



(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



### **Impact Factor: 8.699**

## Volume 14, Issue 5, May 2025

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www.ijirset.com |A Monthly, Peer Reviewed & Refereed Journal| e-ISSN: 2319-8753| p-ISSN: 2347-6710|

#### Volume 14, Issue 5, May 2025

|DOI: 10.15680/IJIRSET.2025.1405452|

## Fish Species Prediction and Blockchain Enabled Auction Platform

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**ABSTRACT:** This project is a web-based application designed to connect fish pond owners and buyers through a secure, predictive, and transparent auction system. The platform includes three primary roles: Admin, Pond Owners, and Buyers, each with distinct functionalities. Admins can manage pond owner and buyer accounts, oversee fish auctions, and validate system integrity via blockchain verification. Pond owners can register, log in, input environmental data (such as pH, temperature, and turbidity) to predict suitable fish species, and create auctions based on the predictions. Buyers can register, log in, view live auctions, place bids, and track their bidding history.

The core feature of the application is the fish prediction system powered by environmental parameters, paired with a blockchain-enabled auction mechanism to ensure transparency and security. By leveraging blockchain, all auction activities and transactions are recorded immutably, preventing fraud and ensuring trust. The fish species prediction enhances decision-making for pond owners, while the real-time bidding system ensures competitive and fair transactions for buyers. This solution streamlines aquaculture sales by offering a data-driven, decentralized, and user-friendly platform that bridges the gap between sellers and buyers effectively.

**KEYWORDS:** Fish Auction System, Blockchain Technology, Environmental Data Analysis, Fish Species Prediction, Aquaculture Management, Secure Bidding Platform, Real-time Auction System, Smart Farming, Water Quality Monitoring, pH Temperature Turbidity Sensors, Transparent Transactions, Fraud Prevention, Decentralized Marketplace, Predictive Analytics, Data-Driven Decision Making, Auction Integrity, Pond Owner Dashboard, Buyer Bidding Interface, Immutable Records, Trustworthy Trading System.

#### I. INTRODUCTION

The global fish industry plays a critical role in ensuring food security and supporting economic livelihoods, particularly in coastal and rural communities. As a primary source of protein, fish continues to meet the nutritional needs of millions worldwide. However, with the rising demand for aquatic products, the industry faces growing challenges related to sustainability, productivity, and market transparency. Modern aquaculture practices increasingly rely on data-driven technologies to optimize operations and improve resource management.

Environmental parameters such as pH, temperature, and turbidity significantly influence the suitability of aquatic habitats for different fish species. Traditionally, fish farmers have depended on empirical knowledge to determine optimal conditions, often leading to inefficiencies. The application of machine learning models to predict fish species based on real-time environmental data offers a promising solution by enabling informed decision-making, enhancing yield, and preventing ecological imbalances.

Simultaneously, fish auctions serve as a critical mechanism for market access and price discovery. Yet, conventional auction systems frequently suffer from issues such as bid manipulation, lack of transparency, and disputes, all of which erode trust and hinder participation. Blockchain technology, with its decentralized, immutable, and transparent ledger capabilities, presents a robust framework to address these shortcomings.

This paper proposes a "Fish Prediction and Blockchain Enabled Auction Platform", a secure, web-based solution designed to streamline interactions among fish pond owners, buyers, and administrators. The platform leverages





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machine learning algorithms for fish species prediction and integrates blockchain to ensure secure and transparent auction processes. Additionally, an administrative module enables effective system monitoring, dispute resolution, and policy enforcement.

By integrating predictive analytics and blockchain technology, the platform enhances the overall efficiency, reliability, and fairness of fish trading. It empowers stakeholders with actionable insights and secure digital tools, promoting sustainability and fostering digital transformation in the aquaculture sector.

