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Project Plan

I PRO 338

Project Management Strategies and Technology
Efficiency for Electrical Contractors'
Construction Projects



Project Sponsor: ECA Chicago

Faculty Advisor: Dan Tomal

Team members: Anderson, Scott

Babnigg, David

Cachero, Eunice

Carroll, John

Jun, Chang Han

Khaleq, Fade

Kim, Suk Won

Kim, Tae-Hoon

Lee, Se Won

Maloney, Michael

Park, Lillian

Rizvi, Syeda Fatima

Son, Min-Jeong

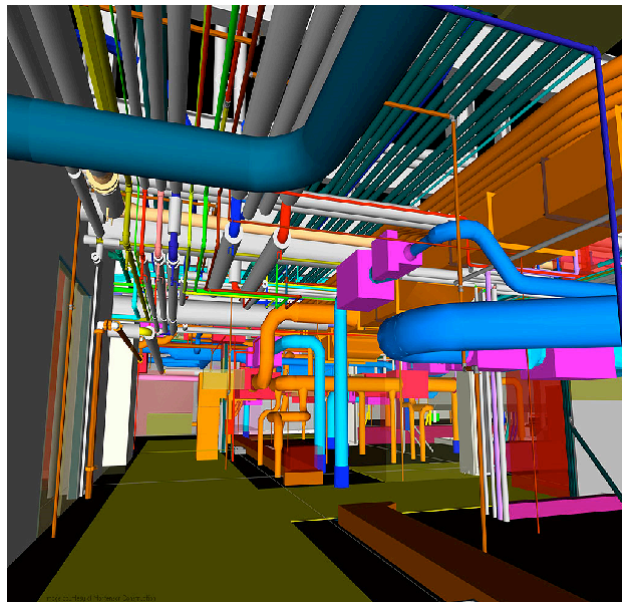
Yi, Jennifer

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Table of Contents

Team Information	...	3
Purpose and Objectives	...	6
Background	...	7
Team Values and Conflict Resolution	...	9
Work Breakdown Structure	...	10
Expected Results	...	11
Project Budget	...	12
Designation of Roles	...	13



Team Information

Team Member Roster

- Anderson, Scott: Civil Engineering (Junior)
 - Strengths: I have attained a B.S in Business/Economics from Wheaton College. I also have good communication and research skills
 - Expectations: My expectations of this IPRO are to gain valuable teamwork experience and become more familiar with BIM software. I hope to gain a broader perspective of the construction industry as well.
- Babnigg, David: Architecture (Senior)
 - Strengths: I have experience in Word Processing, AutoCad 2010, 3D Modeling 3DS Max, Powerpoint, Excel, Revit Architecture Modeling, other considerable physical modeling skills, and Laser Cutter.
 - Expectations: I expect to learn more about BIM.
- Cachero, Eunice: Electrical Engineering (Senior)
 - Strengths: I could help with research.
 - Expectations: I expect to learn about BIM and get some IPRO experience.
- Carroll, John: Electrical Engineering (Senior)
 - Strengths: I have knowledge of electrical construction attained through working experience with a contractor represented by the ECA.
 - Expectations: I expect to acquire knowledge of BIM and its implementation in the electrical construction field, and translate that information to the ECA.
- Jun, Chang Han: Mechanical Engineering (Senior)
 - Strengths: I have experience in AutoCAD, Matlab(basic), Photoshop, and CNC.
 - Expectations: I hope to Learn about BIM in detail and contribute to the success.
- Khaleq, Fade: INTM (Senior)
 - Strengths: I am an electrician by trade and studying Industrial Technology. I am well versed with Microsoft Project.
 - Expectations: I expect to learn more about BIM.
- Kim, Suk Won: Electrical Engineering (Senior)
 - Strengths: I am an ECE student specializing in signal processing.
 - Expectations: I want to broaden my perspective through BIM and information on construction works. I am sure this project will also help improve skills for teamwork.
- Kim, Tae-Hoon: Mechanical Engineering (Senior)

