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PENGANTAR REDAKSI

Assalamu ‘alaikum wr. wb.

Puji syukur kami panjatkan ke hadirat Allah Yang Maha Esa atas limpahan rahmat dan karunia-Nya sehingga Jurnal Pembangunan Kota Tangerang Edisi Volume 2 Nomor 2 Tahun 2024 ini dapat diterbitkan sebagai dokumentasi dari Lomba Karya Tulis Inovatif Tahun 2024 yang diselenggarakan oleh Badan Perencanaan Pembangunan Daerah Kota Tangerang.

Jurnal ini secara khusus memuat karya-karya terbaik dari para pemenang Lomba Karya Tulis Inovatif Tahun 2024, yaitu juara pertama dan juara kedua dari setiap bidang kategori. Karya-karya ini telah melalui proses seleksi dan penilaian oleh tim dari Bappeda Kota Tangerang dan akademisi. Kami percaya bahwa artikel-artikel yang dipublikasikan di dalam jurnal ini merupakan bukti nyata dedikasi, kreativitas, dan inovasi para penulis dalam memberikan solusi atas tantangan-tantangan yang dihadapi di berbagai bidang.

Tujuan penerbitan jurnal ini adalah untuk memberikan apresiasi kepada para pemenang sekaligus menyebarluaskan gagasan inovatif mereka kepada khalayak luas. Kami berharap karya-karya yang terangkum dalam publikasi ini dapat menginspirasi para pembaca, memicu diskusi yang produktif, dan menjadi referensi yang bermanfaat bagi pengembangan ilmu pengetahuan dan teknologi.

Kami menyampaikan penghargaan yang setinggi-tingginya kepada semua pihak yang telah berkontribusi dalam penyelenggaraan lomba ini, termasuk para peserta, panitia, dewan juri, dan akademisi. Tidak lupa, ucapan terima kasih yang mendalam kami sampaikan kepada para pemenang yang telah menyajikan karya-karya luar biasa dalam lomba ini.

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Selamat membaca dan semoga bermanfaat.

Wassalamu ‘alaikum wr. wb.

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SOLUSI BERBASIS TEKNOLOGI UNTUK PENCEGAHAN STUNTING: KOMBINASI VIRTUAL NUTRI MENTOR BERBASIS AI DAN PROGRAM MAKAN BERGIZI GRATIS UNTUK KELUARGA RENTAN

TECH-DRIVEN SOLUTIONS FOR STUNTING PREVENTION: COMBINING AI-POWERED VIRTUAL NUTRI MENTOR AND FREE NUTRITIOUS MEAL PROGRAMS FOR VULNERABLE FAMILIES

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ABSTRAK

Pendahuluan: Stunting adalah masalah kesehatan kronis yang disebabkan oleh malnutrisi berkepanjangan selama 1.000 hari pertama kehidupan serta mempengaruhi 22,3% anak di bawah usia lima tahun di seluruh dunia yang mengakibatkan keterbatasan fisik dan kognitif yang signifikan. Di Indonesia, prevalensi stunting mencapai 21,6% pada tahun 2023, terutama berdampak pada wilayah rentan seperti Tangerang.
Tujuan: Penelitian ini bertujuan untuk mengintegrasikan Virtual Nutri Mentor berbasis AI dengan program makanan bergizi gratis untuk menangani pencegahan stunting pada keluarga rentan.
Metode: Dengan menggunakan Metodologi Agile, chatbot berbasis AI dikembangkan untuk memberikan rekomendasi nutrisi yang dipersonalisasi melalui WhatsApp. Pendekatan iteratif ini memungkinkan penyempurnaan sistem secara berkelanjutan berdasarkan umpan balik pengguna.
Hasil: Virtual Nutri Mentor berbasis AI dapat memberikan rekomendasi diet, dan berpotensi meningkatkan dampak program makanan gratis di tingkat komunitas.
Kesimpulan dan Rekomendasi: Integrasi teknologi AI dengan intervensi tradisional dapat menjadi solusi untuk pencegahan stunting. Diperlukannya penelitian lebih lanjut dan lebih berfokus pada pemantauan jangka panjang dan perluasan ke wilayah rentan lainnya.
Kata kunci: Stunting, AI, Chat Bot, Virtual Nutri Mentor.

