February 16th, 2009

Mr. Patrick Leung
School of Engineering Science
Simon Fraser University
Burnaby, British Columbia
V5A 1S6

Re: ENSC 440/305 Pet Care System Functional Specifications

Dear Mr. Leung:

Please find attached the document, *Pet Care System Functional Specifications*; this document outlines the functional requirements/specifications of our project for ENSC 440/305.

The goal of Pioneer Solutions is to design a system that will allow a pet owner to take care of his/her pet away from home via a webpage. The system will involve multiple components that will assure the pet's health for an extended duration.

Our functional specifications document provides a set of high-level requirements for the prototype system's functionality. These requirements will guide the project manager, design engineers, and test engineers in their development and testing processes. In the end, we expect a product to be completed by April 17th, 2009 that reflects the functional specifications highlighted in the attached document.

If you have any questions or concerns about our functional specifications document, please feel free to contact me by phone at (604) 313-2981 or by e-mail at kwinkelm@pioneersolutions.ca.

Sincerely,

Kyron

Kyron Winkelmeyer
Project Manager
Pioneer Solutions

Enclosure: *Pet Care System Functional Specifications*

Pioneer Solutions

Pet Care System
Functional Specifications

Version 1.4

16th February, 2009

Submitted to:

Patrick Leung (CEO and CFO)

Steve Whitmore (CIO and VP Human Resources)

Jason Lee (Senior Design Engineer)

Jamie Westell (Senior Design Engineer)

Project Team:

David Chin

Alan Lau

Ricky Chau

Rusty Clarkson

Kyron Winkelmeyer

Executive Summary

Contemporary society requires the average adult to juggle multiple tasks and commitments. These commitments are occasionally neglected as there is simply not enough time available in the day. Taking care of one's pets is one example of a neglected responsibility; Pioneer Solutions has realized this difficulty that pet owners face. The solution that has been proposed, and that is currently being designed, is the implementation of a system that will allow the owner to assure the well being of their pet via a website. The user-friendly website will allow the owner to monitor, feed, and exercise their pet without physically being at the residence.

The proposed system is being developed by way of a sequential process; this process is also known as the waterfall model. The process is highlighted by the following steps:

1. Requirements Specification
2. Design
3. Implementation
4. Integration
5. Verification

Pioneer Solutions has completed the first stage of the development process, and this document highlights the functional requirements that the Pet Care System will embody. The requirements list is extensive; however, if a scope modification is required, these requirements may be added to or altered.

List of Figures

Glossary of Terms

ANSI (American National Standards Institute) – A volunteer organization which provides standards and norms for various types of products.

Development board – A single board comprising of common components of a computer as well as extra customized components, such as LED's/LCD's, input devices, etc. Development boards have a broad range, but are limited by their inability to add/remove components easily.

IEEE (Institute of Electrical and Electronics Engineers) – A non-profit organization which develops standards that often become recognized nationally/internationally.

Table of Contents

Introduction

The Pet Care System will enable user(s) to take care of their pet from anywhere that has internet access. The system that Pioneer Solutions will deliver involves multiple components to assure that all essential facets of a pet's welfare are managed. The subsequent sections in this document give an extensive list of the functional requirements that both the overall system and the individual components must possess. All requirements are expected to be covered in the prototype that will be demoed at the end of the project development cycle.

Purpose:

The purpose of the functional requirements is to drive the design of the system, which is the next step in the development model. The requirements themselves are descriptions of the required behavior of the system. The described behavior that has been written in this document has come from elicitation sessions with users, stakeholders, and other experts within and outside Pioneer Solutions.

Audience:

The functional requirements document is intended for use by all members of Pioneer Solutions. The project manager shall use the requirements as a checklist when monitoring the progression of the project. Design engineers shall create a design of each individual component and overall system based on the requirements. Finally, test engineers shall use this document to determine if the final system matches the pre-defined functionality.

Classification:

Throughout this document, the following convention shall be used to denote functional requirements:

$$[R\Omega\text{-}\rho] \text{ -- "Description"}$$

$$\Omega = \text{requirement number, } \rho = \text{priority}$$

The priority shall consist of two values: primary (**I**) and secondary (**II**).

Primary priority denotes a requirement that cannot be modified. Secondary denotes a requirement that can be modified.

Functional Requirements

The welfare of the users' pet is of considerable importance; therefore, the following requirements are extensive. The requirements that will be listed in this document will relate to the development of a prototype that serves dogs or cats. The first set of specifications that will be examined will be of the overall system. Subsequent requirements will include the individual components.

