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VITALENS: An AI-Powered Personal and Family Health and Cosmetic Assistant

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ABSTRACT

Reading ingredient labels can be difficult for people with allergies and for families with different needs. VITALENS is a prototype that screens food and cosmetic ingredient text against stored personal and family profiles. It accepts barcode input and ingredient-label photographs for OCR, then applies keyword rules to flag potential allergens or concerns. For a supported product, barcode scanning retrieves the product name and ingredient list. Unmatched items are labelled "not evaluated" rather than safe. Nine test cases (T1–T9) have been executed, but no formal accuracy, usability or performance evaluation has been conducted. The system is an information aid, not a diagnostic tool.

Keywords: ingredient screening; barcode scanning; optical character recognition; allergen alerts; family profiles

1. Introduction

Packaged foods, cosmetics, skincare and haircare products are used in almost every household, yet the information that determines whether a product suits a particular person is printed in small type as a long ingredient list. People with allergies or sensitive skin must interpret unfamiliar names, and in a family the same exercise must be repeated for every member. The task is slow, depends on personal knowledge and is easily skipped when the buyer is in a hurry. Mobile tools have been proposed to reduce this effort. Wong et al. (2017) describe an application that obtains an ingredient list by barcode scanning or by recognising the text of the ingredient label, and that alerts the user to allergens. Kına (2025) reports an OCR-based allergen detection system and measures how its accuracy changes between offline and real-time image tests. In the skincare domain, Juwanda and Mat Zin (2021) describe an application that recommends ingredients according to skin type. These works address food or skincare separately. We do not claim that VITALENS is novel in any single capability; it is an integration prototype that explores whether one application can accept barcode and label photograph input, handle both food and cosmetic ingredient text, keep several family profiles under one account, and state explicitly when an ingredient has not been evaluated. The problem addressed is therefore the repeated, error-prone comparison of ingredient lists against the needs of several people. The objectives of this work are: (i) to design and implement a prototype that identifies or captures a product, extracts its ingredient text and compares it with stored profiles; (ii) to document its architecture, workflow and analysis rules; and (iii) to report, without overstatement, which features are demonstrated, which are only partly implemented, and what has not yet been evaluated.

VITALENS provides information to support a decision. It does not diagnose any condition and does not replace qualified healthcare professionals. The remainder of this paper reviews related work (Section 2), describes the materials and methods (Section 3), presents results and discussion (Section 4), states limitations (Section 5), and concludes with future work (Section 6).

2. Review of Literature

2.1 Barcode-Based Product Identification

Retail products carry linear barcodes whose identification numbers and symbologies, such as EAN-13 and UPC-A, are specified in the GS1 General Specifications (GS1, n.d.). A barcode encodes a product number rather than the ingredients, so a database that associates the number with product data is needed to obtain an ingredient list. Camera-based reading is practical on mobile phones, but image resolution, focus and motion blur affect reliability; Gallo and Manduchi proposed a deformable-template method for reading one-dimensional barcodes from camera-phone images (Gallo & Manduchi, 2011).

2.2 OCR for Ingredient Labels

Optical character recognition converts text in an image into machine-readable characters. The Tesseract engine, described by Smith (2007), is a widely used open-source example. Ingredient labels are a demanding case because the text is small and often printed on curved or reflective packaging. Kına (2025) notes that OCR errors caused by poor image quality, complex label design or misspelled extracted text limit real-time allergen prediction, and Wong et al. (2017) combine barcode scanning with direct label recognition for products absent from their database. Extracted text therefore needs review and cleaning before it is compared with a rule set.

2.3 Allergen and Ingredient Screening Applications

Wong et al. (2017) report a preliminary user study of their label-reading adviser and describe allergen alerts together with health suggestions. Kına (2025) evaluates several classifiers on ingredient text and an OCR pipeline on label images, reporting lower accuracy in real-time image testing than in offline testing. Juwanda and Mat Zin (2021) report positive usability feedback from 30 respondents for a skincare application that recommends ingredients by skin type. None of these results can be transferred to VITALENS, which uses a different rule-based design and has not been evaluated in this manner.

