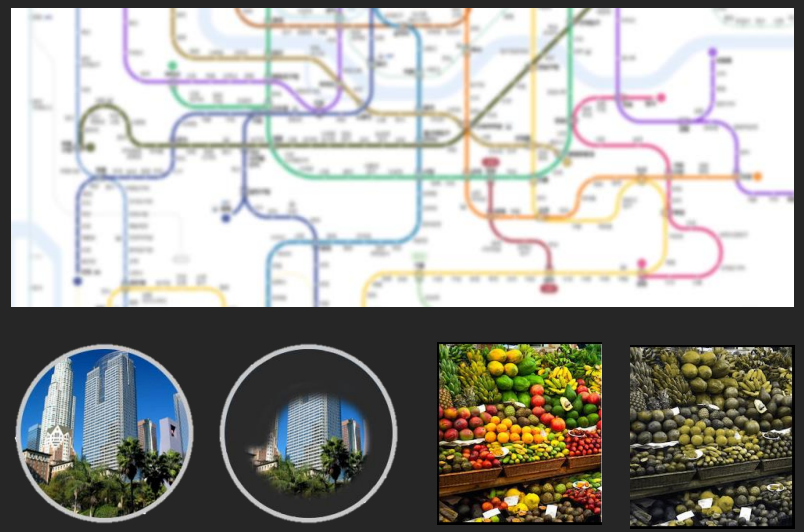

yoplait
original
99% FAT FREE
LOW FAT YOGURT
4 strawberry
4 strawberry banana
KEEP REFRIGERATED
Nutrition Facts
Serving Size 1 container (170g)
Servings Per Carton 8
Calories 170
Total Fat 1.5g
Saturated Fat 1g
Trans Fat 0g
Cholesterol 10mg
Total Carbohydrate 33g
Sugars 26g
Protein
Vitamin A 15% • Calcium 20%
Vitamin D 20% • Phosphorus 15%
Strawberry Ingredients: Cultured Pasteurized Grade A Low Fat Milk, Sugar, Strawberries, Modified Corn Starch, Nonfat Milk, Kosher Gelatin, Citric Acid, Tricalcium Phosphate, Colored with Carmine, Natural Flavor, Pectin, Vitamin A Acetate, Vitamin D3.
Strawberry Banana Ingredients: Cultured Pasteurized Grade A Low Fat Milk, Sugar, Strawberries, Modified Corn Starch, Nonfat Milk, Banana Puree, Kosher Gelatin, Citric Acid, Natural Flavor, Tricalcium Phosphate, Pectin, Colored with Carmine, Vitamin A Acetate, Vitamin D3.
GLUTEN FREE
KEEP REFRIGERATED
© 2012 Yoplait USA, Inc.

Target User

Target Users

- Is it possible for people with impaired vision(particularly, total blindness) to purchase products by checking nutritional facts?

Total Blindness



Low Vision

Type of visually impaired

Difficulties experienced by target users

- Blind people have been alienated from the wellbeing trend because both on/offline shopping have limitations to **identifying product information.**
  - Generally, braille is the only medium they can rely on in the store.
  - Screen reader programs can be used when using online malls, but this is also useless..


탄산
음료
음료
점자표시
탄산
점자표시

Difficulties in the supermarket


Button
Pottery Works Studio
Class Details 2019
Image1.png
Link

Difficulties in the online mall

Related Works & Technology

Related Works / Technologies

- Using video magnifiers or human assistant-based services has several limitations.
  - Both require expensive costs (machines or human resources)
  - Using the video magnifier requires constant vision and takes up a considerable volume.
  - Human assistant-based service is not an automation system.


