

LyfeStock Project Report



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I Project Description

1 Project Overview

LyfeStock is an application that provides users with real-time data surrounding the health of their animals, handing the ownership of the animal and location to provide a full service that ensures the overall well-being of wildlife. Microchips implanted into animals are currently exclusively used for identification purposes, and with modifications to these microchips, biometrics about the animal can be collected and processed to provide useful metrics to the owner.

2 The Purpose of the Project

This project is being done for the convenience of commercial and non-commercial livestock farmers. The utilization of the application will provide farmers with the means to better keep track of the overall health of their animals while being able to detect fluctuations in their health in real-time before they could potentially spread to the entire herd. The target audience would be interested in maintaining a healthy stock of animals to maximize their profits in their respective meat and dairy markets.

2a The User Business or Background of the Project Effort

The businesses that would benefit from this application are any of the major meat-producing or dairy-producing companies such as Tyson Foods Inc, Hormel Foods Corp or Dairy Farmers of America Inc., though smaller scale farms would benefit as well and the technology could even be adapted to include household pets or any individuals that hold the health of their animals in high regard.

2b Goals of the Project

We want to provide an accessible platform to customers so that they can easily monitor and track the health of their livestock and improve the quality of their animal products that head to the market, be it meat, dairy, poultry, etc. Finally, monitor the spread of infectious diseases among animals up-to-date to maximize the well-being of animals and decrease the chances of any diseases spreading to humans.

2c Measurement

Goals will be measured using 4 main metrics. Comparisons will be made before and after some time using the program. First, the percentage of livestock deaths will be a key metric in testing the effectiveness of the program, as a decrease in this will be a telltale sign that it works as intended. Additionally, the speed of disease detection will need to be considered, as alerts will be going out quickly on any decrease in livestock health. The quality of meat and dairy products should improve, so partnering with 3rd party companies may be necessary to find any improvements on that end. Finally, surveys will be conducted and sent out to all end users to see whether the program works as intended if they notice any surface-level improvements, and their overall thoughts.

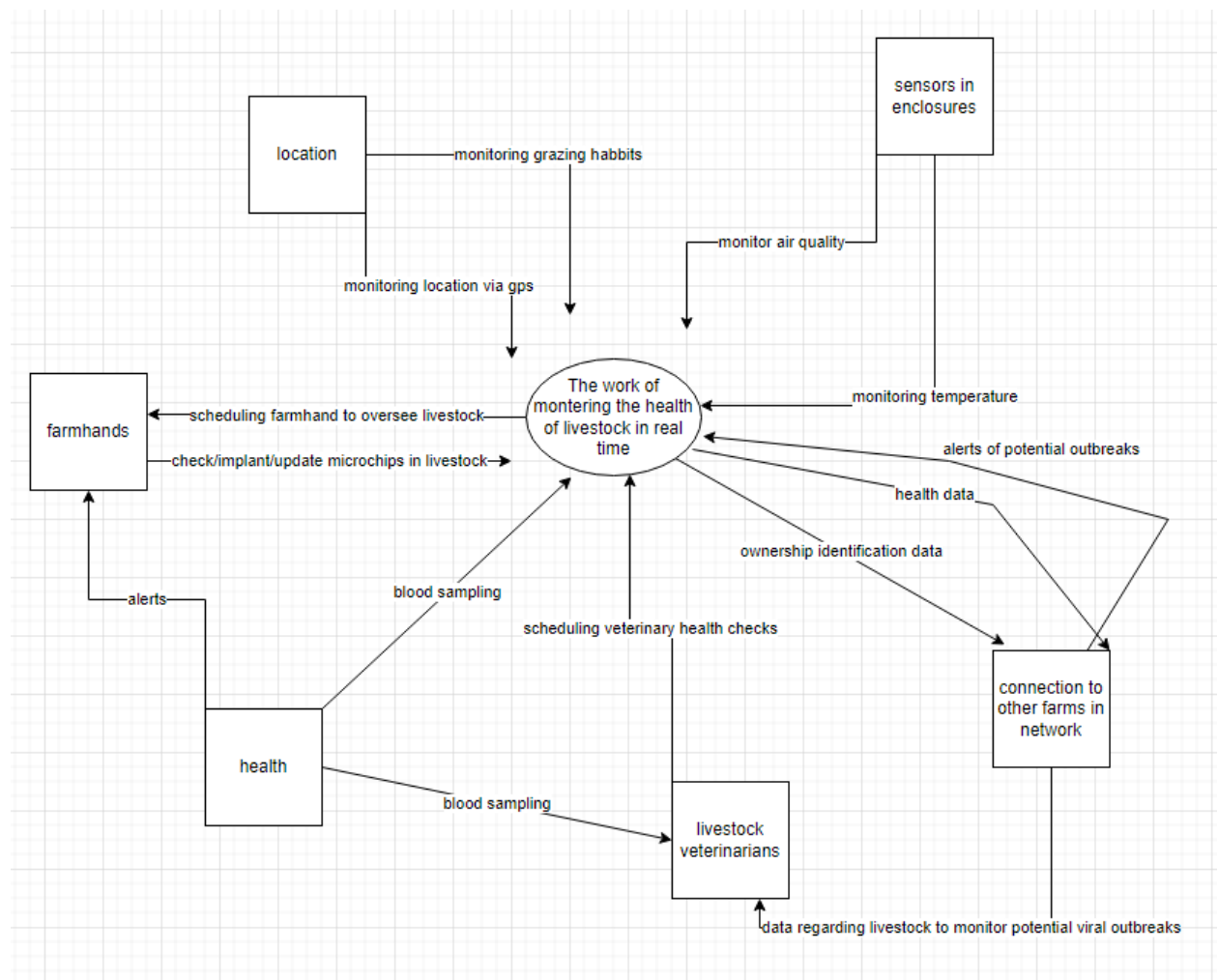
3 The Scope of the Work

The work here is strictly designed for the health of animals. The project would not recommend any possible avenues of treatment for each animal or attempt to branch into applications suited for humans.

