PostMortem of ME 476C

Section Number: 001

Team Name: FMC Wheelchair

Team number: 20Su3

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Project Sponsor:Northern Arizona University

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Introduction:

The Post Mortem analysis contains the team's summary of the completion of various tasks in the previous phase (summer 2020), such as how the team abides by the team chapter, the project performance of the team's design products and specific methods on how to improve these project performance. The team summarizes the new skills that team members have learned and ideas on how to apply them to new products.

Contributors to project success

In the ME 476C project, our team's purpose is to solve three contemporary problems. First of all, improving the brake system to improve safety. Secondly, our team should design a leg support system which can be folded under the wheelchair. So that it can save more space when no one uses the wheelchairs. Last but not least, our team also needs to design a damping which can be raised or lowered slowly and steadily, which can prevent patient's legs from being injured again due to the rapid fall of the leg support. We finally designed a CAD model, but there is no solid model yet. These goals can be displayed in our final CAD.

Team members can basically abide by the rules and regulations established by the team, and can be present on time for each meeting, and complete team discussions efficiently. For team work distribution, we use a Gantt chart to ensure that each member understands when and what results need to be delivered, and also to ensure that the work is evenly distributed. The only problem may be that one member is in the country and cannot work in sync with other members, and there are some problems in communication. But the work can still be completed on time each time. During the design process, team members also had some differences, such as the design of damping and leg support. Since this is an important part, the team is very strict with the design. Finally, through a meeting, we focused on analyzing the advantages and disadvantages of each design, and finally voted for the best design.

The team's project performance has the following aspects: Time management, product quality, manufacturing cost, Stakeholder Satisfaction.
Time management and manufacturing cost are the most positive performance in a team's project. From Figure 1.1, It shows the completion of each member's tasks at different periods. According to the Gantt chart, basically each member can complete the tasks specified by the client on time (100% completion), which reflects the team's time management is perfect.

Figure 1.1

Team's project performance about manufacturing cost is also awesome, below is the table of manufacturing cost for team's project, it shows the key components of the team project product and the corresponding prices. At the same time, the table contains quotations of price data for customers' reference. This ensures the authenticity of manufacturing costs.

Table 1.2

small-scale prototype cost summary					
Part Name	Number	Price per part($)	Total Price($)	Responsbility	Source
Leg Support	2	59.99	119.98	Haoran	https://www.engineeringtoolbox.cor
Anti-theft system	1	149.99	149.99	Simen	https://www.engineeringtoolbox.cor
Disc Brake	2	79.99	159.98	Simen	https://www.engineeringtoolbox.cor
Dampers for rotary joints	4	73	292	Zhenkai	https://www.engineeringtoolbox.cor
Calf support	2	51	102	Jialan	https://www.engineeringtoolbox.cor
Leg support attachment	2	19.99	39.98	Zhenkai	
Normal wheelchair	1	Hospital Donated	0	hospital	
Workoing and designing time	5	1000	5000		
Total cost			5863.93		

In the client's meeting and presentation, the client of the team project showed recognition of the product design of the project, specifically showed interest in the innovative use of leg support and rotary damper.

However, the team cannot guarantee the quality of the product for the time being, because so far the team has only evaluated the product quality through CAD modeling and quantitative analysis of subsystems. The entire team only analyzes the feasibility of the product theoretically, and cannot be proved by specific experiments. . For example, the team could only analyze the scalable and detachable leg support by consulting data and CAD modeling and had not personally assembled the equipment. So, the project performance about product quality is the most negative.

We used QFD to list our customer needs and engineering requirements clearly,giving the weight ratio of different customer needs and the technical requirement units, technical requirement

targets, absolute engineering requirements and relative engineering requirements. Through calculation and analysis,we got our three most Important engineering requirements,which helped us focus on our key points quickly. Besides, we created our Black Box Model and Functional Model to help us understand the energy transfer and the operation principle of the whole system. About our design selected, we brainstormed our design variants firstly. Then we used Morph Matrix to match our design aspects and got our initial design alternatives.Then we used Pugh Chart to narrow our design alternatives qualitatively based on our customer needs. In the end, we used the Decision Matrix which is evaluated quantitatively based on the engineering requirements to narrow the remaining designs to a final design.

Opportunities/areas for improvement

We met a lot of problems during the first half of the project. First of all, one of our teammates is abroad because of the coronavirus, so we have time lag and network delay problems. Sometimes,we cannot get in touch with him in time,and he cannot upload his research effectively. So our project was more or less affected. Besides, we encountered design problems, we had difficulties folding and telescoping our leg support under the wheelchair and controlling the falling speed of the leg support, We also made some adjustments on our initial design plans. We removed the anti-theft design because the anti-theft design was not cost-effective and could not be fully realized for practical reasons though we spent much time researching it.

To improve the whole performance of the product, the team could conduct further orgziantial actions. A more detailed team duty clarification is needed to distribute human resources to the core point of improvement. In the last period of research, the team figured out the outline of FMC wheelchair components and made basic improvements of the wheelchair. However, to make this product accessible and recognized by the public, the team still needed to test the properties of products again and again. Client meetings needed to be scheduled weekly or monthly to fully adjust our product in a professional way.

Team learned a lot of useful technical lessons from so on. Team had a specific CAD maker, Jiaxin, who is responsible for all the CAD model design and most assembly processes, he went more deeply into designing a good virtual model for the project through solidworks. Zhenkai learned mechanical aspects of analysis of ratchet and dampers. He is in charge of parts connection. Jialan and Haoran devoted themselves to make a better leg support with appropriate calf pad. They paid more attention to resources collection and information organization. Simeng looked up disc brake systems and how to apply such systems into the design. Team all made their own effort into improving the technical skills of themselves and bringing this product to a more professional level.

Conclusion

Team did a good start by figuring out the vague model with improvement parts from so on. Further study would be more tough as the team has to inspect all the details of the product and make a mature design that could satisfy clients and potential customers.