Software Engineering Group Project: Nutritics

Requirement Document

Group 15

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CS2013: Requirement Document

1. Introduction

1.1 Overview - Purpose of System

The purpose of building this API system with Optical Character Recognition (OCR) feature is to interpret nutrition labels and organise them into trustworthy and accurate information stored in Nutritics database. Nutritics provide softwares that manage recipes, analyse diets and activities, thus creating meal plans to their clients, such as dietician, sport nutritionist and food manufacturer sectors.

1.2 Scope

This project comprises of a new feature offered by Nutritics as an approach to address the problem of disjunction between software developers and nutritional professionals. This new feature is required to turn photos of food products' nutrition panels into text form and thus, adding newly gathered information into Nutritics database.

1.3 Objectives and Successive Criteria

- The system should be able to scan nutrition tables on food products properly, regardless of their panel sizes and interpret the details listed in it. The details read will then be converted into text form akin to what was read and then be stored in the server database.
- The system should be able to accurately stored the information gathered in the correct section, such as nutrition type, amount per 100g, amount per serving, etc. The system should at least be able to read datas from nutritional tables designated by the **European Food** Safety Authority (EFSA).
- The system needs to be functional on Nutritics server. All the newly gathered information are to be updated in the database and verified by the company. So technically, the system should be semi-automated.
- The system should be maintainable and operational after the project duration, where new information on different food products can be scanned and stored in the database.
- Further functions of the system include extending the feature of the system with machine learning to enable it to learn from verification failures and corrections from the Nutritics. This ensures that the system is sophisticated and flexible to deal with various situations, such as determining if the data scanned is relevant, logical and valid.

1.4 Definitions, Abbreviations

- OCR: **Optical character recognition** or **optical character reader** is the mechanical or electronic conversion of images of typed, handwritten or printed text into machine-encoded text, whether from a scanned document, a photo of a document, a scene-photo or from subtitle text superimposed on an image

1.5 References

Nutritics. *About Nutritics.* https://www.nutritics.com/p/about (accessed February 2, 2018).

2. Current System

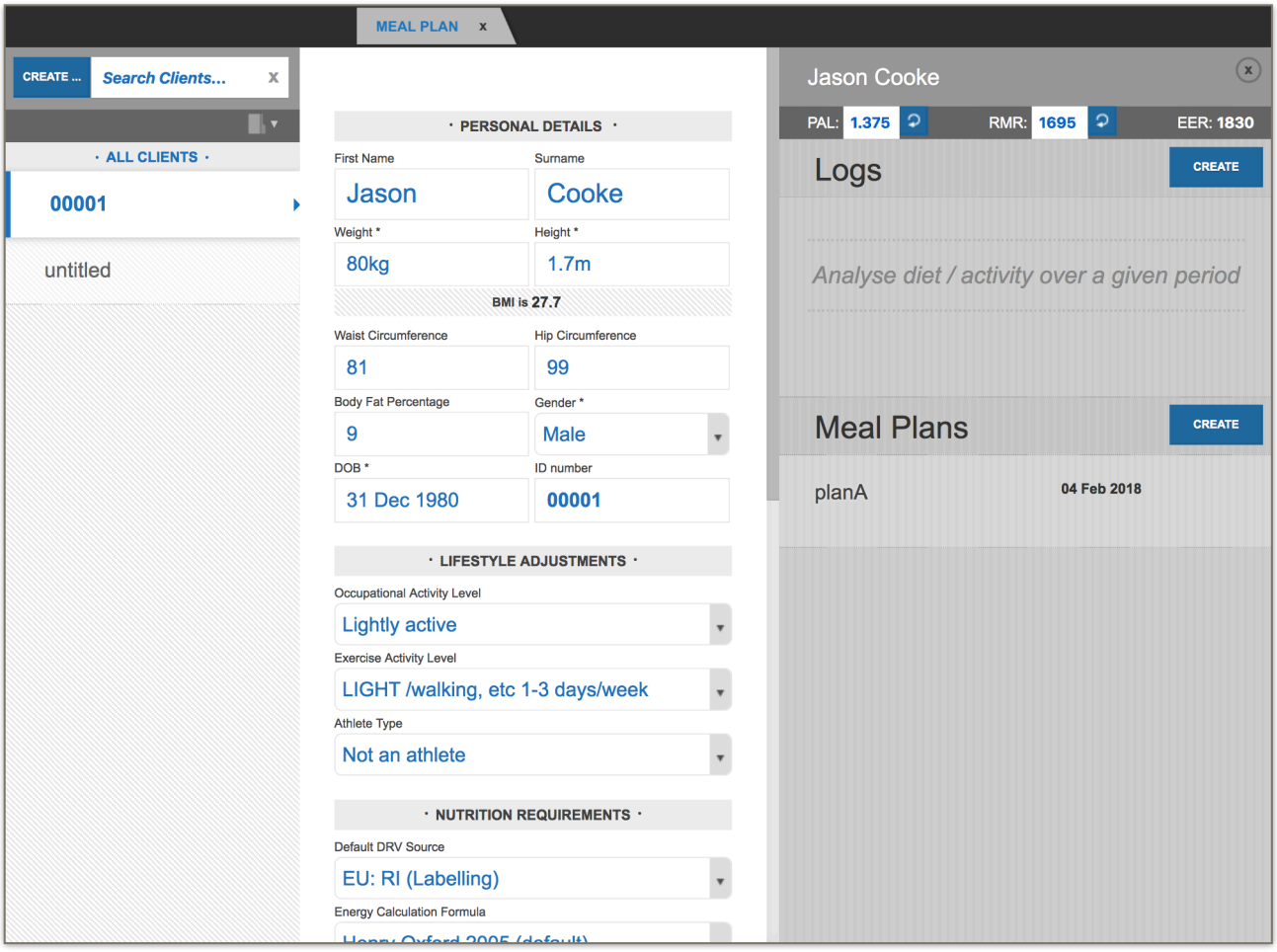
Introduction:

