AUTOMATED INDOOR MINI GROW SYSTEM

Community Service Project report submitted
in partial fulfillment of the requirement for award of the degree of

Bachelor of Technology
in
Biotechnology

By

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SHAIK LAILA	(22UEBT0058)	**(VTU 23597)**
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(Deemed to be University Estd u/s 3 of UGC Act, 1956)
Accredited by NAAC with A++ Grade
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CERTIFICATE

It is certified that the work contained in the project report titled "LED HYDRO INDOOR MINI AUTO GROW SYSTEM" by "MAILAVARAPU SRI RAJESWARI (22UEBTOO45), SHAIK LAILA (22UEBT0058), G.MANOJ KUMAR (22UEBT0018) " has been carried out under my supervision and that this work has not been submitted elsewhere for a degree.

Signature of Supervisor
Department of Biotechnology
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Institute of Science & Technology
Chennai-62

Signature of Professor In-charge
Department of Biotechnology
School of Electrical and Communication
Vel Tech Rangarajan Dr. Sagunthala R&D
Institute of Science & Technology
Chennai-62

DECLARATION

We hereby declare that our team completed the mandatory community service project in the stipulated time period in Arrakambakkam under the guidance of our Project supervisor.

MAILAVARAPU SRI RAJESWARI

Date: / /

SHAIK LAILA

Date: / /

G.MANOJ KUMAR

Date: / /

APPROVAL SHEET

This project report entitled "AUTOMATED INDOOR MINI GROW SYSTEM" by MAILAVARAPU SRI RAJESWARI (22UEBT0045), SHAIK LAILA (22UEBT0058), G. MANOJ KUMAR (22UEBT0018) is approved for the degree of B. Tech in Biotechnology.

Examiners **Supervisor**

Dr.V. Leena Sharan,
Assistant Professor.

Date: / /

Place:

ACKNOWLEDGEMENT

We express our deepest gratitude to our respected Founder Chancellor and President **Col. Prof. Dr. R. Rangarajan** B.E. (EEE), B.E. (MECH), M.S (AUTO). DSc., Foundress President **Dr. R. Sagunthala Rangarajan** M.B.B.S. Chairperson Managing Trustee and Vice President.

We are very much grateful to our beloved Vice Chancellor **Prof. Dr. Rajat Gupta**, for providing us with an environment to complete our project successfully.

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MAILAVARAPU SRI RAJESWARI (22UEBT0045)
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ABBREVIATION	DEFINITION
LED	Light-Emmiting Diode
NGO	Non-Governmental Organization

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Chapter 1

EXECUTIVE SUMMARY

The “Automated Indoor Mini Grow System” is a compact and innovative solution designed to enable efficient and sustainable plant cultivation in small indoor spaces. The system integrates soil-based gardening with advanced automation, including automated watering, lighting, and climate control, creating an ideal environment for growing a variety of plants such as herbs, vegetables, and small flowers.

- **Goals and Objectives:** The primary goals of this project are to facilitate efficient indoor gardening, making it accessible to those with limited space and time. The objectives include automating key gardening tasks like watering, lighting, and environmental control, thereby reducing the need for constant manual attention. Additionally, the system promotes sustainable growing practices by encouraging the use of eco-friendly, space-efficient methods for growing food at home. This project also aims to make it easier for individuals to grow their own food indoors, whether for personal use or to enhance their nutritional intake.

- **Intended Impact:** The intended impact of the “Automated Indoor Mini Grow System” is multifaceted. It seeks to improve food security by providing a sustainable, home-based method for growing fresh, organic produce. The system is designed to “reduce environmental impact” by using minimal water and energy, and by eliminating the need for chemical fertilizers and pesticides. Furthermore, it aims to increase awareness about sustainable gardening practices, helping urban dwellers grow food in confined spaces while contributing to environmental sustainability.

- **Beneficiaries:** This project benefits “urban dwellers” who have limited space for traditional gardening and are seeking a convenient way to grow their own food indoors. It also benefits beginners in gardening, as the automation of key processes makes the system easy to use. Families or individuals interested in reducing their dependency on store-bought produce will find the system ideal for growing fresh herbs, vegetables, and flowers. Additionally, those advocating for eco-friendly

lifestyles will benefit from a system that promotes sustainability and resource efficiency.

