FISHMO
Semi-Automated Aquarium Monitoring System

Software Requirements Specifications
Revision 3

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Group 5

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1 Introduction

This document has been constructed to provide the necessary information required for a software engineer or equivalent, to adequately design and implement the product described. The requirements listed herein provide a justified purpose and scope for implementing the needs of the user.

1.1 Purpose

The purpose of this document is to present a detailed description and all required functionality of the FISHMO Semi-Automated Aquarium Monitoring System. This document will explain the intended purpose and features of FISHMO, what the system will do, the constraints under which the system must operate, as well as introduce some of the requirements for usability.

1.2 Scope

The FISHMO Semi-Automated Aquarium Monitoring system will monitor a fish tank (small or large), or an aquarium. It will monitor the water temperature, and oxygen level. It will also provide a proper lighting and feeding schedule, and a micro-camera to provide real time video monitoring of your fish tank wirelessly. This system will be run on a Raspberry Pi which will connect to a web application, through a network card attach to the Pi, which will have full control on the FISHMO system. The web application will provide an easy to use GUI interface that will allow for customization and altering of the settings for the specific unit attached to the fish tank. The FISHMO semi-automated system allows the user to have a greater control over the companions care. The system will give the user relevant knowledge about the current state of the tank from anywhere in the world, and will give the user the ability to change parameters constraints of the system to offer even greater control of their companions health.

1.3 Definitions, Acronyms, and Abbreviations

Term	**Definition/Acronym**
FISHMO SAAMS	FISHMO Semi-Automated Aquarium Monitoring System
Pi	The Raspberry Pi is a credit-card sized computer that plugs into your TV and a keyboard. It is a capable little computer which can be used in electronics projects, and for many of the things that your desktop PC does, like spreadsheets, word-processing and games.
User	A person who interacts with the FISHMO system
NOOBS	NOOBS (New Out Of the Box Software) is an easy operating system install manager for the Raspberry Pi.
GUI	Graphical User Interface
Camera Board	The Camera Board is a small PCB that connects to the CSI-2 camera port on the Raspberry Pi using a short ribbon cable. It provides connectivity for a camera capable of capturing still images or video recordings.
3D Printer	A process for making a physical object from a three-dimensional digital model, typically by laying down many successive thin layers of a material.

1.4 Revision History

Revision #	**Revision Date**	**Description of Change**	**Author**
0	October 22, 2014	Initial requirements document	All members
1	November 12, 2014	Edited requirements description	All members
2	January 24, 2015	Edited specific requirements	All members
3	April 9, 2015	Revised functional requirements	All members

1.5 References

1. Raspberry PI Foundation, FAQS, http://www.raspberrypi.org/help/faqs/#cameraWhatIs: UK registered charity 1129409.

2. c3D Printing, What is 3D Printing, http://3dprinting.com/what-is-3d-printing/: Genesis Framework.

2 General Description

2.1 Product Perspective

There are multiple products offered already, and built around aquarium owners. Products such as Seneye and Mindstream. These programs provide the user with a system to monitor the aquarium. But what these programs don't provide,is the flexibility and control that is offered to consumers with FISHMO. Other top competitors monitor their aquariums, but don't provide the control to change and manipulate the environment of the aquarium. They also lack the aspect of freedom and the ability to check in live.

FISHMO provides a huge aspect of freedom to the user because it enables the user to not only monitor and automate the fishes living conditions, but it provides the user to do this without being at home. Seneye and Mindstream force the user to maintain a radius around the aquarium in order to receive feedback from the system itself. Where we have expanded the idea to allows user to receive feedback to their phones. It provides convenience, freedom and allows the user to have a sense of comfort when leaving the aquarium alone for an extended period of time.

Through our capstone, the development team will utilize the areas competitors fail to meet or lack in. Our team aims to create and develop a piece of software and hardware from the ground up, which in the long run will change the way aquariums are monitored.

2.2 Product Functions

This product will consist of two main functions, the monitoring section, and the control section.

The monitoring section is the part of the system that monitors the fish tank/aquarium, and reports to the control section. This section includes the sensors related to the water temperature, the water current, the lights, and the mini-camera. It will also include a heating pad to heat the water in the tank, with the constraints provided by the control section of the system.

The control section is the heart of the system and controls all relevant tasks related to the care of your fish. It will accept input from the sensors and properly apply the proper effect. It will also turn on the lights when required, and it will dispense food when needed. The control section will also allow the user to customize the settings to suit their personal needs, and will alert the user when the sensors report an input outside the constraints set.

The variables the user can control are the number of fish in the tank, the size of the tank, the water flow current, the required temperature, the times to feed the fish, the periods of the light the light is on, and view the fish in the tank. The system also automatically will do most of the tasks listed above as its internal database is filled with the fish the user has. The system will automatically populate the variables that can be changed, but will allow for higher control if needed.