Current system of Nutritics only manages recipes, analyses diets and activities, and create meal plans for their users. Nutritics provide software to forward thinking clients around the world in healthcare, education, food services and manufacturers, and elite sport advisors as assistance in growing their business. All of the activities of Nutritics operates on PHP based server platform.

The current system only supports food labelling without comparing brands. The proposed OCR project is a new feature to be added onto the food labelling part, which could provide a better precision and accuracy in delivering and comparing information of different nutritional values of different brands of the same food type to the clients.

Operations performed:

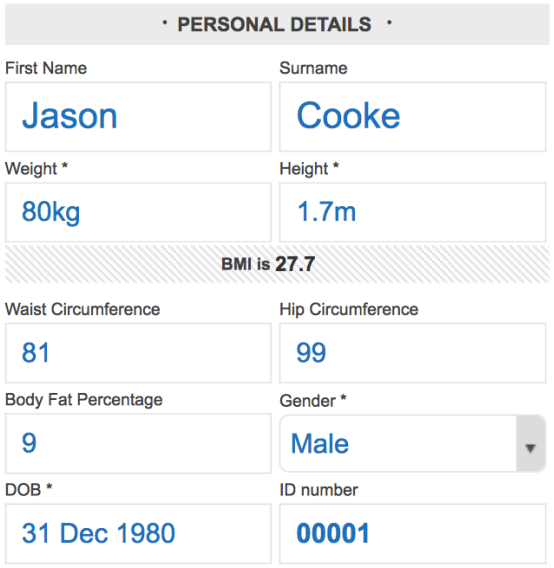
Current System allows users create meal plans for individuals based on their requirements. The user first put in the required details of their clients, where the system will perform calculations on the them, for instance the clients' Body Mass Index (BMI). This is equivalent to creating a profile page for each client of the user.



Criteria in the profile page to be filled in can be categorised into 4 parts:

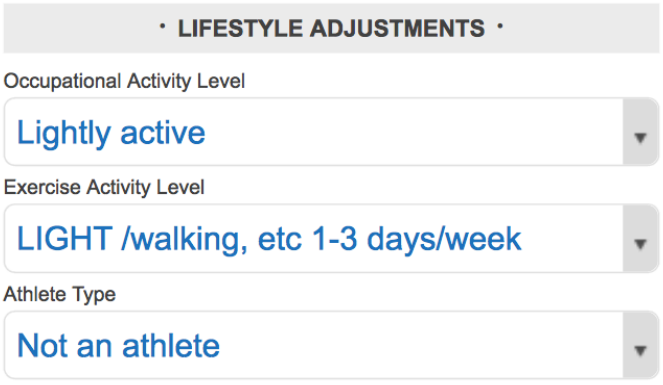
a. Personal Details

- Name (First and Last Name)
- Weight (in Kg or lbs)
- Height (in cm or ft)
- Waist and Hip Circumference (in cm or inch)
- Body Fat Percentage
- Gender
- Date of Birth
- ID number (self-created)



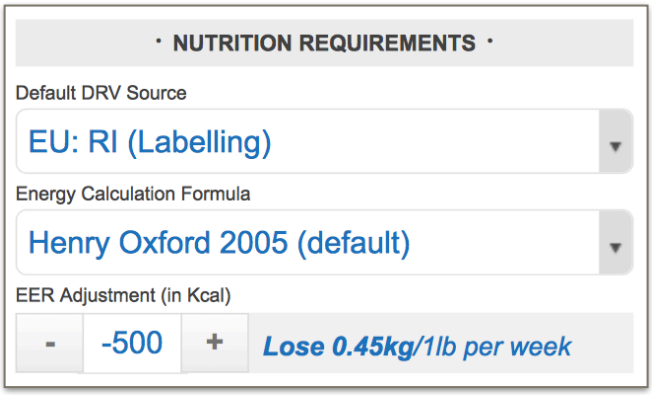
b. Lifestyle Adjustments (Lifestyle embraced by the client of the user)