- **Social Issue:** The “Automated Indoor Mini Grow System” addresses critical issues faced by rural populations, such as the lack of space for traditional gardening, especially in densely populated areas. With water conservation becoming increasingly important, the system uses efficient water management to reduce wastage. The project also tackles the growing need for sustainable farming solutions that are accessible to individuals in cities. By making indoor gardening more accessible, it helps resolve the barriers of space, knowledge, and resource limitations, fostering a more sustainable and self-sufficient urban lifestyle.

Chapter 2

OVERVIEW OF THE COMMUNITY

2.1 Overview of the community

This community service project is taken place in Arakkambakkam. It is part of Tiruvallur district in Tamil Nadu. It is a village of around 1,402 members and comprises of 700 men and 702 women respectively. Thus, the average Sex ratio of Arakkambakkam is 1:1. Developing a automated indoor mini grow system in a village can significantly enhance local livelihoods and food security.

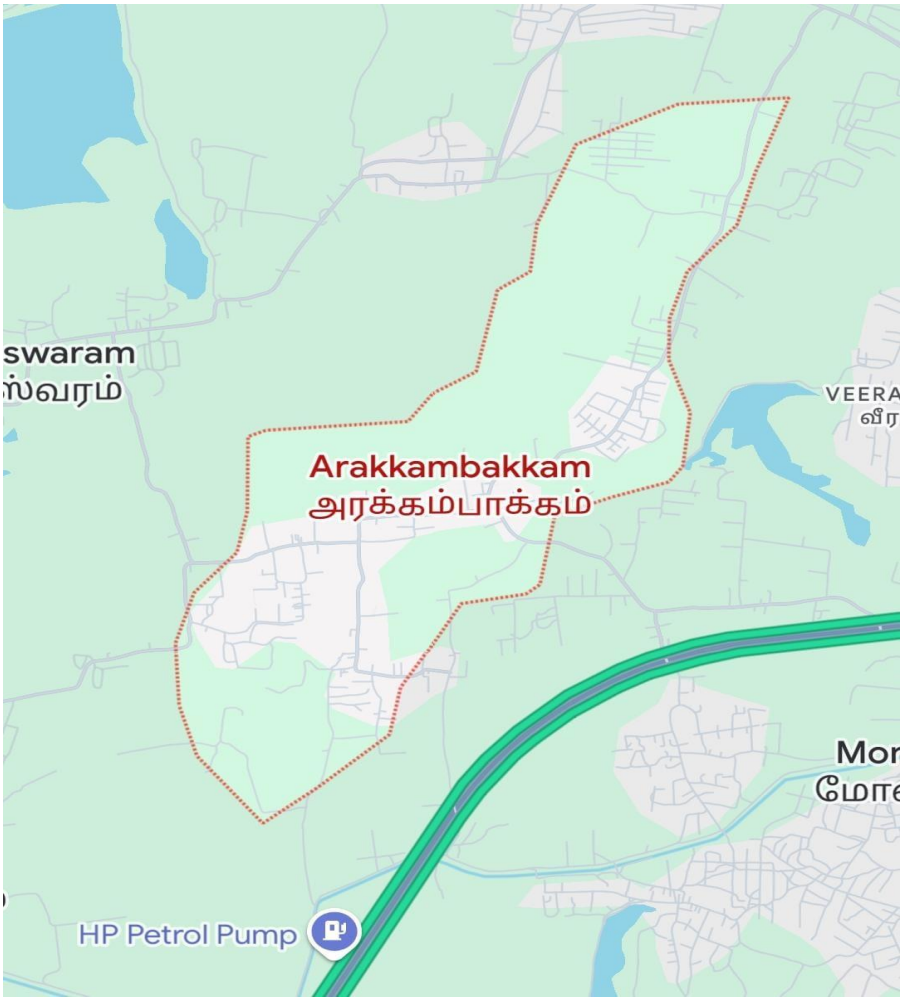

Figure 2.1: Map of Arakkambakkam Village.

