VISVESVARAYA TECHNOLOGICAL UNIVERSITY

BELGAUM-590 018, KARNATAKA.

PROJECT SYNOPSIS

ON

"IOT BASED INTELLIGENT OUTDOOR AQUAPONICS WITH AUTOMATED GROW LIGHTS"

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CONTENT

KEYWORDS

SL.NO	KEY WORDS	ABERIVATIONS
1	TDS	Total dissolved solids
2	NPK	Nitrogen, Phosphorus, and Potassium
3	IOT	Internet of Things

CHAPTER 1

INTRODUCTION

Aquaponics is a technology that showcases a natural way of producing the food by combining two different systems i.e., Aquaculture and hydroponics into a single structure. Here, the fish in the tank will produces waste in the form of nutrients with an NPK (Nitrogen , Phosphorous , Potassium) ratio 5:1:1 , the majority of ammonia from fish is excreted through the gills and also formed by uneaten feed or other organic matter in an aquarium decomposes, that water will pump towards the media chamber where we use biofiltration where ammonia break down into nitrate , nitrogen in two steps know as nitrification and this water again pump towards the grow pipe where plants are placed . The crop will then obtain all the required nutrients from the tank water. Finally, the recycled water from the plants will be circulated back to the fish tank. The cycle of fish getting fresh water and crop receiving nutrients for growth will take place. The main advantage of such an arrangement is conservation of many resources like water, soil and energy.

One approach to the sustainability of food and agriculture systems in the world is aquaponics. Being Food security a concern, this process can solve the issues of Water deficiency, contamination, labor work and give productive results. This system bounds two agricultural products i.e., fish and vegetables being produced from a single source that will improve livelihood strategies to secure food within small income. Aquaponic system will raise fish with the aid of using imparting urea for the nitrogen- eating microorganisms with a view to clean the water where in the fish stay, by breaking down those compounds from the fish waste present with-inside the recirculating water converts ammonia into nitrate, consequently turning it into a vital detail wished for the vegetation' growth. The aquaponic system has its supremacy in solving many societal issues by reducing the amount of land used for the cultivation, food security problems, urban countries where the fresh production isn't available and many such difficulties. The proposed aquaponic system can be an autonomous solution for all these confusions.

The Nutrient Film Technique (NFT) is a hydroponic growing technique adapted to aquaponics because of its simple yet effective design that works well in some environments. This method uses horizontal pipes (usually PVC pipes) with shallow streams of nutrient-rich water flowing through them. Plants are placed in the holes in the top of the pipes and can utilize this thin film of nutrient-rich water.

CHAPTER 2

OBJECTIVES

- To Automate the entire process by installing different sensors.
- To make it cost effective.
- To grow more plants with less space.
- To grow plants using aquatic animal waste.
- To grow nutritious and healthy foods.
- To develop a sustainable and ecologically efficient system.

CHAPTER 3

METHODOLGY

Recent developments in detection, technology, and the IoT have resulted in significant advancements in the applications of environmental monitoring. The major goal is to create an IoT-based aquaponics monitoring system that constantly monitors and shows data like as pH, water level, humidity, temperature, TDS and so on to the user. water inside the aquarium tank may be made to make certain the fish and plants in the system thrive and survive in a healthy environment. We begin by connecting sensors to ESP32 and interacting with pH sensor, water level sensor, grow light, water Temperature sensor, humidity sensor, automatic fish feeding system and electrical conductivity. ADC is the process of converting analogue sensor data to digital data ESP32 is used to manipulate the data. With a serial communication between ESP32 and sensors, all processed data is sent to ESP32. The systems parameters and information may be shown on the server through Arduino IoT Cloud constantly with the implementation of Internet of Things in the Aquaponics Monitoring system. The Arduino IoT Mobile application will be connected to the system and provide alert notification to the user if any disturbance is found. The components mentioned above are utilized in the operation of the aquaponics system, as are the sensors, which are used to manage worst-case circumstances. Sensors are the most frequently used component for the proper working of the system because if any abnormal conditions arise, the sensors will always provide readings for awareness.