- Occupational Activity Level (Sedentary, Lightly Active, Moderately Active, Very Active or Extremely Active)
- Exercise Activity Level (None, Light, Moderate, Very Active, Ultra Active)
- Athlete Type (Skill Based, Not an Athlete, Mixed Active, Strength/Power, Endurance, Ultra Endurance or Intermittent/Team/Field Based)



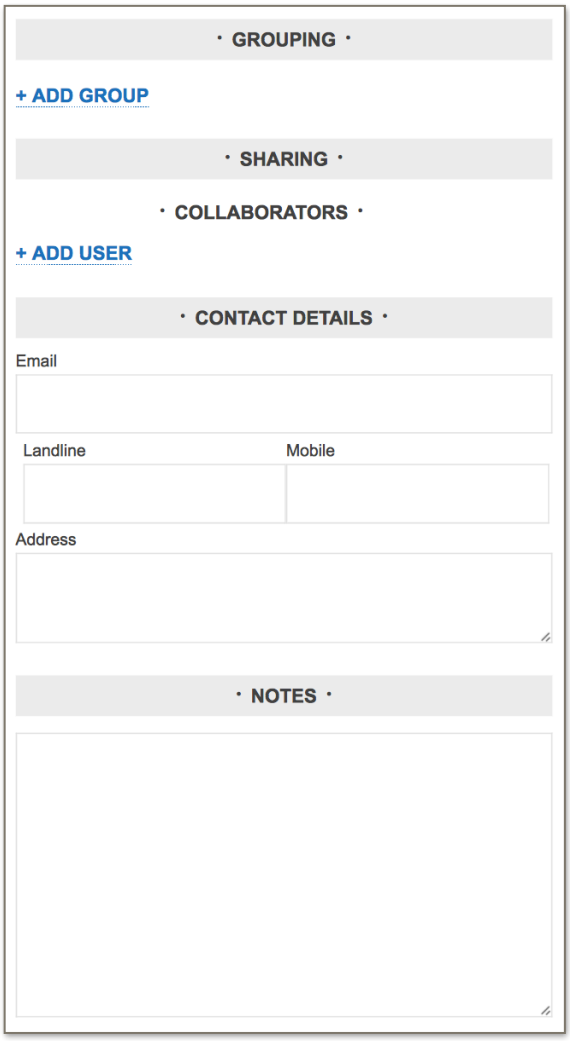
c. Nutritional Requirements

- Default DRV (Dietary Reference Values) Source (EU, UK, US, AUS, Nordic, FDA, FSANZ, EFSA 2017 or Custom)
- Energy Calculation Formula (default: DRV's generic energy value, Henry Oxford 2005, Institute of Medicine 2005, Katch McArdle 1996, Mifflin St.Jeor 1990, Schofield 1985, Cunningham 1980 or Harris-Benedict 1919)
- EER Adjustment (in Kcal)