ABSTRACT

***Introduction**: Stunting, a chronic health issue stemming from prolonged malnutrition within the first 1,000 days of life, affects 22.3% of children globally under the age of five, resulting in considerable physical and cognitive impairments. In Indonesia, the prevalence of stunting was 21.6% in 2023, particularly affecting vulnerable regions such as Tangerang.*
***Objective**: This study seeks to integrate an AI-powered Virtual Nutri Mentor with free nutritious meal programs to combat stunting in vulnerable families.*
***Methods**: By employing Agile Methodology, an AI-based chatbot was created to deliver personalized nutrition advice via WhatsApp. This iterative approach facilitated ongoing system refinement based on user feedback.*
***Results**: The AI-driven Virtual Nutri Mentor provided customized dietary recommendations, which bolstered the effectiveness of community-level free meal programs.*
***Conclusion and Recommendation**: The integration of AI technology with traditional interventions offers a scalable solution for stunting prevention. Future research should focus on long-term monitoring and the expansion of this approach to other vulnerable regions.*
***Keywords**: Stunting, AI, Chat Bot, Virtual Nutri Mentor.*

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1. INTRODUCTION

1.1. Background

Stunting, defined as impaired growth and development due to chronic malnutrition during the first 1,000 days of life, remains a critical global health issue. According to World Health Organization (2024), approximately 22,3% (149 million) of children under five worldwide suffer from stunting, leading to severe physical and cognitive limitations. Indonesia is among the countries with the highest stunting prevalence, with national rates reaching 21.6% in 2023 (Ministry of Health Republic of Indonesia, 2023), and some regions, such as Tangerang, displaying high rates (increase from 11.8% to 17.6%) due to socio-economic disparities (Tanggerang Government, 2024). In these vulnerable communities, stunting disproportionately affects children from families with limited access to nutritious food and healthcare, exacerbating a cycle of poverty and underdevelopment.

The long-term impact of stunting is profound, not only affecting individual health but also the socio-economic fabric of entire communities. Research indicates that stunted children are more likely to experience cognitive deficits, which in turn reduces their educational attainment and future earning potential (Victora et al., 2021). Study estimates that Indonesia has potential economic loss due to stunting in toddlers, IDR 15,062-67,780 billion or 0.89-3.99% of Indonesia's total GDP. The estimated potential economic loss due to decreased productivity in 34 provinces in Indonesia is IDR 381-1,710 billion. If this value is seen as a percentage of GRDP, it is around 1.27-5.72% of the average provincial GRDP in Indonesia (Suryana & Azis, 2023). Stunted children are also more prone to chronic diseases later in life, including obesity and diabetes, further straining health systems (Montenegro et al., 2022). For families, these impacts are multigenerational, trapping them in cycles of poor health and poverty.

Given these devastating outcomes, early intervention is critical in preventing stunting, particularly within the first 1,000 days of life - a period identified as the most crucial for cognitive and physical development (Vyas, 2021). For vulnerable families, early interventions, such as proper nutrition during pregnancy and infancy, can significantly reduce the risk of stunting. Studies have shown that nutritional interventions, such as micronutrient supplementation and balanced diets during this window, can have lasting benefits on child development (Soliman et al., 2022). However, despite the known benefits, access to such interventions remains limited for many at-risk families in regions like Tangerang due to logistical, educational, and financial barriers.

Despite various governmental and non-governmental efforts to reduce stunting, conventional solutions such as public health campaigns and food aid programs have had limited success in significantly reducing stunting rates, particularly among the most vulnerable populations (Achjar et al., 2024). These approaches often rely on generalized advice that fails to account for individual or family-specific needs, leaving large gaps in effectiveness. A report by the Unicef (2023) indicates that many of these programs are poorly targeted, lack the necessary follow-up, and do not provide the tailored support needed for long-term behavioral change. Furthermore, nutritional needs differ based on age, gender, and physical condition, yet conventional programs often apply a one-size-fits-all approach, reducing their efficacy in real-world settings.

