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Algona Municipal Utilities Power System Designs

PROJECT PLAN

Contents

1 Introduction

1.1 PROJECT STATEMENT

Our project is based on the Distribution System, the final stage in the delivery of electric. The distribution system is the middle section of the transmission system to individual consumers. We will design a better reliability distribution system to Algona Municipal Utilities' second largest electric customer, an industrial company, and provide the cost analysis of our design.

1.2 PURPOSE

This project aims to support a better reliability and easy to maintenance distribution system for the target customer. On the same time, the cost of design needs to be considered for Algona Municipal Utilities. A high reliability distribution system can ensure the benefit of the customer, such as some machines need to continuous operate 24 hours. As an electric utility company, some feeders are in some cases difficult to access for repair or emergencies and waste a lot of resources. Our project can help utility company to save resources and support a higher reliability and security for the customer. An efficient and reliability distribution system is important for the development of the world.

1.3 GOALS

The goal of this project is to complete:

- Successful and meet specific requirements distribution system design with Milsoft.
- A detailed and feasible cost analysis about our design.

All goals are to be completed on time, under budget, and with priorities of safety.

2 Deliverables

In order to meet the goals outlined in the introduction, our project will provide:

- A complete distribution system simulation with Milsoft.
- Distribution system report.
- Cost analysis report.

3 Design

3.1 Previous work/literature

The distribution system is common in our life. But based on different customer and company requires, every distribution system is different and unique. So we need to ask some questions about specific requires and goals about distribution system from customer and company.

3.2 Proposed System Block diagram

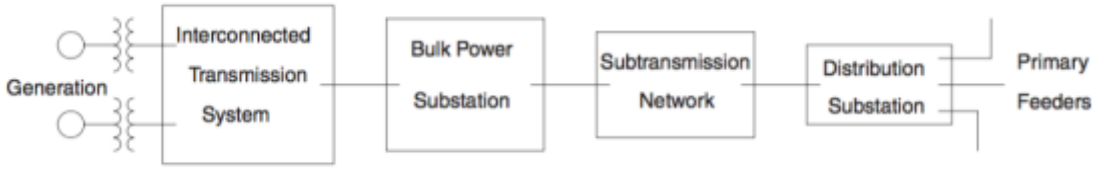
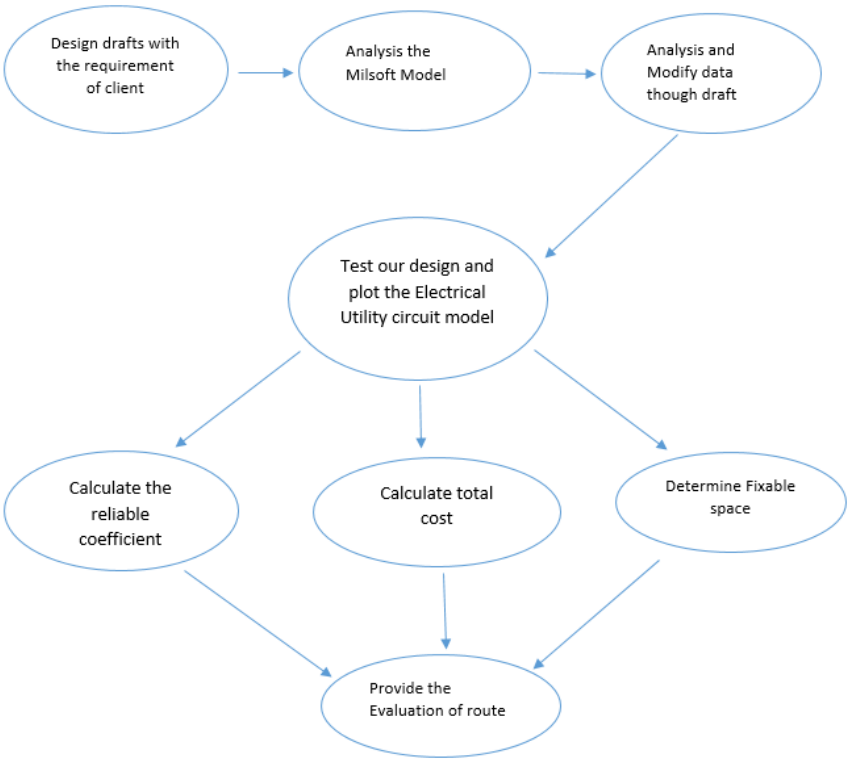


Figure 1 (William H. Kersting, 2012)



3.3 Assessment of Proposed methods

In this project, we use a lot of mathematical ways to prove our simulation results. Like zone branch method, power distribution system reliability method, and so on (Chowdhury, Ali. and Don. Koval, 2011). Our simulations are based on the calculation of data and some coefficients will show the reliability and flexible of our design. For the cost analysis, we use engineering economic analysis to show the cost of our design. We will calculate the MARR (minimum acceptable rate of return), taxable income, total depreciation, margin revenue, and so on. These values will evaluation our design.

3.4 Validation

Our design will be validated in Milsoft and cost analysis. We need to simulate a successful distribution system and think about the cost of design.For the simulation part, we need to think about the specific requirements of company and reality. For the cost report part, we will show the fixed cost and variable cost to help the company evaluate our design.

4 Project Requirements/Specifications

4.1 FUNCTIONAL

For the software part, we use the Milsoft as our software to design this project. The Milsoft is a

popular and powerful software to analysis the electric utility circuit model in the power system area. On the same time, Milsoft provides good customer service and emergency warning. Our client can save a lot of time and resource if we can use Milsoft as our software. At present, DGR engineering works on the Milsoft model of Algona Municipal Utilities.