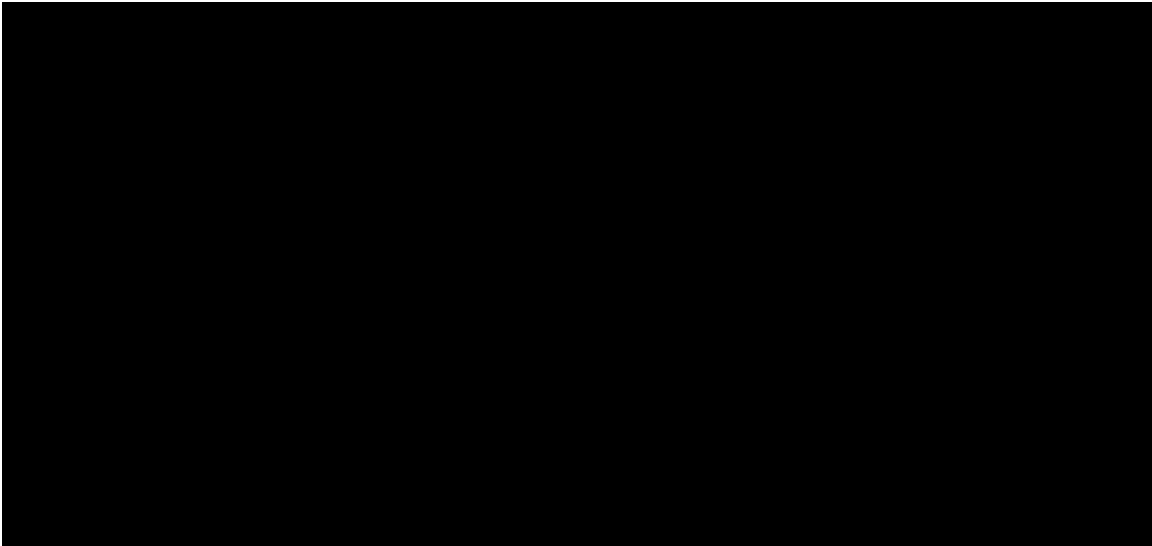
- Strengths: I have some computer skill such as Auto CAD, Matlab, and Power Point
- Expectations: I expect to help bring the advantages of BIM to companies. First of all, I'll research what BIM is and how to apply it for our project.
- Lee, Se Won: Business (Senior)
 - Strengths: I have knowledge of photoshop and AutoCAD.
 - Expectations: I want to learn and understand how to research and develop the BIM project model.
- Michael Maloney: Industrial Technology and Management (Senior)
 - Strengths: I have the ability to research a problem and find a realistic solution; ability to put together and present a high-quality presentation.
 - Expectations: I expect to become more of an out-of-the-box thinker by developing the ability to work well with people from different backgrounds.
- Park, Lillian: Architecture (Senior)
 - Strengths: I'm familiar with design programs such as Auto CAD, Revit, Adobe Photoshop, Illustrator, 3dMax, etc., as well as the basic office programs like MS Word, Excel, and PowerPoint.
 - Expectations: I expect to gain more knowledge of the field to compliment by major in construction management.
- Rizvi, Syeda Fatimas: CPE (Junior)
 - Strengths: I am familiar with Microsoft Office.
 - Expectations: To learn more about BIM and get research experience.
- Son, Min-Jeong: Civil Engineering (Senior)
 - Strengths: I have experience in Auto CAD, Photoshop, Microsoft Office, Sap, and Math CAD.
 - Expectations: I expect to learn BIM and use this program at the other construction works .
- Jennifer Yi: Business (Senior)
 - Strengths: I have the ability to contribute to the team's understanding of the business aspect of the IPRO; creativity; open-mindedness
 - Expectations: I hope to develop research and interviewing skills, learn about the field of electrical contracting, and get real-world experience out of the IPRO.

Team Identity

Team Name: BIM iiT

Team Motto: BIM iiT!

Team Logo:



Team Purpose and Objectives

Team Purpose:

Continuing from last semester, our purpose is to identify ways to improve the efficiency of electrical contracting projects through new software and technology, communications, and project management techniques, especially through Building Information Modeling (BIM) utilization. Since BIM is a fairly new product with few, if any, competitors, we don't see many options for the immediate future, when it comes to IPRO projects.

