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Automatic Demand Fish Feeder

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Abstract: *Humans have kept fish for thousands of years for commercial, research, and aesthetic purposes. These fishes are kept in aquariums, ponds, and other containments and require regular feeding and care. Traditional feeding techniques involve manually dispensing the food at regular intervals, they must alsobe able to control all kinds of factors such as feeding, air pumps, light, and the pH value of water, which may affect the fish. Overall, it's a labor-intensive process. This research aims to develop a simple prototype automatic fish feeder. The product is designed to simplify the process of feeding fish in aquariums or fish farms. The feeder is equipped with obstacle avoidance technology, allowing it to move around the aquarium and ensure equal feeding for all fish. Additionally, the feeder includes a pH sensor, constantly monitoring the water quality in the aquarium to ensure a healthy environment for the fish. This technology not only simplifies the feeding process but also helps to maintain the well-being of aquatic life..*

Keywords: Quantitative Insights, Mathematics and Physics, College Education

I. INTRODUCTION

Aquaculture is a rapidly growing industry that significantly provides food for a growing global population. One of the challenges in fish farming is the need to maintain a consistent feeding schedule while ensuring that the fish receive the appropriate amount of food accordingly. Manual feeding can be a time-consuming and labor-intensive process, particularly in larger fish farms. To address these challenges, automatic fish feeders have been developed.

However, traditional automatic fish feeders lack mobility, which limits their effectiveness in large or irregularly shaped fish farms. Moreover, maintaining water quality is a critical aspect of fish farming that must be considered. The pH level of the water can impact the health and growth of the fish, and maintaining optimal pH levels is crucial for maximizing production.

To overcome these challenges, this project proposes an automatic demand fish feeder that can move around the fish farm and has obstacle avoidance and pH sensors to monitor water quality. The feeder uses a microcontroller and motor to navigate around obstacles, dispense feed andmonitor if the pH level is within the optimal range. Also, an adaptive feeding system could be implemented based on the fish's feeding habits and requirements. This approach ensures that the fish are well-fed, reducing the risk of overfeeding or underfeeding,reducing food waste, andmaintaininga healthy environment for their growth.

This report outlines the design, development, and testing of the automatic demand fish feeder with obstacle avoidance and pH sensors. The project aims to provide a cost-effective solution for fish farmers to improve their production and reduce manual labor. This project seeks to provide an innovative and practical solution for fish feeding and maintaining water quality in aquaculture

1.1 Objectives

The objective of the project is to design and build an automatic fish feeder with obstacle avoidance and a pH sensor that can dispense fish food at the right time and quantity while avoiding obstacles in the feeding area and ensuring that the pH level of the water in the fish tank is within the acceptable range. Must also have an adaptive feeding system could be implemented based on the fish's feeding habits and requirements.The feeder should be easy to use, reliable, and improve the health and well-being of the fish by providing them with the right amount of food at the right time and under the right conditions.

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1.2 Scope

The project has a lot of potential for improvements. Some possible areas for enhancementare obstacle avoidance, feeder capacity, energy efficiency and thecontrol of the bot.

1.3 Potential competitors

There are a few potential competitors to an automatic demand fish feeder robot:

- **Traditional automatic fish feeders:** These devices have been around for a while and are widely used by fish owners. They work on a timer-based system and dispense a predetermined amount of food at specific intervals.
- **Aquarium automation systems:** Some companies offer full automation systems for aquariums, including automatic feeders, lighting, temperature control, and more. These systems can be expensive but provide a complete solution for aquarium maintenance.
- **Manual feeding:** Although not a direct competitor to an automatic feeder, many fish owners still prefer to feed their fish manually. This method allows for greater control over portion sizes and feeding schedules but requires more time and attention.
- **DIY automatic feeders:** Some hobbyists may choose to build their own automatic feeders using various components and electronic devices. While this option can be more cost-effective, it requires technical skills and knowledge

II. REVIEW OF LITERATURE

Several studies have highlighted the benefits of automatic demand fish feeders.

