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
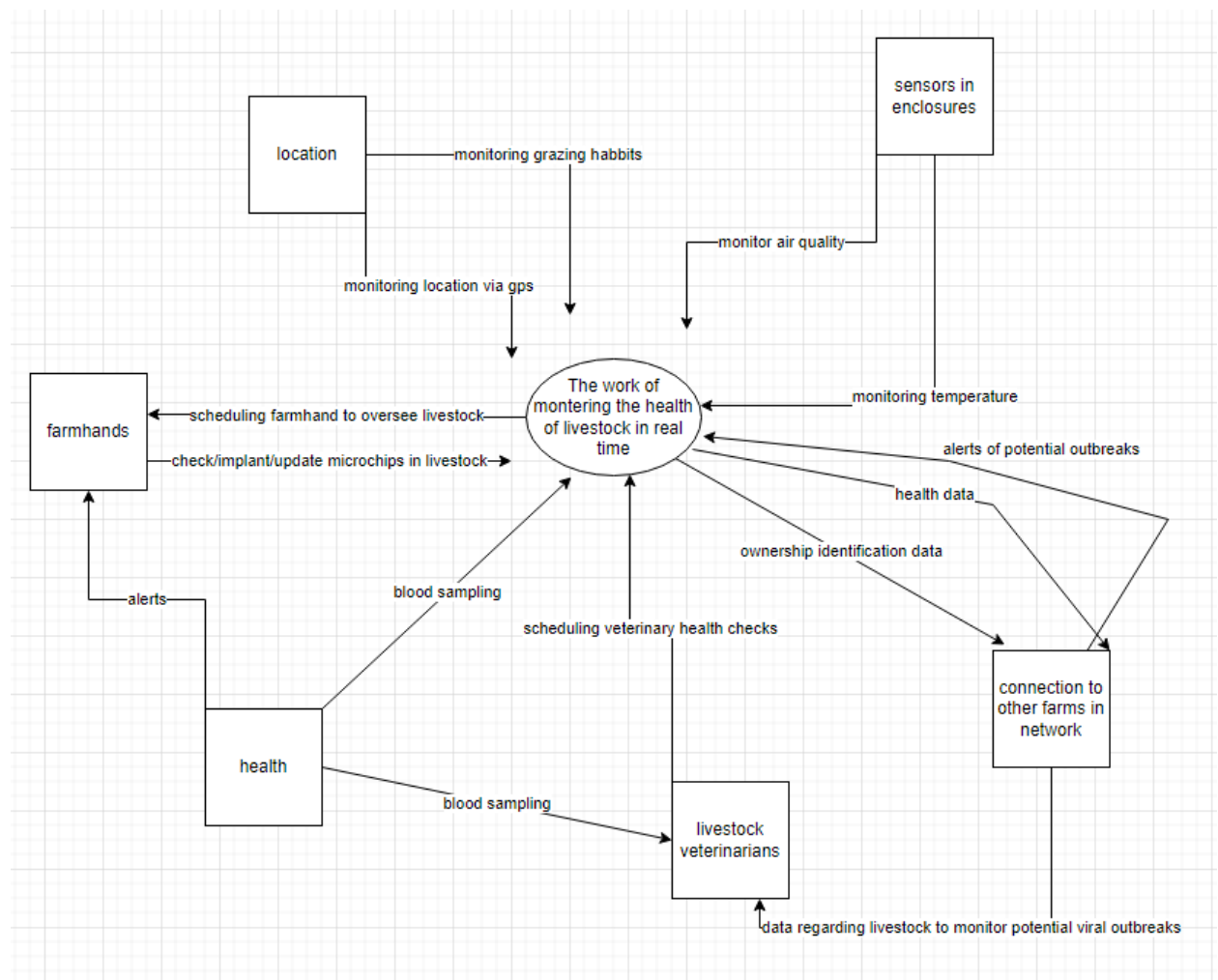
3c Work Partitioning

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.

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)
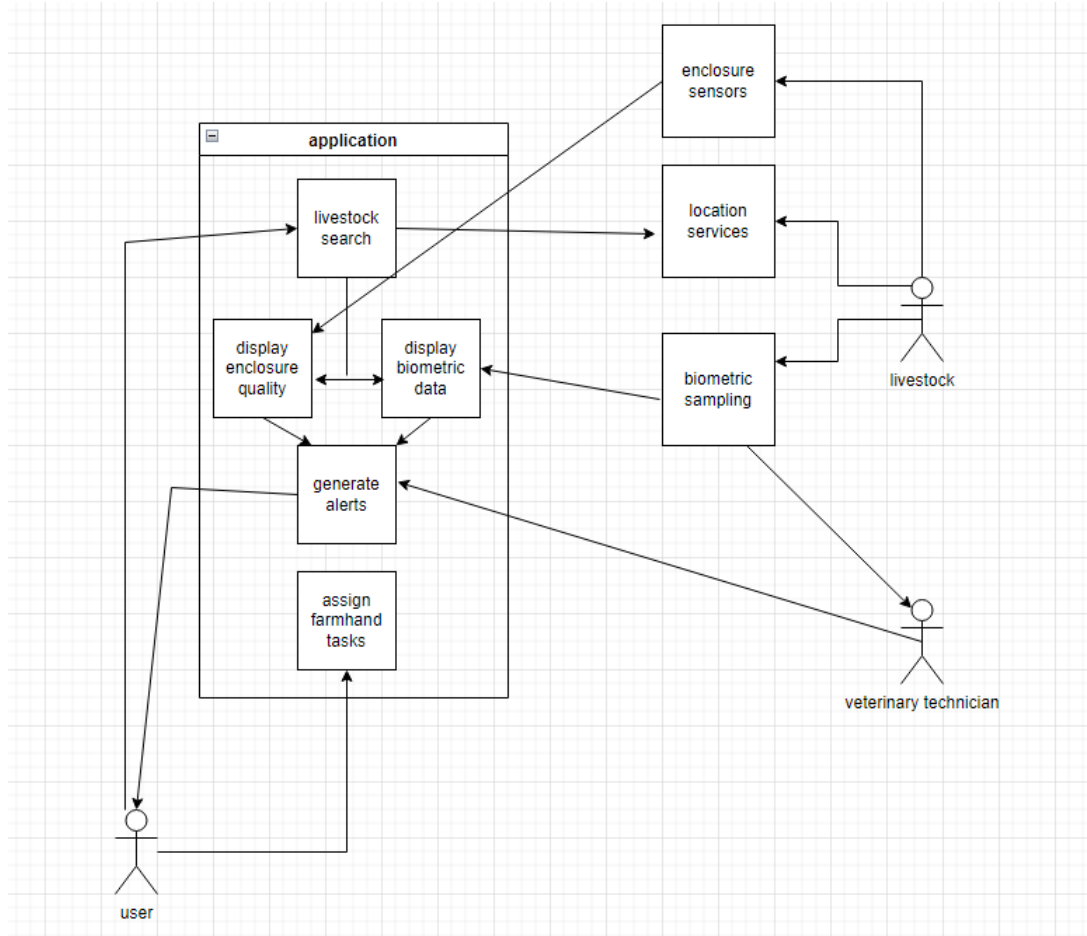
4b Product Scenario List

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 animal 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 present 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

