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11/18/19

Final Project report

# Final Project Report

## Introduction

“According to data from ("Facts And Figures On Adults With Vision Loss | American Foundation For The Blind"), 26.9 million American Adults age 18 and older reported experiencing vision loss.”

In this report we are highlighting the problems faced by people with visual impairments and how do the tackle them every day. We are proposing a solution for a particular task that is difficult for them to perform. We have designed this application keeping in mind the issues in existing applications regarding accessibility and have employed various Human factors principles to come up with a solution.

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## Objective

Apply human factors and Ergonomics principles to design a mobile/wireless application for users with low vision.

## Challenges and barriers to everyday tasks

### Navigating Around the Places (Kumar)

Sighted people rely on the power of their vision to successfully navigate through out their life. Vision is the most important sensory input that we need to successfully navigate. Naturally this poses a huge barrier for people with visual impairment. They cannot rely on the same techniques that sighted people do to navigate in the real world. There are some applications that help them navigate successfully. Due to the advent of technology there have been serious improvements in making visually impaired people independently navigate. But these processes depend heavily on the progress of technology. So, the most effective way of navigating as of now is to have the intervention of a sighted individual or a Service animal which is trained for this explicit purpose. Some people have developed a technique called “Echo location” which helps them navigate without the help of any applications or sighted individuals.

*(Take from user interview)*

One of the users we interviewed has a service animal to help them him navigate and also uses applications like “Aira” and “Be My Eyes” to help them navigate. These applications use human agents and volunteers to help visually impaired people navigate. The second user we interviewed uses a specialized device called as “Bioptics” to help her navigate like people with full vision. With “Bioptics” she can legally drive a vehicle.

### Arranging Clothes (Andress)

The clothes that we wear can be identified using a variety of different techniques. Sighted people rely on the color and type of clothing to recognize what the clothing is. However, this is a major barrier for visually impaired people. Thus, they rely on the clothing’s texture to get a rough idea of what it is. They also use free mobile applications that can help them identify color of the clothing. Every person has developed their own technique of identifying and keeping a track of the clothes they have. They also rely on the help of sighted individuals to help them identify the type of clothing.

*(Taken from user interview)*

One of the techniques mentioned by the user is labelling the clothes. Items like dress slacks can be described with metal Braille labels that he can actually sew into the linings and cuffs. It is easy to read the color and style and the tags survive the washings and dry cleanings until and garment has reached its usefulness. Other items are labeled using a Braille Dymo labeler. The de facto way that blind people have been labeling things forever.

User with partial visual impairment can identify the color and type of clothing under certain lighting conditions and thus maintains proper lighting at home.

### Societal stigma

Having a perfect vision is considered normal. Naturally it is going to be a bit different for people with visual impairment. Everything that we ever design it was meant to be used by people with normal sensory capabilities. Thus, it is a social pressure for visually impaired people to function in the normal working of the society. They are often treated differently and given special attention which can make them feel like they are not capable enough to do day to day activities. This is an annoyance and acts as a barrier for them to function well.

*(Taken from user interview)*

User with complete vision impairment mentioned that people should just realize his condition for what it is and should not be treating him so differently. He also said that people should be mindful of his service animal and that should not close doors on her because she is the one who guides him.

### Withdrawing money from atm

*(This challenge has been described in detail by one of the Users with limited vision and is mentioned verbatim.)*

“ATM machines are different even within banks. It takes an inordinate amount of time to determine what to do and how to proceed. If using headphones, takes time to find the headphone jack. Then takes time to listen and follow prompts. Some machines give you an overview, which means you have to remember what to do. Others give you step-by-step instructions, but you then have to have your items in hand and ready to use. For instance, you have to have your card in your hand and ready, or your money in hand and ready to insert for deposit. It is extremely difficult to use your hands to orient to the machine and use the machine at the same time. Many people listen the first time for orientation, and then follow a second time to execute transaction. However, all of this is time consuming. Many people use the same machine, which requires planning, and no impromptu trips to the ATM. Others will make a trip with trusted assistance (friend, family, associate).

Having to focus on listening can be a security issue depending on the location of the machine because your attention is split. It makes you vulnerable because you are not cognizant of your surroundings as you would normally be in such situations

Difficult because you are not always able to use one machine especially for those of us who travel frequently.”

From this we infer that a lot of the issues with the ATM machine can be solved by simple Human factors principles. The ATM's now-a-days are attempting at making their assistance systems very intuitive and easy to use, but there still remains a huge gap as far as the universality of it is concerned.

### Determining the level of liquid in a cup

Sighted people usually depend on the visual level of the liquid to see if the cup is full or not. This can be an issue for people with low vision and especially people with no vision. It becomes a hazardous situation when the liquid to be poured is scalding hot. For such situations the visually impaired people rely on the help of sighted people or use devices designed to tell them the level of liquid. These devices give a haptic feedback when a container is full.

## Grocery Shopping

Grocery shopping is a task that requires vision the most. People have to see what they need to buy. Visually impaired people usually ask for assistance from the instore staff for buying the things they want. Instore staff isn't necessarily trained in helping them. Moreover, it becomes a social stigma for a few people who are socially inept. However, there are advances in technology that can give visually impaired people the independence they need. Aira is an application that connects visually impaired people with trained agents that can guide them in various situations. People with limited vision make use of "Bioptics" glasses to help them identify the products.

*(Taken from user interview)*

User with complete visual impairment mentioned that her buys almost all of his products online and thus does not need to visit the grocery store to buy them. Nowadays all supermarkets have a website which can be used to order their groceries directly to their doorstep.

## Research

As part of a year-long study conducted in 2013 by researchers from University of Rochester and Microsoft Research, they considered a total of 40,748 questions asked by 5,329 visually impaired users on an application called "VizWiz Social". This application is made only for iPhone users, that is because iPhone works on a ubiquitous accessibility feature called as "Voice Over". This feature is directly embedded in the mobile ecosystem and thus offers greater functionality. Users are asked to click a picture and attach an audio description of what they want to find out about. This application uses a crowd sourcing methodology to answer questions that the users ask.

It was found that visually impaired people asked almost 73% of times to identify an object in the image. 14% of the questions were meant to Describe an object's features, like the brand, flavor, color or appearance. 4% of these questions were asked to read information about the object or reading displays and cooking instructions. 9% of the questions were either unanswerable because of the data not being there in the photo or image is too blurry or audio is not clear.

Out of all the products asked to identify, Food/Drink products accounted to about 28%.

From this brief research study, we concluded that we need to make an application that can help the users identify what are the objects in front of them.

## Target Task

Keeping in mind the challenges and barriers visually impaired people face we have decided to design an application that assists blind and vision limited users in identifying everyday items. This may include things like money, price tag information or description of other objects identified in the environment. It may also include things such as integration of QR code identification or local information provided by wireless beacons or similar technologies.