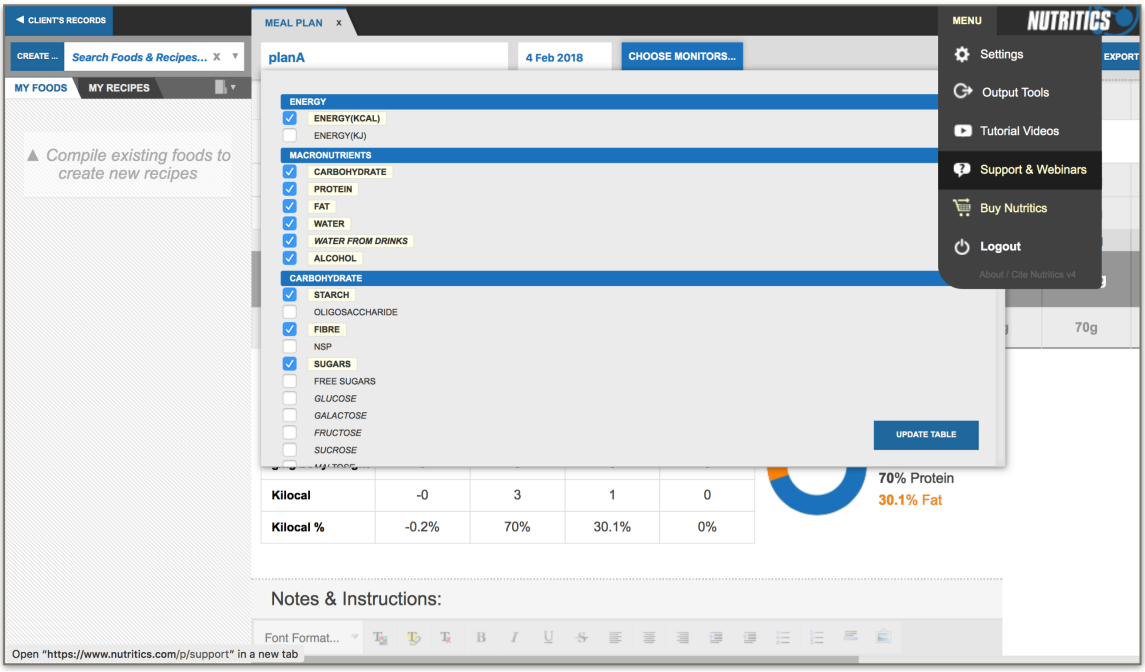


d. Grouping, Sharing, Contact Details and Notes

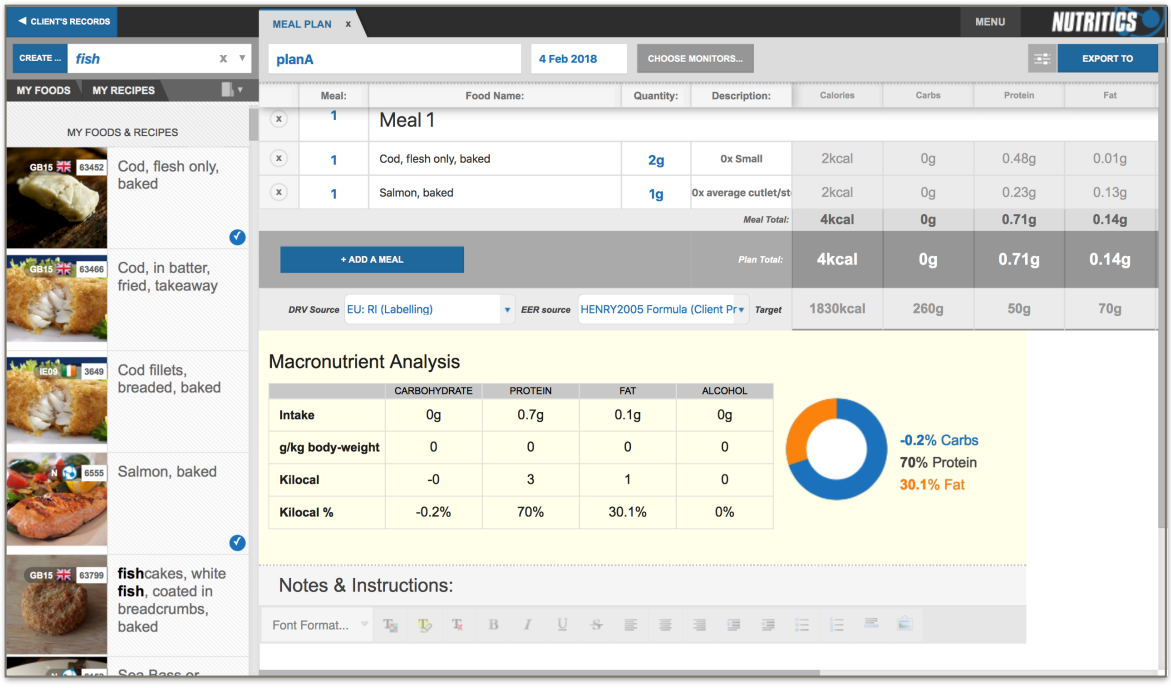
- Meal Plans can be shared with the user or among groups.
- Contact Details of the client of users
- Extra notes to be taken down or reviewed, for instance possible symptoms



After creating the individual profile pages, meal plans can be drafted and created according to the nutritional requirements for the client. The system allows the clients to select the nutrient needed by the client as one of the criteria in a table for nutritional content calculation. For instance, suppose the client of the user needs to watch out on his sugar intake due to diabetes. The user can designate glucose as one of the calculating factor in the table to make sure that the meal plan he/she devised doesn't not contain high level of glucose. The quantity of nutrients available as factors to be included in the table is approximately 70 types.



After choosing the nutritional factors to achieve, the user can now devise a meal plan for the client by choosing foods from a lists to be put into the table. The system then calculates the nutritional values of each food according to their servings and sum them up for the client. The servings of each type of food is described as well. This way the users can come up with a full flex meal.



The results are then displayed in table and pie chart form. There is another note and instruction section at the bottom for further advice. The results can then be exported in pdf and excel form.

Excel Form(size readjusted):

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Meal Plan for Jason Cooke												
2	planA												
3	Male												
4		37											
5													
6	Formula	HENRY2005											
7	Nutritics v4.315												
8	Food Name	Quantity	Measure	Energy(Kcal)	Carbohydrate	Protein	Fat	Water	Water from	Alcohol	Starch	Fibre	Sugars
9	Meal 1												
10	Cod flesh only baked	2	0x Small	2	0	0.48	0.01	1.5	0	0	0	0	0
11	Salmon baked	1	0x average cutlet/steak	2	0	0.23	0.13	0.64	0	0	0	0	0
12	Tuna flesh only raw			0	0	0	0	0	0	0	0	0	0
13			Meal Total	4kcal	0g	0.71g	0.14g	2.2ml	0ml	0g	0g	0g	0g
14			Plan Total:	4kcal	0g	0.71g	0.14g	2.2ml	0ml	0g	0g	0g	0g
15													

