Self-Designed Honors Experience Outline

Basic info

- Name: Matthew Joseph Stang
- Email: stangmj@mail.uc.edu
- College: College of engineering and applied sciences
- Major: Mechanical Engineering
- Title of Project: Endeavor into the field of exo-suits
- Thematic Area: Research

Expected Project Start Date: 7/1/15

- Expected Project End Date: 11/1/15

Detailed abstract of experience

- For this project I will be working independently and will be seeking to gain a working understanding of the existing theories/designs for current exo suits. I will initially investigate general setups, however, I will delve deeper into specific component topics (such as hydraulics, bearings, metal working, etc). In addition, I will further my research to include potential growth markets for this technology in order to obtain a better understanding of where this field may progress in the future. After conducting these two areas of research, I will attempt to combine them into a workable research question that will allow for further inquiry on this topic. I estimate that I will spend between three to five hours a week conducting my research which is why I have allotted a four month time span for my project. For my long-term career goals this project would be immensely helpful. My desires rest in the exploration of smart prosthetics and exo-suits. This project will allow me to gain a deeper background in the basics of this field which will serve as a launchpad for my future studies (be it graduate school or professional).

Connection to learning outcomes

- Possess a well-developed awareness of literature in the field
    - In order to make the most of this research opportunity, it is essential to first understand what research has already been conducted on this topic. Although exo-suits are a relatively new field, my preliminary investigation indicates that phenomenal developments have already been made and there is great potential for expansion and growth. By conducting a period of intensive research, it will allow me to gain a deeper grasp of this field as well as narrow any future research's focus. As excited as I am for the prospect of this project, the overwhelming amount of information available in today's age from websites to videos to books and more, can be daunting. My plan for tackling this will be to first consult with my advisor who will have general experience or interest in the field and will give me an indication of which direction to pursue first; however, I intend on having utilized all of the above mentioned resource types by the conclusion of my project. Finally, I would like to keep an open mind throughout my research and investigate all possible uses for this technology.
- Formulate a theory, problem, or hypothesis for the proposed research project that is based on the literature review
    - After completing the research portion of my project, I will use this information to generate a theory, problem, or hypothesis that will narrow my focus for any future research. At the outset of my project, it is difficult to know exactly what this formulation may be, although I suspect that it will most likely either be on one of the subtopics listed above or on a creative route combining the benefits of various approaches I discover. This task will be greatly aided by seeking out specialized faculty

at the university as well as direct assistance from my advisor. As I have never completed a formal task of this nature, this formulation should be an excellent learning opportunity.

- Demonstrate awareness of key weakness/limitations of the research and provide guidance on the most important and fruitful directions for future research on this topic
    - As this project will be my first foray into a field that I have a strong desire to pursue further, understanding the strengths and possible weaknesses of the previous research I learn about will allow me to make my future work more productive and meaningful. There is always room for improvement and growth, and I believe that actively keeping this in mind is the best way to guarantee a positive takeaway from the project. In addition, identifying the strengths and weaknesses of previous research will have a direct benefit in allowing me to develop a more meaningful theory, problem, or hypothesis while also practicing the skill of building upon existing research.

Connection to goals and academic theories

- Contribute to goals and personal development
    - As previously stated, this project directly ties to my future desires and goals. From playing with Legos as a child to eagerly waiting for and watching each new Iron Man movie that is released, I have always felt fascinated and drawn towards the topics of exo-suits and smart prosthetics. I am extremely interested in further exploring these topics in my academic and professional career, so this project will give me an incredible introduction into this field that will help set me on a path for success. My motivation for completing this project is more purely based on exploring my passions; although, as I am already observing in my first co-op, I may learn something (for example in my coop, a greater understanding of bearings and the critical importance they play in rotation / in this project, perhaps some information on hydraulics) that may help me in a future class at the University of Cincinnati. Finally, as this project is focused on gaining a working understanding of current research and products, it would flow nicely into another project in which I could conduct physical research based upon the theory, problem, or hypothesis that I formulate at the conclusion of this project.
- Connect to academic theories
    - This project is interesting and slightly more challenging from a research standpoint as it does not revolve around a controversial topic or a pressing need (for contrast example, research on stem cells or on cancer cures). Therefore, my theories and resources will arise more from simple searches based on questions I develop throughout the process. As a starting point, simple google searches have yielded these interesting articles/videos:
        - "Ekso Bionics - An Exoskeleton Bionic Suit or a Wearable Robot That Helps People Walk Again." *Ekso Bionics - An Exoskeleton Bionic Suit or a Wearable Robot That Helps People Walk Again*. Ekso Bionics, n.d. Web. 30 May 2015. <http://www.eksobionics.com/>.
            - Company that specializes in health aid usages
        - Bender, Jeremy. "The Military Is Closing In On Powerful Exoskeleton Technology." *Business Insider*. Business Insider, Inc, 18 Aug. 2014. Web. 30 May 2015. <http://www.businessinsider.com/military-exoskeletons-2014-8>.
            - Article on military interest in uses
        - "US Army Test Real Life 'Iron Man' Exoskeleton." *YouTube*. YouTube, n.d. Web. 30 May 2015. <http://www.youtube.com/watch?v=p2W23ysgWKI>.