3a The Current Situation

Currently, microchips placed into animals are used solely for identification purposes. While these chips are useful for farmers for that purpose, we perceive the technology to be outdated and improvable. Our system aims to provide more use to farmers by helping to improve the health of all livestock that are implanted with microchips by collecting biometrics about each animal.

3b The Context of the Work



3c Work Partitioning

Event Name	Input Summary	Output Summary
User wants to check health status of livestock	Application receives biometric readings from livestock (in)	Biometric data displayed on application
Livestock health declines	Application receives biometric data from livestock (in) Yellow alert generated(out)	Alert is generated and application notifies user
Environment alert	Application receives environment data from enclosure sensors (in) Environment alert(out)	Alert is generated and application notifies users
Farmhand chips new livestock	New livestock readings (in)	Records biometric data from new livestock and adds livestock to appropriate herd
Veterinary Tech receives at risk biometric reading	Vet Tech reads biometric reading (in) Alert generated(out)	Vet Tech generates alert and pushes it to application
Chip malfunction in biometric reading	Application receives partial or inconclusive reading (in)	Application displays “Orange” Alert and notifies user that manual check required
Treatment on livestock administered	Treatment administered (in)	Update information chart on livestock
Software in chips needs update	Software update(out)	Farmhands scan outdated chips for software update
Evidence of viral outbreak at neighboring farms	Viral outbreak alert(out) Emergency biometric readings (in)	Veterinary tech receives evidence of viral outbreak occurring at nearby farms. Sends alert to application which begins a series of new biometric readings to track spread.
Livestock wanders out of location tracking	Last known location(in) Alert generated with last known location(out)	Chipped livestock wandered out of range of location services. The

		user is alerted and the last known location is forwarded to the user.
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3d Competing Products

Microchip ID Systems 840-ID Mini Microchip → A microchip that is marketed for farm and zoological uses in large animals for identification purposes, and only contains a unique RFID identifier, not any sensors or even a GPS.

<https://www.microchipidsystems.com/product/usda-840-official-microchip/>

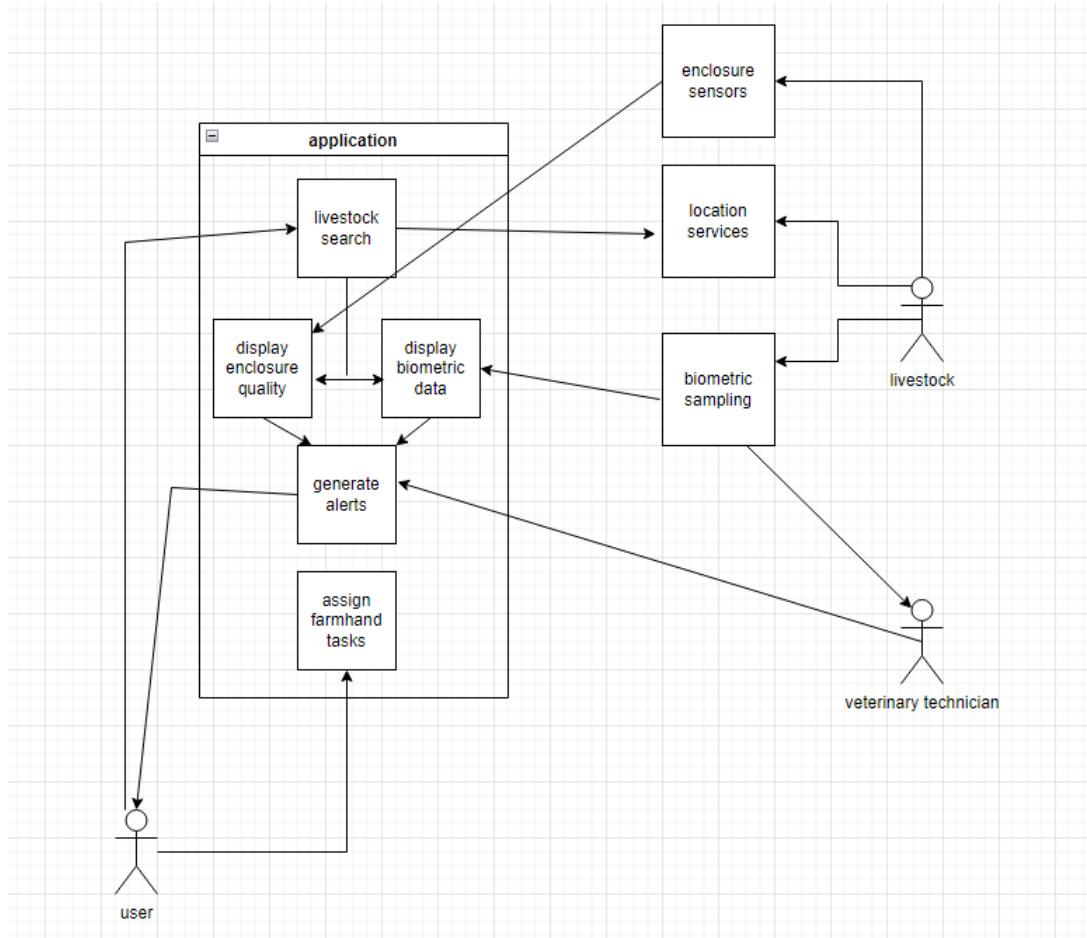
Destron Bio-Thermo Microchip → A microchip that is marketed for farm and show uses in large animals for identification and thermometric uses, containing an RFID identifier and thermometer.

<https://www.lightlivestockequipment.com/product-category/microchips-readers/microchips/>

4 The Scope of the Product

The scope of the product revolves around the collection of biometric information, the calculations made to detect any abnormalities in livestock health, an alert system to notify the user of these abnormalities, and the ability to send flagged data points to expert researchers. This would not include any recommendations on how to solve these problems, as they could be caused by a multitude of factors.

