Міністерство освіти і науки України
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Кафедра програмної інженерії

Лабораторна робота
з дисципліни: «Архітектура програмного забезпечення»
на тему: «Розробка опису проєкту в форматі «Vision and Scope»

Виконав
ст. гр. ПЗПІ-22-10
Душин Богдан Андрійович
01 травня 2025 р.

Перевірив

ст. викл. Сокорчук І. П

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Метою лабораторної роботи було створення документа "Vision and Scope" для проекту BlueSphere — системи автоматизованого управління великими акваріумами. Основні завдання такі як: визначити бізнес-вимоги та ринкові можливості, формулювати бачення рішення, його основні функції та обмеження, описати контекст бізнесу, включаючи стейкхолдерів та пріоритети проекту, встановити технічні вимоги до продукту, такі як продуктивність, безпека та масштабованість.

Документ має стати основою для подальшої розробки, тому критично важливо було чітко окреслити Scope (включені та виключені функції) та врахувати ризики.

Хід роботи

1. Аналіз бізнес-потреб:
    - Досліджено проблеми клієнтів (нестача інтегрованих рішень для моніторингу якості води, ручне управління тощо).
    - Визначено цілі проекту: автоматизація 90% моніторингу, зниження витрат на 20%, масштабування на 10+ акваріумів.
2. Формулювання бачення:
    - Система має поєднувати IoT-датчики, централізоване управління та аналітику для комерційних клієнтів.
    - Основні функції: моніторинг якості води, планування завдань, звітність.

3. Визначення Scope:
    - Початковий реліз: реалізація ядра (моніторинг, базовий UI, прості звіти).
    - Майбутні оновлення: ML-аналітика, мобільний додаток, інтеграції.
    - Обмеження: відсутність AI у першій версії, відмова від підтримки домашніх акваріумів.
4. Стейкхолдери та пріоритети:
    - Визначено 5 груп стейкхолдерів (наприклад, сервісні компанії, IoT-виробники) та їхні інтереси.
    - Пріоритети проекту: випуск версії 1.0 до 01/04, бюджетний ліміт +10%, команда до 8 осіб.
5. Технічні вимоги:
    - Продуктивність: відгук системи ≤5 сек, uptime 99.9%.
    - Безпека: MFA, шифрування даних, відповідність GDPR.

Висновок

Під час роботи було:

Досягнуто: створено структурований Vision and Scope Document, який охоплює всі ключові аспекти проекту — від бізнес-цілей до технічних деталей.

Для успіху проекту критичними будуть інтеграція з IoT та задоволення потреб комерційних клієнтів.

Додаток А - опис проєкту у форматі «Vision and Scope»

Vision and Scope Document

for

BlueSphere

Version 1.0 approved

Prepared by Bohdan Dushyn

16.04.202

Revision History

Name	Date	Reason For Changes	Version
Dushyn Bohdan	16.04.25		1.1

1. Business Requirements

1.1. Background

The need for efficient management of large aquariums has grown due to increased demand from commercial venues like shopping malls, restaurants, and corporate offices. Currently, maintaining optimal water quality and ensuring proper care for aquatic life require significant manual effort and expertise. The absence of a centralized system leads to inefficiencies, such as inconsistent maintenance schedules, suboptimal feeding, and delayed responses to water quality issues. The proposed system addresses these gaps by providing an automated, data-driven solution.

1.2. Business Opportunity

The project addresses a significant market opportunity in the aquarium maintenance industry, where few solutions combine IoT-enabled monitoring, automated analytics, and personnel management in one platform. Current alternatives often lack integration, requiring businesses to use separate tools for monitoring water parameters, scheduling maintenance, and analyzing data. The proposed system is attractive because it offers:

- Real-time water quality monitoring using IoT sensors.
- Centralized data analysis for informed decision-making.
- Streamlined scheduling and personnel management.
  This system positions itself as a competitive advantage for aquarium service providers and facility managers, aligning with market trends favoring automation and data integration.

1.3. Business Objectives and Success Criteria

Objectives:

- Automate 90% of water quality monitoring tasks by integrating IoT sensors.
- Reduce maintenance costs for clients by at least 20% through optimized scheduling and predictive analytics.
- Increase service provider efficiency, enabling personnel to manage 25% more aquariums without additional staff.
- Ensure scalability to support 10+ aquariums within the first year of deployment.
  Success Criteria:

- Successful integration with IoT sensors, achieving real-time data accuracy of over 95%.
- Positive customer feedback with a satisfaction rate of 85% or higher within the first 6 months.
- Revenue growth of 30% for service providers using the system within the first year.
- Deployment of the system within the planned timeline and budget.