2.3 User Characteristics

The users of this product will be aquarium and fish owners. The users of this products, should already be familiar with the concept of owning and being a caretaker for the fish.The users of this product by no means have to be experts as the purpose of the FISHMO is to provide aid and assist the user. The user is expected to regularly service the system in order to keep FISHMO running smoothly and error free. With regular maintenance, the user can expect FISHMO to provide the best quality of care to all living organisms in the aquatic system.

2.4 General Constraints

With the system we intend to implement, we placing the user under multiple constraints. The constraints include physical constraints as to what the FISHMO system is capable of. A list of the capabilities is listed above for more detail. Furthermore, limitations are implied through: the sensors (as they only cover a range of -55 degrees Celsius to 125 degrees Celsius), the heater (Max temperature), LED colors and speed of the water.

The majority of this project development will take place in python, through this we will include visual aids for users to navigate information and a database. There will also be a visual stream included in, constraints on the feed are implied through the Raspberry PI Camera board, and through the web connection. Constraints are also implied on the system through the database, the size of the database, and the type of fish entered.

2.5 Assumptions and Dependencies

Our system implies "automation", but it implies that the user will be a regularly active in the system to maintain the aquarium's environment by regularly receiving monitoring notifications. If the user fails to participate regularly, the living conditions in the aquarium will begin to deteriorate until it is no longer sustainable for life.

2.6 Open Issues and Risks

FISHMO is exposed to an external environment where person or persons can interfere with the operation and/or functionality of the aquatic system. Furthermore, FISHMO is also susceptible to environmental changes, as the aquarium location is a key component which can affect the behaviour of the system.

3 Specific Requirements

3.1 System Constraints

3.1.1 Bandwidth Capacity

Each FISHMO monitoring system will come with an integrated camera, the camera will then stream video to the internet where it will be hosted. That stream will then be incorporated through the web application to show a live stream of the aquarium. The clarity and visibility of the stream will depend on the internet connection at the time of use.

3.1.2 Camera Board

The video stream talked about in the constraint above will be provided directly through the Raspberry Pi. For this we use a camera board attachment for the PI which will allow still and video picture. Video limitations on the camera board are present as it only supports 1080p30, 720p60 and 640x480. Still limitations are also present as the native resolution sensor is capable of 2592 x 1944 still images.

3.1.3 Database

The database for FISHMO will provide the biggest constraint as due to the size of the database. Temperature, friendly and enemy fish etc. The size of this database will not only be the concern, but populating a database in such detail on so many types of fish will also limit the team.

3.1.4 Sensors

The constraints to the system are not only applied within the software perspective, they are applied through hardware as well. The sensors being used have constraints as they are judging water temperature and current etc. For example the temperature sense covers water temperatures of -55 degrees Celsius to 125 degrees Celsius. Although these limitations will likely never be reached, especially with any fish in the water, they are limitations none the less.

3.1.5 Multiple Types of Fish

A difficult type of constraint is applied when incorporating multiple fish into the equation. Due to the fact that many types of fishes live in aquariums, but not all live under the same conditions, presents us a problem. Due to the variety of living conditions, and combinations of fish allowed in the aquarium at a time, users would be restricted in incorporating different fish within the same living conditions. FISHMO will be providing a visual warning when trying to enter two fish in the same aquarium which are incapable of meshing. These fish may be incapable of living together due to water temperature, current or even because it would eat other fish.

3.2 Functional Requirements

3.2.1 Add/Remove Fish to/from Database

User has the ability to add or remove fish in their personal database of fish.

- Inputs
  - A string value for the name of the fish
  - Change of a boolean
- Processing
  - Addition: System will look up fish, and pull relevant information to the database
  - Removal: System will change boolean in the database
- Output
  - Addition: System will update the database with new fish information
  - Removal: System will remove fish and all relevant information from the database

3.2.2 Adjust Water Temperature

User can adjust recommended water temperature manually if needed.

- Inputs
  - A float value for the temperature of the water
- Processing
  - System will update value in the database
- Output
  - System will display current temperature threshold and apply heating as necessary

3.2.3 Adjust Water Current

User can adjust recommended water current manually if needed. They can do this using an on/off switch.

- Inputs
  - A boolean value for the current of water
- Processing
  - System will update the value in the database
- Output
  - System will display current water flow threshold as necessary

3.2.4 Adjust Light

User can adjust whether the light is on or not.

- Inputs
  - Boolean value for whether the light is on or not
  - String value for what colour the lights should display
- Processing
  - System will update values in the database and send the values to the controller
- Output
  - System will display the lights when requested to and with the specified colour

3.2.5 Access Camera Feed

User can access the camera feed via the dashboard on the website.

