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Development of a Centralized Database System for Embracing Horses and the Urban Farm

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I would like to thank my parents for always supporting and encouraging me to pursue my continuing education. They never gave up on me when I took a long sabbatical and gently pushed me to complete my thesis.

Abstract

Embracing Horses and The Urban Farm at Stapleton, is a nonprofit organization whose mission statement is to connect children from inner city neighborhoods to their natural environment, instilling a sense of respect, appreciation, and, ultimately responsibility for the plants and animals which share that space and a working knowledge of responsible stewardship of those plants and animals. To achieve this mission a paper based and generic database system have been utilized to record information pertaining to volunteers, financial donors, program offerings, and mailing distributions. These current systems no longer meet the needs of the organization, as the number of children involved has grown considerably over the past five years.

This project proposes to research, analyze, design, and implement a centralized database system. This system will provide productivity tools, such as queries and reports for users to efficiently and effectively access necessary information about volunteers, financial donors, program offerings, and mailing distributions. Since the organization's primary form of financial assistance comes from government and private grant programs, these tools will also be utilized to provide statistical data in multiple reporting formats to accommodate various grant programs.

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Introduction and Executive Summary

1.1. Problem Statement

The mission statement of Embracing Horses and The Urban Farm (TUF) is to connect children from inner city neighborhoods to their natural environment by instilling a sense of respect, appreciation, and ultimately responsibility for the plants and animals, which share that space. The main stewardship programs offered at TUF are: horseback-riding programs of various skill levels, gardening classes, and animal husbandry skills. These programs, facility maintenance, and animal welfare are made possible by private and public donations, volunteer service hours, and grant funding.

The popularity and success of the organization was evident in the growing number of programs offered because of additional funding availability, volunteer interest, and child enrollment. These successes put a strain on the current paper-based and generic database or file system currently used to record information related to programs, volunteers, program participants, and financial funding. These two systems were not centralized or connected, and required multiple record entries for the same information. Maintaining information accuracy and updating information was also difficult due to the record entry redundancy and lack of a computer-networked environment. The vast majority of the TUF's computers were older models that were not network enabled or would require extensive upgrades to be LAN ready. This contributed to the organization's problem of updating information in a timely manner, and allowing multiple people access to program or class informational data.

1.2. Project Need

The continued growth and success of the TUF cannot be managed or maintained under the current paper-based and generic database or file system. To further enhance current plant and animal programs, and offer additional programs funding is required. Over half of TUF's financial funding comes from public and private grants. The grant application process often requires the need for specific participant demographic information and that program history be reported. Current processes and file systems in use are cumbersome and difficult in retrieving this information. The data sources are disconnected and kept in various Excel spreadsheets and stored in hard paper copy format. Current query and extract tools are also limited. To maximize funding potential, TUF needs a centralized data recording and querying tool to properly support the organization's growth.

1.3. Barriers and Issues

The development team encountered four major barriers for in the project. The first issue was to understand and document the current processes in place. No formal training manuals, diagrams, or process flow charts were readily available that clearly described and identified the organization's business practices. Four full time employees were employed and operated over fifteen different programs that allowed children to interact with over sixty animals. The successes of the programs were largely due to volunteer support and coordination. Day to day operations left little time for documenting how the business operated. Since understanding the basic nature of the

business was critical to the design, development, and implementation of a new database solution, additional attention and focus was spent on examining current registration forms used to register students for horseback riding classes, reviewing how volunteer contact information was stored for later use, and how animal health history information was utilized. It became clear early on in the project that selection and appropriate use of research methods were critical to the effectiveness of the project.

The second major barrier was limited IT infrastructure and IT support. The IT architecture was old and not networked to a LAN. Three out of the seven PCs had Microsoft Windows 98 as the OS and Microsoft Office Professional. The remaining computers contained Microsoft Windows 95 as the OS and Microsoft Office Basic. Hardware specifications for the older computer models were: Pentium I processor with 64 MB memory and 600 MB hard drive. This aging infrastructure needed to be considered in the project scope and development. IT support was also an issue because no full or part-time employee was assigned to upgrading or maintaining the organization's infrastructure. When computer hardware or software problems occurred, assistance was often solicited from volunteers or other co-workers.

Since TUF is a small non-profit organization with a limited budget, capital funds were not available for hardware, software, or cable infrastructure upgrades. Due to the age of the organization's current equipment, this constraint imposed quite a challenge for the proposed solution. The solution needed to provide a single source for program, financial, and contact data, but be small enough to run on Pentium I PCs.

Lastly, the growth of TUF could not be sustained without the help from volunteers who spent their time doing a variety of tasks. Some of these tasks included accessing and entering data about programs, participants, and animal records into the database. Tracking and entering this information is vital for financial funding. The individual volunteer entering the information varies daily. To accommodate multiple skill levels, familiarity with PCs, and the developed program solution, a simple GUI environment with drop down LOVs, pre-formatted fields, and controlled fields was necessary to reduce data entry errors, improve data integrity, and improve query capabilities.

1.4. Project Elements

Simplicity of the project solution had the most benefit to TUF. The current need of the organization was a centralized database that contained all data related to programs, financial donors, volunteers, program participants, and animal records. This need was accomplished using existing older model computers in a non-networked environment. Capital budget for software solutions was also limited. The selected program had to be available for use in TUF software library or available a minimal cost. The selected software solution also required minimal training and be user-friendly so basic computer users were confident in operating the system.

Two potential software candidates that met the above requirements with the known constraints were Microsoft Access and MySQL. Both can be operated on lower performance computers, use a GUI windows environment that most people have been

exposed too, and do not require extensive IT support to operate. TUF already had a license for Microsoft Access and the MySQL cost was in line with the project budget. A feasibility analysis was utilized to determine which software solution was the best fit for TUF's database requirements and needs.

1.5. Project Scope

The scope of this project was to research, analyze, design, and implement a centralized database system for TUF. The project management took into account the scope, time, and money assigned to complete this new database system. Since TUF had not allocated much money to the project or changes made to current IT infrastructure, the project scope and proposed solution was impacted. Timing associated with database use and query tool training was also limited to only the four full-time employees. Additional training of volunteers to use the database, conversion to a web-based capability, and the setup of a LAN network for all PCs would need to occur in future phases.

The project scope of the centralized database analysis and design was further defined by the following:

- Provide input forms for volunteer, financial donation, and program participant information.
- Provide input form for animal medical history information and routine health maintenance.
- Provide input form for program class information and program participant registration.

- Create a program schedule calendar that identified enrolled students and animals used for each open program.
- Develop a query that identified specific demographic information that could be utilized in financial grant applications.
- Create a report for mailing distributions that targeted volunteers, recent financial donors, or former student program participants.

The centralized database would achieve the above requirements in a familiar GUI environment that would present input forms with record entry standardization through the use of LOVs, pre-formatted fields, and limited input capabilities. This improved data entry and accuracy increased entry performance, and maintained data integrity. Upon database prototype approval by the TUF Executive management, the completed database would be implemented and training would be provided to the staff. The complete time frame from design to implementation was expected to be ten months.

1.6. Definition of Terms

These terms have been identified and were specific to the project.

- TUF- The Urban Farm
- IT- Information Technology
- PC- Personal Computer
- LAN- Local Area Network
- OS- Operating System
- GUI- Graphical User Interface

- LOV- List of Values
- COTS- Commercial Off The Shelf
- TCO- Total Cost of Ownership
- OEM – Original Equipment Manufacturer
- ERP – Enterprise Resource Planning

1.7. Summary

The continuing success of TUF instilling respect, appreciation, and responsibility for plants and animals to inner city children was evident in their growing program enrollment and volunteer interest. The current paper-based and generic database system used to record information related to volunteers, programs offerings, program participants, and financial donations was no longer effectively handling the organization's growth. This project proposed to research, analyze, design, and implement a centralized database system. This system would provide productivity tools, such as queries and reports for user to efficiently and effectively access necessary information about volunteers, financial donations, program offerings, and program participants. These business requirements would be achieved under the limitations of a non-networked environment, limited capital budget for software selection, and the utilization of older model PCs.

2. Research

2.1. Overview of Solutions

Many database solutions were available in today's global market. These solutions ranged from highly customized packages that could be vertically integrated with all aspects of the business market to low cost open sourced software solutions that utilized informal developer and technical communities for support and maintenance. For this project, the magnitude of available database options was narrowed down and focus placed on the core business requirements and needs of TUF. Given the known barriers and constraints of the current IT infrastructure, IT support, and project budget, selection criteria was identified. Solutions had to be cost effective, inexpensive to purchase, compatible with the current IT environment at TUF, operate as a relational database, and be supported by current staff knowledge and capabilities.

