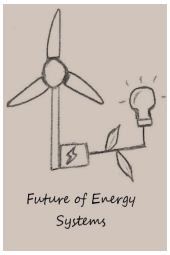
NORTHERN ARIZONA UNIVERSITY

College of Engineering, Informatics, and Applied Sciences



To: Dr. Yaramasu
From: WPC Team: Mohammad Alenezi, Hamad Abdulmalek, Abdullah Alghasab and Fahad Alazemi
Date: 02/15/2019
Re: Schedule Documentation and Client Contract

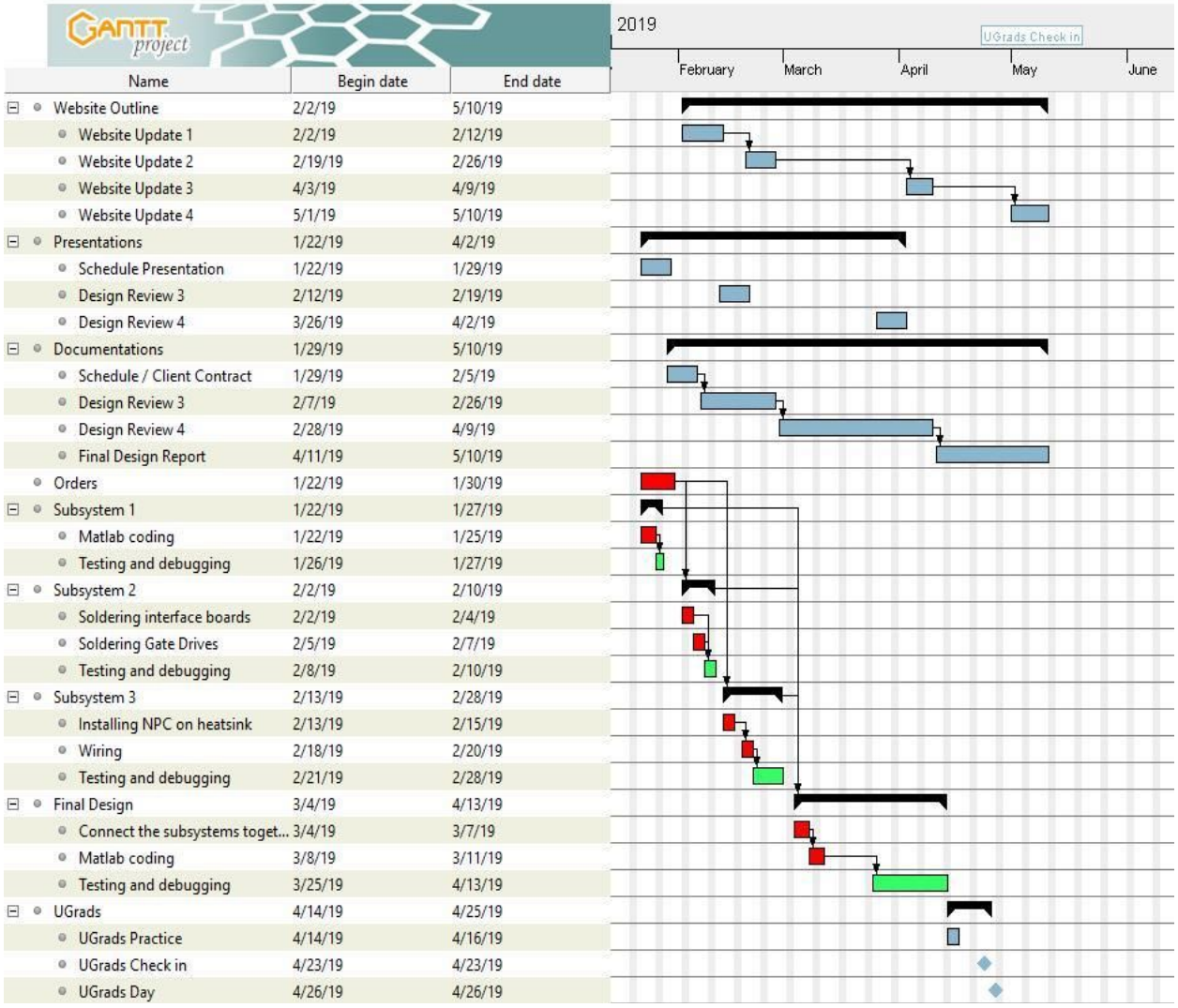
Introduction:

The project is WPC which stands for Wind Power Converter. The team task is to build a converter that converts the wind to a usable type of energy that can be used in places like houses. Wind energy is considered as a renewable energy source, and it the fastest developing/growing source of energy world's wide. Since wind energy is still developing and there are new researches on wind energy every year, Dr. Yaramasu (client) is developing new research that related to wind energy, so the team is asked to build and study the characteristic of an NPC (Neutral Point Clamped) converter, which will be used to in wind turbines. The principle of wind turbine is to converter mechanical energy that comes from the movements (caused by the wind) of the blades of the turbines to electrical energy.

Since the team is working in a closed lab, and we do not have a wind source to test the converter at any time the team wants, the client provided an alternative way to test the converter at any time. In order to create something that will replace the wind, we supply an AC Drive with AC voltage from a grid, the AC Drive will be connected to a motor which will produce mechanical energy (wind source). The AC Drive will allow us to control the frequency and voltage that will go to the motor, which will control the speed of the motor. The motor is attached to a generator so that when the motor shaft moves, it will move the generator shaft with the same speed, and that will convert the mechanical energy that produced from the motor to electrical energy that produced from the generator. The electricity that produces from the generator will be a converter from AC voltage to DC voltage through rectifier then convert from DC voltage back to AC voltage through an inverter. The last stage for this project is to feedback the AC voltage that we get from the inverter back to the grid. Although the power the team feedback to the grid is less than the power the team got in the first grid that way the team will be able to test the project at any time, and as much as possible.

The team has four members; Mohammad Alenezi (client contact), Hamad Abdulmalek (team leader), Abdullah Alghasab (time scheduling) and Fahad Alazemi (treasurer). And the client for our project is Dr. Yaramasu.

Gantt Chart:



Name	Begin date	End date
Website Outline	2/2/19	5/10/19
Website Update 1	2/2/19	2/12/19
Website Update 2	2/19/19	2/26/19
Website Update 3	4/3/19	4/9/19
Website Update 4	5/1/19	5/10/19
Presentations	1/22/19	4/2/19
Schedule Presentation	1/22/19	1/29/19
Design Review 3	2/12/19	2/19/19
Design Review 4	3/26/19	4/2/19
Documentations	1/29/19	5/10/19
Schedule / Client Contract	1/29/19	2/5/19
Design Review 3	2/7/19	2/26/19
Design Review 4	2/28/19	4/9/19
Final Design Report	4/11/19	5/10/19
Orders	1/22/19	1/30/19
Subsystem 1	1/22/19	1/27/19
Matlab coding	1/22/19	1/25/19
Testing and debugging	1/26/19	1/27/19
Subsystem 2	2/2/19	2/10/19
Soldering interface boards	2/2/19	2/4/19
Soldering Gate Drives	2/5/19	2/7/19
Testing and debugging	2/8/19	2/10/19
Subsystem 3	2/13/19	2/28/19
Installing NPC on heatsink	2/13/19	2/15/19
Wiring	2/18/19	2/20/19
Testing and debugging	2/21/19	2/28/19
Final Design	3/4/19	4/13/19
Connect the subsystems toget...	3/4/19	3/7/19
Matlab coding	3/8/19	3/11/19
Testing and debugging	3/25/19	4/13/19
UGrads	4/14/19	4/25/19
UGrads Practice	4/14/19	4/16/19
UGrads Check in	4/23/19	4/23/19
UGrads Day	4/26/19	4/26/19

WPC Team Gantt chart

Gantt Chart Discussion:

This is the Gantt chart that we will follow throughout the semester from January 22 to May 10,2019. It shows all the tasks and plans that the team will be working on for the rest of this semester including all the assignments. Some tasks of the project have higher properties than other tasks. For example, the subsystem two and three depends on the order that the team

placed, Those subsystems can not be completed if the order is delayed or canceled, Each subsystem does not depend on each other, and they can be tested individually, so the team is planning to finish all the subsystem and connect them together to build the final design before spring break. There are about 10 days for the spring break, which the team chooses that gap for any failure in one of the subsystems or the order got delay, and that gap will help the team to go back on the track without delaying the final design in the Gantt chart.