        - Video on military uses
    - "Elysium Exoskeleton Part 16: The Big Test, 170LB Barbell Curl." *YouTube*. YouTube, n.d. Web. 30 May 2015. <http://www.youtube.com/watch?v=aQsAHhRxwvw>.
        - Video on *Elysium* styled exo suit made in real life lift test
- At the outset of this project there are not any specific academic theories that will be focused upon with a passion. Rather, I intend on keeping an open mind an exploring any and all current theories that exist in this field. These starting articles and videos as well as any discovered theories will not only provide critical background knowledge but will help to guide my own project's ~~final~~ direction.

Initiative, independence, and/or creativity

- As I will be completing this project independently, I alone will be responsible for a bulk of the research that is completed. However, it is quite likely that I will come across topics that I will need support in order to fully understanding. In this scenario, I am prepared to take the initiative to reach out to the appropriate faculty for assistance. When I reach the end of the research portion of my project I will be faced with formulating a theory, problem, or hypothesis for future efforts. In order to tackle this task I will need to embrace creative thinking to ensure a unique and productive product.

Reflection

- One topic that is extremely important for any project is active reflection. My plan is to keep both a journal as well as a work log. I will write in the journal frequently (at least once a week) and will focus on how this project is personally impacting me (for example, "Does what I am reading about truly align with what I expected from the field?" or "Is anything I have discovered truly exciting and inspiring?"). The work log will be a more practical running tab that will document the hours of work that are put into my project, general research updates, any challenges that I encounter, and exciting developments. By completing both the journal and the work log during the project, I will ensure that my research stays on track, finishes with some form of productive takeaway, as well as aid my efforts in the dissemination portion. Finally, the reflective essay that I will write at the conclusion of the project will bring everything that was discovered together into one cohesive format (combining the tangible research discoveries as well as the personal impact).

Dissemination

- My general audience for dissemination with this project is any individual interested in this specific area of the robotics field; however, to reach that larger audience I will focus on a variety of smaller target audiences. Overall, my hope is that the results of my project will add to the progression of this field in some form of another (be it a new discovery, improved efficiency, supportive data to previous developments, or simply motivating and bringing awareness to the field). My method for dissemination is going to be a four-pronged approach. First, I will post my project's results on my learning portfolio including the journal, team work log, a general statement as to the results, and my reflective essay. The target audience for this step is anybody that visits my learning portfolio (notably this is difficult to control; although, I will feel good knowing that I have put the information out on the web in a compiled format as well as may use my influence as an Honors Ambassador to direct attention to this page). Next, I will print a copy of all of these documents, neatly compile them into a presentable format (either bound or put in a tabbed binder), and leave it in the Honors suite for interested readers. My target audience here is clearly honors students (which I have targeted for our expected passion of academia/knowledge). I remember during my time in Gateway to University Honors that this was mentioned as a common or possible option for self-designed projects, so I feel encouraged

that this action may attract some motivated or curious honors students. Then, I will make an effort to reach out to the UC Robotics Team concerning my findings (clear target audience in individuals interested in robotics). I am a member of the robotics team, and my hope is that I would be either given permission to discuss my findings to the whole team at the beginning of a meeting or (more optimistically) create a new subdivision within the robotics team centered on this topic (as I am aware that this is a possibility due to the recent aerial unit expansion, which is the portion of the team where I spend my time). Finally, I will maintain electronic copies of all of these documents that I will be able to access and further make available whenever a need or an opportunity to share the results of my project arises.

Project advisors

- The advisors for this project will come from the University of Cincinnati's faculty that have expertise in the necessary areas of research for this project including: mechanics, electricity, and computer science (as well as any other areas that arise throughout the research period). As my project is discovery based, my advisor will serve more as a mentor to aid with direction and reflection, rather than physical assembly or implementation help.

Budget

- I do not believe that my intended project will require any form of budget.