Heuristic Evaluation of AfrIdge

1. Problem
AfrIdge is an intelligent refrigerator with an accompanying smartphone app that allows users to better manage their food.

2. Violations Found

1. **H2-2: Match Between System & Real World / Severity 2 / Found by: A, B, C, D**
   The Inventory screen shows each food item surrounded by a colored ring. It is not clear what these colors mean, and at first just seem to be decorative. It makes sense that the colors represent how fresh the food items are, but these colors don't represent how fresh food is in the real world. Instead, the app could have the number of days before the food item expires underneath the item's icon. Color could be added to the number to help emphasize the number of days. A help page or a tutorial video for the app can be added somewhere in the app explaining their color coding.

2. **H2-6: Recognition Rather than Recall / Severity 1 / Found by: A, B, C, D**
   When a food item icon is clicked, the user is shown a details of the food item. These details include when the item was bought and when it will expire. These dates are in shown in a "mm/dd/yyyy" format, which requires the user to recall and compare against that day's date to find the number of days until the food item expires. This can be annoying, since people take a lot of time to process and remember dates. Instead, as suggested above, the app can use relative dates and specify the number of days left from the current date before the item expires. This will make information more straightforward. It will also be better to use "1 Feb 2016" instead of 2/1/16 as many countries use dd/mm/yy format and it might be confusing.

3. **H2-7: Flexibility & Efficiency of Use / Severity 0 / Found by: A**
   In the food item details modal window, the user has the option of adding the item to the grocery list. It was not discussed whether this will be the only way to add more of a particular item to the grocery list, but, considering that the AI Fridge will have computer vision capabilities to keep track of the items, it would make sense that these items be automatically added to the grocery list when they run out or are near running out.

4. **H2-9: Help Users Recognize, Diagnose, & Recover from Errors / Severity 2 / Found by: A**
   When a modal window opens (after tapping on a food item icon in the inventory screen, or tapping on a recipe from the recipes screen), there is no "X" to close the modal. It was mentioned in the presentation that this was removed because testers clicked on the background, however, users who are not familiar with modal windows will not know that clicking on the background will close the window. Having the "X" there gives these users a recognizable symbol that does the action they expect it to when tapped.

5. **H2-3: User Control & Freedom / Severity 2 / Found by: A, B, C**
   The window that appears when a user taps on a food item on the inventory page has the option of viewing recipes that contain this food item. If a user taps on this option, they are taken to the

recipes screen and shown said recipes. However, if this tap was accidental, there is no easy way to return to the viewing the detail for the food item. Unless the inventory screen maintains some state of where the user was, the user will potentially have to search through the food items again to find the item he/she was looking at. This could be prevented by removing the "View Recipe" option completely from the food item details. If the user is interested in a recipe she/he can go to the recipes screen and find something. Another suggestion would be to add a "back" button to the app that makes the navigation simpler.

6. **H2-1: Visibility of System Status / Severity 2 / Found by: A, B, C, D**
   On the grocery list screen, the "+" button to add a new list item seems hidden in the top right corner. This could make it difficult for first-time users to know what they should on this screen to add an item. The button could be moved to the bottom right corner and float over the list items. This would make it easier to see as well as easier to tap, considering that on larger smart phones, the top right corner can be difficult to reach.

7. **H2-2: Match Between System & Real World / Severity 2 / Found by: A, C**
   On the same grocery list screen, swiping left on a list item reveals the options to edit and delete the item. This action is not intuitive and there aren't any perceptual cues for this affordance. Something like "<" at the right end of each item might be able to act as such a perceptual cue and let the user know that there is some left-gesture action. Edit can also be as simple as tap on an entry in the list (just like how we add things to our to-do list or checklist in apps in general)

8. **H2-10: Help & Documentation / Severity 2 / Found by: A, B**
   There doesn't seem to be a screen aside from those reachable from the navigation bar for settings and for help on using the app. This settings/help screen could be reach from an added button to the navigation bar at the bottom of the each screen, or by adding a settings button at the top left corner of each screen. The latter method avoids adding clutter to the bottom of the screen.

9. **H2-2: Match Between System & Real World / Severity 1 / Found by: A**
   From just looking at the recipe items on the recipes screen, it is unclear if the items are in any order. It would help that these items are in some order and that this order was mentioned just above the list. For example, the items could be sorted based on difficulty, and just underneath the "Favorites" and "Recipe" tabs, it could say "N recipes sorted by increasing difficulty".

