Hazard Analysis
Utrition

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Table 1: Revision History

Date	**Developer(s)**	**Change**
October 19, 2022	All	Initial Version

Contents

List of Tables

1 Introduction

This document discusses the hazards associated with Utrition. In the context of Utrition, hazards are defined to be a set of circumstances that prevent the expected use of the system, leading to an error state. The document will communicate the scope, boundaries and assumptions made when completing the hazard analysis, and provide a list of identified hazards. In addition, it will mention recommended actions to mitigate and circumvent hazards encountered while using the system.

2 Scope and Purpose of Hazard Analysis

The purpose of conducting a hazard analysis is to document the system conditions, that along with conditions in the environment, can cause harm or damage. Documentation for how to control or mitigate these conditions will also be included. The scope of this hazard analysis will span from the time the user inputs an image into Utrition to the time when the nutritional data results of their image are displayed, including the pre-processing, processing, API request, and data representation steps.

3 System Boundaries and Components

The system boundaries for this hazard analysis will include the device that the application is installed on as well as the components of the application itself. These components consist of image upload, image pre-processing, image processing & identification, API request calling, data logging, data log access, and data display components.

3.1 Image Upload

This component allows an image to be uploaded by the user and relayed to the pre-processing component.

3.2 Image Pre-Processing

This component takes an uploaded image and applies the algorithms needed to convert the raw image data into a format that can be used by a machine learning image model.

3.3 Image Processing & Identification

This component is where the machine learning model analyzes the pre-processed image to identify the food displayed by comparing it to the images it was exposed to during its supervised learning.

3.4 API Request Calling

This component allows the application to interface with the Nutritionix API to access nutritional data on a given food.

3.5 Data Logging

This component logs past uses of the application by the identified food and the date it was consumed.

3.6 Data Log Access

This component returns the recorded logs of past uses of the application. These logs include past food items consumed by the user.

3.7 Data Display

This component displays data visually for the user to see, either in textual or graphical formats.

4 Critical Assumptions

In this Hazard Analysis, two assumptions are made. Firstly, the user will not be intentionally trying to cause errors in Utrition. Secondly, the user is assumed to have sufficient storage space to download and run the application.

5 Failure Mode and Effect Analysis

Failure Mode and Effects Analysis

System: Utrition
Subsystem: N/A
Phase/Mode: System Requirements

Design Function	Failure Modes	Causes of Failure	Effects of Failure	Detection	Recommended Actions	SR	Ref
Image Upload	Image of incorrect type inputted	Users attempt to upload a file of an unsupported type	No image uploaded	Upload error will occur	Provide error message that informs the user that only file types of type .png, .jpg, and .jpeg can be uploaded	SR1	H1-1
	Image size inputted is too large	Image file from user is too large to be uploaded and stored	Same as H1-1	Same as H1-1	Provide error message that inputted file is too large	SR2	H1-2
	User tries to upload more than 3 images at once	User attempts to upload more than 3 images	Same as H1-1	Same as H1-1	Provide error message saying up to 3 photos can be uploaded at once	SR3	H1-3
Image Processing & Identification	Food from image is incorrectly identified	a. Poor image quality	a. System will process the incorrectly identified food item	a. User will file a report to the development team with the image that was incorrectly identified	a. If the machine learning model is not confident in result, the system will suggest the user upload another image	SR4	H2-1
		b. Machine learning model has not been trained to identify inputted food item	b. Same as H2-1a	b. Same as H2-1a	b. Same as H2-1a		
		c. Machine learning model accuracy is low	c. Same as H2-1	c. Same as H2-1a	c. Same as H2-1		
	No food is identified in the image	Same as H2-1	No food item will be identified and the system will not be able to proceed	The food identification machine learning process will return an error to the system	Display error message detailing that system could not identify a food item in the uploaded image	SR4	H2-2

Table 2: FMEA Table Part 1

Failure Mode and Effects Analysis

System: Utrition
Subsystem: N/A
Phase/Mode: System Requirements

Design Function	Failure Modes	Causes of Failure	Effects of Failure	Detection	Recommended Actions	SR	Ref
API Request Calling	API call fails unexpectedly	a. Internet connection error b. Too many requests sent to API causing throttling limit to be reached	a. System will not return nutritional data for a food item b. Same as H3-1a	a. The API response will be verified by the system. The system will detect if the response is an error b. Same as H3-1a	a. Display error message detailing a system error due to poor internet connection b. Display error message detailing a system error due to too many requests being sent	SR5	H3-1
	API does not contain nutrition facts for a food item	Food item is not found in API database	Same as H3-1a	The API response will be verified by the system and will detect if the response is empty	Display error message detailing that the food data could not be fetched	SR6	H3-2
Data Log Access	Nutritional data is unavailable	Nutritional data has not been put in the database for that particular input yet	System will not output any nutritional information	Database will return no result for past nutritional data	Display error message explaining that this nutritional data has not yet been added to the database	SR7	H4-1
	Nutritional data is deleted unintentionally	Accidental error of database deleting necessary data	Same as H4-1	Same as H4-1	Display error message explaining that this nutritional data has been deleted	SR8	H4-2
	User past data is deleted	a. The data was not successfully stored within the data base b. The user's past data was deleted unintentionally	a. System will not output any of the user's information b. Same as H4-3a	a. Nothing will be output after user requests past data b. Same as H4-3a	a. Display error message saying that the user's past data has been deleted b. Same as H4-3a	SR8	H4-3