To address these limitations, this study proposes a novel, technology-driven solution that integrates personalized AI-powered nutritional guidance with free nutritious meal programs. The *Virtual Nutri Mentor*, an AI-based mobile application, offers real-time, personalized dietary recommendations tailored to the specific nutritional needs of

pregnant women and school-aged children. This approach is designed to complement existing meal distribution programs by providing families with actionable advice that can improve their dietary habits and optimize the benefits of the free meals they receive. Studies have shown that personalized nutrition advice is far more effective in changing long-term behavior compared to generic information (Bush et al., 2020). By merging AI technology with community-level public health interventions, this study explores how a synergistic approach can offer scalable, impactful solutions to the ongoing problem of stunting in vulnerable communities.

The originality of this study lies in its holistic approach to tackling stunting prevention, merging AI-powered tools with community-level interventions in an underserved region like Tangerang. Although technology-driven health interventions are becoming more common, few initiatives focus on the specific challenges of stunting, and even fewer target family-level interventions using AI. The existing literature often treats nutrition counseling and food aid as separate domains, but this project bridges that gap, creating a comprehensive, scalable model for improving nutritional outcomes.

1.2. Problem Statement

Stunting prevention in vulnerable communities, particularly in Indonesia, remains a persistent challenge due to a variety of socio-economic, educational, and logistical barriers. Traditional approaches, such as food aid programs and public health campaigns, often employ a generalized one-size-fits-all approach that fails to account for the unique nutritional needs of individual families. This lack of personalized intervention reduces the effectiveness of these programs, contributing to the continued prevalence of stunting. Moreover, existing efforts tend to overlook the potential of integrating technological solutions, such as AI-powered tools, to provide real-time, customized nutritional guidance that can optimize the impact of free meal distribution programs. Thus, the central problem lies in the gap between available public health interventions and the need for personalized, scalable solutions to address the root causes of stunting in these communities.

1.3. Objective

The primary objective of this paper is to propose and evaluate the effectiveness of a tech-driven approach to stunting prevention by integrating an AI-powered Virtual Nutri Mentor with free nutritious meal programs for vulnerable families. Specifically, the study aims to:

1. Investigate the potential of personalized AI-based dietary recommendations in improving the nutritional intake of pregnant women and school-aged children.
2. Assess the synergies between AI-driven solutions and community-level meal distribution programs in optimizing stunting prevention efforts.

1.4. Benefits

This study offers multiple benefits for both public health practitioners and vulnerable communities. For policymakers and healthcare providers, the research provides a novel framework for integrating technology into traditional stunting prevention programs, potentially increasing their effectiveness and scalability. For vulnerable families, particularly in underdeveloped regions like Tangerang, this combined approach offers tailored nutritional guidance that addresses individual needs, promoting better dietary

habits and optimizing the benefits of free meal programs. In the long term, the study contributes to a reduction in stunting rates, improved cognitive and physical development for children, and greater economic resilience for affected communities.

2. RESEARCH METHOD

2.1. Research Design

This study adopts the **Agile Methodology** for the design, development, and implementation of an AI-powered chatbot aimed at providing personalized nutritional recommendations via WhatsApp. Agile is chosen for its iterative, flexible nature, which allows for continuous refinement of the system based on real-time feedback, ensuring the chatbot remains user-centered and responsive to dynamic needs. The methodology emphasizes collaboration, adaptability, and incremental progress, making it ideal for the rapid development of technology-based interventions like the proposed chatbot.

This method prioritizes iterative cycles, known as sprints, that focus on delivering small, incremental features. Agile is well-suited for AI and software development because it allows frequent user testing and feedback, ensuring the final product is not only functional but also user-friendly and scalable. The core elements of Agile, such as sprint planning, daily stand-ups, iterative development, and retrospective reviews, guide the entire project from initial conceptualization through to final deployment. This iterative framework is structured to incorporate feedback continuously, enabling the chatbot to evolve based on user needs and performance metrics.

