Enhancement One: Software Design and Engineering

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Briefly describe the artifact. What is it? When was it created?

The artifact selected for Category One, Software Design and Engineering, is coursework completed in IT-145: Foundation in Application Development. This software is a console application written in the Java programming language for the client Grazioso Salvare and their rescue animal operations, and was an introduction to many new concepts, including object-oriented programming. This application displays a menu system in a console environment and allows the user to select different options, ranging from the intake of a new animal, displaying all the registered animals, and updating the status of the animals. One of the downfalls of this application is that it was based on a console application that is not very user-friendly, and it did not have the ability for the data to persist across multiple application runs.

Justify the inclusion of the artifact in your ePortfolio. Why did you select this item? What specific components of the artifact showcase your skills and abilities in software development? How was the artifact improved?

This artifact was chosen because it demonstrates my ability to take a code base that has been written in another programming language, Java, and refactor it into another language, Python, to take advantage of some of the libraries that the programming language offers to improve the software in two key areas, usability and data persistence. By using the built-in tkinter libraries of Python, I am able to build out a GUI that allows the user to interact with the software more efficiently (Figures 1 & 2) and allows for a separate window to be used for registering new animals (Figure 3). To solve the issue of data persistence, I developed a simple file input/output

system that saves the data into JSON files that allow for the data to persist even after the

application closes.
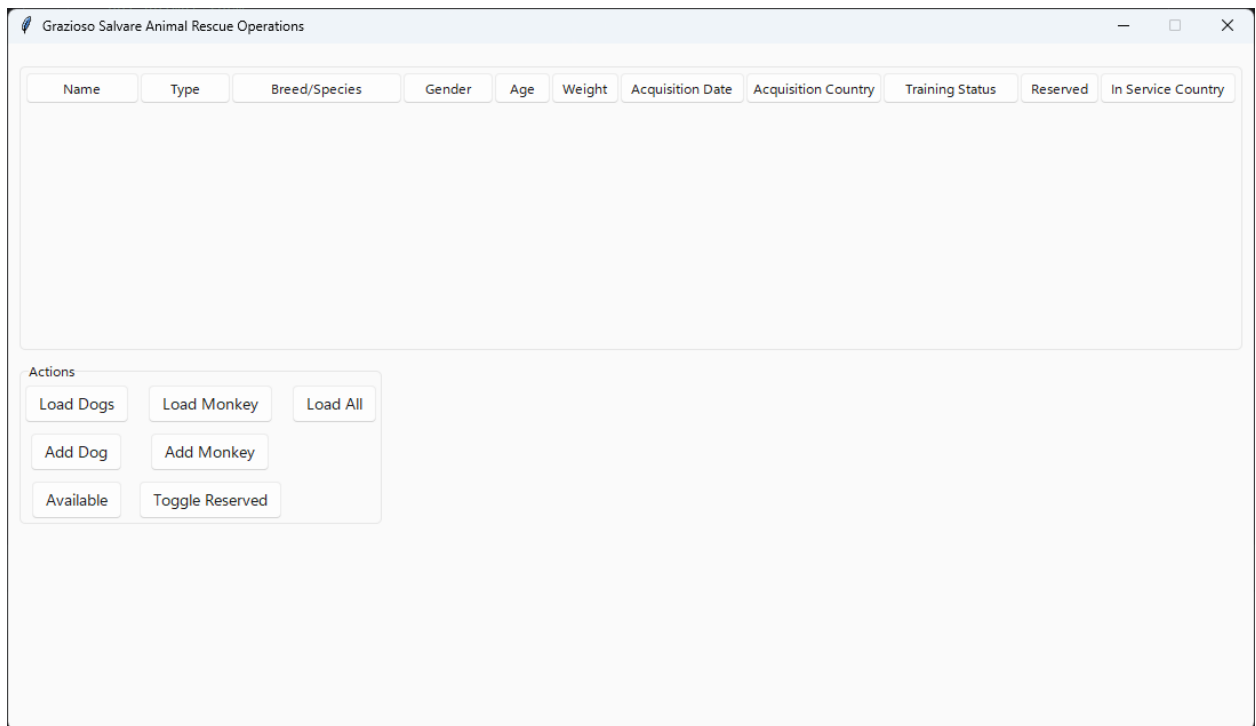
Figure 1 – Main Application Window