2.2 Certificate from the of the community

Arakkambakkam - Village Overview	
Gram Panchayat :	**Arakkambakkam**
Block / Taluka :	**Ambattur**
District :	**Thiruvallur**
State :	**Tamil Nadu**
Pincode :	**600055**
Area :	**182.17 hectares**
Population :	**1,402**
Households :	**374**
Nearest Town :	**Avadi (11 km)**

Administration
Gram Panchayat: Arakkambakkam
Block/Taluka: Ambattur
District: Thiruvallur
State: Tamil Nadu
Pincode: 600055
Census Code: 629162

Chapter 3

ACTIVITY LOG OUTCOME

3.1 Project Activity Log

WEEK/DATE	BRIEF DESCRIPTION OF ACTIVITY	LEARNING OUTCOME
WEEK 1 25/10/2024	Visited Arrakambakkam.	Completed survey.
WEEK 2 26/10/2024 - 28/10/2024	Research on indoor grow systems and selection of soil pellets.	Gained insights into soil based systems and pellets.
WEEK 3 29/10/2024 - 02/11/2024	Assembled prototype with automation and LED lights.	Integrated automation with soil based growth.
WEEK 4 03/11/2024 - 09/11/2024	Tested system , adjusted watering and lighting.	Found optimal growth condition.
WEEK 5 10/11/2024 - 17/11/2024	Documentation and Data collection.	Prepared final report and analyzed results.

Table 3.1: Activity log

3.2 Project Outcome

- **Tracking progress:** The Automated Indoor Mini Grow System demonstrated significant progress throughout its development. The initial design phase involved research and prototyping, which evolved into a fully functional system capable of growing a variety of plants. Over the course of the project, the system's efficiency was tested and improved, with automated watering, lighting, and climate control functioning seamlessly. The final prototype showed improvements in plant growth rates and resource efficiency compared to traditional indoor gardening methods. Regular progress reviews helped fine-tune the system, ensuring it met the goals set for sustainability, user-friendliness, and efficiency.

- **Communication:** Communication played a key role in the success of the project, both within the project team and with the community. Weekly meetings were held to discuss project goals, challenges, and adjustments. Regular updates were shared with stakeholders, including faculty members and local community leaders. Additionally, the demonstration sessions in Arrakambakkam Village allowed for direct communication with the target users, gathering their input on the system's functionality and features. This feedback loop helped shape the final design to better suit the needs of users with limited gardening knowledge and space.

- **Documentation:** Throughout the project, detailed documentation was maintained, including progress logs, system design specifications, and test results. This documentation helped track the changes made to the system and provided a clear record of the methodology used. All data collected from plant growth tests, system performance, and user feedback were documented systematically. The final report was compiled using this data to provide a comprehensive overview of the project, including the design process, outcomes, and recommendations for future improvements. This structured documentation will serve as a valuable resource for scaling the system or implementing similar projects in other communities.

Figure3.1: prototype of the automated indoor mini grow system

- The prototype of the Automated Indoor Mini Grow System was developed as a practical representation of the project's objectives. It integrates soil-based cultivation with automated features, including LED lighting, watering systems, and climate control. The compact design ensures it fits seamlessly into indoor spaces, addressing the challenges of limited space and resource efficiency.

- This prototype demonstrates the feasibility of combining modern automation technology with traditional soil-based gardening techniques, making it an ideal solution for urban households. It also served as the basis for testing and refining the system's performance and usability.

Chapter 4

BACKGROUND SURVEY ANALYSIS FOR PROBLEM STATEMENT

4.1 Background Study:

The project focuses on the challenges faced by urban and semi-urban communities in growing their own food due to space constraints, lack of access to resources, and the growing demand for sustainable farming methods. Traditional gardening requires substantial space, time, and resources, which many urban dwellers find difficult to manage. This project aims to address these challenges by offering an automated indoor mini grow system that utilizes soil-based growing techniques to help individuals grow plants efficiently in limited spaces.

4.2 Survey Analysis with Report

A survey was conducted in Arrakambakkam Village to understand the needs and challenges of the community regarding indoor and small-scale gardening. Key findings included:

1. Interest in Gardening: 70% of respondents expressed interest in growing their own vegetables and herbs but were limited by space.
2. Awareness of Modern Farming: Only 20% of participants were aware of hydroponic or automated gardening systems.
3. Water and Resource Scarcity: A significant number (65%) faced difficulties in maintaining a garden due to water scarcity and lack of proper knowledge about efficient gardening techniques.

