

Nutri Scan: An NFC enabled Salad Counter (Team 23)

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ABSTRACT

Maintaining health is critical, and a healthy diet plays a significant role in achieving it. Often, we consume foods without knowing their nutritional value, making it essential to ensure our diet contributes to a healthy lifestyle. Our project aims to address this issue through NFC-enabled salad counters, allowing users to scan ingredients with NFC tags storing health index information, including calories, fat, and proteins. Upon scanning, an Arduino stores this information and displays the health score on a screen, offering an instant evaluation of the salad's health value. This real-time function enables informed dietary choices.

Our idea of NFC-enabled healthy salad counters combines technology with a health-focused strategy to promote healthier eating. Despite numerous salad counter options, the focus on health and nutritional qualities is often overlooked. Our solution aims to elevate salad counters by integrating NFC technology with Arduino, providing real-time nutritional information and enabling informed ingredient selection. NFC technology is user-friendly and adaptable, enhancing the convenience of salad counters, which are already popular for offering healthy meal options.

In summary, our project leverages NFC technology and Arduino to create an innovative and user-friendly solution for promoting healthier eating habits. By integrating NFC-enabled salad counters, we provide users with real-time nutritional information about their chosen ingredients, including calories, fat, and proteins. This system empowers individuals to make informed dietary choices by instantly displaying a health score on a screen after scanning the NFC tags. Our approach not only enhances the convenience of selecting healthy meal options but also ensures that nutritional value becomes a focal point in the decision-making process. This blend of technology and health-focused strategy aims to transform salad counters into more informative and beneficial tools for maintaining a healthy lifestyle.

1 Introduction

“True wealth is having your health and knowledge of yourself,” said Benjamin Franklin. This quote holds significant value in today's society, where neglecting health can lead to severe consequences impacting both wealth and well-being. Fortunately, solutions exist. Eating well is a key strategy for living a happy, fulfilled, and healthy life. In contemporary society, cautious

dietary choices are essential, as poor decisions can have far-reaching health impacts. By incorporating healthier items into our

daily diets, we can reduce potential adverse consequences. With rising health consciousness, various salads have become a staple for both children and adults. To promote healthier eating, we devised NFC-enabled healthy salad counters, combining technology with a health-focused strategy. NFC technology is user-friendly and easily adopted by end users. Salad counters, offering convenient healthy meal options, often overlook health and nutritional qualities. Addressing this gap, our solution enhances salad counters by integrating NFC technology with Arduino, providing real-time nutritional information for informed ingredient selection.

Here's how it works: Users at a dedicated salad counter select ingredients or purchase pre-measured sachets or packets. They then scan their ingredients using our NFC-enabled reader. Once scanning is completed, the user presses the button to make the system proceed with index calculation. The system displays the health index of the screen, categorizing it as healthy, moderately healthy, or not healthy based on the score. We are giving users two more interaction options: NutriBreak, which allows users to see the nutritional breakdown of individual ingredients on display, and NutriText, which allows users to get nutritional breakdowns on their personal smartphones. This approach leverages technology to encourage healthier eating habits.

2 Related Work

Nutritional Assessment of Ready-to-Eat Salads in German Supermarkets: Comparison of the nutriRECIPE-Index and the Nutri-Score –

This research, published in "Foods," an open-access journal by MDPI, proposes two methodologies for measuring the nutritional index: the "nutriRECIPE-Index" and the "Nutri-Score." The nutriRECIPE-Index categorizes nutrients as desirable or undesirable, while the Nutri-Score assigns a color code based on nutritional content, enabling easy assessment of a food's health index. Our NFC-based salad counter project aims to address the challenge of understanding the nutritional value of salad ingredients and providing real-time assessments. This study can

help us standardize the calculation of ingredient nutritional values, ensuring more accurate and useful assessments.

NFC in the Food Service Industry: Quick Service Solutions -

This source discusses how NFC technology enhances the food industry by improving user experience and operational efficiency. NFC enables features like contactless payments, personalized promotions, and quick order processing. By integrating NFC solutions, food businesses can improve efficiency, customer satisfaction, and loyalty programs, staying competitive in the market. Our solution aims to integrate NFC technology with salad counters, enhancing user satisfaction and promoting a healthy lifestyle. This seamless integration will provide a health-centric angle while improving user experience.

