INFT3075 – Assignment #2

Smart Heating at NSCC Institute of Technology

Pod 5 – Kyle W, Jack G, Liam B

## Proposal Design:

The cost of energy is at an all-time high and the need for smarter, greener solutions has become more important than ever in today's day. From electric cars to more environmental production solutions, everybody is trying to make a difference to improve our ecosystem, and the technology to do so is improving rapidly.

Our proposal is to imagine and design a system for our institution, NSCC, to reduce energy costs on heating and cooling throughout the building. Using some of the existing IT architecture as well as some new smart tools to actively track individuals throughout the campus to automatically control the AC and/or HVAC systems based on which rooms, wings and systems are the most used throughout the day.

To achieve this, our vision is to use the already implemented AD system to track which students and faculty are using which systems/workstations at which time and map those systems to their corresponding rooms within the campus. Although this will work for registered staff and students, a mesh with the guest WiFi network and/or the roaming education network will also help map visitors to the campus and which rooms they may frequent.

To ensure accuracy, the system we are proposing will be monitoring trends in usage and not adjusting the AC/HVAC systems in real-time. This is both to avoid drastic draws in power during outliers (conferences, large meetings in less used rooms, etc.) and to ensure the heating or cooling systems have the rooms at the correct temperatures at the right time, not just starting as soon as the room fills up.

## Outcomes:

The first and most important outcome is efficient energy usage. With this system in place, even a 10-15% decrease in energy consumption would be desirable. Not only great for the environment, but this will also reduce energy costs as well, seeing more funding put towards other educational facilities.

The next being the tools and resources required to achieve this. A way to actively track and record which users are logged into each system/workstation/WAP is the most important. We envision monitoring tools within AD to be used the most for faculty and students and monitoring tools for the network itself (unify/ubiquity, depending on which hardware/software the campus already has in place) such as ManageEngine AD Audit Plus or for built in, Windows Event Viewer.

This method of tracking users will then have to be mapped to which end-point in the network they are currently connected to. Whether this is which workstation they are hardwired to or which WAP they are wirelessly connected to, a system must be implemented to match each to their respective rooms and areas on the campus. From here, a monitoring system will track who is connected to each node and where. This should be an automatic chart that the smart system will be able to interface with directly.

A possible issue that may arise is the number of devices each user might be using. With most people, especially faculty and students, bringing more than one device onto the campus, a more refined way of tracking which connections are the same person may need to be resolved. Because the “eduroam” wireless network within the school requires AD authentication, the correlation between the wireless network and AD should have a system that treats these 2 or more devices as one individual for the AC/HVAC system.

Another concern becomes privacy. We understand that having your individual ID and location always tracked within the campus may be unnerving for many users. A way for this data to be possibly encrypted or have the AD ID changed into a new, unique ID for the purposes of the AC/HVAC system may add the extra layer of security needed for a comfortable implementation.

## SMART Technologies:

One of the benefits of our proposal is that much of the technology we require may already be in place on campus. That being the “eduroam” network set up with AD integrated authentication and each workstation being a part of the same domain across the campus.

However, the largest “if” in our proposal is the SMART heating system being able to not only identify individual rooms/wings but also being able to communicate with the monitoring system we are proposing. We know that many SMART thermostats exist for *residential* structures, but a system that can integrate with an HVAC system for a large commercial/industrial building may not be as common.

If such a system does exist, it would then need a method of communication with our tracking/monitoring software. Many SMART home thermostats can be set on timers for basic routines, however, the system in this proposal would need to be adaptive; changing routines based on data gathered by our software.

Further research into the intricacies of NSCC’s existing heating and cooling system would be required as well. Depending on the level of detail and precision of the existing AC/HVAC system on the campus in regard to specific rooms, changes to the HVAC system ducts could also be required. We imagine SMART nodes placed along the ventilation system to open and close pathways to route heating and cooling effectively. If the cost of renovating and replacing the existing system outweighs the benefits, finding a way to implement our SMART system into the existing system would also have its advantages, albeit at a lower efficiency.

## Timeline

### Phase 1: Research and Planning

Our three-phase plan begins with research and planning. The first step is understanding the existing infrastructure at NSCC and developing a firm understanding of the technology we already have to work with. Once the existing systems are analyzed and recorded, the next step in phase 1 is finding the right SMART heating/cooling interface that could connect with the existing heating and cooling system. The last step in research is finding or even developing a proper monitoring/logging tool that can interface with the network at NSCC.

A network-enabled thermostat, whether we need to add functionality to the duct system to accommodate the new installations, and whether or not this interface can communicate with our monitoring/logging software are additional research steps required to begin the project. Once the tools and infrastructure required are properly mapped and recorded, planning any changes or updates to the system can start to take place.

This is where the team can start to point out changes in the existing heating/cooling system while weighing the cost to do so as well as planning whether the AD/WAP network needs any adjustments to track and record individuals using our software. Whether the proper software exists to track and record both active, logged in AD users as well as wireless devices could also become an issue. Because of this, the possibility of designing and implementing our own monitoring and logging software might be required, especially since we need it to integrate with the SMART thermostat system. The time and cost of developing this software should also be measured here.

### Phase 2: Design and Implementation

During phase 2, we will use the information and analysis from phase 1 to start to build our system. After changes to the existing HVAC system are determined and the scale of the changes are also calculated, we can move forward with additions or even a rebuilding of the ventilation system to accommodate the new system. Part of the cost analysis process plays a big part here. For an average-sized commercial building, costs to replace or rebuild an HVAC system can range from $100-$250 per square foot for the installation. If the entire system needs to be replaced, it could cost hundreds of thousands of dollars.

## Work Journals:

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| Work Journals: Assignment 2 |
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| **Name** = Kyle |
| **Role** = Author |
| **Work Details:** |
| Jan 23rd – 9:30am – 11:30am | |
| 2 hours creating initial document  Added Proposal Design, Outcomes and SMART Technologies sections  Name = Liam  Role = Editor  Work details:  Jan 23rd – 1:30pm – 3:30pm  2 hours editing  January 26th 9:00 –  Editing  Added tools to the AD monitoring tools and removed the editor’s note.  Name = Jack  Role = Research/Writer  Work details:  Jan 24th – 10:30AM – 11:30PM  Hour of Research  Jan 25th – 11:00AM – 12:30PM | | |
| Hour of research and half hour of review/editing | | |
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| Work Journals: Assignment 2 |
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| **Name** = Kyle |
| **Role** = Author |
| **Work Details:** |
| Jan 29th – 8:30am – 9:30am  Added and completed Timeline sections Phase 1 and Phase 2 | |
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