Fitlytics

Introduction

Mission Statement

Fitlytics empowers users to achieve their nutrition goals through precise calorie and macronutrient tracking, enhanced by community-driven AI improvements. Our platform rewards user engagement and contributions with NutritionCoin (NUT), creating a healthy, interactive, and rewarding ecosystem.

Problem Statement

Existing nutrition tracking apps require users to tediously type in or select foods from a list, making the process time-consuming and prone to errors. Fitlytics solves this by allowing users to quickly and easily input their food data with just a picture, leveraging AI to streamline the entire process.

Use Cases and Applications

Food Tracking

Fitlytics allows users to take pictures of their food, which the AI analyzes to estimate the nutritional content. Users can track their macronutrient and calorie intake over any period, helping them stay on track with their nutrition goals.

Community-Driven AI Improvement

Users can correct the AI's predictions and earn NutritionCoin for their contributions. Other users validate these corrections, creating a self-improving system where the AI becomes more accurate over time.

Target Audience

Fitlytics is designed for health-conscious individuals, fitness enthusiasts, and anyone interested in accurately tracking their nutrition. The platform also appeals to AI and crypto enthusiasts who want to participate in a cutting-edge, community-driven project.

Technical Overview

Technology Stack

- **Backend**: Ruby on Rails
- **Frontend**: React-Expo (JavaScript)
- **Blockchain**: Polygon
- **AI Model**: OpenAI's model for food composition analysis and fine-tuning

System Architecture

The Fitlytics backend serves as the hub, interacting with the Polygon blockchain to manage smart contracts for reward NFTs. These contracts are triggered when the backend reports model accuracy milestones. The backend also communicates with OpenAI's API to analyze images submitted by users and fine-tune the AI model based on user corrections.

Key Interactions:

- **Model Accuracy Milestones**: When the backend sends the model's accuracy (updated daily), smart contracts on Polygon unlock reward NFTs if the accuracy meets predefined milestones.
- **AI Model**: The backend sends images to the OpenAI API, which returns predictions about the food's composition. User corrections are used to fine-tune the model for better accuracy.

Improving the AI through Corrections and Validations

Fitlytics leverages community input to continuously improve its AI model. Users are encouraged to submit corrections to the AI-generated food predictions, which are validated by the community through votes.

Correction Submission and Validation

Users can submit corrections to AI-predicted food compositions, which are then validated by other users. Users review each image and correction submitted, marking the correction as valid or invalid. Valid corrections are used to fine-tune the AI model, while invalid ones are discarded. If any correction accumulates **at least 10 votes** with **90% or more support**, the image is finalized. At this point:

- **NutritionCoin (NUT)** is allocated to users who submit a valid correction, as well as those who validated it. If a correction is deemed invalid, those who marked it invalid are rewarded, while users who supported it as valid receive a reputation penalty. Additionally, the user who submitted the invalid correction does not receive tokens.
- **Reputation scores** are updated based on user participation and accuracy in the validation process.

Reputation System

Fitlytics uses a reputation system to manage user credibility within the platform. It is designed to incentivize positive contributions and restrict bad actors without requiring staking.

Reputation Score Calculation

New users start with 5 points. Their reputation score can change based on a combination of factors:

- Submitting correct images: +2 points
- Voting correctly: +1 point
- Voting incorrectly: Penalties vary based on user level

Levels

Level	Max votes per day	Token multiplier	Wrong vote reputation penalty	Reputation score
1, Newbie	20	1	-10	0-499
2, Apprentice	50	2	-20	500-1499
3, Journeyman	100	3	-30	1500-3499
4, Expert	Unlimited	4	-40	3500-7499
5, Master	Unlimited	5	-50	7500+
0, Limited	5	0	-10	< 0

Token Distribution

Token Distribution to Users

Ingredient Correction

A user submits an image correcting a model's wrong ingredient identification.
- User: 1 token per missing/extra ingredient if their correction is verified.
- Verifiers: 1 token each for agreeing with the submitted correction.

Minor Quantity Adjustment

The model correctly identifies the ingredients, but the quantity is wrong by a small amount (less than 50% or less than 100 grams)
- User: 1 token if their correction is verified
- Verifiers: 1 token each for agreeing with the submitted correction

Major Quantity Adjustment

The model correctly identifies the ingredients, but the quantity is wrong by a large amount (more than 50% or more than 100 grams)
- User: 2 tokens if their correction is verified
- Verifiers: 1 token each for agreeing with the submitted correction

Token Distribution to the Team

The team will receive 5% of the total circulating supply of NutritionCoin (NUT) at each 5% model accuracy milestone, starting at 80% model accuracy.

