

Scanitive: Simplifying Nutritional Information for the General Public

Ryan Gordon¹, John Healy¹

¹ Dept. of Computer Science & Applied Physics, Galway-Mayo Institute of Technology, Galway, Ireland

*Corresponding Author e-mail: ryangordon210@gmail.com

Received xxxxxx, Accepted for publication xxxxxx, Published xxxxxx

Abstract

Nutritional information is provided on products using different size metrics such as Per 100g serving, Per Unit (whole item) serving and in some cases a serving size suggestion. Due to a need to compute and calculate the nutritional benefit of a product, consumers can in some cases be misled into getting a less healthy product based on how the information and sizes are presented on each product. Furthermore, consumers trying to make purchase decisions may not have the time or ability to calculate and compare the sugar content of two products during a shopping trip.

In this project, software was designed and implemented to assist the general public to better comprehend the nutritional benefit of their product choices by breaking down nutritional metrics, like the sugar content of a product, and presenting the data in a format which is easier to visualise than adding up grams. The software maintains a synchronised database of other food and drink products, enabling it to suggest similar types of products that contain less sugar. The software is comprised of a cross-platform mobile application and a server administration console. The mobile application allows users to scan the barcodes on food and drink packaging and receive suggestions of similar products with a lower sugar count. The sugar content values for both the scanned product and suggestions are compared and displayed.

Keywords: Nutritional Information, Nutritional Database, Cross-Platform Application.

1. Introduction

Excess amounts of sugar in commercially available food products is believed to be contributing to the increased incidence of type 2 diabetes. As shown by Schulze (Schulze et al., 2004) and Malik (Malik et al., 2010), higher consumption of sugar-sweetened beverages is associated with development of metabolic syndrome and type 2 diabetes.

The project rationale is based on the premise that, if provided with more easily understood information on how much sugar is in a product, a consumer might reconsider buying a particular product or in some cases change their purchase decision entirely for a healthier alternative. This idea is backed by a study completed by Kozup, Creyer and Burton(2003, pp. 19-34) which finds that, “when favourable nutrition information or health claims are presented, consumers have more favourable attitudes toward the product”. Product descriptions can be deceptive in how they are presented to consumers and in some cases, there

can be a misconception of the correlation between certain food types and their nutritional benefit. An example of this is the misconception that all fruit or fruit-based products are healthy, leading to a correlation between fruit based drinks and good nutrition even though in some cases, fruit-based drinks are the highest in sugar concentration. Nutritional information provides consumers with key information about the nutritional content of a given product and in some cases, its nutritional benefit. This information can become especially beneficial to consumers if the individual buying the product has a need to be aware of certain ingredients or closely monitor their daily caloric intake. This nutritional labelling required on products can influence a consumer's decision to buy a certain product in preference to another product if one appears to be healthier(Prathiraja and Ariyawardana, 2003, p.35).

A trend that has emerged in the food industry, is where a products nutritional labelling is given a metric called a 'Serving Size', which is an amount of the product in grams. The definition of serving size is not clear or accurate at present and, due to a lack of regulation regarding this, sellers can provide different serving size weights for their variety of products. The issue with this is that if a merchant offers 3-4 variants of the product in different sizes and is free to choose a different serving size for each product, the producer could then make it appear that a larger product, that costs more is actually more nutritionally beneficial than a smaller, cheaper variant of the same product. EU Law has certain requirements in regards to food labelling, and is one of the reasons why nutritional information is required to be provided on food.

The Food Safety Authority of Ireland (FSAI) has implemented new rules based on EU legislation(Fsai.ie, 2011) on how product suppliers must label their product in relation to the size of a portion. Part of the change introduces a requirement that food products must display a standard metric of nutritional information based on a 100g/ml serving of the product. In addition to this, the Department of Health in Ireland have recently approved a new bill which aims to tackle soft drinks that have excessive levels of sugar(Budget.gov.ie, 2016). As a result of this bill being implemented, a sugar tax is applied to soft drinks which have a level of sugar above 8g/100ml serving and a lower tax for soft drinks between 5-8g/100ml. The rates are €24.39 and €16.26 per hectolitre (100 litres) respectively(Revenue.ie, 2018).