2.2. Agile Development Phases

2.2.1. Backlog Creation

The first step is to create a backlog of features and functionalities for the chatbot. These include:

1. AI-driven Personalized Nutrition Recommendations: Tailored dietary suggestions based on user inputs such as age, pregnancy status, and nutritional needs.
2. WhatsApp Integration: Seamless interaction with users through WhatsApp for sending meal reminders, tips, and nutrition updates.
3. Data Collection and Feedback Loop: Gathering user data for improving the chatbot's functionality over time.
4. Nutrition Monitoring: Tracking user behavior and progress in terms of dietary intake and stunting prevention outcomes.

2.2.2. Sprint Planning and Development

The development process will proceed in iterative sprints, typically lasting 2-4 weeks, with the following stages:

1. Sprint Planning: Outlining sprint objectives and determining which features will be developed.
2. Development: Building and testing the chatbot features, including the integration of AI algorithms and WhatsApp APIs.
3. Testing: Each sprint concludes with testing the new features for functionality and user experience.
4. Review: Post-testing reviews to assess outcomes and plan the next sprint.

2.2.3. Testing and Feedback

User testing will focus on:

1. Usability: Ensuring the chatbot is intuitive and accessible through WhatsApp.
2. Accuracy of AI Recommendations: Evaluating whether the dietary suggestions are practical and appropriate for the target groups.
3. User Engagement: Assessing how well users engage with the chatbot and adhere to its recommendations.

Feedback collected during testing will guide subsequent sprints to enhance the chatbot's functionality and user experience.

2.2.4. Deployment and Maintenance

Upon completing the development, the chatbot will be deployed for public use via WhatsApp. Post-deployment activities will include:

1. Monitoring system performance and resolving issues.
2. Periodically updating the AI algorithms based on new data.
3. Scaling the chatbot to serve a larger user base as required.

2.3. Expected Outcomes

This research is expected to:

1. Identify key factors affecting the success of AI-driven nutritional interventions and mobile health solutions.
2. Develop a functional chatbot that delivers personalized nutritional advice to vulnerable populations through WhatsApp.
3. Demonstrate the potential of combining AI with community meal programs to create a scalable model for stunting prevention.

2.4. Ethical Considerations

While this research does not involve primary data collection from human participants, ethical concerns remain regarding the accuracy of AI-generated recommendations. Ensuring that the AI offers safe, evidence-based guidance is crucial to prevent harm. Additionally, user privacy will be protected through secure data handling practices, adhering to relevant data protection regulations.

2.5. Limitations

One of the key limitations of this study is its reliance on secondary data and theoretical models, without field-based quantitative data. The effectiveness of the AI-driven chatbot will depend heavily on the quality of the algorithm and user engagement, which requires ongoing monitoring and iterative adjustments.

3. THEORETICAL OR CONCEPTUAL FRAMEWORK

3.1. Grand Theory

Parsons' Social System Theory is highly relevant as it focuses on how a society or community functions as a system with subsystems that interact to achieve social equilibrium. In this context, health, economy, education, and technology are subsystems working together to prevent stunting. Stunting is understood as a health issue influenced by various social factors, including economic conditions, access to healthcare services, and nutrition. The technology-based approach in this program can be viewed as an effort to address imbalances within these subsystems, particularly in vulnerable communities (Gerhardt, 2022).

3.2. Middle Theory

3.2.1. *Health Belief Model* - HBM

The Health Belief Model explains how individuals' beliefs about health influence their behaviors, including accepting or rejecting health interventions. In the context of stunting, HBM can elucidate how families may be more willing to adopt nutritious dietary practices if they perceive a greater risk of stunting, the benefits of the intervention, and support from technological applications like Virtual Nutri Mentor. The application of HBM is also relevant as it focuses on factors such as risk perception and benefits, which are crucial for the success of personalized interventions (Green et al., 2020).

3.2.2. Social Ecology Theory (Bronfenbrenner)

This theory emphasizes that human behavior, including health behavior, is influenced by the interaction between individuals and their environment at various levels (micro, meso, exosystem, and macrosystem). In the context of stunting, this theory is highly relevant for understanding how the social environment, family, community, and national policies influence behaviors related to dietary practices and the health of pregnant women and children (Anuar et al., 2020). The implementation of a free nutritious food program combined with the AI-powered Nutri Mentor reflects intervention at various ecosystem levels, from individual to policy levels.