4a Scenario Diagram(s)



4b Product Scenario List

Scenario Name	Involved Actors
001 - Preventative Health Check	LyfeStock user (farmer)
002 - Critical Health Check	LyfeStock user (farmer)
003 - Microchip Sensor Malfunction	LyfeStock user (farmer), LyfeStock technician

4c Individual Product Scenarios

- Scenario 001 - Preventative Health Check

Dale is a Wisconsin dairy farmer who is a client of our product. The past few weeks, he has been noticing a decline in milk production and checks our app to see if the health of his cows could be the reason behind the issue. On the livestock status menu, he sees several yellow alerts which indicate biometric anomalies in some of his cows. Clicking on the alert, he notices that the symptoms presented indicate some sort of infection, and after a physical inspection of the cows in question, determines that his cows show the early effects of udder infection. As udder infection is a very costly ailment for dairy farms, he immediately gets his cows on a series of antibiotics prescribed by a veterinarian in our system, preventing any further illness to his livestock and damage to his profits.

- Scenario 002 - Critical Health Check

Jim is a South Dakota pork farmer who is a client of our product. Before doing his morning rounds, Jim checks the livestock status menu on our app to determine which pigs aren't fat enough to be slaughtered and thereby should be fed more. Opening the menu, Jim sees a red indicator on the status page of one of his pigs. Opening the pig's status menu, the symptoms of high temperature, blood loss, and rapid reduction of fat and cholesterol levels in the blood indicate that the pig has contracted African swine fever, a deadly, hard-to-detect, highly infectious virus that affects pigs and hogs. Realizing the severity of the issue, Jim has the specific pig quarantined and all nearby pigs also checked for any symptoms, referencing the app to do so.

- Scenario 003 - Microchip Sensor Malfunction

Martha is a Texas horse rancher who is a client of our product. One day, she pulls up the app to check on the status of a mare recovering from pregnancy, only to find an orange status indicator on the horse's status page. Clicking on the alert, there are traces of conflicting hormonal chemicals detected, prompting the orange status. Martha runs a diagnostic on the horse to see if the issue could be with the recent pregnancy but determines that it is a fault with a sensor in the microchip. She contacts our support team and a technician arrives within the week to deactivate the horse's current microchip and replace it.

5 Stakeholders

5a The Client

The desired client would be a large agriculture-related or agriculture-adjacent company that deals with microchip-related technology, rather than other fields of agricultural science such as GMO (genetically modified organism) crops, pesticides, and farm equipment. An example would be an animal healthcare company like Elanco.

5b The Customer

The baseline primary customer of this product will be farmers with large farms (>100 livestock). Considering the expected steep cost to microchip the animals and purchase them, it is expected that big farms will be the only customer that can handle it.

Other primary customers would include incorporated farms (networks of farms owned by or otherwise associated with large animals product corporations such as Perdue or Tyson), which maintain large livestock counts to meet commercial needs. Furthermore, these farms make enough money to deal with the high turnover rates for meat farming.

Secondary customers would-be farmers with small-to-medium farms (~100 or <100 livestock), as while useful, the cost-to-value ratio for such farms would be skewed toward costs due to natural livestock turnover rates and the initial cost of purchasing and installing our microchips. The target farmers in this demographic would be subsistence farmers (i.e. dairy, wool) rather than meat farmers, as the microchip cost of the high livestock turnover rate of meat farming would be too high for smaller farms to handle.

5c Hands-On Users of the Product

The primary hands-on users of the application would be the farmers whose livestock have been implanted with our microchips. As farmers tend to be in older, more tech-hesitant demographics who are unwilling and unfamiliar with handling applications of a similar caliber, care will have to be taken when designing systems such as the user interface and data encryption to ensure proper functionality, as a majority of the activity on the application will come from how the hands-on users interact with it.

5d Maintenance Users and Service Technicians

Regular monitoring for potential maintenance (indicated by our Orange alerts) will have to be in place as the physical devices are in a hostile environment - the interior of large livestock. This means that a regionalized maintenance team should be on hand for service up to reinstallation, although the logistics of rapid response in a rural setting will not be the easiest thing to set up.

5e Other Stakeholders

Veterinarians, particularly livestock veterinarians, may be affected by LyfeStock as the application could subvert the necessity for their regularly scheduled visits and testing on livestock at various farms, significantly affecting their source of revenue. Veterinarians may also feel as though the testing and biometric readings that LyfeStock performs may not be extensive enough to ensure the overall health of the animal. Our solution is to include veterinarians in the overall LyfeStock application design and implementation and forward all biometric readings to local veterinarians so they can perform their own medical diagnostics on the data that they receive.

5f User Participation

End users may be contacted to assist with testing early versions of the application. As ease-of-use is important, it must be ensured that the final product is one that the targeted demographic would actually be willing to use. Discussion must be had to create a product that will fit the requirements set by the end user.

5g Priorities Assigned to Users

The key users are those that are fit and looking to maintain a diet with exact macros and also those who are trying to lose weight through a diet. These are the two groups that have the most to gain by consistent use and the features should be prioritizing them. Secondary users would be those who use the app on a semi-consistent basis and are generally into fitness but not fully committed. These users are the most likely to grow into the key user group as time goes on so their needs should also be considered so the biggest part of the user base is cared for. The unimportant users are the ones that use the app for new food recommendations, the app could certainly be used in this way but it is not the intended use, therefore if users are unhappy with the focus on fitness and not just focusing on new meals from restaurants their concerns don't have much weight to the team.

1. Large personally owned farms and corporate farms (>100 animals)
2. Regional farmers with small farms (<= 100 animals)
3. Veterinarians
4. Governmental organizations related to health and animals (USDA)
5. Scientists and researchers

6 Mandated Constraints

6a Solution Constraints

Description:

Protect user privacy

Rationale:

Any issue of privacy or security breach would put the companies that are involved in sensitive positions and threaten their business.

Fit criterion:

Data needs to be encrypted and protected at all stages in which the application handles it.

Description:

The final product must provide accurate biometric information on every tagged animal.

Rationale:

The user is concerned with the health status of their animals in real-time, in case of any issues related to the accuracy, the animals' well-being might be in danger.

Fit criterion:

The app must be able to sample biometric data, package it and send it to labs for analysis. The microchips must be monitored for any hardware failure that could affect the data.