10. **H2-8: Aesthetic & Minimalist Design / Severity 1 / Found by: A**
    Each recipe item on the recipes screen has three dots. It is not clear whether this dots are decorative or meant to suggest that the items are tappable to show more details. In both cases, the items can do without the dots, as the may confuse the user. If the dots are intended to show that the items are tappable, the items could be changed to resemble buttons a little more. Simply adding a slight shadow behind each shadow might do the trick.

11. **H2-4: Consistency & Standards / Severity 1 / Found by: A, C, D**
    The recipe items on the "Recipe" tab of the recipes screen have colored numbers on them. These colors are confusing, especially since they are the same colors used in the inventory

screen to represent how fresh the food items are. If the order of the recipes is made more explicit as suggested above, these numbers will not be needed (as they do not provide much information).

12. **H2-8: Aesthetic & Minimalist Design / Severity 2 / Found by: A, B, D**
When a user taps on a recipe item from the recipes screen, a modal window with information about the recipe difficulty, rating, cook time, ingredients, and more is shown. This window has too much information for the modal window. Also, the user has to tap on "View Recipe" to actually see the recipe. There are several ways to deal with these issues. One can be to completely remove the the modal window and instead direct the user to a screen including these details and the actual recipe. Otherwise, the main reason I see for having this pop-up modal window is to let users see the difficulty, rating, and cook time, and missing ingredients before deciding to actually continue to the recipe itself.

13. **H2-9: Help Users Recognize, Diagnose, & Recover from Errors / Severity 2 / Found by: A**
The ingredients highlighted red on the recipe details modal window are not explicitly noted to be missing items. Explicitly mentioning that items in red are missing will prevent users from going forward with the recipe.

14. **H2-7: Flexibility & Efficiency of Use / Severity 2 / Found by: A**
Currently, to find a recipe, users have to tap on each item until they find something that they might want to make, or they can get to the recipes that contain a particular item from the inventory screen. This can be time consuming. The recipes screen could have a search bar above the list items where users can search for keywords, such as ingredients, dish names, etc. and filter the recipe items.

15. **H2-6: Recognition Rather than Recall / Severity 1 / Found by: A, B, C, D**
The progress screen currently only shows the waste progress of the current month and the previous month. It is not shown whether users are able to view their waste from past months, but this would be important for users who want to track how they do over periods of time and see what months they tend to waste the most food during.

16. **H2-4: Consistency and standards / Severity 2 / Found by: B, C**
In grocery list, they have "checked" and "unchecked" as sub-tabs. The current sub-tab is highlighted in black and the other one in grey. Its confusing what is the current tab and what is not as it is not following the standard convention.
This doesn't follow the standard convention of iphone of android phone and might be difficult for users to remember. Follow the color convention for this from the platform you are using (iphone or android)

17. **H2-2: Match between system and the real world / Severity 3 / Found by: B, C**
In the grocery list, we have the "checked" and "unchecked" sub-tabs. What do they mean? Does checked represent the items I have reviewed and am going to buy in my next grocery trip, or is it the list of items that I keep checking once I buy to denote that they are bought.
Can I uncheck something from the checked list?

"Checked" and "Unchecked" are not words used for grocery shopping in the real world and hence makes its meaning ambiguous.
One suggestion for the sub-tabs can be "wish list" and "to buy" or "to buy" and "bought".

18. **H2-7: Flexibility and efficiency of use / Severity 2 / Found by: C**
The "checked" sub-tab doesn't have an "add" icon. The system doesn't allow me to add an entry directly to the "checked" list. Why should I always add to "unchecked list" and then check it into the "checked" list?
The design restricts some operations that affect the efficiency and flexibility of use.
Add an "+" icon to the checked list too.

19. **H2-1: Visibility of Status / Severity 0 / Found by: B, C**
From the recipe details page, if I add items to the grocery list I should get a message saying it has been added. Without this feedback, user might not know if that feature is actually working.

20. **H2-3: User Control & Freedom / Severity 3 / Found by: B, C**
There is no way to manually enter inventory into the app which were not automatically scanned by the application. User should have the control and freedom to add inventory.

21. **H2-5: Error Prevention / Severity 3 / Found by: B, C, D**
In the inventory details page (for chicken), it shows the bought date and the expiry date. There is no way to change the expiry date if it was added wrongly. With wrong dates, the app would estimate stale foods wrongly and would send unreasonable notifications.
The inventory details page should also have the option of editing.

22. **H2-1: Visibility of Status / Severity 0 / Found by: B, C**
A daily digest notification can be sent to the user giving details about the inventory used on that day, so that if there was error in the camera scanning, it can be caught by the user and rectified in a timely fashion so that the app always reflects the state of the fridge.

