American Red Cross Badge Database and Web Portal

Design Project Report

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Abstract

The purpose of this project is to implement a database to hold American Red Cross historical nurse badge numbers as well as a web portal for secure access and querying into this database. The database is designed to assist the American Red Cross with organizing, maintaining, and searching data of previous Red Cross nurses, as well offering current badge holders with a way to add their information to the database. The primary goal of the web portal is to provide the American Red Cross and any other stakeholders with a secure tool to view and query the database.

Introduction

This describes the design and implementation of a website and portal application for American Red Cross historical nurse badges. Its content chronicles the results of a two-semester capstone project in which our team researched, collaborated, and developed products to meet the needs and specifications of the American Red Cross. This outline serves as a detailed overview of our final products as well as our design and implementation process.

Background For The Project

A key part of the American Red Cross (ARC) is the Red Cross Nurses, most of which are volunteers. Throughout its history nearly 400,000 nurses have served, or are currently serving, as Red Cross Nurses. Beginning in 1909, each nurse was issued a badge (Figure 1), and each badge has a unique number engraved on the back (Figure 2). Up until the early 1990s the ARC kept hard-copy records of information about the holder of each badge, identified by the badge number. Due to budget cuts, this information as not been recorded since the 1990s (Stanley, 2012).

Figure 1: ARC Badge (front)

Figure 2: ARC Badge (back)

The Head Nurse of the ARC wishes to have an online database of holders of the badges (Stanley 2012). Our vision is to create this database of information about holders of the American Red Cross Nurse Badges, and have one or more web portals to support searching and maintenance of that database. Hard copy data will need to be converted to machine readable form and loaded into the database. The database and web portal will be useful to the Chief Nurse of the American Red Cross, family and friends of nurses who want to research family history, historians studying the history of the Red Cross nurse, genealogists, and possibly others.

Project Goals

The primary goal of this project is to implement a database which the American Red Cross can host, maintain, and use for the purpose of keeping track of and querying data on their volunteer nurses. We aim to develop this in a way that closely matches the development format of the American Red Cross in order to maintain consistency.

We will also develop a secure web portal platform that can provide users with a way to update the database and query it, while keeping the data accurate and safe. This portal must allow multiple types of queries into the database, as well as provide a method for holders of American Red Cross badges to enter or update their information in the system.

System Architecture

The badge database was originally implemented in MySQL. However, an early reimplementation of this to SQL Server was necessary in order to follow American Red Cross standards. An entry is referenced using the following fields as a unique identifier: badge number, first name, and last name. An early iteration of the database attempted to use the badge number as a single unique identifier. This was changed after further analysis of the data revealed that this field was not always unique. Approximately 68 fields exist for each entry, with roughly 300,000 – 400,000 entries potentially existing in the database at the time of its completion (Stanley, 2012).

Our web portal, which grants general access to the SQL Server database, was originally developed in ASP.NET, and eventually redeveloped in Visual Basic (in accordance with ARC standards) (Stanley, 2012). This client-side software allows users to create an account (upon confirmation by the database administrator), which grants them query access to the data. Querying is achieved by the user through the selection of built-in query tools.

Raw Data

Previous data collected on American Red Cross nurses is provided to us in a variety of forms. The majority of this data originates from several types of old IBM punch cards (Figure 3), which are loaded into Microsoft Excel spreadsheets (Figure 4) by a third party (Schneidman, 2012). Maintaining consistency and eliminating anomalies from this data has been a primary concern of our capstone team, and has proved to be challenging over the course of implementing our database.

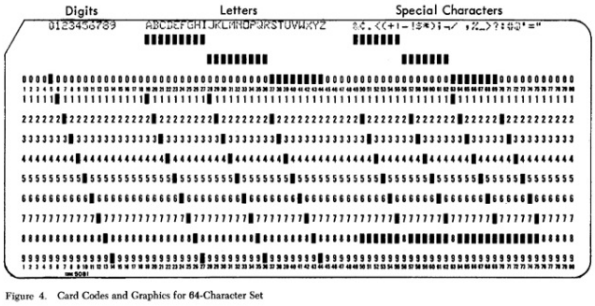

Figure 3: IBM Punch Card

A major obstacle when working with the raw data was identifying and defining a unique primary key to be used in the database. The data that the ARC initially provided us with did not contain any single unique attributes, including the badge numbers. After much analysis and cleaning, we defined our primary key to be the badge number, first name, and last name of each nurse in the tables. Before this was possible, the single name field had to be broken into first, middle, and last name fields.