PDF form:

Meal Plan for Jason Cooke Male , 37, 80kg, 1.7m, 27.7 BMI,9% body fat

planA

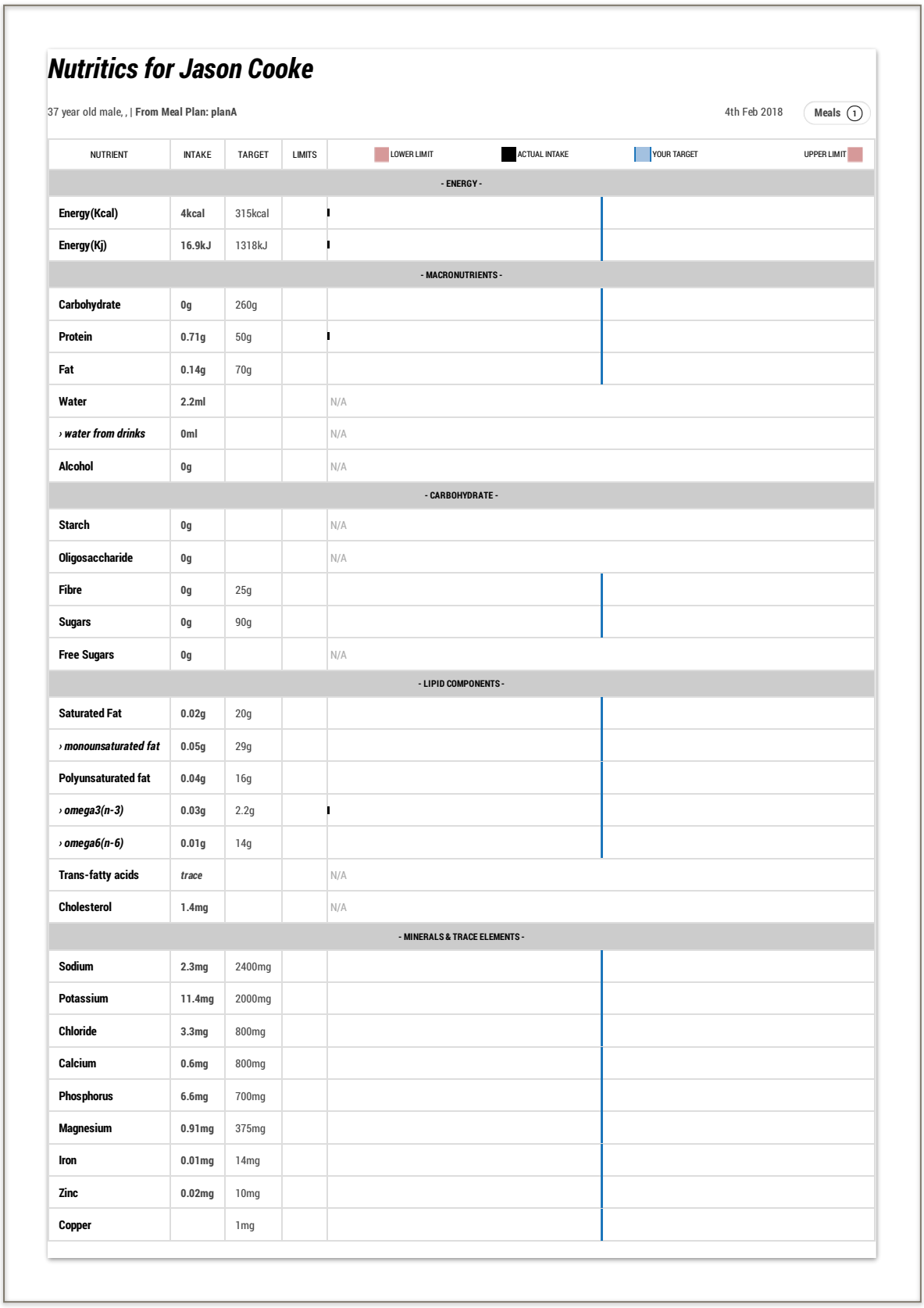
FOOD NAME:	QUANTITY:	DESCRIPTION:	CALORIES	CARBS	PROTEIN	FAT	WATER
Meal 1							
Cod, flesh only, baked	2g	0x Small	2kcal	0g	0.48g	0.01g	1.5ml
Salmon, baked	1g	0x average cutlet/steak	2kcal	0g	0.23g	0.13g	0.64ml
Tuna, flesh only, raw			0kcal	0g	0g	0g	0ml
		Meal Total:	4kcal	0g	0.71g	0.14g	2.2ml
		Plan Total:	4kcal	0g	0.71g	0.14g	2.2ml

Macronutrient Analysis

	CARBOHYDRATE	PROTEIN	FAT	ALCOHOL
Intake	0g	0.7g	0.1g	0g
g/kg body-weight	0	0	0	0
Kilocal	-0	3	1	0
Kilocal %	-0.2%	70%	30.1%	0%

-0.2% Carbs
70% Protein
30.1% Fat

Moreover, the results can also be displayed in a diet log report, which is basically a full scope of nutritional values analysis of the meal plan. In this report, user can directly compare the target nutritional values necessary for the client in every aspect and the amount of in take from the meals.