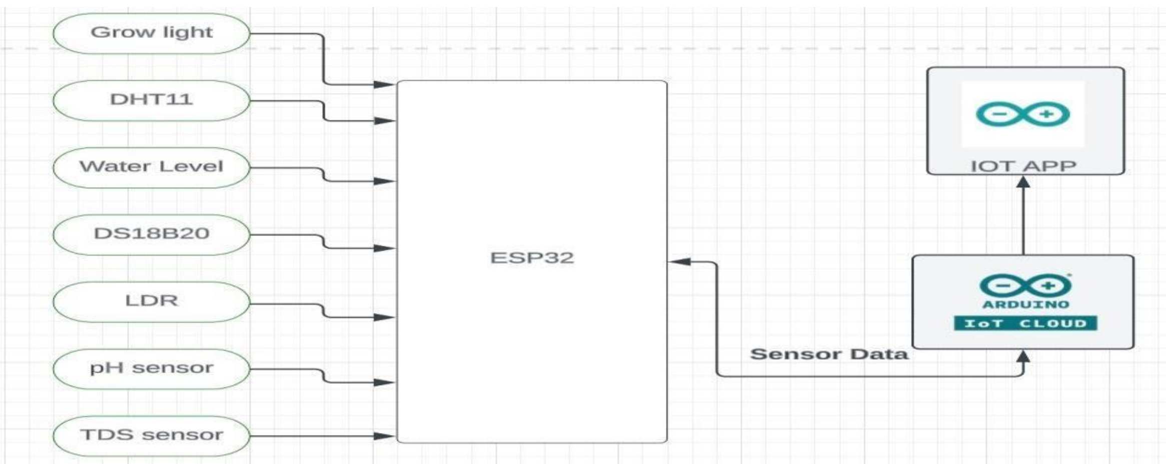

Fig.Block Diagram.

CHAPTER 4

RESULT

Fig 4.1 Exhibits the proposed IoT based intelligent outdoor aquaponics with automated grow lights which we have developed. Various environmental climate data like, relative humidity, and light intensity and water quality data like water temperature, pH, TDS, and water level were continuously collected for 15 consecutive days. The plant used is tomato, and the fish is koi-carp. The fig 4.2 shows the readings of all the sensors.

The automatic activation of grow lights was also observed. Although the grow lights are controlled for 8 hours daily, because tomato requires 8 to 10 hours of light per day, the grow lights are usually activated for only 8 hours, when the surrounding light intensity drops below the preset threshold of 25000 lux.