3.3. Applied Theory

3.3.1. *Personalized Nutrition Theory*

This theory is based on the idea that each individual's nutritional needs are different and influenced by genetic, metabolic, and environmental factors (Chaudhary et al., 2020). Personalized Nutrition Theory is highly relevant to the use of AI in the Virtual Nutri Mentor application, which provides personalized nutritional recommendations based on specific user data (such as pregnancy status or child's age). By applying this theory, interventions can be more effective as they are based on the unique needs of each individual, differing from the general approaches used in most public health programs.

3.3.2. *Community-Based Nutrition Intervention Theory*

This theory supports interventions involving communities in efforts to improve nutritional status through the distribution of free food and nutritional education (Zheng et al., 2017). The free nutritious food program in villages or areas prone to stunting is an example of the implementation of this theory. With the addition of AI technology to provide more specific nutritional guidance, this program reflects the application of community-based intervention theory supported by technological innovation.

3.4. Conceptual Framework

The conceptual framework for this study is designed to explore how integrating AI-powered personalized nutritional guidance (via the *Virtual Nutri Mentor*) with free nutritious meal programs can effectively prevent stunting in vulnerable populations. This framework is grounded in a systems-oriented and multi-level approach that considers individual, community, and policy-level factors affecting stunting. The key theories—*Social Systems Theory*, *Health Belief Model (HBM)*, *Ecological Systems Theory*, *Personalized Nutrition Theory*, and *Community-Based Nutrition Intervention Theory*—inform different aspects of this framework.

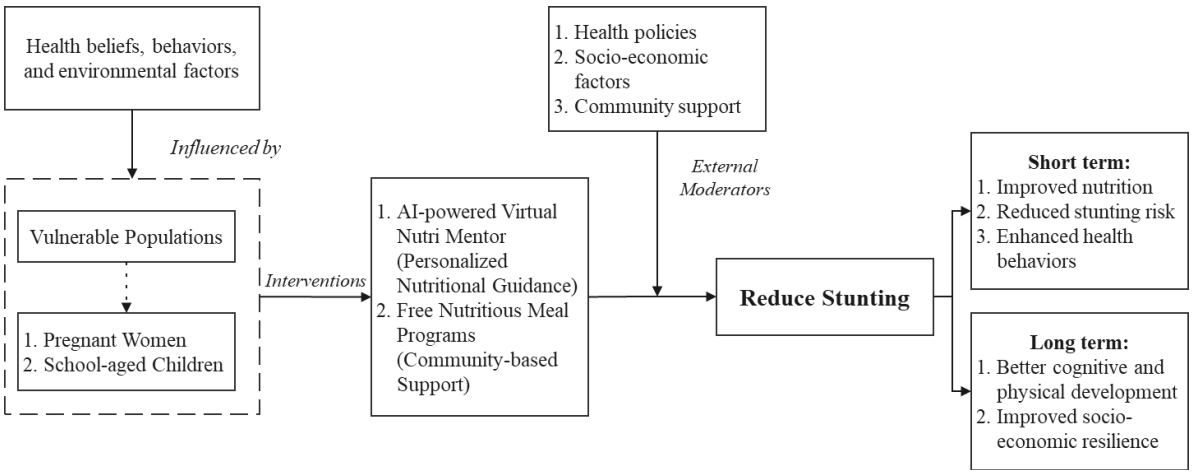

Figure 1.
The Conceptual Framework

The framework branches into two key interventions: the *AI-powered Virtual Nutri Mentor* and *Free Nutritious Meal Programs*. The *Virtual Nutri Mentor* provides personalized, real-time dietary recommendations tailored to the specific nutritional needs of the target groups, leveraging AI technology to optimize their health outcomes. In parallel, the *Free Nutritious Meal Programs* serve as a community-level intervention, ensuring basic access to nutritious meals for families in need. These two strategies converge in a central node representing *Synergy*, where the combined impact of personalized guidance and community-level support enhances the effectiveness of both interventions.

