QTH.com Amateur Radio Web Site Portal

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ABSTRACT


This manuscript describes a web site portal destination for amateur (ham) radio operators. The portal consists of a number of web applications including a classified ad listing system, auction listing system, buyer/seller feedback system, banner advertising system and callsign look-up system with custom profiles. The current QTH.com web site is implemented using procedural code written, ported and extended multiple times leaving it brittle, inefficient and difficult to extend. This manuscript describes the entire software engineering life cycle used to completely redesign and create the web applications and web site portal of QTH.com. The new web site portal will make use of object-oriented design, code reuse, optimized code and improved database queries for optimum performance. In addition, features and functionality not currently available on the existing web site are included in this project.
ACKNOWLEDGEMENTS

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Finally, we would like to thank our families and friends for their encouragement, understanding and sacrifice throughout the duration of this project.
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GLOSSARY

Apache
The term Apache is commonly used as the nickname for the Apache Foundation’s HTTP server project. The HTTP server is an open-source HTTP (web) server for modern operating systems including UNIX and Microsoft Windows. The Apache HTTP server has been the most popular web server on the Internet since early 1996.

Amateur Radio
Amateur radio (often referred to as ham radio) is both a hobby and a service in which participants use wireless radio communications to communicate with other radio amateurs for personal entertainment and public service. Amateur radio operators are able to perform wireless communications worldwide and often offer their support for emergency and disaster communications if necessary.

API
An application programming interface, or API, is an interface implemented by a software program which enables it to interact with another software program. An API specifies the vocabulary and calling conventions used by a programmer to make use of its services [1].

AVS
Address Verification Service, or AVS, helps to verify that a customer's billing address submitted with an e-commerce payment transaction matches the billing address on file with their credit card company. This service does not verify the
legitimacy of a particular transaction but it can help to reduce fraudulent transactions by allowing merchants to accept or decline transactions based on the validity of the billing address information provided by the customer.

**Beta**

"Beta" is a nickname for a release of software intended to be shared with a select group of end-users with the intention of testing or experimentation before its official release. Beta Testing affords the software a phase in which it can undergo testing (of functionality, usability, etc.) in an environment similar to the intended production environment with users representing the actual user-base of the product.

**Callsign**

A callsign is a unique government-issued license issued to an amateur radio operator. Once licensed with a callsign the operator may use it to legally identify themselves as an operator or operating station during radio transmissions.

**CSS**

Cascading style sheets, or CSS, is a style-sheet language designed to specify the appearance (presentation of colors, fonts, margin, padding, etc.) of a document written in a mark-up language such as HTML and XML [14]. CSS is said to cascade because it has a defined hierarchy in which the style rules are applied if they match more than one styled element. This enables elements to override particular characteristics while still maintaining the overall look and feel of its cascaded (inherited) properties.

**FCC**

Federal Communications Commission, or FCC, is the government body in charge of regulating telecommunications in the United States. Specific to amateur radio
operators, the FCC is charged with regulating all non-federal government use of the radio spectrum. Additionally the FCC administers rules regarding radio devices, equipment and services.

**Ham**
Ham is the nickname for an amateur radio operator. Amateur radio is often referred to as ham radio.

**HTTPS**
Hypertext Transfer Protocol Secure, or HTTPS, is a secure transfer protocol combing HTTP with SSL to provide encryption and secure identification of the web server.

**IPN**
PayPal’s Instant Payment Notification, or IPN, is a message-based service that allows web site developers integrating with the PayPal payment system to be notified of events related to PayPal transactions.

**JavaScript**
JavaScript is an object-oriented scripting language designed to enable a web programmer access to the objects within a web browser [4]. Such access allows for client-side programming to be done on web pages. This is commonly used to develop client-side input validation and dynamic web pages which are able to change based on user input or by data fetched in the background without reloading the entire page in the client's web browser.

**jQuery**
jQuery is an open-source JavaScript library which provides cross-browser support for JavaScript and HTML interaction. jQuery is designed to abstract the
differences between the various web browsers (such as Microsoft’s Internet Explorer, Google’s Chrome and Mozilla’s Firefox) while presenting an easy-to-use syntax for interacting with web browser objects. This gives the web developer the ability to create dynamic web pages without the worry of the underlying differences in browsers which streamlines development for significant time savings.

**Keyword (as related to SEO)**
As related to search engine optimization, a keyword is a word or phrase that implies a mindset or particular demand that a targeted web visitor may be searching for in a search engine [13].

**MOD_REWRITE**
MOD_REWRITE also known as the “rewrite engine” is a software module for the Apache HTTP (web) server that allows for the real-time modification of a web URL's appearance. Re-written URLs are used to provide shorter, more relevant or more human-readable (i.e., search-engine friendly) URLs to web pages.

**MySQL**
MySQL is a relational database management system (RDBMS) which runs as a server that provides multi-user access [6]. MySQL has released its source code to be available under the terms of the GNU General Public License which has made it a popular choice for projects that require a full-featured database server.

**PHP**
PHP is a widely-used, general purpose, object-oriented programming language which is most often used for web programming due to its ability for PHP source code to be directly embedded into HTML documents [12].
QTH
QTH is an amateur radio shorthand term which means “your location”. Originally intended to identify an operator’s position in latitude and longitude it is commonly used today to simply identify location within the context of the transmission such as country, or even city and state.

SEO
Search Engine Optimization, or SEO, is the art and science of updating the content of a web site for the purpose of structuring the information published in a search engine friendly manner [13]. The overall goal is to increase the volume and quality of visitors finding your web site via search engines.

SMTP
Simple Mail Transfer Protocol, or SMTP, is an Internet standard for transferring electronic mail across Internet protocol (IP) based networks.

SQL Injection
SQL injection is a technique used to exploit security vulnerabilities in the database handling code of an application. This technique takes advantage of unfiltered or incorrectly filtered SQL statements which allow for the execution of arbitrary code against the target database.

SSL
Secure Sockets Layer, or SSL, is a cryptographic protocol used to provide encryption of communication over computer networks. In web development, SSL is most commonly used to ensure secure communication between the web server software and the client's web browser software.
Subversion
Subversion, or SVN, is an open-source version control system which allows users to keep track of changes made over time to any type of file. Subversion is most often used to control the versioning of programming source code and web pages.

X/HTML
Hypertext Markup Language, or HTML, and Extensible Hypertext Markup Language, or XHTML, are the primary markup languages for web pages. They provide a means to define a structured document by indicating semantic elements such as headings, paragraphs, images, etc. [8] HTML is based on the Standard Generalized Markup Language (SGML) which is a more lenient standard, while XHTML is based on an XML specification requiring XHTML documents to be well-formed per a World Wide Web Consortium (W3C) recommendation document.

XSS
XSS is a common abbreviation for cross-site scripting which is a type of software vulnerability most often found in web applications. Cross-site scripting enables malicious attackers to inject client-side programming into web pages which will be viewed by other users.

Zend Framework
The Zend Framework is an open-source, object-oriented web application framework implemented in PHP version 5. It is commonly used for the creation of web applications utilizing the model-view-controller (MVC) metaphor, however because the Zend Framework was created as a use-at-will framework there is no single pattern users must follow. Each component of the framework is able to be used independently [1].
1. Introduction

The QTH.com Amateur Radio Web Site Portal project was defined to help design, develop, test and deploy a complete replacement for the existing amateur radio operator portal web site operating at QTH.com. Several new features and updates in functionality were also introduced.

Today, the QTH.com web portal site for amateur radio operators receives over two million page views per month, ranking it in the top five web sites for amateur radio operators worldwide. The current site is built upon a patchwork of many different styles of coding (including different programming languages). Due to the site’s popularity and its antiquated programming technology, it is in need of an improved architecture and design. Having a modern and improved software foundation will allow the site to maintain a leading position in the marketplace as well as increase its ability to quickly address the changing needs of its users for features and additional content.

The QTH.com Amateur Radio Web Site Portal project has focused on the development of a complete set of replacement web applications. These applications will fully replace the existing systems while adding additional functionality and a platform for future growth. The new portal site is written in the PHP 5 programming language with extensive use of the open-source MySQL relational database server. The use of PHP 5 allows the design to take full advantage of object-oriented design principles. Additionally, the MySQL relational database server offers a scalable and robust database management platform.
1.1 Disadvantages of Existing Site

The current web site consists of a combination of many programming languages and coding styles pieced together by several project teams over the years. In addition the site is written in a procedural coding style which reduces the ability for code reuse and does not produce a clean and organized design.