Name	Type	Breed/Species	Gender	Age	Weight	Acquisition Date	Acquisition Country	Training Status	Reserved	In Service Country
Padfoot	Dog	Doodle	Male	5	75	2025-05-04	USA	In Training	No	USA
Luna	Dog	Doodle	Female	8	80	2025-05-04	USA	Fully Trained	No	USA
Pepper	Dog	Newfoundland	Female	6	85	2025-05-04	USA	Fully Trained	Yes	USA
DOG	Dog	German Sheppard	Female	5	50	2025-05-05	USA	In Training	No	USA
George	Monkey	Capuchin	Male	5	15	2020-05-12	Brazil	Trained	Yes	USA
Lulu	Monkey	Guenon	Female	4	12	2021-07-21	Cameroon	Not Trained	Yes	Canada
Max	Monkey	Macaque	Male	6	18	2019-11-30	India	Trained	No	USA
Ruby	Monkey	Marmoset	Female	2	5	2022-03-15	Peru	Not Trained	Yes	Australia
Charlie	Monkey	Squirrel Monkey	Male	3	10	2020-08-10	Costa Rica	Trained	Yes	USA
Tina	Monkey	Tamarin	Female	1	6	2023-01-05	Brazil	Not Trained	Yes	Mexico

Grazioso Salvare Animal Rescue Operations

Actions

Load Dogs   Load Monkey   Load All

Add Dog   Add Monkey

Available   Toggle Reserved

Figure 2 - Main Application (Data Loaded)

Figure 3 - Add Animal Window

Did you meet the course outcomes you planned to meet with this enhancement in Module One? Do you have any updates to your outcome-coverage plans?

Yes, I have met the course outcome that I have set out to address, while also touching on some others that I have laid out below:

[CS499-01] Employ strategies for building collaborative environments that enable diverse audiences to support organizational decision making in the field of computer science.

This enhancement employs a modular structure and is well-documented within the code base, while also delivering a templated readme that includes screenshots of the application and contains instructions on how to install the application on both Windows and macOS/Linux systems.

[CS499-02] Design, develop, and deliver professional-quality oral, written, and visual communications that are coherent, technically sound, and appropriately adapted to specific audiences and contexts.

For this enhancement, I have met this criterion by the inclusion of this document. I have also met this outcome by the inclusion of docstrings at the top of each module that describe the purpose of the code and what it is accomplishing, and a well-templated readme that is targeted to a technical audience.

[CS499-03] Design and evaluate computing solutions that solve a given problem using algorithmic principles and computer science practices and standards appropriate to its solution, while managing the trade-offs involved in design choices.

This enhancement used algorithmic principles and computer science best practices to solve the issues with software usability and data persistence, while considering any trade-offs that need to be made to improve the functionality. Also, during development, I used GitHub Actions for automatic unit testing and code analysis.

[CS499-04] Demonstrate an ability to use well-founded and innovative techniques, skills, and tools in computing practices for the purpose of implementing computer solutions that deliver value and accomplish industry-specific goals

By refactoring from Java to Python and introducing a GUI framework and data handling logic, I employed industry-standard techniques to modernize the application and improve user interaction and allow for data to persist on subsequent runs of the application. Furthermore, by implementing GitHub Actions, I implement continuous improvement/continuous development workflows, such as code analysis and testing.

[CS499-05] Develop a security mindset that anticipates adversarial exploits in software architecture and designs to expose potential vulnerabilities, mitigate design flaws, and ensure privacy and enhanced security of data and resources.

I believe to have met this outcome by using GitHub Actions' built-in workflow, CodeQL. According to Budzynska (2024), "CodeQL is a static analysis tool that can be used to automatically scan your applications for vulnerabilities and to assist with a manual code review" (Budzynska, 2024).

Reflect on the process of enhancing and modifying the artifact. What did you learn as you were creating it and improving it? What challenges did you face?

The process of enhancing and modifying the artifact to reach the goals that I had set forth was satisfying when the application reached different milestones during the development. The first milestone that I had set for myself was refactoring the animal data classes into Python, which were reached fairly quickly. The next milestone that I had set for myself was to implement the file input/output to save the data in JSON format. I had some trouble at first due to the time that had passed since I had done this in one of my previous courses, but it was quickly rectified. This is where I began to implement some static testing to make sure that the code was functioning as intended. The last milestone that I had set for myself was the design and implementation of the GUI. I have had some experience in the past with working with tkinter, so that did play into my hands. As I completed the GUI, I encountered some new ways to implement the layout of the action buttons that would allow for the code base to shrink in some areas but still carry out the same functionality. Also, this was the first time that I have used the treeview of tkinter to allow for the data to be displayed in the same manner as a table. After the main code base was completed, I set about using a linter for the first time to make sure that I was following best practices in how the code was templated. This allowed me to improve upon how the code looked and its readability. Overall, I am impressed that I turned this simple console-based application into a full-on desktop application.

References

Budzynska, S. (2024, June 21). *CodeQL zero to hero part 2: Getting started with CodeQL*. The

GitHub Blog. https://github.blog/developer-skills/github/codeql-zero-to-hero-part-2-getting-

started-with-codeql/