Objectives:

Team objectives:

- To avoid procrastination
- To be responsive and accountable
- To have everyone in the IPRO contribute to the project
- To have good interactions with and to satisfy our sponsor

Project objectives:

- To summarize the main sources of inefficiency in the electrical contracting field
- To assess possible solutions to inefficiencies, especially Building Information Modeling (BIM)
- To gain an understanding of technologies such as BIM, with the goal of teaching them to electrical contractors
- To devise and implement a plan for distributing the team's recommendations for improving efficiency to electrical contractors

Background

The sponsor for this IPRO is the Electrical Contractors' Association of Chicago (ECA). ECA helps developers find the right contractor for their needs, provides information for members about training opportunities, Labor Relations services, and information on Codes and Standards. Its members work in a wide variety of contracting fields, from industrial plants, hospitals, and schools to apartment buildings, condominiums, and single-family homes.

The user problem being faced in this IPRO is the problem of inefficiency in the electrical contracting field. Inefficiency is clearly an important issue facing the field: in a 2005 survey by Electrical Construction & Maintenance magazine, developers and property owners stated that their biggest cost concern was general inefficiencies in the construction process rather than materials and labor, and between 40% and 50% of construction projects run behind schedule. Preliminary research points to poor communication, paperwork error, delay in decision making, and the standard design-build-bid method as key concerns for contractors in getting jobs done quickly and profitably. The IPRO team will study these issues as well as new ones brought up in research and interviews, and attempt to pinpoint possible solutions for the most pressing problems.

The key technology this IPRO will study as a possible aid to increasing efficiency in electrical contracting is Building Information Modeling, or BIM. BIM is a building modeling program that incorporates all aspects of the building design, from the architectural frame to the systems and equipment in the building. It can be used to simulate the building's actual performance, and allows designers to pinpoint clashes between systems before construction begins. It also incorporates the dimension of time into the program, allowing scheduling information to be added to the design. Cost and price considerations can be added as well as a fifth dimension of modeling. In addition, energy modeling, acoustic and thermal data, sustainability information, and Green building considerations can be added to the program. The model can also be updated as construction progresses, recording changes to design and schedule, so that all members of the construction/design process are able to see in near-real time the progress of all aspects of the building. BIM has the potential to vastly improve communication between the different areas of a construction project, prevent during-construction conflicts, and improve prediction of systems operations prior to completing the building.

Other technologies that may be investigated include the more traditional AutoCAD Electrical software and EPLAN software. These are commonly used CAD programs for electrical applications that may be easier to use than BIM, but that lack the multi-dimensional, multi-disciplinary aspects that make BIM unique. The team will also consider technologies such as Radio Frequency Identification and Laser Scanners as efficient ways to gather data from construction sites to be incorporated into an up-to-date building model of the site.

This is the first IPRO with the objective of improving efficiency in the electrical contracting industry, so the team has no previous experience of successes and failures to build on. However, there are considerations about past innovations in the electrical industry to be considered. When computer-aided design software first came onto the market in the late 1980s there were high expectations that it would revolutionize the industry. While CAD softwares did have significant effects on many areas of

construction and design, they served to primarily convert what once were paper designs to electronic form without changing the nature of design and management of the project. The team should consider the history and success of other CAD programs when assessing BIM's likelihood to be incorporated by contractors into their everyday operations.

There are several ethical issues that the IPRO team may have to consider as this IPRO progresses. Some are general and team-related: team members must take it upon themselves to all pull their own weight for the team, and must be careful not to make assumptions about the IPRO solution that may make work easier but that aren't supported by research. Other issues are those related to the project itself. One possibility the team may face is that BIM, the program expected to be most helpful in increasing efficiency, may not be the best solution for contractors. The team must be sure not to push BIM if another solution is better, or if it does not fulfill expectations. Another issue is directly related to increasing efficiency for electrical contractors: some jobs could be lost if the IPRO team emphasizes technological solutions for inefficiencies. This is an issue the team will have to spend a good deal of time considering if it arises.