#### **II. LITERATURE SURVEY**

1. Machine Learning Applications in Aquaculture Rajesh and Kumar (2020) explored the use of machine learning techniques in aquaculture for predicting fish growth and species classification based on environmental parameters such as temperature, pH, and dissolved oxygen. Their findings demonstrated that supervised learning models, particularly decision trees and support vector machines, can achieve high accuracy in fish species prediction, helping farmers make informed decisions on breeding and harvesting cycles.

2. Environmental Monitoring and Precision Fish Farming In their 2021 paper, Li et al. presented a precision fish farming system that integrates IoT sensors with environmental analytics to improve yield and sustainability. The study emphasized the importance of continuous monitoring of water quality factors and demonstrated how predictive modeling could optimize feed utilization and reduce mortality rates, directly benefiting aquaculture operations.

3. Blockchain Technology in Agri-Food Supply Chains Kamble et al. (2019) discussed the potential of blockchain technology in enhancing transparency and traceability in agricultural supply chains. Their research highlighted that blockchain can provide tamper-proof records, enhance stakeholder trust, and reduce fraud in trade systems, which is highly applicable to fish auction scenarios where trust and real-time verifiability are crucial.

4. Secure and Transparent Bidding Using Blockchain Sharma and Gupta (2021) proposed a decentralized auction platform that uses Ethereum smart contracts to ensure secure bidding. Their study demonstrated that blockchain-based auctions eliminate third-party manipulation, ensure bid integrity, and foster fair competition. This approach forms the basis for the bidding module in the proposed fish auction platform.

5. Web-based Marketplaces for Rural Farmers A study by Fernandes et al. (2022) investigated the impact of digital platforms on rural farmers' access to markets. The results showed increased market reach, better pricing, and reduced dependency on middlemen, aligning with the goals of connecting fish pond owners to wider markets.

#### **III. PROBLEM STATEMENT**

The fish trading industry faces challenges in optimizing operations due to unpredictable fish species growth influenced by environmental factors like pH, temperature, and turbidity. Additionally, traditional fish auctions often lack transparency, causing trust issues, unfair pricing, and potential fraud. This project aims to address these gaps by leveraging predictive modeling and blockchain technology to create a web-based platform that improves efficiency, ensures fairness, and enhances security in fish trading.

#### **IV. OBJECTIVES**

- 1. To develop a predictive model using environmental factors such as pH, temperature, and turbidity to accurately identify fish species in pond eco systems.
- 2. To design and implement a user-friendly auction management system that enables fish pond owners to efficiently create, manage, and conduct auctions while allowing buyers to participate and place bids seamlessly.
- 3. To integrate blockchain technology within the auction platform to ensure secure, transparent, and tamper-proof recording of bidding activities, enhancing trust and accountability.
- 4. To optimize user experience by providing an intuitive, scalable, and reliable platform that streamlines auction processes and supports informed decision-making for both sellers and buyers.





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#### V. PROPOSED SOLUTION

The proposed Fish Prediction and Blockchain-Enabled Auction Platform offers an integrated, automated solution that leverages environmental data to predict fish species, optimizing fish pond management. It enables secure, transparent auctions through blockchain technology, ensuring fraud-free bidding and immutable transaction records. Digital payment options further enable secure, efficient cross-border trade. By combining prediction analytics, blockchain security, and automation, this scalable system modernizes the fish trading industry, reduces inefficiencies, builds trust, ensures fair pricing, and promotes sustainability and profitability across local and global markets.

#### VI. SYSTEM DESIGN



#### SYSTEM ARCHITECTURE

#### Architecture Diagram

The system's backbone is Python, selected for its flexibility and rich ecosystem of libraries that support web development, machine learning, and cryptographic functions. This project integrates Flask for backend development, the Random Forest algorithm for fish species prediction, and SHA-256 hashing for securing transactions and ensuring data integrity within the blockchain-enabled auction platform.

