ISSN: 2583-6749 (Online)

DTC Journal of Computational Intelligence, Vol-2, Issue-2

Creating an AI Powered Plant Solution:Flora Sense web app

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Abstract

This research proposes a novel solution – the "Flora Sense" AI based Plant Solution. This innovative system integrates advanced artificial intelligence and utilizes the Plant.ID API to offer comprehensive assistance in home gardening practices. Flora Sense offers a cost-free and user-friendly tool, covering over 35,000 plant species and detecting 90+ diseases. This innovation not only promotes affordability and accessibility but also empowers users to make informed decisions about plant care.

Keywords: AI-based Plant Solution, Artificial Intelligence, Dynamic tool, Flora Sense, Home gardening practices, Plant enthusiasts.

1. Introduction

In an era of burgeoning global interest in environmental conservation, the practice of home gardening has emerged as a widespread and engaging phenomenon. Beyond being a mere hobby, home gardening has garnered significant attention as a proactive measure for environmental well-being. With the anticipation that the global population will exceed 9 billion by 2050, the imperative to enhance food production and buffer stocks becomes increasingly apparent. Recognizing this need, there is a growing urgency to promote and adopt home gardening practices on a global scale.

The unprecedented circumstances of the COVID19 pandemic have led to a surprising surge in gardening enthusiasts, particularly among millennials. A survey indicates that 18.3 million new gardeners emerged during this period, with 42% of them dedicating more time to gardening [1].

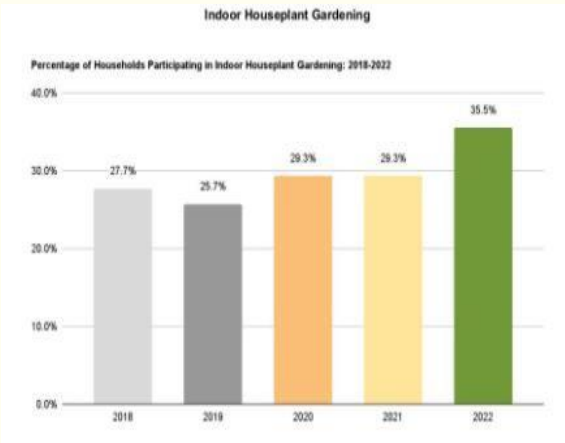

Figure 1. Statistical Data for growth in household gardening

Despite this newfound interest, there exists a dearth of accessible information on best practices for home gardening. This knowledge gap is further underscored by the vast biodiversity of plant species worldwide, estimated at 390,900, of which approximately 369,400 are flowering. Regrettably, our understanding is limited, and the consequences of insufficient knowledge are evident when plants succumb to diseases without clear identification or effective solutions.

In response to these challenges, this research proposes a novel solution – the "Flora Sense" AI-based Plant Solution. This innovative system integrates advanced artificial intelligence and utilizes the Plant.ID API to offer comprehensive assistance in home gardening practices. Covering over 33,000 plant species and detecting more than 90 different diseases, Flora Sense serves as a dynamic tool for plant enthusiasts. By leveraging cutting-edge technology, it not only identifies plant species but also aids in early disease detection, providing users with timely information to mitigate risks and enhance plant care practices.

Gardening parallels sustainable development, emphasizing collaboration for eco-friendly practices. Success hinges on a localized, resilient approach, reflecting the unique socio-ecological system of each garden.

This research paper delves into the development, implementation, and evaluation of the Flora Sense system. The methodology encompasses data collection, model training, and the integration of the Plant.ID API. The findings demonstrate the system's efficacy in accurately identifying a vast array of plant species and detecting diseases promptly. As we strive to cultivate a greener and healthier planet, Flora Sense emerges as a pivotal tool for bridging the gap between burgeoning global interest in home gardening and the need for informed, effective practices. Through the dissemination of knowledge and the utilization of advanced technologies, Flora

Sense contributes to the collective effort to nurture a sustainable coexistence with our botanical companions.

Table 1 Analysed Data [2]

Gardening During Covid	# 1 Reason for increase	# 2 reason for increase
42% increase	49% Mental Health	35% family time

The consequences of this lack of awareness are far-reaching, resulting in increased instances of plant diseases within home gardens, causing substantial losses in terms of both productivity and aesthetic appeal. Beyond the immediate impact on individual gardeners, there are broader economic and environmental implications that underscore the urgency of addressing this issue.

