Identifying and Gathering Requirements

Project Name

February 25, 2025

Product Overview

Product Name:

- AquaBot: IOT-Enabled Smart Fish Care System

Product Description:

- The Automatic Fish Feeder is designed to feed the fish at regular intervals and to maintain at suitable conditions for fish in the fish tank. It regulates feeding schedule, oxygen supply, and environmental conditions using sensor.

Primary Use Case(s):

- This system automatically feeds the fish at set times(user specified) and regulates oxygen supply by an O_2 pump. It makes the water warm with a heater. RGB lights are fixed to improve aesthetic look and make the fish tank look nice. All the data is saved in the cloud for easy access and review.

Target Market/Audience:

- Aquarium owners
- Fish farmers
- Fish farming industries
- Aquarist(a person who grows fish at home).

Value Proposition:

- This reduces manual feeding of fish making it easier for fish care. It monitors the whole environment of the fish tank.Can check and control it from anywhere using a mobile application

Stakeholder Identification

Primary Stakeholders: *(e.g., customers, businesses, manufacturers)*

- Fish farmers.

- Aquarium owners.
- Research institutions.
- Pet store businesses.

Secondary Stakeholders: *(e.g., regulatory bodies, service providers)*

- IoT service providers.

Objectives and Goals

Primary Objectives:

- What problems is the product solving?
    - It reduces manual feeding by automatically feeding the fish at regular intervals and also checks the temperature and pH level and acts accordingly.
- What are the key outcomes expected?
    - Decreasing manual feeding and maintaining water temperature. If the temperature is too low it should heat the water.

KPIs for Success:

Define measurable goals (e.g., cost savings, efficiency improvements).

- The actual cost is less than the predicted cost.

User Requirements

User Personas:

Define different types of users and their characteristics.

- Research Institutes : Uses in their aquaculture lab
- Fish Farmers: Uses for easy food supply and monitoring
- Pet Stores: Uses to handle the multiple tanks

Key User Needs:

List specific needs or pain points the product addresses.

- The user needs to handle multiple tanks at the same time and they may not be available at all time so they need automatic feeding of fish.For healthy environment of fish the user needs the real time data of temperature and pH level.

User Interaction:

Outline how users will interact with the hardware and any companion software/apps.

- According to the feeding time intervals that are specified in the software it feeds the fish. The users can see the data like temperature,pH and time interval of feeding. These are shown in the LCD Display and notifies the user through mobile app.

Functional Requirements

Core Features:

List the main functionalities the product must have.

- The product includes key features like scheduled fish feed, controlling oxygen level using O2 pump and checking water temperature and regulating it using a water heater. It also features RGB light and an LCD display for status updates and buzzer is also fixed to alert and notify.

IoT Features:

Connectivity (e.g., Wi-Fi, Bluetooth, Cellular, LoRaWAN).

- Wi-Fi (ESP32-based).

Sensors (e.g., temperature, motion, humidity).

- Oxygen level, temperature sensor.

Data Collection and Transmission.

- Real-time monitoring and logging to Firebase cloud.

Interoperability:

Will it work with other devices, platforms, or systems?

- The system is designed to work with IOT platforms and smart home devices. It can be integrated with other applications also. In future versions it may support vice assistants like Alexa and Google Assistant.

Technical Requirements

Hardware Specifications:

Size, weight, material, power consumption.

- It is designed with compact size and lightweight for easy installation. It ensures low power consumption for efficient operation. The ESP32 controls the feeder motor, O2 pump, heater, and RGB light. LCD display is placed for updates and monitoring data base.

Connectivity:

Network protocols, range, bandwidth.

- Wi-Fi for Firebase integration

Data Requirements:

Type of data collected, frequency of collection, storage requirements.

- Type: pH level, water temperature, feeding times, user interactions.
- Frequency: Continuous real-time updates
- Storage: Firebase cloud storage

Processing Requirements:

Edge processing vs. cloud-based processing.

- Firebase cloud stores the real time data for analysis and for user access through mobile app or web dashboard.

Environmental and Operational Constraints

Operating Environment:

Indoor/outdoor, temperature range, humidity tolerance.

- Suitable for indoor and outdoor fish tanks and aquariums.
- Operating temperature range: 10°C to 40°C.
- Humidity tolerance: 20%–90% RH (non-condensing).

Power Source:

Battery-operated, solar-powered, or mains-powered.

