*Automatic Fish Feeder & Smart Irrigation System*

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***Abstract*—This project aims to design and develop an automated fish feeder and soil irrigation system that can be controlled remotely by the user. The system comprises of two main components: a fish feeder and a soil irrigation unit. The fish feeder is designed to dispense the right amount of fish feed at specific times of the day, while the soil irrigation unit is responsible for watering plants at regular intervals. The system is built using modern engineering tools and advanced techniques, including Microcontrollers(ESP 8266),Soil moisture sensor, and Relays. The project also involves testing the system and analyzing the results. The proposed system has significant environmental and social benefits, making it a novel and relevant solution for improving aquaculture and agriculture practices.**

***Keywords--* Automatic Fish Feeder,Soil Irrigation System,ESP 8266, Soil moisture sensor, Relays.**

# I. Introduction

A*. Motivation*

Automatic fish feeders and smart irrigation systems are both examples of technology designed to make our lives easier and more efficient. An automatic fish feeder can dispense the exact amount of food needed for your fish, helping to prevent overfeeding and reduce waste. It can also be programmed to dispense food at specific times, ensuring that your fish are fed consistently even when you're not home. Similarly, a smart irrigation system can be programmed to water your plants only when necessary, helping to conserve water and prevent over-watering or under-watering. It can also be controlled remotely, allowing you to monitor and adjust your watering schedule from your phone or computer(Kumar et al. [1]).Overall, the motivation behind these technologies is to provide convenience, consistency, and efficiency, while also potentially reducing waste and conserving resources. With these systems in place, you can spend less time worrying about the care and feeding of your fish and plants, and more time enjoying them.

B*.Background Studies/Literature Survey*

Automatic Fish Feeder:

There are several studies that have investigated the effectiveness of automatic fish feeders(Kumar et al. [1]).For example, a study published in the journal Aquaculture International found that an automatic feeder can improve feeding efficiency and reduce labor costs in fish farming operations. The study also noted that automatic feeders can help prevent overfeeding and reduce waste.

Another study published in the Journal of Aquatic Animal Health(R.C.Marak et al. [4]) found that automatic feeders can be used to provide consistent feeding for fish in aquaculture systems. The researchers noted that this can help improve fish growth rates and reduce stress, which can lead to better overall health and productivity.

Smart Irrigation System:

There is also a growing body of research around the effectiveness of smart irrigation systems. For example, a study published in the journal Sensors found that a smart irrigation system can help reduce water consumption and improve crop yield(V,D.Dung et al. [2]). The researchers noted that the system can be programmed to water crops only when necessary, based on factors like soil moisture, weather conditions, and plant growth stage.

Another study published in the Journal of Irrigation and Drainage Engineering found that a smart irrigation system can help reduce water consumption and improve water use efficiency in residential landscapes(Y.Yang et al. [3]). The researchers noted that the system can be controlled remotely, allowing users to adjust their watering schedules based on changing weather conditions.

C*.Objectives*

The problem with traditional fish feeding methods is that they require manual labor, which can be time-consuming, costly and may not provide consistent feeding, resulting in uneven growth and health of the fish. Similarly, traditional irrigation methods can be wasteful and may not apply water precisely, which can lead to reduced crop yields and plant health.By studying automatic fish feeders and smart irrigation systems, we hope to achieve several goals:

For automatic fish feeders, we hope to develop a system that can automate the feeding process, providing consistent and precise feeding for improved fish growth and health. This can reduce the labor and cost associated with manual feeding, as well as improve the overall productivity of fish farming.

For smart irrigation systems, we hope to develop a system that can conserve water resources by applying water only when necessary and minimizing waste. This can improve crop yields and plant health, as well as reduce the adverse environmental impact.(Y.Yang et al. [3]).

# II. Project Architecture

## A. Design Approach

In order to design the project we first focused on the problems at hand which were the consistent feeding schedules of fish and efficient irrigation of the plants above the aquarium.We faced the issue that even though the fish feeder was timed properly it wasn’t able to feed the food at consistent intervals for a long time i.e it started creating some delay in feeding overtime; and we understood that this was a problem of our IC(microcontroller we used).So we had to research a bit and we found a microcontroller which was more compatible with the feeder and also heated less even if on for a long duration.We faced another problem in smart irrigation part of the project which was that when we used the aquarium water to feed the plants, usually the amount of water irrigated would become much more than the amount needed for the growth of the plants thus resulting in the death of the plants;so we decided to use a soil moisture sensor and with small research we interfaced the soil moisture sensor with the microcontroller in such a way that only after the moisture reaches below a certain threshold, the water will start flowing and after the moisture again reaches the threshold, the flow of water through the dc pump motor will stop.After this, we will build and test a prototype of the system to ensure that it meets the design specifications and is effective in addressing the identified problem. We will then need to conduct rigorous testing and evaluation of the system to ensure that it meets your research objectives and is effective in addressing the identified problem.

Based on the results of testing and evaluation, we refined the design and prototype of the system as needed to improve its performance, efficiency, and usability. Once the system design was finalized, we implemented the system for use in the target environment and developed a plan for ongoing maintenance and updates to ensure continued optimal performance.



Fig1: Pin Diagram of ESP 8266 Microcontroller

## Circuit Diagram



Fig 2: Simulated Circuit Diagram of the Project

We implemented the above circuit in hardware and then did a testing of the prototype.



Fig 3: Hardware Implementation of the Simulated circuit

# III. Working of Prototype

The project involves two main components: a soil irrigation system and a fish feeder.

The soil irrigation system uses a soil moisture sensor to detect the moisture level in the soil. If the soil is dry, the system activates a relay module that powers a DC pump to irrigate the soil with water(A.Shrivastava et al. [5]).

The fish feeder, on the other hand, uses a servo motor to rotate a container filled with fish food at a scheduled time interval. The servo motor is controlled by a NodeMCU microcontroller, which can be programmed to rotate the container every 12 hours or at any other desired interval.

Both components are powered by an external power supply, which ensures that they operate continuously without any interruption. Overall, the project provides an automated solution for maintaining the soil moisture level and feeding the fish in a hassle-free manner.



Fig 4: Flow chart of the Working of Prototype

# IV. Results obtained



Fig 5: Soil Moisture monitoring Graph



Fig 6: Graph showing the change in moisture over time



Fig 7: Graph showing the run time of DC Motor

# V. Acknowledgement

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# V. Conclusion

In conclusion, our project aimed to create an automated aquaponics system that is cost-effective and easy to use for beginners. The project involved the design and construction of two main components, namely the soil irrigation system and the fish feeder system, which were controlled by an Arduino microcontroller. Through our research and experimentation, we were able to demonstrate the feasibility and effectiveness of our system in maintaining a healthy environment for both plants and fish.

One of the major challenges we faced was the integration of the two systems, as they operated on different schedules and required different environment conditions.

However,through careful planning and coordination, we were able to overcome this challenge and achieve a successful integration of the two systems.Moving forward, we believe that our project has great potential for further development and improvement. One area of improvement could be in the optimization of the irrigation and feeding schedules to better meet the needs of the plants and fish. Additionally, we could explore the use of sensors to further automate the system and reduce the need for manual monitoring and adjustment.

Overall, we are proud of the progress we have made and the results we have achieved in this project. We hope that our work will inspire others to explore the possibilities of aquaponics and contribute to the development of sustainable and efficient farming practices.

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