Description:

The final product must be able to alert users of potential issues regarding livestock quickly.

Rationale:

This must be done so users can alert farmhands to resolve potential issues that may arise.

Fit criterion:

The application must have an 80% up time and alerts must be generated efficiently to detect issues in real-time.

Description:

Application must be modularized (can mix and match data collection & visualization)

Rationale:

End user may not have enough of a budget or reason to make use of all data that is collected. The user must be able to pick and choose what data will be collected, and the application must be able to present these different choices with no noticeable slowdown on their version of the product.

Fit criterion:

All classes used for data collection are separate modules. The application must be able to incorporate any combination of classes created by the developer.

6b Implementation Environment of the Current System

The environment that the application will operate in is expected to be rugged. Due to this, communication between the microchips and the data pool will need to be focused on heavily, as it may prove to be difficult to create a working solution that ensures little to no connection issues.

6c Partner or Collaborative Applications

The product must be able to write to a Microsoft Excel data file. This would provide a good format for veterinarians or scientists to parse through data about a list of animals quickly.

6d Off-the-Shelf Software

Content

Pre-existing software that needs to be included in the final product includes a cloud database to store all biometric information collected by the microchips. This cloud database also includes the physical servers that house all of the information.

Motivation

The data must be stored in a cloud, with privacy measures to ensure data cannot be leaked. Since this information can be considered sensitive due to it providing insight into a farm's inner workings, data must be encrypted and must be protected to an extent.

Examples

Already existing services include Google's Firebase and Amazon's Aurora. Both provide a location for data to exist and include strong safety measures to prevent data leakage.

Considerations

There is no visible consideration for the over-the-shelf software that will be used since all the products that will be used will give the clients the ability to use it legally if the clients paid the expenses and it gave them the ability to use it according to the needs of LyfeStock technology without any issues.

6e Anticipated Workplace Environment

Content

The program should be one that farmers will want to use on a day-to-day basis. For this, the user interface needs to be easy for farmers to learn and use. Additionally, considering the background of most farmers, accessibility features must be included in the base product to provide support to those with disabilities.

Motivation

The end user demographic is one that tends to be against the use of technology. With this in mind, we want to make sure that the application is one that the farmers will actually want to use on a day-to-day basis and to help this, we want to make the program as user-friendly as possible.

Examples

of Accessibility features on most mobile devices would be a great example of what should be targeted. Features such as larger font sizes, text-to-speech, and voice recognition would be welcome additions to the program.

Considerations

The technology of the software will allow users to use it in any workplace that has internet access. In the case of the lack of internet access, we will utilize satellite internet(working also with the internet satellite company to support our LyfeStock technology on the internet) with the note that it will be a little costly, in that case, we will work with the government to provide grants and subsites that will allow farmers to obtain such technology, or in case there are so many farms, we will request internet access to such areas by working with the Federal/local government.

6f Schedule Constraints

There aren't any hard deadlines attached to this project. If anything, deadlines should be set such that the release of the application is timed before the typical livestock purchasing season, as livestock would be chipped around the purchase time, however there is no general time for when this occurs. Due to this, there isn't a time that would be considered more beneficial, and deadlines are not of a real concern.

6g Budget Constraints

There is a large financial barrier to entry to chip animals. Since this is the case, the budget will be strict, as the application must remain marketable to a large number of farms. Additionally, resources used to store information on biometrics will need to be kept to a minimum, as the cost to store data may end up being the most expensive portion of this project.

For reference, the average RFID microchip for a domestic pet costs about \$50 for the consumer (including service fees for actually injecting the chip). Current RFID-only microchips for livestock come in around the same cost, with injections being performed by the purchaser. However, even the small \$50 cost per chip can stack up when there are dozens or hundreds of livestock to chip.

7 Naming Conventions and Definitions

7a Definitions of Key Terms

Health: The well-being of animals that indicates the lack of any illness or anomalous biometric readings that need intervention. The use of adjectives indicates the current state of health such as healthy (the above conditions are well-met) or not healthy (the conditions are not met and need intervention) and it is being used in the common language among people.

Alert: A mobile or system notification that informs the user of the condition of livestock, especially if any readings are critical or questionable.

Turnover rate: The rate at which livestock die or otherwise leave the farm system.

Report: A detailed description of a particular livestock animal's biometrics. Also, it provides a general report of the whole livestock at a given location (farm) or multiple locations.

Environment: The current state of the farm specifies → only means what happens on the farm/farms.

7b UML and Other Notation Used in This Document

This document generally follows the Version 2.0 OMG UML standard, as described in, M. Fowler, UML Distilled, Third Edition, Boston: Pearson Education, 2004. Exceptions are noted in their specific cases.

Object-Oriented Software Engineering Using UML, Patterns, and Java™ Third Edition.

7c Data Dictionary for Any Included Models

Report = 1 or more biometric readings

BiometricReading = 1 reading related to 1 specific health area of animal

1- Individual Alerts:

- **Green (safe)** → biometrics within acceptable parameters, no immediate action required
- **Yellow (decline)** → biometrics indicate potential health issues, preventative actions/inspection recommended
- **Red (danger)** → biometrics indicate the animal is in critical condition, intervention required.
- **Orange (malfunction)** → one or more readings inconclusive or contradictory, manual inspection required.

2- Farm-Wide Alerts:

- uses the same colored system as the individual alerts (above) above with a text indicator that is a wide-alert.
- **Purple (Environment Alert)** → indication one or more specific holding pens/enclosures has reached dangerous levels (pertaining to temperature, air quality, etc.)
- **Black (Viral Outbreak alert)** → indication that veterinary technician has received evidence of potential viral outbreak.

8 Relevant Facts and Assumptions

8a Facts

- There are roughly 100 million cattle, 120 million hogs, 8 million sheep and goats, 4 million horses in the United States. Even if less than half of these animals are microchipped, that is still dozens of millions of data points.
- Roughly 35-40% of current livestock on farms are microchipped.

