

Automated Hydroponics System

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Abstract - In some drought-prone areas like Marathwada, Vidarbha in Maharashtra and other Indian states, one may be concerned about the state's precious water supply. However, despite its reliance on H₂O, hydroponics will not negatively impact water availability. On the contrary, hydroponics can actually help the environment. This project encompasses the design, construction, and evaluation of a vertical hydroponic tower. The tower is to be designed to cycle nutrient rich water through hydroponic system; tray and water culture technique then return the water back to the reservoir.

Key Words: soil-less farming, organic farming, water culture, tray system, fodder production

1. INTRODUCTION

Hydroponic systems grow with the water culture. The only requirements with the water culture system is a water reservoir to supply nutrients to the plants, a platform for the plants on top of the nutrient solution. Water culture systems are the systems of leafy lettuce. These are very inexpensive systems, which can be utilized in areas with little to no electricity.

1.1 Resume

In present study, automated hydroponic system is controlled and monitored by different electronic sensors such as water level indicator, humidity sensor, temperature sensor etc. Present work covers mechanical and electronics knowledge for agricultural application. Proposed study will advantageous for soil-less cultivation process whereas in the project water culture is used. All the variables like temperature, humidity and water flow can controlled and supply precisely without manual interface by using automated hydroponic system.

1.2 Motive

In India, the agricultural sector occupies a vital position in the overall economy of the country. Though the share of agriculture in national income has come down, still it has a substantial share in Gross Domestic Product(GDP). Hence, as an engineer, it is our responsibility to contribute for society. Contemporary Exercises – Hanging gardens of Babylon, Aztec floating gardens.

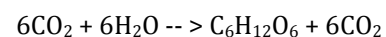
1.3 Statement

Preparation of automated sustainable small-scale hydroponic cropping of fodder for limited resource growers

in draught prone areas and minimization of diseases with the help of suitable pastes and nutrients.

1.4 Working principle

Plants grow through a process called 'photosynthesis', in which they use sunlight and a chemical inside their leaves called chlorophyll to convert carbon dioxide (a gas in the air) and water into glucose (a type of sugar) and oxygen. Write that out chemically



1.5 Need

Green food is the natural diet of cattle. Green food is the most viable method to not only enhance milk production, but to also bring about a qualitative change in the milk produced by enhancing the content of unsaturated fat, Omega 3 fatty acids, vitamins, minerals and carotenoids.

1. Land preservation
2. Water conservation
3. Faster growth and maturity
4. Contamination free
5. Minimal use of Fungicide and Pesticide
6. Less labour and maintenance costs
7. Control over growing environment
8. Time saving
9. Perennial production
10. Highly palatable and Nutritious food

2. EXPERIMENTATION

In natural conditions, soil acts as a mineral nutrient reservoir but the soil itself is not essential to plant growth. When the mineral nutrients in the soil are dissolved in water, plant roots are able to absorb them. When the required mineral nutrients are introduced into a plant's water supply artificially, soil is no longer required for the plant to thrive. Almost any terrestrial plant can grow like this.

2.1 Contemporary Facilities

Now in the present system the structure of hydroponic shade is Bamboo Apparatus, Plant material and Nutrient solution.

We have conducted the experiment in a small room of about 3m x 3m x 3m in dimension. Two sides of the room

have walls, while the other two sides (North-South) have double glazed glass windows, permitting the sunlight, and filtering out the heat. The optimum temperature required for hydroponic crops is around 22°C and the maximum temperature that the crop can tolerate is usually around 30-32°C. Since during winter season the temperature in northern India is well within the acceptable limits, thus facilitating successful hydroponics production.

2.2 Contemporary Operations

We used the seeds of barley and wheat, barley is considered the seed of choice for production of hydroponic fodder. Seeds of this crop are inexpensive and freely available in the Indian market. We also used wheat seeds. The seeds of these two crops (around 1 kg each) were placed in small plastic trays (approx. 100 grams mass each), which were arranged in a shelf system made of bamboos. The choice of bamboo instead of aluminum or steel was to make this economically viable and adaptable by any Indian farmers.

Our goal was to make this fodder completely in an organic manner, and to suit the local Indian conditions for development of a cost-effective hydroponics Fodder device. Hence, we decided to use fungicide and nutrient solution commonly known as *Beejamrit*.