2.4 Personalised and Context-Aware Recommendation

Recommender systems are commonly classified as content-based, collaborative or hybrid, and the incorporation of contextual information is a recognised extension (Adomavicius & Tuzhilin, 2005). Matching product attributes (ingredients) against user constraints (allergies, skin type) is a content-based, rule-driven form of personalisation that can show which ingredient caused a flag. VITALENS follows this style and treats local weather as advisory context only.

2.5 Research Gap and Contribution

The reviewed works do not, to our knowledge, describe a single open prototype that combines barcode and label-photograph input, food and cosmetic ingredient text, multiple family profiles per account and an explicit “not evaluated” state. The contribution of this paper is a documented prototype of that combination and an honest account of its evidence and limits. We make no claim of superiority over existing tools.

3. Framework and Methodology

3.1 System Overview and Workflow

The user creates an account by entering a full name, age, skin type (normal, dry, oily, combination or sensitive), allergies, health conditions, email and password. After signing in, the user can view the stored profile and add family members, each with a name, relationship, age, skin type, allergies and health conditions. On the “Scan product” screen the user either scans a barcode with the camera or selects a photograph of the ingredient label for OCR; the form also accepts manual entry of the barcode, product name (required), brand, product category and ingredient text (required), so extracted text can be reviewed and corrected before analysis. Pressing “Analyse product” opens a results screen that lists every ingredient item with a status, shows allergy alerts for stored family members, and displays a weather tip and a notice that the output is an information aid.

3.2 Architecture

Figure 1 shows the architecture as implemented or evidenced. A front end built with Flutter provides the screens (Flutter, n.d.). The project report specifies cloud authentication and a cloud document database for accounts, profiles and history, and a JSON ingredient dataset for ingredient attributes (Firebase, n.d.). Barcode and label inputs feed a parser; the parser output is matched against keyword rules; and the per-item result is displayed together with family allergy alerts and a weather tip. Product lookup by barcode, product alternatives, a tracker with reports, nearby healthcare services and language-model explanations appear in the project documents as designed or proposed features and are drawn with dashed outlines because they are not demonstrated in the supplied evidence.

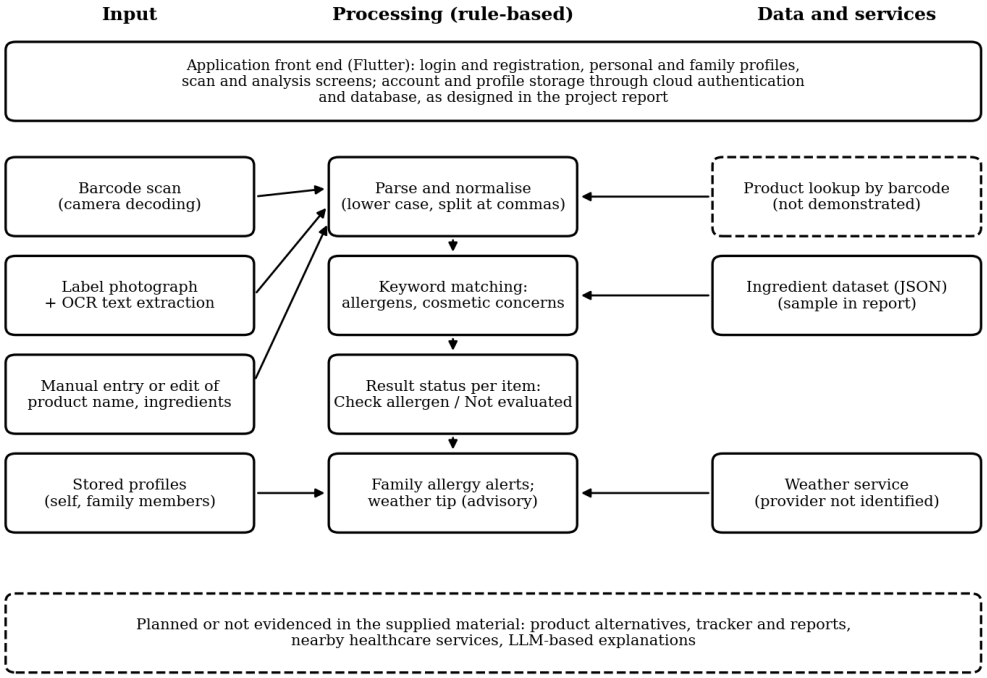


Fig. 1 - Architecture of the VITALENS prototype. Solid outlines indicate implemented or evidenced components; dashed outlines indicate features not demonstrated, planned or proposed.

