Assessment #14

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Subject: Designing & Building A Hexapod

Introduction and Statement of Purpose

The original work I will create is a walking hexapod robot that I've designed & planned to build from scratch to better understand mechanical engineering, electrical engineering, & programming. The primary purpose of the robot will be to build my skills in fields relevant to robotics, however, I plan to design the robot around a purpose of disaster relief in order to get the full experience of designing as all commercial robots created are centered around a function. To design, I have researched into the history of hexapods, different systems, and more in order to be prepared to problem solve as necessary. After researching, I have began using Fusion 360 to design a 3D model of the frame, roll cage, coxa, tibia, and femur which are all the parts necessary to build a hexapod & its legs. Once I get the parts designed and printed out, I have planned to build the entire robot and start coding different gaits in order to make the hexapod move and perform its intended function.

Review of Skills and Research

To create a hexapod, there are a variety of topics that play an important role in determining the different factors in play. For starters, topics around robotics are required such as mechanical & electrical engineering and programming. Along with that,

depending on the purpose of the robot, research may be needed to fully understand what aspect of the problem the hexapod would be best suited for solving. Another topic that is critical to understand are different types of materials used to create robots as that plays an important role in determining what types of actuators would be needed, what 3D printing material would be best, etc.

Methodology

- **Design Process and Procedures**

  I have followed the six step engineering design process used by NASA in order to identify the problem to solve, research solutions using hexapods, plan how to implement my solution, create the hexapod, test it, and improve on the design. Firstly, I have research different problems that could benefit from a specialized hexapod. Next, I have selected the most realistic problem that I would be able to solve and decide on a solution. My selected real world problem is disaster relief in areas of hazardous mobility. After selecting the solution, I have 3D modeled it in Fusion 360 and plan for all the components needed. Next up, I will print the frame, assemble it, and wire the full system & code the gait needed in order to make it move and achieve its purpose. Once coded, I will continuously test it and make improvements as needed.

- **Materials**

  To create a hexapod, I will need to 3D print multiple parts of the hexapod including: a frame, to house all the electronics, a roll cage, to secure the

electronics from falling out of the hexapod, 6 coxas, to facilitate horizontal movement in each leg, 6 tibias, to connect the coxa to the femur, and 6 femurs, to connect each end of the robot leg to the ground. Along with that, I will need an Arduino, to house all the coding, 18 servos, to facilitate each DOF (degree of freedom), a PCA9685, to be a servo shield & regulator, a receiver and controller, to be able to independently move the robot, 2 different batteries, one for the servos and the other for the arduino, and many other miscellaneous & purpose related things.

Utilization of Higher-Level Thinking Skills

As a design project from scratch, this project utilizes many higher-level thinking skills. To begin, researching different problems, solutions, and designs helped me develop great reasoning and analysis of information which can be proven in the design of the hexapod taking multiple points into consideration. Next, designing and modeling the actual robot shows mastery of a professional modeling tool and how different design aspects come together to show understanding of research and prioritizing aspects that are important to the purpose of the robot. After modeling, the process of selecting the ideal material and building the hexapod shows project management and budgeting skills since the goal is to create a working prototype initially that will continuously get improved while still working on a small budget. Once a full model is built, ensuring good electrical connections are done shows a high level understanding of what goes into a robot's electrical aspect along with coding showing a detailed analysis of various gaits and how

to implement them using inverse kinematics. Finally, the continuous cycle of improving the robot will show the good practice of following the design process.

Conclusions

I anticipate that the outcome of this project will be a functional hexapod that will use research done by me in order to effectively solve a problem found in the real work. I hope to learn more about robotics as a whole, especially more on topics that robotics can help in along with skills in electrical engineering and modeling. As previously mentioned, the project will be applicable in the real world by being able to solve a problem that a field currently faces, specifically disaster zone relief, using the innovation and benefits of a hexapod.