Another issue that is presented to consumers is that, even with standardised sizes for nutritional information, these figures can be hard for all consumers to understand, with many using web-based applications which will process this information for them. A solution to this problem is to provide a different standard of measurement that is more easy to understand for everyone. The chosen metric for this project is the teaspoon of sugar. A teaspoon of sugar is a visual representation which can be easier to understand than a nominal metric, such as grams. The weight of a teaspoon sugar has a precise measurement of 4.2 grams per teaspoon accepted as accurate and it has become practice to round this figure to 4 grams exactly for simplicity. During requirements gathering with the project sponsor, a preference was put forward for the 4g measurement to be used.

The purpose of this project is to explore whether a mobile application can be developed, from which, a product's nutritional information can be queried and then converted using simplified nutritional metrics. Providing the converted nutritional metrics alongside additional product suggestions which are of a similar category, is also a key aim of the solution.

Another aim of this project is to make understandable nutritional information more accessible to the general public in the hope that, with this information, consumers will be able to make a fully-informed decision about their purchases, not just in relation to pricing or weight, but in its nutritional benefit also.

2. Materials and Methods

During the initial planning phase of the project, a number of different frameworks and technology stacks were evaluated. The Ionic framework(ionicframework.com, n.d.), supported by Angular 4 was chosen from a range of candidate technology platforms. Ionic provides a number of benefits which simplifies the development of a cross-platform application. The ability to maintain a single code base for all platforms provides a more testable codebase and makes maintaining features easier. Another benefit of the Ionic framework is that it supports development using TypeScript(Typescriptlang.org, 2019); a static-typed language built upon JavaScript.

2.1 Development Methodology

Project Management is a key element in any software project and is essential for both the quality of the end result and the delivery time of the project. An emphasis was placed on having a concise plan and a realistic strategy for managing the lifecycle of the project. Following a defined development methodology removes much empirical work in relation to how deliverables should be organised and done. During the planning phase, a number of milestones and features were identified and each of these was broken down into smaller components which made each finer grain story more manageable. The suite of refined stories were grouped into a number of sprints which last for a predefined duration. The default sprint duration for this project was 2 weeks. During a sprint, a fixed number of stories are assigned and the goal is to have them completed in full by the end of the sprint. After the sprint, a review is typically undertaken and any potential improvements addressed in future sprints.

3. System Design

In this project, a number of deliverables were scoped to be built with the purpose of providing software to assist the general public to better comprehend the nutritional benefit of their product choices. The system architecture of the project included a CouchDB(Couchdb.apache.org, n.d.) database which interfaced with an on-mobile PouchDB(Pouchdb.com, n.d.) database, a project based on CouchDB. Figure 1 shows how the system receives requests from clients and interfaces with the product database as needed. One of the reasons for these choices was the ability to synchronise the product database to a client's device. This provided offline functionality for product queries. Admins perform operations on the database using a separate API developed using Flask(Flask.pocoo.org, n.d.) and deployed as a Docker(Docker, n.d.) container in the cloud. Automated testing was managed with CircleCI(CircleCI, n.d.) on each code checkin, ensuring that new additions don't cause regressions on already working features.



FIGURE 1: OVERVIEW OF THE SYSTEM ARCHITECTURE

A server administration console was developed, to update the database by editing existing product's information or adding new products. A barcode scanner component is provided, which when used on a product will gather relevant information, such as the products EAN-13(GTIN INFO, n.d.) barcode, to minimise the amount of data entry required by the user. To further reduce the amount of manual data entry, additional queries are made to data sources such as the Tesco Products API. This application featured automated testing powered by CircleCI which would run a number of single unit and integration tests across the codebase on each feature delivery to ensure quality. The application was successfully deployed both as a native mobile application and as a web application and Figure 2 outlines the visual differences between each platform.