In a study by Hoang et al. (2020),[1] the researchers found that automatic demand fish feeders increased fish growth and survival rates. The researchers observed that fish fed with automatic demand fish feeders grew faster and had better survival rates than those fed manually. The automatic feeder provided fish with food on-demand, ensuring that they were fed regularly, and this resulted in improved fish health.

In a study by Shahid et al. (2018),[2] another benefit of automatic demand fish feeders that would help to reduce labour costs and improve efficiency was found. The researchers observed that the automatic feeder saved time and reduced labor costs, as fish did not need to be fed manually. Additionally, the feeder provided fish with a constant supply of food, ensuring that they were well-fed and healthy.

One of the main limitations is that they can be expensive to purchase and maintain. In a study by Alawneh and Al-Rousan (2020),[3] the researchers found that the cost of purchasing and maintaining automatic demand fish feeders was high, especially for small-scale fish farmers. The researchers suggested that there was a need for affordable and efficient automatic-demand fish feeders to make them accessible to small-scale farmers.

In a study by Cheng et al. (2019)[4], the researchers found that power outages could disrupt the feeding schedule of automatic demand fish feeders, leading to underfeeding or overfeeding of fish. The researchers suggested that alternative power sources, such as solar power, could be used to ensure a stable power supply.

In a study by Agunloye et al. (2021)[5], the researchers developed a low-cost automatic demand fish feeder using locally sourced materials. The feeder was found to be effective and efficient, and it could be easily replicated by small-scale fish farmers.

Another area of research is the use of artificial intelligence (AI) to improve the efficiency of automatic demand fish feeders. In a study by Li et al. (2021)[6], the researchers developed an AI-based automatic demand fish feeder that could adjust the feeding rate based on the fish's behavior and appetite. The feeder was found to be more efficient than traditional automatic feeders, and it could reduce overfeeding and food wastage.

III. METHODOLOGY

3.1 Procedure

Arduino Nano:

The Arduino Nano is a small, compact microcontroller board that is used to control the stepper motor, servo motor, and BLDC motor in the Automatic Demand Fish Feeder. The Arduino Nano is programmed using the Arduino programming language, and it is responsible for controlling the timing and movements of the motors.

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ESP8266 NodeMCU:
The ESP8266 NodeMCU is another microcontroller board that is used to operate the pH sensor in the fish feeder. The NodeMCU is a low-cost Wi-Fi module that is commonly used in Internet of Things (IoT) projects. It is programmed using the Lua programming language, and it is responsible for monitoring the pH level of the water in the fish tank.

pH sensor:
The pH sensor is a device that is used to measure the acidity or alkalinity of a liquid. In the fish feeder, the pH sensor is used to monitor the pH level of the water in the fish tank to ensure that it is within a safe range for the fish.

Stepper motor:
The stepper motor is a type of motor that is used to control the feeding mechanism in the fish feeder. The stepper motor is controlled by the Arduino Nano, which rotates the motor in precise increments to dispense the correct amount of fish food

Servo motor:
The servo motor is another type of motor that is used to control the rudder in the fish feeder. The servo motor is also controlled by the Arduino Nano, which rotates the motor to steer the fish feeder in the desired direction.

BLDC motor:
The BLDC motor is a brushless DC motor that is used to provide propulsion to the fish feeder. The BLDC motor is connected to an Electronic Speed Controller (ESC), which regulates the speed of the motor. The ESC is controlled by the Arduino Nano, which sends signals to adjust the speed of the motor as needed.

Battery supply:
The fish feeder is powered by an external battery supply of 9V, which is used to power the motors and microcontrollers. In addition, two batteries are connected to the boards, which provide backup power in case the external battery supply fails.

Overall, the Automatic Demand Fish Feeder is a complex system that integrates multiple components to automate the feeding and maintenance of fish in an aquarium. The microcontrollers, sensors, and motors work together to ensure that the fish are fed on a regular schedule, and that the water in the tank is maintained at safe pH levels.