Original data also contained several fields that, after discussions with ARC officials, were discarded from our implementation of the database (Stanley, Schneidman 2012). These arbitrary fields had to be removed from our spreadsheets before loading of data took place. Such fields include: punch card number, unknown questionnaire number, month or day, year, keypunch operator id, checkmark 1, checkmark 2, notes, timestamp, and SSN. Fields such as SSN were also discarded for obvious security reasons.

Additional data cleansing was necessary in order to guarantee a smooth transition from the current data format to the database. Semicolons and hardline returns were replaced with a space, and double quotes were replaced with single quotes. Because the data required such a large number of changes, Microsoft Excel was used in the initial stage of data cleaning.

The next step in the data cleansing process was to import it into Microsoft Access where data types could be changed. The following fields were set to long integers with decimal set to 0: date of birth month/year, date/year graduated, date signed, series, and box. Also, the data enrolled field was set to type date/time. Finally, these Access files were exported as (.csv) files with text delimiters of parentheses(“) and semicolons(;) before being loaded into the database.

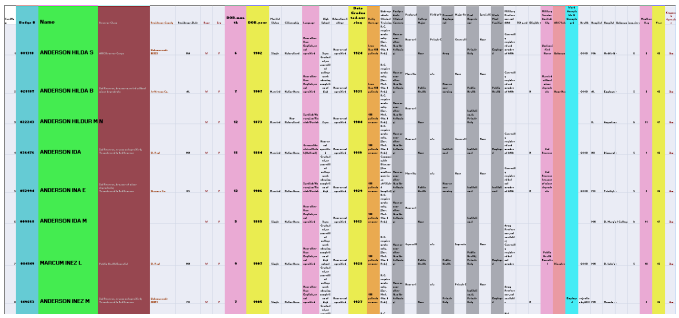

Figure 4: Example Spreadsheet

Database Design and Implementation (*see section XI. Appendix*)

The SQL Server database uses the nurse badge number[1] + first name[2] + last name[3] as a unique identifier for each entry. An additional field was also added, an auto-incrementing integer, to act as a unique field for entries. This is primarily used on the development side to quickly reference user queries for additional information. All implementation for the database design process was done remotely on a server machine using a remote desktop connection. This provided the development team with the advantage of being able to access the information remotely (on campus or through VPN access), as well as providing a single-source to work from rather than using multiple copies (reducing redundancy). Disadvantages of this approach include the time required to centralize all of the data throughout the development process and the inability to directly access the machine, which was done for security purposes.

Web Portal Design and Implementation

The web portal provides general access as well as administrative access to the nurse database. A database administrator will use the administrator login, while general users will login via the public login page (Figure 5).

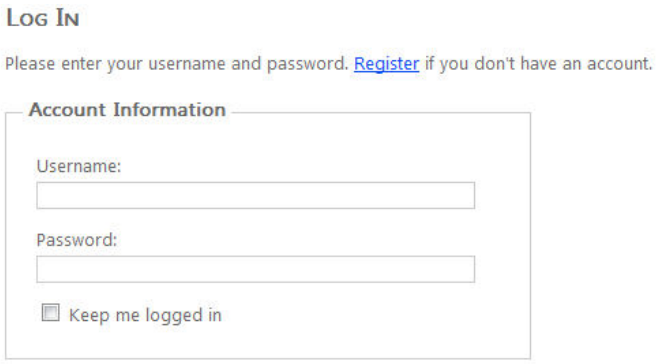

Figure 5: Login Page

This allows different types of accounts with varying degrees of access and visibility. After logging in, users can choose to query the database or view/edit their own personal profile information. Such information includes the users own nurse profile data (if they are/were a volunteer ARC nurse), and/or their account type.