Using these criteria for selecting candidates, two qualified COTS solutions were identified: Microsoft Access 2000 and MySQL 5.0. Both solutions were compatible with TUF's older hardware architecture, operated and functioned in a non-networked environment, and were easy to install and implement. Data migration for both applications was also easier than other database solutions such as Oracle or SAP. Support for data migration and troubleshooting techniques were easily accessible via online support, free Internet message board communities, and various developer textbooks. Additional knowledge base and installation training programs and clinics were also offered by the OEM or through specialized commercial training corporations.

Lastly, the total cost of ownership (TCO) for these COTS applications was relatively inexpensive compared to fully customized and integrated relational ERP databases. These key selection criteria discussed were a major decision factor in selecting Microsoft Access and MySQL as potential database solutions for TUF.

2.2. Available Database Solutions

Microsoft Access 2000 and MySQL 5.0 were identified as potential relational database solutions for this project. Each program's capabilities were reviewed specifically for use in a small business environment, abilities to meet business requirements of TUF, and scope of this project.

2.2.1. MySQL 5.0

The first relational database solution reviewed was MySQL version 5.0. This software package was selected as a potential candidate because of its TCO, open sourced data environment, technical support community, and ability to operate in an older IT infrastructure. Since TUF approved a limited budget for this project, software costs related to licensing were kept to a minimum. MySQL offers licensing agreements free of charge for its MySQL Standard (Bloor 2). Support packages such as MySQL network were also available and started at $595 per license for the basic service ("MySQL Online Network" 1). TCO for this solution was estimated to be 75% less than its competitors because of the reduction in database licensing costs by over 90%, cutting system downtime by 60%, lowering hardware expenditure by 70%, and reduced administration, engineering, and support costs by up to 50% ("A Guide to Lower Database TCO" 11).

One major factor of why MySQL licensing was less expensive than its competitors is that the program is considered an open source database. Open source databases have become more popular over the past ten years and are being seen as an opportunity for companies to reduce infrastructure costs often associated with licensing fees (Yuhanna 2). Since the source code and structure are not proprietary and open for all to view, strong development support is available from the technical community. This support further increases the robustness of the code and allows companies to rely less on commercial technical support when problems arise. Fear of program obsolescence is also reduced and more control is given to businesses using the database programs than to commercial developers. Having a flexible and proven open source database such as MySQL for the TUF would prove to be valuable for technical troubleshooting and support assistance.

Another benefit of MySQL was the program's flexibility with hardware and OS platforms. This database is functional in Microsoft, UNIX, and Linux OS environments ("Choosing The Right Database" 5). MySQL also accommodates TUF's older hardware architecture but to allow simultaneous access to all computers, a token ring network would need to be installed since this solution is a server-based database.

2.2.2. Microsoft Access

The second relational database solution reviewed was Microsoft Access version 2000. This is COTS product that comes standard with the Microsoft Office Professional and Small Business Suite series. The 2000 version is no longer available directly from the

OEM, but the Access 2003 upgrade is available at $109 per license ("How To Buy" 1). TUF has three licenses of Access 2000 installed on their current IT environment. This program performs best when used by 15 or fewer simultaneous users and when the largest table in the database has fewer than 150,000 records ("Choosing The Right Database" 2). Similar to the MySQL database, TUF would need to network all the facilities PCs on a token ring structure to take full advantage of the Access database.

Technical support and training assistance is widely available for most Microsoft products, including Access. Most users familiar with the Window OS environment have been exposed to Microsoft software tools. Various local and Internet based support programs are available for a fee.

2.2.3. The Final Decision

The capabilities of MySQL 5.0 and Microsoft Access 2003 were reviewed and compared to the requirements of TUF and the scope of the project. Of the two database solutions, Microsoft Access 2000 was the chosen solution because its capabilities met all of the critical selection criteria for the project. Since TUF already had three licenses of the program, no cost was associated with licensing and costs were kept within the limited project budget. Access 2000 was able to operate on TUF's older IT infrastructure and can later be networked on a token ring so all PCs can access the database similateously.

Besides licensing fees, the other main criteria that set Access apart from MySQL was the level of general user training required for employees and current technical knowledge of the program. The staff was already familiar with the general operations of

Access and its Windows based GUI environment. Selection of MySQL would have required general user training and technical support training. Management did like the community aspect of MySQL's open sourced database and the flexibility it offered for technical resources. Associated training costs would have been minimal compared to other non-open sourced databases, but the time and schedule needed for training was not convenient or realistic. Typically the summer season at TUF sees the most program activity.

2.3. Summary

The relational database market has grown substantially in product variety and product selection in the last ten years. Software solutions range from highly customizable ERP systems to open sourced databases that offer unlimited access to source code. The level of technical support from commercial competitors to online community forums is also just as varied. The focus of this project was to identify potential database solutions that met the current requirements for TUF and were within the scope of this project. Potential database solutions were to be cost effective, inexpensive to purchase, compatible with TUF's current IT environment, operate as a relational database, and be supported with current staff knowledge and capabilities.

The database selection focused on software solutions MySQL version 5.0 and Microsoft Access 2000. Both were reviewed for performance capabilities, product offering/features, fit with TUF business requirements, and project scope. Both relational databases were viewed as strong solutions, but the final decision was to select Microsoft

Access 2000. This database solution offered the lowest cost since the organization already owned three licenses. Training and technical support were less extensive because employees and some regular volunteers were already familiar with the program. Technical support would still be required, but the learning curve was expected to be less than MySQL. Management liked the flexibility and resources available for MySQL support and training, but the time schedule and training implementation of the program was not convenient or feasible.

2.4. Project Contribution

This project contributed to the field of information technology by exposing at risk or high-risk children to the world of information technology. During the course of project investigation and development, TUF employees and volunteers were asked to provide input for database requirements and offer feedback regarding the ease of database entry and navigation during the prototyping phase. Student volunteers were also exposed to the project life cycle and were able to experience the process from start to finish.

Many students were familiar with computers and information technology through experiences at school, but few had knowledge or experience with the development and project management functions associated with information technology. As student volunteers get more opportunities to interact with the database solution, further interest to explore other areas of information technology will result. Their future and the field of information technology will benefit greatly from this outcome.

3. Methodology

3.1. Research Methods

Multiple research methods and tools were used for this project because it was important to identify, understand, and document the current processes in place at TUF. Interview techniques and data collection were two of these methods. Introduction and fact gathering interviews were conducted with the Executive Director, Operating Director, and Program Coordinator the TUF's main facility. The main objective of these interviews was to discover information about the organization, understand the business function of TUF, gather information about current processes, and identify current business process problems. Open and close-ended questions were asked of each interviewee. Interviews instead of questionnaires were used because of the limited number of people being interviewed, which allowed additional time for interviewees to fully explain current business processes, and to allow the focus of the project to be placed on key business improvements that management and staff thought were critical.

Data collection was also utilized during the interview sessions with management and throughout the discovery phase of the project. As interviewees were explaining and describing the role of TUF and its current processes, data was collected in the below formats:

- Student registration form
- Volunteer contact information form
- Volunteer activity log in form

- Student contact information form
- Liability Release form
- Spreadsheet containing animal health record history and maintenance
- Spreadsheet identifying horse and rider for each horsemanship-riding program
- Spreadsheet of past financial donors
- Documentation of interviews

This data collection was critical in understanding the current state of the organization. Data was lastly obtained through observation of a junior horsemanship riding class and volunteers entering information from recent veterinary checkups into the local PC. These observations were beneficial because they allowed viewing of the current process in practice. I was also able to compare processes and procedures described by staff members in previous interviews to what was actually being performed. Observing also evaluated the effectiveness of current processes and provided recommendations for improvements in the database solution.

Current process mapping can be described as informal with little to no documentation outlining processes and procedures practiced by staff and volunteer members.