3.2 Workflow

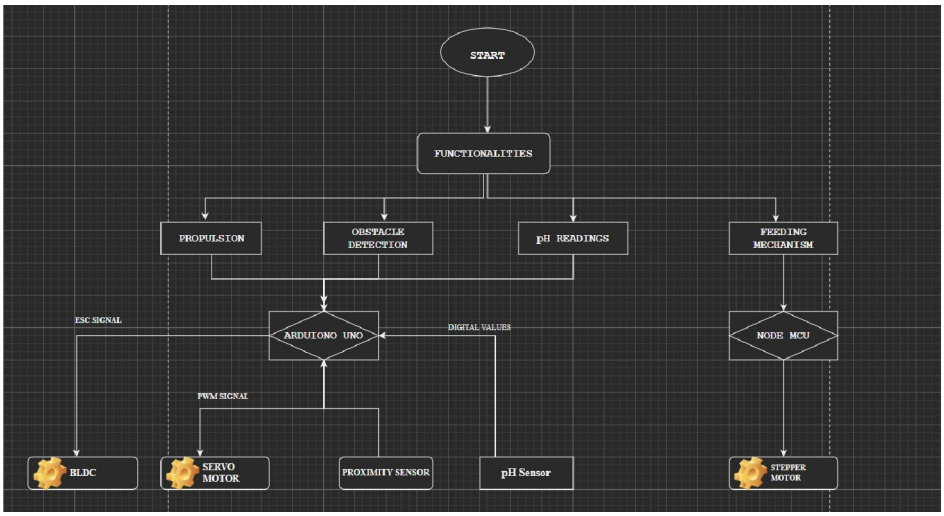

Figure 1 Workflow

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3.2 Schematic Diagram

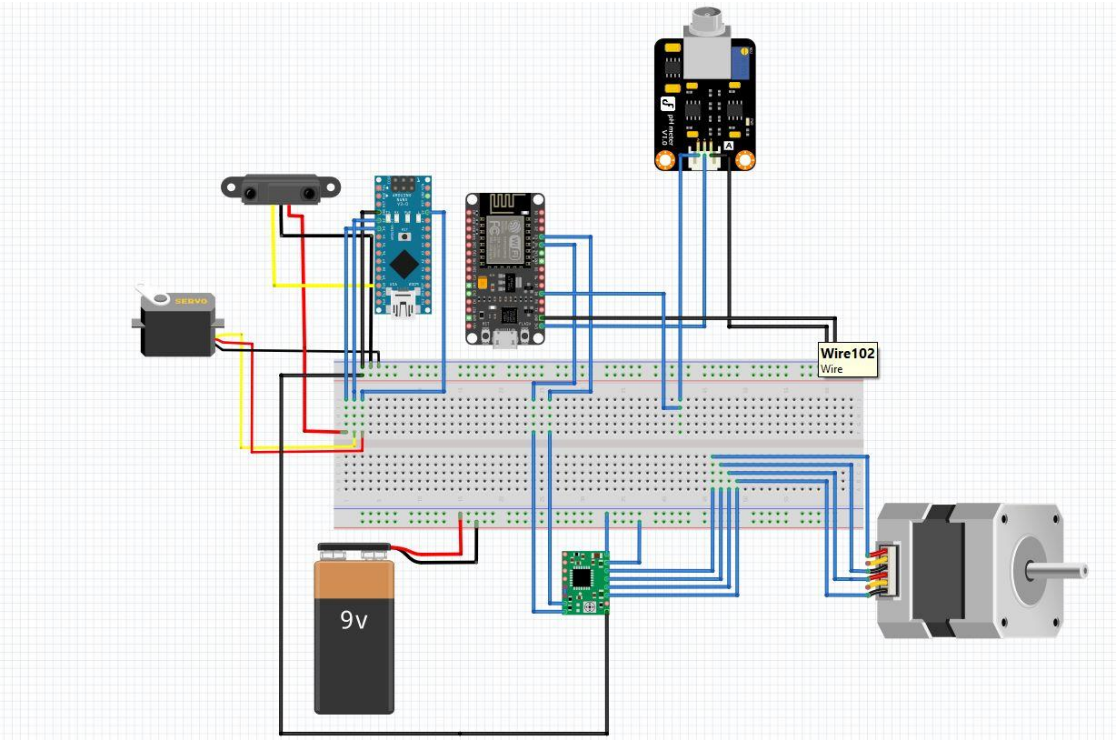

Figure 2 Schematic Diagram

The pH sensor and stepper motor are connected to the node MCU, where the stepper motor serves as a feeding mechanism for fish. A timer is set in the feeding mechanism to enable automatic feeding. Additionally, the node MCU is integrated with a web server, which allows us to control the feeding process through a website. Meanwhile, the Arduino is connected to a proximity sensor that detects any obstacles near the boat. If an obstacle is detected, the direction of the boat is changed using the rudder and servo motor

IV. PROPOSED SYSTEM'S ATTRIBUTES

4.1Features

4.1.1Movement

The two majority movements of our robots are achieved by rudder and propellers.

Rudder: The rudder of a small boat is a crucial component for steering and maneuvering the vessel. It is typically located at the rear of the boat and consists of a flat, vertical surface that is attached to a post, allowing it to pivot left or right.

In this setup, the servo motor is responsible for moving the rudder to the desired positionbasedon input from the boat's control system.

Propellers: It consists of a rotating set of blades, which are typically made of metal and are mounted on a shaft that is driven by the boat's engine. As the propeller spins, it generates a force that propels the boat forward through the water. When used as a propulsion system for boat propellers, a BLDC motor offers several benefits. Because they are highly efficient, BLDC motors require less power to produce the same level of thrust as a traditional motor, resulting in longer battery life and reduced operating costs. Additionally, their precise speed control makes them ideal for use in electric boats, where smooth and consistent operation is important.

4.1.2 Feeding mechanism

The feeding mechanism consists of a hopper or reservoir that holds the fish food, a dispensing mechanism that moves the food from the hopper to the feeding area, and a Node MCU board that regulates the operation of the stepper motor. The control system can be programmed to dispense food at specific intervals.

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4.1.3 Obstacle avoidance

By providing early warning of obstacles in the water or on the boat's path, the rudder has more time to react and take evasive action. Additionally, the use of proximity sensors can help the boat to navigate inside the confines of a fishery.

4.1.4 Water quality

One important factor in water quality is pH, which is a measure of the acidity or alkalinity of the water.A pH sensor is a device that can measure the pH of water and provide a readout of the value.

The sensor can be connected to an Arduino board, which can transmit the pH reading in real-time using digital data and alert the user to any changes or fluctuations.

4.2 CAD Model

Using SolidWorks software, the 3D-CAD Model has been designed within the following design considerations.