NFT Milestone Unlocks

Milestone Unlock Conditions

NutritionCoin (NUT) can be redeemed for exclusive NFTs tied to key model accuracy milestones. Five unique NFTs are available, each unlocked as the model achieves specific accuracy thresholds: 80%, 85%, 90%, 95%, and 100%. Additionally, a minimum of 10,000 NUT tokens must be in circulation before any NFT purchases can be made.

The cost of each NFT, determined at the time of its unlock, is set to half of the circulating supply of NutritionCoin. When a user purchases an NFT, the required NUT tokens are burned in exchange, permanently reducing the circulating supply and increasing scarcity for remaining tokens. This process creates a dynamic incentive, rewarding community contributions that drive model accuracy while introducing a deflationary aspect to the NutritionCoin economy.

Model Accuracy Formula

Correct Predictions: This includes the number of ingredients correctly identified with their correct portion size in each finalized submission in the past 90 days.
Total Predictions: The sum of all ingredient predictions in both finalized images and incomplete images (images with no submissions) from the past 90 days.

$$Accuracy = \left(\frac{Total\ Correct\ Ingredients\ (Finalized + Incomplete)}{Total\ Predicted\ Ingredients\ (Finalized + Incomplete)} \right) \times 100$$

Token Minting and Distribution Mechanism

To facilitate efficient token distribution and minimize transaction costs, NutritionCoin (NUT) tokens are periodically minted into a secure master wallet. Initially, 100,000 NUT tokens are minted, and additional tokens are minted as needed when the master wallet's balance runs low. This ensures a continuous supply of tokens for user rewards without incurring high minting costs each time tokens are distributed.

These tokens held in the master wallet are not counted in the circulating supply, ensuring that only actively distributed tokens held by users contribute to circulation metrics. For security, the master wallet is protected by a multi-signature (multisig) key, requiring multiple authorized signatures for any transaction. This multisig setup safeguards the pre-minted supply and prevents unauthorized access.

Through this periodic minting and multisig-protected distribution model, Fitlytics provides a secure and cost-effective reward system, supporting smooth, reliable transactions within the platform.

Misuse Prevention and Moderation

Fitlytics incorporates multiple mechanisms to ensure a secure and fair experience for all users. To prevent misuse, we apply the following safeguards

Randomized Voting Assignments

Users receive randomly assigned submissions to review, ensuring they cannot selectively vote on specific images. This randomized approach minimizes bias and prevents individuals from disproportionately influencing AI training.

Daily Submission Limits

Users can upload a limited number of images per day. Although they may edit their submissions as often as needed, this daily cap on new uploads prevents any single user from excessively influencing the model.

Voting Rate Limits by Reputation

Voting is rate-limited based on the user's reputation level. This system allows trusted users to participate more actively, while limiting the influence of newer or less experienced users.

Reputation Penalties for Incorrect Voting

Severe reputation penalties apply to users who incorrectly validate or invalidate submissions, particularly if their vote contradicts the majority. This discourages careless or intentionally disruptive voting behavior, reinforcing data accuracy and model reliability.

Email Verification Requirement

To participate in voting or submission, users must verify their email address, adding an additional layer of user accountability and preventing unverified accounts from influencing the platform.

Moderation and Inappropriate Content Detection

Fitlytics leverages AI to detect inappropriate images, automatically filtering and flagging any content that does not meet community standards. Users also have the ability to flag inappropriate images, creating a multi-layered approach to content moderation.

These measures establish a secure and reliable environment for community-driven AI improvement. Future updates may introduce enhanced safeguards such as anomaly detection, CAPTCHA verification for key actions, and additional moderation features to adapt to emerging challenges.

Conclusion

Vision for the Future

Fitlytics aims to revolutionize nutrition tracking by combining AI, blockchain, and community-driven data validation. While calorie and macro tracking are useful starting points, Fitlytics envisions expanding beyond these metrics to provide users with more insightful health data. Future features include a healthiness score for foods, nutrient analysis to help users identify potential deficiencies or excesses, and personalized food recommendations.

Since nutrition is only one facet of health, Fitlytics will also introduce fitness features to create a comprehensive health and wellness platform. This integrated approach reflects our core philosophy: supporting users in achieving balanced, sustainable health.