## Concept

We are going to make an application that scans and records the food products you have and the expiry dates of each and also is able to track the general location of where the product is kept. This app will tell you when your products are nearing expiration and should be consumed. It will also help you keep track of the products you have. This can be extended to include clothing apparel. We came up with this based on the competitive analysis of products that already exist. These applications can scan products but do not have any way of keeping a track of the things that you own. None of the products right now is able to scan and recognize expiry dates because they are not standardized in position and visual format.

## Existing Solution

Currently there exists an app called “No Waste” which keeps a track of all the products you have in your freezer, fridge and pantry.

Table 1

App	Features
No Waste	<ul style="list-style-type: none"><li>• Inventory lists for your freezer, fridge and pantry</li><li>• Sorting food by expiration date, name or category</li><li>• Search food you have</li><li>• Creating a family to share list of items</li><li>• Be mindful of food wasting by updating list and getting statistics</li></ul>

This application is not designed explicitly for people with visual impairment and so has many flaws as far as Human factors and ergonomics principles are concerned. We are attempting to redesign the application to include accessibility features for visually impaired people.

Table 2

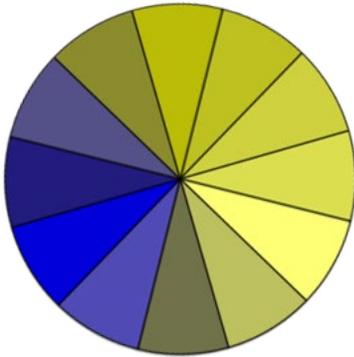
Human Factors Principles	Violations
Working Memory	<ul style="list-style-type: none"><li>• The application does not have a simplified layout to prevent giving the user a task of working with lesser than 9 chunks of information</li><li>• The user has to remember all the places of the buttons present which can be challenging especially if the user cannot use visual input</li></ul>

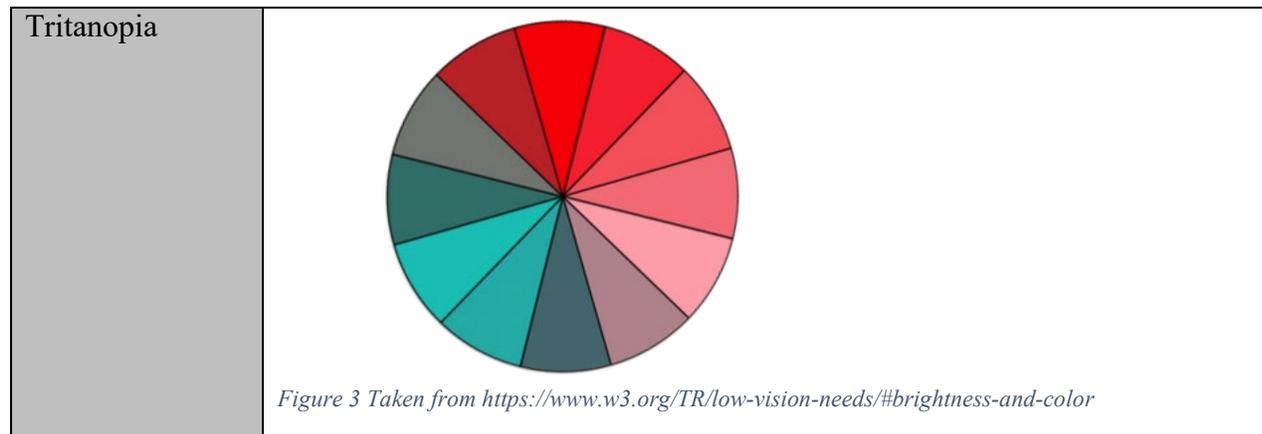
Audio Feedback	<ul style="list-style-type: none"> <li>• The application has no audio feedback that is native to the application</li> <li>• Voice Over cannot read all the things on the screen because the application is not designed keeping accessibility in mind</li> <li>• The barcode scanner has no audio response essential for framing the barcode.</li> </ul>
Color	<ul style="list-style-type: none"> <li>• The application uses a color scheme which cannot be use by people who have color based visual impairments. <i>(More on this mentioned below)</i></li> </ul>

	Cones	Affected men	Estimated perceived color spectrum
Protanopia	L-cones absent	1%	
Protanomaly	L-cones abnormal	1%	
Deuteranopia	M-cones absent	1%	
Deuteranomaly	M-cones abnormal	5%	
Full color vision		92%	

Figure 1 Taken from [https://colororacle.org/resources/2007\\_JennyKelso\\_ColorDesign\\_hires.pdf](https://colororacle.org/resources/2007_JennyKelso_ColorDesign_hires.pdf)

Table 3

Type of Color blindness	Suggested color scheme
Protanopia	 <p>Figure 2 Taken from <a href="https://www.w3.org/TR/low-vision-needs/#brightness-and-color">https://www.w3.org/TR/low-vision-needs/#brightness-and-color</a></p>



Based on the above studies the existing “No waste” Application cannot be used by visually impaired individuals. This is because the applications use a color scheme of “Blue” and “White” which cannot be perceived by people with certain color blindness and also does not follow human factors norms to improve accessibility.

We have briefly mentioned what drove us to choose this particular concept backed with research done prior to this.