1.4. Customer or Market Needs

Key customer needs include:

- Real-time water quality monitoring for temperature, pH, oxygen levels, and other critical parameters.
- Alerts for water quality deviations to prevent harm to aquatic life.

- A centralized platform for managing aquarium data, including fish species, feeding schedules, and temperature requirements.
- Automated scheduling for maintenance tasks with location-based assignment for personnel.
- Historical data analysis and reports to optimize feed and chemical usage.
- Compatibility with existing aquarium equipment and IoT infrastructure.

1.5. Business Risks

- Marketplace Competition: Similar systems may emerge, leading to reduced market share.
- Timing Issues: Delays in development could result in missed opportunities during peak market demand.
- Implementation Issues: Challenges in integrating IoT sensors and ensuring data accuracy.
- Scalability Risks: Difficulty in handling a growing number of aquariums or clients.

2. Vision of the Solution

2.1. Vision Statement

The proposed system aims to revolutionize the management of large aquariums by providing an intelligent, integrated platform that combines real-time water quality monitoring, automated analytics, and streamlined personnel scheduling. It caters to the diverse needs of aquarium service providers, commercial venues, and aquarium enthusiasts, delivering an intuitive and scalable solution that aligns with modern technological trends and sustainability goals.

2.2. Major Features

IoT-Based Water Quality Monitoring

- Continuous tracking of key parameters like temperature, pH, oxygen levels, and ammonia concentration.
- Automated alerts for deviations from optimal conditions.

Centralized Aquarium Management System

- Database for fish species, feeding schedules, and temperature requirements.
- Recommendations for optimal feeding and chemical usage based on historical data.

Advanced Scheduling and Personnel Management

- Automated task scheduling for maintenance staff with location-based optimization.
- Real-time updates on task status and personnel performance tracking.

Comprehensive Analytics and Reporting

- Detailed reports on water quality trends, maintenance activities, and resource usage.

- Predictive analytics for feed and chemical requirements to optimize inventory management.

User-Friendly Web Platform

- Dashboard for real-time data visualization and control.
- Integration with mobile devices for on-the-go monitoring and management.

Scalability and Integration

- Support for managing hundreds of aquariums across multiple locations.
- Compatibility with existing IoT infrastructure and third-party systems.

2.3. Assumptions and Dependencies

- Reliable IoT sensors and hardware for water quality monitoring.
- Availability of cloud infrastructure for data storage and analytics.
- Third-party APIs or systems for integrating existing aquarium equipment.

3. Scope and Limitations

3.1. Scope of Initial Release

The initial release will focus on delivering core functionality that provides maximum value to customers while ensuring a streamlined development process. Key features will include:

Real-Time Water Quality Monitoring

- IoT-based tracking of temperature, pH, oxygen, and ammonia levels.
- Automated notifications for deviations from set thresholds.

Aquarium Information Management

- Database for fish species, feeding schedules, and environmental requirements.
- Recommendations for feed types and chemical usage.

Personnel Management and Scheduling

- Automated task allocation for maintenance staff based on location and availability.
- Calendar view for tracking scheduled maintenance tasks.

Analytics and Reporting

- Basic reporting on water quality trends and maintenance activities.
- Predictive analytics for resource planning, including feeds and chemicals.

Web Platform

- Dashboard for visualizing real-time data and managing schedules.
- Mobile-responsive design for easy access on-the-go.

3.2. Scope of Subsequent Releases

Future releases will expand functionality and improve user experience with the following features:

Enhanced Analytics

- Advanced reporting capabilities, including customizable metrics and forecasts.
- Integration of machine learning for predictive maintenance.

2. **Integration with Third-Party Systems**
   - Support for external aquarium equipment and additional IoT devices.
   - APIs for data export and integration with other platforms.
3. **Mobile Application**
   - Dedicated mobile app for enhanced accessibility and notifications.
4. **Scalability Improvements**
   - Support for thousands of aquariums across multiple geographic locations.
   - High-availability infrastructure to ensure seamless operation.
5. **Customization Options**
   - Tailored dashboards and alerts for different customer roles.
   - Multi-language support for broader market reach.

3.3. Limitations and Exclusions

Limitations in Initial Release

- Advanced AI-based analytics will not be included.
- No integration with third-party hardware or software systems.
- Limited customization options for dashboards and reports.

Exclusions

- The system will not directly provide hardware components like IoT sensors or maintenance tools; customers must procure these separately.
- No on-site setup or maintenance services for IoT sensors will be included.