The site currently is not implemented with any modern security features and has not been programmed to defend against common security threats such as SQL injection and cross-site scripting (XSS) vulnerabilities by filtering input and output of user-supplied data.

Due to the programming techniques implemented on the current site it is difficult to add new features and functionality. This limitation diminishes the owner’s ability to keep up with competitive pressures and functionality demands from customers.

1.2 Goals of Project

The goal of the QTH.com Amateur Radio Web Site Portal project is to redesign and develop a full replacement for the existing web applications and related systems. This project will not only replace existing functionality but will expand it as well, setting the foundation for a more flexible and scalable architecture for future functionality enhancements.

The replacement web applications for this project will use a common underlying architecture and be developed against a common set of coding standards.

A strong emphasis will be placed on security in the new site. All user-generated content will be filtered on both input and output. Coding techniques to defend against SQL injection attacks and cross-site scripting will be used throughout.
Finally, the new web applications will be built with search engine optimization (SEO) in mind. Implementing additional search engine optimization features will improve the quantity and quality of visitors to the site which will increase the number of auction and classified swap listings (both posted and sold) and also benefiting advertisers by providing more visibility of their banner ads.
2. Brief Introduction to Software Life Cycle Models

A software life cycle model is a well-defined sequence of phases by which the elements of a software product or project may be organized. As a software project progresses, the project team will advance from phase to phase (sometimes revisiting previous phases) until the project is complete.

There are many software life cycle models to choose from, however there is no particular model specifically designed for a given type of project. Each project team must choose a life cycle model which fits both the type of the project and the working style of the project team. When choosing a software life cycle model for a given project, care must be taken to account for many variables including: the type of project, the specificity of the project definition, the skills of the project team, the availability of project resources and the overall desired timeline for the project [11]. The use of a software life cycle model does not guarantee the success of a project; however organizing the project within a software life cycle model will increase the likelihood of a successful project.

Software development life cycles organize the common activities of software development such as: requirements engineering, design, implementation, testing and maintenance [11]. After reviewing several software life cycle models and discussing the project with our project sponsor, the waterfall model was chosen for this project.

We chose the waterfall model because we believed it would streamline the development process by facilitating the creation of a single set of requirements which would then be carried through the remaining phases of the model to completion. We wanted to prevent designing a system which may later fail to satisfy the sponsor's requirements. It was our hope that doing this up-front work
would help avoid major changes to the project once development work had begun.

The waterfall model is a straightforward process model in which the project is organized in sequenced phases which follow one another. As shown in Figure 1 below, the phases are organized in a downward progression, similar to a natural waterfall.

![Figure 1. The Waterfall Model](image)

### 2.1 Requirements Engineering

The main purpose of the requirements engineering phase in the waterfall model is to determine the needs (i.e., functions and features) for the given project. This is typically done in three phases:

1. Requirements Gathering
2. Requirements Analysis
3. Requirements Documentation

In requirements gathering, the overall goals of the software project are broken down into detailed, unambiguous, and verifiable pieces. These pieces represent the overall definition of the project and define the final product and its features and functionalities [11].
Once the requirements have been gathered, the project team will analyze the requirements to ensure they are well-defined and resolve any issues with requirements that are ambiguous, contradictory or otherwise unclear.

Finally, the requirements are documented to ensure a common understanding amongst the project stakeholders and to produce an official record of the project goals by which future phases are measured.

### 2.2 Design

The design phase is used to analyze the documented requirements and translate them into a technical solution by which the features and functionalities described in the requirements will be produced. Once the work of organizing the requirements into technical challenges and solving the problems presented by the requirements are completed, several work products such as class diagrams and database designs may be produced. The deliverable from this phase is a set of the actionable items for the project team to complete in the implementation phase.

### 2.3 Implementation

The implementation phase is where the actual development of the end product begins. In this phase, the tasks of writing, testing and debugging the source code for the project is completed. The requirements are turned into functioning features and functionalities by following the plan of development set forth in the design phase.

This phase is not limited to computer programming (i.e., authoring source code) as the creation of other project deliverables is also done in the implementation phase. Such deliverables may include: graphical elements (logos, buttons, etc.), screen text (copy), and other items loosely related to site functionality such as end-user documentation.
2.4 Testing

In the testing phase the functioning product (delivered from the implementation phase) is verified against the requirements and design set forth in earlier phases. In addition to ensuring that the implemented product satisfies the documented requirements, the product is also tested to verify that it is free of defects and that the implemented product works as expected from a user's perspective.

2.5 Maintenance

The maintenance phase is where the product is modified after it has been released. Maintenance may be used to implement new requirements, changes in existing requirements or to correct defects discovered after the release of the product. Maintenance may also be required to keep a product up-to-date with its environment. For example, if the product interacts with third-party tools such as a relational database, updates to the third-party tools may cause the need for maintenance on the project to keep the integration between the two pieces of software operational.
3. QTH.com Development

This chapter will describe the project phases as outlined in chapter two as they pertain specifically to the QTH.com Amateur Radio Web Site Portal project. As mentioned in chapter two, this project utilized the waterfall life cycle model of software development. This software life cycle model was chosen due to the desire to implement a specific set of requirements without the need for prototyping work and to reduce the amount of change in project scope throughout the life of the project.

3.1 Collecting Requirements

To collect requirements, the project team began by familiarizing themselves with the domain of the project, i.e., amateur radio, specifically amateur radio classifieds, auctions and swap meets. Additionally, the project sponsor performed a demonstration of the web site’s current functionality to the project team. The project team then interviewed the project sponsor from the perspective of a potential user of the system.

The team then reviewed the usage patterns of the existing web site users as well as reverse-engineered the requirements of the existing web site by studying the source code and database tables of the operational web site.

After gaining an understanding of the problem domain and the current site’s operation and design, the project team met with the project sponsor on several occasions to discuss the pros and cons of existing functionality. The team also reviewed feature requests and bug reports from existing users, the list of features and functionality the project sponsor had compiled for the new site and also
competitor sites to discover any functionality that should be provided to stay competitive in the market space.

From the information gathered in those discussions, the project team created a prioritized list of features and functionality for the new project. From this list the team worked to create a structure by which functionality could be clearly organized. This structure, referred to by the team as the information architecture, was used to organize the features and functionalities into groups of “Sections” and “Pages”. Each page was then assigned an unique page ID number.

### 3.2 Documenting Requirements

Having established an inventory of requested features and functionalities in the structure of page IDs the team then began working through the details of those requirements with the project sponsor. The team employed the approach of fully discussing and detailing the functionality of each page ID from the perspective of an end-user. The page itself was then described in a paper prototype. Each prototype was hand-drawn to accurately describe how each page would appear. This allowed the team to visually express the requirements from the perspective of a potential site user. It also allowed for an efficient translation of ideas into concrete prototypes of each screen.

Building on the paper prototypes, each screen was fully described in a requirements document. The document details each page ID by describing its purpose and operation. Details included the wording on each page, a description of the overall visual design as well as clear definition of the actions available on the screen. The processing of each action (such as button clicks) is described in detail including which error conditions are possible (such as a required field which has not been completed), and the exact wording of each error message.

The project team found this to be an effective technique to disambiguate the requests of both the users and project sponsor into visible and verifiable
functionalities that could be easily changed without any lost design, programming, or testing work. The project sponsor was appreciative of this approach because it allowed him to easily envision the completed project and how users might interact with it.

Through education and first-hand experience the project team heavily weighted the requirements phase to minimize the cost to correct defects and introduce new functionality or features. Figure 2 below represents the cost to fix a defect or add a new feature as the project moves through the phases of the waterfall life cycle model.

![Figure 2. Cost of Defects Over Life of Project](image)

**3.3 Design**

Using the highly-detailed functional requirements the design phase organized the page IDs into logical pieces, by creating a common design template, designing database tables and designing high level classes.
While creating the functional requirements the order and grouping of page IDs fell into a natural organization of complementary and related functionality. These natural groupings became the eight main sections of the QTH.com Amateur Radio Web Site Portal project shown in Table 1 below.