### Statistics to support our concept choice

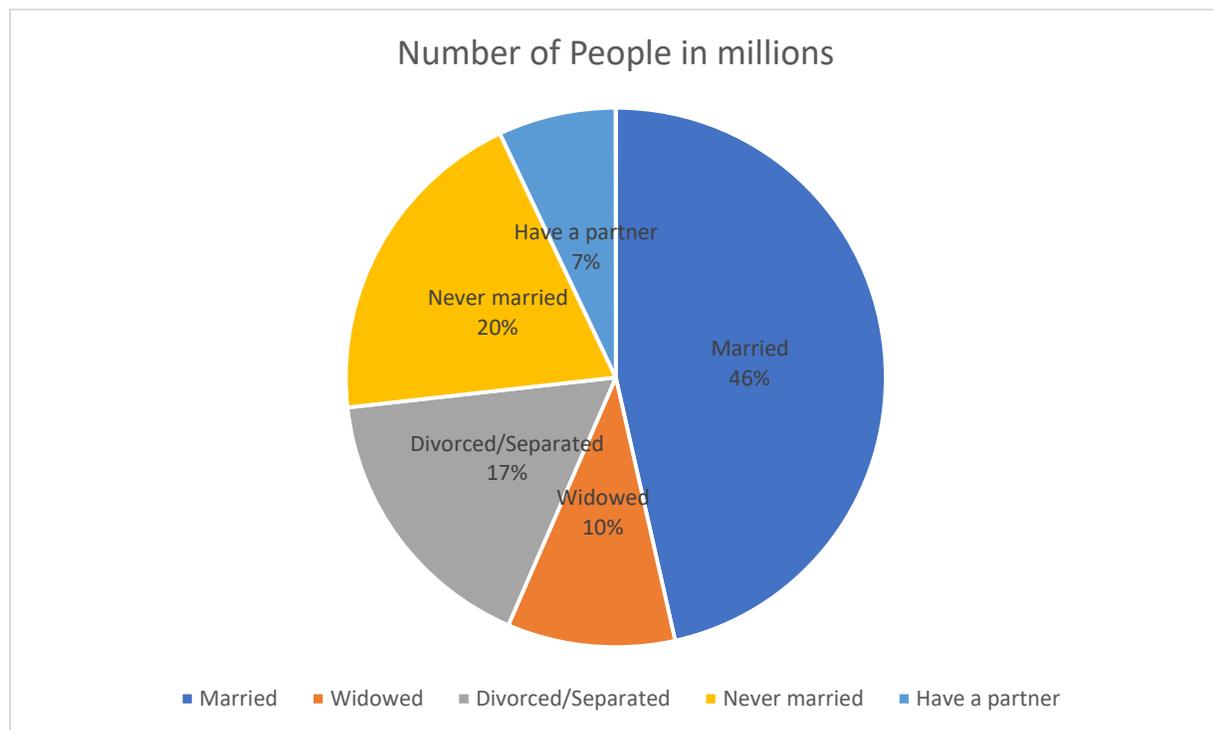


Chart 1 Showing the statistics of visually impaired people with possible sighted people assistance. Based on the data provided in <https://www.afb.org/research-and-initiatives/statistics/adults>

This suggests that even though there is a huge percentage of people with possible help from sighted people, there is an even larger portion of people who have to rely on technology to do everyday tasks easily.

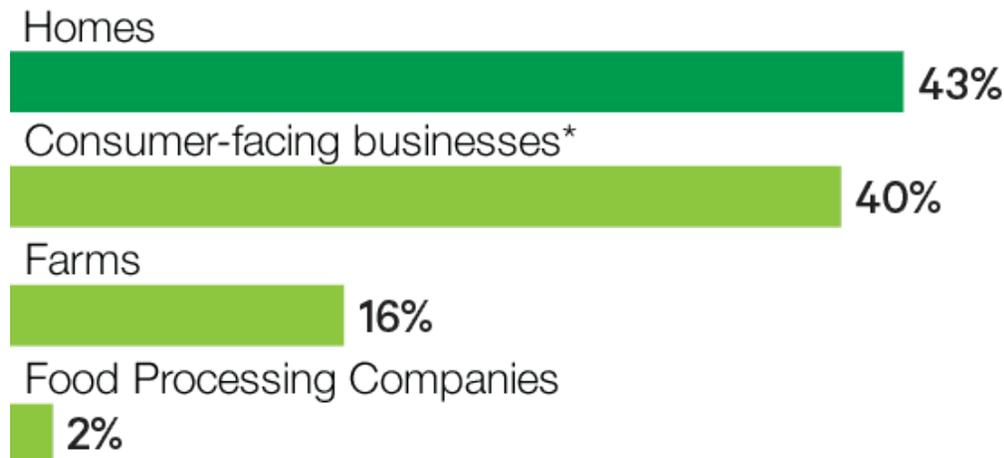
Identifying objects is one of the most difficult tasks to perform especially if the objects have similar packages and textures. In a quote by one of the users with complete vision loss about how they identify their grocery: “In my own personal case, it is pretty easy to determine which ones are what I am getting. I mostly order non-perishable goods that are easily identifiable. I also have the luxury of having a person that is here that is able to see what I ordered.” The same user also mentioned about how he identifies things with no help. In his response he said that he relies on apps like Seeing AI, Digit Eyes, Be My Eyes and Aira.

In his response he mentions:

Table 4

App	Review
Seeing AI	Works fine for easy daily tasks.
Digit Eyes	Gives a lot of information from a barcode and has the option of printing out braille tags and also has metal braille tags to be put in clothes
Be My Eyes	He says it is difficult to get a sighted volunteer and once you get them, they are not trained to communicate with visually impaired users and can't understand the nuances of their disability.
Aira	It is a paid application and users are given glasses fitted with cameras. The users are connected with Aira agents who assist them in their tasks. These are trained agents who can help them well.

## Food wastage in United States



\*Supermarkets, restaurants, institutional and food services, and government.

Figure 4 Taken from <https://www.consumerreports.org/food/how-dated-food-labels-contribute-to-food-waste/>

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This statistic is specifically for food wastage due to the product going beyond the expiry date. Looking at this shocking statistic of food wastage and keeping in mind the applications out there to tackle this we decided to make our application. So, our application will work to improve the “No Waste” application to incorporate accessibility using the model of “Aira” and improvements on “Be My Eyes”. We have done a detailed comparative analysis of the applications that are designed specifically for the visually impaired users.

## Comparative Analysis based on our research

Table 5

Apps	Features
TapTapSee	<ol style="list-style-type: none"> <li>1. Picture recognition</li> <li>2. Ability to repeat the last identification</li> <li>3. Upload pictures from the camera roll</li> <li>4. Save pictures to the camera roll with attached definition</li> <li>5. Share results via text, email, or social media</li> <li>6. Rotor reader</li> <li>7. Barcode and QR code reader</li> <li>8. Auto-focus notification</li> <li>9. Flash toggle</li> </ol>
Vizwiz	<ol style="list-style-type: none"> <li>1. Take pictures</li> <li>2. Record a question</li> <li>3. Set up resources</li> <li>4. Send a question</li> <li>5. Answer notification</li> </ol>
Be My Eyes	<ol style="list-style-type: none"> <li>1. Call sighted volunteers</li> <li>2. Multiple Language support</li> <li>3. Specialized Help</li> <li>4. Share Story</li> </ol>
LookTel Money Reader	<ol style="list-style-type: none"> <li>1. Recognize currency</li> <li>2. Speak the denomination</li> <li>3. Different currency available</li> </ol>
Aipoly Vision	<ol style="list-style-type: none"> <li>1. Recognize plants and animals</li> <li>2. Recognize food</li> <li>3. Recognize text</li> <li>4. Recognize currency</li> <li>5. Recognize colors</li> <li>6. Recognize scene and a general setting to see whatever it can find in the view of the camera</li> <li>7. Voice over</li> <li>8. Works without internet connection</li> <li>9. Multiple language support</li> </ol>

VIP code reader	<ol style="list-style-type: none"> <li>1. Detect QR code/Barcode</li> <li>2. Listen to the content</li> <li>3. Change the setting (Voice over, vibration, app sound)</li> <li>4. Multiple language support</li> <li>5. History feature to save what has been scanned before</li> </ol>
Seeing AI	<ol style="list-style-type: none"> <li>1. Read short text, documents</li> <li>2. Identify products using barcode, and give audio feedback to locate the barcode</li> <li>3. Recognize a person</li> <li>4. Describe the scene</li> <li>5. Identify currency</li> <li>6. Give the information of lighting, perceived color</li> <li>7. Identify handwriting</li> </ol>