Fig. 4.1 Aquaponics System

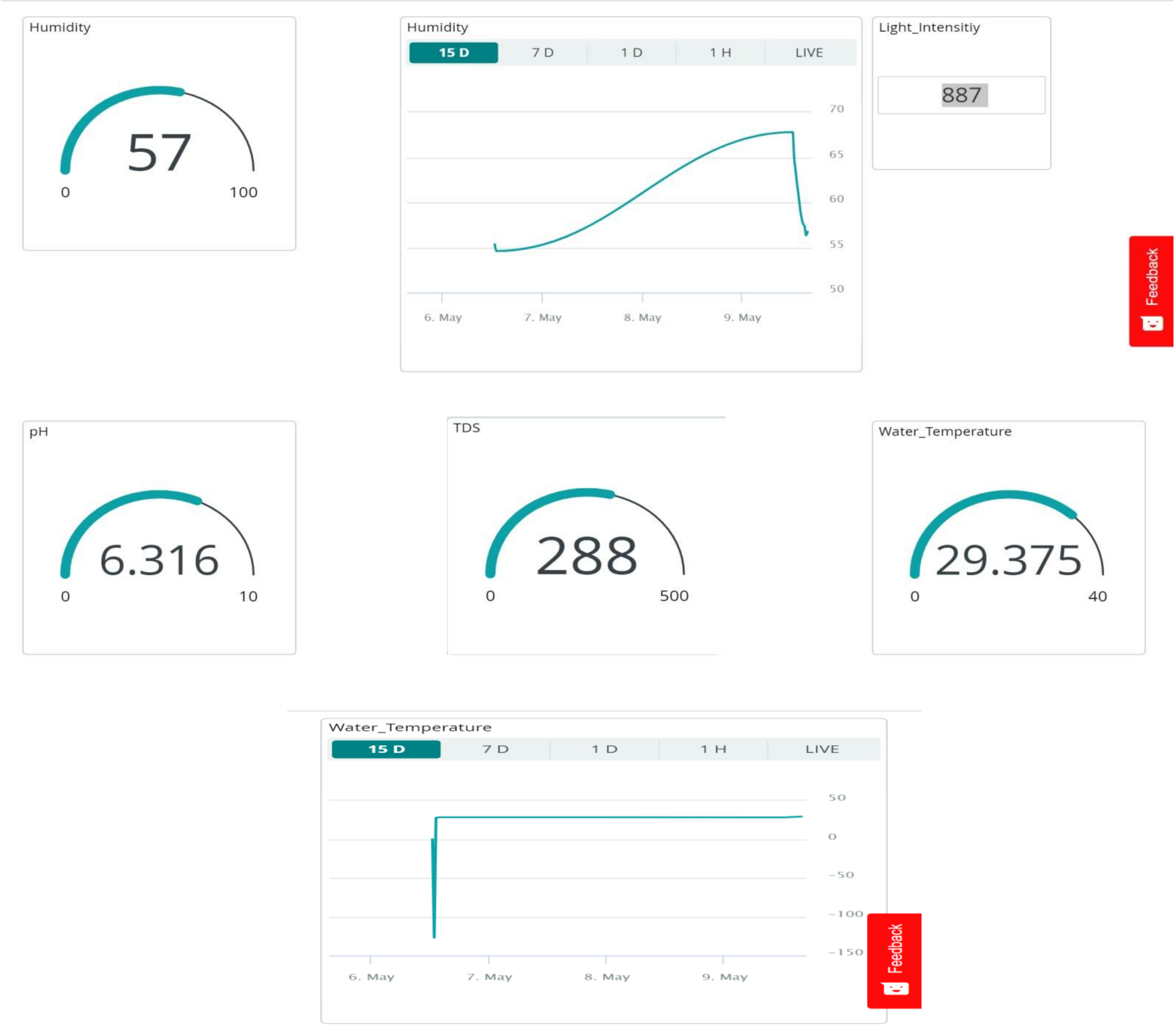

Fig. 4.2 Sensor Data

CHAPTER 5

5.1CONCLUSION

An intelligent outdoor aquaponics system with automated grow lights and IoT was successfully designed and built. The proposed aquaponics system consists of sensors unit, actuators unit, alerts and notifications unit, central control and processing unit, and graphical user interfaces for web and desktop applications. The grow lights are automatically activated when the ambient light intensity falls below the required light intensity for growing plants. The proposed aquaponics also requires low labour and operating costs because there is continuous monitoring and control of environmental climate, water quality, and fish feed; provision of early warnings to the user short text messages, as well as rectification of abnormalities with minimal human intervention.

While the proposed high-tech and high-yield aquaponics can potentially improve food security and sustainability, we recommend three areas of improvement. First, computer vision, a category of artificial intelligent, could be adopted to monitor the activeness of the fish. Algorithms such as image segmentation and object detection would be useful in detecting the fish within the fish tank and tracking the fish movement. Based on the activeness of the fish, the health of the fish can be determined. Next, machine learning and statistics, for example classification or regression algorithms, can be utilised to detect the health status of the plants. By training the classification model with healthy and unhealthy plant images captured through computer vision, the health status of the growing plants can be determined. Last but not least, solar panels with automatic solar tracker could be implemented to harness solar energy for powering the proposed outdoor aquaponics system with automated grow lights and IoT.

5.2 FUTURE SCOPE

The scope for future work in IoT-based Intelligent Outdoor Aquaponics systems is quite promising. Here are some areas that offer significant potential for advancement:

1. **Data Analytics and Machine Learning:** IoT sensors collect vast amounts of data in Aquaponics systems. The future lies in leveraging this data through advanced analytics and machine learning algorithms. This can help optimize resource usage, predict system behavior, identify patterns, and make informed decisions for maximizing efficiency and productivity.
2. **Automation and Control:** Integrating IoT with Aquaponics allows for intelligent automation and control. Future work can focus on developing smart algorithms and actuators that automatically adjust parameters like temperature, pH levels, water flow, and nutrient distribution. Such automation can enhance system stability, reduce manual intervention, and improve overall performance.
3. **Energy Optimization:** Aquaponics systems often require energy for various components such as pumps, lighting, and climate control. Future work can focus on developing energy optimization techniques using IoT. This may involve integrating renewable energy sources, like solar panel.
4. **Scalability and Modular Design:** Aquaponics systems can vary in size, from small-scale home setups to large commercial operations. Future work can focus on designing scalable and modular IoT-based systems that accommodate different scales and allow for easy expansion or replication. This would enable wider adoption and customization according to specific needs.