4.2.1 Design considerations

- Weight distribution
- Buoyancy
- Water proofing

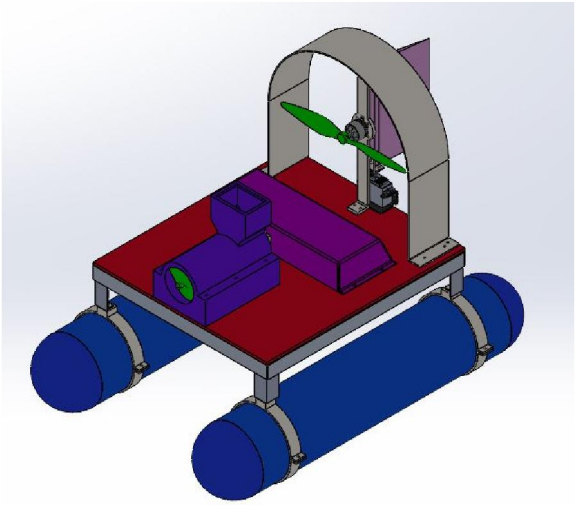

Figure 3 Floating Mechanism

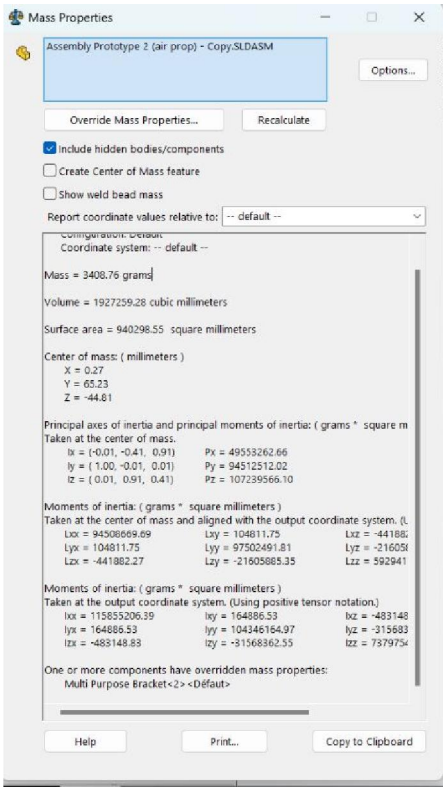

Figure 4 Mass Calculations

The baseplate is made of acrylic plastic, measuring 400cm x 300cm, while its electronics are housed in a waterproof stainless-steel box. The robot's floatation system consists of 12cm diameter hollow PVC pipes that are 50cm long, its rudder is made of 175 mm long Nylon101. The feeder is made using a 3D printer, with PETG material of diameter58mm. The robot's shroud is made of stainless steel, length of 716mm. Overall, the Sea Skimmer Robot weighs 4.975 kg.

4.3 Electrical Simulations

For the electrical simulations of the pH sensor Proteus software is being used.

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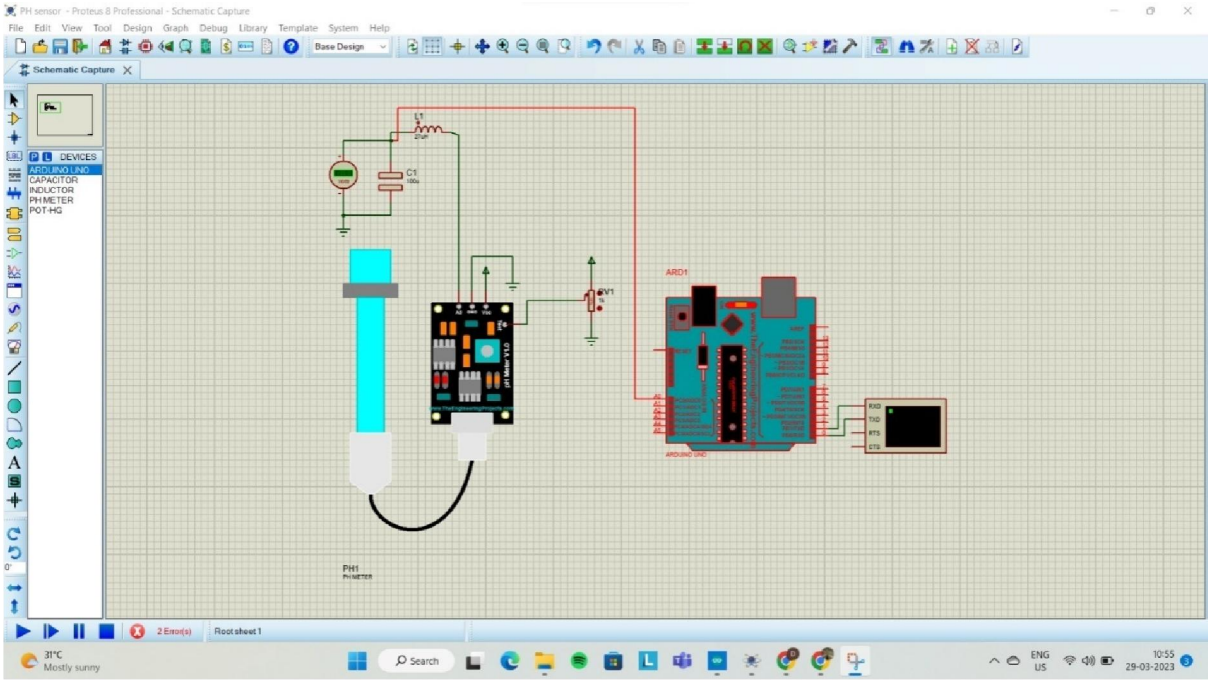
Circuit:



Output:

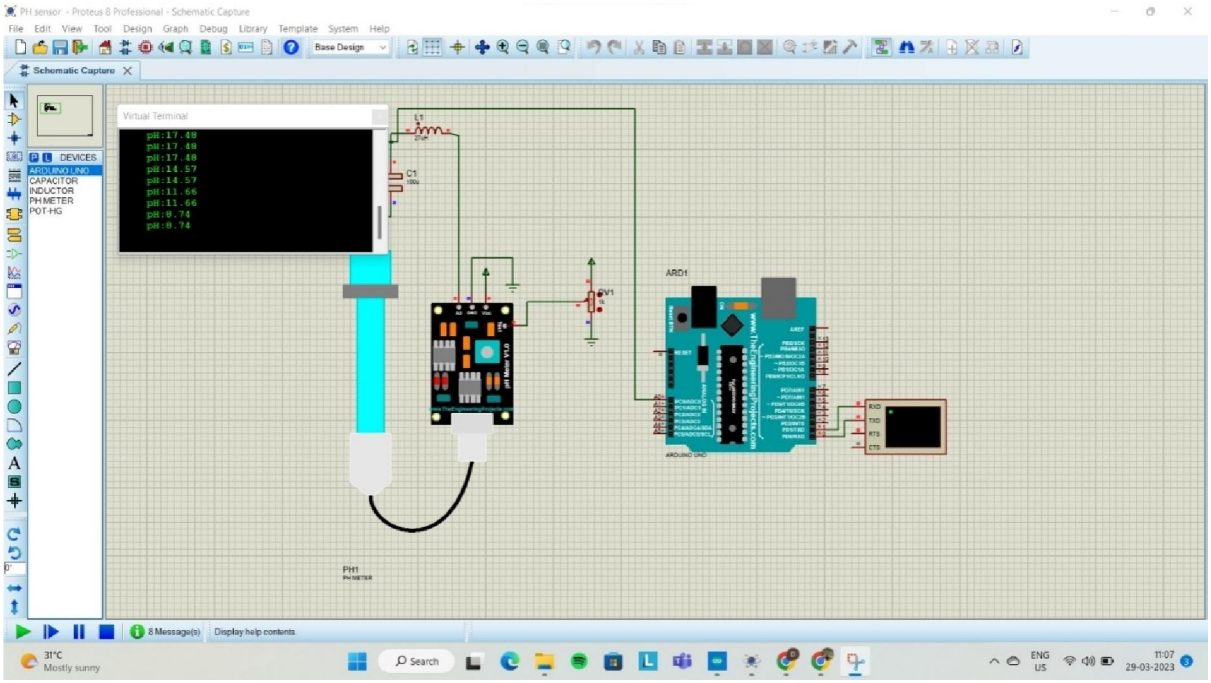


Figure 5 pH sensor simulation

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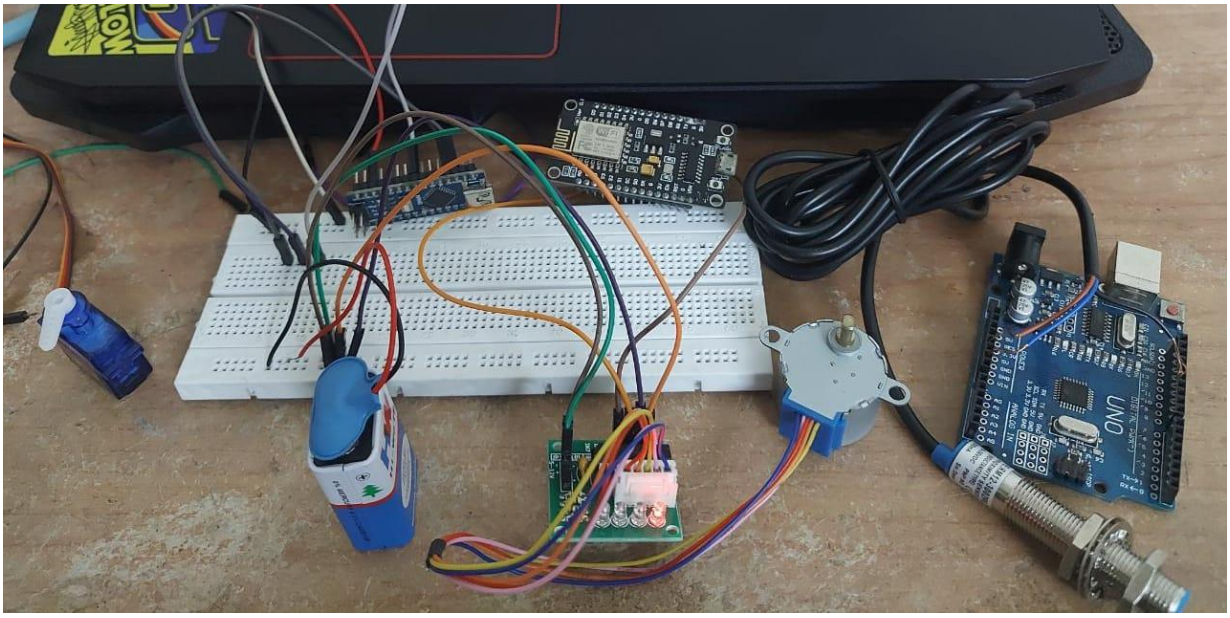
Hardware