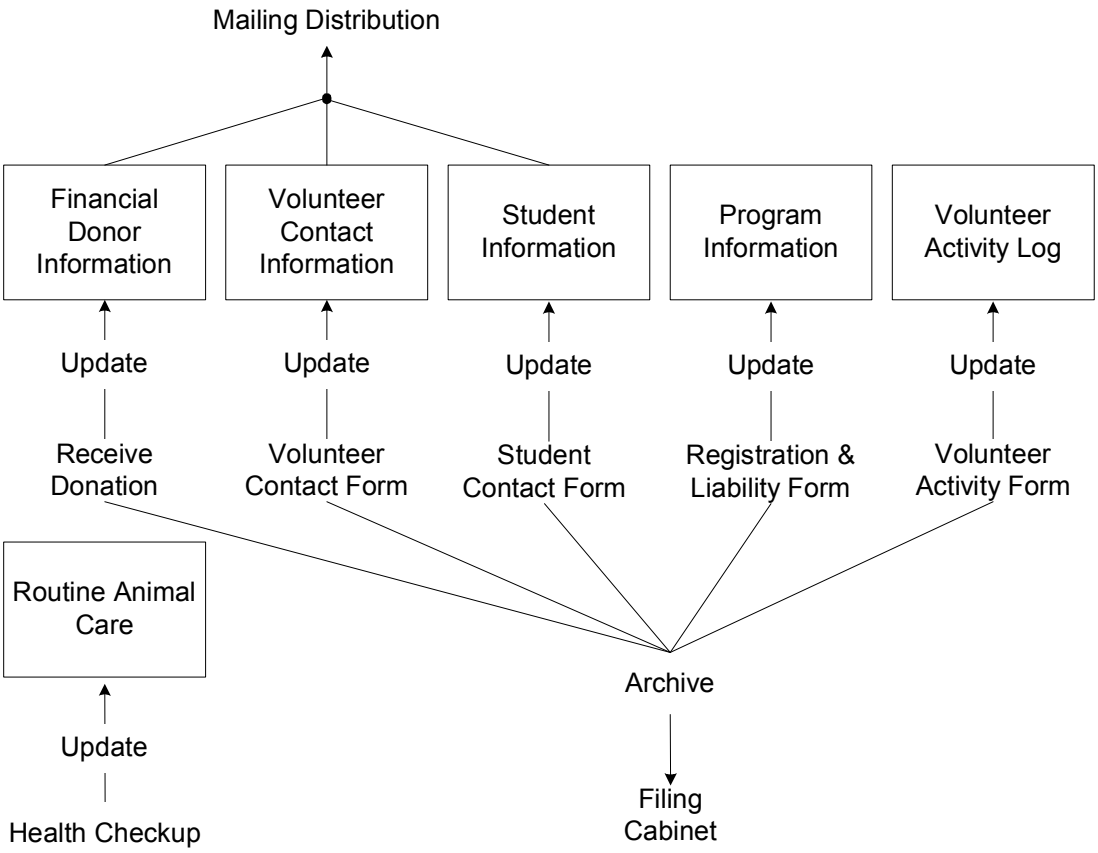


Figure 3.1 Current Process Mapping

Most records on animals, volunteers, students, and financial donors were kept in spreadsheet format on a local PC. Most information in the spreadsheets was easily accessible standard contact-type information. Animal records also contained informational data, as well as, health and maintenance history. Record updating varied by entry recorder. Program volunteers or those performing general activities also tracked their services on a paper activity log. Periodically this form was updated in the spreadsheet version kept on the local PC. The hard copy was also filed in a cabinet.

Information containing program registration and classes was noted in the horse and rider spreadsheet if registering for a riding class and also kept on the original form

students would complete to sign up for a class. This form along with the signed liability form was stored in a filing cabinet grouped by program session with all other class forms. If any informational data on the form had changed, it was noted and later updated in the appropriate spreadsheet. This updating was performed either by a staff or volunteer member and is important because mailing lists are generated only from these files.

The IT infrastructure that supports these processes is on a non-networked environment. Three out of the available seven PCs use Microsoft Windows 98 as the operating system and contain the Microsoft Office Professional Suite. Hardware specifications for these PCs are a Pentium II processor with 128 MB of memory and 4GB hard drive. The remaining four PCs use Microsoft Windows 95 as the operating system and contain the Microsoft Office Basic Suite. Hardware specifications are a Pentium I processor with 64MB memory and 600 MB hard drive.

Completion of the research and discovery phase resulted in identifying the business need and requirements at TUF for this project. Taking into consideration the project timeline and the current IT environment and resources, business requirements were identified. A centralized database system would be designed and developed that would operate under the current network environment and with existing PC hardware and software. This database would contain the following requirements:

- Provide input forms for volunteer, financial donation, and program participant information.
- Provide input form for animal medical history information and routine health maintenance.

- Provide input form for program class information and program participant registration.
- Creation of a program schedule calendar that will identify enrolled students and animals used for each open program.
- Develop a query that will identify specific demographic information that can be utilized in financial grant applications.
- Create a report to be used for mailing distributions targeting volunteers, recent financial donors, or former student program participants.

Phase one would also include implementation and training sessions for each staff member. Program support would also be provided, but for a limited time.

3.2. Life-cycle Models

The traditional waterfall and prototyping life cycle models were reviewed with TUF's executive sponsor for this project. The waterfall life cycle model was known by the sponsor and had been utilized effectively by the organization in the past. Although this model can lack project flexibility and be very time consuming, its ability to keep the project within scope and on course was seen as a positive feature. The sponsor also liked the clear progression between phases.

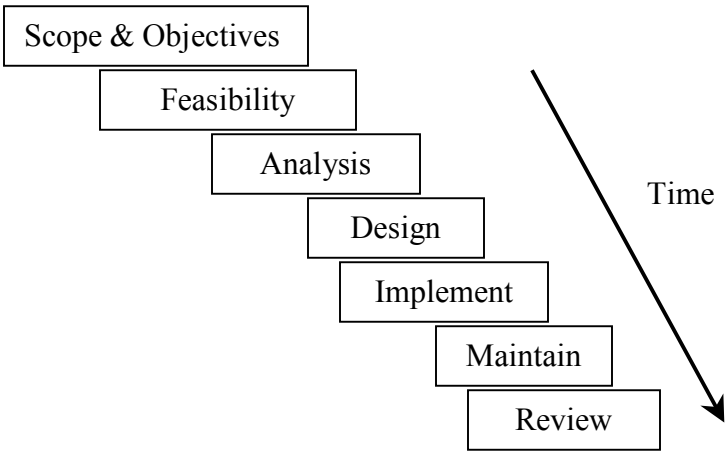


Figure 3.2 Traditional Waterfall Model

The prototyping model was the second life cycle model reviewed for the project. This model differed from the waterfall model in that the system was usually developed in smaller units and used multiple revisions of the analysis, design, code, and review process to create the database solutions model. This allowed more user participation in the development process and improved the overall development time of the project. The downside to this model was that is can be confusing to some users and seems never ending because improvements can be continuously made. This approach was also discussed with TUF sponsor as a model for the project. High levels of user participation in the development process and the ability to quickly see prototype models of the database were seen as positive features in this model.

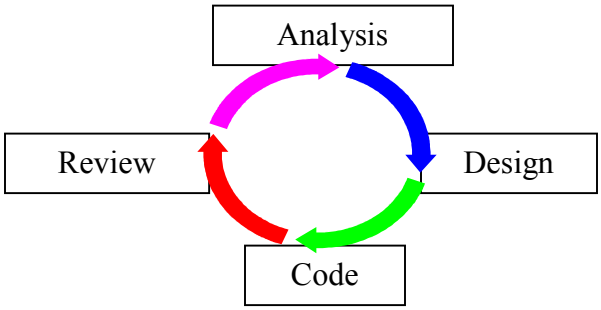


Figure 3.3 Prototyping Model

After reviewing both system development life cycle options for this project, the sponsor agreed that the recommendation of using a slightly modified version of the waterfall model was the best methodology. The waterfall model was adapted to handle the limitations and barriers of the project scope.

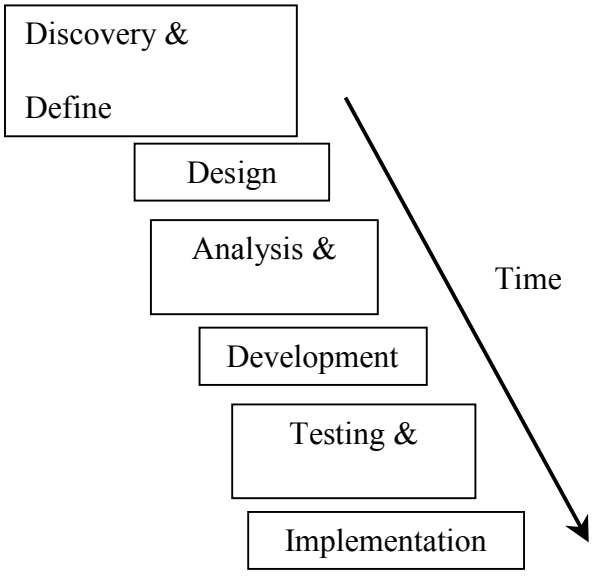


Figure 3.4 Modified Waterfall Model

The maintenance and review phases of the model were removed to allow focus to be placed on the analysis and approval and testing and approval phases. The sponsor felt that more effort could be gained in these areas and leveraged in future development of the database system, which was out of scope for this project. This life cycle model was also chosen over the prototyping model because of project time constraints and resources. Having access to database prototypes early in the project development would be beneficial, but this might actually delay the project, due to staff resources available to review the prototypes and provide beneficial feedback. Mapping of the project timeline identified that the database prototype would likely be available during the busy summer session at TUF, when few staff resources are available.