9 Product Use Cases

9a Use Case Diagrams
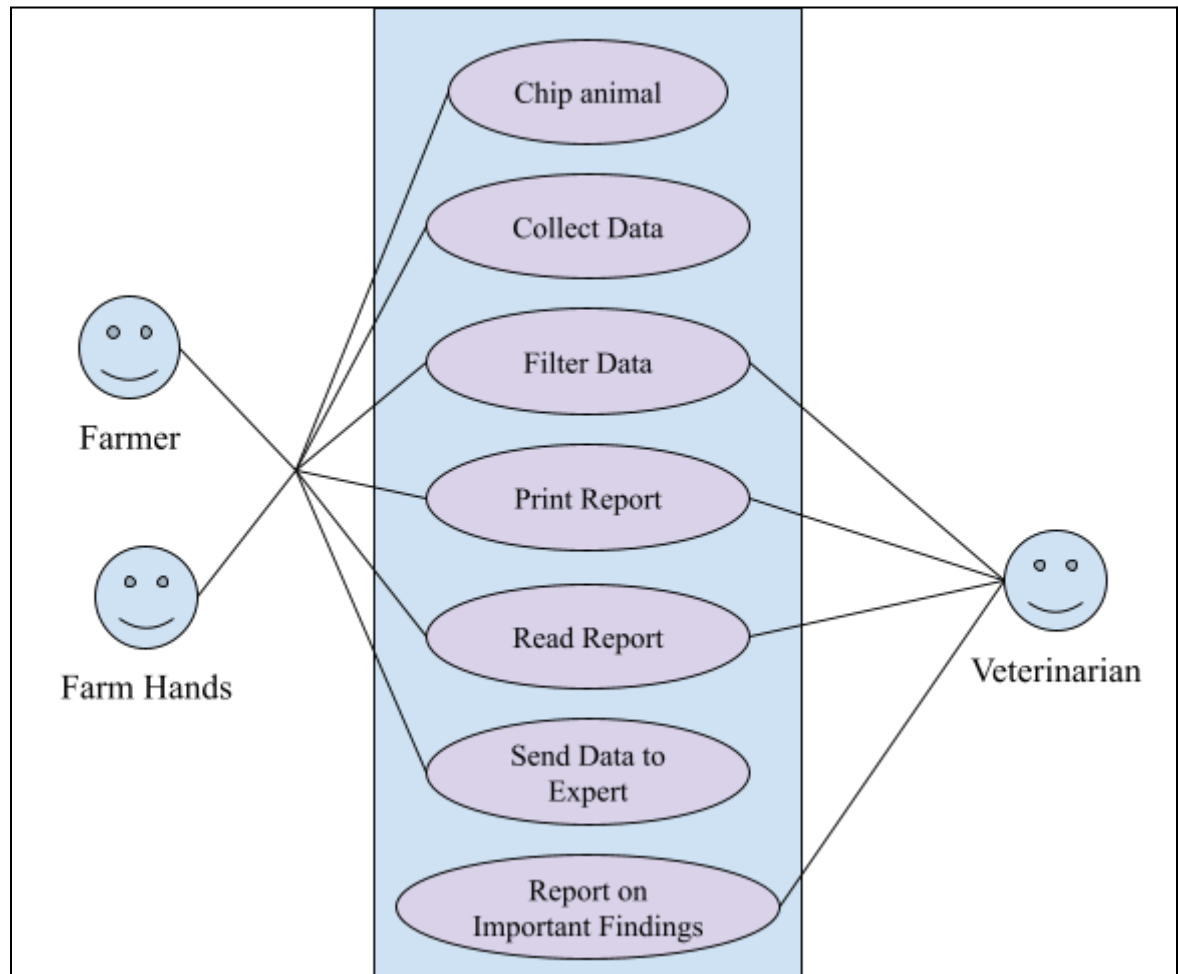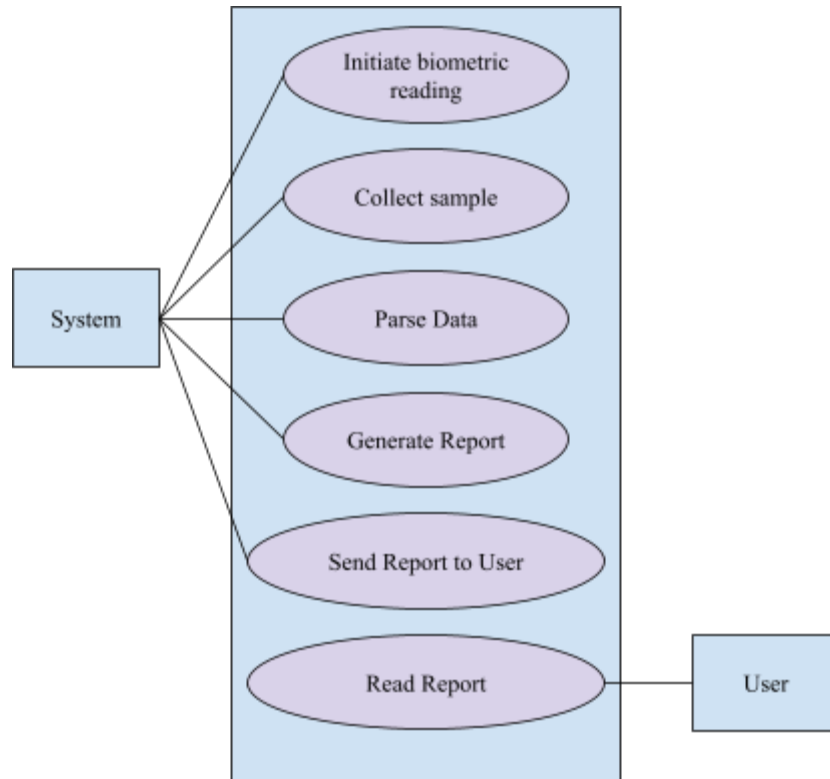
Obtain Biometric Reading for Livestock
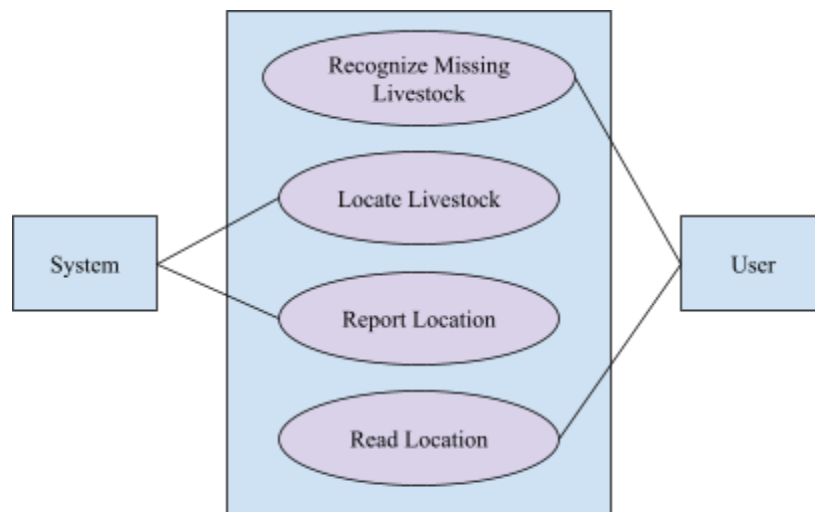
Locate Missing Livestock
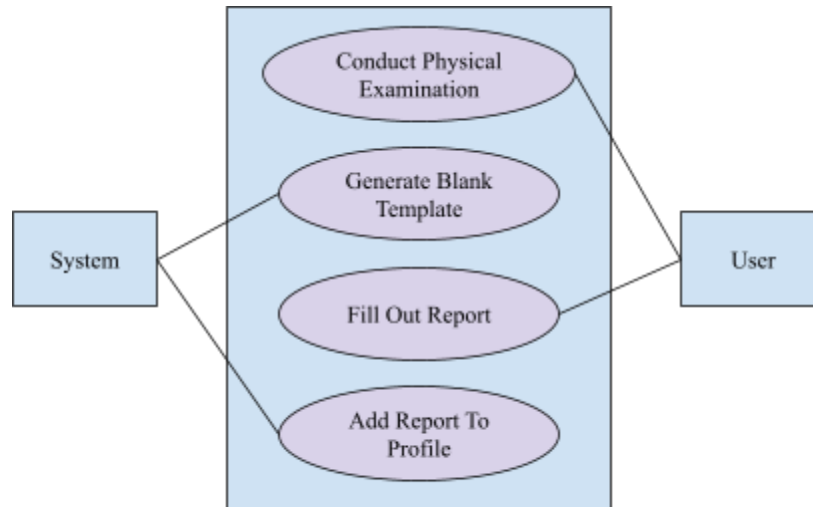
Report Result Third Party Health Check
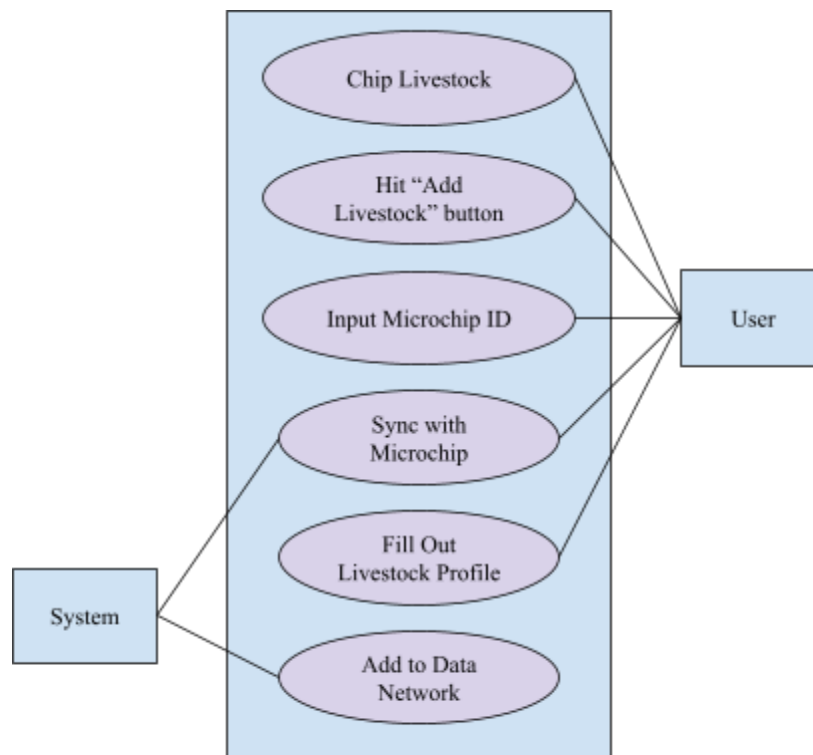
Add Livestock to User Database
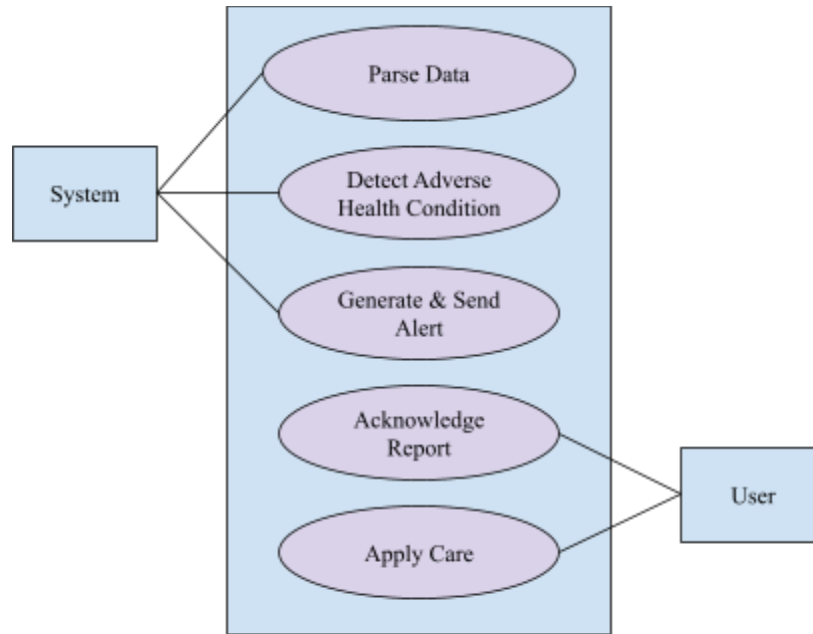
Act on Livestock health Alert
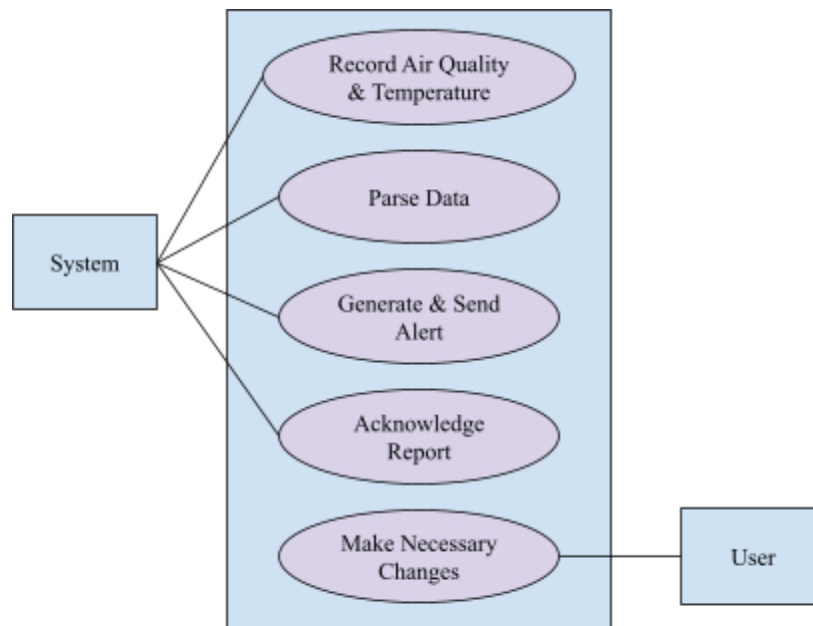
Act on Environment Alert