<table>
<thead>
<tr>
<th>Main Section Name</th>
<th>Functionalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>Portal homepage, terms of service, FCC warnings and disclaimers, customer and user testimonials, contact, site search and callsign search.</td>
</tr>
<tr>
<td>My QTH</td>
<td>Create an account, update/view profile, make a donation, view past donations, personalize site preferences, subscribe or unsubscribe from site newsletter, view personal current and past listings, create listing alerts and create or respond to user feedback.</td>
</tr>
<tr>
<td>Swap</td>
<td>Browse swap listings by category, advanced search, view listing, add listing, edit listing, delete listing, contact a listing's owner, report abusive listing, place an auction bid and view safe trading tips.</td>
</tr>
<tr>
<td>Links</td>
<td>Links to customers currently hosted with QTH.com.</td>
</tr>
<tr>
<td>Donate</td>
<td>Make a donation to QTH.com through Check, Money Order, Cash, Credit Card or PayPal.</td>
</tr>
<tr>
<td>QTH Services</td>
<td>Informational area for services of QTH.com, banner advertising information and an area to view all current banner ads.</td>
</tr>
<tr>
<td>About QTH</td>
<td>Detailed description about QTH.com, its</td>
</tr>
</tbody>
</table>
Prior to beginning design and implementation the project engineers established a common set of coding standards. The goal for these standards was to create code that is both easy to read and easy to understand [7]. In addition to agreeing on common coding techniques, spacing, comment usage, etc. the team also agreed to perform code reviews on each other's code. Performing peer reviews helps maintain consistent usage of the coding standards, spread the technical knowledge of the project beyond the original author of the code, and most importantly, increase quality while reducing software defects found during the review.

After organizing the pages into the main sections to match the visual site design, a shared include file was designed to control the presentation layer, shown in Figure 3, using a single file. This design significantly increases the efficiency of site-wide changes and also provides a convenient vehicle for global access to data values commonly accessed from most pages on the site. Such values include database connection parameters, outgoing mail server specifications, administration e-mail addresses for automated e-mails, etc. The shared include file also controls the navigational elements in the header (tab controls) and the footer allowing for easy site-wide changes to add, edit or remove sections from the site.
Next the database tables were designed for each of the sections with relevant relationships identified. Figure 4 below shows the design for the project using an entity relationship diagram. Each entity shown is a table in the database system with its primary key (PK), foreign keys (FK) and uniqueness constraints identified.
Figure 4. Database Entity Relationship Diagram for QTH.com
To encourage consistency in classes created for this project the team designed an interface and abstract class to be implemented and extended respectively. An object interface allows the team to specify methods a class must implement without writing code for the methods. Essentially the interface contains method declarations which must be further defined by the implementing class.

```
+Validate() : Boolean
+Save() : Integer
+FillWithPostValues() : Integer
+PrintHtml()
+PrintDebugData()
```

Figure 5. Data Object's Class Interface

The abstract class takes the concept of the object interface one level further and allows for the implementation of specific methods, which may be common amongst all classes in the system. For example, this project contains a Save method which is implemented in the abstract class and is inherited by all classes extending the abstract class. This Save method takes the primary key field and table name as arguments and uses reflection to obtain the properties of the class to save all fields to a database table.
3.4 Implementation

With multiple development engineers working on the same project a few additional steps were needed to ensure a smooth working environment at all times. Each development engineer configured a local development environment as their primary workspace. The local environments consisted of a common technology stack of the Apache HTTP (web) server, MySQL relational database server and PHP all running on a Microsoft Windows-based operating system.
All development work done locally was maintained using the Subversion source code version control system. With multiple engineers on the team, the use of automated source code control provided an easy mechanism of backing-up our work to the staging server, synchronizing changes between developers, merging changes to a single file from multiple developers and maintaining a history of changes with the option to view or rollback to earlier versions if necessary. When checking in updated files to the staging server, a Subversion post-check-in script was executed which copied the latest branch of code to the document root folder of the staging server. This kept the staging server on the latest branch of source code at all times. The staging server uses the same technology stack as described in Figure 7. However, unlike the development environment, the staging environment is housed on a Linux-based operating system.

The synchronization of files from the staging server to the production server will be done manually via secure FTP as careful control over the files and updates are needed to ensure minimal down-time for users of the site.
3.5 Testing

The QTH.com Amateur Radio Web Site Portal project has been tested with many different techniques to minimize the number of defects introduced into the production web site. As mentioned previously, the development engineers practiced peer code reviews as the first level of testing and defect prevention.

Prior to testing, a migration tool was created to convert existing listings from the current QTH.com database into the format of the new site. This allowed for easy population of the local development and staging server MySQL databases. Having actual production data to supplement the test case data helped to provide a more realistic test environment.

Once a section of functionality was completed, checked into source control and loaded to the staging server additional testing was performed from the user's perspective. White-box testing was performed using available designs and source code. White-box testing is a form of testing which takes into consideration the internal logical structure of the software [11]. Black-box testing is also performed using detailed functional requirements to recreate the functionality described, including appropriate error messages [11]. In black-box testing the test cases are determined by looking at the requirements to not only find defects but also to verify all of the stated functionality has been implemented. After white and black-box testing was completed, the site was subjected to a thorough round of ad-hoc testing (clicking links, submitting forms, and casual use). Ad-hoc testing can be a very effective method when testing web-applications because the testing user typically assumes the role of a site visitor and uses the site as it was meant to be designed rather than following a strict set of tests derived from requirements, design and source code.

Prior to the site launching to production the project sponsor intends to engage a select group of individuals he considers power users on his current site. This group of individuals, along with the sponsor himself, will perform additional
testing by forming a beta testing group. To accommodate a beta testing phase, the
new QTH.com Amateur Radio Web Site Portal project will be loaded onto the
production server under a separate domain name. The beta test period will allow
other individuals with different perspectives and varying levels of computer skills
to use the new features and functionalities. This will not only uncover defects in
software but also may reveal usability problems and overlooked functionality.

Credit card processing is one of the most critical areas of the site to be
meticulously tested. Credit card testing was performed by placing the 3rd party
payment processing gateway into a special test mode. When in test mode, special
indicator codes can be used to trigger error messages to ensure the integration
code handles each error condition correctly.

For PayPal integration, the source code must be modified to direct transaction
requests to a special sandbox area designed specifically for testing PayPal
integrations. This sandbox testing area treats transactions as if they are real
however none of the transactions performed are actually processed through the
production PayPal payment gateway.

Finally, after the launch of the new QTH.com Amateur Radio Web Site Portal
project, the project team will continue to monitor the server logs for errors,
warnings and notices. While not a formal method of testing, the log files are an
efficient method for the project team to capture evidence of real-world problems
as discovered by users of the site.
4. The QTH.com Web Site

This chapter outlines the main highlights of the QTH.com Amateur Radio Web Site Portal project. As stated in chapter three the site has been organized into sections and pages. The items below describe the sections as documented in the requirements engineering phase.

4.1 High Level Architecture

The QTH.com Amateur Radio Web Site Portal project was built using a three-tier web application architecture. The three-tier architecture is a common client-server architecture for web-based applications. This architecture creates a logical separation between the presentation tier (user interface), logic tier and the data tier. Each tier is then integrated with each other, allowing for each tier to be maintained and upgraded independently while still taking advantage of common components.

4.1.1 Presentation Tier

As is common in web applications, the presentation tier for the QTH.com Amateur Radio Web Site Portal project is built using X/HTML and styled with cascading style sheets (CSS). These pages serve as the main user interface for the users of the system. However, there are some additional user-interface functionalities such as e-mails sent from the system and RSS feeds. In the future there may be additional interfaces added such as an application programmer’s interface (API) to enable customers to interact with the system and access the data in the system without using the traditional web site interface.
4.1.2 Logic Tier

The logic tier consists of several classes allowing the calling pages to create objects which represent items in the system such as users, listings, testimonials, etc. Each object has been created to implement an abstract class as well as satisfy a common data object interface. This allows a common methodology for objects in the system to be retrieved, updated and stored in the database through the data tier.

4.1.3 Data Tier

The data tier is implemented within the MySQL database for the QTH.com Amateur Radio Web Site Portal project. This tier consists of a set of normalized database tables which are used by the logic tier to persist data needed by the system's set of class objects (listings, users, etc.). These database tables have been carefully indexed to ensure the proper performance balance between index maintenance and query performance.

