Geographic Information Systems and University Asset Management

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Abstract
The Physical Plant Geographic Information Systems (GIS) Initiative, began with the need to develop secure, digital data on campus infrastructure. This infrastructure includes assets managed by two divisions within the Physical Plant, Landscape Services and Maintenance Services. The GIS Initiative was made possible by enlisting the help and support of two academic programs within WMU. This was a mutual benefit, financially to the University, while providing professional experience for students from the College of Engineering and Applied Sciences and the Department of Geography. The GIS Initiative has grown from a program of unknown benefit to one that has likely saved WMU hundreds of thousands of dollars in outside contracts, engineering, and consulting. Much of the data created and maintained by the Physical Plant GIS can be accessed from both secure and public access web pages at http://gis.pp.wmich.edu.

Introduction of Organization

The Physical Plant at Western Michigan University is responsible for delivering public services to the pedestrian friendly campus consisting of approximately 25,000 students. This includes 151 buildings with 8,814,880 square feet of building space, over 1,200 acres of grounds, 23 lane-miles of roadways, 39 miles of walkways,13.4 miles of underground electrical cable, 2.2 miles of overhead electrical cable, 12.75 miles of steam and condensate lines, 6.59 miles of water lines, 6.94 miles of sewer lines, and 7.4 miles of storm piping.

The staff consists of engineers, technicians, skilled tradespersons and many others, all with the combined skills and abilities to maintain the wide variety of buildings and equipment on the campus. These services must be provided in a manner which minimizes disruption of the research, instructional and public service missions of WMU.

Statement of the Problem/Initiative

In the late 1990's WMU's Physical Plant staff knew it had a growing dilemma. Maintenance Services and Landscape Services had millions of dollars of assets, both above and below the ground. In order to secure funding for projects they need to have assurance that they know

where all their assets are located, as well as what condition they are in. Unfortunately, information on these systems existed primarily on old faded drawings, or in many cases only inside the minds of a select few experienced individuals. The Physical Plant knew having such knowledge about campus tied up solely into institutional knowledge would be a large speed bump as WMU continued to move into the digital age.

Design

Facility administrators from the Physical Plant had heard the statements from their colleagues in both the public and private sectors, suggesting that the future for utility and grounds asset management involved Geographic Information Systems (GIS). The key problem for WMU was that they were lacking the funding to go out and contract the collection of all this data in a digital format with an outside consultant, nor did they have the staff time or expertise to undertake such a task internally.

Instead of investing up to 1 million dollars into a program that at the time had an uncertain benefit, the Physical Plant moved forward with a small scale GIS Initiative that solicited the help from students from the Department of Geography and the College of Engineering and Applied Sciences. The University saved money by paying part-time student wages, while at the same time the students gained valuable professional experience that was relevant to the their field of study. In the worst case scenario the Physical Plant would get a better idea of the scope of their assets, and get the digital documentation they so badly needed. In the best case, all that would be realized, plus it would have a positive return on investment and play a vital role within the University as well as preparing its students for the occupations of their choice.

Initially, the student employees were managed by the Campus Utilities Manager and the Landscape Services Director. However, it was the students who where the driving force behind

the GIS Initiative. It was their knowledge of GIS data models and practices that drove the development of GIS data. The supervisors simply expressed what was needed and it was up to the students to design, complete and integrate the projects.

What is the value of knowing where all your assets are at the push of a button, or inversely, what is the cost of not knowing where your assets are? Absolute value is a difficult thing to ascertain to a program that ran for 10 years on supervisor input and student labor. The GIS has added value not only by saving dollars, but it has also provided unique knowledge on campus systems and helped staff make more informed decisions. In the underground utility world it might be best to think of this in terms of the cost and liability if something goes wrong. The best estimates put the 10 year cost between $500,000 and $600,000 dollars, or between $50,000 and $60,000 per year. This includes part-time student wages, a percentage of time for the supervision from full-time staff and contracted services, as well as hardware, software, and data purchases. The bulk of the money was spent on part-time student wages, and staff support. Also, significant cost savings was realized due to the fact that the Physical Plant was able to utilize a pre-existing, university-wide site license for ESRI GIS software. It can be said that at no time in the last 10 years of public financing in Michigan would the University have been able to make an upfront fiscal commitment of that size without sacrificing other infrastructure needs. The initial start up consisted of 2 Trimble Global Positioning System (GPS) data collectors, a power workstation pc, and the hiring of student staff, representing an upfront cost of approximately $20,000.

Since the addition of a full time GIS staff person in 2008, the GIS operates on a slightly larger budget, in the neighborhood of $125,000. This is comprised of one full-time staff member with benefits, 4 part time student employees and 4 PC workstations on a replacement cycle of approx 1 PC per year.

Implementation

The GIS Initiative can be broken into 3 generations of development.

Stage 1 – 1997 to 2001

During this initial stage the primary focus was on the student employees working in collaboration with full time staff to locate and collect data on the location of systems as well as the general properties of the systems. For Landscape Services this included starting a Tree Inventory of all trees on campus and tracking their species and size, as well as developing the digital base map of the University. A base map includes features such as water bodies, roads, sidewalks, parking lots and building footprints. For Maintenance Services and the Campus Utility Division, the focus was on locating the underground utility systems. This consisted of first recording the GPS position of features on the surface such as manholes or vault covers with sub-meter accuracy GPS receivers. Then the data collected was combined with field notes and staff would digitize the lines of each system accordingly.

