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Hydration Recommendation System

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ABSTRACT: Hydration is fundamental to human health and wellness, influencing everything from temperature regulation and nutrient absorption to cognitive clarity and cardiovascular stability. Despite its importance, hydration often remains inadequately addressed in daily health routines due to the generic nature of traditional water intake guidelines such as the "8-glass rule." This paper introduces a machine learning-based Hydration Recommendation System that calculates personalized daily water intake by accounting for individual parameters like age, weight, gender, and physical activity level, as well as environmental conditions such as temperature. The system employs a Linear Regression model, chosen for its simplicity and effectiveness in handling continuous outputs. By delivering adaptive and context-aware recommendations through a real-time interface, the solution not only increases hydration awareness but also aligns with modern health tracking technologies. This innovation contributes to Sustainable Development Goal 3 (Good Health and Well-being) by offering a proactive, data-driven approach to managing personal hydration.

KEYWORDS: Hydration, Machine Learning, Linear Regression, Personalized Health, Water Intake Prediction

I. INTRODUCTION

Water is an essential component of the human body, comprising approximately 60% of body weight. It supports critical physiological functions such as metabolic processing, joint lubrication, detoxification, and thermoregulation. Inadequate hydration can result in symptoms ranging from fatigue and headaches to kidney dysfunction and cognitive decline. Yet, despite widespread health advisories, most people follow generic water intake guidelines which fail to account for the variation in hydration needs based on personal and environmental factors.

In this study, we propose a Hydration Recommendation System that uses machine learning to tailor daily water intake recommendations. By factoring in inputs like body weight, age, gender, activity level, and ambient temperature, the system dynamically predicts how much water an individual needs. This level of personalization aims to bridge the gap left by conventional guidelines and empowers individuals to maintain optimal hydration through actionable insights.

II. LITERATURE SURVEY

The Recent advancements in health informatics emphasize the role of machine learning in personal health recommendation systems. A. Sharma et al. (2023) proposed a model for predicting hydration needs based on basic physical metrics but lacked temperature sensitivity. Kumar and Meena (2022) advocated for the integration of real-time environmental data in health monitoring tools. Studies by Singh and Raj (2021) showed that tree-based algorithms like GBDT outperform linear models in handling heterogeneous data, but for linear relationships, simplicity and interpretability often make Linear Regression more suitable.

Other researchers, like Iyer and Fernandez (2023), demonstrated the effectiveness of integrating behavioral data for lifestyle recommendations. Despite these advancements, there remains a research gap in systems that combine physiological and environmental data to offer real-time, personalized hydration advice. Our system addresses this gap with a robust, lightweight model capable of integration into wearable devices or health apps.

III. METHODOLOGY

The proposed system uses a Linear Regression algorithm for predicting daily water intake. It collects six primary inputs: age, gender, weight, physical activity level, ambient temperature, and special needs (e.g., pregnancy, high-

altitude living). These inputs are processed through data normalization and categorical encoding pipelines. The steps involved are:

1. **Data Cleaning:** Removing null or irrelevant entries, and standardizing units.
2. **Preprocessing:** Normalization of numeric data and encoding of categorical values.
3. **Model Training:** A Linear Regression model is trained on historical data using scikit-learn.
4. **Evaluation:** Model performance is evaluated using Mean Absolute Error (MAE) and R^2 Score.
5. **Deployment:** The model is integrated into a Streamlit interface for real-time use.

The model outputs the predicted water intake in liters and adapts dynamically based on varying inputs, making it suitable for real-world deployment.

IV. EXISTING SYSTEM

The Existing hydration guidance systems are primarily static, relying on standardized rules such as the “8x8 rule”. These systems do not consider inter-individual variability or context, leading to underhydration or overhydration in different individuals. While some mobile apps exist to track water intake, they mostly operate on fixed goals without predictive capability.

Moreover, there is minimal integration of environmental factors such as temperature, which significantly affects hydration needs. The absence of machine learning-driven, real-time analytics means these systems fall short in terms of adaptability, accuracy, and user relevance.

V. EXPERIMENTAL RESULTS

The model was trained on a dataset containing user demographic and environmental parameters, with water intake as the target variable. The dataset was pre-processed and split into training (80%) and testing (20%) sets.

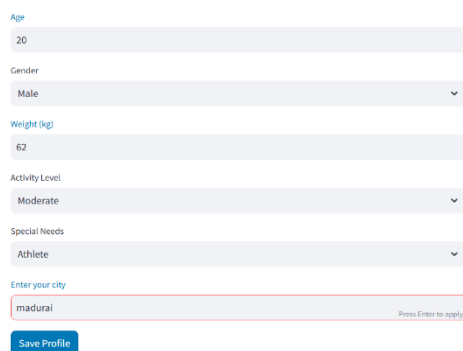
Performance Metrics:

- **Mean Absolute Error (MAE):** 0.29 liters
- **R^2 Score:** 0.91

These results indicate a high level of accuracy and predictive performance. Visualizations and screenshots from the Streamlit interface demonstrate user inputs, predicted outputs, and hydration history tracking.

VI. OUTPUT

Tell us a bit about yourself:



Age
20

Gender
Male

Weight (kg)
62

Activity Level
Moderate

Special Needs
Athlete

Enter your city
madurai

Save Profile

Today's Hydration Summary

Water Intake Today

1.10 L

↑ +1.60 L left

🌟 Goal: 2.7 L | You've reached 40.7% of your goal!

Progress: 40.7%

VII. CONCLUSION

This project showcases the effectiveness of using machine learning for personalized health recommendations, specifically hydration. By considering both personal attributes and external conditions, the system delivers accurate, real-time hydration advice. It outperforms traditional methods in adaptability and user relevance. The use of a lightweight model makes it feasible for mobile or IoT deployment, supporting broader health-monitoring goals. Future developments can include integration with electronic health records and wearable biosensors for automated data collection and prediction.

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