Querying into the database is achieved in the web portal through user customization of pre-built queries. Users may specify any combination of the visible fields for each entry in the database when searching. Results are presented on a result page with a brief description of each entry. The six most identifiable fields (determined by the development team) are presented, rather than all 68, allowing users to quickly browse results. When a specific result is clicked, the full list of its fields is shown to the user, allowing a more detailed view of data (Figure 6)

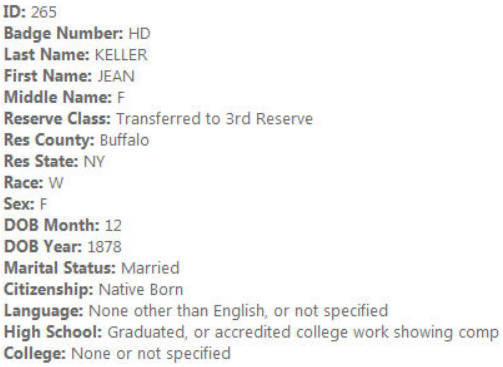

Figure 6: Example Query Results

Maintenance and Hosting of the Database

Maintenance of the nurse badge database primarily involves validation of account creation requests. When the database is handed over to the American Red Cross, these tasks will likely be undertaken by a volunteer nurse, selected by the head nurse.[1] Our team has taken several measures to reduce the need for additional maintenance by designing the database with these layers of information security and access controls. The database will also be backed up to a local machine should unforeseen corruption events take place.

The actual job of hosting the database will likely be passed on to the third-party company upon delivery of the final product to the American Red Cross. This will provide reliable universal access as well as additional layers of network security. Hosting the product in this fashion provides current badge holders with a way to update or add to the database.

Future Enhancements

Ultimately, the American Red Cross would like for a way to reduce the amount of required maintenance while maintaining the current level of security. The task of approving changes and account creations provides an effective solution to many security issues. However, volunteer nurses are busy, and developing a way to make the database more self-sustaining is desirable. With additional time, this is a future enhancement that both our group and the American Red Cross would like to see implemented.

Conclusion

At this point in the semester, our group has implemented a fully functional database that keeps track of nurse badge numbers. We have also implemented a web portal for secure access and querying into this database. However, many of the records that will be loaded into this database could not be processed for us fast enough. The fraction of records that we have received has been successfully loaded into the database.

We have performed tests on both the database and the web portal for accuracy and have eliminated any bugs. Queries are appropriately described and consistently return the desired set of results. Also, the user access levels in the web portal never allow inappropriate operations on the data. Finally, connectivity to the web portal has been successfully tested outside of Miami's network to ensure that public access is reliable.

An unexpected turn in the development of the database and web portal was conforming to the American Red Cross development standards of using SQL Server and VB.net. Maintaining consistency meant rebuilding the database using SQL Server (initially built using MySQL) and recoding the web portal from ASP.net to VB.net. This significantly slowed the development process but was a good lesson in the importance of gathering requirements early in the cycle.

Another unforeseen obstacle faced by our group was the amount of data cleaning that was required before loading records into the database. Identifying which fields were necessary, defining data types for each field, and removing anomalies was an iterative process throughout the entire development cycle. While we initially expected that some minor data cleaning would be necessary, we did not expect to have to manipulate so much of it.

References

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[7] Stanley, Sharon A. R. PhD, RN, RS. Chief Nurse and Director, Disaster Health and Mental Health Services. American Red Cross, National Headquarter. StanleyS@usa.redcross.org.

Appendix

Term	Definition and Information	Format	Validation Rules	Aliases
[1] Badge #	Badge number of the nurse	String	Can be a mix of text and/or numbers A – African American M – Male Y – Home Defense	
[2] LastName	The last name of the nurse	String	Not null	
[3] First Name	The first name of the nurse	String	Not null	
[4] Middle Name	The middle name of the nurse	String	Not null	
[5] Reserve Class	ARC Nurses are classified into 4 reserves: War, First, Second, and Third- non Qualifying	String	War, First, Second, and Third- non Qualifying	
[6] Residence.County	County of residence where the nurse lives	String		
[7] Residence.State	State of residence where the nurse lives	String		
[8] Race	Race of the nurse	Character	W – White C – Colored	
[9] Sex	Sex of the nurse	Character	M – Male F – Female	
[10] DOB.month	Displays the number for the month in which the nurse was born	Number	Between 1 and 12	
[11] DOB.year	Displays the year that the nurse was born	Year		
[12] Marital Status	Shows information pertaining to the nurses marital status	String	Single, Separated, Widowed, Married	
[13] Citizenship	Shows which country the nurse holds citizenship	String	Native Born, Naturalized, Non-Naturalized	
[14] Language	Lists all of the languages that the nurse may speak	String		
[15] High School	Shows if the nurse completed high school or an equivalent, if they did not complete high school it shows number of years completed	String and/or Digit	Digit must be between 1 and 4.	
[16] Education.College	The college that the nurse attended.	String and/or Digit	Digit must be between 1 and 4	
[17] Date Graduated.nursing	Shows the date that the nurse graduated from nursing school	Date		
[18] Daily Average	The # of daily average patients at hospital during training period	String		