3.3. Specific Procedures

The current process map and modified waterfall system development life cycle were used to develop data models and diagrams for the new system.

3.3.1 Data Flow Diagrams

The context data flow diagram developed for the new database system identified four key external entities (Volunteers, Students, Financial Donors, and Animal Health Services) that contributed to the new database system. Each entity requested or provided specific information to the system. The information was then processed and a response or acknowledgement was provided. The level zero data flow diagram defined five key processes that the TUF database provided. These processes were: process animal

services, process volunteer, process financial donation, process student, and process schedule program.

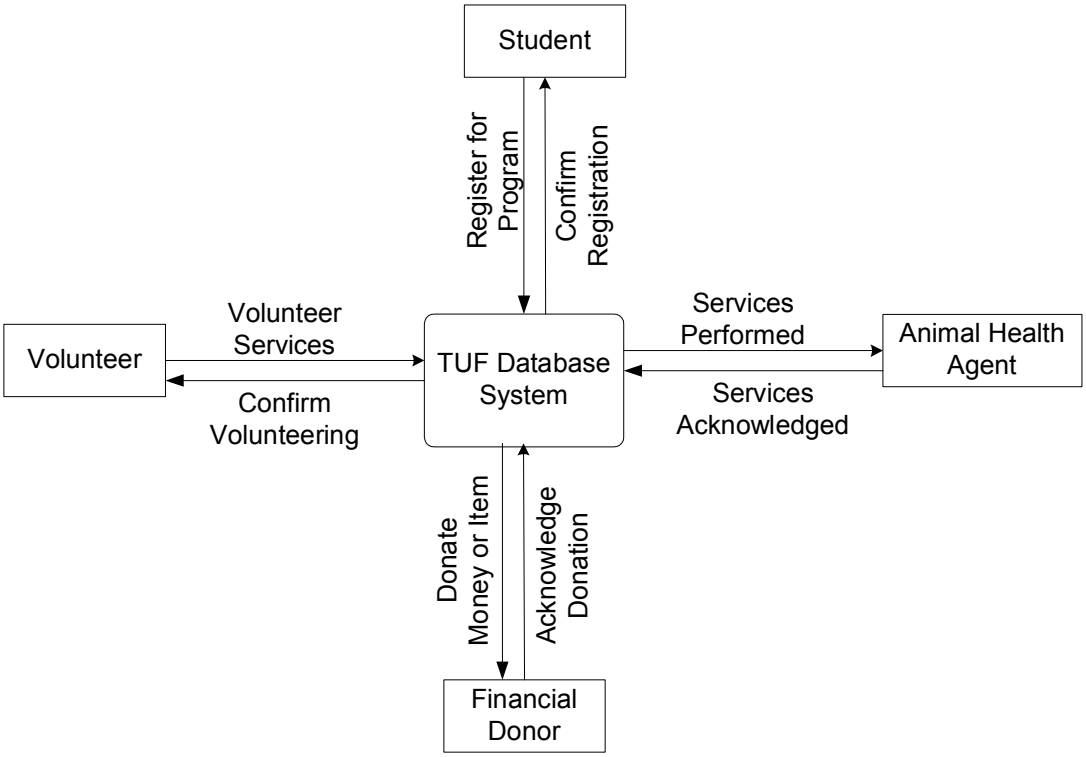


Figure 3.5 Context Data Flow Diagram

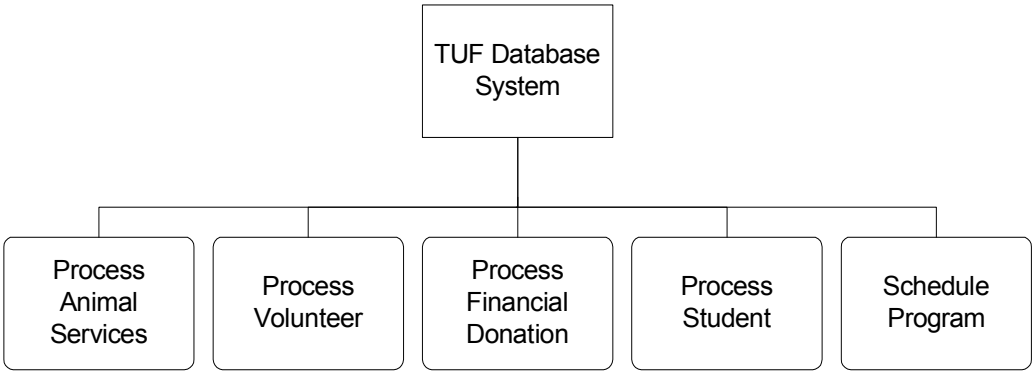


Figure 3.6 Data Flow Diagram Level Zero

Each process was further described in the level one data flow diagram. Animal care providers performed a service on one or more TUF animals and bill the organization. This service was processed and the routine medical care information for the animal was updated in the Animal History data store. Requests from new and existing volunteers were added and updated in the Contacts and Contact History data store. Financial donations were processed for new and existing financial donors. This information was then added or updated in the Contact and Contacts History data stores. Student registration to open programs were processed if an existing student and then added to the Schedule data store. If the student was new, the information would be added to the Contacts data store and then the student would be registered to the program and added to the Schedule data store. Employees request a new program by adding the program to the Program Names data store and then schedule it in the ProgramDate data store. Existing program requests could also be scheduled in the ProgramData data store.