- The cost of microchip purchase and the implant is currently around \$50, with prices going down as chips are purchased in bulk.
- The estimated annual turnover rate for large livestock is that 1 out of every 3 animals presents on a farm at the start of a year will be killed either for meat/other products or die of natural causes. This is high compared to the 1 out of 6 turnover rate of domestic pets who are microchipped more regularly.

8b Assumptions

- Assuming all developers will be able to code in all mobile environments
- Assuming consumer diet won't change drastically
- Assuming consumers care about the quality of their food
- Assuming microchipping animals remains a legal practice
- Assuming cost to end user won't outweigh the benefit of product

II Requirements

SV: Sections 9 and 10 deal with functional requirements. Sections 11 to 20 are a very thorough list of possible non-functional requirements, not all of which apply to every project. You should think carefully about each of these, form requirements if applicable, or write "Not Applicable" otherwise. See section 10 for the format of individual requirements. Section 21 documents the acceptance tests planned to verify the requirements – See that section for further details, and be aware that every requirement needs at least one verifying acceptance test (though some tests may verify more than one requirement.)

1 Product Use Cases

SV: Product Use Cases are very similar to Product Scenarios, but in more formal detail. They serve as a first step towards developing functional requirements, and can aid in organizing requirements according to the use case(s) from which they were developed. See the CS 440 web site for a sample use-case form, with instructions.

1a Use Case Diagrams

SV: Use case diagrams list the use cases developed for a system, mark the boundary of what is internal or external to the system to be developed, and indicate which external entities (actors) are associated with each use case.

Examples

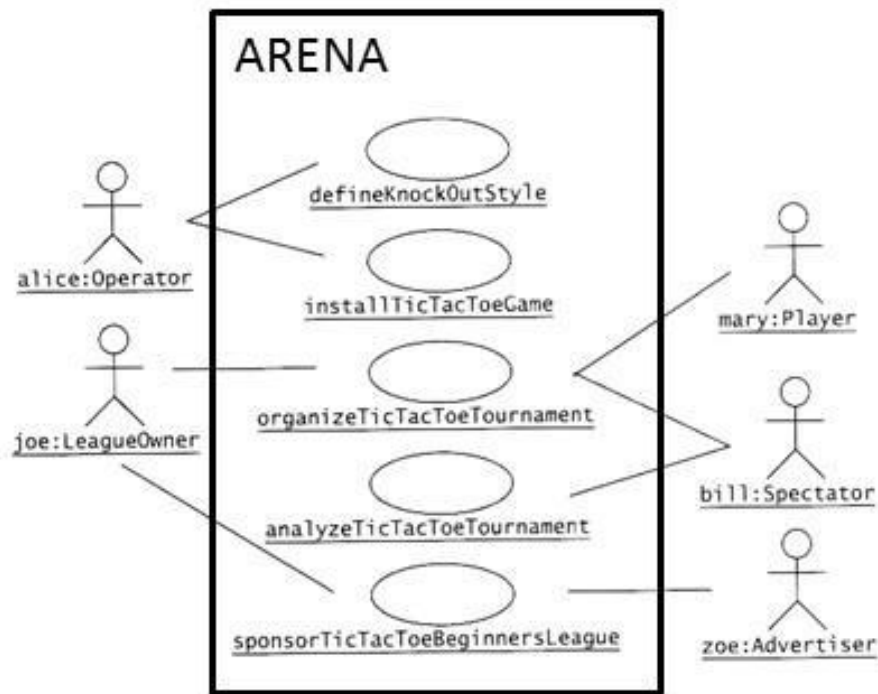


Figure 1 - Sample Use Case Diagram from Bruegge & DuToit (modified)

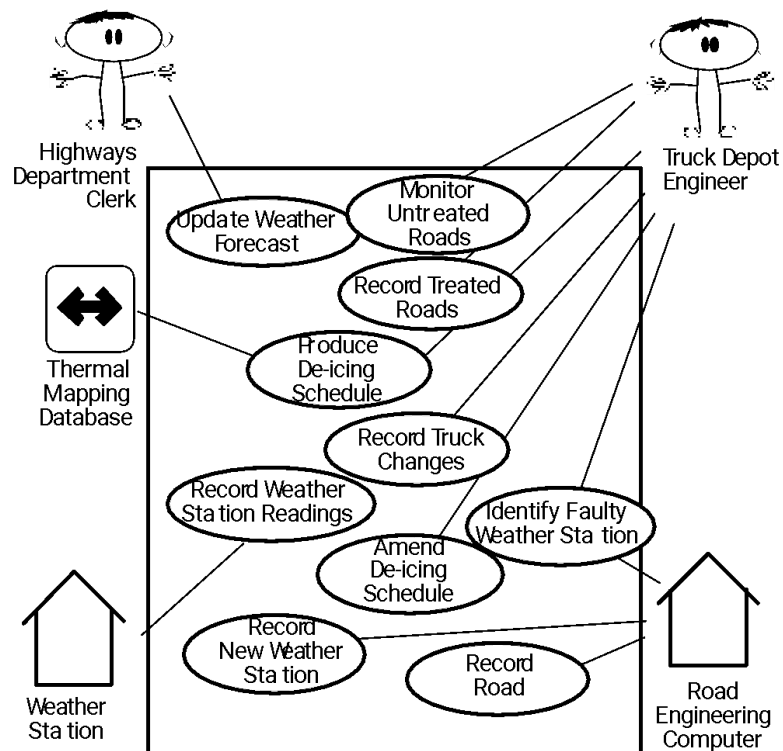


Figure 2 - Sample Use Case Diagram from Robertson and Robertson

1b Product Use Case List

SV: A list (table) of use cases is an alternative to the use case diagram, particularly when there are many use cases. There may be additional information in the table not found in the diagram, such as cross referencing to other sections or materials.

1c Individual Product Use Cases

SV: The following example was copied from "useCaseFormWithInstructions.docx", available on the CS 440 web site. (There is also a blank version available.)