3.3 Ingredient Analysis Procedure

The analysis logic listed in the project report is a deterministic, keyword-based procedure. The steps are:

(1) The ingredient text, typed, extracted by OCR or taken from the form, is converted to lower case.

(2) The text is split into items at commas and each item is trimmed of surrounding spaces.

(3) Each item is compared with a list of allergen keywords (the listing in the report contains milk, peanut, wheat, egg, soy and sesame). A match produces the status “check allergen”.

(4) Items matching cosmetic-concern keywords (parfum, fragrance, alcohol denat) receive the status “review”.

(5) Every other item is not judged safe; the interface labels it “not evaluated” with the note that its safety is unknown.

(6) A summary message is chosen by priority: potential allergen detected, then review ingredients, then no listed match with a reminder to check the full label.

3.4 Implementation and Technologies

According to the project report, the application is written in Dart using the Flutter framework, which targets several platforms from a single codebase (Flutter, n.d.); user accounts and profile data are handled with Firebase Authentication and Cloud Firestore, with access rules restricting documents to the signed-in owner (Firebase, n.d.); and barcode decoding and image selection use the mobile_scanner and image_picker packages shown in the report’s code listing. The specific OCR engine, the weather service and the barcode-to-product data source are not identified in the supplied material. The supplied screenshots were captured from the application running in a desktop web browser (a browser file chooser is visible in the OCR capture); a run on a physical Android device is not shown.

5. Results and Discussion

5.1 Evidence Base and Evaluation Method

The project report contains a feature-status table and a test-case table of nine cases covering registration and login, profile creation, family profiles, barcode scanning, OCR, ingredient analysis, analysis for a second member and use with location denied. The authors report that all nine cases (T1–T9) were executed and that the application was demonstrated to the project guide. The authors additionally confirm that, during barcode testing, scanning a supported barcode retrieved the product name and ingredient list automatically. This confirms the feature for the tested product, but does not establish

database coverage or retrieval accuracy across products. The supplied material does not document pass/fail outcomes for every test case. No timing measurements, accuracy figures, sample sizes or user-study data were supplied, so no formal performance metric is computed. The evidence examined consists of the team's status classification (Table 1), screenshots and code listings in the report. As a plausibility check, the EAN-13 check digit of the displayed barcode number was recomputed and found to be valid. A successful example does not establish general accuracy.

5.2 Implementation Status

Table 1 - Feature status based on the project report and evidence reviewed.

Feature	Status	Evidence examined
Registration and login	Implemented	Login and registration screens (D1–D2)
Personal profile	Implemented	Profile screen with stored fields (D3)
Family member profiles	Implemented	Add-member dialog and members listed in results (D4, D8)
Barcode scanning	Implemented and tested for a supported product	Barcode scan retrieved product name and ingredient list in the authors' test; broader coverage and accuracy not measured
OCR ingredient extraction	Partial	Label image selected and text field populated (D6); accuracy not assessed
Ingredient database lookup	Partial	Dataset sample in report; lookup behaviour inferred from flag results only
Allergen / concern identification	Partial	Five of 14 items flagged for one food (D7); rule-set inconsistency noted
Family-member-specific scoring	Partial	Alert and allergy listing shown (D8); no per-member suitability scoring shown
Personalised recommendations and alternatives	Partial	Generic advisory message shown (D7–D8); no alternatives shown
Location/weather-aware flags	Partial	Temperature and humidity text shown (D9); weather does not change suggestions
Tracker and reports	Planned	No evidence supplied

5.3 Observed Behaviour

Figures 2 and 3 reproduce the barcode, OCR and analysis screens. The authors confirm that barcode scanning retrieved the product name and ingredient list for a supported product during testing. However, the product name differs between supplied captures ("Marie Gold" in the report figures; "Biscuits", brand Britannia, in a later capture), and the label image chosen in the OCR capture lists pistachio, almond and cashew quantities that differ from the text analysed in D7. D5–D7 therefore must not be read as one continuous end-to-end run; broader retrieval coverage and end-to-end accuracy have not been measured.