Choice Green Salad Nutritional Value Calculator - This tool allows users to customize salad ingredients, choosing from categories like lettuce, toppings, grains, proteins, cheeses, nuts, and dressing. It then displays the nutritional values based on the selected ingredients. Similar to our goal, this tool provides nutritional analysis of salad ingredients. However, our solution focuses on real-time functionality, enhancing user experience and convenience, and helping users make better dietary decisions before purchasing. These sources collectively support our NFC-enabled salad counter project by offering insights into nutritional assessment methodologies, the integration of NFC technology, and tools for nutritional analysis, all of which contribute to a more informed and health-conscious user experience.

3 Use Cases

User Persona:

Username	Fiona Anderson
Age	35
Location	Berlin, Germany
Occupation	HR manager
Needs	She wants to be sure the components she chooses are healthy, so she's looking for a solution or system that would assist her make wise and healthy decisions

Photo



Use Case 1: Assessing Salad Health

Scenario: Fiona is at the supermarket selecting ingredients for her dinner salad and wants to check its overall healthiness.



User Flow:

- Fiona enters the supermarket's dedicated salad ingredients section.
- She picks pre-measured packets of desired ingredients.
- Fiona proceeds to the NFC-enabled salad counter.
- The screen prompts her to scan the ingredients and press "Done" once finished.
- Fiona presses the button, and the system calculates the overall health index of her chosen ingredients.
- The screen displays the health score and categorizes the salad as Healthy, Moderately Healthy, or Not Healthy.

Use Case 2: Checking Nutritional Breakdown

Scenario: Fiona wants to check the nutritional breakdown of a single product on the salad counter display.

Nutri Scan: An NFC enabled Salad Counter (Team 23)



User Flow:

- Fiona enters the supermarket's dedicated salad ingredients section.
- She picks up the ingredient to check its nutritional value.
- Fiona proceeds to the NFC-enabled salad counter.
- The screen offers two options: 1. Scan ingredients, 2. Check nutritional breakdown.
- Fiona selects the option to check nutritional breakdown and scans the ingredient.
- The screen displays the nutritional values of the selected ingredient.

Use Case 3: Retrieving Information on Smartphone

Scenario: Fiona, being tech-savvy, wants to get the nutritional information from Use Case 2 on her smartphone to keep records.



User Flow:

- Fiona opens Telegram on her phone and accesses SaladcounterBot.
- She scans or enters the ID of the chosen ingredient.
- Fiona receives the detailed nutritional breakdown in the Telegram chat window.

4 Implementation

4.1 Design

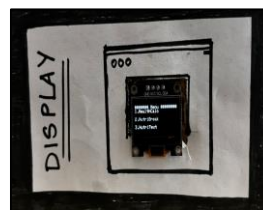


Figure 1: OLED Display



Figure 2: NFC Reader



Figure 3: Breadboard, Buzzer, Pushbutton setup

Our design is consisting of three main components-

1. NFC reader, allowing users to scan the ingredients and obtain information about the healthiness of their salad combination.
2. A breadboard with all hardware attached includes a buzzer that provides feedback to the user.
3. OLED display allows the user to navigate the system and view information.
4. The Telegram bot allows users to provide input to the system, which then selects the mode based on the user's demands.

4.2 Hardware

- ESP8266 Wemos D1 mini
- NFC Card Reader (PN532)
- Buzzer
- Resistors
- OLED Display (SSD1306)

4.3 Libraries

- NFC Reader: Adafruit PN532@ 1.3.3
- OLED Display: SSD1306@ 2.2.3
- UniversalTelegramBot @ 1.3.0

4.4 Health index calculation

We're utilizing different NFC cards to represent different ingredients. (In the actual situation, tags will be connected to the ingredient packet, however for demonstration purposes, we are utilizing cards.)

Each of these NFC cards contains the health index for that specific ingredient, for our project, we utilize secondary data sources, including articles, books, and online resources, to develop a generalized health-index formula based on research and AI models. This formula calculates the Health Index (HI) for food items, considering essential factors like nutritional content, caloric content, harmful substances, natural ingredients, and processing level.