Nutritics for Jason Cooke

37 year old male, , | **From Meal Plan: planA** 4th Feb 2018 Meals 1

NUTRIENT	INTAKE	TARGET	LIMITS	LOWER LIMIT / ACTUAL INTAKE / YOUR TARGET / UPPER LIMIT
- ENERGY -				
Energy(Kcal)	4kcal	315kcal		
Energy(Kj)	16.9kJ	1318kJ		
- MACRONUTRIENTS -				
Carbohydrate	0g	260g		
Protein	0.71g	50g		
Fat	0.14g	70g		
Water	2.2ml			N/A
› water from drinks	0ml			N/A
Alcohol	0g			N/A
- CARBOHYDRATE -				
Starch	0g			N/A
Oligosaccharide	0g			N/A
Fibre	0g	25g		
Sugars	0g	90g		
Free Sugars	0g			N/A
- LIPID COMPONENTS -				
Saturated Fat	0.02g	20g		
› monounsaturated fat	0.05g	29g		
Polyunsaturated fat	0.04g	16g		
› omega3(n-3)	0.03g	2.2g		
› omega6(n-6)	0.01g	14g		
Trans-fatty acids	*trace*			N/A
Cholesterol	1.4mg			N/A
- MINERALS & TRACE ELEMENTS -				
Sodium	2.3mg	2400mg		
Potassium	11.4mg	2000mg		
Chloride	3.3mg	800mg		
Calcium	0.6mg	800mg		
Phosphorus	6.6mg	700mg		
Magnesium	0.91mg	375mg		
Iron	0.01mg	14mg		
Zinc	0.02mg	10mg		
Copper		1mg		

3. Proposed System

3.1 Overview

The proposed project is to add a new API feature onto the current system to enhance its functionality to scan labels from food products and directly updating them on the server database. This allows the system to not only deal with food products in general, but also narrow it down to which brand of a certain type of food products is suitable to the client. Subsequently, it also saves the time of the user to fill in the form in the app as shown above.

This new API will be written in PHP as it is most compatible with the system structure of Nutritics. Open sources chosen for OCR would be either be GPL, MIT, BST or preferably Google.

3.2 Functional Requirements

The designed API must be able to

- at least scan labels of food products designated by the European Food Safety Authority (EFSA).
- read relevant information on the labels and interpret the important parts as nutritional facts of the product.
- return a text form result that contains types of nutrients and its nutritional content per serving and per 100g.
- determine the validity and trustworthiness of the information collected.
- Semi-Automated (verification is partly done by Nutrilitics staffs)
- updates the information on the server database.
- incorporates machine learning onto its functionality, so that it will be able to learn from verification mistakes and failures. (This is for further enhancement)

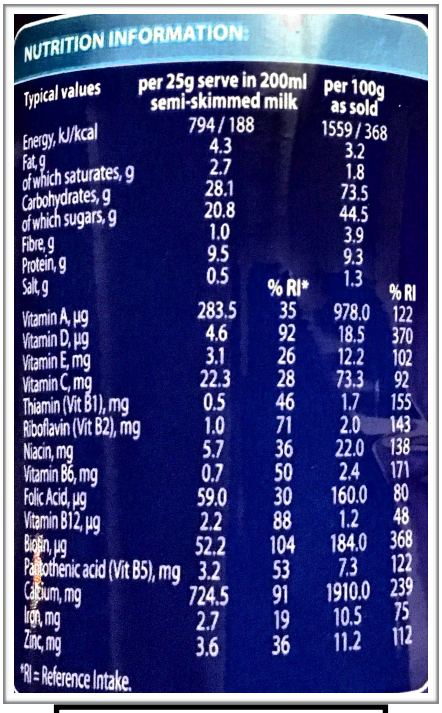
3.3 Non-Functional Requirements

- Provides reliable and clear scan on the food label
- Flexible and works in different structures of food labels
- Able to gather correct and relevant details from the scan
- Securely updates the newly added information onto the database
- Responsive to mobile devices mainly
- Capacity for addition functionalities (eg. machine learning for error detections)

3.4 System Prototype

3.4.1 User Interface Mockup

The OCR project should be able to read most food labels present on the market. Below is an example of a food label of Horlicks original malted milk drink powder. There are various nutrients labelled on it with their corresponding values per serving or 100g. The API should ignore irrelevant text such as “nutritional information”, “reference intake” and etc. Instead it should be able to read the headers such “typical values”, “per 100g as sold “and “per 25g serve in 200ml….” and determine the information below might be relevant to be extracted and converted to text form.