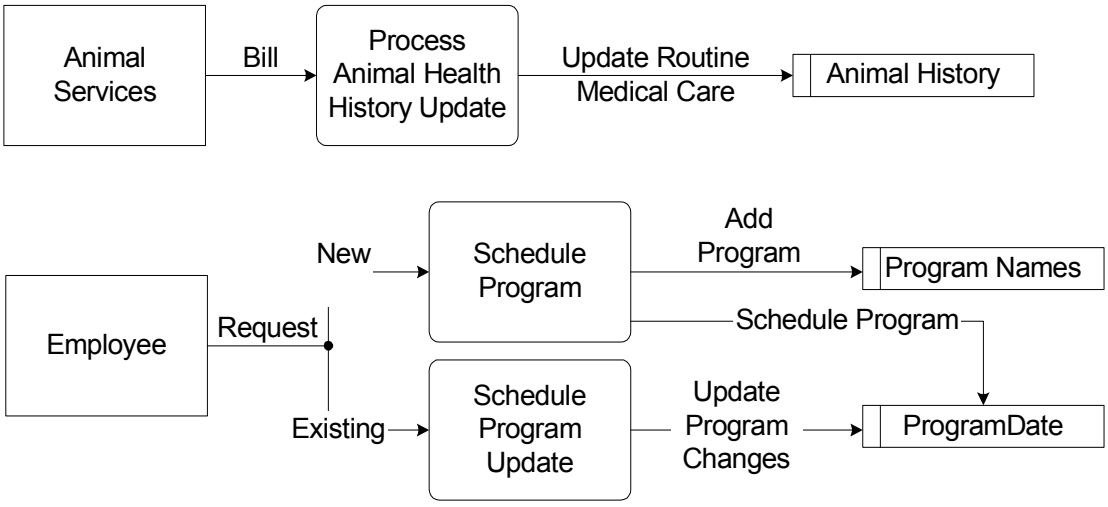


Figure 3.7 Data Flow Diagram Level

One

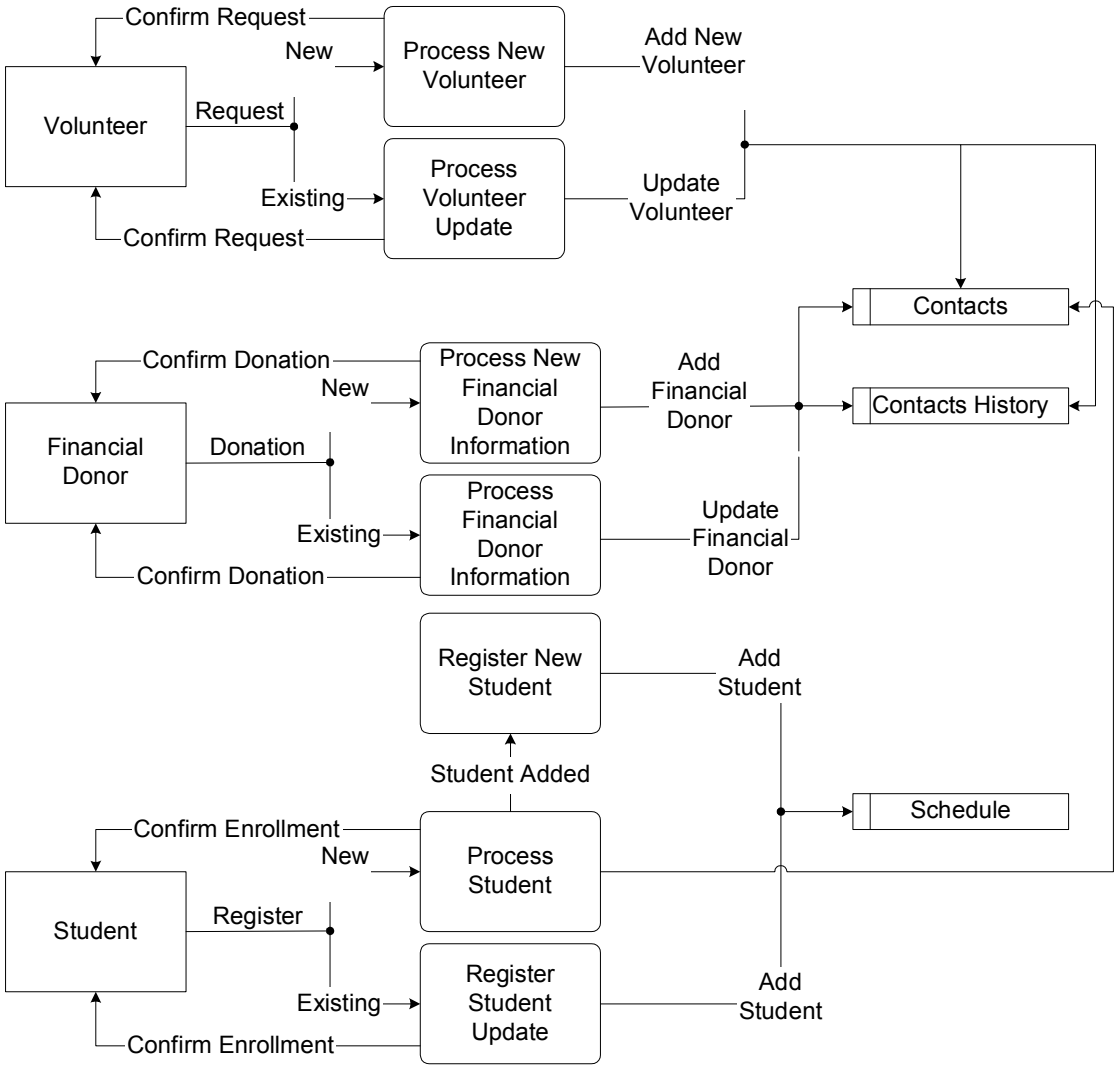


Figure 3.7 Data Flow Diagram Level One Continued

3.3.2 Entity Relationship Diagrams

The context entity relationship diagram for the new database system displayed an overall view of the key entities. The fully attributed entity relationship data model shows all relationships and attributes contributing to the database. This picturial view shows eight entities that were translated into tables and linked or joined via the apporiate relationship. Both ERDs were useful in contructing the new database system.

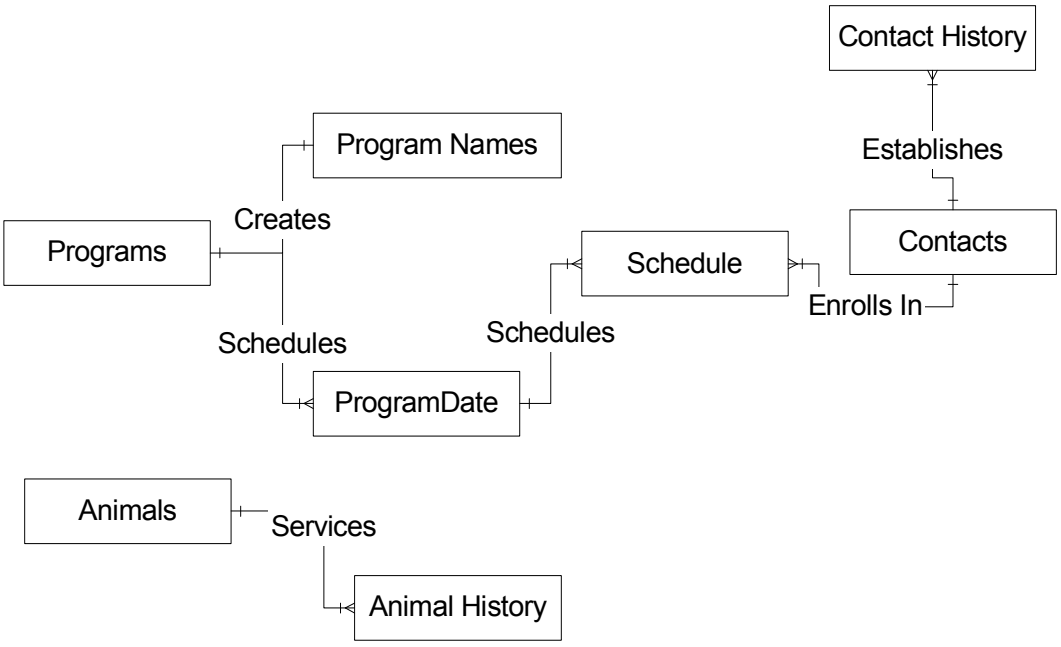
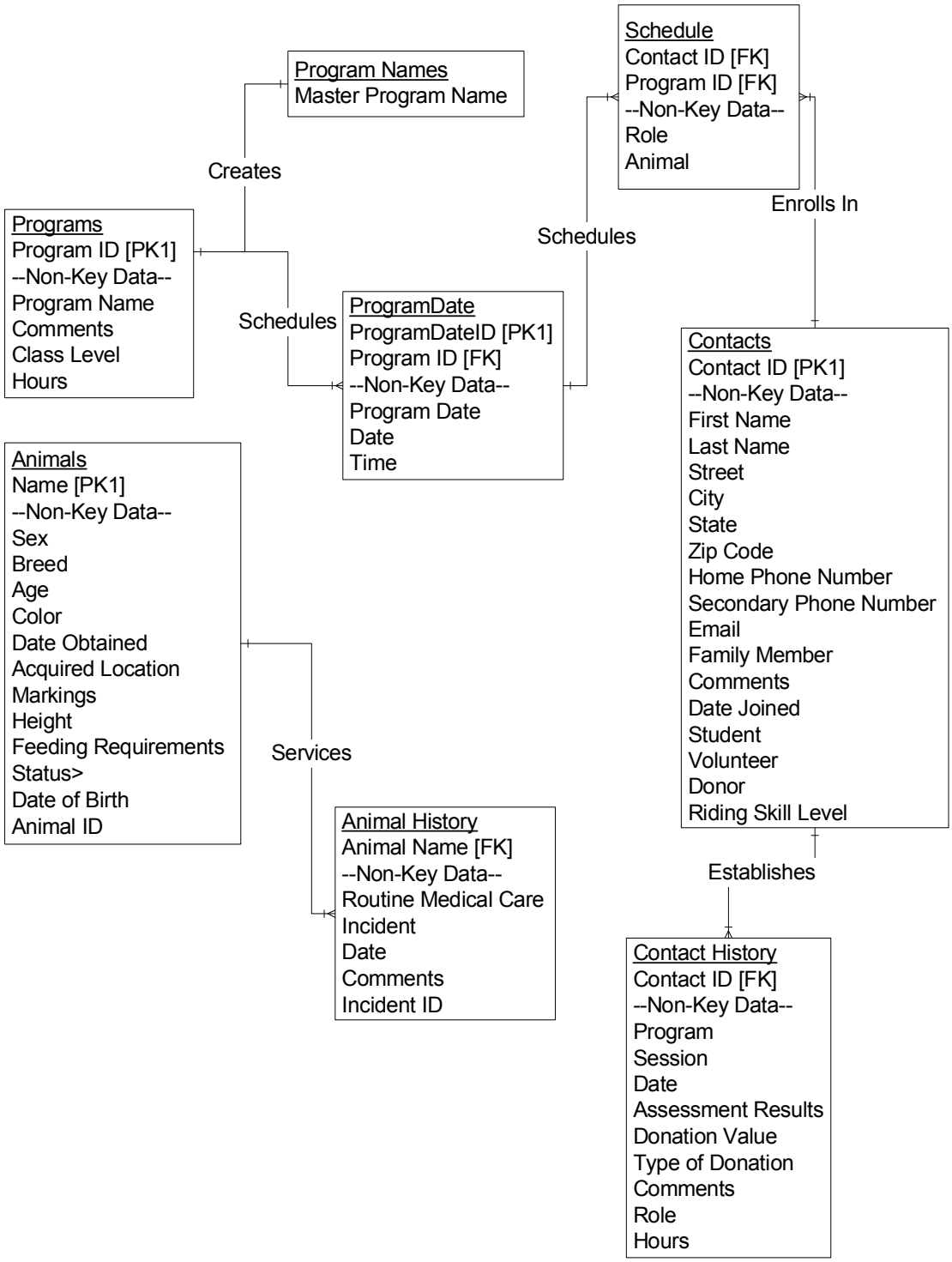


