

# Aqua MMS (Monitoring and Management System)

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Abstract - Aquarium maintenance is a crucial task for the health and sustainability of aquatic life. This research focuses on developing a cost-effective and efficient system for automating fish feeding while monitoring water clarity.Aquatic environments require constant monitoring to ensure water quality and optimal conditions for aquatic life. This research introduces an integrated Aqua Monitoring and Management System (Aqua MMS) that automates fish feeding, monitors water turbidity, and controls water temperature. The system utilizes an Arduino Microcontroller for processing data from a turbidity sensor and a digital temperature sensor. Real-time data is displayed on an LCD 16x2 I2C screen, while a servo motor is used to automate feeding. The study validates the system's ability to maintain water quality and feeding schedules effectively, contributing to sustainable aquaculture practices.

*KeyWords*: Sensors,LCD(Liquid Crystal Display), Arduino,Fish,Water,Turbidity Sensor,Aquarium, Digital Temperature Sensor,Servo Motor

### **1.INTRODUCTION**

Aquaculture and aquarium maintenance require consistent monitoring of water quality parameters such as turbidity and temperature. Manual processes for feeding and water quality assessment are labor-intensive and prone to human error. Automating these processes improves efficiency

and ensures the well-being of aquatic life.

This research develops an Aqua Monitoring and Management System (Aqua MMS) to integrate automated fish feeding with turbidity and temperature monitoring. By maintaining optimal water conditions, the system reduces labor requirements and supports sustainable aquatic management.

Aquatic management systems have primarily focused on individual aspects such as automated feeding or water quality monitoring. Recent advancements integrate multiple sensors for comprehensive monitoring, but these systems are often costly or require complex setups.

This study builds on existing research by combining turbidity and temperature sensors with an automated feeding mechanism. The addition of an LCD display ensures user-friendly interaction, and the Arduino Microcontroller provides an affordable platform for integration.

#### 2. Body of Paper

Automated systems for aquarium management have gained attention due to their ability to reduce manual labor and improve efficiency. Previous research primarily focuses on time-based feeding mechanisms without accounting for water quality parameters. Recent advancements incorporate sensors like pH, temperature, and turbidity to enhance the effectiveness of automated systems. However, the application of turbidity sensors specifically to regulate feeding and maintain water clarity is underexplored. Studies have shown that turbidity measurements can serve as a reliable indicator of water quality. The integration of turbidity-based feedback in an automated feeding system presents a novel approach to balancing feeding schedules and water health.

#### System Design

The system combines hardware components and Arduino-based software for real-time data acquisition, processing, and action execution. A



turbidity sensor and temperature sensor continuously monitors water clarity,water temperature providing analog data to the Arduino. When the turbidity is within a predefined safe range, the system triggers a servo motor to dispense a precise amount of food. The LCD displays turbidity levels and system status.

### Components

Component	Quantity	Description	
Arduino Uno	1	Microcontroller for processing sensor data	
Turbidity Sensor		Measures water clarity	
Digital Temperature Sensor	1	DS18B20 or equivalent, for accurate temperature reading:	
Servo Motor (SG90)		Rotates to dispense fish food	
LCD 16x2 I2C	1	Displays turbidity, temperature, and status	
Buzzer	1	Alerts when parameters exceed thresholds	
Breadboard & Jumpers	As needed	For prototyping connections	

## Arduino UNO

Arduino UNO is a low-cost, flexible, and easy-touse programmable open-source microcontroller board that can be integrated into a variety of electronic projects.



### **Turbidity Sensor**

A turbidity sensor is an analytical sensor that measures turbidity. They are highly useful and effective instruments to identify the clarity and particle content in a solution, like water.



### **Digital Temperature Sensor (XH W1209)**

Digital temperature sensors can convert temperature physical quantity and humidity quantity into a digital sensor through a temperature and corresponding circuit.



Servo Motor (SG90)

A servomotor is a closed-loop servomechanism that uses position feedback (either linear or rotational position) to control its motion and final position.



## LCD(Liquid Crystal Display) 16x2 I2C

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation.





# Software Implementation

# Algorithm

# • Initialization:

Initialize sensors, LCD, and servo motor.

# • Data Acquisition:

Read turbidity from the sensor (analog input).

Read temperature from the digital sensor.

# • Decision Making:

Compare turbidity and temperature readings to predefined thresholds.

Trigger servo motor if turbidity is within the safe range.

Trigger buzzer if turbidity or temperature exceeds safe limits.

### • Display:

Update LCD with turbidity and temperature readings, and system status.

### Objectives

The primary objectives of the Aqua MMS include:

- 1. Monitoring water turbidity to assess clarity and quality.
- 2. Measuring and controlling water temperature using a digital temperature controller.
- 3. Automating fish feeding through a servo motor.
- 4. Displaying real-time turbidity and temperature data on an LCD 16x2 I2C.
- 5. Providing an affordable and scalable solution for aquariums and small-scale aquaculture setups.

### **Experimental Setup**



### Observations

Condition	Turbidity	Temperature	Action	LCD Output
Clear Water	< 300	< 30°C	Dispense Food	"Turb: 250 Temp: 25 Feed"
Slightly Turbid Water	300–700	< 30°C	Dispense Food	"Turb: 450 Temp: 27 Feed"
Highly Turbid Water	> 700	> 35°C	No Feed, Buzzer On	"Turb: 800 Temp: 37 No F"

### Advantages

- Real-time monitoring and decision-making.
- Prevents overfeeding and water degradation.
- Cost-effective and easy to assemble.

### 3. CONCLUSIONS

The Aqua Monitoring and Management System provides an integrated approach to aquarium management by automating feeding and monitoring critical water parameters. The system is userfriendly, cost-effective, and ensures optimal conditions for aquatic life. This research



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demonstrates the successful implementation of an automated fish food feeder with turbidity and temperature monitoring. The system offers a practical solution for maintaining aquarium health through efficient feeding and water clarity control. With further enhancements, it has the potential to be a robust tool for aquarium enthusiasts and aquaculture professionals.

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