Table 6

App Name	Pros	Cons
Taptapsee	<p>Take multiple images to decrease the chance of user missing the object</p> <p>Auto-focus notification</p> <p>Ability to repeat and save</p> <p>Give audio description of the object(color)</p> <p>Single tap on screen to take photo makes the process very easy</p>	<p>It can only identify one object at a time</p>
Vizwiz	<p>Feedback they heard is more specific to their question</p> <p>Sighted people receive images and questions; thus, output is reliable</p>	<p>If the user misses the object while capturing the image, there will be a lot of back and forth between the user and helper</p> <p>Users' Privacy is at stake</p>
Be My eyes	<p>the volunteer can see the item or subject the user needs assistance with using the blind or low vision user's rear-facing camera and provide the visual description he or she needs. It is more accurate, and reliable</p> <p>Some of blind people feel uncomfortable always asking friends/family to help</p>	<p>Not all calls are answered</p> <p>Users may need privacy</p> <p>They still need someone else's help</p>

LookTel: The Money Identifier Mobile App	Independence Focus on one thing	Does not offer an all-inclusive solution
Aipoly Vision	Can identify: Scene, Color, Text, Food, animal, flowers, etc. Gives audio feedback when it identifies anything Currency identification works with the best accuracy Does not need internet for most identifications and so is fast	The user has to select an option to identify an object The phone does not give any feedback as to whether the camera is positioned correctly or not Identification depends a lot on the color of the surroundings and gives incorrect results a lot of times Too often audio feedback for same object with fluctuating identification
VIP Code Reader	Gives constant audio feedback for camera location does not do a lot of things and focusses on just one	user has to hold the device at least 30 cm from the code It can only identify a QR or a barcode requires an internet connection
Seeing AI (3 million users)	It can identify a wide variety of things including people You can record a person and it will be able to identify that person faster next time Barcode scanning gives constant audio feedback for positioning of camera	user has to choose a specific category The text identification reads everything the camera sees and not just what makes sense, thus it can be very confusing at times

## Task and Function Analysis

### TapTapSee

#### Function Analysis:

- Take pictures/videos
- Upload pictures/videos
- Picture recognition
- Rotor reader
- Save pictures/videos

**Task Analysis:**

Step 1. Open the App

- A. Tap the “TapTapsee” app icon twice

Step 2. Take pictures

1. Frame a picture
  - 1.1. Point the camera to the object
  - 1.2. Tap the screen hear “camera” “Double tap to take a picture of what is in front of you”
2. Take a picture
  - 2.1. Double tap the screen
  - 2.2. Hear the “click” sound and “Picture one in progress”

Step 3. Hear the description

1. Hear the description of what is in the picture
2. Repeat the result
  - 2.1. Tab the bottom of the screen once

Be my Eyes

**Function Analysis:**

- Call sighted volunteers
- Get help from them via video call

**Task Analysis:**

Step 1. Open the App

1. Tap the “Be My Eyes” icon twice.

Step 2. Call a volunteer

1. Tap the screen hear” Connect to first available help button”
2. Double Tap the screen and hear “creating request” and ringtone “waiting for other part”

Step 3. Asking for help

1. Point the camera to the object
2. Ask question and hear answers from the volunteer

Step 4. Disconnect the call

1. Tap the center of the screen hear “disconnect button”
2. Tap the screen twice hear “It is an Alert. Are you sure you want to disconnect?”
3. Tap the screen hear “No button” Tap again hear “yes button” Tap it twice

## Vizwiz

### Function Analysis:

- Take pictures
- Record Questions
- Read out Answers
- Repeat Answers
- Set up Sources
- Notification when got answer

### Task Analysis:

#### Step 1. Open the App

1. Tap the “Vizwiz” app icon twice

#### Step 2. Take a picture

1. Frame the picture
  - 1.1. Point the camera to the object
  - 1.2. Hear “Take a photo”, Use the camera button to take a new photo
  - 1.3. Tap the screen hear “camera button Take a new photo”
  - 1.4. Tap the screen twice here the “click” sound and “camera”

#### Step 3. Record a Question (Time limit, device vibrates when you reach the limit)

1. Tap the screen hear “Record a question. Use the Record button to record a question”
2. Tap the screen twice here the “Record”
3. Speak out the question
4. Tap the Screen twice to end record hear” Recording finished”

#### Step 4. Submit a question

1. Set Sources & Send (Choose from Web workers, IQ Engines, Email, Facebook, Twitter)
2. Double tap Send button

#### Step 5. Hear the answer

## Seeing AI

### Functional Analysis:

- Illuminate areas to identify for better color identification
- Speak out audio feedback
- Scene detection
- Handwriting detection
- Text detection
- Text to speech
- Document frame detection
- Currency detection
- Color and lighting level detection
- Taking and saving Photos

- Object framing
- Saving person data

### **Task Analysis:**

#### Step 1. Open the App

1. Tap the “Seeing AI” app icon twice

#### Step 2. Choose the function

1. Tap the function you want to perform
2. The app will give an audio feedback
3. Based on the audio feedback double tap the function you want

#### Step 3. Identify Text

1. Point like the camera to the typed text you want to hear
2. The app will start speaking out the text
3. Do not move camera

#### Step 4. Read Document

1. Point camera to the document you want to be read, and listen to the audio prompt for framing.
2. Tap on the screen to click a picture and wait for a few seconds.
3. Hit the play button to read the text.
4. Hit the share button to share the text.

#### Step 5. Identify Product

1. Point camera to the barcode based on the sonar like audio feedback for framing
2. Wait for a ding for the processing to start
3. Listen to the audio feedback

#### Step 6. Save a person face

1. Ask the person to hold the camera or use the rear facing camera and point to the person
2. Take three images of the person based on the audio prompts
3. Assign a name to the image

#### Step 7. Identify Person

1. Point the camera to a person you want to identify
2. If you have saved the persons image before it says his/her name or else it says a person present at a certain distance from you and at a certain location on the screen.
3. Tap the screen to take an image
4. Wait for processing and hear the description that the app speaks out.

#### Step 8. Identify currency

1. Choose the currency you want to identify
2. Point the camera to the note you have
3. wait for the app to speak out the currency

#### Step 9. Scene detection

1. Point the camera to the scene you want to know about
2. tap the screen to take a pic
3. wait for few seconds and listen to the description

#### Step 10. Color detection

1. Point the camera to the place/object whose colour you need
2. The app constantly keeps speaking the color

#### Step 11. Handwriting detection

1. point camera to text to identify
2. tap screen to take image
3. wait for processing

#### Step 12. identify intensity of light

1. Point camera at the place whose lighting intensity you want to find out
2. listen to the audio feedback in the form of series of beeps.
3. frequency of beeps gives information about intensity of light

## Wireless technology and applications used by the user

In the discussion with the users it was found out that they rely on a plethora of wireless technologies and applications to make them work as efficiently as any sighted person would. Let us look at each technology carefully.