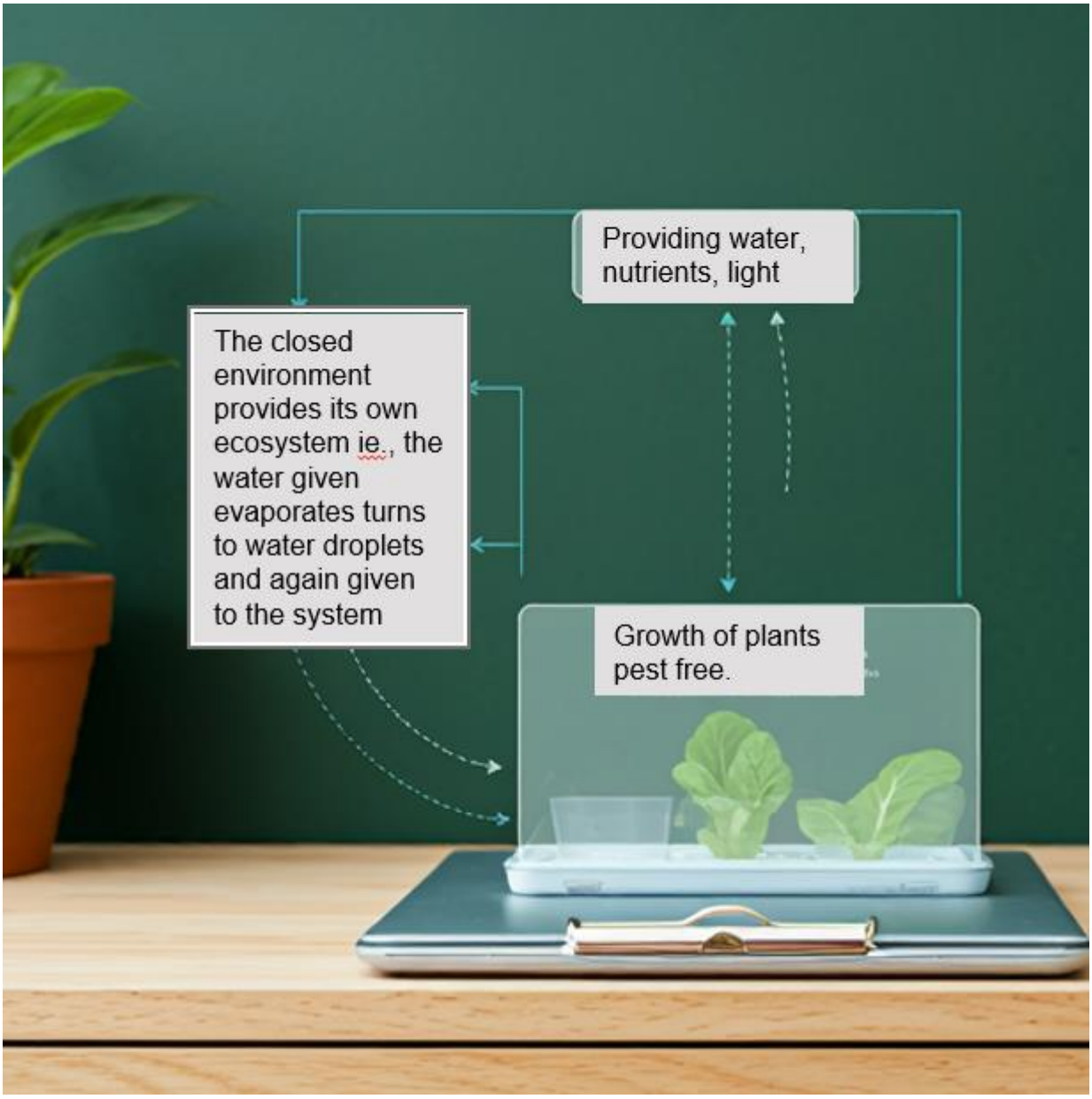

Figure 4.1: Model Flowchart

These insights highlighted the demand for an easy-to-use, resource-efficient gardening solution that could fit within the constraints of small urban spaces.

4.3 Geotagged Photos and Details

During the survey, photos were taken of various households' existing gardening setups in Arrakambakkam Village, documenting the lack of space and resources. These geotagged images provided visual evidence of the need for space-saving solutions. The photos captured small balcony gardens and indoor setups, showing limited plant

growth due to insufficient resources and space.

Figure 4.2: knowing about there interests in indoor gardening

Society-Relevant Problem Identification

The “Automated Indoor Mini Grow System” offers a sustainable, efficient solution to the challenges of space, water scarcity, and food security in urban areas. It empowers individuals to grow their own food, fostering self-sufficiency, better nutrition, and a more sustainable lifestyle.

1. Limited Space for Gardening

Urban areas often lack outdoor space for traditional gardening, particularly in high-rise buildings and apartments. The “Automated Indoor Mini Grow System” provides a compact solution that allows individuals to grow plants indoors, even in small spaces.