System:

The system is the product that the user will purchase; this product is an interaction between many individual components. Figure 1 illustrates the overall system and the communication network.
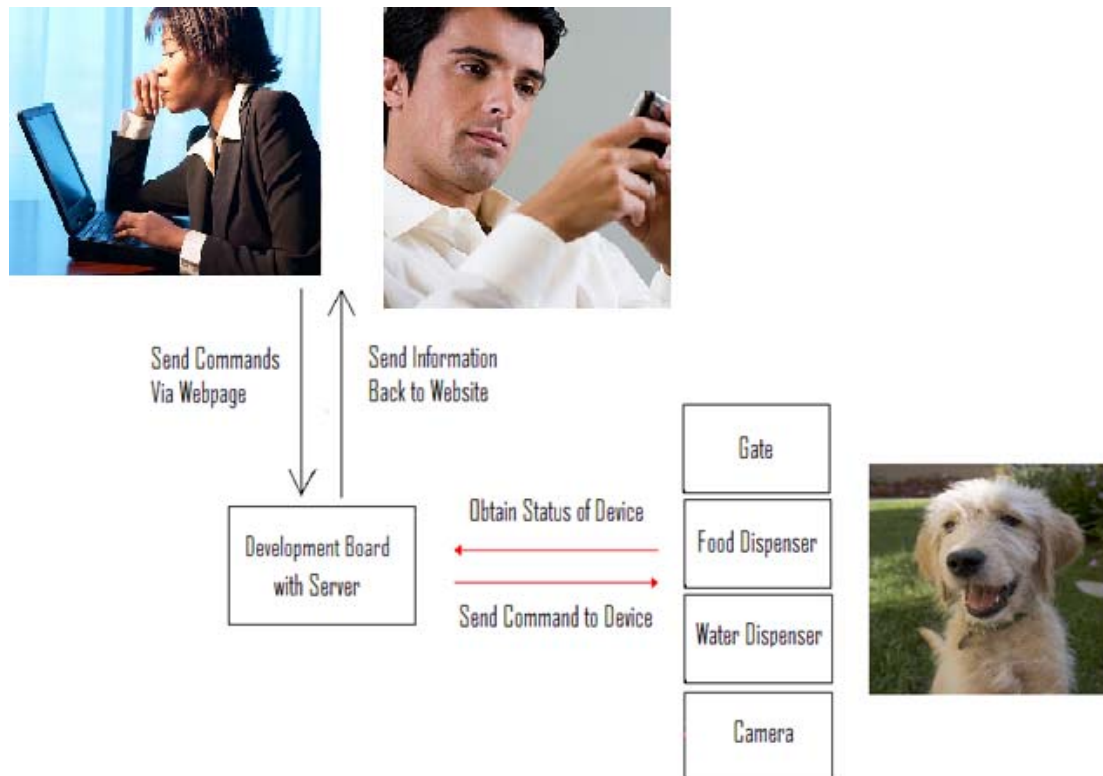

Figure 1: Overview of Pet Care System [1] [2] [3]

In order for this system to be practical, user-friendly, and useful, a series of functional requirements for the overall system are listed below:

1. System Requirements – General

   [R1 – I]   The user shall be able to interact with their pet without being in the home residence.

   [R2 – I]   The system shall perform essential services for the pet on an automated basis.

   [R3 – I]   The system shall perform essential services for the pet on a user requested basis.

2. System Requirement – Physical

   [R4 – II] The system shall consist of 5 physical components in the form of a development board, food dispenser, water dispenser, gate, and camera.

   [R5 – I]   The system shall not be obtrusive to the residents of the domicile in which the pet resides.

   [R5 – I]   The components of the system shall have a robust enclosure.

3. System Requirement – Electrical

   [R6 – II] The system shall require DC and AC power sources.

   [R7 – II] The DC power sources shall be obtained from a 9V battery.

   [R8 – I]   The AC power source shall be obtained from the residence's electrical infrastructure.

4. System Requirement – Mechanical

   [R9 – II] The system shall consist of moving parts.

5. System Requirement – Environmental

   [R10 – I] The system shall operate under normal resident temperatures (15 - 30°).

   [R11 – I] The system shall operate in an indoor setting.

   [R12 – I] The system shall be silent when inactive.

   [R13 – II] The system shall not be audible above 40dB when performing a task.