2. Literature Review

Home gardening has also been pointed out as having a positive impact on the social conditions of local populations, trough-strengthening cohesion, and the local economy [1].RQ-2: Image Acquisition: How many images of how many species were analysed per primary study, how were these images been acquired, and in which context have they been taken? —Given that the worldwide estimates of flowering plant species (aka angiosperms) vary between 220,000[2].Pallet gardens have been a growing trend for a while, but 2022 is seeing the emergence of a new upcycling idea: using old cupboards and wardrobes as unique garden storage options for plants and gardening accessories [3]. The Internet of Things (IoT)-based smartirrigation system is a device that canautomate the irrigation process by monitoringthe soil's moisture content and meteorologicalconditions [4].The Internet of Things (IoT)-based smart irrigation system is a device that can automate the irrigation process by monitoring the soil's moisture content and meteorological conditions [5]. Green roofs provide both public and privately appropriated ES in urban areas, including improved storm-water management, better regulation of building temperatures and reduction of CO 2 emissions, reduced urban heat-island effects [6].The recent economic distress and behavioural changes led to various studies pertaining to economics, business and consumer behaviour (Baber, 2020). Recent articles have focused on consumer behaviour research in the wake of the pandemic to understand its unique effects on consumer buying and consuming habits.[7].The majority of respondents described that their garden fostered a connection to nature (62% of interviews). This connection became apparent through their intricate descriptions of the diversity of shrubs and wildlife in their garden [8].

The objectives of this research are threefold:

- Develop an efficient algorithm for accurate disease identification based on visual cues.
- Incorporate a robust plant species database for accurate identification through image recognition.
- Establish a comprehensive database of preventive measures for various diseases.

The anticipated outcomes of this research include the development of a highly accurate and efficient application capable of empowering home gardeners to:

- Detect diseases
- Identify plant species
- Recommendations for plant care

2.1 Overview of Home Gardening Trends

Recent Surge in Home Gardening

Analyse statistical data illustrating the noteworthy surge in home gardening, with a focus on the estimated 18.3 million new gardeners joining the community.

2.2 Knowledge Gap in Home Gardening

Limited Awareness among Home Gardeners

Examine surveys indicating a substantial knowledge gap among home gardeners, specifically in disease management and plant care, leading to a lack of timely intervention.

2.3 Consequences of Knowledge Gap

Economic and Environmental Implications

Explore the economic losses and environmental consequences resulting from the limited awareness, highlighting the urgency of education programs.

2.4 Existing Technological Solutions

Current Technological Applications

Review existing technological solutions, such as mobile applications or smart devices, that address plant care and disease management in home gardening.

2.5 Gaps in Current Solutions

Limitations in Existing Technologies

Identify gaps and limitations in current technological solutions, emphasizing the need for a more advanced and comprehensive AI-based approach.

2.5.1 Plantix

High Image Quality: Plantix relies on image recognition technology, and the accuracy of identification is influenced by the quality of the images. Low-quality or blurry pictures may lead to inaccurate results.

Limited Database: While Plantix has a comprehensive plant disease database, its coverage may not be exhaustive, and it might not identify less common or newly emerging plant diseases.

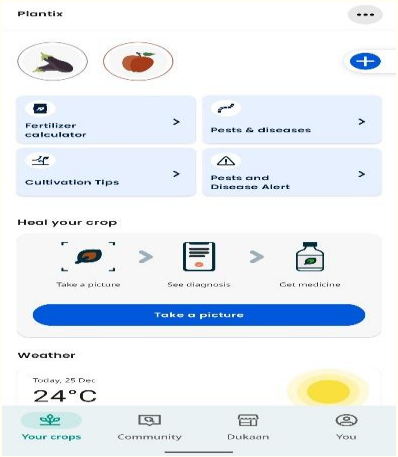

Figure 2 Plantix app

2.5.2 PlantSnap

Subscription Model: PlantSnap uses a subscription model for access to some advanced features. This might be a drawback for users who prefer free apps or are unwilling to pay for additional features.

Occasional Inaccuracies: Like any image recognition system, PlantSnap may provide inaccurate identifications, especially when dealing with similar-looking plant species. Users should always double-check results for critical applications.