9b Product Use Case List

1. Obtain a biometric reading for livestock

2. Locate missing livestock.

3. Report result of third party health check.

4. Add livestock to user database.

5. Act on livestock health alert.

6. Act on environment alert.

9c Individual Product Use Cases

Use case ID: 0001   Name: Obtain a biometric reading for an animal

pre-conditions: The livestock must be implanted with the microchip

post-conditions: Biometric reading is taken and sent to user

Initiated by: Time

Triggering Event: Regularly scheduled interval of time

Additional Actors: Farmers, Farm Hands, Veterinarians

Sequence of Events:

1. Microchip: Initiates biometric reading

    2. Takes samples from livestock.

    3. Parses data from samples.

    4. Generates report

    5. Sends report to user

6. User: Receives report

    7. Displays report on user interface

Alternatives:

1a. Any of the other additional actors can independently trigger the event.

6a. Any of the other additional actors will receive the report

Exceptions:

4a: If the report is inconclusive, an error report is generated and sent to the user in it's stead signifying to the user that a manual check is necessary.

Use case ID: 0002   Name: Locate missing livestock

pre-conditions: The livestock must be implanted with the microchip

post-conditions: Location is determined by GPS

Initiated by: User

Triggering Event: Farmer notices his livestock is missing

Additional Actors: GPS services

Sequence of Events:

1. Notices livestock is missing and initiates location finder

    2. System Utilizes GPS services to locate the livestock within 100 meters

    3. Sends location to user

4. User Reads location displayed on their device

Alternatives:NA

Exceptions:

2a. It is possible that the animal is out of GPS range depending on the availability of connections in certain areas. The system will throw and generate an error report forwarded to the user.

Use case ID: 0003   Name: Report result of third party health check

pre-conditions: A health report has been taken, but not added to a livestock data profile.

post-conditions: An official veterinarian's report (similar to a doctor's report with a human) has been written up and added to the information of the livestock in question

Initiated by: Veterinarian

Triggering Event: Veterinarian conducts a physical examination on an animal.

Additional Actors: N/A

Sequence of Events:

1. Conducts physical examination on an animal.

2. Generates blank report template to be filled.

3. Fills report template with data from examination.

4. Asks if report should be filed under specific animal's data profile.

5. Confirms data profile to add report to.

6. Adds report to chosen profile.

Alternatives:

3a. If the user fails to fill out specific data (i.e. animal ID number, an identifier for the initiating actor, or at least one vital statistic) on a report template, the system should throw an error and ask to fill out all required areas before submitting again.

