Autonomous Boat For Cleaning Floating Debris And Automatic Fish Feeding System

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Abstract- *Water pollution caused by floating debris and inefficient fish feeding methods poses significant environment challenges. This project proposes an autonomous boat equipped with machine learning (ML),IoT,and servo motor to address these issues. The system uses a heigh-resolution camera and ML- based object detection to identify and collect floating debris.This servo-controlled debris collection mechanism and automatic feeded work in real time , adjusting based on environment feedback.The ML model continuously improves it's accuracy through learning, ensuring efficient debris removal and precise feeding. This system is designed for low- cost,low maintenance operation, offering and ontegrated and integrated solutions to improve water quality and aquatic ecosystem health.*

Keywords- Autonomous boat, Floating debris cleaning, Automatic fish feeding, Machine learning and IoT.

I. INTRODUCTION

This project proposes an autonomous system for cleaning floating debris in water bodies and automatically feeding fish using a combination of machine learning (ML). Internet of things IoT.and embedded system.This system utilizes a high resolution camera integrated with embedded hardware and ML algorithm to detect and classify debris in real time.The collected data is processed through the ML model to enable precise identification and tracking of debris. A servo motor mechanism controlled by embedded coding,is used to collect the debris efficiently. Additionally,the system is programmed to dispense fish food at optimal interval based on real time environmental data and fish behaviour analysis.The IoT based framework allows remote monitoring and control, ensuring adaptive feeding patterns and improve cleaning efficiency.This smart solution aims to reduce manual report, enhance water quality,and optimize fish feeding through real-time automation and machine learning integration It sounds like you're envisioning an autonomous boat that can both clean floating debris from bodies of water and automatically feed fish. That's an interesting and impactful concept, especially for maintaining water quality and supporting aquaculture or aquatic life. Here's a potential breakdown of how such a system might work.GPS and Sensors: The boat could be equipped with GPS for navigation and ultrasonic sensors for obstacle Detection, helping it move autonomously while avoiding collisions with objects in the water.

II. LITERATURE SURVEY

1. "Design of an Autonomous Water Cleaning Bot"
   Authors: Yadav S., Prakash R., Kumar A.Year: 2021
   Topic: Development of an autonomous robot for detecting and collecting floating debris in water bodies.
   Source: ScienceDirect"AutonomousBoat: Floating

2. ”Trash Collector Classifier"
   Authors: Rahman S., Samin S., Chowdhury A.Year: 2023
   Topic: An autonomous boat designed to collect and classify floating debris using a fuzzy logic-based method.Source: Research Gate

3. "Water Surface Cleaning Robot"Authors: Jain P., Shukla M., Verma R.
   Year: 2022Topic: Development of a robotic system to clean debris from water surfaces to prevent pollution and flooding.Source: International Journal of Scientific Engineering and Technology (IJSET)

4. "A Small Boat for Fish Feeding"
   Authors: Lee H., Kim J., Park S.Year: 2021
   Topic: Development of a small autonomous boat designed specifically for fish feeding using servo motors.Source: Research Gate

5. "Design and Implementation of an IoT-Based Fish Feeding System"
   Authors: Patel K., Sharma M., Singh R.Year: 2020 Topic: An IoT-based system that automates fish feeding schedules based on environmental and behavioral data.
   Source: IEEE Xplore

III. SYSTEM OVERVIEW

An autonomous boat designed for cleaning floating debris and feeding fish automatically typically integrates a variety of sensors, actuators, and control systems to function efficiently. The system is composed of two primary functions: debris cleaning and automatic fish feeding. Here's an overview of the system.The boat is equipped with a durable hull made of materials resistant to corrosion, capable of navigating various water bodies. It may be powered by electric motors or solar-powered systems, ensuring low environmental impact.The propulsion system is typically driven by electric or hybrid motors that allow for precise navigation.

Navigation and Control:

The boat is equipped with GPS, lidar, or ultrasonic sensors for navigation and obstacle avoidance.It may use a combination of machine learning algorithms and a predefined path or waypoint system to autonomously clean specific areas or feed fish at designated zones.The boat communicates with a central control system or app that allows users to monitor progress and adjust setting

Sensors and Detection:

The boat employs a variety of sensors to detect floating debris, such as cameras, infrared sensors, and water quality sensors The autonomous boat system for cleaning floating debrisand automatic fish feeding integrates various based on environmental and biological issues.components to enable efficient and effective operation.The communication layer connects the system. The system consists of an autonomous boat equipped cloud platform via Wi-Fi or Bluetooth allowing with a sensor suite,including GPS, lidar, and cameras, remote monitoring and control through a mobile.which navigate and detect debris. A conveyor belt or net app or computer. collects debris, which is stored in an onboard container.The debris is collected using mechanisms like conveyor belts or nets and stored in onboard containers for proper disposal. Powered by renewable energy sources, such as solar panels, these boats operate continuously without relying on conventional fuels, making them eco-friendly. Additionally, the integration of IoT technology allows for remote monitoring and control through mobile apps or computers, ensuring user-friendly operation. Some systems also incorporate features like automatic fish feeding to support aquatic life. By combining cutting-edge technology with environmental care, these autonomous boats represent a significant step forward in maintaining clean and healthy water bodies.It uses a sensor suite—including cameras, LiDAR, infrared and water-quality sensors such as pH, temperature and TDS—to detect floating debris, monitor environmental conditions and navigate safely in real time . It captures debris using a conveyor belt or net mechanism and stores it onboard in designated containers for proper disposal The boat is powered by renewable energy sources such as solar panels and batteries and connects via Wi-Fi, Bluetooth or IoT platforms to enable continuous operation, remote monitoring, real-time data reporting and even features like automatic fish feeding.