23. **H2-4: Consistency & Standards / Severity 1 / Found by: C**
The top bar in all the pages and the pop ups have a blue colored theme while the bottom navigation bar and the sub-tabs have a black colored theme. It will be better to follow one consistent coloring scheme.

24. **H2-2: Match Sys & World / Severity 3 / Found by: B**
The inventory list currently shows icons of food, which might be confusing to the user since it takes longer to tell which type of food that actually is from the black icons. The system representation of inventory doesn't match the real world. Changing icon representations to photo thumbnails of the real inventory photo would resolve this issue.

25. **H2-7: Flexibility & Efficiency of Use / Severity: 4 / Found by: B**
The inventory list currently uses large icons to represent the food and only when the icon is pressed does the app show simple details of the food. This is not efficient as user wants to know the details of inventory efficiently just by browsing. Mark the details of each inventory on

top of or next to the icon would make it more efficient to use.

26. **H2-4: Consistency & Standard / Severity: 2 / Found by: B**
The app allows the user to add a recipe to favorite list through the "heart" icon on each recipe card, but the "Favorites" tab doesn't use the same heart icon, creating an inconsistency in the system language. Consider adding heart icon to the "Favorites" tab or change the "heart" button rto a text button that says "add to favorite".

27. **H2-2: Match Sys & World / Severity: 4 / Found by: B, D**
The recipe card shown has no image of the cooked food and the ingredients, adding to the difficulty for user to understand and doesn't match with the real world representation. Adding images of what the cooked food would look like would improve the usability for the user.

28. **H2-7: Flexibility & Efficiency of Use / Severity: 2 / Found by: B**
What if the user adds a recipe to favorite by mistake? There should be a way (such as to toggle the "add to favorite" button to say "remove from favorite") to cancel that action easily and intuitively.

29. **H2-7: Flexibility & Efficiency of Use / Severity: 2 / Found by: B**
The app doesn't allow the user to add a new recipe or customize the existing recipe on their list, which is not convenient for the user since sometimes the user would want to customize the recipe for their use and other times would want to include their own recipe into the list so they can better manage food supply associated with that dish. Adding an option to "add new recipe" and then letting the user choose between "choose from existing" or "customize recipe" would work well.

30. **H2-2: Match Sys & World / Severity: 1 / Found by: B**
Currently the inventory list is in random or not very obvious order. This doesn't not represent the real world very well as intuitively people want to grab the ingredients as fast as possible by knowing where to look for it in the fridge. Since the app is scanning the fridge intelligently to know where each item is, the representation of the inventory could map that of the fridge, having the fresher and the freezer as two sections on the screen, with each section containing different food groceries.

31. **H2-5: Error Prevention / Severity: 4 / Found by: D**
On the inventory screen, it seems like all the items are placed into very broad categories such as chicken. What happens if there is both raw chicken and cooked leftover chicken in the fridge? It is unclear if your app would create two different items in the inventory or combine them into one. If they are combined into one, the information such as expiration dates may be inconsistent. However, if two items are created, this can lead to a very cluttered inventory. I would suggest having sub inventories for the general categories that you currently have. Therefore, if the user clicks chicken, it can go to a chicken inventory that has items for each food item that contains chicken in the fridge (i.e. leftover grilled chicken, raw chicken, chicken soup, etc.).

32. H2-4: Consistency and Standards / Severity: 2 / Found by: D

In the grocery list, all the items have a picture inside of a ring, and all the rings are the same color. In the previous screen, different food items had different colors. This inconsistency can confuse the user and leave him/her wondering why all the colors are now the same. I would suggest either getting rid of the rings so that they don't confuse the user, or making them green because that would signify that the food is fresh since it is currently being bought.

33. H2-6: Recognition rather than recall / Severity: 1 / Found by: D

I noticed that in the grocery list, there isn't an estimate of how much each item will cost. One big factor regarding whether to delete items from a list is their cost. Therefore, I would suggest including a rough estimate of price for each item, and an estimated total of the grocery list. This way, the user won't have to recall how much an item costs when he/she is deciding if the item is worth it.

34. H2-5: Error prevention / Severity: 3 / Found by: D

In your grocery list, you can click on "chicken" which will lead to details about the item. From here, you can click on a button that leads you to the recipes section. Once there, you get a list of recommended recipes for that item ("chicken" in our example). However, from this page, you can click on the "Favorites" button and this will lead you to recipes that don't contain chicken. This is an error because the user was trying to find a recipe with chicken, but he stumbled upon recipes that didn't have chicken. I would suggest that when a user is looking for recipes for a certain item, make the app filter out any recipes in the "Favorites" tab that don't have that item as an ingredient.