Figure 3.8 Context Entity Relationship Diagram


Program Names
Master Program Name
Creates
Programs
Program ID [PK1]
--Non-Key Data--
Program Name
Comments
Class Level
Hours
Schedules
ProgramDate
ProgramDateID [PK1]
Program ID [FK]
--Non-Key Data--
Program Date
Date
Time
Schedule
Contact ID [FK]
Program ID [FK]
--Non-Key Data--
Role
Animal
Schedules
Enrolls In
Contacts
Contact ID [PK1]
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Last Name
Street
City
State
Zip Code
Home Phone Number
Secondary Phone Number
Email
Family Member
Comments
Date Joined
Student
Volunteer
Donor
Riding Skill Level
Animals
Name [PK1]
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Sex
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Color
Date Obtained
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Markings
Height
Feeding Requirements
Status>
Date of Birth
Animal ID
Services
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--Non-Key Data--
Routine Medical Care
Incident
Date
Comments
Incident ID
Establishes
Contact History
Contact ID [FK]
--Non-Key Data--
Program
Session
Date
Assessment Results
Donation Value
Type of Donation
Comments
Role
Hours

Figure 3.9 Fully Attributed Entity Relationship Diagram

3.3.3 Prototype Database

A prototype version of the database was developed for the project during the develoment phase of the life cycle. This allowed the sponsor to quickly see the preliminary results of the identified business requirements. The prototype was reviewed for ease of navigational use, graphical appearance, and commitment to business requirements. Verbal and written feedback was provided. These comments were noted and modifications were made as apporiate and if within the scope of the project. Development of a prototype database impacted the project schedule, but was beneficial in providing necessary feedback that improved the end results of the database and project.

3.4. Deliverable Formats

Formats utilized for presenting project results and deliverables were:

- Email and presentation to executive staff
- Written reports and documents
- Database prototype via Microsoft Access
- Data modeling and process flow diagrams

3.5. Deliverables

The following project deliverables were presented to TUF executive staff at the end of the project:

- Initial requirements request
- Context data flow diagram
- Level zero and one data flow diagrams
- Context entity relationship diagram
- Fully attributed entity relationship diagram
- Project plan or schedule
- Resource schedule
- Feasibility analysis matrix
- Database prototype
- Approved finalized database

These deliverables served as documentation for the project and were utilized as reference aids for future database upgrades or modifications. General screen shots of each process task were also generated to act as a training guide for staff and volunteers. Formalized training documents were not in the scope of the project, but training assistance was provided to employees during implementation.

3.6. Resource Requirements

The new centralized database system had to work within TUF's current hardware and IT environment, as monies were not available for upgrades at this time. The current hardware in use at TUF was:

- Three PCs containing a Pentium II processor, 128 MB memory, and 4GB hard drive.

- Four PCs containing a Pentium I processor, 64MB memory, and 600 MB hard drive.
- Microsoft Windows 95/98
- Microsoft Office Professional & Basic Suites

TUF also provided three employee resources for input into the business requirement identification, current business process mapping, and feedback on prototype design. These employee resources were provided training on the use of the database and general recommendations on design modifications for future phases. The amount of time associated with training and training documentation was limited. Minimal time was allocated to database training in the project scope. Since all employees were familiar with Microsoft Access and some employees participated in the prototype design review, the executive sponsor felt minimal training would be required.

3.7. Project Outcome

The outcome of this project was a centralized database system for TUF. Besides the complete database, the project also had the following deliverables:

- Initial requirements request
- Context data flow diagram
- Level zero and one data flow diagrams
- Context entity relationship diagram
- Fully attributed entity relationship diagram
- Project plan or schedule

- Resource schedule
- Feasibility analysis matrix
- Database prototype

The successful implementation of the database was made possible by the full cooperation of TUF employees. They were easily accessible for questions and concerns relating to the PC setups and IT infrastructure questions. User training was also implemented with minimal problems due to the availability and commitment of the employees.

3.8. Summary

Multiple research methods were chosen for this project. Interview techniques, observation, and documenting current processes in practice were used to identify the project business requirements. The traditional waterfall and prototyping system development life cycle models were evaluated as development candidates. A modified waterfall model that included discovery and define requirements, design, analysis and approval, development, testing and approval, and implementation was recommended for use and approved by the project sponsor. This model approach worked well with the organization's practices and communication culture. The completed project resulted in an implemented database solution that allows TUF to register students for programs, maintain centralized electronic records and history on volunteers, students, financial donations, and animals. The outcome of this project improved volunteer and employee productivity, created efficiencies, and implemented an improved record history and retention program.

4. Project History

4.1. Project Beginning

Over the past five years, TUF felt the growing pains of a successful nonprofit organization. Participation in programs increased, more children and adults were providing volunteer services, and the variety of animal species and riding skill level of horses increased. Employees were beginning to complain about the current record keeping processes and its ability to handle multiple programs and scheduling capabilities. Volunteer service hours were not being documented accordingly and some horses were being used in consecutive programs because instructors were unaware of their use in classes conducted earlier that same day. The rapid growth of TUF made demographic information on participants difficult to track with the current system. This information was needed for grant applications and government funding. Financial opportunities were lost because the information could not be processed or formatted in a timely manner.

These multiple factors encouraged TUF executive staff to embrace a project that would assess the current state of the organization's business processes and recommend process improvements that would leverage existing Urban Farm business processes and IT solutions. The final solution would provide a comprehensive database solution that could overcome the current growing pains and provide business process efficiencies for employees and volunteers in their daily work activities. These improvements would allow the organization to better focus on their mission of connecting inner city children to

their natural environment by instilling a sense of respect, appreciation, and responsibility for the plants and animals around them.

4.2. Project Management

The majority of the project was managed via emails and telephone calls with the executive staff. Occasional on site visits occurred to conduct interviews with employees, to observe programs in session, and implement the database. Email and telephone communications were important in documenting current processes and in determining requirements for the project. The executive sponsor had previous project experience and was comfortable using this forum to manage the project. The project timeline was not impacted by this decision, but was affected by other external factors.

To avoid confusion and reduce project development delays, the executive sponsor was the main Urban Farm representative for the project. Since TUF is a small organization, most employees wear multiple hats to get the job done. This multi-role environment benefited the project such that the executive sponsor was very familiar with employee responsibilities and was able to provide key requirements needed for the new database system. Other employees assisted as needed on documenting current processes and providing feedback on the database prototype. This main point of contact allowed the project to stay on time, but the initial brainstorming of system functionality requirements could have been impacted because of limited resources and input.

The completion of project deliverables were communicated via email and presented in person when possible. The executive sponsor was asked to approve and sign

off on each phase of the project. Outputs of the seven project phases were: initial requirements request, detailed ERD and DFD diagrams, project timeline, resource schedule, feasibility analysis, database prototype, and final database product. The next phase did not began until approval of the agreed upon outputs of the previous phase were received. Relying on one contact for phase approvals was a minor issue when time availability and schedule coordination conflicts occurred.

4.3. Events & Milestones

Although the project was delayed and unable to meet the August 1, 2003 original go-live date, the new database system was implemented on June 9, 2005. This delay was caused by unforeseen external factors unrelated to the project. Fortunately the extended two and a half year delay allowed additional business requirements needed by TUF to be incorporated into the new database design, since the analysis phase of the project had not been completed. Here were the major milestones of the project.

Milestone	**Date**
Project Kick-Off Meeting	September, 02 2002
Interviews and Observations Complete	September 30, 2002
Current Processes Documented	October 10, 2002
Phase I - Discovery and Define Requirements Complete	October 18, 2002
Phase II – Design Complete	January 29, 2003
Feasibility Analysis Complete and Recommendation Approved	February 7, 2005

Phase III – Analysis and Approval	February 10, 2005
Phase IV – Development Complete	April 26, 2005
Preliminary Database Prototype Complete	May 1, 2005
Phase V – Testing and Approval Complete	June 8, 2005
Phase VI – Implementation	July 1, 2005
Project Go-Live	July 5, 2005
Project Close	August 15, 2005

4.4. Project Changes

A major impact to the project was the two and a half year delay in the schedule. The delay was the result of external factors and was not caused by the TUF. A temporary transfer assignment to Europe and a temporary leave of absence from my permanent employer caused the schedule delay. Upon my return, TUF was eager to complete the project and provided ample resources to expedite the revised schedule when possible.