Table 2 - Observed behaviour in the supplied screenshots; no pass/fail judgement is made.

ID	Scenario	Observed evidence	Status
D1	Login screen	Email/password fields, Login button, Create account and Forgot password links; informational medical disclaimer visible.	Observed
D2	Registration	Fields for name, age, skin type, allergies, health conditions, email and password; one test profile entered.	Observed at sign-up
D3	Personal profile	Name, email, age, skin type, allergies and health conditions shown with an Edit profile action.	Observed
D4	Family member	Dialog includes name, relationship, age, skin type, allergies and health conditions; members appear in results.	Observed

ID	Scenario	Observed evidence	Status
D5	Barcode scan	Barcode number 8901063028210 was decoded; the authors confirm that scanning a supported product retrieved its product name and ingredient list. This specific retrieval was tested; general coverage is not measured.	Observed; retrieval confirmed for tested product
D6	Label photograph / OCR	Image selected through file chooser; ingredient field contains text ending "CONTAINS WHEAT, NUTS, MILK AND SOYA." Fidelity to label not measured.	Observed; accuracy not assessed
D7	Ingredient analysis	Of 14 listed items, 5 were flagged "check allergen" and 9 "not evaluated"; "Wheat" and "Nut" were among the un-evaluated items.	Observed; inconsistency noted
D8	Two family profiles	Banner lists both members' allergies and asks user to verify; interface states that the prototype does not automatically diagnose compatibility.	Observed; no scoring
D9	Weather tip	Two captures show 28.1 °C / 67% humidity and 28.9 °C / 60% humidity, with advisory text.	Observed in two captures

