Universal Food Allergy Number

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ABSTRACT

In 2007 the European Union defined a list of 14 food ingredients which are likely to cause adverse reactions in susceptible individuals. As such, legislation mandates that these ingredients must be indicated on the label of relevant foodstuffs. However, there is no machine readable standard for the declaration of these ingredients. We propose to encode this information in a 5-digit number. The number can either be added to items on a menu card or printed as a barcode on food products. Further, we propose a complementary, 5-digit number which contains information about food allergies of an individual. The number is short enough to share verbally, for instance over a phone call for a restaurant reservation. By comparing both sets of numbers as a food allergy test, individual intolerances are immediately visible. As a proof of concept, we developed an app enabling users to quickly check whether or not foodstuffs are safe to consume based on their allergies.

Author Keywords

Health; Food Allergies; GS1; Barcode; Allergy Check.

ACM Classification Keywords

J.3 Life and medical sciences: Medical information systems.

MOTIVATION

Food allergy is an abnormal response to a food triggered by the body's immune system. In the developed world between 4% and 8% of people have at least one food allergy [1]. Other studies indicate that food allergies, in particular allergy to peanuts, are on the rise. As a result, more and more people are becoming aware of food allergy safety, making it a subject of increasing public concern [2]. The European Union established a list of the 14 most prevalent food ingredients which can cause food allergy reactions and which by law must be indicated on the label of foodstuffs [3]. There are similar regulations in the United States [4] and other countries. The recently introduced EU Food Information Regulation [5] on the provision of online food information requires manufacturers and brands to provide ingredient and allergen declaration of food products in an electronic form, via a publicly accessible product database. Additionally, companies have started offering products and services which help deal with individuals' food allergies. For example, wristbands are available that hold personal allergy data ready in case of an emergency.

In spite of such progress, we identified two gaps which are still unsolved. First, the existing concepts deal only with the

foodstuff or with the people's health data. But, there is no approach to automatically combine both together. As such, consumers still have to check manually if they are safe to eat a food product. Second, there is no solution which works both online and offline. Extra search and transaction costs are incurred as product databases with allergy information are only available online. However, dealing with food allergies is often separated from online processes. For instance, people still prefer to make a phone call when reserve a table for dinner in a restaurant. Two other offline examples are shown in Figure 1.
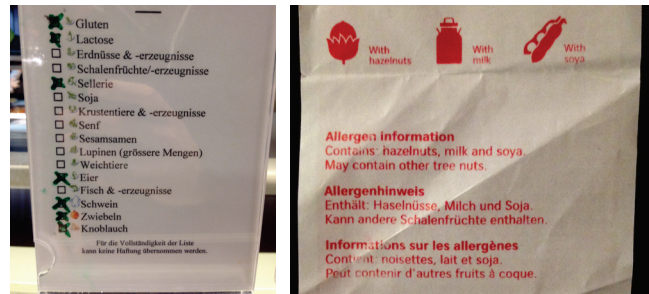

Figure 1. Two offline examples of ingredient declaration related to food allergies. Left: meal declaration on the counter of a university canteen. Right: chocolate snack packing.

SOLUTION

The key idea of our solution is to encode all 14 EU-defined food allergies into a single 5-digit number. The number is short enough to keep it simple for a typical customer and to integrate it in automated business processes. We propose to put the number in a standard GS1 EAN-8 barcode to bridge the gap between the offline and online world. Such a machine readable code is not only helpful for end consumers, it also supports processes in the supply chain management, in which barcode technology has a long tradition. The two kind of food allergy numbers are explained in the following subsections. In the third subsection, the numbers are combined to a food allergy test.

Food Allergy Number for Food Products

Labeling food products with an adequate allergy declaration is a challenge. The allergy information on foodstuff is required by law, but the lack of space on the packaging and machine readability are two main issues. A standardized process would be beneficial to manufacturer and consumer [6]. We propose to use a barcode to provide all necessary information. Figure 2 shows how food allergy data are encoded in a 5-digit decimal number that can be part of a GS1 EAN-8 barcode. Transformed into the binary number system, the number has 15 bits, one bit for each food ingredient who is likely to cause adverse reactions. The 15th bit is used for 'other' food allergies. The barcode can be put on food products, menu cards, etc. Consumers can then simply check with a barcode scanner on their smartphones if a product is edible for them or not. Thanks to the

Figure 2. Left: 5-digit food allergy number as a GS1 EAN-8 barcode. The binary representation of the number allows to encode the existence ('1') or absence ('0') of the food ingredients. Right: Example of an enhanced menu card.