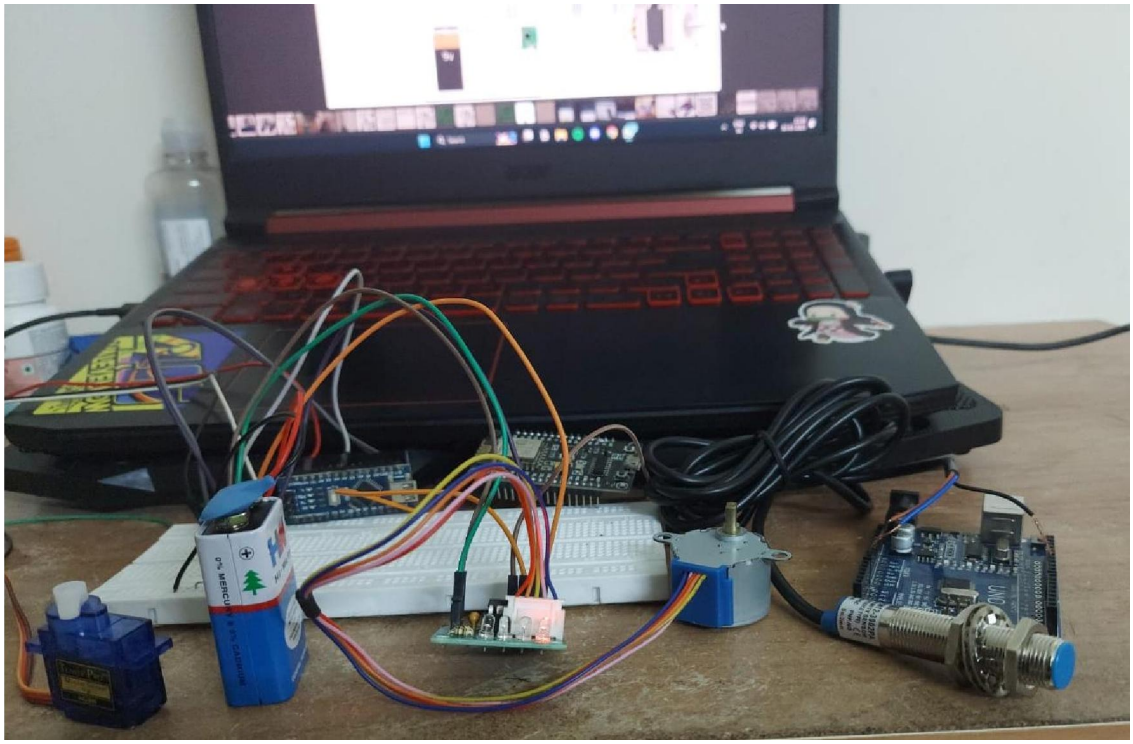


Figure 6 Electrical Hardware

V. RESULTS AND DISCUSSION

5.1 Results

With this robot, we have achieved a certain clarity on how important the matter of fish feeding is. To address this, we have designed a surface-level robot with the aim to satisfy 4 major concerns:

Consistent feeding schedule: An automatic fish feeder ensures that the fish are fed on a regular schedule.

Precise portion control: The use of a servo motor allows for precise control over the amount of food dispensed, reducing the risk of overfeeding or underfeeding the fish.

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Reduced waste: By dispensing food in smaller portions, an automatic fish feeder can reduce waste and prevent uneaten food from accumulating in the fish tank.

Improved fish health: Consistent and appropriate feeding can improve the health and well-being of fish, leading to a longer lifespan and more vibrant colors.

Overall, building an automatic fish feeder using a servo, proximity sensor, and stepper motor can be a cost-effective and convenient solution for fish owners who want to ensure that their fish are fed on a regular schedule with precise portion control

VI. CONCLUSION

In conclusion, this project represents an innovative solution to many of the challenges faced by fish farmers. The system's ability to adapt to changes in fish feeding patterns and maintain optimal pH levels can improve fish health and overall growth. Furthermore, the obstacle avoidance feature ensures that the feeder operates without interference, reducing the risk of damage or malfunction.