4.2 Search Engine Optimization

Care has been taken in the presentation layer to ensure the X/HMTL pages generated have been created with search engine optimization (SEO) in mind. All pages contain the following elements:

- **HTML Headings** – Heading 1 or H1 tags with keyword rich content relevant to the meaning of the page.
- **Page Titles** – Each page has a proper HTML title tag which accurately describes the content of the page in a keyword-rich description.
- **Link Content** – HTML links to other pages, whether internal (links to other pages on the site) or external (links to other web sites) were created with careful wording to ensure the links have keyword-rich content.
• Meta Keywords – Keywords are included in each page’s meta keyword HTML tag to help search engines determine which keywords may be relevant on this particular page.

• Meta Description – The meta description HTML tag is used to help communicate a short description of a page’s content to a search engine. Search engines may use this description as the synopsis for a page on the search engine results page (SERP).

• XML Sitemap – This file is used to indicate which pages are to be indexed or crawled by a search engine’s indexing engine (often referred to as a crawler or robot). The XML-formatted file uses a standardized format to communicate the locations of pages on your web site as well as their relative importance to each other and an indication of how often they are updated.

• SEO-Friendly Page URLs – URLs are said to be SEO-friendly when they contain keyword content which might be relevant to a user’s search. For example, for this QTH.com Amateur Radio Web Site Portal project a page with an auction listing for an “Icom IC-R75 receiver” might have traditionally had a URL location such a “listing.php?id=123”. A more search-engine friendly manner was implemented to provide URLs using URL rewriting technology (such as the Apache HTTP server’s MOD_REWRITE capabilities). This technology allows for the creation of more SEO-friendly URLs which are then translated to the older style of URLs. In this new method the same URL is “/auction-listing/icom/ic-r75/receiver/123.”

4.3 Security

There have been many security precautions implemented during the development of the QTH.com Amateur Radio Web Site Portal project. Among
the items secured are: user input filtering, user output filtering, SQL injection protection, SSL encryption of sensitive data and fraud prevention algorithms.

- **User input filtering** – All user input is filtered to ensure that the data entered by users has been validated for its correct format and intended purpose. This prevents any invalid data from being used by the application.

- **User output filtering** – All user-generated data is escaped by modifying any special characters contained in the data to ensure they are correctly interpreted before being output. This ensures the characters generated as output are not able to create client-side exploits such as those found in cross-site scripting vulnerabilities. For example, no JavaScript tags or other framing tags are able to be output because the user-generated output is escaped as HTML entities so the client’s browser cannot interpret the data as HTML.

- **SQL injection protection** – All user data is filtered before being sent to the database by escaping database queries with the “Quote Into” functionality of the Zend Framework’s database classes and queries are built using parameterized queries with bound values when possible.

- **SSL encryption** – When sensitive user data is being transmitted (specifically on pages handling personal information and credit card information) the communication with the end user is switched to HTTPS which utilizes SSL encryption to securely transfer page data of the pages between the client’s browser and the web server.

- **Payment gateway** – A credit card payment gateway is utilized for real-time credit card payments. By utilizing a real-time credit card payment gateway there is no need to store sensitive credit card data in the database. Each credit card transaction is sent through the gateway over a secure connection in real-time which will then return an indication of success in the form of a transaction ID (a transaction receipt number) or an error
code indicating why the transaction could not be completed. Among other more commonplace errors, such as invalid credit card number or invalid expiration date, the credit card payment gateway also supplies additional security features such as Address Verification Service (AVS). The AVS system allows the credit card payment gateway to verify the billing address for the customer’s credit card against the address input to the web site.

- Fraud prevention – Throughout several areas of the site there has been functionality created to prevent fraudulent use based on the particular usage patterns of the site and past history of fraudulent activities. Specifically, the following areas have added fraud prevention functionality:
  
  - E-mail addresses – The system allows the administrators of the QTH.com Amateur Radio Web Site Portal to white list and black list individual e-mail addresses. This allows the fraud prevention system to block usage by known fraudsters and automatically approve usage of pre-approved e-mail addresses.
  
  - Callsigns – Similar to e-mail addresses, the system allows the administrators of the QTH.com Amateur Radio Web Site Portal to white list and black list individual amateur radio callsigns. This allows blockage of known fraudsters and automatic approval of pre-approved callsigns.
  
  - IP addresses – Like e-mail addresses and callsigns, administrators of the QTH.com Amateur Radio Web Site Portal are able to block usage of the site by IP address of the client. Occasionally individuals known to engage in fraudulent activity can be effectively blocked by denying access to the site from their IP address.
• URLs – URLs supplied by end users can often be identified as malicious or potentially fraudulent. This system allows administrators of the QTH.com Amateur Radio Web Site Portal to create a list of known URLs which should be blocked or white listed.

• Keywords – Similar to fighting spam in e-mail, the words used in the auction and classified listings on the QTH.com Amateur Radio Web Site Portal are often used for fraudulent or unintended purposes. This system allows administrators of the QTH.com Amateur Radio Web Site Portal to white-list known valid keywords and black-list known invalid keywords which would block placement of the auction or classified listing.

## 4.4 Navigational Template

The HTML pages on the QTH.com Amateur Radio Web Site Portal are generated from the same set of navigational template programming. Designing a common navigational template for all pages has several advantages: a consistent look and feel for every page on the site, easier implementation of site-wide changes such as navigational menus and placement of banner advertising, footer text, etc.

Creating a common look and feel is important for the users of the QTH.com Amateur Radio Web Site Portal because it ensures the navigational elements are located in the same place from section to section and page to page. This consistency allows users to comfortably navigate the site without feeling lost within the various pages. The navigational template defines consistency for:

- Styles – Each usage of headings, sub-headings, paragraph text, bullet lists, ordered lists, etc. will have a consistent look from page to page.
• Layout – Each page is centered within the user’s web browser and has the same width and general layout.

• Banner area – Each page contains space in the upper right-hand area of the page for banner advertisements.

• Header area – Each page has a consistent header area. This is the main site navigation which defines the tabs / sections of the site as well as consistent placement of the sub-navigation in the area below the main tabs. Also in the header area, each page has a search bar allowing the user to search the web site itself, the auction and classified listings and to look up another Amateur Radio operator by callsign.

• Footer area – Each page contains the same footer area. This area reiterates the main navigation sections and contains the standard copyright statement and link to the site's terms of service.

4.5 Banner Advertising

The QTH.com Amateur Radio Web Site Portal uses banner advertising as one of its methods of financial support. The site has been offering banner advertisement opportunities for its customers for many years; and it typically has approximately 150 banner advertisements are typically displayed. Since banner advertising is one of the more mature areas of the site, the functionality required for this service was well defined. In the requirements engineering phase we learned that banner advertising must include:

• Management and delivery of advertisements in multiple sizes.

• Ability to store the banner files in the database.

• Ability to deliver banner advertisements locally (on the QTH.com Amateur Radio Web Site Portal) or on a remote site such as another QTH.com related site or a partner site.
• Ability to distribute banner impressions evenly over each hour of the day and evenly over multiple days.
• Ability to present banner advertisements based on activation and expiration dates, a maximum number of impressions or clicks, or a combination of all.
• Ability to track and report on statistics to advertisers.
• Ability to automatically e-mail statistics to advertisers.

After determining the full functionality required for banner advertising the project team researched the best full-featured, commercial off-the-shelf (COTS) product which would provide the features required. After examining several options and comparing the costs to build a custom solution the project team chose to integrate the OpenX advertising platform. OpenX is a GNU General Public License open-source advertising server which nicely fits the features required for the QTH.com Amateur Radio Web Site Portal.

### 4.6 E-mail Template

Much like the common navigational template, the QTH.com Amateur Radio Web Site Portal makes use of a common e-mail template to promote consistency and ease of use. Each message sent by the system is in plain-text format to help ensure deliverability as many anti-spam filtering mechanisms inadvertently mark HTML e-mails as spam.

A standard footer is included on all messages. This footer can be edited by the QTH.com Amateur Radio Web Site Portal administrators at any time. The footer is used to help explain the site as well as help advertise the need for donations. Finally, the footer is also used to request testimonials and referrals. It also contains links to other QTH.com related services such as domain name services, web hosting, etc.
4.7 Home Section

The Home section of the QTH.com Amateur Radio Web Site Portal is the main landing page for visitors to the site. On the left side of the page users are presented with an overview of the QTH.com service offerings, an area highlighting a featured site hosted by QTH.com and a featured user of the QTH.com web site. On the right side of the page, users see the latest auction and classified listings in the swap area of the site.