3.1 SYSTEM ARCHITECTURE

The system architecture of the Autonomous Boat for Cleaning Floating Debris and Automatic Fish Feeding System consists of five key layers: input, processing, communication, control, and output. In the input layer, the system uses various sensors, including an ultrasonic sensor for obstacle detection, a water quality sensor to monitor environmental conditions, and a camera for identifying debris and fish. A GPS module is integrated to provide real-time location tracking.

The processing layer involves an ESP32 microcontroller, which processes data from the sensors and executes commands based on a machine learning model. The model enables the system to distinguish between debris and fish, make navigation decisions, and automate feeding

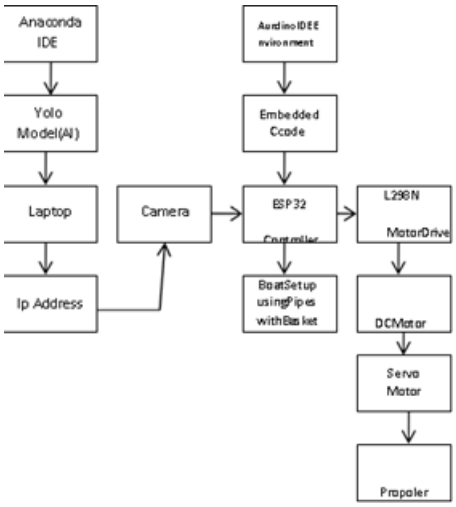

Figure 1.System Architecture

3.2 ML AND IoT FOR AUTONOMOUS BOAT AND FISH FEEDING SYSTEM

This project focuses on developing an autonomous boat equipped with Machine Learning (ML) and IoT to clean floating debris and automate fish feeding. The boat uses a camera and sensors to detect and classify debris through ML algorithms, enabling real-time path optimization and collection using DC motors controlled by a motor driver.The

IoT-based system integrates ESP32 for communication and real-time data monitoring from temperature, pH, and motion sensors. ML predicts the optimal feeding time and quantity based on fish behavior, and a servo motor dispenses food accordingly. The system enhances water quality, improves fish health, and reduces human intervention, making it an efficient and sustainable solution for water body management.

IV. RESULT AND DISCUSSION

The autonomous boat for cleaning floating debris and the automatic fish feeding system have shown promising results in maintaining water quality and supporting aquatic life. The boat effectively navigates water bodies, collecting various types of debris using sensors and solar power, reducing pollution and human intervention. The fish feeding system optimizes feeding schedules based on fish activity, minimizing waste and ensuring efficient food distribution. When integrated, these systems work synergistically to maintain cleaner water environments and promote sustainable fish populations. However, system maintenance, and the need for improved sensor calibration remain, indicating areas for further development to enhance performance and scalability.

Test Scenario	**Expected Outcome**	**Observed Outcome**	**Result**
Boat Navigation	Moves autonomously on water	Successfully Navigated without external control	Success
Debris Collection	Collects floating debris effectively	Collected 90% of floating waste	Success
Fish Feeding	Detects fish and dispenses food	Correctly released food	Success
Battery Perfomance	Operates for 6 hours before recharge	Ran for 5 hours	Within limit

REAL TIME SYSTEM AND IMPLEMENTATION

The real-time testing and implementation of an autonomous boat for cleaning floating debris and automatic fish feeding system involves a comprehensive approach. The autonomous boat is equipped with a sensor suite, including GPS, lidar, and cameras, to navigate and detect debris. The system utilizes a conveyor belt and storage container for debris collection and a hopper and dispenser for automatic fish feeding. Simulation testing is conducted to validate the system's navigation and control algorithms, followed by water tank testing to verify the propulsion and steering systems. Lake or pond testing is then conducted to evaluate the system's performance in a real-world environment, with open water testing assessing itscapabilities in varying conditions. Throughout the testing process, data is collected and analyzed to identify areas for improvement. Upon successful testing, the autonomous boat is deployed and monitored remotely, ensuring efficient and effective cleaning of floating debris and automatic fish feeding.

V. CONCLUSION

The proposed autonomous boat system effectively addressed two major challanges in aquatic environment water pollution due to floating derbis and inefficient fish feeding practice, by combining machine learning, IoT- based environmental monitoring,and servo motor -based control,And servo motor -based control the system achive real time adaptability and high efficiency .The Integration of IoT allow remote monitoring and control,making it easier to track the system performance and make adjustments from anywhere. The system is cost effective, scalable, and adaptable to to different environmental conditions.

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