Although the design phase of the project was completed in January of 2003, minimal changes occurred after the project started again in 2005. The original initial requirements request document was reviewed with the executive sponsor for validity and a second approval before the feasibility analysis was conducted. Minor modifications were made to the program calendar request to include more comprehensive features. Since a program calendar was included in the original request, these modifications were not viewed to be outside the scope of this project.

4.5. Project Evaluation

The goal of the project was to meet customer requirements identified in the initial requirements request document and project scope. These specific database requirements were identified as:

- Provide input forms for volunteer, financial donation, and program participant information.
- Provide input form for animal medical history information and routine health maintenance.
- Provide input form for program class information and program participant registration.
- Creation of a program schedule calendar that will identify enrolled students and animals used for each open program.
- Develop a query that will identify specific demographic information that can be utilized in financial grant applications.

Taking into account the known IT infrastructure and technology limiters, the developed centralized database system met these requirements. Various query templates were created to allow the user to retrieve specific fields using criteria pertaining to contact demographics, animal history, and program registrations. A program calendar was created to allow instructors to view registered students and assigned horses or animals. All animals, students, volunteers, and financial donor information and history are now kept in one central location and are easily accessible to employees upon demand.

Another objective of the project was to provide user-friendly accessible tools to employees and volunteers that would improve user efficiency and productivity. Simplified forms with LOVs and pre-defined fields were created to improve data entry accuracy, data entry performance, and data integrity. Total cost of the project was also kept within budget at $1,000.

4.6. Project Discussion

There were several factors that lead to a positive result for the project. Excellent use of communication skills through consistent use of emails, telephone calls, and formal presentations aided in the project's success. Each phase of the project was properly documented and necessary approvals were gained before moving on to the next phase. This uniformity helped the team to stay on target and reduce creep of the project scope. Overall project objectives were additionally met by coordinating the database implementation so that it did not conflict with the summer program registration. Open registration began in May and the new database was implemented in July. This delayed implementation allowed data from summer classes to be use for testing, but did not interfere with actual class registration. A summer implementation also provided an opportunity for volunteers to take advantage of the initial training since volunteer participation in higher in the summer months.

Although the project was viewed as a success, there were opportunities for improvement. A major change in the timeline did impact the project. This two and a half year gap caused the team to lose focus on the original objectives. The team was forced to

regroup and review all previous work that had been completed, such as the project scope, objectives, and preliminary design. This further delayed the schedule, but was necessary for the team to reassess the project goals. After the schedule was revised, it became clear that Urban Farm staff resources available to participate in the prototype testing were limited. This limiter was primarily due to the prototype being released during the start of the summer session. This was the busiest time of year for TUF with all employees preoccupied with teaching classes, organizing fundraisers, and grounds keeping activities. Only one and a half employee equivalents were available to test the prototype database and provide feedback. Concern for the lack of participation was noted with the executive sponsor, but no further action to resolve the issue was taken.

4.7. Project Variables

Three critical variables had a direct impact on the project. A sudden move of the project lead to Europe for over a year made communication difficult during the discovery and design phases. Standard emails continued as normal, but phone calls were limited due to the time zone difference. Opportunity for additional observations of current processes was also limited by the difference in geographic location. Since little existing documentation was available, effective communication via email was extremely important. Detailed explanation of the design became very tedious and time consuming. These complications had a direct impact on the project schedule and the team agreed to place the project on hold until the project lead returned from Europe. The final variable that affected the project was resource availability of TUF staff members. The revised

timeline had the prototype database review and database implementation scheduled in the summer. This was during TUF's busy summer program session, which made employee resource availability scarce. Few employees were able to view the prototype and provide valuable feedback. Also limited training was provided to all employees. Only two of the four full time employees received the full user training.

4.8. Results and Project Findings

The results of this project confirmed that the project scope and objectives were realized in the form of a centralized database system. Given the known IT infrastructure constraints and technology barriers, the implemented database was viewed as a success to the organization. An improvement in employee productivity was provided in the form of search tools for querying student records and class registrations. Increased performance for volunteer data entry accuracy and integrity also occurred.

4.9. Summary

The intent of this project was to allow TUF to focus more of their efforts on their mission of connecting inner city children to their natural environment by instilling a sense of respect, appreciation, and responsibility for the plants and animals around them. The development and implementation of a centralized database system allowed them to cope with the recent growing pains and extend their services offerings to more children. Specific business needs were identified and project requirements were created to fulfill the need. The end result of a centralized database system was delivered and evaluated against the original project goals and objectives.

5. Lessons Learned

5.1. Project Experience

Overall, the experiences gained from this project were positive. Insights and practical experience were gained in managing people from diverse professional backgrounds and cross-functional areas. Different organizational skills were utilized to effectively understand and describe business processes and technical requirements to the team. Documenting all discussions via email and meeting summaries proved to be a valuable method of communication. Since the team was located in different geographic regions, written and verbal communications had to be clearly understood, and effective. Any misalignment between team members would further delay the project or potentially cause scope creep.

Effective communication skills were further developed within the technical aspect of the project. Programming and development knowledge for Microsoft Access was increased for the project manager and end users. Comprehensive understanding of the new database tool also gave employees confidence in their technical abilities when problems arose and troubleshooting techniques were required. Microsoft Access knowledge varied greatly between users, which also created a training challenge. The ability to adapt training requirements during sessions was cumbersome until a knowledge baseline was established. This issue decreased as sessions progressed. Although no training was provided to volunteers, a basic user's guide with database screen shots was provided to assist employees who will later train volunteers on data entry. This solution

was a compromise of providing some training documentation to the volunteer users and not further extending the project timeline.

5.2. Things to Handle Differently

Initial expectations for the project were high and had an optimistic completion time of ten months. This timeline was further delayed two and a half years because of unforeseen external factors out of the control of the project team. Better time management would have completed the project on time or at least suggested a more realistic completion date. TUF was disappointed that we had to place the project on hold, but was satisfied with the end database result upon completion. Timely communication to TUF regarding the geographic transfer and its impact to the timeline might have reduced their frustrations. The official hold placed on the project was not formalized and communicated until one and a half months after the transfer was known. This issue also created tension within the team and caused communications lines to temporarily deteriorate.

The importance of full employee participation and involvement should have been given more attention during the prototype database review and implementation training. The organization did not gain the full potential of the system development life cycle by not requiring all employees to provide feedback on the prototype database or receive user training on the finalized solution. Most employees perform multi-functional positions and could have provided valuable insight on areas that might have been overlooked.

Volunteer participation in all phases of the project would have also provided insight into the project, since TUF relies heavily on community assistance.

5.3. Expectations

The expectation of this project was to meet all goals identified in the discovery and define requirements phase. These goals were stated in the project scope and expected to be complete by July 7, 2003, which was later revised to July 1, 2005. The goals as stated in Chapter One were:

5.3.1. Provide input forms for volunteer, financial donation, and program participant information

This goal was met. User-friendly input forms were created to allow volunteers to quickly add or modify contact information in the database. The main switchboard form provides access to all needed forms to complete this task.

5.3.2. Provide input form for animal medical history information and routine health maintenance

This goal was met. This form was very similar to the contact form, but contained information pertaining to animal medical history and routine health maintenance. This form was also located on the main switchboard for easy accessibility.

5.3.3. Provide input form for program class information and program participant registration

This goal was met. These forms allowed employees to add classes to the schedule and then add students and the appropriate animal if applicable to the class. Students and animals could also be removed from the class if needed. Like all previous form mentioned, these forms were located on the main switchboard form.

5.3.4. Creation of a program schedule calendar that would identify enrolled students and animals used for each open program

This goal was met. This feature allowed employees and instructors to review open classes for a specific date. The form displayed what students were enrolled in the course and if an animal had been assigned to the student or course. This feature was not available for the organization in their existing processes and was identified as a critical requirement for this project. This form was located on the main switchboard.

5.3.5. Develop a query that would identify specific demographic information that can be utilized in financial grant applications

This goal was met. A query template was developed that allowed employee's access to contact information and contact history. Specific attributes would be selected from the tables for viewing based on specific criteria set by the user. Flexibility was

created in the template to alter the returned fields and query criteria since the demographic requirements for each grant application varied. This template was also located in the query section under the objects section in Microsoft Access.