Use case ID:

Name:

pre-conditions:

post-conditions:

Initiated by:

Triggering Event:

Additional Actors:

Sequence of Events:

1. Initiating event or action should be step 1, taken by initiating actor.
2. System response follows, indented right.
3. All external action steps are aligned with step 1. ("stimulus" style)
4. All system responses are indented right, aligned with step 2. ("response" style)
5. All steps should be expressed in the active voice, clearly indicating **who** performs each action
6. The sequence of events should show a back-and-forth stimulus-response relationship.

Alternatives: These would be normal and expected variations from the base case.

Exceptions: These would be unusual variations from the base case, often caused by problems.

-
- *For all of the above, list as NA if not applicable.*
 - *The following may be added if relevant, or omitted otherwise:*
 - o *related use cases or scenarios*
 - o *associated tests, systems, classes, etc.*
 - o *revision history*
 - o *references to other documents*
 - o *author(s) / originator(s)*
 - o *notes*
 - *Alternatives and Exceptions may be listed either as separate use cases or as notes to a base case, depending on their significance and similarity.*
 - *For regularly occurring periodic events, "time" can be listed as the initiating actor.*

2 Functional Requirements

SV: Each requirement listed needs to have a unique identifier, a short name, a one- or two-sentence description, a rationale, a fit criteria, and reference to one or more acceptance tests to be used to confirm the completion of this particular requirement. The acceptance tests themselves are documented in section 0- See that section for further details. It is recommended to number the requirements according to their type, such as F-4 for the fourth functional requirement or U-2 for the second usability requirement. Functional requirements specifically deal with the functionality the system must have, and are generally derived directly from the steps the system takes during use cases.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

3 Data Requirements

SV: Data requirements deal with requirements that are somehow related to data, such as the definition of what is included in a "student record" or the acceptable form of an e-mail address or allowable range of certain data items.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

4 Performance Requirements

4a Speed and Latency Requirements

SV: Requirements specifying how fast (or slow) the product must operate or how much lag is allowable between stimulus and either initial response or task completion. Other timing-related requirements could go in this section.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

4b Precision or Accuracy Requirements

SV: Self-explanatory. How accurate or precise must the system be.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

4c Capacity Requirements

SV: Requirements regarding the largest “thing” the system must be able to handle, or perhaps how many things it can handle (at once.) Note: Requirements regarding how many things it can handle in a given time period would be a speed requirement, covered in section 12a above.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

5 Dependability Requirements

5a Reliability Requirements

SV: Reliability relates to how frequently the system fails, (either by shutting down or by delivering erroneous results), and the consequences of those failures. These requirements may also address the conditions under which it is allowed to fail (or not.), See also availability and robustness in the following sections.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

5b Availability Requirements

SV: Availability addresses the amount of time the system is running and available for use. It is affected by how often the system goes down (reliability), but also by the time required to bring the system back up again, the availability lost due to regularly scheduled maintenance down times, and the ability of the system to offer at least partial functionality in the face of failures or resource shortages. See also reliability and robustness.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

5c Robustness or Fault-Tolerance Requirements

SV: This section deals with the system's ability to provide at least partial functionality in the face of failures or resource shortages, such as operating in offline mode when network connectivity is unavailable. See also reliability and availability.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

5d Safety-Critical Requirements

SV: These requirements address potential harm to health, safety, or property, and may refer to relevant standards such as OSHA compliance.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

6 Maintainability and Supportability Requirements

6a Maintenance Requirements

SV: This section deals with the ease with which the system can be maintained, and possibly who will perform system maintenance and under what conditions. The ease of evolving the system into future versions may also be addressed here, or in a separate section (not included in this template) if that is a major concern.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

6b Supportability Requirements

SV: What ongoing support is to be provided, e.g. through a help desk. See also training requirements in section 16g below.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

6c Adaptability Requirements

SV: Description of other platforms or environments to which the product must be ported.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

6d Scalability or Extensibility Requirements

SV: The ease of expanding the system to a larger capacity as the business grows.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

6e Longevity Requirements

SV: This specifies the expected lifetime of the product.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

7 Security Requirements

SV: Security requirements address who is allowed what type of access to the system, and what areas require special protection or diligence. In practice security requirements must often be written by security experts, and may refer to standards.

7a Access Requirements

SV: These requirements address who has access to what (data or functionality) and under what conditions or restrictions.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

7b Integrity Requirements

SV: These requirements address the protection of data(bases) from intentional or accidental corruption, loss, or theft.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

7c Privacy Requirements

SV: These requirements address data that must remain confidential, such as medical records or other personally identifiable data. Laws often apply. (See also section 20.)

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

7d Audit Requirements

SV: This section applies when a system must provide support for transaction auditing, such as some financial or medical systems.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

7e Immunity Requirements

SV: This section addresses the system's ability to resist viruses, worms, Trojan Horses, etc.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

8 Usability and Humanity Requirements

SV: This section is concerned with requirements that make the product usable and ergonomically acceptable to its hands-on users.

8a Ease of Use Requirements

SV: This section addresses the ease with which the intended audience can use the system properly, and conversely the difficulty with which they can use it improperly.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

8b Personalization and Internationalization Requirements

SV: This section addresses the ease with which the system can be configured for personal preferences, and for things such as language, currency, units, symbols, etc.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

8c Learning Requirements

SV: Requirements related to how easy it is for the intended audience to learn to use the product.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

8d Understandability and Politeness Requirements

SV: These requirements relate to how intuitively the intended audience understands what the program does, what its messages mean, and how to use it. Definitely related to ease of use, (section 16a), but more specifically addressing comprehension of the program output, instructions, and other messages.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

8e Accessibility Requirements

SV: Requirements related to use of the product by individuals with disabilities.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

8f User Documentation Requirements

SV: List of the user documentation to be supplied as part of the product.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

8g Training Requirements

SV: A description of the training needed by users of the product.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

9 Look and Feel Requirements

9a Appearance Requirements

SV: These requirements address things such as the colors, fonts, and logos used, often to reflect corporate branding or similarity to related products. See also style in the next section.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

9b Style Requirements

SV: Style requirements address the impression the product makes upon users, such as professionalism for a tax accounting package, friendliness for a children's game, or how "cool" it is for a teenage audience. Product packaging may also be addressed here, and/or appearance in the previous section.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