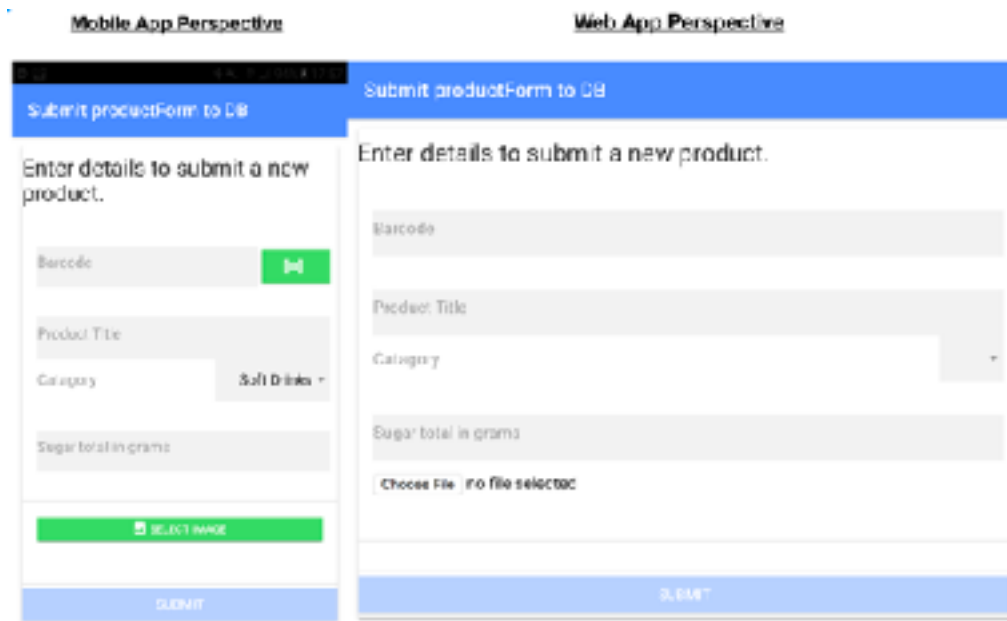


FIGURE 2: SCREENSHOTS OF THE ADMIN APPLICATION

The main deliverable of the project was a cross-platform mobile application which could be used by clients to scan the barcodes on food and drink packaging and receive suggestions of similar products with a lower sugar count. The nutritional information and a converted unit for sugar content is displayed for both the product and all suggestions of alternative products. The product database is synchronised from the server to the client every time the user opens the app which ingests any product updates. The benefit of this is that, after an initial sync period to download the database the first time, the app will continue to function for clients even if they lose internet connectivity, which was a concern during the design phase as not all supermarkets have free internet facilities. The mobile application was tested on a variety of phone and tablet OS types, to verify the user interface remained responsive to different screen sizes. Figure 3 shows how the application looks and performs on an Android test device. Users are supported by a chat bot which recognises and responds to frequently asked questions, can provide a tutorial and has a fallback mechanism for unrecognised requests.