First, for the first subsystem which focus on the motor/generator, which we need to write the MATLAB code for dspace which will read the motor status and test the motor at different speeds, the team already finished the first subsystem, as for The second subsystem which is voltage and current sensors, we estimated it to take eight days, and during these days the team breakdown the voltage and current sensors into three tasks, first the team will be soldering a new interface PCB boards for three days, then we will take three days to solder a gate drives, and finally test both the PCB boards, The third subsystem NPC converter will take longer than the first two subsystems since it's the main part of this project, and in order to build the NPC converter, the team must measure the heatsink to place the diodes and the IGBTs evenly spaced out, so that it distributes the heat evenly and looks good for the business market. After placing the diodes and IGBTs, the team will connect them together then test them to check if there is any lose connection.

The previous part was working on all the subsystems and get all of them checked for our final design, which we plan to finish before spring break and start testing from March 25 to April 13, we will connect all the three subsystems together and build a new MATLAB code to check the values that will be produced through the converter. Also, the final design will be displayed vertically to satisfy the company expectation.

Communication Strategy:

Communication with the client and mentor is mandatory for everyone's sake because they both provides a feedback on our work and for clear understanding on the capstone assignment and the process we are going through in building our project. Regarding this the group asked to meet at least 6 hours weekly to work on the project in Dr. Yaramasu's lab in the AMPERE lab 101 in SICCS building. Depending on our classes schedule we have divided the meetings into two days and three hours in each day, Wednesday from 2:00 PM to 5:00 PM and Thursday from 1:00 PM to 4:00 PM. Also, the client is showing up during our meeting time to check the process and the work have done so far. Nonetheless, the ways we communicate with the client through email or face to face during our meetings time we have set.

The mentor of our team is Ms. Korenda she requested to have a weekly meetings with the group in order to provide the group with a feedback and an answer for the assignments requirements. Also, the reason she asked us for a weekly meetings is to get to understand the project more and to know the weekly improvement on the group work. The ways we communicate with our mentor are slack, email, and face to face meeting in every Thursday of

each week at 2:30 PM in SICCS building. Her expectation of all team members is to show a new process done by each week and see an improvements in working on the project.

Client Contract:

- NPC converter (use SKM300MLI066TAT Power Module).
- project will be displayed vertically, so that it will be more visible for people from business industrials.
- Subsystem 1: synchronous the motor and generator, so that there will be no rush current going through the generator when the motor is turn on.
- Subsystem 2: build voltage/current sensors from scratch made by PCB boards, which will be used to check the voltage and current through the converter.
- Subsystem 3: the IGBT and Diode will be spaced out evenly on the heatsink.
- Final Design: connect the subsystems together so that the generator will be connected to the NPC converter then connect to the grid and to the Voltage/Current sensors.

The requirements are listed above, which were giving by the client. One requirement changed from last semester, which were using another power module for the NPC converter, and that module required a bigger heatsink, and now the team will use the SKM300MLI066TAT power module, which will reduce the heatsink by half in size. According to the Gantt Chart figure, the team is expecting to finish installing the final design before spring break, which will give the team more time advantage if something break down to find an alternative way to fix any device. The team is already finished with the first subsystem, and started with the second subsystem.

Conclusion:

The wind energy provided around 4.7% of the United State electricity in 2015, and that percentage is still increasing every year. That is one of the reason why we should focus more on the renewable energy, and also this is the reason why Northern Arizona University cares and offered a project in the Capstone class that involves a renewable energy. As shown in the Gantt Chart we have been working on testing the motor and generator and soldering the boards and gate drives in the previous weeks. Also, by the end of each subsystem we devoted a period of time for testing and debugging before start working on the next step because each subsystem is depending on the the previous tasks. If things goes as planned in our overview Gantt chart we will be done with project before the spring break and start testing it until the UGrads day. So, if any problem show up we will have enough time to recover the problem and insure that everything is working properly before the due date of presenting the final project.