- Operates on a 12V DC adapter with a backup battery option for power outages.
- Future versions may include solar-powered support for outdoor fish farming applications

Durability:

Waterproof, shockproof, dust-resistant (IP rating).

- Water-resistant enclosure (IP65-rated) for protection against splashes.
- Shockproof casing to prevent damage from accidental drops.
- Corrosion-resistant materials for longevity in humid environments.

Compliance and Standards

Regulatory Requirements:

Industry-specific standards (e.g., FCC, CE, UL).

- FCC (Federal Communications Commission) certification for wireless communication compliance.
- CE (Conformité Européenne) marking for electronic safety standards in the EU.
- UL (Underwriters Laboratories) certification for electrical safety.

Data Privacy and Security Standards:

GDPR, HIPAA, or other relevant standards.

- GDPR compliance for handling user data securely.
- End-to-end encryption for secure data transmission between the IoT device and cloud storage.
- OAuth 2.0 authentication for secure mobile app access

Design and Usability

Form Factor and Aesthetics:

Physical design considerations.

- Compact and lightweight design with a modern, sleek look.
- Wall-mountable or tank-side attachment for flexible installation.
- RGB lighting for aesthetic appeal and visibility enhancement.

User Interface:

Buttons, display screens, LED indicators.

- Touch buttons for manual operation.
- LCD display showing real-time data (temperature, pHlevel, feeding status).

- LED indicators for power, connectivity, and error notifications.

Ease of Installation and Use:

Plug-and-play, user manual requirements.

- Plug-and-play setup with step-by-step installation guide.
- Mobile app walkthrough for easy onboarding.
- Low-maintenance design with easily replaceable parts.

Software and Cloud Integration

Companion Software:

Mobile apps, web portals.

- Mobile app (iOS & Android) for remote monitoring and control.
- Web portal for advanced analytics and device management.

Cloud Services:

Data storage, analytics, and dashboard.

- Firebase cloud for real-time data storage and analytics.
- Historical data logs for trend analysis and fish health monitoring.

APIs:

Open APIs for third-party integration.

- REST API support for third-party integrations.
- MQTT protocol for real-time IoT communication.

Budget and Cost Constraints

Target Production Cost:

Per unit hardware cost.

- Estimated ₹3,000 – ₹4,500 per unit, depending on production scale.

Development Budget:

R&D, prototyping, and testing costs.

- Prototyping and R&D: ₹4,00,000 – ₹8,00,000
- Testing and certification: ₹1,60,000 – ₹4,00,000
- Marketing and distribution: ₹2,40,000

Cost of Ownership:

Maintenance and service costs.

- Annual maintenance cost: ~₹800 per device for cloud storage.
- Potential add-ons: Subscription for premium cloud analytics.

Timeline and Milestones

Development Phases:

Prototype, testing, deployment.

- Phase 1: Research & Concept Development (1–2 months)
- Phase 2: Prototyping & Hardware Development (2–3 months)
- Phase 3: Software & Cloud Integration (2 months)
- Phase 4: Testing & Certification (1–2 months)
- Phase 5: Product Launch & Marketing (2 months)

Critical Deadlines:

Product launch, certifications.

- MVP prototype completion: Month 4
- Beta testing: Month 6
- Final product launch: Month 8

Risk Analysis

Potential Risks:

Technical risks, supply chain issues, market adoption challenges.

- Connectivity issues, sensor failures.
- Delays in sourcing electronic components.
- Users hesitant to switch from manual feeding.

Mitigation Strategies:

- Robust testing to identify hardware/software issues early.
- Multiple suppliers to ensure steady component availability.
- Marketing campaigns demonstrating ease of use and benefits.

Feedback and Validation

Prototype Testing:

Feedback from users and stakeholders.

- Conducted with aquarium owners, fish farmers, and pet stores.
- Collect feedback on usability, reliability, and performance.

Iteration Plans:

How feedback will be integrated into the design and development process.

- Enhancements based on user feedback, such as additional alerts and integration options.
- Software updates to improve app functionality and security

Future Scalability

Expansion Plans:

Additional features, new markets.

- New features like automatic water pH regulation.
- Expansion into smart aquaculture systems for large-scale fish farms.
- Compatibility with AI-based fish health monitoring.

Upgradability:

Hardware and software upgrade options.

- Monitoring the fishes Using Cameras

Team Members

	
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