6. System Requirement – Standards

   [R13 – I] The system shall conform to ANSI standards.

   [R14 – I] The system shall conform to IEEE standards.

7. System Requirement – Reliability and Durability
   [R15 – I]   The system shall be serviceable by trained technicians.
   [R16 – I]   The system shall be able to withstand reasonable pet behavior.
   [R17 – II] The system shall require bi-monthly service intervals.
   [R18 – II] The system, or the components of the system, shall not need replacing before 2 years of operation, if maintained as required.

8. System Requirement – Safety
   [R19 – I]   The system shall not cause bodily harm to the residents or the pet.
   [R20 – I]   The system shall include physical measures to ensure safety for the residents and pet.
   [R21 – I]   The system's electronic and mechanical components, as well as power connections, shall be enclosed.
   [R22 – II] The system shall be able to detect mechanical and electrical failure. Upon failure, the user(s) will be notified.

9. System Requirement – Performance
   [R23 – II] The system shall be able to monitor the pet's activities visually.
   [R24– I]   The system shall be able to perform operations within a short period of time following user's manual directive.
   [R25– I]   The system shall be able to perform operations on a predefined basis.
   [R26– I]   The system shall be able to notify user if the pet is outside or inside.
   [R27– I]   The system shall be able to notify user about the quantity of food.
   [R28– I]   The system shall be able to notify user about the quantity of water.

10. System Requirement – Usability
   [R29– I]   The system shall be user-friendly to install.
   [R30– I]   The system shall be user-friendly to maintain.
   [R31– I]   The system shall include a user manual.
   [R32– I]   The system shall be upgradeable by a trained service technician.

Webpage and Server:

The development board shall host a webpage and a server that will act as an intermediary between the user and the devices that assure the pet's health. Due to the hard deadline of the project, the prototype will feature only the development board with pre-installed server and webpage features. In the future, it is expected that an installation procedure for any PC will be included along with a compatible piece of hardware to communicate with the other components of the system.

The requirements below encapsulate the functionality of the webpage and server:

1. Webpage and Server Requirements – General
   [R33– I]   The webpage and server shall be hosted on a development board.
   [R34– II]   The webpage and server shall be run on a Linux operating system.
   [R35– II]   The webpage shall not be customizable.
   [R36– II]   The server shall be able to handle 10Mb in web traffic.

2. Webpage and Server Requirements – Performance
   [R37– I]   The webpage shall update information regarding the quantity of food remaining.
   [R38– I]   The webpage shall update information regarding the last time food was dispensed.
   [R39– I]   The webpage shall update information regarding the last time the pet was let outside.
   [R40– II]   The webpage shall stream real-time video of pet around the feeding station.
   [R41– I]   The webpage shall update status alerts on the mechanical and electrical welfare of the system.
   [R42– II]   The webpage shall be able to upload 3 voice commands from the user(s).
   [R43– I]   The webpage shall include an automated or manual user interface to interact with pet.
   [R44– I]   In manual mode, the user(s) shall be able to instantly disperse food, open/close gate, and call pet.
   [R45– I]   In automated mode, the user(s) shall be able to define the interval in which the food is dispersed, gate is opened/closed, and pet called.

Food Dispenser:

As discussed in the aforementioned sections, dogs and cats will be the focus of the prototype; therefore, the food dispenser will only cater to food eaten by these animals. Furthermore, the dispenser will only focus on food that is of a hard consistency.

1. Food Dispenser Requirements – General
   [R46– II] The food dispenser shall hold enough food to feed a 50kg dog for a 1 week period.
   [R47– I] The food dispenser shall only food of a hard consistency.

2. Food Dispenser Requirements – Physical and Electrical
   [R48– I] The food dispenser shall be hard-wired connected to development board.
   [R49– II] The food dispenser shall be enclosed in a plastic structure.
   [R50– I] The food dispenser shall include a speaker on the top of the structure.
   [R51– II] The food dispenser shall include a 9V battery to power dispenser.

3. Food Dispenser Requirements – Performance
   [R52– II] The food dispenser shall dispense food within 2 seconds of being directed to do so by development board.
   [R53– I] The food dispenser shall monitor food level.
   [R54– I] The food dispenser shall call pet through the speaker.

Gate:

The gate's function is to allow the pet outside to exercise. It is important that the pet is able to get back inside; however, it is equally important that the gate can prevent the pet from going outside if the conditions are not suitable.