5.3.6. Create a report to be used for mailing distributions targeting volunteers, recent financial donors, or former student program participants

This goal was met. Another query template was created to allow employees or volunteers to access the mailing address for students, volunteers, and recent financial donors. The selection criteria can be modified to customize the query. This template was located under the query section in the objects section in Microsoft Access.

5.3.7. Utilize a user-friendly GUI environment that standardized data entry.

This goal was met. The decision to use Microsoft Access as the new database application provided a familiar software tool for employees and volunteers. Microsoft's GUI environment was a well-established brand and was at no cost since TUF already owned a license agreement.

5.4. Next Phase

Future phases of this project would include implementation of the following:

- Network the three newer computers to allow multiple users simultaneous access to the database.

- Add security features to the network to prevent unauthorized access.
- Transfer the database to a Web based application environment.
- Upgrade the remaining older model computers so they are network compatible and provide improved system performance.

5.5. Conclusions

The result of this project was a new database system that was able to replace the existing file based record keeping system. Existing IT infrastructure limited the network capability of the solution, but still met TUF's requirements identified in the project scope.

5.6. Summary

TUF had out grown their current paper based filing system and needed an electronic centralized database base system to help better serve the community. Current processes were noted, system requirements were identified, existing limitations were documented, and a new database was developed and implemented. Achievement of project goals was assessed against identified requirements listed in the project scope. Opportunities for improvements in project scheduling and communicating the importance of full employee participation were identified. Despite these lessons learned, the executive sponsor deemed the project a success.

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Appendix A
Initial Requirements Request

SUBMITTED BY: April Hoskins Date: 10/18/02

DEPARTMENT or OFFICE: The Urban Farm

TYPE OF REQUEST

1. **New System – no current database system** ←
2. Redesign current database system

PROBLEM STATEMENT or REQUEST DESCRIPTION

No current centralized database system exists at TUF to track volunteers, financial donations, student program registrations, and animal health records. All current records are kept in spreadsheet or paper copy format. The majority of TUF's computers are older models and the IT infrastructure is limited. Limited monies are available to be allocated to this project. A centralized database is needed that allows employees and volunteers to register students for programs, maintain records on volunteer, students, and financial donations, and tracks routine healthcare history of TUF resident animals.

ACTION

Project Approved ←

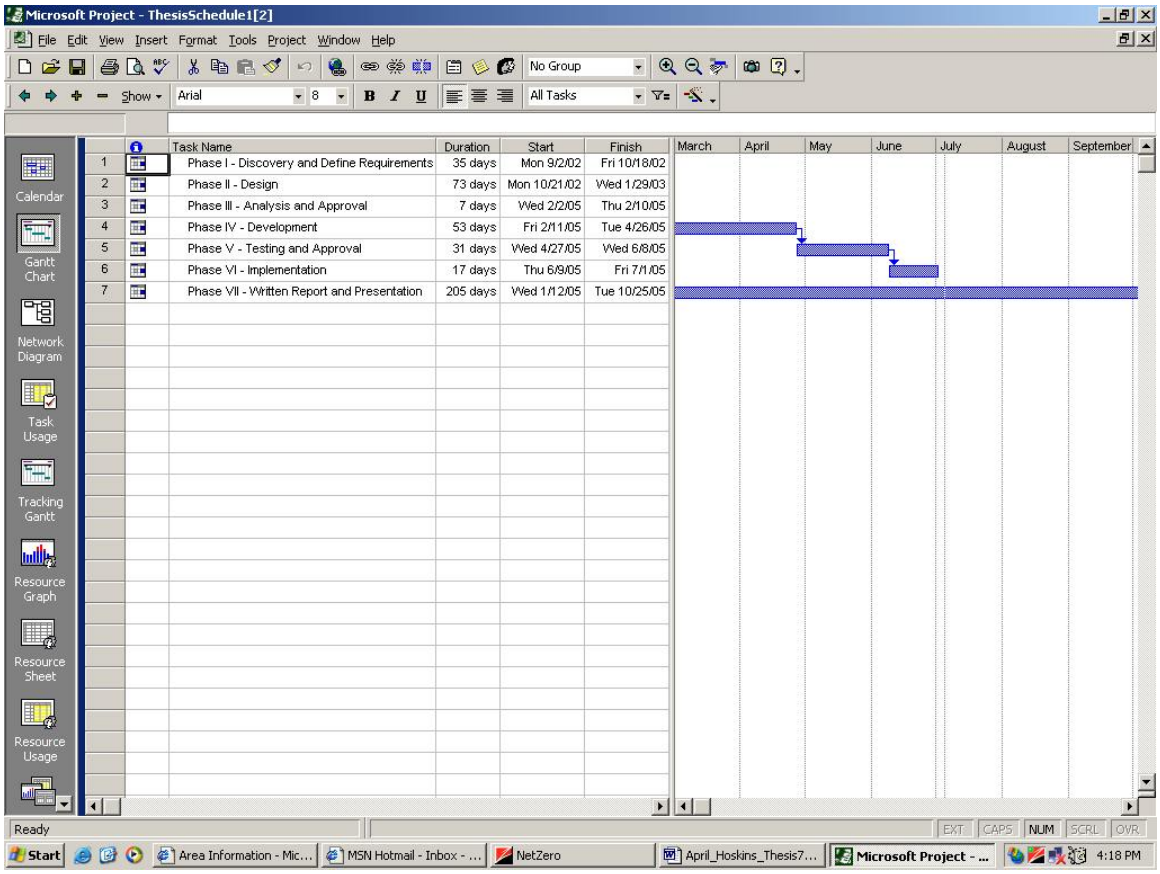
Project Approved with suggestions

Project Rejected

Decision Pending

AUTHORIZER: Executive Director DATE: 10/18/02

Appendix B
Project Task Plan



Appendix C
Software Candidate Systems Matrix

Characteristics	**Microsoft Access 2000**	**MySQL**
Portion of System Computerized	COTS package currently owned by TUF that would be used to created a custom centralized database.	COTS software package available for purchase that would be customized to meet the database requirements of TUF.
Benefits	This solution can be implemented quickly at minimal cost. Training would be reduced because employees are familiar with the software.	This solution can also be implemented quickly, but the software will need to be purchased. Training will be more extensive since employees are not familiar with package.
Servers and Workstations	Package can run off a Pentium II PC.	For maximum performance a server should be utilized.
Software Tools Needed	Customization of the MS Access package.	Customization of the MySQL package.
Application Software	Package Solution	Package Solution

Method of Data Processing	Local PC	Client/Server
Output Devices and Implications	Printer capability; no special out device required.	Printer capability; no special out device required.
Input Devices and Implications	Keyboard & mouse.	Keyboard & mouse.
Storage Devices and Implications	MS Access on local PC with 4GB storage capacity.	MySQL on server with at least 40 GB storage capacity.

Appendix D
Software Feasibility Analysis Matrix

Feasibility Criteria	Wt.	Microsoft Access 2000	MySQL
Operational Feasibility **Functionality:** To what degree the candidate would benefit the business and how well the system would work. **Political:** How well received this solution would be from user management, user, and business perspective.	20%	• Increases employee efficiency and productivity. • Provides data analysis and query capabilities. • Automated process • Most employees and staff are familiar with this COTS package. • Training time would be reduced. **Score: 90**	• Increased employee efficiency and productivity. • Also provides data analysis and query capabilities. • Automated process • Requires more staff training on tool use and supportability. • Employees and volunteers are not as familiar with this solution and might be apprehensive to learn. • Supportability costs are higher. **Score: 80**
Technical Feasibility **Technology:** Assessment of maturity, availability, and desirability of the computer technology needed to support. **Expertise:** Assessment of technical expertise needed to develop, operate, and maintain the system.	15%	• COTS package that is already owned by TUF. • Common database solution used for small organizations. • Multiple support tools and media forums available. • User currently proficient in application. **Score: 90**	• COTS package that will require some customization. • Open-sourced technology that is mature. • Use becoming more common. • User not proficient in the application. • Multiple support tools and media forums available. • Extended training would be required to operate and maintain the package. **Score: 70**
Economic	40%		

Feasibility **Cost to Develop:** **Payback period:** **Net Present Value:**		• Approximately $ 0; TUF owns license agreement • Approximately $ 0 • Approximately $ 0 **Score: 95**	• Approximately $2,800 • Approximately 6 months • Approximately $2,800 **Score: 65**
Schedule Feasibility Assessment of how long the solution will take to design and implement.	25%	• Approximately six months **Score: 100**	• Approximately six months **Score: 100**
Ranking	100%	**94.5%**	**77.5%**