SPACE AND NAVAL WARFARE SYSTEMS CENTER

Summer Internship Experience

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Introduction

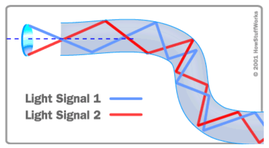
SPAWAR (Space and Naval Warfare) is the U.S. Navy's center for Command, Control, Computers, Communications, Intelligence, Surveillance, and Reconnaissance (C4ISR). Their goal is to ensure that the war fighter has the Command & Control data and Intelligence, Surveillance, and Reconnaissance data that they need to fight at the tactical edge. Their mission is to provide much of the tactical and non-tactical information management technology required by the Navy to complete its operational missions.

With locations across the globe, we were fortunate enough to be able to work at the SPAWAR Systems Center (SSC) Pacific, San Diego where it occupies a portion of the Point Loma peninsula. As student interns hired through our college, we were given the opportunity to spend a summer working at the site working with engineers and scientists.

Each of us worked in various locations from the Advance Technology Building, to the Automated Image Analysis building, to the Network Centric Warfare Analysis Branch. We were each individually given a mentor who we reported to and worked with. Our aim was to acquaint ourselves with the culture of the industry and to gain as much experience as we possible could in the ten weeks we were going to be there. We were given a ten week time frame to complete assigned projects by our mentors.

Methods

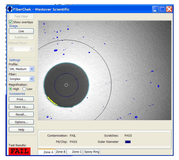
•The understanding of fiber optic communications is very critical in this field, therefore before doing any hands on work, some reading was assigned. The concepts and terminology of chapter 1 and 4 of a fiber optic communications book was needed in order to understand the physical application of fiber optics.



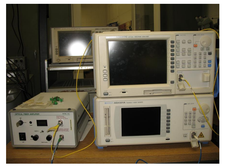
The signal in a fiber optic travels by bouncing between the cladding and the core.

•For the first couple of weeks we had to use customized software that allows us to understand fiber optics in real world applications. This software allows you to evaluate a fiber optic cable, and determine how good or bad a fiber is. We were given the task of determining the quality of the fiber optic cables and consult the results with our mentor.

Result of the quality of a fiber optic cable.



•The experiment was basically to collect data obtained from the spectrum analyzer and analyze it. The objective is to be able to determine the factors that affect the input power versus the gain. The main factors that we focused on were the input power, wavelength of laser and the current to run the EDFA. We had to get the graphs of each data to be able to compare visually.



The set up that runs the experiment consisted of three main devices, the laser source, EDFA (amplifier), and the spectrum analyzer.

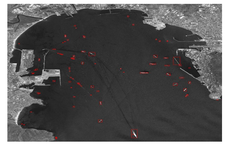
•Though we had minimal experience in networking ourselves, some of our mentors and co-workers were very experienced network engineers in network modeling and simulation, network design and architecture, and wireless networks.

Efficient networks are vital for transmitting data and communication for operational missions.

•While we were not able to work on an actual networking project, one of our mentors came up with an assignment that had us programming in java language to come up with a graphical user interface (GUI). The GUI was to work in conjunction with an existing program that generated a service map for a user chosen node (client/user). The service map would include details such as specific server locations, closest DECC (Defense Enterprise Computing Center) and defines where specific data service resides.

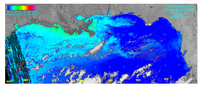
•Various programming languages and mathematical theories were required to understand the information that the RAPIER (Rapid Image Exploitation Resource) project needed. This was done by studying Visual Basic, C++, Java, and Matlab scripting as well as studying math theory and its applications to computer vision systems.

RAPIER system at work determining ships in the bay and recognizing them automatically



•One task was to analyze data and create excel spreadsheets that compared the data from RAPIER to AIS (positioning system for ships) to determine the accuracy of the RAPIER system.

•Another project was to determine the potential glare of an image based on the angle of the sun and angle of the satellite when the image is taken.



Reflectance image from NOAA, shows potential high image noise RAPIER might face

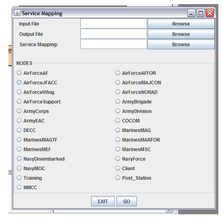
Results

•We were able to determine the quality of a fiber optic cable which is very critical in reducing losses and decide based upon the results whether the cable is good to use or not.

•The data collected from the spectrum analyzer confirmed what my mentor predicted, as input power increases the gain starts decreasing because of the output power saturation.

•Along with the service mapping GUI assignment, a class was attended on site for simulations with R computer language.

•Course activities included integrated lecture and in-class laboratory exercises.

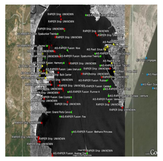


Service mapping graphical user interface

•The results of the RAPIER project is that the accuracy of the system, when compared to AIS, is fairly good. The results are around 70-80% accurate on most images when it came to length and width. Heading of the ships on most images was accurate to around 80-90%. This is before taking into account some ships being too close to one another which could be ignored for the time being since the system is meant for automatic detection of large vessels.

•The results of the graphical user interface is that it accurately projects a flat map to the user of the location of their ship and other ships by taking latitude and longitude data. Those points on the map are accurately represented and the curvature of the earth is considered when they are plotted.

Output of Rapier, which plots the ships in images on google earth,(graphical user view of ships)



•The results of the glint project (reflection of the sunlight on satellite images) is that the theory of specular reflection on a sphere is understood, however work on this project is still in process until the end of August 2009

Conclusion

While at times the internship experience may have been challenging, the knowledge and skills we've gained through it all is invaluable. Being given the opportunity to work with engineers and scientists allowed us to familiarize ourselves with the nature of our future career fields. Our mentors not only provided us with challenging projects and tasks, but also a fun educational experience.

Acknowledgements

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