Figure 3. Screenshots of our food allergy check application. Left: select user's allergies. Right: Check food by scanning or manually entering the food allergy number.

shortness of the number, it can also be printed without the related barcode, as shown in Figure 2, right.
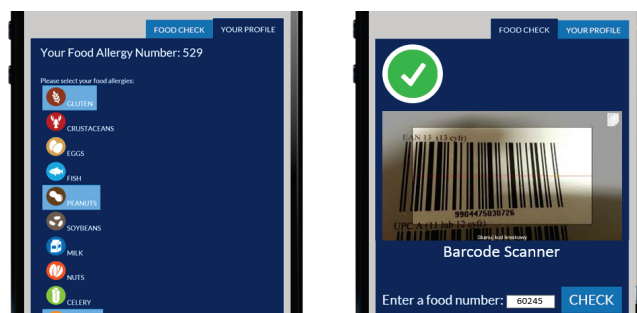
Food Allergy Number for Humans

Complementary to food products, all possible combinations of food allergies can be encoded as a 5-digit number for people. Individuals generate their own number where all personal food allergies are encoded. Similarly to the food products, the binary representation of the number provides a single bit for each allergy. '0' means that the person as no allergy related to the specific ingredient, '1' means that there is one. People can share the number with family and friends; (When one person in a family has a food allergy, the whole family is affected [2].) in case of emergency with the doctor or hospital; or easily use it for flight, hotel or restaurant reservations in order to inform about their allergies. Since the 5-digit number is very brief, it is easy to remember, to type in an online reservation form or to mention it in a phone call. The number is language independent, i.e. usable worldwide, and it can be printed on the personal insurance card, medical bracelet, etc. Children are particularly vulnerable as they may not be able to communicate their allergies, and the literature recommends parents to establish a collaborative partnership between school and family [7]. Thanks to the standardized number, the school is easily able to receive, store and use children's allergy information.

Food Allergy Check

The number for humans can be compared with the number for food products by the bitwise AND operator on its binary representations. The resulting binary number is then interpretable as follows: '1' on a specific position means that there is a conflict between user and product; '0' marks no conflict. If the complete resulting number (binary or decimal) is zero, no food allergy conflict is expected and the food product can be eaten without any concerns.

PROTOTYPE

We developed a mobile application with the aim to demonstrate the efficiency and power of the presented food allergy number. Such an application is just one use case and there are many other ways to apply the number in our daily life. The prototype works as follows: First, the user enters her allergy profile by selecting the allergies she is suffering under. The individual food number is immediately determined and displayed on the top of the screen. As a second step, the user can compare her own food allergy profile with the number of any food she wants to check. As shown in Figure 3, the user can check the foodstuff by either using the integrated barcode scanner, or entering the

number manually into the text field,. The matching result is shown by a tick mark immediately if there is no conflict. Otherwise, the problematic food ingredients are displayed. As all necessary information is stored in the food allergy number itself, as such, the app works offline as there is no connection to an online database or service required.

DISCUSSION, LIMITATIONS AND FUTURE WORK

We present the idea of a universal food allergy number. This number could potentially help society to better handle the severe and growing problem of food allergies. The short number contains all necessary information to prevent people from suffering under food allergy symptoms. There are already several commercial approaches available combating this problem, however, none of them are understandable worldwide, nor usable both online and offline. We present a prototype application to address this gap, making use of the proposed universal food allergy number. In future work, we plan to a conduct a field study in a restaurant with real customers to evaluate the prototype. Since the implementation of this service is simple, the focus of the study will be on the user acceptance. Unfortunately, there are certainly limitations and difficulties in promoting a global standard for such a number. However, non-profit organizations such as GS1, main issuer of unique product identifiers worldwide, could initiate such a standard. For example, the barcodes on the usual retail products are released by and defined by GS1. Today, GS1 rules do not allow more than one barcode on a product and most products already carry one as a product identifier. The food allergy barcode could then at least be marked or appear in another color or shape. An alternative solution may store the information in a QR-Code which can be read with similar scanner technology and would be able to handle even more than the given 14 food allergies.

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