#### **Flask Framework:**

Flask is a lightweight and modular Python web framework that offers simplicity and high customizability. It serves as the core framework for building the backend of the platform. Flask's routing capabilities allow for precise control over URL handling, which is essential for managing different user roles—pond owners, buyers, and administrators. Its support for RESTful APIs enables smooth communication between the frontend and backend, ensuring real-time updates during fish auctions and prediction results. The lightweight nature of Flask makes it ideal for building scalable systems that can evolve as the platform grows from local to global fish markets.

#### SHA-256 Hashing (Secure Hash Algorithm 256-bit):

Security and transparency are critical in online auctions, and the platform uses the SHA-256 hashing algorithm to ensure data integrity and prevent manipulation of auction records. Each bid placed in the system is hashed using SHA-256, producing a unique fixed-length hash value that acts as a digital fingerprint of the transaction. These hashes are





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stored in a blockchain-like structure where each block contains the hash of the previous block, forming an immutable chain of transactions. It builds trust among buyers and sellers by ensuring that auction activities are verifiable and secure.

#### **Random Forest Algorithm**

The Random Forest algorithm, a supervised machine learning model, is used in the system to predict fish species based on environmental parameters such as pH level, water temperature, and turbidity. It operates by constructing a multitude of decision trees during training and outputting the species prediction that is the mode of the classes from all trees. This ensemble approach enhances prediction accuracy, reduces the risk of overfitting, and handles missing or noisy data effectively.



#### VII. FLOWCHART

Fig: Data Flow Diagram

A Data Flow Diagram (DFD) is a graphical representation that depicts the flow of data within a system. The above diagram presents an integrated system view of the Fish Prediction and Blockchain-Enabled Auction Platform, highlighting the roles of Admin, Owner, and User (Buyer). The Admin has privileges to view or delete fish buyers, pond owners, and auctions, maintaining platform control and database integrity. The Pond Owner can register/login, predict fish species using environmental parameters (pH, temperature, turbidity), and create auctions. They can also view environmental data and track bids received on auctions.

On the buyer side, the User can register/login, view auctions, and place bids. Their bidding activities are recorded and accessible through the bid details database.

The DFD for this system can be outlined as follows:





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#### **External Entities:**

- 1. Admin: Represents the system administrator who manages all users (pond owners and fish buyers) and oversees auction activity.
- 2. **Owner (Pond Owner):** Represents individuals who own fish ponds, input environmental data, and create auctions based on predicted fish species.
- 3. User (Fish Buyer): Represents registered users or buyers who view auctions and place bids.

#### **Processes:**

- 1. Registration/Login Process
- Inputs: User credentials and registration details from Admins, Owners, and Buyers.
- **Outputs:** Authenticated sessions allowing access to respective dashboards.

#### 2. Environmental Data Input & Prediction Process

- **Inputs:** Environmental parameters such as **pH**, **temperature**, and **turbidity** entered by pond owners.
- **Outputs:** Predicted suitable fish species based on environmental data using predictive models.
- **3.** Auction Creation Process
  - Inputs: Predicted fish species and user-defined auction details (quantity, pricing, timings).
- **Outputs:** New auction entry stored in the Auctions database, viewable by users.
- 4. Auction Viewing & Bidding Process
- **Inputs:** Auction listings from the database.
- **Outputs:** Displayed auctions for buyers; placed bids stored in the Bid Details data store.

#### **Data Stores:**

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• Fish Buyers Database: Stores registered buyer information, accessible by the Admin for viewing or deletion.

- **Pond Owners Database:** Stores registered pond owner data, accessible by the Admin.
- Auctions Database: Contains all auction listings created by pond owners, viewable by both users and admins.
- **Bid Details Store:** Stores all bid transactions placed by users during live auctions.

#### **Data Flows:**

- 1. **Registration Flow:**
- Carries registration and login credentials to the system for authentication and role-based access.
- 2. Environmental Data Flow:

• Transfers environmental parameters from owners to the prediction model and then to the auction creation process.