2. Water Scarcity

Water shortages are common in urban areas, and traditional gardening methods waste large amounts of water. This system uses efficient watering techniques, reducing water consumption while ensuring plants receive the moisture they need.

3. Environmental Sustainability

Traditional farming contributes to soil degradation and pollution. The system reduces the environmental impact by using “LED lights”, minimizing water use, and avoiding

harmful chemicals, offering a more sustainable alternative to conventional farming.

4. Lack of Knowledge of Modern Farming Techniques

Many Rural residents lack awareness of efficient farming methods like hydroponics and automated gardening. This system simplifies the process and provides an easy-to-use solution, promoting awareness and accessibility to modern, sustainable farming practices.

5. Dependence on Commercial Food Supply

Urban areas rely heavily on commercial food systems, which can be disrupted by crises. The system helps individuals reduce dependence on these supply chains by growing their own food, increasing food security.

6. Health and Nutrition

Urban diets often rely on processed food, contributing to health issues. By enabling people to grow fresh, organic produce at home, the system promotes healthier eating and better nutrition.

Development of Problem Solution

The "Automated Indoor Mini Grow System" was developed to directly address the key challenges identified in urban gardening, offering a practical, sustainable, and efficient solution.

1. Space Efficiency

Urban environments are often characterized by limited space for gardening, especially in high-density areas such as apartments and rental housing. Traditional gardening requires large outdoor areas, making it impossible for many urban dwellers to grow their own food. The "Automated Indoor Mini Grow System" solves this by providing a compact design that fits into small spaces like balconies, windowsills, or kitchens. This system is designed to grow a variety of plants indoors without the need for large outdoor gardens, maximizing limited living space and enabling city residents to cultivate their own food efficiently.

2. Efficient Water Use

Water scarcity is an increasing concern in urban areas, especially in regions where

water resources are limited or unreliable. Traditional gardening methods often result in significant water waste, as they rely on watering large areas of soil. The “Automated Indoor Mini Grow System” uses a “precise, automated watering system” that monitors the moisture level of the soil and waters the plants only when needed. This efficient watering mechanism minimizes water consumption, making the system ideal for areas facing water shortages. Additionally, the use of “soil pellets” helps retain moisture, reducing evaporation and further conserving water.

3. Sustainability and Environmental Impact

The environmental impact of traditional agriculture is a significant concern, with issues like soil erosion, overuse of water resources, and pesticide pollution. The “Automated Indoor Mini Grow System” promotes “sustainable living” by encouraging the use of “organic soil” and avoiding synthetic fertilizers and pesticides. The system is powered by “energy-efficient LED lights’ that consume less electricity compared to traditional grow lights, making it a more eco-friendly alternative. By enabling individuals to grow their own food indoors, the system reduces the need for food transportation, packaging waste, and the environmental cost associated with large-scale farming.

4. Accessibility and Knowledge

One of the main barriers to urban gardening is the lack of knowledge and experience with modern farming techniques such as hydroponics, aquaponics, or automated systems. Many people are unfamiliar with how to grow food efficiently in small spaces, and without the right tools, it can be difficult to get started. The “Automated Indoor Mini Grow System” simplifies gardening by integrating “automation” for lighting, watering, and climate control. This makes the system user-friendly, even for beginners with no prior gardening experience. The automated features eliminate the need for constant monitoring and adjustments, making indoor gardening accessible to everyone.

5. Reducing Dependence on Commercial Food Supply

Urban areas are heavily dependent on commercial food systems, which are vulnerable to disruptions from factors such as natural disasters, economic instability, or global supply chain issues. The “Automated Indoor Mini Grow System” provides an independent food source by enabling people to grow fresh, healthy produce at home. This “local food production” reduces reliance on external food supply chains, increases “food security”, and offers a sustainable solution in the face of potential disruptions. During crises, such as the COVID-19 pandemic, having access to home-grown food

becomes crucial, and this system empowers individuals to ensure they have a steady supply of fresh produce.

6. Improving Health and Nutrition

Access to fresh, healthy, and organic produce is often limited in urban areas, where processed and packaged food is more readily available. Lack of access to nutritious food contributes to health problems like obesity, diabetes, and cardiovascular diseases. The “Automated Indoor Mini Grow System” allows individuals to grow a variety of “nutritious vegetables and herbs” at home, providing them with fresh, organic food at their fingertips. This not only improves “dietary habits” but also promotes healthier eating and lifestyles. Fresh home-grown produce is free from pesticides and chemicals, making it a safer option for families.