### 1. Bioptic Telescopes

These are a set of glasses that give the user exceptional enhancement in far vision. It is mostly used by people with severe visual impairment but not complete blindness. Users do not need a mobile application to use them, they just put on the glasses and they can see everything a sighted person can. People have demonstrated playing complex games that rely on strong vision to succeed with these glasses. Some states allow people equipped with such glasses to drive a car. These gadgets defy our earlier understanding of visually impaired people finding it difficult to do daily tasks. With these glasses they can navigate any unknown territories and streets without having to memorize them. Usually a cane is used in conjunction with a navigation application to successfully navigate. Disadvantage of these glasses are that they have to be carried everywhere and are too expensive to be used every time.

### 2. Bone Conduction headphones

Bone conduction headphones as the name suggest works on the principle of directly vibrating the stirrup, anvil and hammer of the inner ear. As demonstrated by the user this enables him to listen to his phone all the while being able to listen to everything around him. This enables him to avoid the social stigma of having iPhone voiceover speak out aloud in a crowd.

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3. Digit Eyes

This is an application that reads digital barcodes. They also provide patches that can be put on things to help identify them. They provide accurate information about barcodes. The objects that do not have a barcode are difficult to identify.

4. Braille Dynamo Labeler

These are braille label makers that help visually impaired people make labels with braille on them. Braille is a universal language taught to every visually impaired person. This device is a standard for every visually impaired person to have especially for someone with no vision capabilities.

## Proposed Solution

Welcome to Alfred!

Our very own butler who keeps a track of all the food you have, where it is and when it's going to expire!

Here at Alfred you will be able to identify, locate and consolidate your grocery based on expiration dates. Once you use Alfred you get to use two of our main services, namely: -

1. Our A.I. called Alfred
2. Sighted human Alfred agents who are trained to interact and help people

Alfred can be used by sighted as well as visually impaired people. One of the user inputs was that applications that have universality to them are better because of the socio-economic aspects related to it. Thus, we designed an application that can be used by everyone. You can choose whether you are sighted or not during login and the application will change appearance based on your choice. The application is made accessible to visually impaired people and optimized for sighted people.

### Features of Application

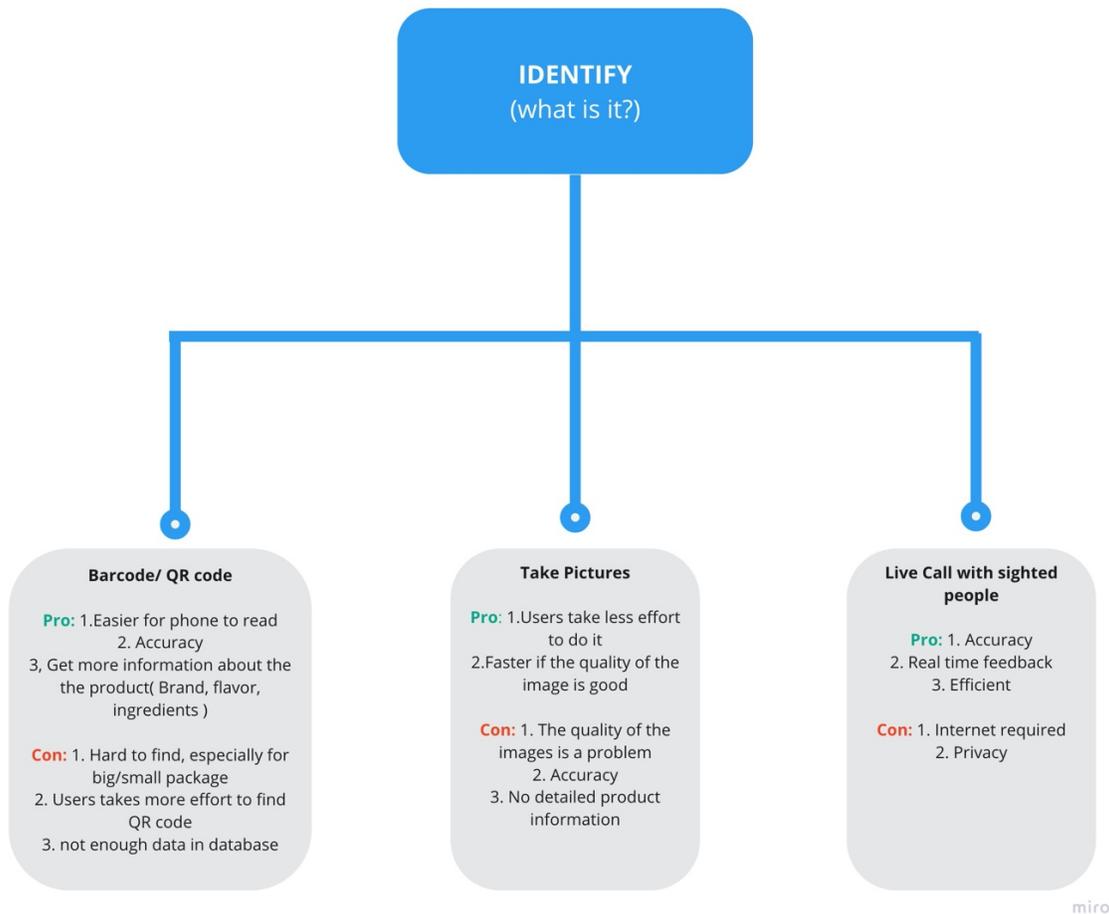
1. Login and account creation based on your visual impairments (Partially or totally blind, sighted)
2. Create a family where you can share your list with fellow members
3. Identify your grocery
4. Track the place your grocery is kept in
5. Keep a record of the expiry date of your grocery