The business-related costs of the current inefficiency in the industry are obvious: loss of time means loss of money, delays in the overall construction project, and dissatisfaction from the developer. However, it must be considered that though in the long run implementing a solution like BIM might increase profitability, in the short term it would require a number of expenditures including the purchase of the program and training of operators for the program. The problem has a clear economic cost, but the solution will also carry a cost.

The most effective way of communicating the team's results to a large number of electrical contractors is one of the topics to be studied during the IPRO. However, a tentative plan for sharing the team's recommendations includes: an easily navigated website explaining the IPRO's purpose, research, results, and a comprehensive tutorial on any technologies selected as solutions; a presentation of the team's results to the Electrical Contractor's Association of Chicago (ECA), the IPRO sponsor; and easily readable pamphlets to be given to ECA for distribution among their members.

This IPRO is facing a new challenge as there has not been a concerted effort to improve efficiency in electrical contracting in the past. The advent of computer design programs such as AutoCAD can be seen as a similar situation to the more recent development of BIM software; however, since this IPRO's goal is not only to find a solution to inefficiencies in electrical contracting, but also to share the team's proposed solution with electrical contractors, the team will face the challenge of finding a way to motivate contractors to try to learn and incorporate new technology into their everyday work. The team's solution will also not be based entirely on the implementation of BIM in electrical contracting; failures in communication, inefficient use of time and resources on the job, and paperwork errors are all areas that will be addressed. This approach of considering all aspects of electrical contracting is a novel challenge for the IPRO team.

Team Values and Conflict Resolution

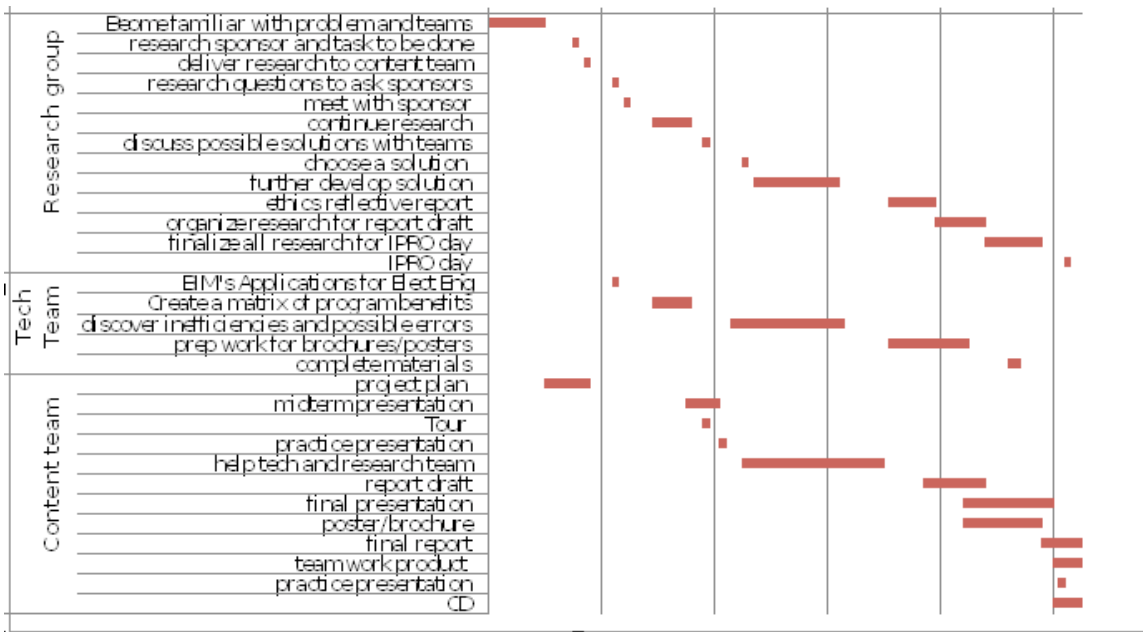
Desired Team Behavior:

- Be on time
- Fulfill responsibilities assigned by the team
- Communicate clearly with other team members
- Respond promptly to phone and email communications from the team
- Address conflicts between members immediately
- All team members are responsible for helping the leader when necessary

Conflict Management:

- Team members who have personal conflicts should go to Dr. Tomal, who will mediate a face-to-face discussion between them.
- Team members who have IPRO-related problems should go to their subteam leader, who will take the problem to the rest of the team if it cannot be solved within the subteam.

work Breakdown Structure



Expected Results

Expected activities involved in the project will include interviews with electrical contractors, research on the electrical contracting industry and BIM, BIM software practice and exploration, visits to construction sites to view management techniques firsthand, assessment of inefficiencies, and the development of a plan to improve efficiency in electrical contracting. The team will also develop a way to communicate the results of the IPRO to the electrical contracting industry.