5a. If the animal who was the subject of the report is not suggested by the system at Step #4, the system should enter Use Case 0004: Add Livestock to User Database, after user does not confirm in Step #5 before repeating Step #4.

Exceptions:

2. Blank report generation is incorrect or invalid somehow (memory limit reached, attempts to create an invalid form, etc).

Use case ID: 0004   Name: Add livestock to user database

pre-conditions: Livestock has been chipped but not added to the network of chipped livestock to be monitored by the user.

post-conditions: Livestock has been added to the network of chipped livestock to be monitored by the user.

Initiated by: User

Triggering Event: User chips livestock.

Additional Actors: N/A

Sequence of Events:

1. Chips livestock.

2. Clicks on button to "Add Livestock"

   3. Prompts User to input microchip ID.

4. Inputs microchip ID.

   5. Synchs with microchip

   6. Begins recording biometric and location data from microchip

   7. Prompts user to fill out livestock data profile.

8. Fills out and submits livestock data profile.

   9. Stores livestock data profile in user data network.

Alternatives:

4a. User inputs incorrect/invalid microchip ID. System should prompt the user to double check microchip ID and re-enter information.

8a. User incorrectly fills out initial livestock data profile. System should prompt the user to fill in all required areas before submitting.

Exceptions:

5a. Sync with microchip fails.

Use case ID: 0005   Name: Act On Livestock Health Alert

pre-conditions: Livestock has been chipped and Biometric reading has been taken

post-conditions: Health Alert has been generated and sent to the user.

Initiated by: MicroChip

Triggering Event: Adverse Health condition detected after Biometric reading

Additional Actors: Veterinarian, User

Sequence of Events:

1. Samples taken

    2. Parses data

    3. Detects adverse health condition in livestock

    4. Generates alert

    5. Sends alert to Users and Veterinarian

6. User Receives alert regarding adverse health condition

    7. User: acknowledge report

    8. Applies preventative care corresponding to the health of the animal

Alternatives:

3a. In the event that a particular reading is higher than normal, but still out of dangerous levels, a less severe alert can be generated and sent to the User

4a. Veterinarians receiving biometric reading can also generate reports if they notice anything out of the ordinary.

Exceptions: N/A

Use case ID: 0006   Name: Act On Environment Alert

pre-conditions: Environment Sensors installed in livestock enclosure

post-conditions: Environment alert is generated and sent to user

Initiated by: Enclosure Sensors

Triggering Event: Environment Sensors detect harmful air/temperature quality

Additional Actors: User

Sequence of Events:

1. Environment Sensor: records air quality and temperature in enclosure

   2. Parses data

   3. Determines air quality at unsafe level

   4. Generates appropriate alert

   5. Sends alert to User

6. User: Receives alert on their device and makes necessary changes to the enclosure to remedy situation.

Alternatives: N/A.

Exceptions:

1a. It is possible that the sensors are malfunctioning and not providing readings.

1a/4a. In the event that the sensors are malfunctioning and error will be generated and sent to the user so they can be aware.

10 Functional Requirements

#1011 - Biometric Reading

Description: The system must gather biometric information from livestock.

Rationale: The app can not keep track of the health of the livestock without a biometric reading.

Fit Criterion: When signaled, the microchip in the livestock will take blood samples.

Acceptance Tests:
Test #10111 - Biometric Reading Test

#1012 - Locate Livestock

Description: The system must broadcast the location of the individual livestock. This is to monitor grazing habits and to locate the livestock in the event of theft or if it were to escape confinement.

Rationale: The user must know the location to ensure the safety and wellbeing of their livestock.

Fit Criterion: The application broadcasts the location of the livestock accurately up to 100 meters.

Acceptance Tests:
Test #10121 - Location Test

#1013 - Parse Data

Description: The app must be able to parse the biometric readings from the livestock and send it to the user.

Rationale: The application will be taking biometric readings from the livestock in regular intervals, it must interpret the data to send to the user.

Fit Criterion: The user receives accurate quantifiable data from the biometric readings

Acceptance Tests:
Test #10111 - Biometric Reading Test
Test #10131 - 10% Margin of Error Test

#1014 - Establish Baseline

Description: The application must establish a standard baseline for the livestock's health.

Rationale: This is to determine if the livestock's health is in decline or if it is responding positively to treatment for an existing condition.

Fit Criterion: The application stores the history of livestock's health.

Acceptance Tests:

Test #10111 - Biometric Reading Test
Test #10141 - Livestock Well-being Test

#1015 - Generate Livestock Health Alert

Description: The application must generate an alert if a livestock's health is determined to be in a state of decline.

Rationale: The user must be alerted to the declining health of their livestock as to ensure that preventative care can be administered in the form of medication, diet change, environmental change etc.

Fit Criterion: When biometric readings on a livestock fall below a certain threshold, an alert is generated and forwarded to the user.

Acceptance Tests:
Test #10151 - Generate Livestock Health Alert Test
Test #10111 - Biometric Reading Test

#1016 - Generate Environmental Alert

Description: Sensors in the livestock's living area, such as a pen or stable, take in and monitor data from the air around the animals to detect potential anomalies.

Rationale: The app can not keep track of the health of the livestock without ensuring the reading of the surrounding environments is safe.

Fit Criterion: When signaled, the environmental sensors will take readings every 2 hours.

Acceptance Tests:
Test #10131 - 10% Margin of Error Test
Test #10161 - Environmental Reading Test

11 Data Requirements

#1111 - Storage Capability

Description: The application must store all data in a storage container that can keep up with the amount of data being collected.

Rationale: There will be a large amount of data being collected during the application's runtime, and the data must be able to store all of this data reliably for later use.

Fit Criterion: Data must be stored in a widespread and accessible database.

Acceptance Tests:
Test #11111- Complete Database Linking Test

12 Performance Requirements

12a   Speed and Latency Requirements

#1211 - Tens of Thousands of Data Input a Minute
Description: Data is coming into the system at an extremely fast rate, and it is assumed that all data incoming has the possibility of holding data that can reveal threats to the animal's life
Rationale: There are a large amount of sources that data is expected to come into the system, and the application must be able to keep up with it at all times.
Fit Criterion: The application must successfully transfer 99.9% of all data that is output from the animals into the database.
Acceptance Tests: Test #11111 - Complete Database Linking Test Test #12111 - Data Loss Minimization Test

12b   Precision or Accuracy Requirements

#1221 - Biometric Reading Accuracy Margin of Error
Description: The application must be able to compute and register biometric readings with a suitable margin of error compared to the actual status of the livestock.
Rationale: Medical readings from sensor data should give an accurate representation of the physiological state of the livestock in order for proper diagnosis. An inaccurate reading can be the difference between a proper and improper diagnosis and response.
Fit Criterion: All readings must be within a margin of error of 10%.
Acceptance Tests: Test #10131 - 10% Margin of Error Test

#1222 - Biometric Reading Precision Level
Description: The application must be able to calculate biometric readings with a certain level of precision.
Rationale: Medical readings from sensor data are a vital part of how our application obtains and processes data and precise data readings will allow for ease of diagnosis and alerting users. An imprecise reading can be the difference between a proper and improper diagnosis and response.
Fit Criterion: All readings must be calculated and presented to the user rounded to the nearest thousandth of a unit (0.001).
Acceptance Tests:

Test #12221 - Fine Precision Test

12c   Capacity Requirements

#1231 - Millions of Active Animals Handling
Description: The system will read data for 1 to 2 Million animals at once and perform the expected operations and data.
Rationale: The app can not make the expected predictions and ensure the overall goal of the application without the ability to read millions across many locations at once
Fit Criterion: The system must be able to read data for 1 to 2 million animals at once across more than two locations with a minimum distance of 50 km and perform the expected operations on the fetched data.
Acceptance Tests: Test #12311 - Animal Capacity Test Test #12312 - Various Locations Test