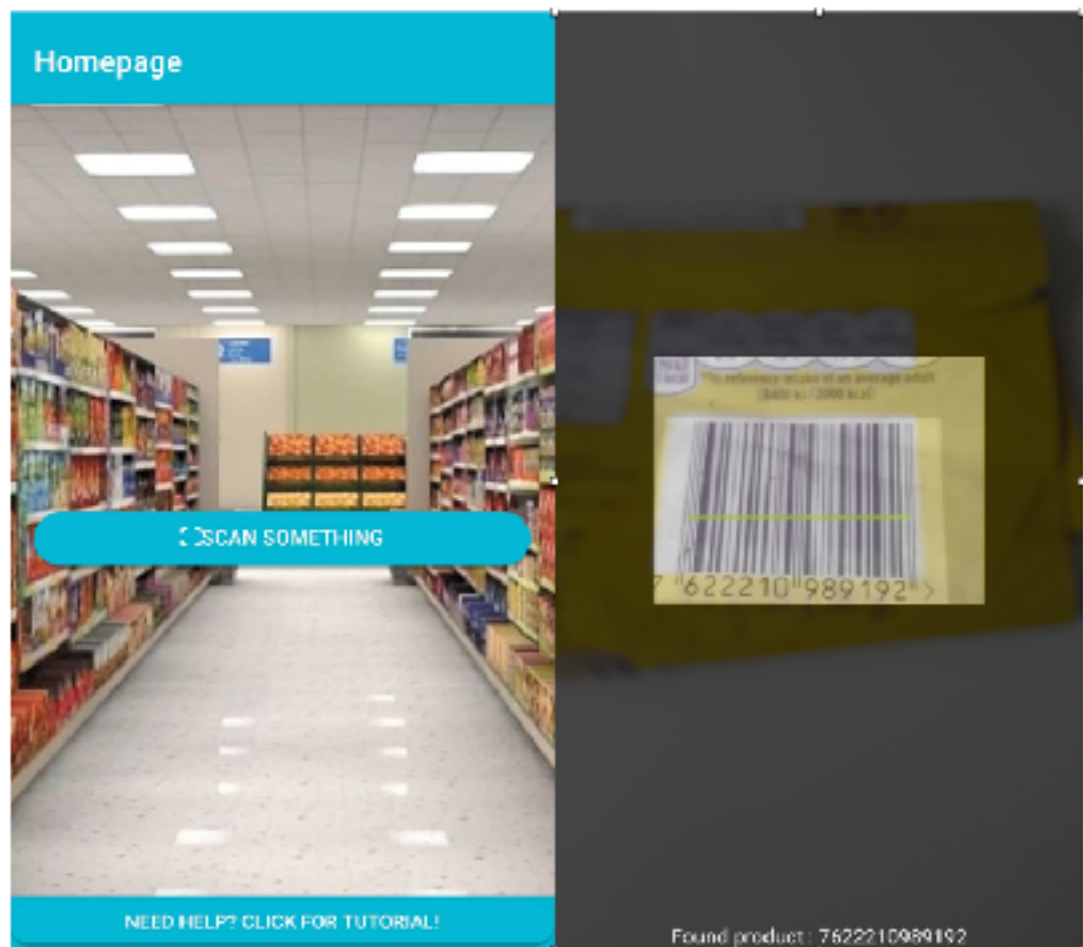


FIGURE 3: SCREENSHOTS OF THE MOBILE APPLICATION

4. Discussion

Open Data through REST API's

One of the added benefits that came from the need to have an RESTful API was the opportunity to provide our data to consumers. During development, it was noticed that there is currently a lack of web services which provide easy access to nutritional information on products. To address this shortcoming, we developed a REST(Fielding, R., 2000) API that enables remote users to query the nutritional database through a simplified facade.

The API is written using the Python 3.5 distribution and powered by Flask(Flask.pocoo.org, n.d.) as a framework for handling the requests. On each request, a model object which has the implementation logic for each route and resource, is injected using Flask-Injector(Flask

Injector. (n.d.). Provided with the API, is an endpoint which hosts interactive documentation which is based on an OpenAPI Specification YAML file(Swagger.io, n.d.).

The OpenAPI Specification (OAS)(Swagger.io, n.d.) defines a standard, programming language-agnostic interface description for REST APIs, which allows both humans and computers to discover and understand the capabilities of a service without requiring access to source code, additional documentation, or inspection of network traffic. The main aim of the OAS is to reduce the amount of implementation logic that needs to be implemented by a consumer of the API.

During the requirements gathering or early development stages of the creation of an API, part of the OpenAPI Specification relies on the consumption of a document (or set of documents) that defines or describes an API. An OpenAPI definition uses and conforms to the OpenAPI Specification. Enforcing this syntax definition is done with the aim of all API's conforming to some similar syntax, lowering the barrier of entry to API development. As stated by the leaders of the OAS : “Similar to what interface descriptions have done for lower-level programming, the OpenAPI Specification removes guesswork in calling a service”(OpenAPI-Specification Github, n.d.).

Providing Support to Users via a Chat Bot

Support and maintenance of a software project accounts for a substantial portion of the overall development cost of an application(Dehaghani, and Hajrahimi, 2013, p. 63). No matter how well the system is designed, some users may struggle with it and there should be some form of support to facilitate the users of any system. Handling a support centre for a small application requires manually managing some communication channel and this incurs a cost in the form of time, money and other resources. A potential solution to this is to provide an alternative method to answer some of the most frequently asked questions. One way to facilitate users is to give the perception of human intervention through a chat bot. Information that would normally be on a FAQ can be sent as a reply to very common questions in an automated, on-demand fashion, reducing man hours needed to handle these common issues.

The Chat Bot uses DialogFlow(DialogFlow, n.d.) to interpret a meaning or intent from a user-provided message. Once this intent is established, a number of different responses may be available. An intent represents a map of what a user says and what we feel they mean or what action we think they would like to take. If no intent is matched to the users message they will get a standard fallback message and the maintainer of the chat bot will be notified via a DialogFlow console. One unique aspect to this feature is the ability to use integrations with popular communications tools such as Slack(Slack, n.d.), where the fallback can be to notify and connect a support agent to the user.