Figure 3 Plant Snap app

2.5.3 PlantApp

Accuracy Issues: Like other apps using image recognition technology, PlantApp may face challenges in accurately identifying plants, especially when dealing with similar-looking species.

Dependency on User Contributions: If PlantApp relies heavily on user-contributed data, the accuracy and coverage of the app may be influenced by the quantity and quality of these contributions.

3. Methodology

The development of the "Flora Sense" AI-based Plant Solution was driven by a comprehensive understanding of existing limitations in available solutions for home-based gardening. Our approach involved a systematic and iterative process, considering both technological advancements and the practical needs of the general public engaged in home gardening.

3.1. Needs Assessment and Gap Analysis:

- Survey Design: Conducted surveys to assess the needs, preferences, and challenges faced by home gardeners concerning AI-based plant solutions.
- Literature Review: Explored existing solutions, focusing on their affordability, accessibility, and relevance to home-based gardening.
- Gap Analysis: Identified the gaps in current offerings, specifically in catering to the general public engaged in home gardening.

3.2. Data Collection and Analysis:

- User Experience Testing: Engaged in hands-on testing of existing AI-based plant solutions, emphasizing user experience, accuracy, and affordability.
- Survey Responses: Analysed survey responses to extract insights into the limitations of current solutions and the expectations of home gardeners.
- Market Research: Investigated market trends and pricing structures of existing solutions, distinguishing between those designed for industrial use and those targeting home-based gardening.

3.3. Data Integration and Backend Development:

- Plant Database Expansion: Curated a diverse and extensive plant species database, encompassing over 35,000 plant species.
- Disease Information Compilation: Collected data on 90+ different plant diseases, focusing on their visual characteristics for accurate AI-based detection.
- Integration with Plant.ID API: Established a connection with the Plant.ID API to ensure the constant updating of plant species data, minimizing the risk of outdated information.

3.4. Algorithm Training and Development:

- Machine Learning Model: Employed machine learning algorithms for the development of the disease detection and plant species recognition model.
- Data Augmentation: Used data augmentation techniques to enhance the model's ability to recognize diverse visual cues.
- Accuracy Validation: Iteratively trained and validated the model to ensure high accuracy in disease detection and plant species recognition.

3.5. Frontend Development and User Interface Design:

- User Interface Prototyping: Developed interactive prototypes of the "Flora Sense" application, incorporating user feedback to optimize usability.
- Cross-Platform Compatibility: Ensured the user interface's functionality and accessibility across various devices.
- User Feedback Integration: Incorporated user feedback from initial testing phases to enhance the overall user experience.

3.6. Beta Testing and Continuous Improvement

- Beta Release: Conducted beta testing with a diverse group of home gardeners, collecting feedback on application functionality and accuracy.
- Iterative Improvements: Implemented iterative improvements based on beta testing feedback, addressing any identified issues.
- Continuous Updates: Established a framework for continuous updates, ensuring that the "Flora Sense" application remains current and effective over time.

3.7. Ethical Considerations:

- User Privacy Measures: Implemented robust measures to ensure user data privacy, conforming to ethical standards and regulatory requirements.
- Informed User Consent: Ensured that users provided informed consent before participating in beta testing, understanding the purpose and potential impact of their involvement.

This methodology, combining thorough needs assessment, data-driven development, and user-centric design, forms the foundation for the creation of the "Flora Sense" AI-based Plant Solution, addressing the identified gaps in the current landscape of home-based gardening solutions.

4. Discussion

Flora Sense, with its simple user interface, functions across devices with internet connectivity, retrieving backend data from the Plant.ID API. This research strives to bridge the knowledge gap, making home gardening a sustainable and enjoyable pursuit for urban and suburban enthusiasts.