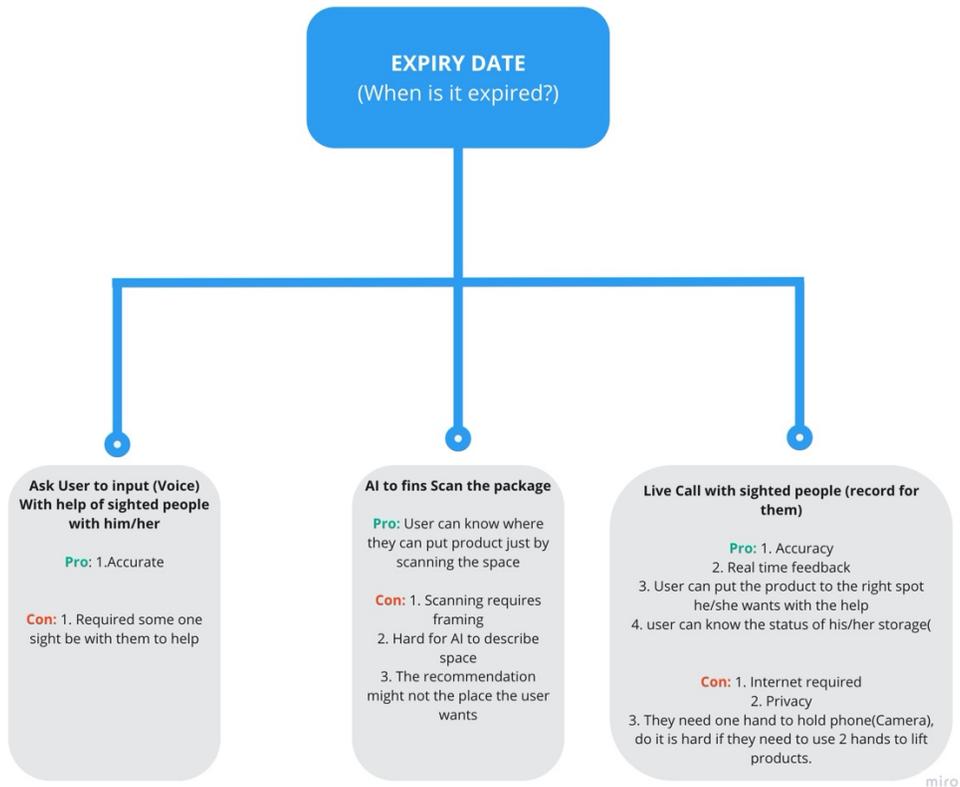
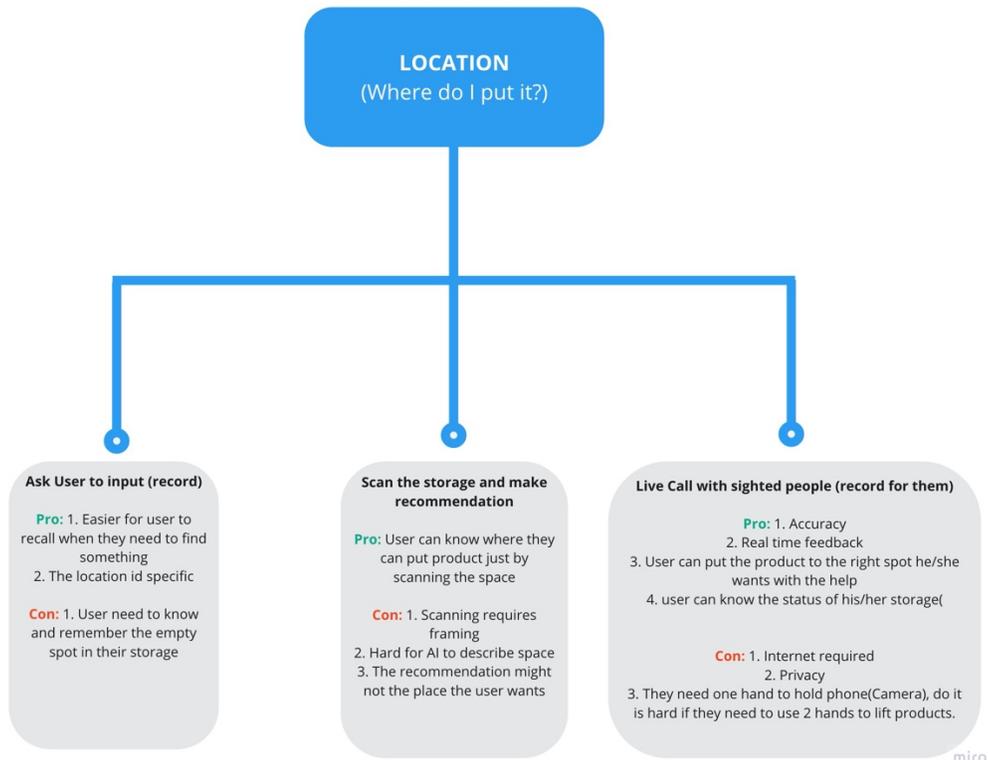
## Ideation

Alfred was a culmination of research done in what visually impaired people struggle with on a day-to-day basis and what is the social impact of food wastage as well as how visually impaired people interact with mobile applications.

We decided that Alfred would have three main functions; Identifying grocery items, track location of grocery item, keep a track of the expiry date.

Off these three functions we have identified the best possible task to perform using the following analysis





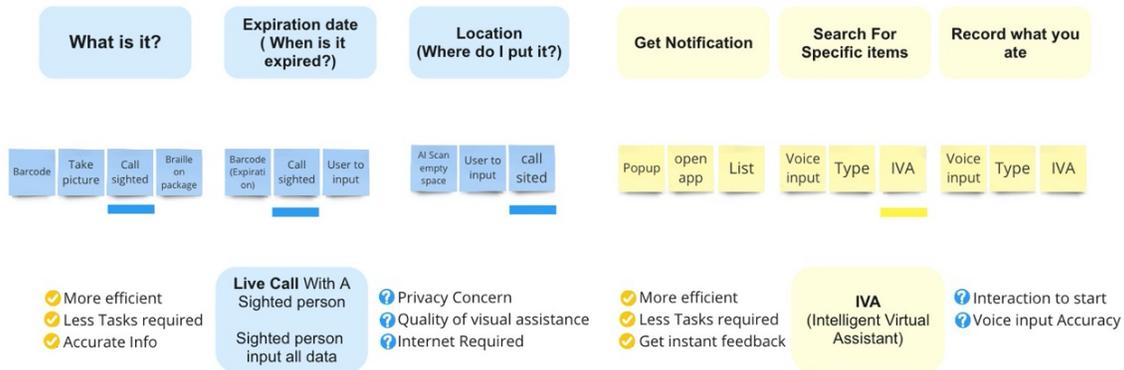
## Open the App



Identify Object  
(What, When, Where)



Keep Track of Location and  
Expiration Date



Viz WIZ

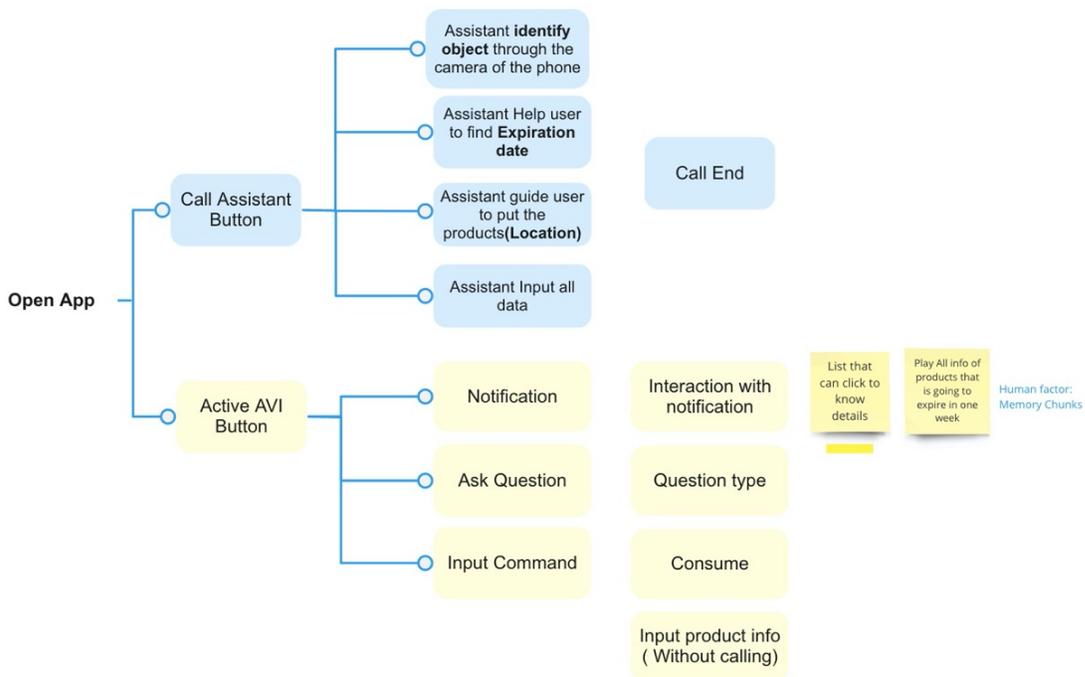


Privacy Concern ————○ Privacy Concern  
 Quality of visual assistance ————○ Trained assistant  
 Internet Required