13 Dependability Requirements

13a   Reliability Requirements

#1311 - Biometrics Failure Rate
Description: The application should minimize the downtime of the biometrics functionality.
Rationale: Especially when animals are already sick or in need of treatment, constant monitoring is important to make sure that any medical intervention done is having an effect, positive or negative. Furthermore, constant/regular monitoring will be required for cases of infectious diseases. Also, in general, farmers will like to have the app available at their disposal to determine the health risks, if any, to their livestock and livelihood.
Fit Criterion: Biometric services should be up 85-90% of the time.
Acceptance Tests: Test #13111 - Biometric Uptime Consistency Test

#1312 - GPS Failure Rate
Description: The application should minimize the downtime of the GPS tracking functionality.
Rationale: Especially for free-range farmers, the whereabouts of their livestock are important and, given the large size of many farms used for livestock, having constant location availability is important for farmers.
Fit Criterion: Outside of circumstances where GPS services are unavailable, GPS services

should be up 85-90% of the time.
Acceptance Tests: Test #13121 - GPS Uptime Consistency Test

13b   Availability Requirements

#1321 - General System Uptime
Description: The application must have a stable and consistent uptime.
Rationale: As the application is tied to both animal health and the general livelihood of livestock farmers, consistent uptime is required to maintain reliability and proper usability.
Fit Criterion: The application should have an uptime of 80%.
Acceptance Tests: Test #13211 - Uptime Longevity Test

13c   Robustness or Fault-Tolerance Requirements

#1331 - Offline Mode
Description: The application must have an offline mode in which biometric readings are taken and stored and the last known GPS location is preserved. The data will then be uploaded and updated once the system reconnects.
Rationale: The application must continue to attempt to log data in the event the system goes offline so the user can be made aware of health fluctuations.
Fit Criterion: Upon reconnecting the application receives all biometric readings since the last available connection and updates GPS locations.
Acceptance Tests: Test #13311 - Offline Mode Test

13d   Safety-Critical Requirements

#1341 - USDA Compliance
Description: The chips implanted in the livestock must be up to consumer food industry standards.
Rationale: The chips and biometric readings must comply with USDA regulations on animal safety with regards to animals involved in the food industry.
Fit Criterion: Implantation and biometric sampling at regular intervals do not cause adverse health effects or lower the health of the livestock.

Acceptance Tests:
Test #13411- USDA Compliance Test

14 Maintainability and Supportability Requirements

14a   Maintenance Requirements

#1411 - Regular Maintenance Cycles
Description: The application must undergo routine maintenance to update software both on the platform and in the chips to ensure the longevity of the system. Maintenance updates can be applied by
Rationale: The application can not produce accurate biometric readings unless it is regularly updated and faulty chips are replaced.
Fit Criterion: The lack of regular maintenance for the system would impact the accuracy of the data which will impact the overall health of the animals and make the system malfunction.
Acceptance Tests: Test #10131 - 10% Margin of Error Test Test #10161 - Environmental Reading Test Test #12311 - Animals Capacity Test Test #12312 - Various Locations Test Test #13211 - Uptime Longevity Test Test #14111 - Regular Maintenance Test

14b   Supportability Requirements

#1421 - Constant System Support
Description: The application must provide support through a hotline and office location located in the top 10 areas with the highest number of clients, with at least a single available engineer to handle any unexpected issues for clients.
Rationale: The system should stay available and if there is not constant support, any issue that occurs at a given location would set the system down, which is against the main purpose of the system and would put the health of animals at risk.
Fit Criterion: The support should be available 24/7 at any time of the day in the year and should have at least a single system engineer ready to respond to the malfunctions.
Acceptance Tests: Test #10111- Biometric Reading Test Test #10131 - 10% Margin of Error Test Test #14211 - Support Call Test Test #14212 - Sudden Issue Test

14c   Adaptability Requirements

#1431 - Mobile Backwards Compatibility
Description: The system is compatible with most versions of older mobile operating systems.
Rationale: It is assumed that many target users of this system may still be running on old hardware and software, and they must not be forced to upgrade anything on their end.
Fit Criterion: The mobile end system must have applications for all Android and iOS versions within a 5 year development lifetime.
Acceptance Tests: Test #14311 - Mobile Compatibility Test

#1432 - Desktop Backwards Compatibility
Description: The system is compatible with most versions of older desktop operating systems.
Rationale: It is assumed that many target users of this system may still be running on old hardware, and they must not be forced to upgrade anything on their end.
Fit Criterion: The desktop end of the system must have applications for all Windows versions, going back to Windows XP.
Acceptance Tests: Test #14321 - Windows Compatibility Test

14d   Scalability or Extensibility Requirements

#1441 - Dynamic Data Storage
Description: The system is able to expand to multiple data centers to keep up with storage demands.
Rationale: The application must be able to keep up with the storage requirements of data for users, and depending on how widespread the use of this application becomes, data will need to be stored across multiple locations.
Fit Criterion: The application must be able to collect data from and send data to different data storages.
Acceptance Tests: Test #14411 - Different Locations Data Reading Test

14e   Longevity Requirements

#1442 - Microchip Lifetime
Description: The microchips implanted in a given animal must be functional for 6-12 months
Rationale: The microchips are an important part to determine the validity of the data and safety of the animals.
Fit Criterion: The lifetime of a microchip must be between 6-12 months and should be evaluated regularly at least once a month to ensure over that period of time to work properly with accurate readings of data.
Acceptance Tests: Test #10111- Biometric Reading Test Test #10131 - 10% Margin of Error Test Test #10161 - Environmental Reading Test Test #14421 - Physical Chip Check Test

15 Security Requirements

15a   Access Requirements

#1511 - Limited System Access
Description: All data should for a given location be accessed by the client and the company support team.
Rationale: The client data is their right and they should determine the parties which should have access to it. The company access would benefit the client to ensure that the system is functional.
Fit Criterion: The data should not be accessed by anyone but a known client representative, and only the support team in the company.
Acceptance Tests: Test #15111 - Unauthorized Access Test Test #15112 - Third-Party Access Test

15b   Integrity Requirements

#1521 - Database Backup
Description: User data (including user profile and the array of the user's active chips and chip data) should be backed up to prevent loss of data or data corruption.
Rationale: For many of our intended users, their livestock (and thereby their livestock's data) are a major part of their income and livelihood, so data security is a key priority.
Fit Criterion: A working data backup system must be implemented and function to create data redundancies and be able to replace any lost or corrupted data.

Acceptance Tests:
Test #15211- Database Backup Implementation Test

15c   Privacy Requirements

#1531 - Data Depersonalization
Description: The system must implement data depersonalization in order to protect user privacy when used in a veterinarian setting.
Rationale: Data and user privacy for medical settings is a key priority protected by law (HIPAA and related laws for veterinarians).
Fit Criterion: User data should be depersonalized to prevent identification or access by a third party.
Acceptance Tests: Test #15311 - Data Depersonalization Test

#1532 - Data Encryption
Description: The system must implement data encryption as a second layer of defense to protect user data.
Rationale: For many of our intended users, their livestock (and thereby their livestock's data) are a major part of their income and livelihood, so data security is a key priority.
Fit Criterion: User data should be protected by encryption capable of resisting the most common data theft techniques.
Acceptance Tests: Test #15321 - Data Encryption Implementation Test

15d   Audit Requirements

#1541 - Audit-Related Data Requisition
Description: The system should have depersonalized user and livestock medical data available for an authorized third party to access in the case of an audit.
Rationale: As our application has medical connotations, regular data audits may be conducted to maintain the accuracy of readings and proper operating procedure.
Fit Criterion: Depersonalized user data should be pulled in more than a single location when it is requested in above 95% of the time.
Acceptance Tests: Test #15311 - Data Depersonalization Test

Test #15411 - Data Requisition Test

15e   Immunity Requirements

#1551 - Firewall
Description: The system must implement a firewall to protect user data.
Rationale: For many of our intended users, their livestock (and thereby their livestock's data) are a major part of their income and livelihood, so data security is a key priority.
Fit Criterion: User data should be protected by a firewall capable of resisting the most common data theft techniques for 95% of the time.
Acceptance Tests: Test #15511 - Firewall Implementation Test