- The product will not include features tailored specifically to small personal aquariums, as the focus is on commercial and large-scale applications.

4. Business Context

4.1. Stakeholder Profiles

Stakeholder	Major Value	Attitudes	Major Interests	Constraints
Aquarium Service Providers	Improved productivity through automated scheduling and water quality monitoring.	Receptive, especially to cost-saving and efficiency-improving features.	Centralized management of multiple aquariums, analytics to reduce operational costs, and scalability.	Must integrate with existing IoT infrastructure and provide easy onboarding for personnel.
Commercial Venue Managers	Reduced frustration through real-time monitoring and predictive analytics to prevent aquatic life issues.	Receptive to user-friendly dashboards and reports but wary of implementation complexity.	Reliable water quality alerts, easy-to-use platform for non-technical users, and detailed reports.	Limited time to train staff; system must be intuitive and require minimal setup.
High-End Private Clients	Peace of mind from real-time updates and automation, ensuring healthy aquatic environments	Enthusiastic about state-of-the-art solutions but expect high customization.	Aesthetic dashboards, compatibility with luxury aquarium setups, and reliable alert systems.	Expect a premium experience; system must cater to unique setups and designs.
IoT Sensor Providers	Increased hardware adoption due to integration with the system.	Supportive, as collaboration drives sensor sales and broader market adoption.	Seamless compatibility with their sensors and opportunities for co-marketing efforts.	Dependence on timely updates to API documentation and technical support.
Development Team	Clear requirements and scope reduce rework and improve development efficiency.	Motivated if requirements are well-defined and achievable within the timeline.	Integration with robust cloud infrastructure and minimal external dependencies.	Limited development time; dependencies on third-party integrations and hardware reliability.

4.2. Project Priorities

Dimension	*Driver (state objective)*	*Constraint (state limits)*	*Degree of Freedom (state allowable range)*
Schedule	*Release 1.0 must be available by 01/04, Release 1.1 by 25/06.*	*Delays beyond 30 days are not acceptable.*	*Up to 10% delay in milestone dates for critical features.*
Features	*75% of high-priority features included in Release 1.0.*	*Remaining features to be deferred to subsequent releases.*	*Allow inclusion of lower-priority features in later releases.*
Quality	*90% of user acceptance tests must pass for Release 1.0.*	*95% acceptance required for Release 1.1.*	*Minor non-critical bugs acceptable in Release 1.0.*
Staff	*Maximum team size is 5 developers + 3 testers.*	*Limited ability to scale team size mid-project.*	*Redistribution of resources between teams if necessary.*
Cost	*Budget overrun of up to 10% acceptable.*	*Any overrun above 10% requires executive approval*	*budget overrun up to 15% acceptable without executive review*

4.3. Operating Environment

Geographic Distribution and Time Zones

- **Users**: Th
- **Access Needs**:

Data Generation and Usage

- **Data Sources**: Io
- **Data Storage**: Data will be centralized in a cloud-based database for easy access and scalability.
- **Data Combination**: Data from multiple locations will be combined for analytics, reporting, and predictive maintenance.

Performance Requirements

Response Time:

- Dashboard updates and real-time alerts must occur within 2-5 seconds after a parameter change is detected.

- Historical data and reports must be accessible within 2-3 seconds of user request.

Scalability:

- The system must support at least 100 aquariums in the initial release, with the ability to scale up to 1,000+ aquariums in subsequent releases.

Availability and Reliability

- **Uptime**: The system must maintain 99.9% uptime to minimize service interruptions.
- **Fault Tolerance**:
  - Automated failover mechanisms will ensure uninterrupted service in case of server outages.
  - Data integrity must be preserved during network interruptions, with queued updates synced once connectivity is restored.

Access Security and Data Protection

Security Controls:

  - Multi-factor authentication (MFA) for user access.
  - Role-based access controls to ensure that users can only access relevant data and functionalities.

Data Encryption:

  - End-to-end encryption for data in transit and at rest.
  - Compliance with data protection standards, such as GDPR, for international users.
- **Data Backup**:
  - Automated daily backups with a minimum retention period of 30 days.
  - Disaster recovery plans to restore operations within 1 hour in case of critical failures.

Tolerance for Service Interruptions

Critical Systems: Continuous access is critical for real-time monitoring and alerting functions. Any service interruptions must trigger automated alerts and emergency escalation procedures.

- **Non-Critical Systems**: Features like reporting and analytics can tolerate brief interruptions but must be restored within 1 hour of a failure.