Data Analysis: Creating A Virtual Platform to Test the NGS Shipboard

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Abstract

One of the biggest problems encountered while I was working as a software engineer intern for the United States Navy was the lack of a platform to analyze data from various naval gunfire support shipboards. In order to thoroughly test naval gunfire shipboards, we designed a virtual platform that would allow us to record data from different virtual systems. We modeled and designed a next generation simulation (NGS) shipboard that made it possible to multicast to a virtual machine and record data from different ships. Using scrum and agile methodologies, we were able to model and outline requirements, as well as implement a virtual platform in our program. Major outcomes from this project were a next generation simulation of various naval gunfire support ships to test accuracy and different components crucial for the U.S. Navy. Future work to be done on the NGS shipboard includes additional testing to identify bugs and errors throughout the application to ensure that it is recording accurate data.

1. Introduction

The United States Navy is a seaborne branch of the military of the United States. Their mission is to deliver ready naval forces to win conflicts and wars for the United States. I worked for the navigation team during my internship and our main objectives were where to work with navigation and combat system of naval gunfire ships. We needed a platform for testing the navigation and combat ranges of different naval gunfire ships to ensure that we were equipped and organized to deliver naval forces to battle in conflicts and wars. We modeled and designed a next generation shipboard that allowed us to record data from different ships. During the modeling and design stage of the project, we needed to find a way that we can record and parse information efficiently.

Having learned how to parse information through a previous internship, I taught my team different techniques of data parsing and how to implement it in the NGS shipboard. Using Python and Beautiful Soup, we were able to create data scrapers to analyze and record data for the virtualization of ships, which was crucial because we needed to examine real time monitoring tools for lab-based testing.

2. Related Works

Virtual reality is a computer-generated simulation that can model real-world experiences. Many industries are using virtual systems to help test different situations to record data and analyze information in order to reduce future risks.
Another place we may see a virtual platform used is in the automotive industry. There are different use cases of VR in the automotive industry such as prototyping which is designing a model before building it and testing design requirements and developments. VR can be utilized to test numerous things in a car such as the safety, reliability, and much more. This is similar to the work I did as it shows how VR is used in different industries, serving similar purposes like testing, and prototyping different components.

Another related work would be through a previous internship during the summer of 2021. I interned at Flag Media Analytics as a software engineer intern and my tasks were to develop site parsers for different news media outlets for clients. We needed to retrieve data and extract

information efficiently for our clients. From the experiences I gained from my internship at flag media analytics, I was able to use those skills and create parsers enabling me to extract information from the next generation simulation and to analyze the data efficiently.

An automotive industry-related article published by the Ford MotorCompany (2022) presented the reasons they utilize VR in their auto design work. In particular, this method saves time and money, allowing engineers to find potential issues and do a redesign without having to build the entire vehicle. This was also a reason the Navy chose to utilize virtual reality in their design of work because itwould save time to model and test ships.Sulcas, (2021) published one of the mostrecent studies related to site parsing during my time at my previous internship. That,along with my prior experience with site parsing for Flag Media Analytics influenced my decision to utilize this technology in the Navy simulation project. We needed to find a way to take all the data and analyze it but going through it manually would take too much time. With learning concepts of data parsing and analysis, we were able utilize that technology in our project.

3. Process Design

The process design of my project consisted of three major elements: 1) Process Design; 2) Site Parser Design Requirements; 3) Website Repository Requirements; and 4) Challenges. These elements all led to help the overall process design of the project.

3.1 Project Design

A lot of planning went into designing the NGS shipboard. While working on the project, we use agile based software development. Agile development practices include where requirements and solutions are evolving and being modified through collaboration between cross-functional teams. Prior to beginning the project, we met with our team lead to discuss requirements that needed to be implemented in the project. After planning and discussing the first part of our requirements, each team took on different takes of the project. Every two weeks, we held sprints to demo the progress on the project.

