Interactive Geo-visualization of Dynamic Radiation Level Change

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Nuclear technology has been developing and its usage expands over the past few years in a rapid speed. However, nuclear disasters such as the one happed in Fukushima Daiichi, Japan, back in 2011 brought up people's attention with its tragic and irreversible consequences. Researchers and general public are interested in up-to-date radiation data for their different purposes. We now can collect radiation data from geo-tagged sensors people placed around the states. The goal of our project is to provide an optimal way to present interactive geo-visualization of these dynamic radiation data.

Unfortunately, the raw data received from the sensors does not directly speak for the level of radiation for the monitored area due to other factors such as "weather conditions, naturally occurring radioactive materials (NORM), and large marble structures", which may affect the data in background (Myeong-Hun). In order to provide more meaningful and accurate data to meet different needs of various groups of users, our project will provide multiple ways to visualize and analyze the data from various perspectives with the input parameters set by users.

Working on the front-end part of the project, we will make sure to balance between performance and usefulness with speed and user experience. Our project face two main challenges. First of all, considering the huge streaming dataset we get from all the sensors, we need to come up with an appropriate algorithm to extract the information. We have more than 10 GB data produced each week, meaning we should find a way to ensure performance without sacrificing too much of the information obtained by users. Right now it takes hours for simple graphs to be rendered at the local machine. We will be researching on ways to finish graph rendering in seconds on our web application. There are many similar academic papers discussing ways of web-based visualization. For example, Kee's paper compares different interaction techniques such as SVG, HTML 5 WebGL Canvas with SVG, Processing.js and etc. (Kee). It remains our task to decide on the right tools and frameworks to use for this project. Lastly but not least, the way users interacting with the graphs needs to be straightforward and flexible. We want to tailor our product for the user groups we have. For accomplishing these goals, we will analyze and summarize users' need. We will need to be able to answer question like "How much does the fulfilment of each requirement worth to each type of users and to all of them in general?". Surveying or even talking to potential users is a great way for us to better understand their needs. It is also important to communicate with researchers of this project and discuss what features of the data are crucial and which part of the data we should emphasize.

This radiation application provides great potential benefits. Provided with reliable and accurate data sources, scientists can perform close observation and analysis on the dynamic changes of the radiation level. They can also monitor the speed of regression of radiation levels in different districts.

Hopefully, this would help capture signs of potential radiation threats and alert people when there is more than safe amount of radiation in their living area. The general public can also directly benefit from our app by getting easy access to information through our user-friendly interface if they are ever concerned about radiation in some area.

Nuclear technology has been rapidly developed and it became more and more common to be applied for commercial usage as opposed to only military usage. In an era where energy consumption has been growing exponentially and energy shortage becomes a huge problem, people turn to nuclear power for the huge potential it carries. It is not likely for us to give up nuclear power for its risk but meanwhile it is hard to completely eliminate that huge risk. We want to use our geo-visualization radiation application to help minimize the risk as much as possible.

We have successfully finished implementing the basic components of this web application in stage one, which include a map with sensor track information, a date selector, a menu where users can select the particular sensor tracks they want to inspect, a chart for radiation level VS. time and a chart for weather information (precipitation and wind level) of the corresponding day. We had a demo and review meeting with Dr. Myeong-Hun and he presented to his client Claire, who likes our product. During our meeting, we discussed what we have accomplished and what changes and improvements does Dr. Myeong-Hun want to see on our app. Currently Xinyao and I are working on revising goals and to-dos for stage two of the development of the app.

This summer at NCSA has been really meaningful for me. I especially love that I get to learn something new every day while at work. Our mentor, Xincheng, is always willing to listen and answer our questions in patience and we have been getting great ideas from him for problem-solving. But he is careful about giving us suggestions and hints rather than giving away his answers straight-up. I feel like I have learned not only the web-developing routines and skills, but more importantly how to solve problems myself and how to manage the project in order to be more organized hence more efficient.

References

Myeong-Hun Jeong, Shaowen Wang, Clair J.sullivan, Analysis of dynamic radiation level changes using surface networks, CyberGIS Center for Advanced Digital and Spatial Studies Cyber Infrastructure and Geospatial Information Laboratory, 2016

Kee, Daniel E. Comparing Interactive Web-Based Visualization Rendering Techniques. Tech. Tufts University. N.p.: n.p., n.d. 1-2. Print.