10 Operational and Environmental Requirements

10a Expected Physical Environment

SV: These requirements relate to the physical environment in which the product will operate.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

10b Requirements for Interfacing with Adjacent Systems

SV: This section describes the requirements to interface with partner applications and/or devices that the product needs to successfully operate.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

10c Productization Requirements

SV: Requirements related to the distribution and/or installation of the product.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

10d Release Requirements

SV: Specification of the intended release cycle for the product and the form that the release shall take.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

11 Cultural and Political Requirements

11a Cultural Requirements

SV: This section contains requirements that are specific to the sociological factors that affect the acceptability of the product. If you are developing a product for foreign markets, then these requirements are particularly relevant. Bear in mind that “cultural groups” may also apply to population subgroups such as teenagers, the elderly, or ironworkers.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

11b Political Requirements

SV: Requirements included strictly to make “the boss” happy, either internally to the development company, or internally to the client company, or possibly an external third party.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

12 Legal Requirements

12a Compliance Requirements

SV: A statement specifying the legal requirements for this system, often referring to relevant laws and/or requiring approval by the legal department.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

12b Standards Requirements

SV: These requirements specify documented standards to which the product must conform, as opposed to legal regulations.

ID# - Name

Description: Your description here . . .

Rationale: Your rationale here . . .

Fit Criterion: Your fit criteria here . . .

Acceptance Tests: List ID# and/or names here . . .

13 Requirements Acceptance Tests

SV: Every requirement must have one or more acceptance tests associated with it, to confirm that the requirement has been met. At this point these tests are not yet completely specified – A one- or two-sentence description of each test will suffice. Note that some tests may verify more than one requirement, and that some requirements may require multiple tests for their confirmation.

13a Requirements – Test Correspondence Summary

SV: The following sample table is available from the CS 440 web site as “Sample Requirement Test Correspondence Table.xlsx” It is recommended that you work with the table in Excel, and then drag it into the document when it is completed. Depending on the number of requirements and/or tests included, it may be necessary to use multiple tables, and/or use landscape mode. Every row and every column of the table should include at least one X. Below the table list the ID #, name, and short description of each individual acceptance test.

Test	Requirements																			
	Req 1	Req 2	Req 3	Req 4	Req 5	Req 6	Req 7	Req 8	Req 9	Req 10	Req 11	Req 12	Req 13	Req 14	Req 15	Req 16	Req 17	Req 18	Req 19	Req 20
Test 1	X																			
Test 2		X				X														
Test 3			X	X																
Test 4					X	X														
Test 5																				
Test 6																				
Test 7																				
Test 8																				
Test 9																				
Test 10																				
Test 11																				
Test 12																				
Test 13																				
Test 14																				
Test 15																				

Table 1 - Requirements - Acceptance Tests Correspondence

13b Acceptance Test Descriptions

SV: Provide a brief description of each acceptance test. Detailed test specifications will appear in a separate document, which may be referenced here when available.

ID # - Name

Description: Your description here . . .

III Design

1 Design Goals

SV: Identify the important design goals that are to be optimized in the proposed design.

Your text goes here . . .

2 Current System Design

*SV: **IF** the proposed new system is to replace an existing system, then the current system should be described here. Otherwise insert a brief statement that there is no pre-existing system.*

Your text goes here . . .

3 Proposed System Design

This section will make heavy use of class diagrams, and also sequence and deployment diagrams where noted. However don't overlook finite state, activity, communication, or other diagram types as needed for effective communication.

3a Initial System Analysis and Class Identification

SV: Perform grammatical and similar analyses to identify the most important and obviously needed classes, and to organize them into an initial class structure. An initial class diagram is appropriate, containing few if any internal details.

Your text goes here . . .

3b Dynamic Modelling of Use-Cases

SV: Insert sequence diagrams of (at least the most important) use-cases, as a means of identifying other needed classes.

Your text goes here . . .

3c Proposed System Architecture

SV: Identify the Software Architecture to be applied to this project, such as Client-Server, Repository, MVC, etc., along with justification for the choice.

Your text goes here . . .

3d Initial Subsystem Decomposition

SV: A slightly more detailed class diagram, showing the classes identified in sections 24a, 24b, and 0 above, partitioned into subsystems. For each subsystem provide a brief description of the subsystem, including its key responsibilities. There should still be few if any internal details.

Your text goes here . . .

4 Additional Design Considerations

SV: The sections listed here do not need to be presented in the order given, and may not all be relevant for any particular project. Those that are relevant can help identify additional classes that are needed as a result.

4a Hardware / Software Mapping

SV: This is particularly important for distributed systems, such as those employing a client-server architecture. Use a deployment diagram to indicate which subsystems are mapped onto which piece(s) of hardware, and what communication subsystems need to be added to the system as a result.

Your text goes here . . .

4b Persistent Data Management

SV: Document the classes and perhaps subsystems necessary to store persistent data when the system shuts down, and to restore that data when the system starts back up again.

*Reiterate key data structures and information as necessary for the understanding of this design phase. Refer the reader back to the data dictionary in section **Error! Reference source not found.** to avoid undue repetition, while reviewing only the most relevant items here.*

Your text goes here . . .

4c Access Control and Security

SV: Identify the access control and security concerns for this system, and the new classes and/or subsystems that must be added to handle those concerns.

Your text goes here . . .

4d Global Software Control

SV: Identify the global software control concerns for this system, and the new classes and/or subsystems that must be added to handle those concerns.

Your text goes here . . .

4e Boundary Conditions

SV: Identify the boundary condition concerns for this system, and the new classes and/or subsystems that must be added to handle those concerns. In particular consider startup, shutdown (normal or abnormal), and the creation and/or maintenance of any configuration files, databases, or similar supporting data files.

Your text goes here . . .

4f User Interface

SV: Include a preliminary user interface design here, possibly as a rough sketch or other mockup, in order to identify additional classes needed to implement the interface.

Your text goes here . . .

