Abstract
Managing a vast array of assets on a large college campus poses many challenges and requires extensive planning, management, and coordination among different offices. In this research, we have developed a WebGIS based facilities management system to help optimize management functions including visualizing the campus assets and resources consumption across campus as well as identify problem areas to address the issues promptly. Existing data in AutoCAD format from the Facilities office was imported, georeferenced, and combined with other sources of spatial data. Energy usage from various meters across campus buildings were acquired to study the temporal variability in energy use over daily, monthly, and yearly scales. In order to make the data comparable across campus, various area and type, energy use was normalized using the heated square footage of the individual buildings. Analysis energy use shows that Furman’s Chapel is unique in being the highest energy consuming building (twice that of the second highest building per unit area). Energy consumption at the Chapel seem to be negatively related to the outside temperature, indicating that higher amount of energy is needed to heat the building during winter than cool it during the summer months. The ability to visualize any changes in energy consumption patterns or location of consistent problem areas can help track down potential hidden problems related to utility network or deferred maintenance. The WebGIS based Asset Map developed through this project will help improve the efficiency of operations and decision making process at Furman University.

Geographical Information System (GIS) is a collection of tools that helps to improve the efficiency of collecting, organizing, and analyzing a large amount of data with the goal to increase accuracy and speed of decision making. In the recent years, there has been a tremendous growth in the area of web based GIS mapping and modeling applications to increase the ease of use of the GIS program and its analytical capabilities without the need for technical GIS expertise. Until recently, most of the tasks involved in managing campus facilities have been done through CAD, which generally lacks the ability to reference the data geographically, include attribute data, and the ability to conduct some spatial analysis of the data. In contrast, GIS stores information regarding the physical location, additional information files and real world coordinates of any feature of interest. Mike (Cuthbertson, 2012) organizational big and small have embraced GIS for operations management and decision making. Redlands University, CalTech, King Saud University in Saudi Arabia, and Kaohsiung International Airport in Taiwan are some examples of organizations that have studied and implemented GIS for its abilities to map, monitor, and manage data in real time using mobile devices (Diamantini et al., 2012; Ho and Garni, 2012; Kartal and Longhi, 2012; Garni and ROMERO, 2008; King et al., 2010). Great amount of work goes into campus expansion or renovation projects, and having GIS based system can really help expedite and maximize efficiency (Gemelli et al., 2013). Given this context, the primary objective of this research is to develop and demonstrate a webGIS enabled Facilities Management system with some analytical capabilities and visualization capabilities.

Methodology
The facilities asset map created and presented here is the starting point in transforming the campus resources are managed, monitored, and maintained. The GIS core and the Web interface makes it possible for anyone without technical GIS background to be able use this as a decision making tool. Collecting the data for use in the map viewer for analyzing the building level energy use across campus shows a glimpse of the potential uses of the technology. The most notable feature of this tool is the ability to work across all platforms and the ability to use mobile devices in the field to view and modify information in real-time.

Future work should integrate the energy dashboard with the Facilities WebMap so that energy consumption can be monitored visually on a map in real time. Other future work can include creation of 3D virtual campus, analyzing energy distribution as well as sensor information efficiency.

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References

Spatial and Temporal Variability in Energy Consumption at the Building Scale

The large-map panel on the left (figure 1) shows all campus related data, both above ground and below ground through a browser based webGIS map viewer. This web map not only allows facilities managers to interact and manipulate the data but also make changes in the field in real time.

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Development and Application of a WebGIS based Facilities Management and Decision Support System
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Figure 1: Facilities Asset Map Viewer

Figure 2: Dolly in of energy use normalized to the area of the buildings for a past of the campus. These four maps represent seasonal variability.

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