I was taking on the data analysis requirements of the project so I was on the Navigation and analysis team. While other teams were building the NGS shipboard, the Navigation and Analysis team needed to find a way to gather all the information at once and analyze the data efficiently. Our goal was to create a data scraper that would allow us to parse data efficiently and extract information that was essential to testing phases. While building the NGS shipboard, we realized that we had no location where all our teams could access this information. We needed to keep a website repository for all the data analyzed so I was also given the task of supporting the data management repository development project, which involved designing and creating a wiki page using confluence for all the extracted lab-based testing data.

3.2 Site Parser Design Requirements

For our site parser design, we needed to make sure that we were extracting key component essential for lab-based testing. While the ships were being tested on the NGS shipboard on a virtual machine, all the data was just being thrown onto a website. Since all the information was being sent to a website, I informed the team we could use Python and Beautiful-Soup, a Pythonpackage for parsing HTML documents. We started by designing a database model that

would highlight all the data that would have to be extracted.

We then designed a data parser and implemented unit and integration testing to ensure the correct information was being extracted. Since there was so much data being pulled initially, we followed a specific algorithm we had designed to ensure that the most accurate data was being extracted. After performing unit and integration tests, we were able to implement it inside the NGS shipboard so, instead of having to analyze the data manually, data was being analyzed and extracted constantly every time a ship was being tested.

3.3 Website Repository Requirements

After designing and creating the data scraper for the NGS shipboard, the Navigation and Analysis team noticed that there was online repository to keep all the lab-based testing analysis in lieu storing it on the computer locally where the virtual machine was running the NGS shipboard. I took on the task of designing a wiki page using confluence, a web-based wiki developed software. This collaboration tool for the workspace allowed me to easily design and develop a webpage that stored all the data. Specific requirements of the webpage included being able to search for certain documents, add and remove documents, and filter through documents. After designing a prototype, I developed the webpage and presented a demo to the team lead before it was approved for use.

3.4 Challenges

We faced many challenges throughout the project. Often the problemwas getting in communication with other teams. Since the team that was building the NGS shipboard worked in a classified lab, it would be difficult to get in contact with them since they would not have their devices on them in the lab or have access to devices to get in contact with us. Most of the time, we would need to work around our schedules and find times when all of us were available to set up meetings to discuss specifics of the project.

Another challenge I faced was that I was the only intern on the team and had difficulty finding help from others since my manager or mentor were always in different meetings. I solved that by scheduling meetings in advance.

4. Results

The results from this project were exceptional. The Navy now has a platform for testing multiple ships at the same time, and recording and analyzing data to see where the ships can be improved on. Havinga method for automating data instead of having to analyze it manually reduces the time needed to find accurate data andpotentially reducing human error. Testing ships at a faster rate which will speed the production of naval gunfire ships since we can implement changes to design and test theships faster in a virtual simulation rather than having to test them with real-worldexperiences.

5. Conclusion

The importance of this project was to be able to test numerous ships at the same time, making testing phases efficient before sending them out to battle. Working with a team of computer scientists, we modeled and designed a NGS Shipboard that enables recording data from numerous ships running at the same time, analyzing the different outcomes and determining whether the specifications are met.

With the production of the NGS shipboard, the Navy has a software that

allows them to efficiently test ships without having to manually work and test every ship before it is sent out. Another important element of this effort was supporting the data management repository development project. This allowed us to have a centralized location of all the reports that were collected from testing numerous ships. We designed the wiki page so that all files and data can be stored and found in one location, instead of the user having to scavenge for them.

6. Future Work

Although the development of the NGS shipboard was a successful project that allows us to test numerous ships and record and analyze data, there is still unfinishedwork to be completed. Additional testing will be performed on the NGS shipboard to identify bugs and errors throughout the application to ensure that it is recording accurate data. Also, while working on this project, my team and I learned a lot about virtual reality and working with virtual systems. After completing the project, we proposed the idea of utilizing virtual reality concepts throughout shipbuilding to make it possible for the interior of the ship to be builtfaster. The next phase of this project is to identify and resolve different bugs to ensure data is being read and analyzed thoroughly.

References

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