4g Application of Design Patterns

SV: Any design patterns applied as a result of previous sections should have been addressed there, and identified as such at the time. Use this section to document only the additional design patterns that were not previously covered elsewhere. (If any.)

Your text goes here . . .

5 Final System Design

SV: Include here the final version of the overall system design, incorporating all the subsystems and classes added as a result of additional design considerations. Multiple diagrams may be needed, possibly starting with an overall package diagram showing all the different subsystems and the (important) classes contained within each one. Still not a lot of internal details.

Your text goes here . . .

6 Object Design

This section documents the internal details of each class, to the extent that they can be designed at this time. Included should be the class interfaces (public method signatures and responsibilities) and constraints. It is probably best to break this section up into subsections corresponding to subsystems as documented above, and/or by (Java) packages if those are designed. It may also be appropriate to address additional design pattern considerations here, but not to the point of being redundant of previous documentation.

Certain methods, such as simple getters, setters, and constructors are not always documented, unless there is something special about them such as in the Singleton or Factory Method design patterns.

6a Packages

SV: If the design involves assigning classes to packages (.e.g Java packages), then the packages to be created should be documented here.

Your text goes here . . .

6b Subsystem I

Your text goes here . . .

6c Subsystem II

Your text goes here . . .

6d etc.

Your text goes here . . .

IV Project Issues

1 Open Issues

SV: Issues that have been raised and do not yet have a conclusion.

Your text goes here . . .

2 Off-the-Shelf Solutions

SV: Discussion of products or components currently available that could either be incorporated into the new solution or simply used instead of developing (parts of) the new solution. The distinction between sections 35 a, b, and c is subtle, and not very important.

Your text goes here . . .

2a Ready-Made Products

SV: Products available for purchase that could be used either as part of a solution or instead of (a part of) a solution.

Your text goes here . . .

2b Reusable Components

SV: Similar to 35a, but for components such as libraries or toolkits instead of fully blown products.

Your text goes here . . .

2c Products That Can Be Copied

SV: Products that could legally be copied would typically be past projects developed by the same development group, provided there were no restrictions that would prevent their reuse.

Your text goes here . . .

3 New Problems

SV: The proposed new system certainly has its benefits, but it could also raise new problems. It is a good idea to identify any such potential problems early on, rather than being surprised by them later.

3a Effects on the Current Environment

SV: Could the new system have any adverse effects on the working environment, e.g. the way people do their jobs?

Your text goes here . . .

3b Effects on the Installed Systems

SV: Could the new system have any adverse effects on other hardware or software systems?

Your text goes here . . .

3c Potential User Problems

SV: Could the new system have any adverse effects on the users of the software? Could users possibly have a negative response to the new system?

Your text goes here . . .

3d Limitations in the Anticipated Implementation Environment That May Inhibit the New Product

SV: Are there any (physical) limitations in the expected environment that could inhibit the proposed product? (e.g. weather; electrical interference, radiation, lack of reliable power, etc.)

Your text goes here . . .

3e Follow-Up Problems

SV: Basically any other possible problems that could occur.

Your text goes here . . .

4 Migration to the New Product

SV: This section only applies when there is an existing system that is being replaced by a new system, particularly when data must be preserved and possibly translated / reformatted. Otherwise just write "Not Applicable" under section 38 and remove sections 38a and 38b.

4a Requirements for Migration to the New Product

SV: These are a list of requirements relevant to the migration procedures. For example a requirement that the two systems be run in parallel for a time until the client is satisfied with the new system and the users know how to use it.

Your text goes here . . .

4b Data That Has to Be Modified or Translated for the New System

SV: This section specifically addresses data that must be preserved and/or translated / reformatted during the migration process.

Your text goes here . . .

5 Risks

SV: Consideration of the potential risks that could cause the project to fail / underperform.

Your text goes here . . .

6 Costs

SV: An estimate of what it will cost to complete this project. Think not only in terms of dollars, but also time, resources, lost opportunities, etc.

Your text goes here . . .

7 Waiting Room

SV: This is a place to record ideas or wishes that will not be included in the current release of the product, but which might be worth reconsidering at a later date.

Your text goes here . . .

8 Ideas for Solutions

SV: When developing requirements only, it is not the role of the business analyst to dictate the implementation of the solution. However they can pass along any ideas they have here as suggestions to the developers. For CS 440 this report includes system and object design, so this section would make suggestions for implementation

and testing that would come after design, such as the use of a particular language, IDE, library, or other tools.

Your text goes here . . .

9 Project Retrospective

SV: At the conclusion of the (CS 440) project, reflect back on what worked well and what didn't, and how the process could be improved in the future.

Your text goes here . . .

V Glossary

SV: The glossary is a more complete and inclusive dictionary of defined terms than that found in section I.7.a, the latter of which only covered the most important key terms needed to understand the report.

Your text goes here . . .

VI References / Bibliography

This section describes the documents and other sources from which information was gathered. This sample bibliography was generated using the “Insert Citation” and “Bibliography” buttons in the “Citations & Bibliography” section under the “References” tab of MS Word. Creating new citations will not update this list unless you click on it and select “Update Field”. You may need to reset the style for this paragraph to “normal” after updating.

- [1] Robertson and Robertson, Mastering the Requirements Process.
- [2] A. Silberschatz, P. B. Galvin and G. Gagne, Operating System Concepts, Ninth ed., Wiley, 2013.
- [3] J. Bell, "Underwater Archaeological Survey Report Template: A Sample Document for Generating Consistent Professional Reports," Underwater Archaeological Society of Chicago, Chicago, 2012.
- [4] M. Fowler, UML Distilled, Third Edition, Boston: Pearson Education, 2004.

VII Index

This section provides an index to the report. The sample below was generated using the “Mark Entry” and “Insert Index” items from the “Index” section on the “References” tab, and can be automatically updated by right clicking on the table below and selecting “Update Field”. To

remove marked entries from the document, toggle the display of hidden paragraph marks (the paragraph button on the “Home” tab), and remove the tags shown with XE in { curly braces. }

Design	61, 63	Test	64, 65
Requirements	35, 51, 58		