7. Cost-Effective Solution

While traditional gardening requires an investment in tools, fertilizers, water, and outdoor space, the “Automated Indoor Mini Grow System” provides a “low-maintenance”, “cost-effective solution” for urban gardening. By using automated features and soil pellets, the system reduces the need for frequent maintenance and replanting, which can be time-consuming and expensive in traditional gardening. Over time, the cost savings from growing your own food, combined with reduced reliance on commercial food sources, make this system a smart and affordable investment for urban households.

Chapter 5

RECOMMENDATIONS AND CONCLUSION

Recommendations

1. Increase Awareness and Training:

Organize workshops and community outreach programs to educate the public about the benefits of automated indoor gardening systems. Demonstrate how easy it is to integrate such systems into small urban spaces and how they can significantly improve food security and sustainability.

2. Affordable and Scalable Solutions:

Develop cost-effective models of the Automated Indoor Mini Grow System to make it accessible to a broader audience, especially in low-income communities. Collaboration with local manufacturers can help reduce production costs, allowing for a more affordable product.

3. Government and NGO Partnerships:

Work with government bodies and non-governmental organizations (NGOs) to promote the adoption of sustainable farming solutions. These partnerships can provide funding or subsidies to make systems more accessible to communities, especially in urban and rural areas where space and resources are limited.

4. Expand the System's Capabilities:

Improve the system by integrating additional features such as solar power for energy savings, sensor-based monitoring for more precise watering and lighting adjustments, and smartphone integration for remote control. This will enhance the user experience and make the system more adaptable to varying environmental conditions.

5. Encourage Community-Based Initiatives:

Establish community hubs where individuals can share resources, such as water

or nutrients, and collaborate on gardening projects. This can help lower costs for individuals and increase the system's effectiveness on a larger scale.

Conclusion

The Automated Indoor Mini Grow System addresses critical challenges faced by urban communities, such as limited space, water scarcity, and the need for sustainable food sources. By providing a compact, efficient, and easy-to-use solution, this system enables people to grow their own fresh produce indoors, improving food security and promoting eco-friendly living. The project's success in Arrakambakkam Village highlights its potential to empower communities by offering an innovative, scalable solution for urban gardening.

With further refinement and broader adoption, the Automated Indoor Mini Grow System can become a powerful tool for fostering self-sufficiency, sustainability, and healthier living in urban areas. By addressing both the practical and social challenges of modern agriculture, this system represents a step forward in creating more sustainable and resilient urban communities..

Appendix A

REFERENCES

[1].Atmadja, W., Alexander, I., Dewanto, S., Nugraha, A. C., & Gokparulian, S. (2022, February). Indoor hydroponic system using IoT-based LED. In IOP Conference Series: Earth and Environmental Science (Vol. 998, No. 1, p. 012048). IOP Publishing.

[2].Van, L. D., Lin, Y. B., Wu, T. H., Lin, Y. W., Peng, S. R., Kao, L. H., & Chang, C. H. (2019). PlantTalk: A smartphone-based intelligent hydroponic plant box. Sensors, 19(8), 1763.

[3].Palande, V., Zaheer, A., & George, K. (2018). Fully automated hydroponic system for indoor plant growth. Procedia Computer Science, 129, 482-488

[4].Nguyen, H. C., Thi, B. T. V., & Ngo, Q. H. (2022). Automatic monitoring system for hydroponic farming: Iot-based design and development. Asian Journal of Agriculture and Rural Development, 12(3), 210-219.

[5].Narvios, W. M. O., Cesa, C. K. N., Batayola, F. F., Bolo, K., Verdida, S. M., & Nguyen, Y. Q. (2022, October). Smart aquaponics system for a small-scale farmer for highly urbanized settler. In AIP Conference Proceedings (Vol. 2502, No. 1). AIP Publishing.

[6].Lund, H. H., Exner, M., Jensen, N. E., Leggieri, M., Outzen, M., Ravn-Haren, G., ... & Andersen, R. (2022). GrowBot: An Educational Robotic System for Growing Food. Applied Sciences, 12(11), 5539.

[7]. Mir, M. S., Naikoo, N. B., Kanth, R. H., Bahar, F. A., Bhat, M. A., Nazir, A., ... & Ahngar, T. A. (2022). Vertical farming: The future of agriculture: A review. The Pharma Innovation Journal, 11(2), 1175-1195.

[8]. Morgan, L. (2021). Hydroponics and protected cultivation: a practical guide. CABI.