4.8 My QTH Section

The My QTH section of the QTH.com Amateur Radio Web Site Portal is where users customize their experience with the site. In this section users are able to become members, sign in (if they are already a member), update their profile, make donations, set their preferences, view and update their swap listings, manage their listing alerts and leave or rebut feedback.

4.8.1 Profile

This sub-section allows users to update their profile information. Having a full profile on the site allows users to build a more complete picture of who they are. This helps potential buyers interested in their classified and auction swap listings feel more comfortable with their potential purchase. The required information maintained in a user’s profile is: e-mail address, password and full name. Users may also optionally include additional information such as callsign, phone number, ZIP code, biography, web site link and a photo.
4.8.2 Donations

The donations sub-section allows users to easily review their contributions and user status. Users are presented with a short overview of their donation contributions to-date and a short paragraph highlighting reasons to donate. The bottom of the page contains a more detailed view of their donation history and a set of links for easily making additional donations.

4.8.3 Preferences

The preferences sub-section allows users to update their viewing preferences when logged into the QTH.com Amateur Radio Web Site Portal. Regular QTH.com members are able to manage their subscription to the QTH.com newsletter. However, premium QTH.com members (those donating $20 or more in the last twelve months) are able to set additional preferences:

- Number of swap listings shown per page while browsing listings.
- Ability to disable thumbnail pictures while browsing swap listings.
- Ability to display titles only while browsing swap listings.
- Ability to hide auction listings while browsing swap listings.
- Ability to remember previously viewed swap listings and show only newly added (unseen) listings while browsing categories.

4.8.4 Listings

The listings sub-section presents users with an area to manage their bookmarked listings, current auction bids, last twenty listings and auction listings they have won. From this page users can easily revisit classified and auction swap listings in which they have expressed interest or in which they have participated.
4.8.5 Alerts

The alerts sub-section is where premium members of the QTH.com Amateur Radio Web Site Portal are able to set listing alerts. Alerts will automatically notify premium users of newly created classified or auction swap listings based on criteria specified when the alert is created. Searches may be done by listing category, keyword, ZIP code or a combination of all three.

Non-premium members of the QTH.com Amateur Radio Web Site Portal will be presented with text highlighting the features available to premium members along with encouragement to make a donation.

4.8.6 Feedback

Feedback may be generated when a transaction has occurred between users. The feedback sub-section allows users to see a high-level overview of their feedback activity on the QTH.com Amateur Radio Web Site Portal. Users are presented with any feedback left about them and feedback left by them. From this page the users are able to easily review all feedback related to their account as well as the ability to write rebuttals.

4.9 Swap Section

The swap section of the QTH.com Amateur Radio Web Site Portal is where users are able to see an overview of the swap listings for free classifieds and auctions (the main content of the site). The landing page for this section is split into two columns. The left side of the page displays an overview of the listing categories, the number of listings in each category and a link to browse the listings.

On the right side of the page users are presented with several sections allowing them quick access to listings such as:
• Quick links – A set of links to easily jump to a special set of listings such as today’s listings, yesterday’s listings and all listings.

• Recent activity – Three sections containing: recent classifieds, recent auctions and auctions ending soon.

4.9.1 Add Listing

The add listing sub-section of the swap section is where users are able to create a listing for the swap section of the QTH.com Amateur Radio Web Site Portal. Users must be logged in to create a listing. Once logged in, the user must choose whether they are adding a classified listing or an auction listing. To create a listing, users must enter the following information:

For classified swap listings:
• Type (for sale, wanted, want to trade)
• Category
• Title of listing
• Length (1, 2, 4 or 6 weeks)
• Text of listing
• Up to three photos with captions

For auction swap listings:
• Category
• Title of listing
• Length (5, 7 or 10 days)
• Starting bid
• Text of listing
• Up to three photos with captions
4.9.2 Edit Listing

This sub-section allows users to edit an existing listing they have published on the QTH.com Amateur Radio Web Site Portal. Classified swap listings are able to be edited an unlimited number of times during the first three hours after they are added. Auction swap listings are also able to be edited an unlimited number of times during the first three hours or until a bid has been placed. After the first three hours users may only edit their listing a maximum of three times.

4.9.3 Remove Listing

This page allows the user to remove their swap listing. When removing the listing the site will ask the user why they are removing the listing, if they intend to make a donation and for any additional comments they may have.

4.9.4 Contact Swap Listing Owner

This page allows a site visitor to contact the owner of a swap listing via e-mail. A form is used to protect the e-mail address of the swap user from being displayed on the site to prevent their e-mail address from being discovered by malicious robot scripts looking for e-mail addresses to collect for spam. After completing the contact form both the swap listing owner and the user requesting the contact are sent an e-mail introducing one another allowing them to carry on a private conversation through e-mail about the listed item.

4.9.5 E-mail Listing to a Friend

The e-mail listing to a friend page allows viewers of a swap listing to easily send an e-mail to someone with their comments about a listing and a link to the particular listing to which they are referring.
4.9.6 Report Abusive Listing

This page is an important feature for the new QTH.com Amateur Radio Web Site Portal as it allows site viewers to easily report a listing containing offensive text, photos or any violation of the QTH.com posting rules. Once reported, a notification to review the listing will be sent to site administrators.

4.9.7 Place a Bid

This page allows users to place a bid on an auction swap listing. From this page users will enter their bid amount. Once a bid is made e-mails will be generated to the bidder and seller. If a user has been out-bid by this new bid an additional e-mail is generated to the previous high bidder.

4.9.8 Retract a Bid

This page allows an auction bidder to retract their bid. As long as an auction has not yet ended and the bid they wish to retract was added within the last thirty minutes, the user is able to retract their bid.

4.9.9 Feedback

The feedback sub-section is where users of the QTH.com Amateur Radio Web Site Portal can search for another user to read feedback left about the user. The search may be done by listing number, callsign, name or e-mail address. Having the ability to look up the feedback of a seller’s previous transactions will help a potential buyer make decisions on their level of trust in a particular seller's listing. This will also help deter fraudulent use of the QTH.com Amateur Radio Web Site Portal by publicizing any untrustworthy users of the site.
4.9.10 Advanced Search

This sub-section allows users to search the QTH.com Amateur Radio Web Site Portal’s swap listings with a more fine-tuned search query. Users are able to search for listings using one or more of the following criteria:

- Listings containing:
  - All of the specified words
  - Any of the specified words
  - None of the specified words
  - An exact phrase

- Listings in a given category or categories

- Listings by type:
  - Auction
  - Classified – For Sale
  - Classified – Wanted
  - Classified – Want to Trade

- Listings by location:
  - Country
  - Within a specified number of miles from a particular ZIP code (within the United States)

4.9.11 Safe Trading Tips

This page lists several safe trading tips for users of the QTH.com Amateur Radio Web Site Portal. It supplies valuable advice and reference information for interacting with other buyers and sellers on the site. By following the tips in this section users learn how to identify potential fraudulent listings and protect themselves from malicious users. By following the safe trading tips users increase their likelihood of a smooth and trouble-free experience.
4.9.12 Promote Listings

The promote listings sub-section is a page designed to encourage users to promote listings on their own web sites by showing examples of the three types of remote listing services the QTH.com Amateur Radio Web Site Portal offers. This page also includes a form which generates the code users need to place the listing promoting items on their own web site.

4.10 Links Section

The links section of the QTH.com Amateur Radio Web Site Portal is an area where the site administrators can publicize links to QTH.com customers, users and related web sites. Links to sites will be organized into four sections: Ham Businesses, Ham Clubs, Personal Ham Sites and Non-Ham Sites.

4.11 Donate Section

The donation section of the QTH.com Amateur Radio Web Site Portal is devoted to spreading the message that the site is made possible by the generous donations of its users. This section contains three sub-sections offering users easy ways to donate funds to support the operation and maintenance costs of the site.

4.11.1 Check, Money Order or Cash

This page highlights the process for making a donation with a check, money order or cash. The page contains a form designed to help the user generate a donation “receipt”. The form asks for the amount of the donation, the donor’s name, callsign, e-mail address and comments. An optional testimonial may also be entered. Completion of this form creates a printable submission form to be
mailed along with the payment. This form helps QTH.com staff properly attribute the donation to the user.

### 4.11.2 Credit Card

Similar to the check, money order or cash page above, the credit card donation page contains a form collecting the details of the donation. This form also includes the billing address of the donor to be used for credit card validation purposes. Donations made with credit cards are performed in real-time by directly integrating with the Authorize.net payment gateway. Credit card donations are immediately recognized in the user's profile including access to premium member status if applicable.