- Inputs
  - Boolean values controls the current state of the stream
- Processing
  - System will update stream state in the database
- Output
  - System will receive the live camera stream from the PI and display live camera stream on the web site

3.3 Non-Functional Requirements

3.3.1 User Interface

- UI should provide a sense of consistency throughout all features.
- UI should provide a very high level of learnability.
- UI should be relevant and applicable to the real world functions.
- UI should have a camera option and options to access all features or be easily viewable.
- UI should have a home button.
- UI should automatically update and display data.
- UI should automatically open full screen.

3.3.2 Software Interfaces

- The web application will be accessible on all modern web browsers.

3.3.3 Hardware Interfaces

- The FISHMO will be applicable to all standard aquarium tanks.
- The Raspberry Pi will be responsible for all data sent between the environment to the user.
- The sensors will be responsible for correct data sent to the Raspberry Pi.
- The controller will use Wifi in order to interact with the user.
- Applications will be run on all computer with assistance of the mouse.

3.3.4 Performance

- The performance will pass all development testing before finalizing.
- The performance of the FISHMO will not impair the uses, nor will it inconvenience the user.
- Some aspects of the web application's web performance will be dependent on the speed of the database queries

3.3.5 Security

- Users should not be able to change settings to a dangerous environment for the fish.
- The FISHMO system will undergo beta testing before being finalized in order to maintain physical security of the system.
- The security and validity of the database information will continuously be supervised to prevent flaws.

3.3.6 Maintainability

- The application will minimize updates to the software creating long term maintainability.
- The FISHMO will be be constructed to provide minimal updates and maintenance to the hardware.
- The FISHMO will update the database efficiently in order to easily add and delete new and outdated entries.

3.4 Use Cases

3.4.1 Simulating a Living Environment for Fish

FISHMO will provide accurate data and feedback in order to create and simulate an optimal living environment for any type of fish in the database. This includes fishes compatible with the current occupant, optimal temperature, optimal current and other types of information detrimental to a fishes overall health and well-being. The system will not only inform the user of optimal living conditions but will be able to perform some of the changes itself.

3.4.2 Providing Feedback of Changes in the Environment

The primary use of the simulation is to provide home and professional users with an accurate way to monitor the changes within the aquarium. FISHMO will provide live time results on any changes being monitored within the aquarium. FISHMO will monitor the aquarium and will notify the user of any changes. Changes will notify the user accordingly with what aspect of the environment has changed and if needed, will inform the user any dangers associated with the change.

3.5 Design Constraints

There are alternative limitations that are opposed on the design. These limitations are brought into play based off of the strength of the Raspberry Pi. In order to power a lot of the hardware used within a fish tank, the PI would have to give out over 12V. Due to the limited power of the Raspberry PI the design has to be based around the 5V output of the Pi. There were also more hardware limitations, due to the fact that the pi can only outsource a limited amount of power and still maintain its composure and portability.

3.6 Logical Database Requirements

Data formats at this time will be entered into a MySQL database. These entries will cover:

- Database of species of fish and their ideal living conditions
- User settings for their FISHMO
- Tank settings for the user's tanks
  - Real-time information of the tank settings
  - Saved information of the type of fish the user has in their tank

The data types being used are the standard SQL types where needed. For example using VARCHAR for string values and INT for number values. When dealing with sensitive information like a user's password or personal information, the values will be put through a hash function to encrypt it in order for the values to be put into the database.

4 Analysis Models

The following subsections have the different diagrams used to explain the analysis of the FISHMO system. We have provided the data flow diagram to show how data moves through the FISHMO system, as well as a state transition diagram to show a visualization of the state the user goes through when using the FISHMO system.