Pravastatin Sodium
Tablets USP
20 mg
Rx only
PLAN
DRAW
APPROVE
Name
Date
Status

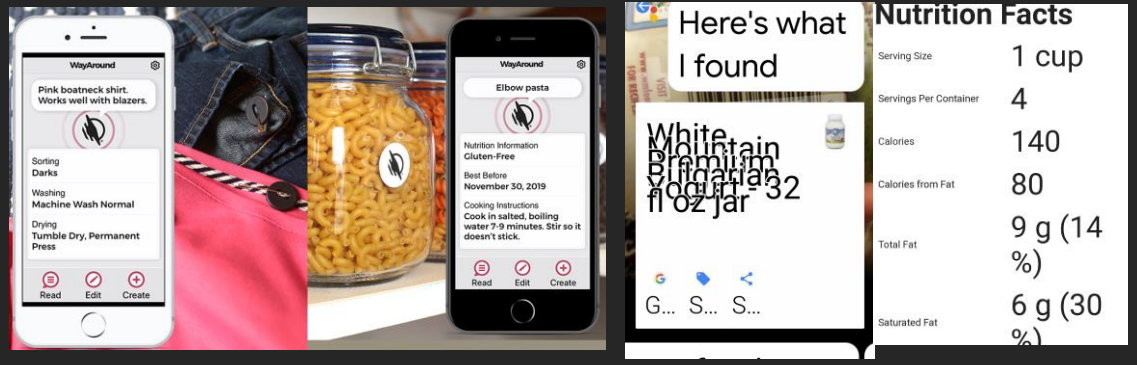
Video Magnifiers


387
129
626
Be My Eyes
What is your role?
I am sighted
I am blind
End session

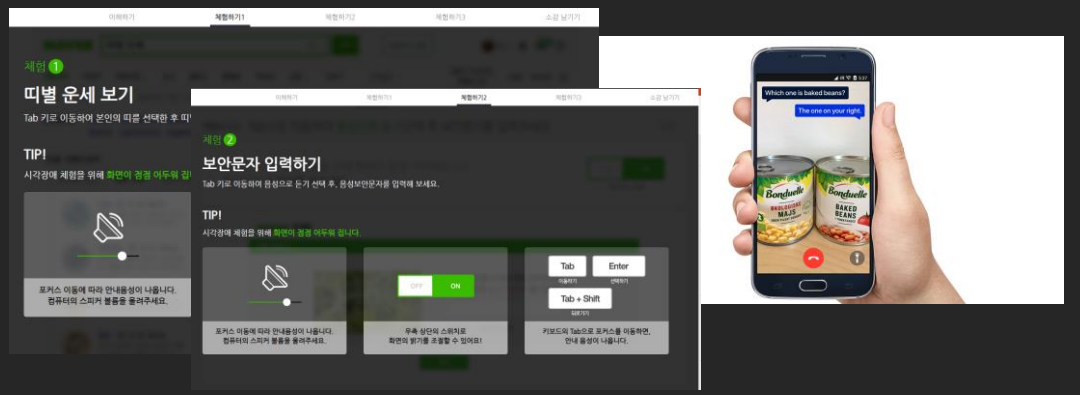
Human assistant-based services
(Be My Eyes, Aira Smart glass)

Related Works / Technologies

- DB based system or Text-to-Speech have several limitations.
  - DB based system(RFID tag, Barcode scan) requires **prior works for information registration** which is provided by normal-visual abilities. (Also, it targets on low vision people.)
  - Text-to-Speech(TTS) has poor information accessibility.
    - Passive Access
    - Sound-based feedback is difficult with continuous feedback.


WayAround
Pink boatneck shirt. Works well with blazers.
Sorting
Darks
Washing
Machine Wash Normal
Drying
Tumble Dry, Permanent Press
Read
Edit
Create
WayAround
Elbow pasta
Nutrition Information
Gluten-Free
Best Before
November 30, 2019
Cooking Instructions
Cook in salted, boiling water 7-9 minutes. Stir so it doesn't stick.
Read
Edit
Create
Here's what I found
Nutrition Facts
Serving Size
1 cup
Servings Per Container
4
Calories
140
Calories from Fat
80
Total Fat
9 g (14 %)
Saturated Fat
6 g (30 %)

DB based system
(Way around / Google Assistant Camera)


띠별 운세 보기
TIP!
보안문자 입력하기
TIP!
Tab
Enter
Tab + Shift
Which one is baked beans?
The one on your right.