### 4.11.3 PayPal

This donation page allows a user with PayPal account to make a donation through the PayPal payment system. The user is asked for the amount of their donation, the frequency of donation and the PayPal funding (credit card or funds in account). Once submitted the user is sent to the PayPal site to complete the transaction. Once the PayPal transaction has been submitted the user is returned to a page thanking them for their donation. Similar to credit card donations, PayPal donations are immediately recognized in the user's profile including access to premium member status if applicable.

### 4.12 QTH Services Section

The QTH services section of the QTH.com Amateur Radio Web Site Portal is used to highlight other services of QTH.com besides the classified and auction swap listings. Highlighted in this section are:
• Web Hosting – An explanation and a link to the web hosting offerings from QTH.com.

• Web Site Design – An explanation of the web site design offerings and a link for more information.

• Banner Advertising – An explanation advertising opportunities available on QTH.com with a link for more information.

• Domain Names – An explanation of the domain name services offered by QTH.com and a link to another site with additional information.

**4.12.1 Banner Advertising**

This sub-section of the QTH services section fully explains the banner advertising offered at QTH.com and offers links to the pricing options for varying lengths of time for single, double, triple and quadruple rotations. Also available in this section is a link to view the current banner ads in rotation as well as links to purchase QTH.com services for the design of a banner advertisement.

**4.13 About QTH Section**

This section highlights Scott Neader, the owner and administrator of the QTH.com Amateur Radio Web Site Portal. It contains a photo of Scott, his personal story and amateur radio credentials.

**4.14 Administration Section**

The administration section of the QTH.com Amateur Radio Web Site Portal encompasses a large area accessible only by the site administrators. This password-protected area offers the administrators management capabilities over many areas of the site described below.
4.14.1 Management of Listing Categories

This set of pages allows the QTH.com Amateur Radio Web Site Portal to manage listing categories including: adding new categories, editing existing categories, suspending existing categories and deleting categories. The functionality to suspend a category is required to ensure listing categories can be phased-out and deleted. The system does not allow a category which contains listings to be deleted. Instead, the category must be suspended which stops new listings from being added to that category. Once the existing listings have expired the category may be deleted.

Categories are hierarchical in nature allowing larger categories to be broken up into smaller more focused sub-categories. The system allows a sub-category to be added to a category only if that category has no listings within it. i.e., parent categories may not contain listings.

4.14.2 Management of Testimonials

This set of pages gives the QTH.com Amateur Radio Web Site Portal administrators the ability to create, moderate, edit and delete customer testimonials displayed throughout the site. Each testimonial contains the person’s name, their callsign (optional) and up to 300 characters of testimonial text.

Testimonials may be directly added by an administrator if they were received through e-mail or postal mail. Customers may submit testimonials online where they are added to a queue to be moderated before being publically displayed. Administrators may then moderate the testimonials by choosing to delete, edit or post/approve them. Once approved, testimonials are randomly selected and displayed through various areas of the site.
4.14.3 Management of Hosted Customers

The QTH.com Amateur Radio Web Site Portal includes a page listing the customers hosted by the QTH.com hosting services. This helps build a list of credible referral sources as well as providing customers hosting with QTH.com some additional exposure to a market relevant to their services. In these pages, the QTH.com Amateur Radio Web Site Portal administrators are able to add, edit, and delete entries from the list of QTH.com hosted customers.

The entries for hosted customers contain the type of site (Ham Business, Ham Club, Personal Ham Site, or Non-Ham site), the name of the site, a short description of the site and the site’s URL. These entries are displayed in the links section of the site and used to highlight the QTH.com-hosted customer on the home page of QTH.com.

4.14.4 Moderation of Reported Abuse

The moderation of reported abuse section allows QTH.com Amateur Radio Web Site Portal administrators to process the auction and classified swap listings that have been reported by the site users as abusive. Each submission is presented with the following options:

1. Not Abuse
2. Edit
3. Delete
4. Delete & Add Fraud Checks

Site administrators are able to simply return the listing to normal status by selecting “Not Abuse”. They may also edit the listing in the case that potentially offensive wording could be edited to make the listing acceptable. Administrators are able to simply delete the listing if it is clearly an abuse of the system (spam, scam or simply inappropriate). Finally, if the listing is abusive, administrators may also select “Delete & Add Fraud Checks”. This option allows them to not
only delete the listing but it also pre-populates certain inputs to the fraud subsystem. This allows future abusive listings to be blocked. By using this option the content of the abusive listing can be used to add new fraud checks for:

- E-mail Address
- Callsign
- IP Address
- Keywords

### 4.14.5 Management of Donations

The donations management area allows the QTH.com Amateur Radio Web Site Portal administrators to log new donations and process incoming automated donations. This area specifically tracks the donations to correctly identify users who have become premium members. From this donations management area site administrators are able to add, moderate and delete donation records from the database.

The ability to add donation records allows donations collected outside of the system (by postal mail or in person; i.e. check, cash or money order) to be included in donation totals. This ensures any donating user receives credit for their donation which may allow them to achieve premium QTH.com member status, regardless of the donation method.

### 4.14.6 Management of User Profiles

QTH.com Amateur Radio Web Site Portal administrators are able to manage all aspects of user profiles (accounts) from this management area. Administrators are able to locate the account by searching by name, callsign, or e-mail address. Once located, the user profile may be edited or deleted.
Each user profile contains (at a minimum) full name, e-mail address and password. User profiles may also contain a callsign, phone number, ZIP code, web site, photo and biography text.

Administrators may use this functionality for simple updates such as correcting typographical errors, however the primary use for this area is to handle requests of lost profiles / accounts, i.e. locate an account when the user cannot remember the e-mail address under which they registered or if a user is unable to reset their password.

Additional extended permission levels are also managed in this section. Administrators are able to grant extended permissions to user profiles which allow the site to have help from volunteer administrators. These volunteer administrators are able to receive any of the following extended permission levels:

- **Administrator (Full Access)** – Allows the user access to all administrative functions.
- **Feedback Moderator** – Allows the user to moderate incoming user feedback submissions.
- **Feedback Management** – Allows full management of all feedback entries in the database.
- **Listing Abuse Moderator** – Allows the user to moderate auction and swap listings reported as abusive.
- **Listing Management** – Allows full management of all listing entries in the database.
- **Testimonial Moderator** – Allows the user to moderate incoming testimonial submissions.
- **Testimonial Management** – Allows full management of all testimonials in the database.
- **Hosted Customer Management** – Allows full management of all hosted customer entries in the database.
• User Profile Management – Allows full management of all user profile entries in the database (including the control of extended permissions levels).
• Donation Management – Allows full management of all donation tracking entries in the database.
• Fraud Subsystem Management – Allows full management of the fraud system entries for e-mail address, callsign, IP addresses, URLs, keywords, and feedback.

4.14.7 Management of E-mail Footer Template

This management section allows for the update of the site-wide e-mail footer. This footer is used for all e-mails generated by the QTH.com Amateur Radio Web Site Portal. Utilizing a common footer helps to maintain consistency in communications from the site as well as taking advantage of an opportunity to request a testimonial or donation for the site.

4.14.8 Management of Fraud Avoidance Subsystem

The fraud avoidance subsystem was designed to provide a filtering service to the QTH.com Amateur Radio Web Site Portal. From this management area administrators will be able to add, edit and delete entries from the system as well as test the operation of the system by supplying potential input to see if it would be flagged by the system as a fraudulent item.

The system is able to filter several types of data. Each fraudulent item is entered into the system with a particular type assigned such as e-mail address or callsign. This allows the system to filter with the context of use for the given item.

The following types of data may be tested with the fraud avoidance subsystem:
• E-mail Addresses
• Callsigns
• IP Addresses
• URLs
• Keywords

The data, in full or partial form, may be added to the fraud avoidance subsystem as either white-listed or black-listed. This allows site administrators to block the use of known bad data or white-list known good data.

4.14.9 Feedback

The management of the Feedback section allows QTH.com Amateur Radio Web Site Portal administrators to edit, delete and approve entries in the feedback system. The entries are able to be located by listing ID, user's name or feedback ID. Once located the feedback entry may be deleted or edited.