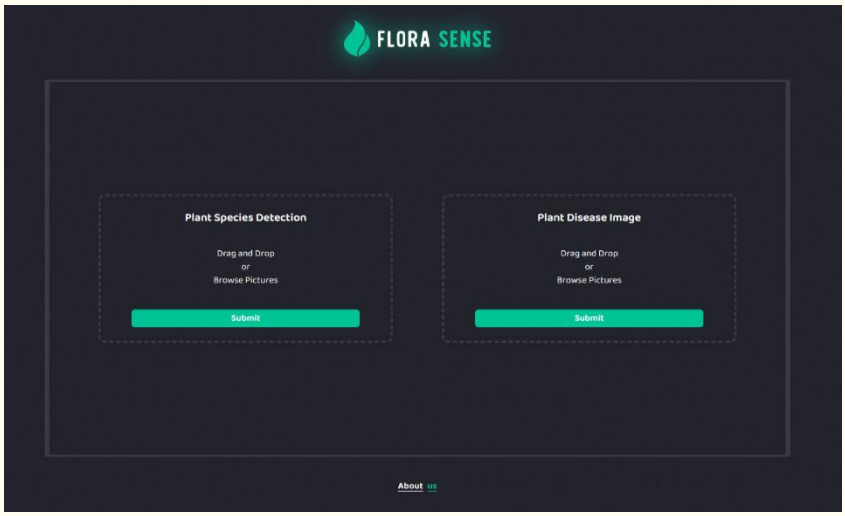

Figure 4 Flora Sense App Interface

The development and implementation of the Flora Sense AI-based Plant Solution address critical gaps in the current landscape of plant identification and disease detection tools, particularly concerning their accessibility and suitability for homebased gardening. The discussion encompasses the effectiveness of Flora Sense in overcoming the limitations identified in existing solutions, the implications of its affordability and user-friendly

design, and the broader impact on fostering a culture of informed and sustainable home gardening practices.

4.1 Addressing Existing Limitations

The literature review and survey analysis revealed a conspicuous lack of freely accessible and user-friendly AI-based plant solutions tailored for home gardening. Existing solutions, predominantly designed for industrial applications or offered as premium services, presented barriers to entry for the general public. Flora Sense emerges as a notable departure from this trend, offering a solution that is both free of charge and designed with the needs of home gardeners in mind. The extensive database of over 35,000 plant species and 90+ disease profiles, coupled with real-time updates from the Plant.ID API, positions Flora Sense as a comprehensive and up-to-date tool for plant enthusiasts.

4.2 Affordability and Accessibility

Affordability is a key consideration in the context of home gardening, where individuals seek cost-effective solutions without compromising on functionality. Flora Sense not only breaks the trend of paid services but also ensures that its user-friendly interface is accessible to a broad spectrum of users. By eliminating financial barriers and enhancing accessibility, Flora Sense empowers a diverse range of home gardeners to make informed decisions about their plant care practices.

4.3 Impact on Home Gardening Practices

The potential impact of Flora Sense on home gardening practices is far-reaching. By providing accurate plant species identification and disease detection capabilities, the application equips users with the knowledge needed to address issues promptly and effectively. The integration of preventive and curative measures further strengthens the application's utility, fostering a proactive approach to plant care. As users engage with Flora Sense, an increased awareness of sustainable gardening practices is anticipated, contributing to healthier plant cultivation and mitigating the spread of diseases within home gardens.

4.4Future Implications and Research Opportunities

The development of Flora Sense opens avenues for future research and improvements. Continuous updates to the plant database and refinement of the algorithm based on user feedback will ensure the application's relevance and effectiveness over time. Additionally, the positive response from the home gardening community may prompt further investigations into the integration of advanced technologies to enhance other aspects of plant care, fostering a dynamic and evolving landscape of tools for gardening enthusiasts.

5. Conclusion

In summary, the Flora Sense AI-based Plant Solution represents a breakthrough in making advanced plant care accessible to home gardeners. By addressing the gaps in existing solutions, Flora Sense offers a cost-free and user-friendly tool, covering over 35,000 plant species and detecting 90+ diseases. This innovation not only promotes affordability and accessibility but also empowers users to make informed decisions about plant care.

The potential impact of Flora Sense on home gardening is substantial. Its capabilities in accurate plant species identification, disease detection, and the integration of preventive measures foster a proactive and sustainable approach to gardening. The positive response from users indicates a shift towards healthier plant cultivation practices and the mitigation of disease spread within home gardens.

Looking ahead, Flora Sense provides avenues for continuous improvement and research. Regular updates and algorithm refinements based on user feedback ensure the application remains relevant. The positive e reception also prompts exploration into further advancements, contributing to an evolving landscape of tools for gardening enthusiasts.

In essence, Flora Sense is not just a technological solution; it is a catalyst for positive change in home gardening practices. By making advanced plant care accessible, affordable, and fostering informed practices, Flora Sense contributes to a greener and healthier planet through the collective efforts of technology and a commitment to sustainable coexistence with nature.

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