From this synergy, the framework outlines several expected outcomes, including *Improved Nutritional Behavior*, *Reduced Stunting Rates*, and *Enhanced Cognitive Development*. These outcomes reflect the holistic benefit of integrating personalized dietary advice with practical food aid, leading to better health and development for children in vulnerable communities. The diagram also acknowledges the influence of *External Factors*, such as *Socio-economic Conditions* and *Health Policies*, which may either support or hinder the success of the interventions. These external factors play a critical role in shaping the accessibility and impact of both the AI-powered guidance and meal programs. Overall, the framework presents a scalable, tech-driven solution for tackling stunting, bridging the gap between personalized health recommendations and broad community-based interventions.

4. RESULT AND DISCUSSION

4.1. Results

The "Virtual Nutri Mentor" system is an AI-powered chatbot that provides personalized dietary recommendations, particularly designed for school-aged children and pregnant women. Utilizing WhatsApp to enhance accessibility and user engagement, the chatbot gathers basic demographic and anthropometric information to offer guidance on balanced daily meal plans. These recommendations are tailored to the individual's caloric and nutritional needs, taking into account their age, weight, height, and specific dietary requirements based on their health status.

Figure 2.
The AI-powered Virtual Nutri Mentor

This system employs structured logic to cater to different demographic dietary needs. The chatbot's backend infrastructure utilizes conditional algorithms to analyze user profiles, delivering customized responses that improve dietary adherence and overall nutritional intake. To address the distinct needs of children and pregnant users, the following pseudocode illustrates how a Virtual Nutri Mentor program can differentiate between user profiles and generate tailored recommendations.