Feedback items are associated with completed auction or classified swap listings. Feedback items contain a comment and a rating of positive, neutral or negative. There may only be four items of feedback for a single auction or classified swap listing:

1. The first person leaves feedback for the listing’s owner.
2. The listing owner is able to leave a rebuttal for the initial feedback.
3. The feedback user (buyer) is then able to rebut the rebuttal.
4. The last feedback entry allowed is a final rebuttal by the original user.

Also available in this section is the administrator’s ability to moderate incoming feedback entries. Each time feedback is left by a user the feedback entry is flagged for moderation. Until it has been moderated (and approved) by a feedback administrator the feedback entry will not appear on the site.
4.14.10 Management of Safe Trading Tips

The safe trading tips are an important aspect of the QTH.com Amateur Radio Web Site Portal. This management area allows administrators to easily add, edit and delete entries in the safe trading tips database. Users of the site are highly encouraged to review and utilize the tips in this database. As with any modern web site there are dishonest users of the system attempting to defraud users. This system allows the site administrators to keep users informed of new scamming techniques as well as common tips to avoid being tricked by dishonest users.

4.15 Automated Processes

The QTH.com Amateur Radio Web Site Portal has several automatic processes which run on varying schedules and do not require direct user interaction. Additionally, there are several processes or sets of functionality which do not require the standard web page user-interface. These items offer functionality to other sites, or as infrastructure pieces to other parts of the QTH.com Amateur Radio Web Site Portal. Both are explained in the sections below.

4.15.1 Backend Alerts - Instant

Users of the QTH.com Amateur Radio Web Site Portal who have achieved premium member status are able to enter an instant notification search for keyword use to which they would like to be alerted. Optionally, users may also enter a ZIP code, distance radius and a listing category to further filter their alerts.

Each time the instant alerts process runs it searches new listings for criteria specified in premium member alerts. If listings are found with the criteria the user has selected, an alert is sent via e-mail notifying the premium member that a new listing has been added to the site which matches their criteria.
4.15.2 Backend Alerts - Daily

Alerts are also offered on a daily basis. Premium members of the QTH.com Amateur Radio Web Site Portal are able to set up an alert for new listings in their geographical area or in a category they are interested in (or both). Each day, this automated process sends an e-mail announcement of new auction and classified swap listings in the selected categories and/or ZIP code radius selected by the users.

4.15.3 Backend My QTH Premium Expiration

Each member of the QTH.com Amateur Radio Web Site Portal is able to become a premium member by donating at least $20 within the last 12 months. Once per night, this process examines the database table of users and donations to determine which users will lose their premium member status in the near future. The process then sends an e-mail reminder to these members. Reminder notifications are sent out in the following intervals:

- 30 days prior to expiration
- 7 days prior to expiration
- Day of expiration

4.15.4 Backend Remote Listings

The QTH.com Amateur Radio Web Site Portal offers the owners of web sites the ability publish their QTH.com auction and classified swap listings to their own web site in addition to twenty of the most recent general auction and classified swap listings. Additionally, the functionality allows users to easily place a listing search box on their site. This helps to build awareness for the QTH.com Amateur Radio Web Site Portal while also helping the user promote the listings they own.
4.15.5 Backend Listing Category Delete

Each night, the QTH.com Amateur Radio Web Site Portal permanently deletes any category which has been flagged for deletion once it no longer has any active listings within it.

4.15.6 Backend Listing Notifications

Owners of auction and classified swap listings in the system are notified when their listings are about to expire. Each night this process will notify users with classified swap listings expiring in two days. The users are given a link which allows them to extend their listing by two weeks. Auction listings may not be extended.

Additionally, users with recently expired listings will be sent an e-mail notification informing them of their listing’s expiration including instructions to place this listing again if their item has not been sold.

4.15.7 Backend PayPal Integration

For the purpose of the automated processing of PayPal donations a back-end integration page was created which takes advantage of the PayPal Instant Payment Notification (IPN) system. This system allows PayPal to instantly inform the QTH.com Amateur Radio Web Site Portal of a processed PayPal payment by posting the information to the integration page which notifies the site of payments made outside the normal donations system and to immediately update the donating member’s premium member status. Using this system also allows the site to send thank you e-mails to the donating member.
4.15.8 Backend FCC Database Update

The callsign lookup functionality throughout the QTH.com Amateur Radio Web Site Portal is powered by the integration of amateur radio license data provided by the United States Federal Communications Commission (FCC). This page automates the download and synchronization with the amateur radio license data published by the FCC. Additionally, the FCC also releases daily transaction files containing changes to the license data which eliminates the need to download the entire amateur radio license database each day. This page takes advantage of these daily transaction files whenever possible to efficiently update the callsign database.

4.15.9 Backend Callsign lookup via URL

This functionality allows users of the QTH.com Amateur Radio Web Site Portal to easily perform lookups against the FCC’s callsign license data by entering the callsign at the end of the special lookup URL: http://qth.com/callsign/. For example, to lookup the callsign of the project sponsor a user would enter the following into their browser: http://qth.com/callsign/ka9fox. If the URL matches a callsign request, a lookup against the FCC amateur radio license data is performed. If the lookup succeeds, the callsign lookup results page is displayed. If not, the server will return a callsign not found error.

4.16 Conversion Script

Due to the fact that this QTH.com Amateur Radio Web Site Portal project is a redesign of an existing successful web site, care must be taken to migrate the users and site data to the new system at the point of launch for this project. A conversion script has been created to automate the conversion of the site data.
from the old system into the new QTH.com Amateur Radio Web Site Portal. The old system does not have the concept of user accounts so the conversion script creates new users accounts from the existing swap classified listings and maps all listings for a particular user to their new account. Additionally, all listing photos are automatically organized, resized and thumbnail versions will be created for the listings with photos. The user will be sent an e-mail notifying them of the launch of the new site along with an explanation of the user account concept and an overview of how their listings were converted. Users will be encouraged to visit the new site to review their account, listing information and to update their password.
5. Future Work

Due to the size of the QTH.com Amateur Radio Web Site Portal and its growing user-base the project team anticipates a steady stream of work to be completed in the future. In addition to the normal project life cycle of bug fixes and maintenance work, the site’s new code base will allow for easier addition of new features. As the community begins using the site’s new features, enhancement requests and adjustments to existing functionality will be discussed and weighed against their potential benefit to the entire community by the project team. Changes will be carefully managed. The first set of changes is expected as a result of the beta test period described below.

5.1 Community Beta Testing

Prior to the re-launch of the QTH.com Amateur Radio Web Site Portal the project team will be performing a wide-spread beta test with a selection of the site’s volunteer administrators and several frequent users of the system. The team expects this test period to help reveal any usability issues that may be present. Additionally, the use of the system, including tests of the conversion scripts, will help ensure a smooth launch to the general public.

After the beta testing period the project team will review and address any defects found, feature requests and functionality adjustments which need to be made prior to the launch of the new QTH.com Amateur Radio Web Site Portal.
5.2 Launch Tasks

Once the QTH.com Amateur Radio Web Site Portal is ready to be launched, the existing web sites will be replaced with a “Down for Maintenance” message as the data is converted. The current site data will be migrated and users will be notified as described in section 4.16. Once the site has been launched, the related domain names will be re-mapped as described in the requirements to point them to the new sections of functionality on the site and the site will be opened for business.

The project team will closely monitor the performance and functionality of the new site as well as helping with incoming customer support requests. It is expected there will be users who need some help with their new user accounts. Due to this expected increase in customer support requests the project team will reserve the day after the launch to monitor the support queue and handle any issues as they arise.

5.3 Performance Improvements

Once the QTH.com Amateur Radio Web Site Portal has been launched and is operational for a period of time, there are several additional tasks which could be implemented to help boost the performance of the site:

- Database query optimization – Many database queries drive the content pages on the site. Analysis of the most-used queries could be performed to ensure the queries are optimized. Also, care should be taken to ensure proper indexes have been created to help the database server process the queries more efficiently. The database server could be configured to log slow queries which MySQL defines as a record of all SQL commands that take longer than the time specified in the long_query_time system variable [6]. Logging all SQL statements which take longer than a configurable
number of seconds to execute and require at least a configurable number of rows to be examined will produce a log of queries which need this type of analysis.