Interaction to start



HOLD TO SPEAK      PRESS A BUTTON      VOICE AWAKEN  
 Voice input Accuracy ————○ Be able to use keyboard



We have decided to use an agent to assist the visually impaired user because the study made on the VizWiz application by researchers from University of Rochester and Microsoft Research found that using inputs from sighted people is the most effective for identification tasks that do not have contextual significance.

## Designing

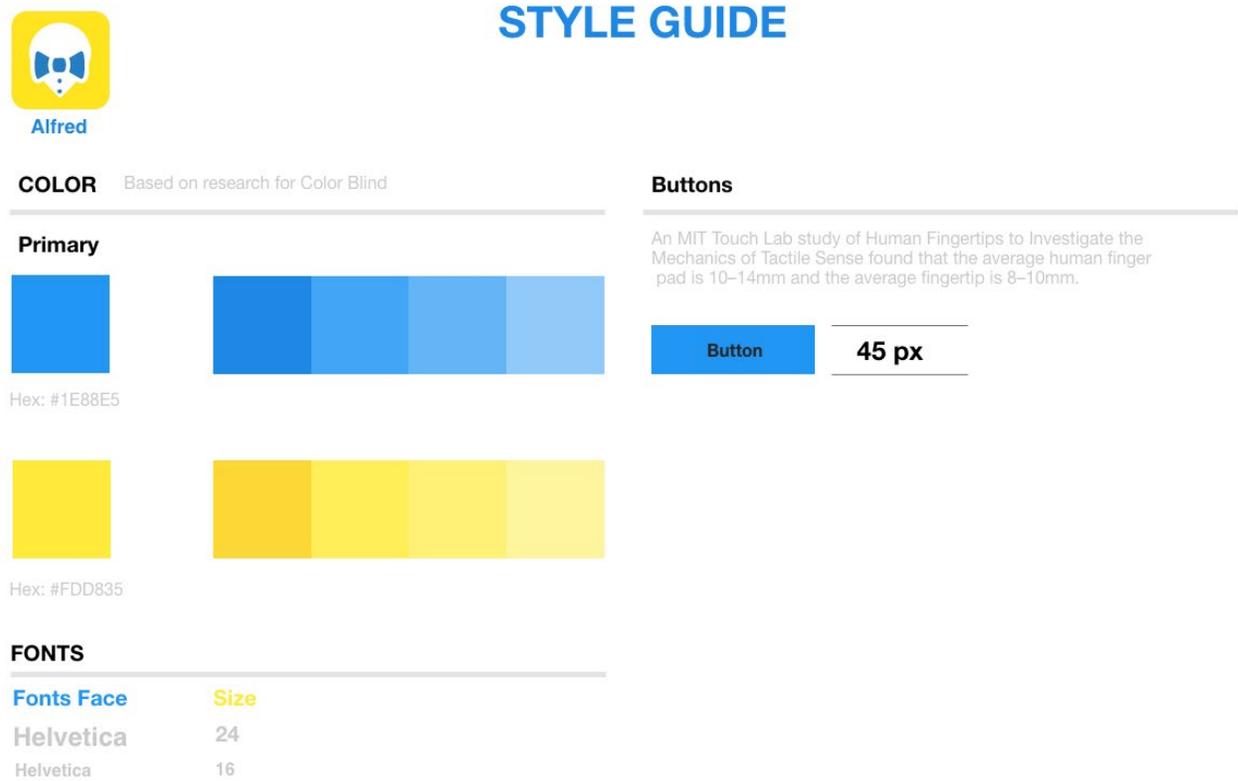
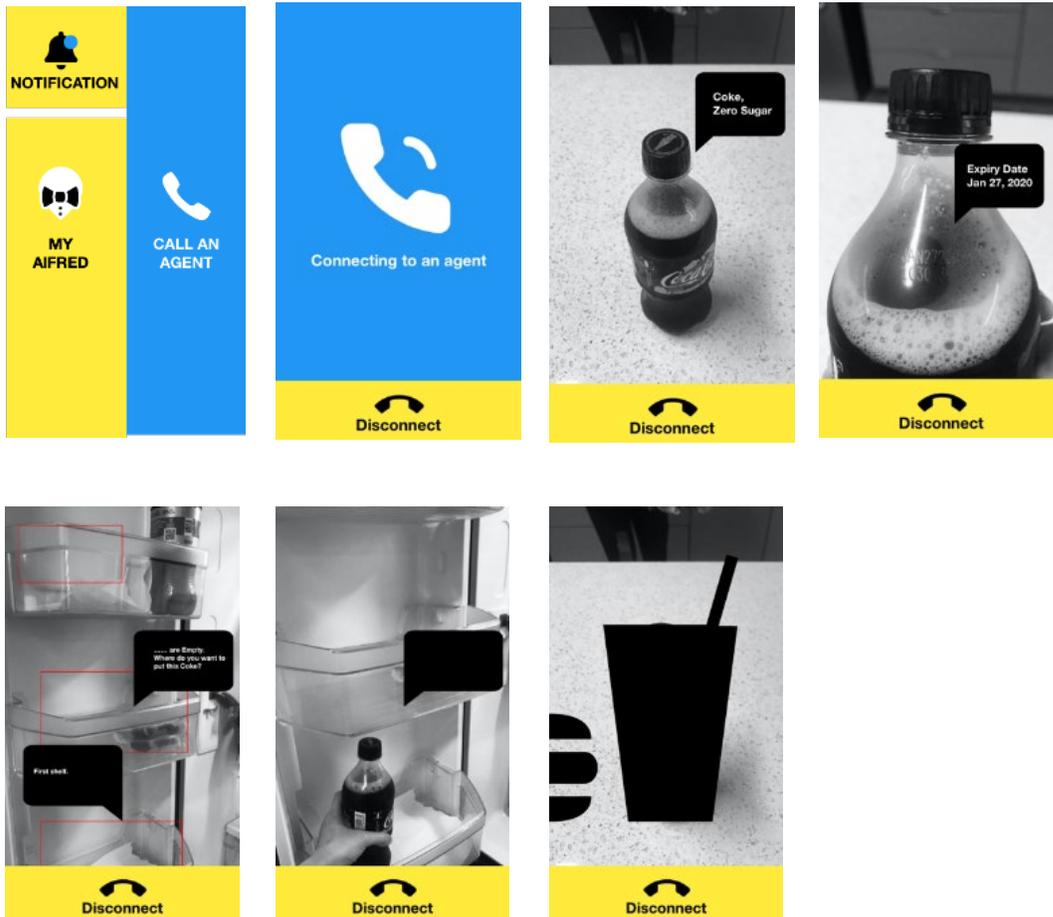


