VISTA DATA VISION

Meteorological and Environmental Radiation Monitoring

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Introduction

A recent increase in local environmental radiation interest due to factors such as the Fukushima meltdown and national security concerns is what led to the prototype of an environmental radiation monitoring station at the University of Michigan. The purpose of this station is to create a streamlined monitoring system which collects and displays both meteorological and radiological data in live time in a setting that is easily accessible to the public. Displaying the combination of weather and radiation data allows users to interpret the radiation levels in the context of weather occurrences. Included in the collection are basic weather parameters and gamma radiation dose rates. Utilizing VDV's live display functionality made our parameters simple to both visualize and understand. This project is currently spearheaded by undergraduates Rebecca Lynch and Travis Smith, with the advisement of Dr. Kimberlee Kearfott of the University of Michigan Department of Nuclear Engineering and Radiological Sciences. Additionally, the set-up and continuation of this project would not be possible without the technical support from University employee, Jeffrey Weatherup.

Project Hardware

A Campbell Scientific CR1000 data logger was used with an Apogee solar radiation monitor, a Vaisala WXT520 weather station, and a Texas Electronics TE525 precipitation monitor. These devices collected all of the weather data for the configuration. A GE Reuter Stokes monitor was also used to collect the dose rate of gamma radiation. Collectively, the parameters monitored include solar radiation, temperature, air pressure, wind speed, wind direction, precipitation, and dose rates of gamma radiation.

Equipment Configuration

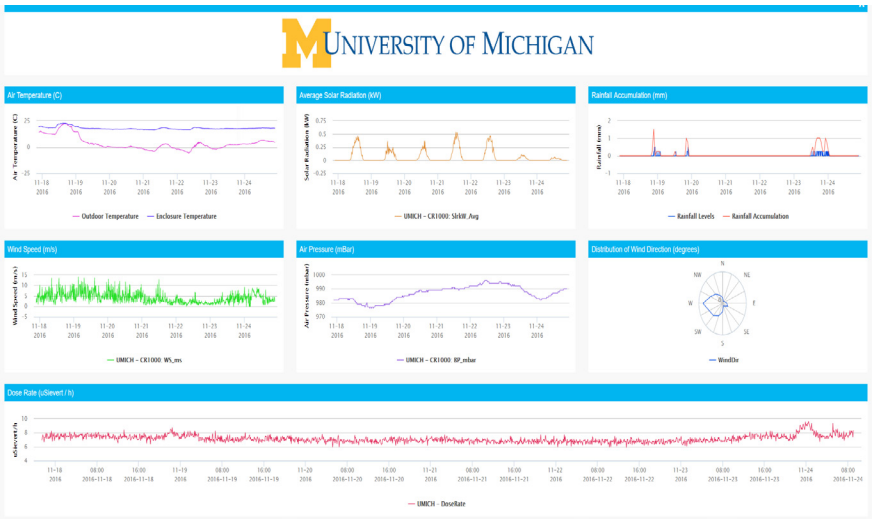
The equipment used in conjunction with the VDV display was mounted on the rooftop of the Mortimer E. Cooley laboratory at the University of Michigan. This required steel mounting equipment and a weatherproof, temperature controlled enclosure. Located outside of the weatherproof enclosure were all of the meteorological devices, as well as the GE Radiation Monitor. The data logger was kept inside of the enclosure to prevent water damage.

Data Transfer

Data from the data logger was communicated using the CR1000's software, known as LoggerNet. This software saved the data from each of the connected sensors in one concise .DAT file, which was then saved to a directory on the laboratory network. Syncovery was used to monitor the directory, and, upon detecting any modifications, send the entire .DAT file to the Vista Data Vision FTP directory. The data from the gamma radiation monitor was extracted from the device using a Java program, which communicates with the device

Configuration on the rooftop. The enclosure was mounted to the rooftop, with the data logger and backup power supply inside, and the GE Gamma Radiation Monitor, TE Precipitaiton Monitor, and Vaisala Weather station to the left of the enclosure.

by sending it a request, and receiving and interpreting the response. The response is then saved as a text file, which is automatically converted to a CSV file using a VBScript. Once the CSV file was created, containing a single data point, the same protocol was followed as the data logger, with the CSV file being saved in a directory on the shared laboratory network. Using Syncovery, the file is automatically transferred to the FTP directory as soon as it is saved.



Finished display using VDV. Variables (right to left, top to bottom) include air temperature, solar radiation, rainfall accumulation, wind speed, air pressure, wind direction, and gamma radiation dose rate. This capture demonstrates the spike in gamma radiation levels accompanying a spike in rainfall.

Using VDV

VDV was used largely to display our parameters in live time to allow users a chance to understand radiation threats in context with the weather in their area. For example, we had noticed occasional peaks throughout the fall in the levels of gamma radiation that were far greater than normal background levels. Upon using the VDV display to visualize the entirety of our collected parameters, however, we realized that these peaks uniquely correlated with occurrences of rainfall. Given further research, it was determined that this was a relatively normal phenomenon and did not pose any particular threats. Our use of VDV began in May of 2016 and has continued ever since. For our purposes, we collected data in "Near Real Time", with weather parameters collected in 10 minute intervals, and radiation data collected in 5 minute intervals. The data being sent to VDV has been continuously collected and monitored, with a few minor setbacks.

Server Overload

A recent issue was discovered with the realization that the data from the GE Radiation Monitor was not being updated on the display. Upon conferring with the technicians at VDV, we came to the realization that Syncovery was failing to discern between files that were recently added to a directory and files that had already been accounted for and sent to the FTP server. This resulted in Syncovery sending each data file in the directory to the FTP server. Eventually, this meant that thousands of files were being sent every five minutes. As a result, the FTP server experienced an overload and stopped updating the graph display. To resolve this, we configured Syncovery so that each file would be immediately deleted from our directory once it was sent to the FTP server.

Virtual Variables

One particular function of VDV that we found incredibly useful was the site's virtual variable function. The GE Radiation Monitor collects data in Sievert/hr, despite the fact that typical background radiation sits between 6-8 micro Sievert/hr. The result was a graph with very small values on the y-axis, making it difficult to interpret. Using VDV's virtual variable capability, we were able to configure a function which multiplied each value received from the GE Radiation Monitor by 10e-06, in order to correctly convert to micro Sievert/hr. This created a much more succinct display that was incredible simple to interpret and understand.

VDV Support

Throughout the entirety of our project and our time working with VDV, they were exceptional in providing a customized and unique display, and they delivered their product with outstanding customer service. Their technicians are always happy to explore new ideas and potential personalizations for our page, allowing us the chance to grow and display our project in the best way possible. Working with them has been incredibly simple and exceedingly satisfactory. They are quick to respond and highly qualified, making every inquisition, interaction, and technical difficulty a breeze to work through.

Conclusion

VDV has allowed us a platform for our prototype in order to showcase the effects of weather on local radiation, and explore the prototype of a real-time environmental radiation monitoring station. The flexibility of their staff and accessibility of their website has exceeded our expectations, and has given our data the platform that it needs to make an impact in radiation safety.