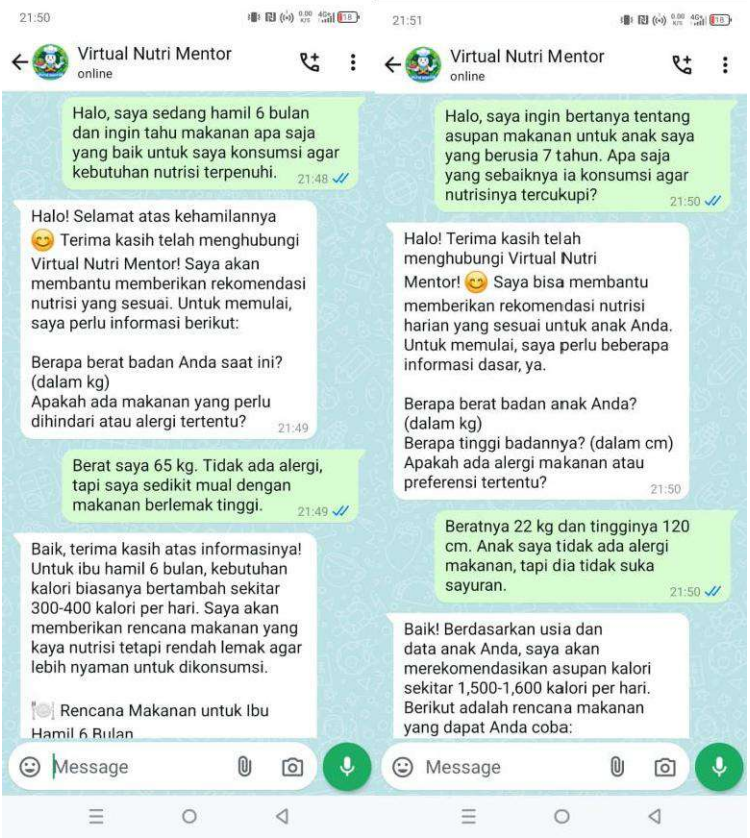

Figure 3.
The Simulation of Virtual Nutri Mentor

```
# Define function to handle different user types
```

```
def calculate_nutrition(user_type, age=None, weight=None, height=None, pregnancy_stage=None):
    """
    Returns dietary recommendations based on user type.

    Parameters:
    - user_type (str): 'child' or 'pregnant'
    - age (int): Age of the user (required for child)
    - weight (float): Current weight of the user in kg
    - height (float): Current height of the user in cm (optional)
    - pregnancy_stage (int): Trimester stage for pregnant users (optional)

    Returns:
    - dict: Recommended daily intake and meal suggestions
    """

    if user_type == 'child':
        return child_nutrition_recommendations(age, weight, height)

    elif user_type == 'pregnant':
        return pregnancy_nutrition_recommendations(weight, pregnancy_stage)

# Example recommendation functions for each user type
def child_nutrition_recommendations(age, weight, height):
    # Calculate caloric and nutrient needs based on child's age, weight, and height
    # For example, a 7-year-old child might need ~1,500-1,600 calories daily
    recommendations = {
        "breakfast": ["1 egg", "oatmeal with fruit", "milk"],
        "lunch": ["rice", "grilled chicken", "vegetable soup"],
        "dinner": ["pasta", "steamed veggies", "fruit salad"]
    }
    return recommendations

def pregnancy_nutrition_recommendations(weight, pregnancy_stage):
    # Calculate caloric needs and nutrient requirements for pregnant users
    # For example, a 6-month pregnancy might need an additional 300-400 calories daily
    recommendations = {
        "breakfast": ["egg or yogurt", "whole grain toast", "fruit smoothie"],
        "lunch": ["lean protein like chicken or tofu", "brown rice", "mixed vegetables"],
        "dinner": ["fish or chicken", "potato", "vegetable stir-fry"]
    }
    return recommendations

# Example function call
user_type = 'pregnant'
age = None  # Not required for pregnant users
```

```
weight = 65  # in kg
pregnancy_stage = 2  # second trimester
recommendations = calculate_nutrition(user_type, age, weight, height=None,
pregnancy_stage=pregnancy_stage)
print(recommendations)
```

Code 1.

Code Snippet: Supporting Multiple User Types in Virtual Nutri Mentor

The code outlines a function, ***calculate_nutrition***, to determine tailored dietary recommendations for both children and pregnant users. It includes sub-functions such as ***child_nutrition_recommendations*** and ***pregnancy_nutrition_recommendations*** to address specific nutritional needs. This design supports flexibility for multi-user applications within a single chatbot system, enabling precise, user-specific responses. This approach offers a foundational framework for an AI-based virtual nutrition mentor suitable for deployment on WhatsApp.

4.2. Discussion

4.2.1. The Potential of Personalized AI-Based Dietary Recommendations

The Virtual Nutri Mentor system customizes meal recommendations to meet the unique needs of pregnant women and school-aged children. By integrating specific health and demographic information—such as weight, age, pregnancy stage, and dietary preferences—the chatbot provides individualized dietary guidance. This method ensures that each user receives recommendations aligned with their physiological requirements and preferences, aiming to improve nutritional intake. The AI's capacity to analyze and respond to real-time user data highlights its potential to positively influence the dietary habits of high-risk groups, particularly those susceptible to nutrient deficiencies, such as pregnant women and children.

Artificial intelligence (AI)-based technology holds significant potential for the personalization of dietary recommendations aimed at improving nutritional status, particularly for vulnerable groups such as pregnant women and families with young children at risk of stunting. AI can process detailed individual data, including age, gender, caloric needs, food preferences, and health conditions, to offer specific advice. This approach provides a more accurate method for nutritional planning compared to general guidelines typically applied to the broader population. A study by Fadhilah et al., (2024) indicates that the integration of chatbot features in health applications based on machine learning allows for more personalized and responsive interactions. These chatbots are designed to provide specific information according to users' health conditions, thereby enhancing service quality and facilitating access to appropriate dietary recommendations.

Moreover, AI-based nutritional recommendations can be dynamically adjusted in real-time based on user feedback. This technology enables daily menu adjustments according to user-provided information, such as recently consumed foods. This is crucial in maintaining the daily nutritional balance needed by families at risk of stunting. Zhang et al., (2020) found that delivering nutritional recommendations directly through AI-based applications increases user compliance with healthier eating patterns.

Another advantage of AI-based technology is its accessibility. Applications integrated with chatbots, such as the "Virtual Nutri Mentor," can be accessed via widely used platforms like WhatsApp. This allows individuals to receive dietary advice without needing

to meet nutritionists in person, offering more flexible and convenient interactions. Additionally, AI technology can support long-term behavioral changes in diet and lifestyle. Personalized dietary recommendations can help individuals develop healthier and more sustainable eating habits. A study by Joshi et al., (2024) found that technology-based interventions, especially those using AI-based chatbots, can increase fruit and vegetable consumption and positively impact dietary changes.