- **Creation of an asset server** – Most web browsers will open at most two connections to the same server (URL). By creating an asset server and serving images, JavaScript and CSS from a different URL the browser can parallelize the loading of the web site's content. For example, to load a web page's content, CSS, JavaScript and all images the browser will open two connections to qth.com and stream all of those assets through only those two connections. However, if two assets servers were created the browser could download various parts of the page through up to six connections in parallel which will decrease the load time of the entire page.

- **Minify JavaScript and CSS** – Another potential optimization technique is to minify the site’s JavaScript and Cascading Style Sheets. The process of minifying involves removing unnecessary comments, spaces, tabs, and various other selected characters which generally increase the human readability of the file but increase the overall size of the file as well. With smaller JavaScript and CSS files the end-user’s web browser is able to fetch them more quickly which helps produce a faster page load.

- **General monitoring** – In addition to the performance related tasks, other areas should be monitored for potential issues. Notations in server log files (such as Apache HTTP logs and MySQL database logs) as well as other logs such as Google’s GoogleBot indexing log may identify potential areas for improvement or issues which need to be addressed. These logs should be checked periodically to ensure there are no issues which may not normally be noticed in the day-to-day operation of the site.

- **Google Analytics** – Beyond time-based performance, additional research and monitoring can be done with tools such as Google Analytics to
monitor the performance and quality of the traffic to the web site. Such tools offer the QTH.com Amateur Radio Web Site Portal administrators the ability to study detailed statistics about the visitors to the site. Google Analytics can be used to track which search engines and sites are referring visitors (including which keywords they use to find the site) as well as which content is the most popular on the site. Using this information the content and functionality of the QTH.com Amateur Radio Web Site Portal may be adjusted to better serve the needs of the user base as well as attract new users for the site.
6. Conclusion

This manuscript describes the project to define, design, implement and test a complete replacement for an existing amateur radio operator portal web site operating at QTH.com. This new QTH.com Amateur Radio Web Site Portal was built to help the amateur radio (ham radio) community buy, sell and swap items related to their hobby such as radios, manuals, cables, antennas, etc.

In conclusion, the QTH.com Amateur Radio Web Site Portal project was focused on the development of a complete set of replacement web applications to bring both new functionalities to the site as well as create a stable and well-organized foundation on which the future development of new features may be built. It is our hope that this project continues on to the planned beta feedback phase, an update phase and eventually on to the public launch of the new QTH.com Amateur Radio Web Site Portal capstone project.
7. Bibliography


Appendix A: Screen Shots

QTH.com Portal – Home Page
QTH.com Portal – My QTH
Hello, Bob Lindner. (If you're not Bob Lindner, click here.)

Account Status: Premium Member

Your Donations
Thank you for your support of QTH.COM. In the last 12 months you have contributed $160.00 towards the operation of QTH.COM. Your contributions are greatly appreciated.

Reasons to Donate
If you like the way the QTH Free Ham Radio Listings have worked for you, please consider a small donation. If you've sold an item, we suggest giving 2% of the sale price of your item or $5.00, whichever is greater. If you just want to help out, any amount would be appreciated!

Donation History
We have recorded the following donations for your account in the last 12 months. Thank you for your support of QTH.COM. Your contributions are greatly appreciated!

- May 6, 2010: $65.00
- May 5, 2010: $100.00
- May 15, 2009: $5.00

12 Month Total: $160.00

Ways to Donate
VISA, MasterCard and American Express
To make a donation using Visa, MasterCard or American Express, please use our Secure Credit Card Donation Form.

PayPal
To make a donation using PayPal, please use our Secure PayPal Donation Form.

Check, Money Order or Cash
To make a donation using check, money order or cash, please use our Secure Cash Donation Form.
QTH.com Portal – My QTH / Preferences
QTH.com Portal – My QTH / Listings
QTH.com Portal – Swap / Category View
Listing #35567

HV Power XFMR!!

Submitted by KB7IXG (+33/3r-1) on 03/27/2010 at 12:30 AM

Contact Listing Owner  ~  Report Abuse

Description

NEB (New In Box), Hammond 276x, 890vct 200 ma, 6.3vct-6 amp, 6v-3 amp Weight 7 lbs. $75.00 + Shipping. (OBO).

Return to Browsing by Category

QTH.com Portal – Swap / Listing View
Customers Hosted on QTH Servers

To have your site listed here host with QTH today!

Ham Radio Companies hosted on QTH.COM
Ham Radio Organizations hosted on QTH.COM
Ham Radio Personal Pages hosted on QTH.COM
Non Amateur Radio Pages hosted on QTH.COM

Ham Radio Companies

ACULA Antenna Modelling Software – MultiNEC, EZPlots, TLDetails, MoxGen, and more
Acme QRQ – Low Power Ham Radio Kits
Affordable Radio Repair – Quality repairs by NGBXE
Alpine Antenna – Screwdriver Antennas – reasonably priced and work well!
Amp Lady – Sales and Service of Amplifiers - HF/VHF/UHF
Antenna Zoning – Cases and info. How to get a permit. Atty. Fred Hopengarten, K1VR
Array Solutions – Antennas, towers, RF switching, phasing, filtering, surge suppression & More!
Cook’s Radio Retreat – P49V Anibha Ham Radio Rental
BIRD RF Test Equipment by N83E – Tested and guaranteed BIRD meters, elements, dummy loads, parts & much more
Better RF Company – ICOM 7000 Screwdriver Control, Icom and Yaesu Tune Control, More!
Bulldog Iambic Key by K4LU – Inexpensive, lightweight CW key
Champion Radio – Professional tower supplies and specialty products for hams and industry
Cheap QSLs – Your low priced QSL printer $9.99 per 100 Everyday!
Cuteles Electronics – Repair Services for Kenwood, ICOM and Yaesu Radios and Amplifiers
Donate to QTH

If you like the way the QTH Free Ham Radio Listings have worked for you, please consider a small donation. If you’ve sold an item, we suggest giving 2% of the sale price of your item or $5.00, whichever is greater. If you just want to help out, any amount would be appreciated!

Did you know premium members (those donating at least $20 in the last twelve months) are able to set additional preferences such as:
- Set number of Swap listings shown per page
- Disable thumbnail pictures while browsing Swap listings
- Display titles only while browsing Swap listings
- Hide auction listings while browsing Swap listings
- Remember Swap listings previously shown and only show new Swap listings while browsing categories.

Ways to Donate

VISA, MasterCard and American Express
To make a donation using Visa, MasterCard or American Express, please use our Secure Credit Card Donation Form.

PayPal
To make a donation using PayPal, please use our Secure PayPal Donation Form.

Check, Money Order or Cash
To make a donation using check, money order or cash, please use our Secure Cash Donation Form.
About QTH

I was born in Chicago, IL, then my family moved to Minneapolis, MN for 5 yrs. Mitchell SD for 5 years, then finally Onalaska and La Crosse, WI.

I am married and have three kids. My oldest is 13 year old Cameron, then comes 10 year old Ashlyn and our little redhead is 7 year old Macy.

I became interested in ham radio during the CB Radio craze in the 70’s when I was 10 years old. By the age of 14, I had my ham ticket and was assigned KASFOX as a novice. I have kept this call sign all the way through Extra. I’ve been a ham for 28 years now.

My favorite thing to do in ham radio is Contesting and DXing. I am a member of the Society of Midwest Contesters. I have done pretty well in the past in Contests, including several Top 16 finishes in the SSB Sprints, and some Sweepstakes wins in the QRP category. Unfortunately, with my current family situation, I don’t have much time to do contesting anymore. But sometimes I do get to do some Contest Expeditions, which is always fun.

Some highlights include: In October 99, I was on 10 meters at KH7R and managed to work 16 guys in 68 seconds, which made the rate meter read 600/hr!! Also, in 1994, while I was in St. Maarten as PJ6Z I worked over 300 guys in an hour during CW SSB, many of which were European. What a blast!

Some DX places I have been and calls I have used include TD9GI, T20AA, PJ8Z, KH7R, KP4/KASFOX, TG/KASFOX, LA/KASFOX and AH7/KASFOX. I have also operated several US Contest stations, including K4AJ (ex KS9K, W6JA), W0AIH, K3LR, W3LPL and WE3V.

My home equipment consists of... Two FT-1000MPs, IC-746 (mainly for 6m and 2m), TS-830 as back-up. AL-1200, Clipperton L (needs tubes!), AL-80. After moving to a location with 5 acres I’ve put up a single 85 ft Rohn 55 tower.

73 - Scott KASFOX

QTH.com Portal – About QTH