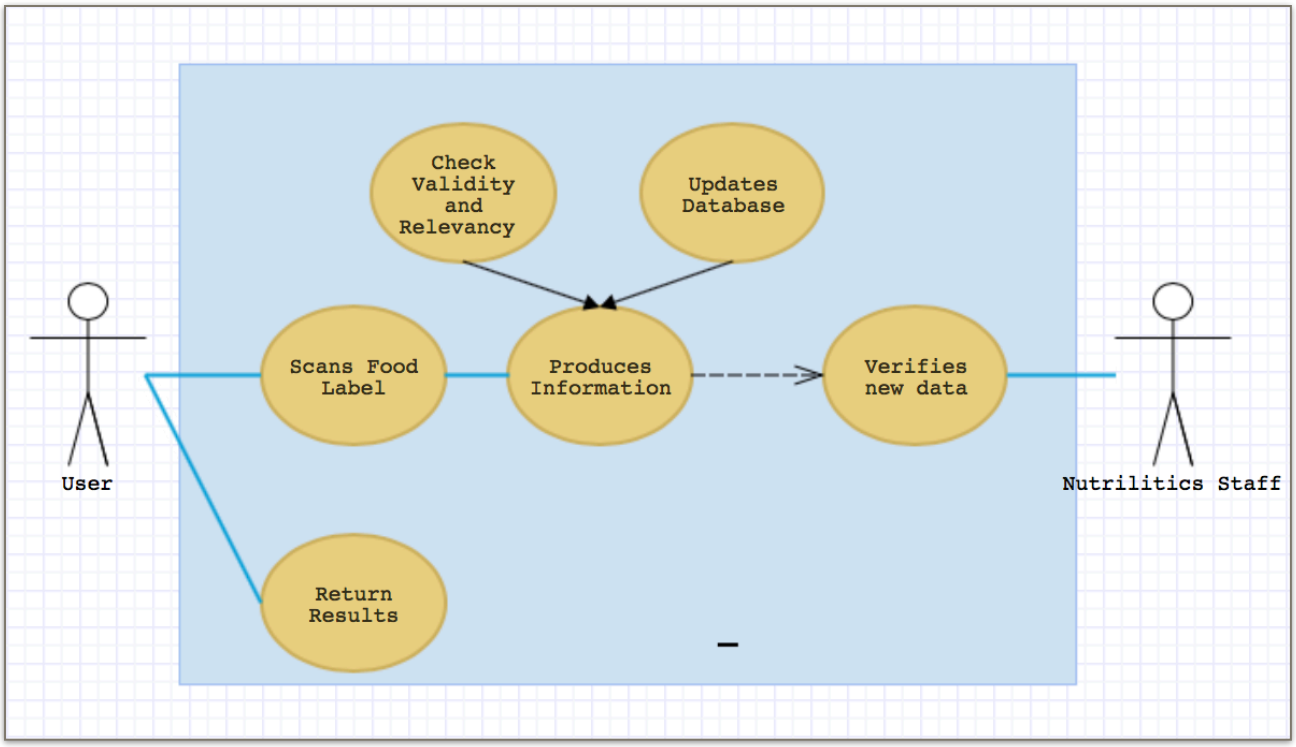
Sample Image

Results:

Food: Malted Milk Powder
Brand: Horlicks
Portion:[per 25g serve in 200ml served in skimmed milk, per 100g]
Nutritional Information:
Energy: [794kJ/188 kcal,1559kJ/368kcal]
Fat: [2.7g, 1.8g]
Carbohydrate: [28.1g, 73.5g]
Sugar: [20.8, 44.5]
Fibre: [1.0g, 3.9g]
Protein: [9.5g, 9.3g]
Salt: [0.5g, 1.3g]
Vitamin A: [283.5µg, 978.0µg]
Vitamin D: [4.6µg, 18.5µg]
Vitamin E: [3.1mg, 12.2mg]
Vitamin C: [22.3mg, 73.3mg]
Thiamin: [0.5mg, 1.7mg]
Riboflavin: [1.0mg, 2.0mg]
Niacin: [5.7mg, 22.0mg]
Vitamin B6: [0.7mg, 2.4mg]
Folic Acid: [59.0µg, 160.0µg]
Vitamin B12: [2.2µg, 1.2µg]
Biotin: [52.2µg, 184µg]
Pantothenic Acid: [3.2mg, 7.3mg]
Calcium: [724.5mg, 1910mg]

The results should always have a standard, uniform orientation like the above result.

3.4.2 Use Cases



UML Use Case Scenario Descriptions

1.

Name:	Scans Food Label
Participating Actor:	User
Entry Condition:	User scans a label on a food product
Exit Condition:	Scanning was successful.
Normal Scenario:	User scans the image of the label by accessing the camera of the mobile device with the app.
Error Scenario:	Scanning failed.

2.