16 Usability and Humanity Requirements

16a   Ease of Use Requirements

#1611 - Usability
Description: The software must be intuitive to use with minimal training. Users (farmers and farm hands) must be able to easily and intuitively navigate the system to read the results/alerts from any particular biometric reading.
Rationale: Because of the amount of scientific information the app will store, providing an intuitive interface will ensure that the user does not get confused or discouraged while navigating the application.
Fit Criterion: No user should require more than 10 minutes to navigate to a particular biometric reading and understand the severity of said reading's result.
Acceptance Tests: Test #16111 - Usability Test

16b   Personalization and Internationalization Requirements

#1621 - Language Personalization
Description: Users shall be able to customize their language settings within the settings menu. This ensures users from many backgrounds aren't restricted in their ability to utilize the application.
Rationale: Not all users may be primary English language speakers, so other languages should be implemented, prioritizing languages common as second languages in America.
Fit Criterion: No user is forced to navigate the application in a language that they are

unfamiliar with.
Acceptance Tests: Test #16211 - Language Personalization Test

16c   Learning Requirements

#1631 - Fast Learning Pace
Description: The new users of the application should have the ability to learn how to use the system fast within a limited specified period of time.
Rationale: The system should provide new users with the ability to learn fast since the design of the system is targeted at inexperienced users with technology, so it must be beginner friendly design that is easy to learn.
Fit Criterion: A user with only limited experience with using a smartphone must be able after completing the training, to start using the system in 24-72 hours and utilize all the features available in the system.
Acceptance Tests: Test #16311 - Fast Pace Learning Test Test #16711 - Training Test

16d   Understandability and Politeness Requirements

#1641 - Simplified Data Presentation
Description: The application should present the user with possible diagnoses, rather than a list of numerical readings and levels.
Rationale: Our intended hands-on users (farmers and others involved with consumer livestock) may not be able to determine any useful information from raw biometric data, so the data from the biometrics in the chips should be interpreted and possible diagnoses in plain English should be outputted to the user.
Fit Criterion: The application should take in biometric data as raw numerical input, with units, and convert it into a reading of "NORMAL" (for readings within baseline) or a potential symptom(s) based on any detected anomalies in English text (i.e. "INFECTION").
Acceptance Tests: Test #16411 - Simplified Presentation Test

16e   Accessibility Requirements

#1651 - Text to Speech
Description: The application has text-to-speech (TTS) functionality included with the base product.

Rationale: Some users may have trouble reading text that is presented to them on a mobile or desktop platform, and to cater to this, text-to-speech should be included.
Fit Criterion: The application includes a text-to-speech feature.
Acceptance Tests: Test #16511 - TTS Implementation Test

16f   User Documentation Requirements

#1661 - User Manual
Description: There must be a user manual included with all purchases of the application, and it must also be accessible online.
Rationale: There may be many functions of the application that might not be immediately noticeable by the end user, so all functions must be outlined in a manual.
Fit Criterion: A user manual is created for the application
Acceptance Tests: Test #16611 - User Manual Development Test

16g   Training Requirements

#1671 - Training Test
Description: Training will be required to adjust the frequency and types of the biometric readings to ensure the health and stability of the livestock.
Rationale: Increasing the frequency of biometric readings could have an adverse effect on the health of the livestock.
Fit Criterion: Technicians will certify users.
Acceptance Tests: Test #16711 - Training Test

17 Look and Feel Requirements

17a   Appearance Requirements

#1711 - Appropriate Colors
Description: The appearance of the application should refrain from the use of an extravagant color scheme so as to not confuse the user and diminish the severity of an alert that appears on the UI.
Rationale: The appearance of the application requires that certain fonts and colors are used

to communicate to the user the severity of alerts and biometric readings.
Fit Criterion: The application uses a neutral color palette with the exception of the color-coded alerts.
Acceptance Tests: Test #17111 - Color Test

#1712 Dark Mode colors
Description: The appearance of the application should provide a dark mode/night mode for users.
Rationale: The appearance of the application requires that sometimes the user will have to use the application during the night time with limited light which damages the eye.
Fit Criterion: The application uses dark contrast of colors and the user could use the able as in regular color mode.
Acceptance Tests: Test #17111 - Color Test Test #17121 - Dark Color Test

17b   Style Requirements

#1721 - Minimalistic and Professional
Description: The system is minimalistic, and doesn't include too many extra features apart from the actual needs of the system.
Rationale: The target demographic likely will not care for whether it looks cool or not, only that it is functional and does what it says it will do.
Fit Criterion: The application does not include unnecessary features, and only does the bare minimum in functionality. It also holds a minimalistic style.
Acceptance Tests: Test #16111 - Usability Test Test #16411 - Simplified Presentation Test Test #17111 - Color Test Test #17211 - Simple Style Test

18 Operational and Environmental Requirements

18a   Expected Physical Environment

#1811 - Farms and Animal Plants Usage

Description: The system must be compatible with the environment of farms
Rationale: The system is designed to target frames and be used in such an environment of which lifestocks are part of that ecosystem.
Fit Criterion: The system must work in farms and animal plants and perform all the implemented functionality without any needs for additional technology beyond what has been determined previously in the application report.
Acceptance Tests: Test #18111 - Farms Usage Test

#1812 - Weather Conditions
Description: The system must be compatible to work in farms and animal plants farms with any weather conditions
Rationale: The system is designed to target frames and be used in such an environment of which lifestocks are part of that ecosystem, in case of a change in the weather, the health and safety of the animals might be impacted ,therefore , the system must work under these conditions.
Fit Criterion: The system must remain working and provide accurate reading and up-to-date data for all the animals without any change in case of it's running or snowing.
Acceptance Tests: Test #10111- Biometric Reading Test Test #10131 - 10% Margin of Error Test Test #10161 - Environmental Reading Test Test #18111- Farms Usage Test

18b   Requirements for Interfacing with Adjacent Systems

#1821 - GPS Interfacing
Description: The system must be able to interface with preexisting GPS services to keep track of the location of the livestock.
Rationale: Implementing and installing a new GPS system could be costly for farms, therefore we must ensure the product interfaces with existing GPS systems negate startup costs
Fit Criterion: The application utilizes existing GPS systems to determine the location of livestock.
Acceptance Tests: Test #18211 - GPS Interface Test

18c   Productization Requirements

#1831 - Software Installation

Description: The application software will be distributed by the owner to the users.

Rationale: Because the product is paired with the hardware, the app will be distributed by the owner to the users in order for the readings from the microchips to be utilized and read by the users.

Fit Criterion: The user will have the application installed on their system.

Acceptance Tests:
Test #18311 - Software Installation Test

#1832 - Hardware Installation

Description: Hardware, in the form of microchips, should be installed by a trained technician to ensure proper placement and the ability to receive accurate biometric readings.

Rationale: If installed incorrectly, data from biometric readings may be inconclusive or functionally useless and chips may have to be removed and reinstalled at the expense of the health of the livestock.

Fit Criterion: After installation, the microchip produces accurate biometric readings.

Acceptance Tests:
Test #18311 - Software Installation Test
Test #18321 - Hardware Installation Test

18d   Release Requirements

#1841 - Update Limitations

Description: Any updates to the application should not generate major changes to the user interface (UI) or the navigation of the application, only offer security updates to exposed weaknesses and minor options (i.e. a new available language, general visual bug fixes).

Rationale: Our target users tend to be unfamiliar with technology in general, so constant changes in forward-facing elements like the UI and system navigation will serve to confuse users and promote inefficient or ineffective use.

Fit Criterion: Updates should be checked to make sure that no major UI overhauls are done.