1. Gate Requirements – General
   [R55– I] The gate shall let pet in and out of house.

2. Gate Requirements – Physical and Electrical
   [R56– I] The gate shall be hard-wired connected to development board.
   [R57– I] The gate shall be of a non-conductive material.
   [R58– II] The gate shall include a 9V battery to power its movement.
   [R59 – I] The gate shall conform to a standard household door.

3. Gate Requirements – Performance
   [R60– I] The gate shall unlock/lock within 2 seconds of being directed to do so by

development board.

[R61– I]   The gate shall monitor if pet is inside or outside.

[R62– I]   The gate shall not lock if pet is obstructing the gate.

Water Dispenser:

As discussed in the aforementioned sections, dogs and cats will be the focus of the prototype; therefore, the water dispenser will only cater to an apparatus that can be used by these animals.

1. Water Dispenser Requirements – General

   [R63– I]   The water dispenser shall not cause a flood in the residence.

   [R64– I]   The water dispenser shall hold enough water to hydrate the pet for a 1 week period.

2. Water Dispenser Requirements – Physical and Electrical

   [R65– I]   The water dispenser shall be hard-wired connected to development board.

   [R66– I]   The water dispenser shall be of a non-conducting material.

   [R67– I]   The water dispenser components shall be water resistant.

3. Water Dispenser Requirements – Performance

   [R68– I]   The water dispenser shall dispense water within 2 seconds of being directed to do so by development board.

   [R69– I]   The water dispenser shall monitor the quantity of water remaining.

Camera:

The camera will provide the user a visual surveillance of their pet; therefore, its function will not assure the welfare of the animal in the same sense as the other components mentioned.

1. Camera Requirements – General

   [R70– I]   The camera shall provide a visual aid in monitoring the welfare of the pet.

2. Camera Requirements – Physical and Electrical

   [R71– I]   The camera shall be hard-wired connected to development board.

   [R72– II]   The camera shall be capable of being mounted on an elevated stand.

3. Camera Requirements – Performance

   [R73– II]   The camera shall have the ability to rotate 120° on its base.

   [R74– I]   The camera shall perform an action within 2 seconds of being directed to do so by development board.

   [R75– II]   The camera shall record in color.

System Test Plan

The Pet Care System will undergo a rigorous testing procedure. All five individual components will undergo a unique test that will verify if the functional requirements have been satisfied. Following the verification of the individual components performance, the entire system will be tested. Although a thorough test plan has not been created, the subsequent paragraphs give an overview of the testing.

Each component will be tested with a sole connection to the development board. The functionality of each component will be verified by manually controlling the component and forcing the component to perform its respective functions.

Due to reliance on the respected power supplies, the individual components' power supply will be tested to ensure that is sufficient to perform normal operations. Subsequent tests will examine the power supply's performance when all individual components are operating simultaneously. With all individual components moving, the power drawn will be measured and compared with the rating of the power supply. After the parts have been moving continuously in excess of 2 minutes, visual inspections will be performed to confirm the system's operation and to verify that the operating temperature of the various components are within safe limits.

Following normal operation tests, the component will be put in a compromised scenario and error conditions will be simulated and the system response verified.

Following the tests in the laboratory, typical usage scenarios will be developed and performed with real animals. A typical normal operation scenario, featuring a pet dog, is given below:

1. Press webpage button to use speaker to call dog over to food dispenser
2. Feed dog by pressing the webpage button to control food dispenser
3. Press webpage button to use speaker to tell dog to go outside
4. Press webpage button to unlock gate
5. Press webpage button to lock gate

As in the laboratory, additional usage scenarios will verify the operational safety and error handling.

<u>Conclusion</u>

The functional specification clearly defines the capabilities and requirements of the Pet Care System. The prototype that will be delivered on April 17, 2009 will follow these requirements and will focus on the market of owners with dogs and cats. Following the acceptance of this document, Pioneer Solutions will begin the designing phase.

References

[1] Woman on Computer, [Online picture – cited April 12, 2009], Available: www.myfrontline.info/woman-laptop-horiz.jpg

[2] Man Using Cell Phone, [Online picture – cited April 12, 2009], Available: http://wwwdelivery.superstock.com/WI/223/1804/PreviewComp/SuperStock_1804R-12045.jpg

[3] Happy Dog, [Online picture – cited April 12, 2009], Available: carolynbremer.com/wordpress/images/HappyDog.jpg