The Health Index formula:

The Health Index formula:

$$HI = \sum_{i=1}^n w_i \cdot s_i$$

For example, with weights assigned to nutritional content (0.30), caloric content (0.20), harmful substances (0.25), natural ingredients (0.15), and processed level (0.10), and corresponding scores of 80, 70, 50, 90, and 60, the health index provides a normalized value between 0 and 100. This formula helps to determine the effective Health Index for each food item, enhancing dietary choices.

For example,

Tomato:

Nutritional content: 80 (weight: 0.30)

Caloric content: 70 (weight: 0.20)

Harmful substances: 50 (weight: 0.25)

Natural ingredients: 90 (weight: 0.15)

Processing level: 60 (weight: 0.10)

The Health Index (HI) is calculated as follows:

$$HI = (80 \times 0.30) + (70 \times 0.20) + (50 \times 0.25) + (90 \times 0.15) + (60 \times 0.10)$$

$$HI = 24 + 14 + 12.5 + 13.5 + 6 = 70$$

Tomato HI (Health Index) = 70

Similar way we have used for the other ingredients as well.

4.5 Usage

Our system communicates and provide feedback to users in three ways

Users have provided with 3 modes:

- **Health Calc**
- **Nutri Break**
- **Nutri Text**

1. In HealthCalc, once the user is done with scanning their ingredients and presses the button, the system immediately displays healthiness by categorizing combinations into healthy, moderately healthy, and not healthy on the OLED display.
2. Users can also get detailed nutritional breakdown for individual ingredients. After selecting the NutriBreak, once user scan their ingredient, they get a detailed nutritional breakdown on OLED display.
3. Users also have the option to get a nutritional breakdown on their smartphone. After selecting the NutriText from the menu, once the user scans their

Nutri Scan: An NFC enabled Salad Counter (Team 23)

ingredient, they get a detailed nutritional breakdown in the Telegram chat window of their personal smartphone.

4.6 Challenges & Limitations:

4.6.1 Challenges:

1. **NFC tag data storage and extraction:** We constructed the code and tested it to ensure that the correct data was extracted for further computations.
2. **Telegram bot integration:** We thoroughly tested with numerous inputs to ensure that the end user received the proper response.
3. **Integrating the push button to calculate the final score:** We collaborated on the coding part and designed the code such that it monitors whether the button is pressed or not, and if it is, it ensures that the calculation stops and the result is displayed.

4.6.2 Limitations:

1. **Touch Screen Integration:** Currently, our system uses a conventional OLED display, and users must interact with it via phones or computer keyboards, which can be improved by employing a touch screen, enabling greater accessibility to end users.
2. **Limited Data:** The system is currently developed for smaller scale and stores a limited quantity of data; however, this can be addressed by integrating a backend database to store a large amount of health data.
3. **Suggestions based on user input:** The system is currently not intelligent enough to make user recommendations for alternative healthy ingredients; however, this can be accomplished by properly integrating ML-based models and training them based on user inputs.

5 Pseudo-Evaluation and Results

5.1 User Feedback

The Nutri-index calculator for salads aims to offer real-time

feedback on the nutritional quality of salads prepared at supermarket counters. Utilizing NFC for user identification, along with a buzzer and LED display, the system computes and presents a nutrition score. If the salad exceeds predetermined nutritional thresholds, an audible alert is activated.

This evaluation involved two participants with varying dietary preferences: one who prioritizes health-conscious choices and another who is less focused on health, based on initial research. The objective was to gather their feedback on the system's usability, perceived accuracy of nutritional information, and overall satisfaction. A small user test was conducted where participants used the Nutri-index calculator to create salads, followed by a questionnaire to capture their insights.

User feedback highlighted the system's usability and potential value in everyday supermarket settings. It enabled the health-unaware participant to make informed health choices, while the health-conscious participant validated the accuracy and utility of the data provided. The real-time calorie count feature empowered users to make conscious dietary decisions.

Overall, users appreciated the immediate feedback on their salad's nutritional content and found the display informative. They described the system as intuitive, with an average interaction time of 2 minutes from salad creation to receiving feedback.

It is essential to note that this evaluation was conducted in a simulated scenario and not with actual test data. Therefore, while the findings are hypothetical, they provide valuable insights for future development and rigorous testing of the system.

