Memorias Científicas y Tecnológicas | Volumen 4 | Número 2 | Septiembre 2025 (edición especial)

M Difusión Científica desde el Posgrado. Carteles Académicos de Estudiantes Investigadores

Intelligent food optimization for generation Z using social IoT and the Walrus Optimization Algorithm (WaOA)

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Resumen

This project presents an innovative solution aimed at Generation Z, leveraging Social IoT technology and the Walrus Optimization Algorithm (WaOA) to revolutionize meal planning and food management. By integrating an Amazon Echo Show1 0 (3rd Gen) with an Instaview smart refrigerator, the system continuously monitors food inventory, tracks expiration dates, and intelligently suggests meal options, significantly reducing foodwaste. The core of this approach lies in the WaOA, which optimizes meal scheduling by considering multiple factors such as ingredient availability, dietary preferences, expiration dates, and even spatial constraints within the refrigerator. By dynamically adapting to user habits, the system not only enhances efficiency in food consumption but also promotes sustainable eating practices. Ultimately, this project bridges the gap between smart home technology and intelligent resource management, empowering Generation Z to make informed, sustainable food choices while benefiting from an optimized and highly interactive meal-planning experience.

Palabras Clave

Internet of the Things (IoT) – Walrus Optimization Algorithm – Sustainability – Smart Home

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Referencias

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Abstract

This project presents an innovative solution aimed at Generation Z, leveraging Social IoT technology and the Walrus Optimization Algorithm (WaOA) to revolutionize meal planning and food management. By integrating an Amazon Echo Show1 0 (3rd Gen) with an Instaview smart refrigerator, the system continuously monitors food inventory, tracks expiration dates, and intelligently suggests meal options, significantly reducing foodwaste. The core of this approach lies in the WaOA, which optimizes meal scheduling by considering multiple factors such as ingredient availability, dietary preferences, expiration dates, and even spatial constraints within the refrigerator. By dynamically adapting to user habits, the system not only enhances efficiency in food consumption but also promotes sustainable eating practices. Ultimately, this project bridges the gap between smart home technology and intelligent resource management, empowering Generation Z to make informed, sustainable food choices while benefiting from an optimized and highly interactive meal-planning experience.

Problem Statement

Global consumer trend reports in the food service industry suggest that businesses must adapt to younger consumer demands, offering personalized, flexible meal options to meet the expectations of Generation Z and beyond. Research from 2020 predicts that future generations, raised in a fully digital environment, will demand even greater levels of personalization, expecting their nutrition, content, and meal options to be tailored seamlessly to their preferences. This study explores whether food services targeted at Generation Z can be enhanced through Social IoT-based approaches, where consumers act as intelligent agents, generating and sharing personalized dietary data.

Objectives

General

The primary objective of this project is to develop a smart Meal Scheduling System for Generation Z, leveraging IoT technology and advanced optimization algorithms. This system aims to plan daily meals based on the available food in the refrigerator, effectively reducing food waste and optimizing refrigerator space.

Specifics

- Suggest meal options, help users manage their stock, and reduce unnecessary food purchases, utilizing real time data from the IoT network.
- Identify the food that enters the refrigerator to calculate expiration dates and prioritize consumption, so that waste for the user decreases.
- Achieve connectivity with Echo show 10 (3rd Gen) device, to bring us closer to the concept of Smart Home.
- Identify the user's profile so that each suggestion is adapted to their needs, ensuring their satisfaction.

Introduction

In the era of Industry 5.0, personalization and optimization have become essential for fostering a more sustainable and efficient lifestyle. This project aims to assist Generation Z in optimizing meal planning by making the most of the available food in their refrigerator while minimizing food waste. By leveraging a Social IoT (Internet of Things) approach, integrating an Amazon Echo Show 10 (3rd Gen) and an Instaview smart refrigerator, the system proposes a meal-planning solution that dynamically optimizes the contents of the fridge based on recipe variety, storage constraints, and expiration dates.

To achieve this, we incorporate a cutting-edge metaheuristic, the Walrus Optimization Algorithm (WaOA), which ensures an efficient and diversified use of ingredients, ultimately reducing food waste while enhancing sustainability. The Social Internet of Things (Social IoT) refers to the interconnectedness of people, processes, data, and devices, fostering intelligent automation through smart hardware interfaces that interact with users and their environments. In this context, personalized diet generation has emerged as a relevant challenge, considering factors ranging from nutritional and economic values to cultural aspects.

From a theoretical standpoint, this research builds upon adaptive complex systems theory, which suggests that emerging properties arise from large-scale collective interactions. This principle is crucial for understanding the evolution of socially complex systems, where bipolar multi-directionality defines the structure and self-organizing mechanisms drive system evolution.
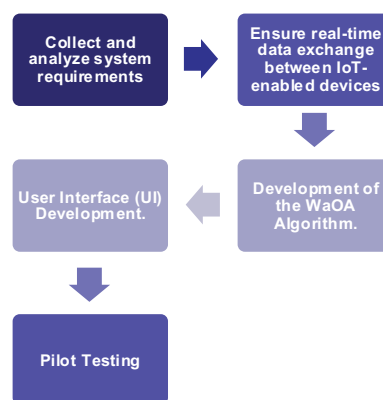
Justification

New consumer behaviors have arisen, especially among Generation Z, a demographic group characterized by their constant interaction with digital technologies, data networks, and smart devices. Thus, IoT and Social IoT technologies become pivotal for addressing this new paradigm. Since food plays an integral role in **human life—from nutritional value to social, cultural, and psychological satisfaction—**this study focuses on creating highly personalized meal plans, considering three fundamental dimensions: individual preferences, family dynamics, and health factors. Ultimately, this research emphasizes the importance of personalized nutrition as a key component of human well-being, aligning with the principles of Industry 5.0, which promote human-centric, environmentally responsible solutions.

Methodology

```
Collect and analyze system requirements
        →
Ensure real-time data exchange between IoT-enabled devices
        ↓
Development of the WaOA Algorithm.
        ←
User Interface (UI) Development.
        ↓
Pilot Testing
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Expected results

| Improved Meal Planing for Gen Z Users | Reduction in Food Waste | Offer a variety of options for different dietary needs | Learn from user preferences and adjust meal suggestions |

References

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Figura 1. Cartel Académico: Intelligent food optimization for generation Z using social IoT and the Walrus Optimization Algorithm (WaOA).