Figure 5

From the above-mentioned Style guide, we have solved the accessibility issue for users with color blindness. Based on the study by MIT Touch Lab, we have decided the button size that our application should have for better use and less error. Moreover, the color scheme is so designed that even a person with color vision impairment can use it. Font size is chosen to help users with partial vision impairment be able to read the text from a standard viewing distance from the mobile screen.

As per Apple Human Interface Guidelines we have kept the tappable area at least 44pt X 44pt.

## Task Analysis



### Step 1: Open the App

1. Double tap the “Alfred” icon to open it

### Step 2: Call an agent

1. Double tap on the right side of the screen to initiate a call with our agent (Most frequently used “Call agent and My Alfred” buttons are placed closest to the thumbs of a person using the phone.)

### Step 3: Talking to our agent

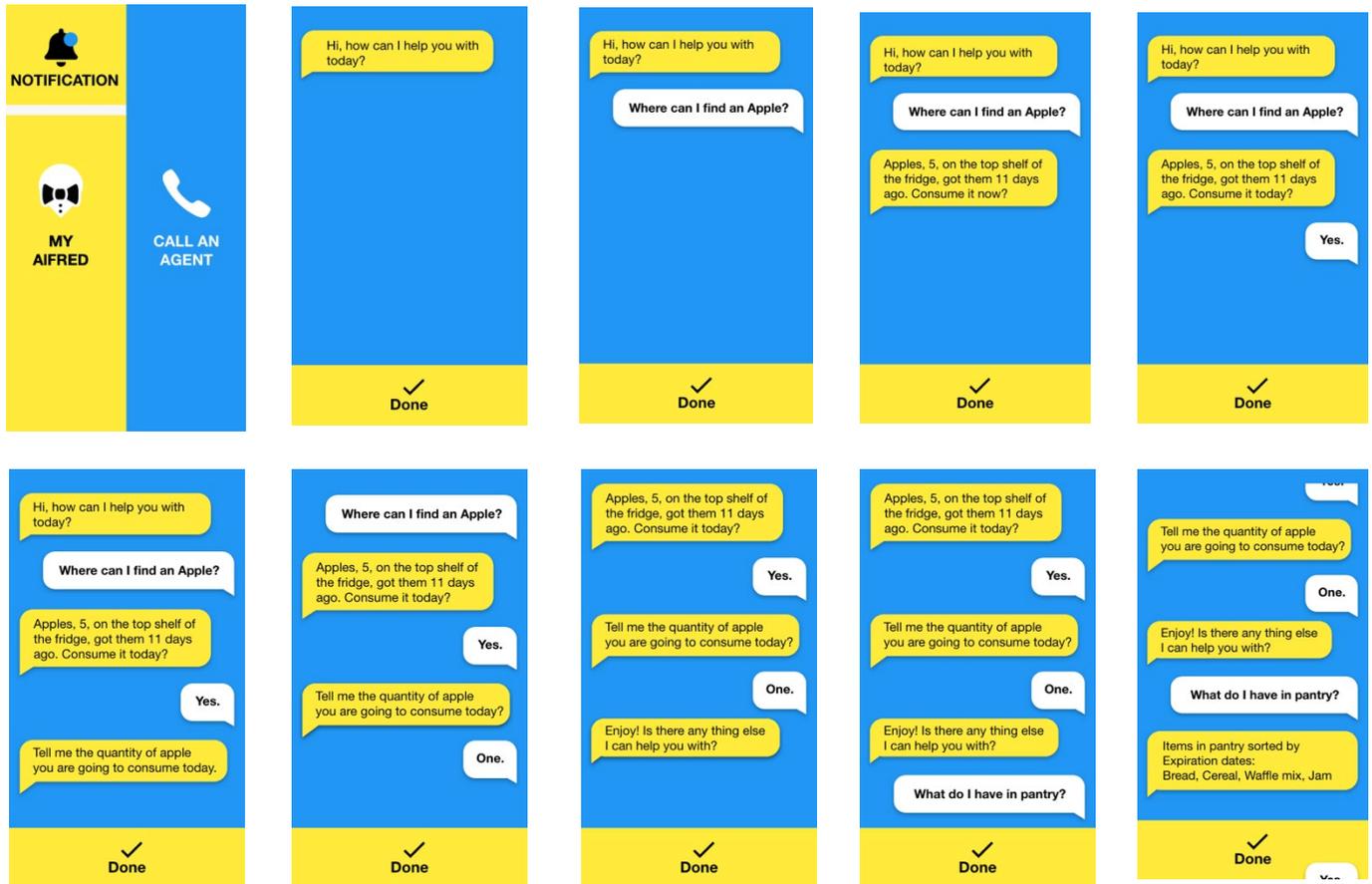
1. Hold the camera of the phone facing to the object you want to identify
2. Wait for our sighted agent to respond
3. Listen to the answer given by the agent
4. If the answer is satisfactory ask him to add item to list

### Step 4: Adding the expiry date

1. Agent will ask for watching the package to get the expiry date
2. Agent will add the expiry date

### Step 5: Populating the location of product

1. Point the camera to your fridge, freezer or pantry
2. Wait for the agent to tell you where an empty spot is
3. The agent will guide you while putting the product in place and record the location of your item in the application



### Step 6: My Alfred

1. Click on the My Alfred button to activate our AI
2. Alfred will speak to you in a low-pitched male human voice (Low pitched sounds are not easily masked by surrounding noise, human voice helps in remembering instructions easier than artificial robotic voices)
3. You can ask Alfred to find an item for you, he will respond with the location of the item that you had previously asked an Alfred agent to record for you
4. He will ask if you wish to consume the said item
5. If you wish to eat it, then he will ask you the quantity and update the list of items for you
6. You can also ask him to speak out the list of items you have in your pantry and he will speak them based on the closest expiration date first.

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## Why this?

We chose the approach of combining an A.I. and a sighted agent is because we wanted to leverage the benefits of both approaches for assistance.

A.I. is extremely powerful and fast in sorting and manipulating lists.

A sighted agent is very helpful and efficient in identifying objects and expiration dates.

Expiration dates by design are difficult to be read by any form of image processing owing to randomness in their location and poor contrast or visibility.

Thus, we found it to be most efficient to use a combination of both modern technology and the best image processing unit out there called human eyes!

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