Name:	Verifies new data
Participating Actor:	Nutrilitics staff
Entry Condition:	A food product (can also not be a food) with a food label or nutritional values per serving unrecognised or unseen by the OCR API
Exit Condition:	The new food product is verified by Nutrilitics staff.
Normal Scenario:	Nutrilitics staff checks if the label scanned is actually a food. Nutrilitics calculates the nutritional values per serving of the food listed on the label to determine if the values are true, valid and relevant.
Error Scenario:	Nutrilitics staff determined errors or fallacy on the label and thus verification of the new data fails.

3.

Name:	Return results
Participating Actor:	User
Entry Condition:	Verification of a new data scanned a user is done.
Exit Condition:	The user receives a JSON text format of the contents verified and its results.
Normal Scenario:	The OCR API creates a JSON text format of the food label scanned. The OCR API sends the text and results to the user.
Error Scenario:	The user does not receive the relevant or correct results and text.

4.

Name:	Produces new Information
Participating Actor:	-(managed by the OCR API)
Entry Condition:	The OCR API receives a new image scanned by the user.
Exit Condition:	The new image is interpreted successfully and relevant information on it is extracted to form a new piece of nutritional information of a food product.
Normal Scenario:	The OCR API attempts to read and interpret relevant information on the food label image it receives. The API checks the validity and relevancy of the information and updates it on the database.
Error Scenario:	The newly scanned image cannot be recognised by the API to create a new information and is sent to the Nutrilitics staff to be verified.

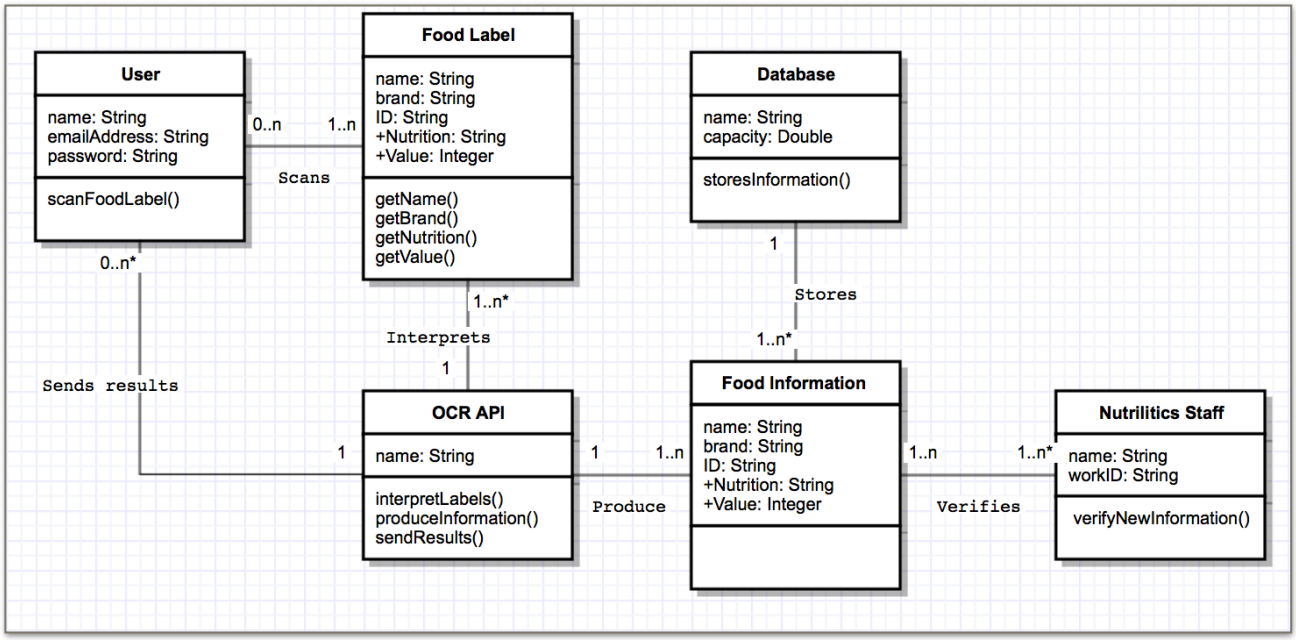
5.

Name:	Checks Validity and Relevancy
Participating Actor:	-(managed by the OCR API)
Entry Condition:	A new information is processed by the API and needs to be examined.
Exit Condition:	The API approves the new information.
Normal Scenario:	API search for related words on the image structure. API works out if each nutritional values corresponds to their types logically.
Error Scenario:	The API is unable to determine the validity and relevancy of the information and it is sent to the Nutrilitics staff to handle it.

6.

Name:	Updates databases
Participating Actor:	-(managed by the OCR API)
Entry Condition:	A newly produced information is to be stored in the database for future reference.
Exit Condition:	The information is successfully stored.
Normal Scenario:	The API stores the information in the database by organising the correct content values of each nutrient at the right category.
Error Scenario:	The database does not accept the new information, thus update on database fails.

3.4.3 Object Models



3.4.4 Dynamic Models