35. H2-5: Error Prevention / Severity: 2 / Found by: D

In the grocery list, when an item is deleted, it is unclear if there will be a way to undo that deletion. I would suggest adding a confirmation before an item is deleted, or an undo button to add a mistakenly deleted item back to the list.

36. H2-8: Aesthetic and minimalist design / Severity: 1 / Found by: D

In the progress screen, all the categories are part of a single gradient color scheme that goes from green on the bottom to red on top. However, it almost makes it seem like butter is always a good thing because it is green, and chicken is a trouble spot because it will always be red/orange. I would suggest displaying the information for each category separately instead of on top of each other, so that you can easily see what items increased/decreased.

3. Summary of Violations

Category	# Viol. (sev 0)	# Viol. (sev 1)	# Viol. (sev 2)	# Viol. (sev 3)	# Viol. (sev 4)	# Viol. (total)
[H2-1: Visibility of Status]	2		1			**3**
[H2-2: Match Sys & World]		2	2	2	1	**7**

[H2-3: User Control]			1	1		**2**
[H2-4: Consistency]		2	3			**5**
[H2-5: Error Prevention]			1	2	1	**4**
[H2-6: Recognition not Recall]		3				**3**
[H2-7: Efficiency of Use]	1		4		1	**6**
[H2-8: Minimalist Design]		2	1			**3**
[H2-9: Help Users with Errors]			2			**2**
[H2-10: Documentation]			1			**1**
Total Violations by Severity	**3**	**9**	**16**	**5**	**3**	**36**
Note: check your answer for the green box by making sure the sum of the last column is equal to the sum of the last row (not including the green box)						

4. Evaluation Statistics

Severity / Evaluator	Evaluator A	Evaluator B	Evaluator C	Evaluator D
sev. 0	33%	100%	66%	0%
sev. 1	56%	44%	56%	56%
sev. 2	56%	44%	31%	31%
sev. 3	0%	60%	60%	40%
sev. 4	0%	66%	0%	33%
total (sev. 3 & 4)	0%	45%	27%	27%
total (all severity levels)	42%	52%	42%	36%

5. Summary Recommendations
Overall, the AfrIdge app is very clean and fairly simple to use. We think that the main issues were that some of the aspects of the UI were oversimplified and others could be simplified more.

For the inventory feature, more helpful information would be helpful. I like that the interface is designed to be minimalist, but in real world situations, I don't this it would be as easy as the prototype suggests. For example, there are only 14 food items in the inventory for the prototype. However, an actual fridge may contain much more food than that, and there may be some items that would fall under the same category such as a PB&J or a BLT falling under the "sandwich" category. At this point it is unclear what your app would do in this situation, but I think it would be worth considering having an intended functionally in that situation. On the other hand, sometimes too much information is provided. Some examples include the pop-ups that appear when clicking on an item in the inventory, or a recommended recipe. I thought that some of that information could get reduced.

The UI colors don't seem to give a lot of meaning. The top bar on each page saying "inventory", "recipe", etc are huge and can be made shorter to make good use of the space. The inventory details

(when i click on "chicken") and the recipe details ("chicken masala") show up as pop ups on the screen.These are the primary features of the app and it would be better to have separate screens for them as it will give them more space and importance. Some of the buttons have too much text. For example "add missing items to grocery list", "add to grocery list". It will be better to have shorter labels for buttons.

There are several things that may introduce confusion to users and make some of the tasks time consuming to complete. Many of the things that may seem non-intuitive such as the colors used in the inventory screen, the affordance of swiping left on each recipe item to edit or delete the item, or the list orderings of these recipe items, and other things mentioned above can be explained in a settings/help screen. In terms of speeding things up for users, keep in mind that users usually want to do the least amount of work possible (this includes mental work) to accomplish a certain task and that repetitive actions get boring quick. This is why some of suggestions to the violations above include using relative dates instead of absolute dates, and allowing users to search for particular list items instead of looking at all of them.

In terms of usability, the inventory list doesn't show any information about how much food of each kind is left in the fridge, and there's no apparent function to let the user update (or update automatically) how much food is consumed after a while. This is a more advanced problem and needs some thinking around the functionality design. Overall I really enjoyed interacting with this interface, as it is intuitive to understand on a conceptual level. Maybe to make it more feasible to use, more work needs to be done around convenience and speed of use.

Lastly, the progress tab wasn't associated with any task, and it seemed like it may have been added as a small less important feature. However, I believe that many people would enjoy this feature and it should be fleshed out more than it currently is. You may want to make it into a fourth task, because it can be a big selling point for people who value sustainability, or just want to decrease their waste.

Overall, we believe that AfrIdge was a great idea, and the app is well made.