Autonomous Aquaponic System

Team 120

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Introduction

Aquaponics represents an innovative and sustainable approach to agriculture that integrates aquaculture (fish farming) and hydroponics (soil-less plant culture). This symbiotic system offers significant advantages over traditional farming methods, including efficient resource utilization, reduced environmental impact, and increased productivity. This executive summary provides an overview of aquaponics, its benefits, challenges, and potential applications.

Problem Statement

Traditional aquaponic systems require constant human oversight, limiting scalability and efficiency, particularly in remote areas. Fluctuations in environmental conditions can disrupt the ecosystem balance, impacting fish and plant health.

Constraints

1. Temperature(81-84°F).
2. pH(7-8).
3. Total Ammonia Nitrogen (TAN) (<1ppm) and Nitrite (NO2) (<1ppm).
4. Dissolve Oxygen (DO) > 7pmm.

Specifications

1. Production of 28 tons of fish yearly.
2. Reduce the water usage from regular farming by 90%
3. Lettuce harvest each 35 days.
4. Number of lettuce produced 2,324,000 heads yearly .

Project Impact

1. Economic
Aquaponic systems offer efficient, sustainable food production, innovating agriculture and stabilizing consumer prices. They boost regional development, especially in land-constrained areas, with potential for automation to enhance autonomy.
2. Societal
Aquaponic systems positively impact society by addressing food security, promoting healthier lifestyles, and fostering community engagement, resilience, and self-sufficiency.
3. Environmental
Aquaponic systems promote sustainable agriculture by minimizing resource consumption, reducing pollution, and conserving water and energy, fostering environmental conservation.

Testing & Validating

Biological Health: The health and growth rates of both plants and fish were monitored closely. Specific tests ensured that water temperature remained between 81-84°F, pH levels were maintained between 7 and 8, ammonia and nitrite levels stayed below 1 ppm, and dissolved oxygen was above 7 ppm. These parameters are crucial for the vitality of the system and directly impact its productivity and sustainability

Day	pH	NH_4	NO_2	NO_3	PO_4	O_2	Date
1	7.3	0.3	2	40	0.3	9	16.04.2024
2	7.4	0.3	1.8	40	0.3	9	17.04.2024
3	7.3	0.3	2	40	0.3	9	18.04.2024
4	7.4	0.3	1.8	40	0.3	9	19.04.2024
5	7.3	0.3	2	40	0.3	9	20.04.2024
6	7.4	0.3	1.8	40	0.3	9	21.04.2024
7	7.3	0.3	2	40	0.3	9	22.04.2024
8	7.4	0.3	1.8	40	0.3	9	23.04.2024
9	7.3	0.3	2	40	0.3	9	24.04.2024
10	7.4	0.3	1.8	40	0.3	9	25.04.2024
11	7.3	0.3	2	40	0.3	9	26.04.2024
12	7.4	0.3	1.8	40	0.3	9	27.04.2024
13	7.3	0.3	2	40	0.3	9	28.04.2024
14	7.4	0.3	1.8	40	0.3	9	29.04.2024
15	7.3	0.3	2	40	0.3	9	30.04.2024

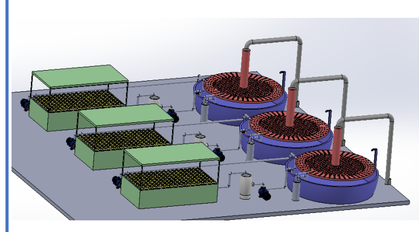
Prototype Designing

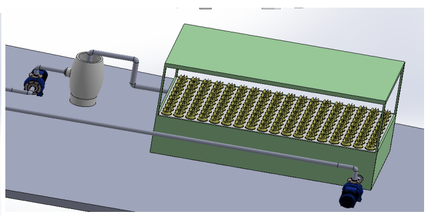
For the prototype assembled, there are iron stand that collect all the components. Firstly, we have a fish tank with a size of 90 cm length, 35 cm width and 70 cm height. Above that tank, we have 15 cm then the plant tank with a size of 90 cm length, 35 cm width and 35 cm height. And finally there are light bare at the top of the stand. In addition to that , the biofilter and mechanical filter box are designed to be in parallel to the plant tank to be in good shape. The stand will be carried by four tires to easily move it.

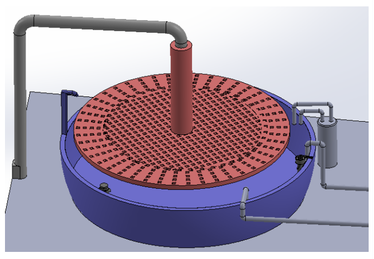
the prototype components and materials are :

1. Fish tank, is made of laminated glass that does not break
2. Plant tank, is made of laminated glass that does not break
3. DWC stand, is made of reinforced aluminum.
4. Prototype stand, is made of iron and painted with rust insulator
5. Water pump, is made of plastic
6. Air pump, is made of plastic and has a black distributor
7. UV filter, is made of plastic
8. Biofilter and mechanical filter, are assembled by plastic box
9. Protein skimmer, is made of plastic
10. Heater, is made of steel and irons

Full System Designing







Conclusion

The Autonomous Aquaponic System revolutionizes urban agriculture, optimizing resource use for high yields while minimizing environmental impact, offering scalable, sustainable food production worldwide.