5.2 Buzzer and visual display effectiveness

Assessing the effectiveness of the buzzer and LED display was a key focus of this evaluation. It aimed to test the accuracy of nutritional scoring and the responsiveness of the buzzer and LED Display when activated manually by participants. The buzzer effectively alerted users when the nutritional score is less than the certain score, providing immediate feedback. The LED Display offered clear visual cues regarding nutritional status, enhancing user understanding.

Overall, the results from this experiment underscore the Nutri-index calculator's potential as a valuable tool, showcasing strengths such as accurate nutritional scoring and reliable user feedback mechanisms through LED Display and the buzzer. Further refinements in the manual input process and buzzer volume could enhance the product's overall effectiveness in practical settings.

These insights provide a solid groundwork for ongoing development and comprehensive testing of the system. The focus is on refining its performance and enhancing user experience for widespread adoption in real-world applications. By continuing to refine and iterate on these aspects, the aim is to maximize the system's effectiveness and usability, ultimately supporting healthier dietary choices among users.

5.3 Results

Real- time Feedback	
Was the feedback accurate according to your expectations?	Yes, the feedback matched their expectations
Did you find the real-time feedback helpful in making healthier salad choices?	The real-time feedback was helpful in guiding the users towards healthier salad choices.
Notifications	
Did the system notify you about any nutritional deficiencies in your salad?	The system notified the health-unaware individual about nutritional deficiencies in his salad.
Were the notifications clear and easy to understand?	The notifications were clear and easy to understand.
LED Display and Buzzer	
Did the LED display and Buzzer contribute to the usability of overall product?	They found that the LED Display was useful to check the calorie count and ingredient values of individual food item. Moreover, getting notified by buzzer when the health index falls to unhealthy status was also helpful.
User Experience	
Was the system easy to use?	Overall, the system was easy to use
Did the feedback enhance your understanding of healthy salad composition?	The feedback greatly enhanced their understanding of healthy salad composition also user's appreciated mode to get feedback on smartphone and most of them found it very helpful to keep track of breakdown.
General Questions	
Would you rate the system's overall performance on a scale of 1-5?	Users rate the system's overall performance as 4 on the pointer scale of 5.
What additional features would you like to have in the system to enhance its capabilities even more?	Participants suggested a quieter, more pleasant notification sound for the buzzer.
Additional Questions for Health-Conscious User	
Did the system meet your expectations for providing detailed nutritional insights?	Yes, the system met the expectations for providing detailed nutritional insights
Additional Questions for Non-Health-Conscious User	
Did the system encourage you to make healthier salad choices?	Yes, the system encouraged the user to make healthier salad choices.
Additional Questions	

Would you recommend this system to others?	The user expresses satisfaction with the system, noting that they would recommend it to others. They found the real-time feedback on their salad's nutritional quality to be accurate and beneficial for making healthier choices. The notifications regarding nutritional deficiencies were clear and helped enhance the nutritional value of their salads. The user found the process of inputting salad ingredients straightforward and appreciated how the system improved their understanding of healthy salad composition. Overall, they found the system's performance satisfactory and credited it for assisting in creating salads that met their dietary goals.
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6 Team Contribution

Task Name	Team Member
Project development (Including code and hardware setup)	Samarth Divya
Background Research and concept formulation	Pranjal
Prototype Design	Divya, Samarth, Pranjal

7 Conclusion

We aimed to solve the problem of providing real-time nutritional information for salads at supermarket counters. Our solution, the Nutri-index calculator, uses NFC technology to scan ingredients and display their nutritional value instantly on an OLED screen. We implemented this by integrating an NFC reader, Arduino, and display system, allowing users to quickly assess the healthiness of their chosen ingredients. User feedback confirmed that the system effectively promoted informed dietary choices. Our key contribution is the development of an easy-to-use tool that

Nutri Scan: An NFC enabled Salad Counter (Team 23)

delivers immediate nutritional insights, encouraging healthier eating habits. Future improvements could include adding a touchscreen for better interaction, expanding data storage with a backend database, and using machine learning for personalized recommendations. These enhancements will make the tool even more effective and user-friendly.

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