Text-to-Speech
(Screen Reader Experience Site / Seeing AI)

Additional Backgrounds

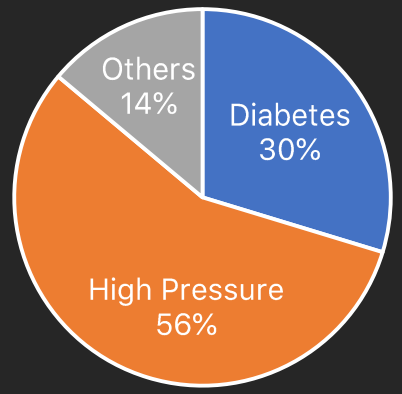
Additional Backgrounds

- Even though there are many visually impaired people who need to be ingested in consideration of nutrition, they are not guaranteed the right to choose and consume for health.


장애유형별 비만율 (단위: %)
2011년 기준
지체(전체) 42.3
뇌병변 35.8
시각 35.2
자폐 37.2
정신 48.7
심장 38.2
간질 37.7

Korea Ministry of Health and Welfare, 2011

Health issues of blind people


Others 14%
Diabetes 30%
High Pressure 56%

Korea Disabled people's development institute, 2017

Quantitative studies				
Date of publication (reference) country	Age	Sample size (gender)	Type of visual loss	Authors key findings
May/June 2014 (Muurinen et al., 2014) Finland	Mean age 83 years	245	Unable to read regular print with/without spectacles	Those with vision impairment were older females. They were malnourished according to MNA. They also had lower BMI than those without vision impairment. **(GOOD)**
June 2015 (Acil & Ayaz, 2015) Turkey	10.43 ± 2.88 years	74 (females 36, males 38)	Acquired and congenital sight loss (partial and complete)	The children who were visually impaired were mainly obese or overweight, and they showed poor nutritional habits skipping meals (58.1%; mainly lunch). **(GOOD)**

Jones, Nabila, and Hannah Bartlett.
"The impact of visual impairment on nutritional status: A systematic review."
British Journal of Visual Impairment 36.1 (2018): 17-30.

Solution Summary

Solution Summary

- NutriSeeON will act as the eye of total blindness users, helping them to consume healthy groceries.

We will implement the system by leveraging

Image Sensing by mobile camera , tactile/soundness feedback, and deep learning based data processing

Find out nutritional facts label as if they had a full vison

Consider their health concern


Nutrition Facts

Access to interesting information & use the information when purchasing product

Usage Scenario

Usage Scenario

Step 1

Set user health concerns.
(e.g., Diabetes, high blood pressure, weight loss, ...)


YOUR HEALTH INTEREST?
☑ Diabetes
☐ Blood Pressure

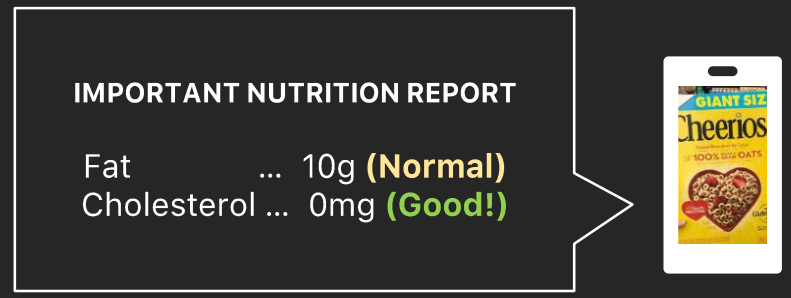
Step 2

Pick up food and take a picture of it.
It helps user to take photos of the food.


GIANT SIZE
Cheerios
100% WHOLE GRAIN OATS
Gluten Free

Step 3

It collects nutritional information from photos and informs the information that suits the user's interest.


IMPORTANT NUTRITION REPORT
Fat ... 10g (Normal)
Cholesterol ... 0mg (Good!)
GIANT SIZ
Cheerios