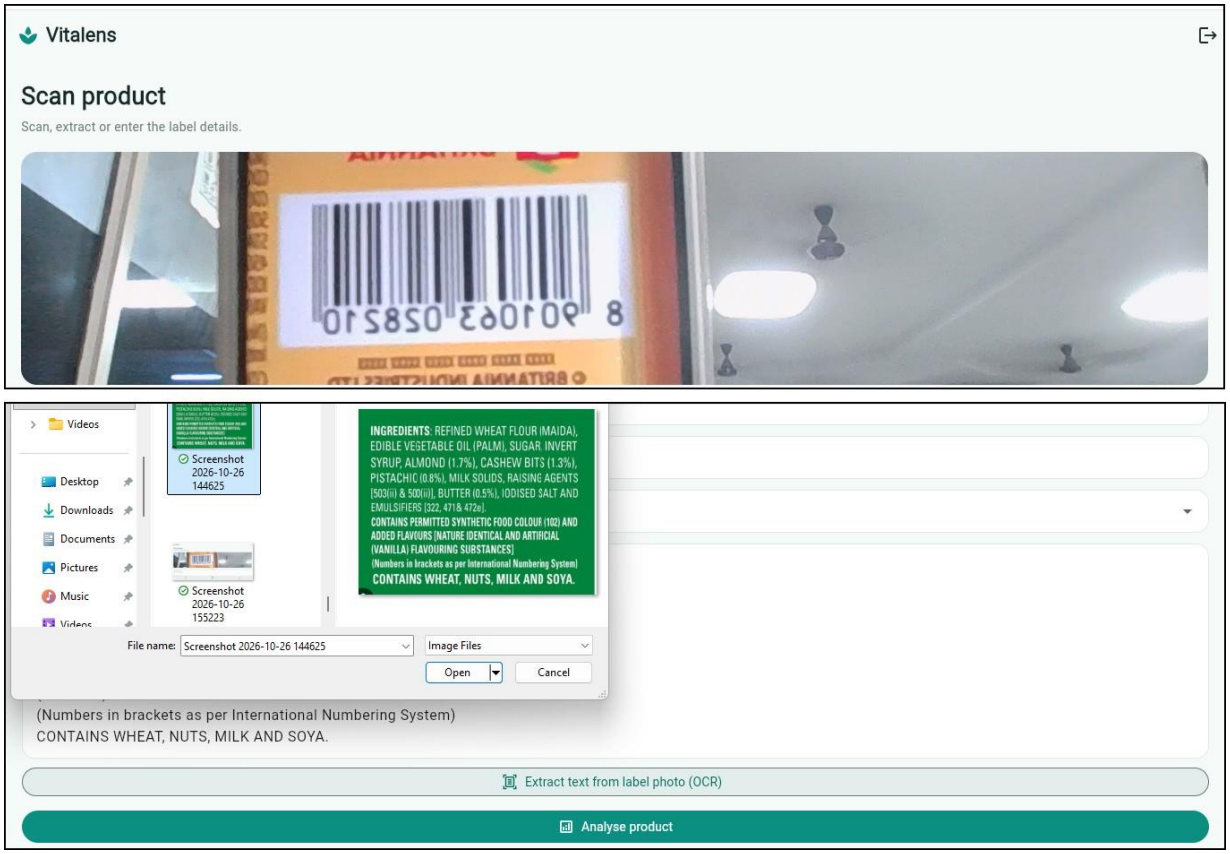


Fig. 2 - Barcode-scanning and OCR text-extraction screens of the prototype, captured in a desktop web browser.

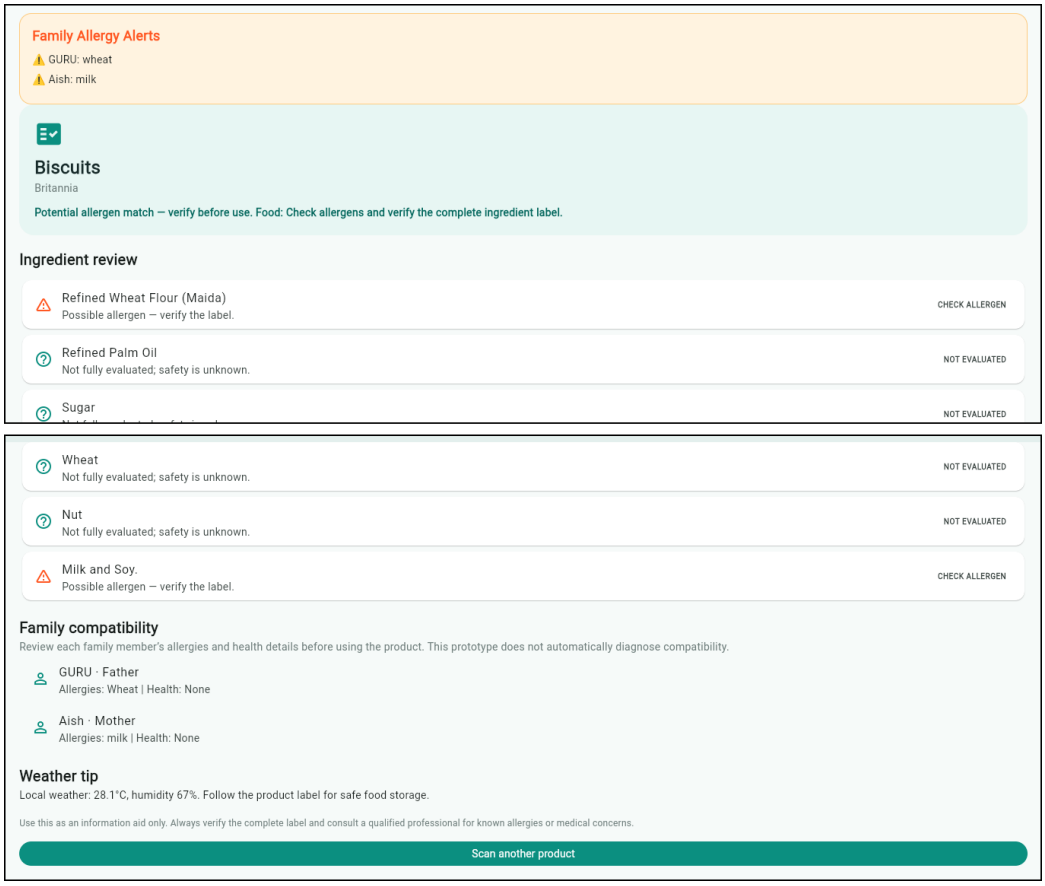


Fig. 3 - Analysis results showing family allergy alerts, ingredient review, family listing and weather advice.