#### 3. Auction Data Flow:

- Transfers created auctions from owners to the auction database, and subsequently to the buyer's interface.
- 4. Bidding Flow:

• Carries placed bids from buyers to the system and stores them in the Bid Details store for tracking and analysis.

#### 5. Admin Control Flow:

• Allows the Admin to fetch, view, and delete records from buyers, owners, and auctions databases.

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VIII. RESULTS

**HOME PAGE** 



Fig a: Home Page

The Home Page of the Fish Pond Portal features a clean layout with a navigation bar and a central banner highlighting its purpose—fish species classification and auction management. It includes relevant images and a mission statement to guide users, with a fresh green theme reflecting aquaculture and sustainability.

#### LOGIN PAGE



#### Fig b: Login Page

The image displays the login page of the Fish Species Prediction & Sales Portal, offering three login options: Admin, Pond Owner, and Buyer. Admins manage users and auctions, pond owners predict fish species and create listings, while buyers view auctions and place bids. The interface is clean and role-based, supporting secure and efficient fish trading.





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#### **PREDICTION PAGE**

Owner Panel		Home	Logout
ピ Dashboard			
Diredict	Fish Type Prediction		
• New Auction	pH Level		
Auctions	5	\$	
Profile	Temperature (*C)		
Password	Ψ Turbidity		
	16	0	
	PREDICT FISH TYPE Predicted Fish Type: karpio		

#### Fig c: Fish Species Prediction

The image shows the Fish Type Prediction feature in the Owner Panel of the portal. Pond owners enter values for pH, temperature, and turbidity, and the system predicts a suitable fish species—in this case, karpio. The panel includes options like Predict, New Auction, and Profile for easy navigation and management.

#### **CREATING NEW AUCTION**

Owner Panel		Home	Logout
🗠 Dashboard			
>> Predict	Create New Auction		
• New Auction	Fish Type		
Auctions	Katla		
Profile	Start Date 17/05/2025, 10:00 am		
Password	End Date		
	26/05/2025, 10:00 am		
	Quantity (Approx KGs)		
	5000	0	
	Starting Bid (in ₹)		
	500000	0	
	CREATE AUCTION		

#### Fig d: Creating new Auction

This interface is part of the Owner Panel for a blockchain-enabled fish auction platform. It allows fish farm owners to create a new auction by entering details such as fish type, auction duration, quantity (in KGs), and starting bid (in  $\mathfrak{X}$ ). The intuitive UI ensures smooth auction setup, contributing to transparency and fair pricing in the fishery supply chain.





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**BLOCKCHAIN VALIDATION STATUS** 

Admin Panel		Home	Logout
🝘 Dashboard			
🗮 Pond Owners	Blockchain Validation Status		
😤 Buyers	Blockchain is valid and untampered.		
Auction			
🖈 Validate Bids	Back to Home		

#### Fig d: Blockchain validation status

This image shows the Admin Panel of the Fish Pond Portal, specifically displaying the Blockchain Validation Status. It confirms that the blockchain is valid and untampered, ensuring the integrity and security of all auction transactions. The left sidebar provides navigation options for managing Dashboard, Pond Owners, Buyers, Auctions, and Bid Validation, while the top bar offers Home and Logout buttons for easy access and session control.

#### IX. CONCLUSION

The Pond Auction System is a user-friendly web application developed using Flask and MySQL, designed to streamline the process of leasing ponds through online bidding. It provides a secure platform for users to register, log in, browse available ponds, and place bids, while the admin manages pond listings, monitors bidding activity, and assigns ponds to the highest bidder. This system eliminates the delays, biases, and paperwork associated with traditional pond allocation methods, ensuring transparency and fairness. By digitizing the auction process, the project supports better governance and resource management. It is especially useful for local bodies, fishery departments, or private pond owners seeking an efficient and accessible way to lease ponds for activities like fish farming or water storage. With potential future enhancements like digital payments, automated notifications, and mobile accessibility, the system can be further developed into a robust digital solution for managing aquatic resources.

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