Fig -1: Bamboo Structure and Tray

In our system, we have used automatic water sprinkling system. This constitutes temperature & humidity control, water level control. In this system, GSM module is also used to inform user or farmer, about water level in tank and readings of temperature and humidity.



Fig -2: GSM Module

Sensor Inputs

1. Temperature
2. Humidity
3. Water level

After-Effects

1. Sprinkling time - 1min. after every 1 hour.
2. Temperature and humidity display
3. Text message to user after fall in the water level
4. Sprinkling of water if temperature exceeds 35°C until it reaches set value.

3. STRUCTURE AND HARDWARE IMPLEMENTATION

3.1 Structure

The vertical hydroponic unit needed to be constructed for the cultivation of crops into it. It was a multi-storey cultivation of crops in trays. In this system, we used PVC pipes as frame or structure.

1. Selection of material for structure

1. Steel Pipes - Weight carrying capacity of Steel pipes is good but they might corrode and also has high weight. So, PVC pipes was good alternative.
2. Cutting of pipes
3. Trays of 1.5"x1" are selected.
4. Assembling
5. Installation of sprinkler and pipes.



Fig -3: PVC Structure and Trays

3.2 Hardware implementation

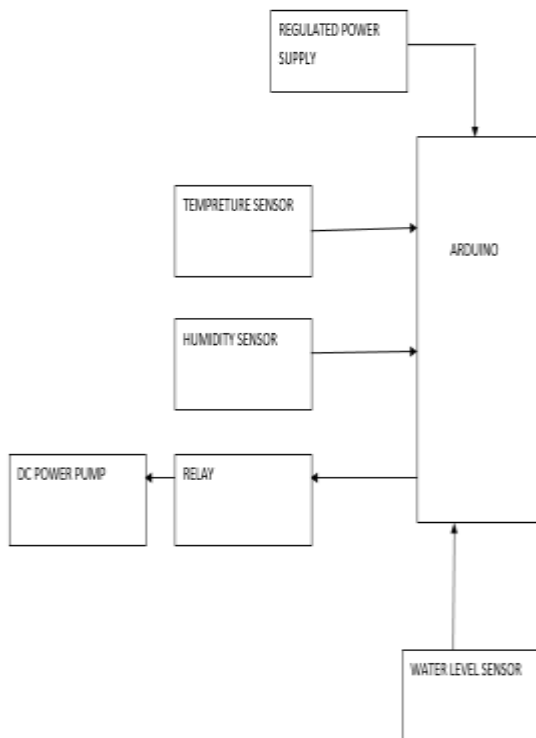


Fig -2: Block Diagram

As shown in diagram, parts given below are used in hardware part of control system:

- Arduino Uno
- Temperature and Humidity module DHT11
- DC water pump 12V, 3.0A, 9.6 LPM, 6.8 Bar
- Atmega 328p
- GSM kit SIM900
- Crystal
- Relay
- Float sensor
- Liquid Crystal Display (LCD)
- Diode
- Transistor
- Preset
- Voltage regulator
- Light Emitting Diode (LED)

4. EXTENSIONS

This is small version of hydroponics farming, we can extend this system to the next level. Some Ideas we are going to implement are:

- Wi-Fi Module
- Android and iOS Application.
- Automated Tray rotation cycle

- Bluetooth Module for Near Field Communication
- Nutrient Film Technique and other advance systems.

5. LEADS



6. CONS

- Water and electricity risks
- System failure threats
- Initial expenses – High
- Diseases may spread quickly

7. APPROXIMATE COSTING

As per our construction, costing for the fodder system varies according to the number of cattle. This also includes capacity of the plant, production rate, number of trays, quantity of fodder per tray.

Control system varies with the head required by structure, flow rate of sprinklers and extra requirements of the user. For production in large scale, high number of trays, big structure and high capacity pump is required.

8. RESULTS

1. In a period of week, fodder grown up to 11.
2. Water requirement was 30% of conventional farming.
3. If trays are not provided with holes, it results in accumulation of water which leads to fungi growth. Hence, one should provide 8 to 10 holes per tray.
4. Noticeable reduction electricity consumption.

9. CONCLUSIONS

It has now been a little over 2 weeks since we've begun our deep-water culture hydroponic system. The roots of plants are visible. By using this system, farmers in draught prone areas can grow fodder at affordable price. Price of the fodder per kg reduced up to ₹ 2 to ₹ 3.

Thus far we've tested and adjusted the water sprinkling time, we think that this system is successfully conducted.

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