Challenge & Solution Ideas

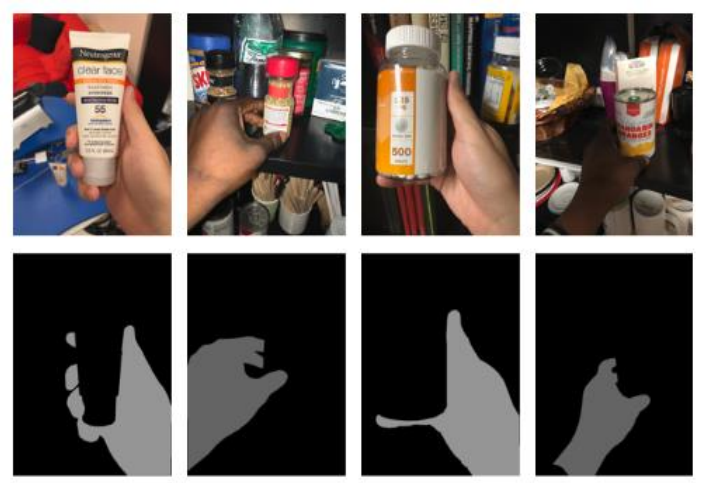
Expected Challenges

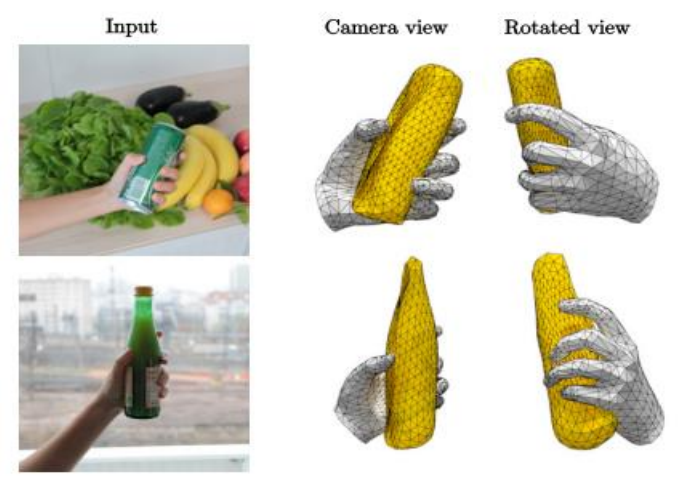
1. Recognizing target object in wild environment (e.g., grocery shop)
2. Providing intuitive feedback for target users to find nutrition facts label
3. Gathering nutritional information from photos taken in real-world
4. Effectively delivering nutritional information to visually impaired user


Dashboard
Track Your Day
Water
Weight
Shakeology
Meals
Featured Recipes

Solution ideas for challenges

1. Recognizing target object in wild environment (e.g., grocery shop)
   - Hand-holding object detection [1, 2]
     : Public hand-annotated dataset and hand-holded object recognition model



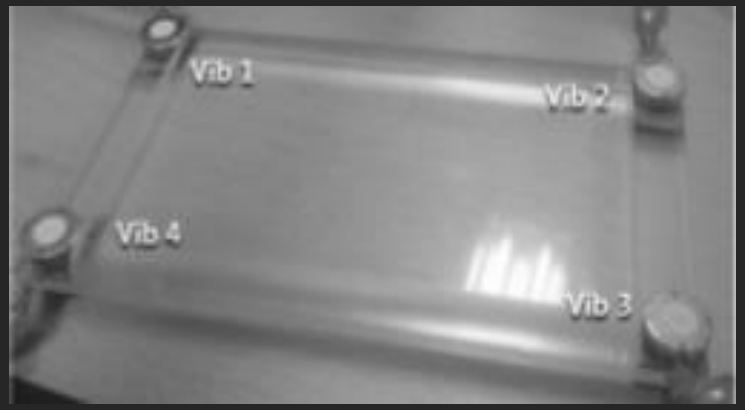

Input
Camera view
Rotated view

[1] Lee, Kyungjun, and Hernisa Kacorri. "Hands Holding Clues for Object Recognition in Teachable Machines." *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*. 2019.
[2] Hasson, Yana, et al. "Learning joint reconstruction of hands and manipulated objects." *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*. 2019.