Acceptance Tests:
Test #18411 - Update Criteria Fit Test

#1842 - Quarterly Update Schedule

Description: The application should exist on a quarterly update schedule, with room for

emergency hotfixes in case major bugs are detected.
Rationale: For a system that is designed to be "always up" like our application and deals with privacy-heavy topics like biometrics and the personal information of farmers, constant updates at a reliable rate (generally monthly or quarterly) are required to maintain peak security and functionality.
Fit Criterion: Updates should be expected at a quarterly rate.
Acceptance Tests: Test #18421 - Update Timeline Test

19 Cultural and Political Requirements

19a   Cultural Requirements

#1911 - Cultural Acceptance
Description: The user interface must be easy and intuitive to use.
Rationale: 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.
Fit Criterion: Users that fall into the target demographic must be able to confidently navigate the application.
Acceptance Tests: Test #19111 - Culture Fit Test

19b   Political Requirements

#1921 - Healthcare Check
Description: There will be strong emphasis on properly utilizing the application and applying appropriate preventative medical intervention to livestock to prove the viability of the application.
Rationale: The political aspect of the application primarily revolves around maximizing the overall health of the animals, thereby increasing the quality of products heading to market.
Fit Criterion: Regularly scheduled health checks implemented to verify success of application.
Acceptance Tests: Test#19211 - Health Check Test

20 Legal Requirements

20a   Compliance Requirements

#2011 - AWA Conformance
Description: Our application should conform with the legal restrictions and standards laid out by the Animal Welfare Act (AWA).
Rationale: Our app is intended to be used with animals raised and bred for commercial purposes, and is therefore subject to the AWA and similar regulations laid out by the USDA and other organizations on behalf of the wellbeing of the animals in question.
Fit Criterion: After submission for official review, the entire system (including the microchip hardware and the data collection software) should be in compliance with the AWA and other USDA regulations.
Acceptance Tests: Test #13411 - USDA Compliance Test

20b   Standards Requirements

| #2021 - Industry Standard Compliance |
|---|
| **Description**: The application, in both hardware and software settings, should conform with existing industry standards for livestock microchipping and data gathering. |
| **Rationale**: Current livestock chipping standards promote animal safety first and current data gathering standards, while limited to mostly location data, are likewise set up to prioritize ease of access and livestock safety. |
| **Fit Criterion**: The application should be designed with the industry standards of putting livestock welfare and user ease of access in mind. |
| **Acceptance Tests**:
Test #20211 - Standard Compliance Test |

21 Requirements Acceptance Tests

21a   Requirements – Test Correspondence Summary

Test	Req 1011	Req 1012	Req 1013	Req 1014	Req 1015	Req 1016	Req 1111	Req 1211	Req 1221	Req 1222	Req 1231	Req 1311	Req 1312	Req 1321	Req 1331	Req 1341	Req 1411	Req 1421	Req 1431	Req 1432	Req 1441	Req 1442	Req 1511	Req 1521	Req 1531	Req 1532	Req 1541	Req 1551	Req 1611	Req 1621	Req 1631	Req 1641	Req 1651	Req 1661	Req 1671	Req 1711	Req 1712	Req 1721	Req 1811	Req 1812	Req 1821	Req 1831	Req 1832	Req 1841	Req 1842	Req 1911	Req 1921	Req 2011	Req 2021
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Test 10121		X																																															
Test 10131			X						X					X			X					X																		X									
Test 10141				X																																													
Test 10151					X																																												
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Table X - Requirements-Acceptance Test Correspondence Chart

21b   Acceptance Test Descriptions

Test #10111 - Biometric Reading Test

Description: The test will read all the biometric data of a single livestocks and report the result on the system for displaying one of the colors indicated based on the current expected health of the animal(refer to **Section 7c** for the coloring convention).

Test #10121 - Location Test

Description: The test will determine the location of a given livestock in a given point of time, displaying the expected location of which must match the current physical location of the animal.

Test #10131 - 10% Margin of Error Test

Description: The test will determine the accuracy of the biometric reading of a given livestock in a point of time, with a margin of error less than or equal to 10% of the total number of readings. The test will perform a large number of readings and 90% or the must must be correct.

Test #10141 - Livestock Well-being Test

Description: The test will determine the ability to store and save the old biometric readings of a given livestock and view the full complete history of the livestock health with past health alerts(refer to section 7c for information on the alerts).

Test #10151 - Generate Livestock Health Alert Test

Description: The test will determine if the system could generate the correct colored alerts.Also, the test here could be a negative test of which the system is tested to attempt to generate the wrong colored alerts (unlike **Test#10111** of which is an attempt to be a positive test).

Test #10161 - Environmental Reading Test

Description: The test will determine the environmental alerts system is functioning properly based on the environmental readings and the weather information that is occurring currently at a given location(refer to section **7c** for more information about the environmental alerts). The test should be very similar or a combination of **Test#10111** and **Test#10151** .

Test #11111- Complete Database Linking Test

Description: The test will determine if the data being collected during the system use is stored properly and could be restored correctly for a given farm, so linking

the farm with the database is determined to go in both directions.

Test #12111 - Data Loss Minimization Test

Description: The test will test if the data collected for a given farm is obtained with a less than 5% loss margin. The data will be tested to determine if the reading collected is guaranteed to be saved at a rate of 95% at any point of time.

Test #12221 - Fine Precision Test

Description: The test will determine if a biometric with floating points has a margin of error in rounding less than or equal to 0.001% for a given reading of a given animal. So, if the number is 3.145 and the reading is 3.144 it should be accepted reading.

Test #12311 - Animal Capacity Test

Description: The test will determine the amount of animals that the system could collect and handle their data at any given point of time of which the system must be able process 1-2 million animals without any delay of disturbance and behave normally.

Test #12312 - Various Locations Test

Description: The test will determine the ability of the system to pull a massive amount of data from at least 10 different locations with a given 30 km distance between each location and pull that data for 1-2 million animals at once.The test will utilize **Test #12311** and combine location testing to generate this test.

Test #13111 - Biometric Uptime Consistency Test

Description: The test should determine during a 24 hours of constant testing that the biometric reading subsystem is functional for 85%-90%. The test should perform a consistent call for the system during a 24 hour period every 1 minute and collect the overall up and down time to evaluate the test.

Test #13121 - GPS Uptime Consistency Test

Description: The test should determine during a 24 hours of constant testing that the location reading subsystem is functional for 85%-90%. The test should perform a consistent call for the system during a 24 hour period every 1 minute and collect the overall up and down time to evaluate the test.

Test #13211 - Uptime Longevity Test

Description: The test should determine during a 24 hours of constant testing for the entire system with all of its subsystems to evaluate if it is functional for

85%-90%. The test should perform a consistent call for the system during a 24 hour period every 5 minutes and collect the overall up and down time to evaluate the test.

Test #13311 - Offline Mode Test

Description: The test should determine during a 24 hours of constant collecting of data for a biometric readings for a given location to be stored at the local subsystem in that farm and remain safe after the time period is over(24h) and being upload to the system servers after that, and that data could be collected every 15 minutes .

Test #13411- USDA Compliance Test

Description: The test should evaluate the methods and the way of which the microchips are implemented to match the requirements of USDA.The tester could request a support from the USDA.

Test #14111 - Regular Maintenance Test

Description: The test should evaluate the effectiveness of the system maintenance of which it should determine the amount of errors it has found as a result of constant maintenance evaluation. The time period should be on weekly to monthly basis and it should calculated by **(user found issues / system maintenance issues**) * 100 to be less than 50%. This is just one method to determine that the maintenance is effective.

Test #14211 - Support Call Test

Description: The test should evaluate the effectiveness of the system support by performing a constant call for the support office during random calls in every single hour of the day during 24/7 of the week. So, the measurement should be at least a single call every hour and it should be with a response time of +95% of the time with an immediate response at every given support call location. Finally, the rate for solving the issue should be above 50% of the time.

Test #14212 - Sudden Issue Test

Description: The test should evaluate the effectiveness of the system support by performing a constant call for different types of issues including both technical and non-technical issues .The rate for solving the issue should be above 60% of the time for all types of the issues that are being called for by clients.