Term	Definition and Information	Format	Validation Rules	Aliases
[19] Undergraduate Clinical Training	Shows what training the nurse has received and what they are able to administer	String		
[20] Postgraduate Clinical Courses	Shows any clinical courses that the nurse may have taken after graduating college	String		
[21] Postgraduate Academic Courses	Shows any courses that the nurse may have taken after graduating	String		
[22] College Major	Displays the nurses major	String		
[23] Field of Nursing Before Military	Lists which field of nursing the nurse was in before joining the military	String		
[24] Present Employment	Shows where they nurse is employed if they are currently employed	String		
[25] Major Responsibility	The highest level that the nurse can handle is displayed	String		
[26] Past Experience	Shows what other work the nurse has done in the past.	String		
[27] Specialties	Displays if the nurse has any specialties that are important to military service	String		
[28] Work Most Familiar	Shows what sector of work the nurse is most familiar with	String		
[29] Military Preference and ANA	States with which service the nurse prefers to serve	String		
[30] 761 card with Military	Shows whether the nurse has a 761 card	Character	Y or N	
[31] Eligible for Military	Shows if the nurse is eligible for military duty	Character	Y or N	
[32] Military Service Availability	Shows if the nurse is eligible for active service	String		
[33] ARC Volunteer Service Availability	Displays if the nurse is able to volunteer with ARC	String		
[34] Work Acceptable if Unemployed	Shows if the nurse is employed or what they are doing if not holding a full time job	String		
[35] Health	The current health of the nurse	String	Must be Good or Poor	

Term	Definition and Information	Format	Validation Rules	Aliases
[36] Hospital Code.state	State Code of the Hospital that nurse graduated from	String	2 digit state code from school of nursing code directory	
[37] Hospital Code.school	School of nursing code of hospital nurse graduated from	String	5 digit school of nursing code directory	
[38] Series	Box location of original data	Number		
[39] Box	Box location of original data	Number		
[40] Retired	Shows if the nurse is currently active	Character	Y or N	
[41] Deceased	Shows if the nurse currently living	Character	Y or N	
[42] Pin Returned	Displays if the nurses pin what returned at death	Character	Y or N	
[43] Date Enrolled	Date of enrollment in ARC (from 1947 – forward only)	Date		
[44] Surnames	What other names the nurse may have had	String		
[45] Maiden name	Maiden name of the nurse if they are married	String		
[46] DOB	The nurses date of birth	Date	##/##/####	
[47] Area	Regional groupings (changes through the years)	String		
[48] School of Nursing Attended	Name of the nursing school attended by the nurse	String		
[49] Address of School	Address of the school they are currently attending or have attended	String		
[50] Year Graduated	Year they graduated from nursing school	Number	####	
[51] Chapter Name	The chapter of Red Cross nurses that the nurse is a member	String		
[52] City & State	The city and state of the chapter	String		
[53] Badge 2	Replacement badge	String	Will be the same badge number as the original badge. Just identifies that a replacement badge was issued	
[54] Address	Address of the chapter	String		
[55] Requirements Completed	Describes what the nurse does within the program	String		

Term	Definition and Information	Format	Validation Rules	Aliases
[56] Signature of Chairman or Secretary of Enrollment Committee	Name of the person that is in charge of enrollment	String		
[57] Title	Job title of the person who signed the enrollment of the nurse	String		
[58] Reg. No.	Registration number - This was issued before the state license no	String	Can be text and/or numbers	
[59] License State	State that granted License number	Character	Two letter state code	
[60] Reg. State	State that granted registration number	Character	Two letter state code	
[61] License No.	Nurse's state license number	String	Can be text and/or numbers	
[62] Date Signed	Date that the nurses enrollment was signed	Date	##/##/####	
[63] Nurse Title	Title of the nurse within medicine	String	Mr., Ms., Mrs.	
[64] Highest Degree and Field	Displays the highest degree earned and in which field it was earned	String		
[65] Military Status	Shows which armed service the nurse is currently active within if any at all	String	Often empty or Enrolled	
[66] Spouse Name	Name of the nurses spouse	String		
[67] State	State of current residence	Character	State Abbreviation	