Solution ideas for challenges

2. Providing intuitive feedback for target users to find nutrition facts label
   - We devised a new design for the intuitive feedback module.
     - [Idea 1] Divide into 2 types feedback : moving objects & mobile
     - [Idea 2] Deliver proper tactile & auditory feedback directly for each hand


Flip
Rotation
Directions of NEWS
Depth(close/far)
locate behind mobile
Acoustic support
Vibration band
Vibration board with directional expression


Vib 1
Vib 2
Vib 4
Vib 3

Tactile Flow [1]

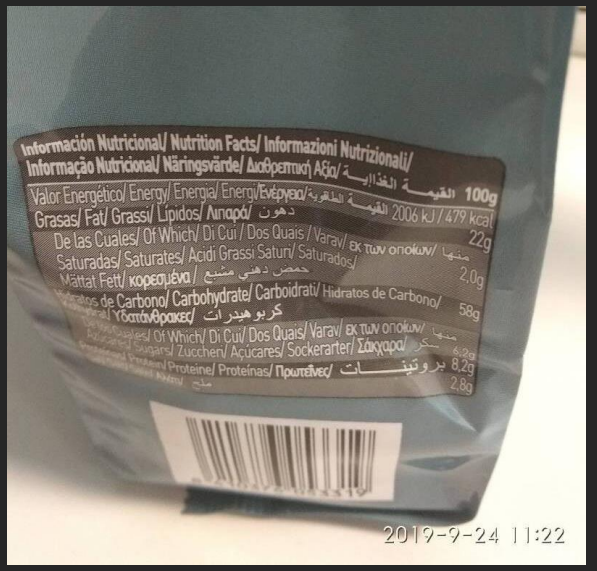
[1] Jongman Seo, and Seungmoon Choi. "Tactile Flow : 2-D Directional Information Transfer on Mobile Device." *Proceedings of the 2011 The Journal of KINGComputing.* October, 2011.

Solution ideas for challenges

3. Gathering nutritional information from photos taken in real-world
   - Optical Character Recognition (OCR)
   - Additional optimizations to effectively extract nutritional information
   - Heuristics to get nutritional facts label from curved or crumpled surface

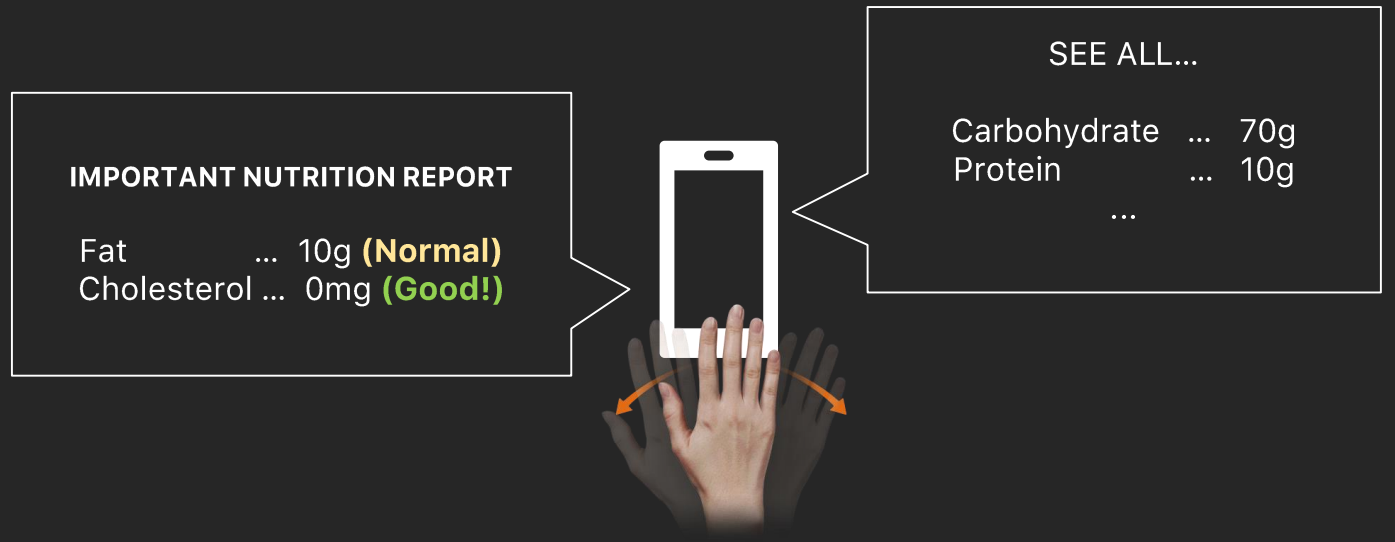

Amount Per Serving
Calories
Calories from Fat
Total Fat 2g*
Saturated Fat 0.5g
Trans Fat 0g
Polyunsaturated Fat 0.5g
Monounsaturated Fat 0.5g
Cholesterol 0mg
Sodium 140mg
Potassium 180mg
Total Carbohydrate 20g
Dietary Fiber 3g
Soluble Fiber 1g
Sugars 1g
Other Carbohydrate 16g
Protein 3g