Test #14311 - Mobile Compatibility Test

Description: The test should evaluate the ability to use all the mobile features on a wide variety of mobiles OS (specially it should work for Android). For Android

it must work on Android 6 and above with all types of screen sizes. For IOS it should be valid to work with IOS 12 and above.

Test #14321 - Windows Compatibility Test

Description: The test should evaluate the ability to use all the mobile features on Windows XP and above. All the functionalities should be working in every single OS above Windows XP.

Test #14411 - Different Locations Data Reading Test

Description: The system should be able to read data from at least 10 separate locations and ensure the accuracy of 90% of the time and all the functionality of the system should be working for 9 out of 10 locations.

Test #14421 - Physical Chip Check Test

Description: The system should issue a constant check for the physical test of the chips at a given location, the system must be able to find areas with 10-20% chips issues for at least 90% of the time in any size farms.

Test #15111 - Unauthorized Access Test

Description: The system should prevent more than 95-98% of unauthorized access to the system across any location at any given period of time. The system must also test unauthorized access by hackers who try to access it using social engineering by calling the support center.

Test#15112 Third-Party Access Test

Description: The system should prevent more than 96-99% of access to the system across any location at any given period of time for a third-party software or people who are a member of the client's organization but try to exploit the system.

Test #15211- Database Backup Implementation Test

Description: The system should ensure that 95-98% of all the Database backup is valid to be restored and the system should also ensure that the backup is issued and performed every 3 hours with a falling rate of 95%.

Test #15311 - Data Depersonalization Test

Description: The system should ensure that 90-95% of all the data in the database is distributed across many locations(servers) and not in a single location. The system must evaluate the servers' location response during a 24 hours testing period and get the expected result.

Test #15321 - Data Encryption Implementation Test

Description: The system must ensure that 99% of all the data that channels across the system is encrypted, and that should test every single data collected it can not be read and it is not in its raw format(stored and passed to the servers).

Test #15411 - Data Requisition Test

Description: The system must ensure that 95% or above of all the data request is met without any failing with a constraint that the system must up in all of these tests.

Test #15511 - Firewall Implementation Test

Description: The system must ensure that 95% or above of all attempts to break into the system if caught by the fire wall in a given period of at least two weeks.

Test #16111 - Usability Test

Description: The system should be designed so that single blind beta tester runs on testers with no prior knowledge of the system and how it operates should be able to navigate to a specific page or location within the system (i.e. the data profile of an animal displaying its blood SpO_2 levels) within the time threshold of 10 minutes or less consistently. The demographic of beta testers should be prioritized to be within the primary demographic of our majority target user base - older individuals with little to no prior experience with this level of web/mobile application.

Test #16211 - Language Personalization Test

Description: The test should be a thorough overview of the software once the multiple languages are implemented to make sure that 1:1 English translations are as accurate as possible, especially since we are dealing with vital medical terminology, and that translation is complete with no sections bearing incorrect or incomplete translations. Target languages - based on frequency - should be Spanish, Chinese, Tagalog, and Vietnamese.

Test #16311 - Fast Pace Learning Test

Description: The system should be designed so that single blind beta tester runs on testers with no prior knowledge of the system and how it operates should be able to perform basic and required functions such as signing in, registering new livestock, managing alerts, and complex page navigation with 0-5 errors in between steps and taking up to the 10 minute time frame (see **Test #16111**) to accomplish a task without further prompting or guidance.

Test #16411 - Simplified Presentation Test

Description: The test should run test numerical data that is based on different sensors and different units of measure (i.e. blood pressure and white blood cell count) through the system on the back-end through a placeholder microchip and determine that 100% of all numerical data is converted in some way or form into an English language presentation of a diagnosis or a status alert regarding the measurement.

Test #16511 - TTS Implementation Test

Description: The test should go through various areas of the system where there are either large chunks (>2 sentences) of text or key text phrases (i.e. an alert message) and return a generic text to speech audio representation of the target text with a 100% success rate, even counting for medical terminology not found on standard TTS services.

Test #16611 - User Manual Development Test

Description: The test should confirm that a user manual going over basic application functionality, microchip installation, and courses of action for troubleshooting common issues and handling events such as alerts or system breakdowns are developed. This manual should also meet the usability and learning requirements previously laid out (see **Test #16111** and **Test #16311**).

Test #16711 - Training Test

Description: The test should confirm that a system of technicians is in place (depending on size, a team of 1-10 people) to go around to end users and certify them on proper usage of the application, especially with regards to installing the microchips.

Test #17111 - Color Test

Description: The test should consist of polling users and recording their feelings concerning the color scheme of the application while using it. Pollers should take note of color schemes that detract from the ability to navigate the application or diminish the severity of the alerts generated and sent to the users.

Test #17121 - Dark Color Test

Description: The test should consist of polling users and recording their feelings concerning the color scheme of the application, with particular attention to the use of the application during night hours. Pollers should take note of mentions of eye strain or fatigue while using the application, especially if it were to discourage the users from using the application altogether.

Test #17211 - Simple Style Test

Description: The test should consist of polling users and recording their feelings concerning features and their layout on the application. Pollers should take note of mentions of superfluous information, animations, GUI designs etc and whether they detract from the overall ability to use the application.

Test #18111 - Farms Usage Test

Description: The system should be tested on a test site simulating its working environment over a period of up to 1 year. During this 1 year trial period, all functionality should be within the testing parameters laid out by other tests and all non-functional components should also be re-determined at that time.

Test #18211- GPS Interface Test

Description: This test that the system should be able to interface with existing GPS systems, i.e. Google maps, and be able to accurately detect the location of a microchipped livestock with accuracy within 100 meters.

Test #18311 - Software Installation Test

Description: The test should confirm that the software portion of the system can be successfully installed and operated on the devices and systems noted earlier (see **Test #14311** and **Test #14321**) in 100% of cases and that the system can only be successfully installed and operated when set up through desired channels.

Test #18321 - Hardware Installation Test

Description: The test should confirm that the hardware portion of the system can be easily installed with upwards of an 85% success rate and that, once installed, the system begins immediately reading and sending biometric data within the established accuracy and precision standards (see **Test #10131** and **Test #12221**). In case of incorrect installation, the system should be able to be easily removed with a 95% success rate.

Test #18411- Update Criteria Fit Test

Description: The test should confirm that any updates to the system (software or hardware) should not result in a loss of functionality for the user, meaning that new features implemented do not confuse the user's general use of the application. Users should be polled after software updates to confirm that confidence navigating the application remains at an 80% success rate.

Test #18421 - Update Timeline Test

Description: The system should issue an update every two weeks. The method for testing should monitor the system for 6-12 months and report at least 95% updates issued by the system.

Test #19111 - Culture Fit Test

Description: The test should primarily consist of the comfortability of the target demographic (Farmers) with navigating the application and utilizing the various features designed.

Test#19211 - Health Check Test

Description: The test should be a thorough overview of the quality of the animal products heading to market up to one year after the implementation of Lyfestock. This test will be deemed successful if there is a noticeable increase in quality of animal products.

Test#20211 - Standard Compliance Test

Description: The test should be designed to evaluate that the implementation of Lyfestock adheres to industry standards regarding software design and implementation while also adhering to the USDA and AWA guidelines for microchipping animals.

III. Design

22 Design Goals

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

Your text goes here . . .

23 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 . . .

24 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.

24a   Initial System Analysis and Class Identification

SV: Perform grammatical and similar analyses to identify the most import 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 . . .

24b   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 . . .

24c   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 . . .

24d   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 . . .

25 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.

25a   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 . . .

25b   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 . . .

25c   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 . . .

25d   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 . . .

25e   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 . . .

25f   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 . . .

25g   Application of Design Patterns

Your text goes here . . .

26 Final System Design

Your text goes here . . .

27 Object Design

27a   Packages

Your text goes here . . .

27b   Subsystem I

Your text goes here . . .

27c   Subsystem II

Your text goes here . . .

27d   etc.

Your text goes here . . .

II 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 . . .

III 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 . . .

IV 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.

V 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. }