4.1 Data Flow Diagram (DFD)

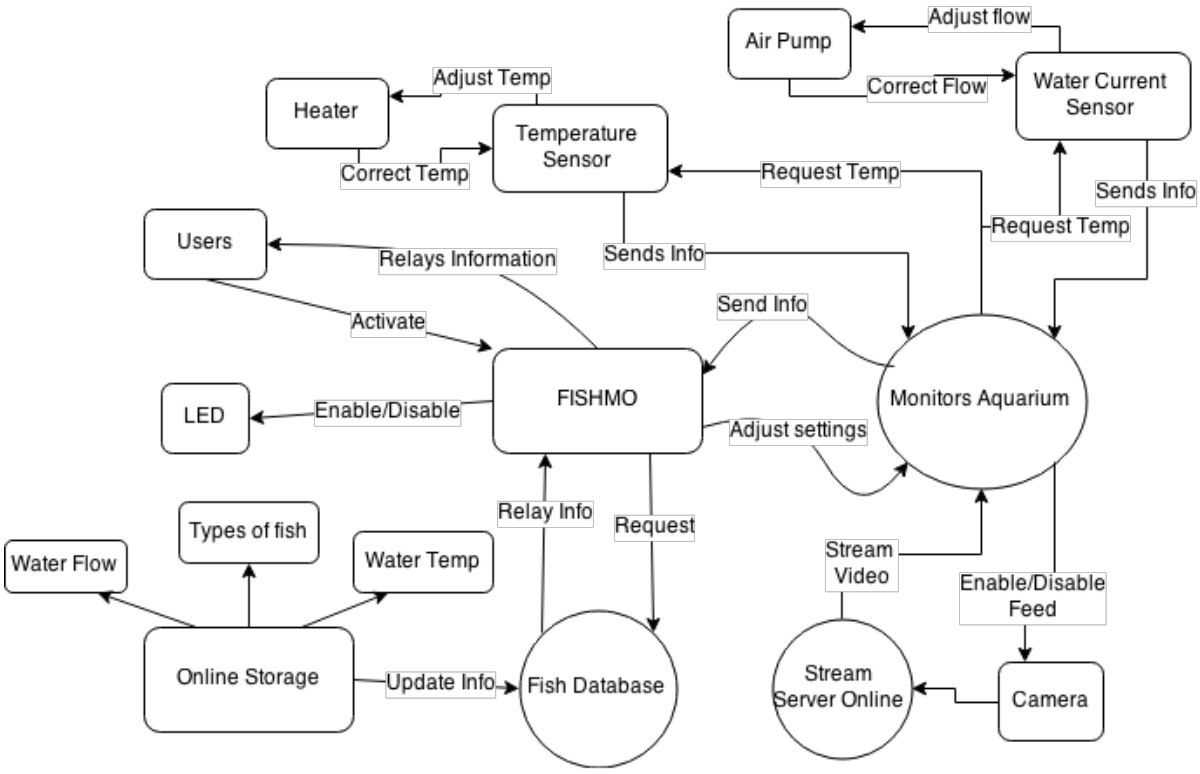

Figure 1: FISHMO System - Data Flow Diagram

4.2 State Transition Diagram (STD)

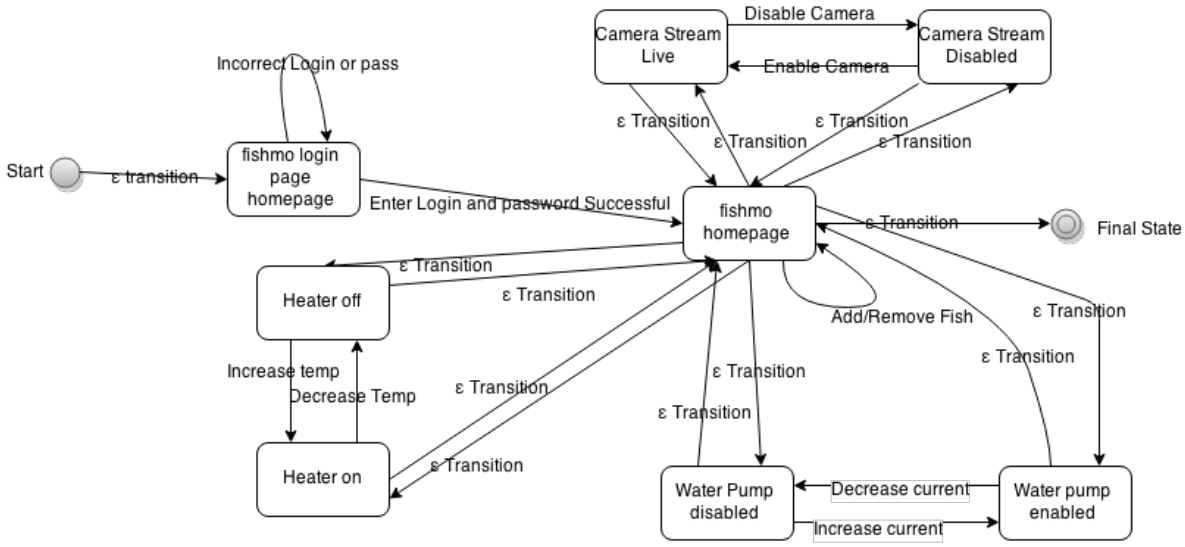

Figure 2: FISHMO System - State Transition Diagram

5 Change Management Process

This SRS will be kept updated on an ongoing basis in the project Github repository, located at: `https://github.com/MichaelLiut/FISHMO`

Changes to the SRS will be written then approved by the group members of this project on a change by change basis as needed. All members of the project must be e-mailed or told in person about required changes, but no formal review is strictly required.