NUTRITION FACTS
INFORMACIÓN NUTRICIONAL
Calories/Calorías 150
Total Fat/Grasa total 8 g
Cholesterol/Colesterol 0 mg
Sodium/Sodio 160 mg
Total Carbohydrate
Carbohidratos totales 17 g


Información Nutricional/ Nutrition Facts/ Informazioni Nutrizionali/
Valor Energético/ Energy/ Energia/ Energy/
Grasas/ Fat/ Grassi/ Lípidos/
Saturadas/ Saturates/
Hidratos de Carbono/
Proteínas/
2019-9-24 11:22

Solution ideas for challenges

4. Effectively delivering nutritional information to visually impaired users
   - [Idea 3] Provide personalized nutritional information based on user's health concern
     :Prioritize information that user will consider important
   - [Idea 4] Gesture-driven traverse module to provide the rest of information


IMPORTANT NUTRITION REPORT
Fat ... 10g (Normal)
Cholesterol ... 0mg (Good!)
SEE ALL...
Carbohydrate ... 70g
Protein ... 10g
...

System Overview & Main Functions

System Overview & Main Functions

System Overview

Setting up

Nutrition facts selection relevant to personal health issue

Main Service

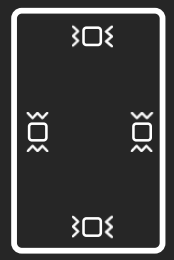
Receiving a nutrition fact label from user's device

Data Processing & Analysis

Providing summary & additional information

Main Functions

Tactile/Auditory based Nutrition Facts Recognition Guide Module



Vibration board with directional expression

Gesture based Selective Information Traverse Module

Evaluation

Evaluation

- **Accuracy of the intuitive feedback**
  - Evaluate whether our intuitive feedback is providing an accurate guide for users to take pictures

- **Task completion time without vision**
  - Measure time for taking a picture of nutritional information with closed eyes
  - Compare the task completion time with and without the intuitive feedback.

- **Accuracy of nutritional information collection**
  - Evaluate whether our nutritional information extraction module obtains accurate nutrition information from a photo.

- **Qualitative interview to explore user experience**
  - Subject assume visual impairment and attempt to obtain the nutritional content of food with this application. After that, we conduct an interview on the user experience.

Overall Plan

Overall Plan


Set Up
Core Function
Application
Test Evaluation

Project Set-up

- Development environment setting
- Specifying Application design

Core Function Implementation + Prototyping

- Tactile, Auditory feedback interaction method
- Gesture Recognition
- Object Recognition

Application Development

- Client Implementation (Mobile + Wearable)
- Server Implementation (Network, Data Processing)

Test and Evaluation

- Field Test
- Evaluation

Final Deliverable & Success Criteria

Final Deliverable & Success Criteria

Final Deliverable

Mobile Application

Intuitive Feedback Module

Server

Application
that effectively helps blind people to discover nutritional facts
and easily get customized information.

Success Criteria

- Based on Evaluation Time and Accuracy of Each Task

- Does this app help user to find the nutrition facts label and recognize them correctly?
- Does this app provide the proper nutrition information for customized user preference?
- Can the tactile/auditory module provide accurate feedback to the user?
- Can the gesture recognition module accurately recognize the action intended by the user?

Thank you


Nutrition Facts
About 14 servings per container
Serving size 2 Tbsp (32g)
Calories 200
Total Fat 16g 21%
Saturated Fat 3g 15%
Trans Fat 0g
Cholesterol 0mg 0%
Sodium 90mg 4%
Total Carbohydrate 10g 4%
Dietary Fiber 2g 7%
Total Sugars 6g
Includes 6g Added Sugars 12%
Protein 5g 3%
Vitamin D 0mcg 0%
Calcium 50mg 4%
Iron 0.7mg 4%
Potassium 90mg 2%