Stage 2 – 2002-2007

In the 2nd stage of development, as the collection of data became closer to complete and the staff came to the realized that they needed a better strategy to manage the valuable data and keep it up-to-date. They also worked to ensure that there was a way for staff to access the gigabits of data that had been collected without having to be well versed in running GIS software. One of the solutions was to the solicit the help of the Physical Plants in house Network Services to work with a contracted software vendor to purchase an interactive web mapping application based on ESRI's ArcIMS. After it was implemented, it became apparent that the GIS data had become critical to day-to-day operations and the Physical Plant could no longer simply rely on students to maintain the data and an already over taxed IT staff to keep the web site current. Knowledge

on projects could not be effectively shared from student to student and much of the data became fragmented, and began to fall into disrepair. It was evident that something bigger was needed to best manage the investment that had been made.

Stage 3 – 2008 – current

The 3rd and current stage for GIS has seen the Physical Plant add a full time staff member. The GIS Initiative had grown too large to depend on the combined efforts of existing staff and student employees. In 2008 the position of GIS Manager was created at time of re-organization within the Physical Plant. This was necessitated by rough economic times throughout the State of Michigan. The position is part of a goal to fill the need for more services, despite a shrinking labor force by continually looking for ways to implement technology. The GIS Manager is principally responsible for managing the student GIS staff by coordinating their time with the needs of the Physical Plant, as well as the management of web content. This works to replace the time that had been spent by staff that lacked advanced GIS knowledge with a staff member versed in running a public GIS system. The GIS Manager would also take on the task of maintaining the ArcIMS web mapping application, which helped to alleviate an already overtaxed IT staff. *(WMU's Physical Plant GIS manager is available to discuss the secure access application with other colleagues.)*

Benefits

Beyond the best estimates of saving between $300,000 and $500,000 over the 10 year implementation of GIS, WMU has also benefited by going through the growing pains inherent in taking on a task with minimal help from outside contractors. Today WMU has 100% ownership of all their GIS and data, and has built a system that has evolved along with the University and is flexible in a way that serves the needs of WMU. Many staff members as well as student

employees have taken personal ownership of this program and speak very proudly of its successes. Also, the access to information has become much more efficient with the implementation of GIS. Utility Managers use the mapping website to confirm piping locations and sizing, Landscape services has used it to visually communicate grounds maintenance and tree plantings. The Service Center inside of Maintenance Services generates maps that are attached to Miss Dig requests to help expedite utility locates in a more efficient manner. On an annual basis Landscape Services uses GIS to modify and update their snow removal plan. Previous to GIS this was done quite literally with colored pencil and represented hours of staff time to conceptualize plowing routes and priorities. Maintenance Services is now expanding the data inside of GIS to help get a handle on condition analysis and the cost replacement value of existing systems.

In 2007 the GIS team participated in Google's "Model Your Campus" competition.

The scope of this project was to model all 151 of WMU's buildings in 3 dimensions (3-D) and submit them to Google for inclusion in the Google Earth database. The incorporation of rendering technology led to a new initiative that is now in its infancy where WMU is working to transform existing CAD drawings into 3-D renderings of underground utility vaults. This is an application which will allow anyone within the Physical Plant to view the actual layout of the vaults in 3-D, thus eliminating the necessity of one having to go through confined space training to simply see the contents and layout of a vault. Furthermore this data will be accessible from the ArcIMS mapping site.

Also, in 2008 the GIS partnered with the Network Services Application Developer to create a Google "Mash-up" of campus to more accurately give driving directions to points on campus. With a simple search for a campus building the user can get easy to understand driving directions

from any point of origin using the Google Maps routing system. This provided a solution to a long standing problem that WMU had of giving driving direction to certain buildings on the pedestrian friendly campus. This application also has links for the WMU parking map, as well as ADA accessibility information to help best route physically disabled students from point to point on campus. This was all done with existing knowledge inside of the Physical Plant. Without the availability of GIS data this would have been a large and potentially costly endeavor on its own. The interactive map for campus directions can be viewed at;

http://maps.pp.wmich.edu/interactive.

Retrospect

The GIS Initiative that WMU has undertaken over the last 10 years has seen an enormous development in the quality and security of vital information on university assets. When asked what we could have changed, the easy answer is to say that WMU should have searched the cushions to add professional staff or contract with a consultant to collect the data and implement the web applications. By spending more money this might have been completed over the course of a few years. The reality is that because of the way WMU went about obtaining this dataset, the staff at the Physical Plant has a unique understanding of GIS technology. This is knowledge that they likely would not have gained had they simply hired a contractor, and the systems in place are better because of the staff involvement. The key shortcoming to the program would likely be the lack of medium and long term plans from its outset. Then again in 1998 there were not that many models to follow for setting up a GIS office principally responsible for asset management. In fact before the Physical Plant went ahead with creating a full-time GIS position, they had looked at hiring a contractor to manage the program. The University was basically told they were beyond the services they had to provide.

Also, as a testament to what the Physical Plant has accomplished, there are several other municipalities in Southwest Michigan that have implemented varying degrees of the model used by WMU for asset management. The acceptance of, and reliance on GIS data services, coupled with the rate at which it continues to be used and implemented across the University are evidence to the positive impact it has on business practices at the Physical Plant and across WMU.