4.2 NON-FUNCTIONAL

Based on the purpose requirement of client. We need to build a high flexible, high reliability, and small cost distribution system for Industrial Company. We need to use different mathematical methods to prove three points.

For the flexible problem, our design should have a higher electric capacity rather than the demand of Industrial Company. And we also consider the future expand of Industrial Company to design our electric quantity.

For the reliability problem, different substation should necessary to guarantee primary reliability in a distribution system. And we need to calculation the reliability data of every line and get some coefficients to prove high reliability level, like SAIFI (System Average Interruption Frequency Index), SAIDI (System Average Interruption Duration Index), and CAIDI (Customer Average Interruption Duration Index).

For the small cost problem, we combine the annual revenue of client and cost of our design to evaluation the influence of our plan. We need to consider the annual inflation ratio and interest ratio in 2017. And based the requirement of client, we will try to find the forecast about annual inflation ration and interest ratio. We will use annual inflation ratio and interest ratio to calculate the payback period. The payback period shows the how many years client can obtain net income in our design.

Based on the design requirement of the client, we need to think about a lot of things because our project is close to life. We need to think about the difficult to across farmland and railway. And our target company plans to expand double factory space in the future. In our design routes, we need to think about all possible factors that impact our result.

4.3 STANDARDS

We will use Milsoft to design our project. The standard is Milsoft EA that is a defect industry standard for electric distribution system analysis. In addition, we will use American National Standards Institute (ANSI) C84 standard to test our design that the service voltage should be 120±5%(Table 1). We also will use IEEE Power Transmission and Distribution Standards

Table 1. National Steady State Voltage Regulation Standards

Nominal	*Service*	*Utilization*	*Nameplate*	*NEMA*
Standard	**-5%, +%5**	**-13%, +6%**	**Motor**	**-10%, +10%**
120	114 - 126	104.4 - 127.2	115	103.5 - 126.5
208	197.6 - 218.4	181 - 220.5	200	180 - 220
240	228 - 252	208.9 - 254.4	230	207 - 253
277	263.2 - 290.9	241 - 293.6		
480	456 - 504	417.6 - 508.8	460	414 - 506
	bandwidth 10%	bandwidth 19%		bandwidth 20%

5 Challenges

The first challenge is how to meet every requirement of client. We have a trip to Algona and observe the whole the distribution system at present. The pond, farmland, trees, and railway will influence our design. And based on the low cost, we cannot build more overheads from other feeders. For the future plan, client hopes we use all underground to build our circuit.

The most important challenge is that we don't have the correct license of Milsoft. Milsoft is professional software for power engineer and we don't have fund about that. ISU should have the license with Milsoft but ETG and Dr. Kimber have no idea about that. We need to communicate with Greg, the engineer of Milsoft, to solve that.

Currently, we have student version that allows maximum 150 elements with one circuit. But the circuit of industrial company has more than 150 elements and full version should necessary. We try to set up the full version under the help of Milsoft.

The technical challenge is how to use Milsoft correctly like power engineer. Milsoft is really stranger for us and a few instructions can help us. We need to explore the function of Milsoft by ourselves.

Another challenge is the calculation of coefficients. We need to meet the three main requirements of the client about distribution system. That means we need to find suitable mathematics methods for each requirement. How to find the better methods to improve the accuracy is a big problem for us.

6 Timeline

6.1 First Semester

Spring 2017 Algona Municipal Utilities Power System Designs	
Time	Event
Week 1 (Jan/9/2017)	Introduction of EE 491
Week 2 (Jan/16/2017)	Determine project and choose one project
Week 3 (Jan/23/2017)	Meet with advisor and set up a team and choose one power project
Week 4 (Jan/30/2017)	Finish the NDA form. Also decide to visit company about project and prepare question list about project
Week 5 (Feb/6/2017)	Confirm the schedule to visit company with advisor. Improve the quality of questions and make sure which lab we can use for data analysis
Week 6 (Feb/13/2017)	Cancel the visit date because of weather and reschedule date. Also finish the final version of problem lists
Week 7 (Feb/20/2017)	Discuss with advisor about Algona distribution system map and find more questions.

Week 8 (Feb/27/2017)	Visit Algona Municipal Utilities with Dr. Kimber and Dr. Wang. We have two hours meeting and observe the whole distribution system about Industrial company
Week 9 (Mar/6/2017)	Design 4 draft routes of industrial company and discuss about Milsoft.
Week 10 (Mar/13/2017)	Spring Break. Think about the response of client. Read relative books.
Week 11 (Mar/20/2017)	The license of Milsoft causes the error of login. Keep to Communicate with DGR and Milsoft to solve that.
Week 12	
Week 13	
Week 14	
Week 15	
Week 16	

7 Conclusions

In conclusion, this is a big project for us to spend a long time to finish with a clear but difficult goal. We have a plenty of specific requirements from client because our project is a real-life project. It is important to follow all requirements to guarantee the possible of our design. To design a high reliability, high flexible, and low cost distribution system for the customer, industrial company, we firstly need the basic knowledge from the relative books. Then we need to learn how to use Milsoft because Milsoft is a very powerful and convenient electrical utility circuit analysis software for almost all utilities company. Later, we need to analysis and calculate the reliability coefficient, the space of our design, and the cost of our design. These values will help to evaluation our design. We hope our project can improve the power supply of industrial company.

8 References

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