5.4 Discussion

The screenshots show that the main user journey exists: profile creation, barcode decoding, label-based text entry, per-item ingredient status, allergy alerts for stored members and an advisory weather tip. A design choice that is visible in the interface and worth keeping is that ingredients without a matching rule are labelled “not evaluated; safety is unknown” rather than being implied safe, which is consistent with the cautious role of an information aid. The observations also expose weaknesses that a reader should weigh. First, splitting at commas breaks bracketed lists: the emulsifier entry appears as two fragments (“Emulsifiers [322(i)” and “471 & 472e]”), and the trailing declaration “Contains: Wheat, Nut, Milk and Soy.” becomes three items. Second, “Milk and Soy.” is flagged while the separate items “Wheat” and “Nut” are marked “not evaluated”, although refined wheat flour and cashew are flagged; this shows that the matching is not a uniform substring test over the listed keywords and needs investigation. Third, the family section lists each member’s allergies but, as the screen states, does not compute compatibility, so member-specific suitability is only partly realised. Fourth, flagging an item shows that a keyword matched, not that the product is unsuitable for a particular person. The nine test cases in the project report are listed in Table 3. All nine (T1–T9) have been executed by the authors; their observed outputs and pass/fail outcomes are not documented in this manuscript, so Table 3 records execution status only and does not claim that any test passed.

Table 3 - Test cases T1–T9 and their execution status. All nine were executed; the table does not imply that every expected outcome was independently verified.

ID	Test case	Expected result	Status
T1	Register and log in with valid details	Account created and home screen opens	Executed
T2	Create a personal profile with an allergy and skin type	Profile saved and shown on reopening	Executed
T3	Add a family member profile	Member appears in profile list	Executed
T4	Scan a barcode with a supported product record	Product name and ingredient list are retrieved and displayed	Executed
T5	Scan a barcode absent from the data	Clear message; label-capture option offered	Executed

ID	Test case	Expected result	Status
T6	Capture a clear ingredient label	Text extracted and shown for review	Executed
T7	Analyse a product containing a profile allergen	Allergen flagged with a reason	Executed
T8	Analyse same product for another member	Result differs according to member profile	Executed
T9	Use application with location denied/unavailable	Application works; weather suggestion unavailable or handled gracefully	Executed

6. Limitations

This work has the following limitations. (1) No formal evaluation was performed: OCR accuracy, allergen-flag recall and precision, response time and usability are unmeasured. Although all nine test cases were executed, detailed observed outputs and pass/fail outcomes are not recorded for every case. (2) Barcode-based product-name and ingredient retrieval was confirmed for a supported product, but database coverage and retrieval accuracy across a representative product set have not been measured. (3) The evidence comes from a few screenshots and one packaged food; the demonstrations are not a continuous end-to-end run. (4) The screenshots were captured in a web browser, so behaviour on a mobile device is not shown. (5) The rule set is small, ingredient splitting is naive, and synonyms or regional names (for example, maida for refined wheat flour) are not systematically handled. (6) Product alternatives, member-specific scoring, and the tracker and reports are not demonstrated. (7) The weather tip does not influence ingredient analysis. (8) The report's listing of Firestore security rules covers only the users collection, while the database listing names further collections for family members, ingredients and analyses; the rules for those collections must be checked, because profiles contain allergy and health details. (9) Cross-contamination and "may contain" statements are not modelled. The application must not be used to decide safety for a person with a known allergy or medical condition; the product label and a qualified professional remain the authority.

7. Conclusions and Future Work

VITALENS is a prototype that brings together personal and family profiles, barcode-based product identification and ingredient retrieval for supported products, label-photograph input, keyword-based ingredient screening and an advisory weather tip. It labels unevaluated ingredients explicitly. The available evidence demonstrates the main screens and a first, partly inconsistent ingredient-flagging behaviour for one food product. It does not support claims about general retrieval coverage, accuracy, usability or performance, and the work should be regarded as an early prototype. Future work should document detailed outcomes for each test case and build a labelled set of products and label images to measure barcode retrieval coverage, OCR error, ingredient-extraction quality and allergen-flag recall, since missed allergens are the most serious failure. Further steps include a bracket-aware ingredient parser and synonym lexicon, validation of the barcode-to-product data source, member-specific analysis, evaluation on cosmetic labels, review of database security rules and a usability study with appropriate ethical approval. Any language-model explanation should be added only after its outputs have been validated against label text.

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