**CS 499 Module Four Milestone Three Narrative**

Andrew Emilio DiStefano

SNHU

Professor Neil Kalinowski

May 31, 2025

**Part One:**

1. **Have you changed your career plans? If so, what prompted this change? If not, why have you remained with your original plan?**

I have not changed my career plans, and there are many reasons for which this is the case. Among them is the fact that I have been planning to develop skills as a robotics software engineer since before I started pursuing my degree. Defense-oriented robotics is what I am passionate about and I truly believe that my life’s purpose is to help keep our nation and her allies at the cutting edge of robotics autonomy. What I have learned during my time in the Computer Science program at SNHU has served to further my belief not only that this is an achievable goal, but that I am not incredibly close to achieving it.

1. **How has your thinking about your career evolved?**

My thinking about my career has become more refined through my learning of different aspects of software engineering throughout this program. Now that I have written programs for embedded systems, I understand what the development of robotics software would look like and how it would run on a single-board-computer or microcontroller. Now that I know how to implement complex data structures and use non-relational databases, I can imagine how these components would be used in robotics projects. Learning about front-end design and development gives me an idea of how I might create an intuitive user interface for relatively non-technical robotics system users.

1. **Have you completed any research about your choice of career? How has this impacted your thinking? Have you thought about seeking an advanced degree or certification after earning your undergraduate degree?**

I have spent the past three years researching my choice of career, primarily because I work as a recruiter for robotics companies in the defense industry. I frequently recruit professionals into positions very similar to that which I would like to work in, and I have developed a firm understanding for what these companies are looking for in a software engineer. One important detail which has become apparent to me through my research and experience over the past few years is that I would definitely like to work for a smaller company or a start-up than a large company full of bureaucracy and ritualism. My clients up until this point have all been start-ups, and the satisfaction of my placed candidates suggests that the type of work that is done for start-ups is far more rewarding than the work which is usually done by most software engineers at large companies.

1. **Which course outcomes have you achieved so far, and which ones remain?**

I have certainly touched on the first four of the course outcomes in what I have accomplished so far in this course. My use and citation of open-source libraries in my MemoryBot project shows my commitment to employing strategies for building collaborative environments that enable diverse audiences to support organizational decision-making in the field of computer science. My comprehensive documentation and easily interpreted ReadMe instructions show my ability to design, develop, and deliver professional-quality oral, written, and visual communications that are coherent, technically sound, and appropriately adapted to specific audiences and contexts. My choice of an inverted index as my data structure rather than the binary search tree which I had originally planned on using for question-answer querying displays my proficiency in designing and evaluating 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. My implementation of an inverted index, which is the same data structure used by popular search engines like Google (Slawski, 2021), demonstrates my 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. My upgrade from a *TXT* to a *JSON* data file, which greatly facilitates the potential future integration of a non-relational database system such as *MongoDB*, has also contributed greatly to my achievement of this course outcome.

Up to this point, I have touched less on the fifth course outcome of developing 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. While I have been taking note of important security features to add to the MemoryBot system, I have yet to implement the actual functions which will accomplish this. This is not one of the more difficult areas of this project, and I am confident that these functions will be relatively easy to write after having successfully implemented an inverted index which reads and writes to and from a *JSON* file.

**Part Two:**

Provide an update to your instructor on your progress with each category of artifacts for the ePortfolio:

* **Software design and engineering**

I have mostly focused on my MemoryBot project this week. I spent a great deal of time comparing and contrasting different data structures for use in this program, and I came to the conclusion that a binary search tree (or any search tree for that matter) would not likely be the best data structure for this project. Since questions will rarely end up being written exactly the same way twice, a data structure which requires exact key matches to reveal the value associated with said key is not the best choice for this situation. Since I want the system to be able to infer the question that a user is asking along with the appropriate answer, I need a data structure that can facilitate this behavior by the system. Based on my research, an inverted index is an ideal data structure for this purpose.

* **Algorithms and data structures**

My implementation of the inverted index this week resulted in a functional program which is able to interact with a user and print the appropriate answer from question-answer (key-value) pairs is something that I am quite proud of. My search for this data structure leverages the ingenious design of this data structure type and allows questions to be compared to the question asked by the user so that the most appropriate answer to said question can easily be found. The function achieves *O(t \* q)* time complexity, *T* being the number of words in an input string and *Q* being the number of questions with matching words. This essentially means a less efficient time complexity than would be achievable through the use of a balanced binary search tree, but the added functionality of finding the appropriate answer rather than simply the first answer with a substring in common will greatly enhance the system’s ability to produce useful output for the user based on their input. *O(t \* q)*  is certainly an acceptable time complexity, and the difference will not be noticeable for users even if the data stored in the system contains thousands of key-value pairs.

* **Databases**

I am proud to say that I have completely done away with the use of a *TXT* file in the MemoryBot program, and that the system now uses a *JSON* file to store data while the program is not running. This chance was not originally stated in Module One, but using a *TXT* file for data storage and processing felt amateurish and frankly unacceptable for a professional-level program. Having made this important change to the MemoryBot project, the system could easily be connected to a *MongoDB* database.

### **Status Checkpoints for All Categories**

| **Checkpoint** | **Software Design and Engineering** | **Algorithms and Data Structures** | **Databases** |
| --- | --- | --- | --- |
| **Name of Artifact Used** | PlantSitter | MemoryBot | PlantSitter |
| **Status of Initial Enhancement** | Initial enhancement almost complete | Initial enhancement almost complete | Initial enhancement still needs work |
| **Submission Status** | 80% | 80% | 20% |
| **Status of Final Enhancement** | This enhancement is very close to being finished. The functions are all ready to receive data from the soil moisture sensors. The sensors were supposed to arrive this week but unfortunately there was an issue with the delivery. If I am unable to procure them by mid-next-week, I will add air moisture sensors instead (of which I already have several). | This enhancement is also very close to being finished, as the system is already up and running with the functional inverted index data structure and search algorithm. There are still bugs which need to be ironed out, including the fact that the appropriate answer is put to output once for every shared word between the user input question and the question for the appropriate question-answer (key-value) pair in the *JSON* file. | I am still in the research phase for my implementation of the RedustStore database. I do not think that this will be especially difficult, but the correct implementation of an advanced data structure which I had never even heard of let alone implemented before researching for this project took up the majority of my time this week. Next week I will be focusing on adding ReductStore database functionality to my PlantSitter system. |
| **Uploaded to ePortfolio** | Yes | Yes | Yes |
| **Status of Finalized ePortfolio** | Currently posted and public | Currently posted and public | Currently posted and public |

**Sources:**

Slawski, B. (2021, July 9). *Google’s Inverted Index of the Web*. Seo by the Sea.

<https://www.seobythesea.com/2021/07/inverted-index-of-the-web/>