5. Conclusions

Due to the need to calculate and compare nutritional benefits of products using the variety of different size metrics, consumers can in some cases be led toward purchasing an unhealthy alternative, based on how the information is presented. The goal of the project was to design

and implement software to assist the general public to better comprehend the nutritional benefit of their product choices. The project yielded a number of key outputs :

- **A cross-platform nutritional app.** The application allows users to scan products and provides converted metrics for nutritional values and displays similar types of products with a lower sugar content as alternative suggestions.
- **Full REST database of Nutritional Information.** The database provides open data to consumers and can be further expanded to accept submissions from the public.
- **Interactive intelligent help provided with a chat bot.** Accessible through the mobile application and can be integrated with other communication tools, allowing for human intervention to provide a complete support experience.

Overall the project was a success with the proposed solution successfully providing a method to retrieve a products nutritional information as well as some alternative product suggestions. The efficiency of a query over a large dataset of products was an initial concern which raises the question; how greatly does the speed of this information retrieval impact a purchasing decision. Additionally, how much of an influence, could such an application have in a consumers purchasing decision.

6. References

Budget.gov.ie. (2016). *SUGAR-SWEETENED DRINKS TAX — Information Note*. [online] Available at: http://www.budget.gov.ie/Budgets/2017/Documents/Sugar-Sweetened_Drinks_Tax_Public_Consultation_final.pdf.

CircleCI. (n.d.). *Continuous Integration and Delivery*. [online] Available at: <https://circleci.com>.

Couchdb.apache.org. (n.d.). *Apache CouchDB*. [online] Available at: <http://couchdb.apache.org>.

Dehaghani, S.M.H. and Hajrahimi, N., 2013. Which factors affect software projects maintenance cost more?. *Acta Informatica Medica*, 21(1), p.63.

Dialogflow. (n.d.). [online] Available at: <https://dialogflow.com/>.

Docker. (n.d.). *Docker Documentation*. [online] Available at: <https://docs.docker.com>.

Fielding, R., 2000. *Representational state transfer (REST). Chapter 5 in Architectural Styles and the Design of Networkbased Software Architectures* (Doctoral dissertation, Ph. D. Thesis, University of California, Irvine, CA).

Flask.pocoo.org. (n.d.). *Flask (A Python Microframework)*. [online] Available at: <http://flask.pocoo.org>.

Flask Injector. (n.d.). *alecthomas/flask_injector*. [online] Available at: https://github.com/alecthomas/flask_injector.

Fsai.ie. (2011). *REGULATION (EU) No 1169/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL*. [online] Available at: https://www.fsai.ie/uploadedFiles/Consol_Reg1169_2011.pdf.

GTIN INFO. (n.d.). *GTIN DEFINITION : INFORMATION - GTIN INFO*. [online] Available at: <https://www.gtin.info>.

Kozup, J.C., Creyer, E.H. and Burton, S., 2003. Making healthful food choices: the influence of health claims and nutrition information on consumers' evaluations of packaged food products and restaurant menu items. *Journal of Marketing*, 67(2), pp.19-34.

Malik, V.S., Popkin, B.M., Bray, G.A., Després, J.P., Willett, W.C. and Hu, F.B., 2010. Sugar-sweetened beverages and risk of metabolic syndrome and type 2 diabetes: a meta-analysis. *Diabetes care*, 33(11), pp. 2477-2483.

OpenAPI-Specification Github. (n.d.). *OAI/OpenAPI-Specification*. [online] Available at: <https://github.com/OAI/OpenAPI-Specification>.

Pouchdb.com. (n.d.). *PouchDB, the JavaScript Database that Syncs!*. [online] Available at: <https://pouchdb.com>.

Revenue.ie. (2018). *Sugar Sweetened Drinks Tax*. [online] Available at: <https://www.revenue.ie/en/companies-and-charities/excise-and-licences/excise-duty-rates/sugar-sweetened-drinks-tax.aspx>.

Schulze, M.B., Manson, J.E., Ludwig, D.S., Colditz, G.A., Stampfer, M.J., Willett, W.C. and Hu, F.B., 2004. Sugar-sweetened beverages, weight gain, and incidence of type 2 diabetes in young and middle-aged women. *Jama*, 292(8), pp.927-934.

Slack. (n.d.). [online] Available at: <https://slack.com>.

Swagger.io. (n.d.). *OpenAPI Specification | Swagger*. [online] Available at: <https://swagger.io/specification/>.

Typescriptlang.org. (n.d.). *TypeScript - JavaScript that scales.*. [online] Available at: <https://www.typescriptlang.org>.