AI enables the development of more efficient dietary models by integrating large data sets from diverse populations. This approach allows for more targeted guidelines that consider not only caloric needs but also environmental, cultural, and local food availability aspects. Consequently, AI technology can play a vital role in supporting free nutritious food programs, providing more responsive approaches to individual nutritional needs, and contributing significantly to broader and more effective stunting prevention efforts.

4.2.2. Synergies Between AI-Driven Solutions and Community-Level Meal Distribution Programs

Beyond individualized support, the Virtual Nutri Mentor chatbot can act as a scalable component of wider stunting prevention initiatives, particularly when integrated with community-level meal distribution programs. By incorporating meal options available through local distribution efforts, the chatbot can align its recommendations with accessible food items, creating a seamless synergy that enhances meal planning and supports balanced nutrition within the community. This integration increases the utility of AI in public health contexts, merging personalized guidance with existing resources to facilitate practical and sustainable nutrition interventions. Consequently, AI-driven solutions like Virtual Nutri Mentor can significantly contribute to stunting prevention, especially when combined with community resources to ensure comprehensive nutritional support.

AI can also assist in monitoring the effectiveness of food distribution programs through periodic data analysis. By employing machine learning algorithms, AI can identify consumption patterns and evaluate the impact of food distribution programs on the nutritional status of beneficiaries. This enables adjustments to be made in the menu or portion sizes distributed based on analysis results, enhancing the program's responsiveness to the actual nutritional needs of the served community. A study by Namkhah et al., (2023) demonstrates that AI-based evaluation can identify changes in the nutritional requirements of the target population, resulting in more adaptive and efficient food distribution programs.

A key advantage of the synergy between AI-based solutions and food distribution programs is the increased access to nutritional information. AI-based applications that provide nutritional advice and daily meal guidance can offer community members better information about healthy eating patterns, even after the food distribution programs have ended. This not only enhances short-term effectiveness but also has a long-term positive impact on nutritional knowledge at the community level. Pedro et al., (2019) report that using AI applications integrated with community programs improves public understanding of healthy nutrition, showcasing the significant potential of this technology in public education.

Collaboration between AI and food distribution programs also allows for menu adjustments that are more inclusive of local cultural and food preferences. AI can gather

data on community food preferences, enabling food distribution to be adapted without compromising nutritional quality. Therefore, the synergy between AI-based solutions and community-level food distribution programs can yield significant benefits, not only in terms of program effectiveness and efficiency but also in raising public awareness of the importance of healthy eating habits. This combination becomes a powerful tool in efforts to improve community nutritional status, especially in areas facing nutritional challenges such as stunting.

5. CONCLUSION AND RECOMMENDATION

5.1. Conclusion

The "Virtual Nutri Mentor" system exemplifies the efficacy of AI-driven chatbots in refining dietary recommendations for at-risk populations, such as children and pregnant women. Utilizing widely accessible platforms like WhatsApp, it provides personalized guidance tailored to individual health profiles, enhancing dietary compliance and addressing nutritional deficiencies. Moreover, when integrated with community-level meal distribution programs, the system fosters comprehensive stunting prevention by aligning dietary recommendations with locally available food options, thus contributing to broader public health objectives. This synergy highlights AI's capability to offer both individualized and community-oriented nutritional support, promoting sustainable improvements in dietary practices and health outcomes.

5.2. Recommendation

To fully realize the potential of the "Virtual Nutri Mentor," it is advised to enhance its accessibility on platforms such as WhatsApp and integrate it with local meal distribution initiatives for practical application. Improved data collection and user feedback mechanisms should be employed to refine personalized recommendations, with a focus on fostering long-term dietary behavior change. Continuous AI-driven monitoring will ensure that dietary guidance remains adaptable, while educational efforts can elevate public awareness of healthy eating, thereby supporting nutritional improvements at both individual and community levels.

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