Overall, this research paper has provided a comprehensive overview of the design and development of the automatic floating demand fish feeder. Through a combination of 3D simulations, electrical simulations and experiments along with theoretical analysis, the paper has demonstrated the feasibility and effectiveness of this innovative system. As such, it has the potential to revolutionize the fish farming industry and improve the sustainability and profitability of fish production

REFERENCES

[1] Hoang, Q. T., Nguyen, T. N., Nguyen, V. H., & Nguyen, T. T. (2020). Automatic demand feeding improves growth and survival of Pangasius catfish (Pangasianodon hypophthalmus). Aquaculture Research, 51(4), 1554-1563.

[2] Shahid, K., Khalid, M., & Abbas, G. (2018). Economic and technical feasibility of automatic demand feeders in fish farming. Aquaculture International, 26(4), 1119-1134.

[3] Alawneh, A., & Al-Rousan, W. (2020). The impact of automatic feeding machines on the Jordanian fish farming sector. International Journal of Environmental Science and Technology, 17(11), 4921-4930.

[4] Cheng, Y. H., Hsu, T. H., Chang, C. H., & Tsai, S. H. (2019). Design of an automatic fish feeder with solar-powered system. In Proceedings of the 2019 International Conference on System Science and Engineering (ICSSE) (pp. 1-4). IEEE.

[5] Agunloye, O. M., Adeleye, E. O., Oyediran, O. E., & Oke, M. A. (2021). Design and performance evaluation of a locally fabricated automatic fish feeder for small-scale aquaculture. Journal of Aquatic Food Product Technology, 30(2), 212-226.

[6] Li, B., Yang, L., Jiang, W., Zhang, Y., & Wang, Y. (2021). An automatic fish feeder based on artificial intelligence with adjustable feeding rate for cultured fish. Journal of Aquatic Animal Health, 33(3), 274-281