Table 3: FMEA Table Part 2

Failure Mode and Effects Analysis

System: Utrition
Subsystem: N/A
Phase/Mode: System Requirements

Design Function	Failure Modes	Causes of Failure	Effects of Failure	Detection	Recommended Actions	SR	Ref
Data Display	Graph cannot be generated	Not enough past information from user	No graph is displayed to the user	There is no information available in user's past data	Display error message stating there is not enough data to create the graph	SR9	H5-1
General System	Device loses internet connection	a. Internet connection used by device is too weak	a. Unable to access nutrition facts for food items	a. API calls will fail	a. Display error message that informs the user that they must be connected to an internet connection to use the system	SR10	H6-1
		b. Internet shutdown on connected network	b. Same as H6-1a	b. Same as H6-1a	b. Same as H6-1a		
	System closes unexpectedly	a. Host device shuts down (loses power)	a. Loss of recently inputted data	a. Device screen will turn black	a. System should save data with each new input to minimize lost data	SR11	H6-2
		b. Internal error occurs	b. Same as H6-2a	b. Application will become unresponsive	b. Same as H6-2a		

Table 4: FMEA Table Part 3

6 Safety and Security Requirements

6.1 Safety Requirements

SR1. Utrition will return an error message when the user uploads an abnormal image format that is not .png, .jpg, or .jpeg.
Rationale: Utrition should not crash by improper user input. Users should have an opportunity to upload a new file of an appropriate format.
Associated Hazards: H1-1.

SR2. Utrition will return an error message when the user uploads an image file that exceeds the maximum size.
Rationale: Utrition should not crash by improper user input. Users should have an opportunity to upload a new file of an appropriate size.
Associated Hazards: H1-2.

SR3. Utrition will return an error message when the user uploads more than three images at once.
Rationale: Utrition should not crash by improper user input. Users should have an opportunity to upload three or fewer images to the system.
Associated Hazards: H1-3.

SR4. Utrition will prompt the user if food identification cannot be completed successfully. The user will be notified on the type of error that occurs.
Rationale: Food identification may fail due to a variety of reasons, and the user should be notified so they may attempt to find a workaround for the issue.
Associated Hazards: H2-1. H2-2.

SR5. Utrition will return an error message if the request to retrieve nutritional information cannot be completed successfully.
Rationale: Information retrieval requests may fail due to a variety of reasons, and the user should be notified of the reason why the service could not be completed as expected.
Associated Hazards: H3-1.

SR6. Utrition will return an error message if the nutritional information of a specific item cannot be found.
Rationale: The user should be notified if the nutritional data of their food item cannot be fetched.
Associated Hazards: H3-2.

SR7. Utrition will return an error message if the user's part nutritional logs cannot be found.
Rationale: The user should be notified if their nutritional data of past meals cannot be found.
Associated Hazards: H4-1.

SR8. Utrition will return an error message if the user's part nutritional logs have been deleted.
Rationale: The user should be notified if their nutritional data of past meals are no longer saved in the system.
Associated Hazards: H4-2, H4-3.

SR9. Utrition will prompt the user if past nutritional trends cannot be displayed successfully. The user will be notified on the type of error that occurs.
Rationale: Failure to display past nutritional trends may fail due to a variety of reasons. The user should be made aware of the issue, and the underlying cause behind it.
Associated Hazards: H5-1.

SR10. Utrition will prompt the user if their device is not connected to the internet when attempting to access the system.
Rationale: The user should be notified if they are unable to connect to the system so they may apply a fix to the issue.
Associated Hazards: H6-1.

6.2 Security Requirements

SR11. Utrition will periodically save user's data during use.
Rationale: In the event of unexpected shutdown, the user should not lose all information from the last session. Periodically saving user information will allow users to continue from their last step in the event of an unexpected shutdown.
Associated Hazards: H6-2.

7 Roadmap

Durum Wheat Semolina is planning to implement SR1-SR10 during Utrition's capstone timeline. The safety requirements (SR1-SR10) are easy to implement and do not provide much strain to the system. They exist to guide the user through Utrition, and to aid Utrition in being an easy-to-understand application. SR11 is not required to allow the user to use Utrition. The cost of implementing and utilizing SR11 is high with the reward being low. Therefore, the implementation of this requirement, during Utrition's capstone timeline, cannot be prioritized.