The research team expects to gather include subjective data from interviews, information on the division of time spent on each aspect of a contracting project from paperwork to materials handling and physical labor, economical data about the cost of time wasted in each area of the project and the money that could be saved by increasing efficiency, and information on the amount of time each solution the team proposes will save a contractor.

The IPRO team does not plan to create a marketable product by the end of the IPRO. The end result of the semester will be a proposal for electrical contractors detailing the team's research and suggestions on how to improve efficiency on the job.

The outputs from the project tasks are fairly straightforward: interviews will result in transcripts and recommendations from experts in the electrical contracting field; the tech team's study of BIM and other software and technology will result in a definition of the pros and cons of each technology and a report on how to use the technologies; other research will result in reports, and collections of statistics and other data collected by previous researchers; economic studies of the situation will result in a report on the economical aspect of the project; and all of these will combine to allow the team to make a recommendation on the best way to improve efficiency in electrical contracting.

The main deliverable from this IPRO will be the team's description of how they propose to best improve efficiency in electrical contracting. The information gathered and proposed solutions will be presented to electrical contractors in a way that allows the contractors to implement the suggestions directly in their everyday work.

Some challenges the IPRO team will face include the vast amount of research that must be done to construct a well-rounded view of all aspects of the electrical contracting process and the fact that the path to increasing efficiency will probably include many aspects of the job rather than just one technological aspect. The team will need to avoid focusing all effort on the most clearly obvious solution, BIM, and develop a solution that addresses all aspects of inefficiency. There are also challenges related to the implementation of BIM as a solution to inefficiencies. One is that since BIM is a dynamic model, able to be modified by all parties, it will be important to ensure that all parties involved in the project are working from the most recently updated version of the model, rather than older versions missing recent modifications by other parties. Also, in order for BIM to be used to its full capacity, the model will have to be continuously updated as construction proceeds, which will demand that everyone working on the project be responsible to make additions and update as they make modifications on-site.

All research, both quantitative (economic models, statistics) and qualitative (interviews and contractor opinions), will be taken into consideration by the team in selecting the areas of the greatest inefficiency and selecting the optimal set of solutions for the final recommendation.

Project Budget

The team will take several trips to construction sites to observe, and individual team members may need to travel to perform interviews with contractors. The only cost that needs to be budgeted for is the cost of travel at the standard reimbursement rate per mile, not exceeding \$100.

Designation of Roles

The team is split into three sub-teams; Content, Research, and Technology. A project manager and a co-leader was chosen to delegate responsibilities and oversee that the project was running smoothly. Each team has its own leader that will divide the work throughout the members of his or her team. The team leaders are also responsible of collaborating with the other team leaders to ensure good communication among the teams. A secretary was established to keep a record of minutes and any other important documents. The Content team is responsible of all the IPRO deliverables and anything else that needs to be written up. The Research team is responsible for researching and interviewing experts in the field as needed. Finally, the Technology team is responsible for tasks that require technological skills. All teams will help each other out as needed.

CONTENT TEAM

- Yi, Jennifer - Sub-team leader
- Lee, Sewon – Secretary
- Kim, Tae-Hoon

RESEARCH TEAM

- Maloney, Michael – Co-leader, Sub-team leader
- Cachero, Eunice
- Anderson, Scott
- Khaleq, Fade
- Kim, Suk Won
- Rizvi, Syeda Fatima
- Son, Min-Jeong

TECHNOLOGY TEAM

- Carroll, John – Co-leader, Sub-team leader
- Jun, Chang Han
- Babnigg, David
- Park, Lillian