

Assessment #13

Original Work Research #3

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Subject: Robotics

Key: (1) Citation (2) Understanding (3) Applying (4) Synthesizing/Analyzing (5) Creating (6) Evaluating

(1) Rashid, M, et al. "Development of Hexapod Robot with Manoeuvrable Wheel." *Research*

Gate, Vol. 49, Dec. 2012,

www.researchgate.net/profile/Mohd-Shahrieel-Mohd-Aras/publication/267752436_Development_of_Hexapod_Robot_with_Manoeuvrable_Wheel/links/54d1d9f70cf25ba0f041ec1d/Development-of-Hexapod-Robot-with-Manoeuvrable-Wheel.pdf.

(2) In the article "Development of Hexapod Robot with Manoeuvrable Wheel", the authors explain the idea of a hexapod that uses wheels to travel faster across even terrain and swap to it's six legs to travel across uneven terrain. To begin, the authors referred to many different hexapods to gain a background understanding of the nature of this complex machine. This included the likes of LARUON, RHex (who I have analyzed in the past), Bill-Ant-P, and many others which have played a bigger role in the research and development of the next-generation of hexapods. Furthermore, the article dives into the specific walking system needed in hexapods due to their six legs known as gait which includes discussion on tripod gait, wave gait, and crawling gait. After this research, the article moves onto the steps leading to the development of the first prototype. They begin by making eight unique sketches of different hexapods that use wheels & label each one in a table with each ones features. To select a sketch in an unbiased way, the authors used the House of Quality to determine what would be the best design based on both design and customer requirements. After selecting one, they move on to modeling the object in a

CAD model using Solidworks. Using this tool, they were able to effectively get an accurate measurement of what each part would look like compared to the rest of the robot. After modeling, they used Solidworks' built-in simulation software to test each parts' reaction to different types of stress which helped them decide on what part to make it out of. Finally, the object was made into a prototype and coded with different gaits and utilized a sensor to function from the wheel mode to legged mode autonomously. (3) This information is relevant to me because of my personal project of trying to build a hexapod from scratch. The reason for picking this project is to help me gain more engineering experience in mechanical engineering and electrical engineering, especially design since that is where most of my interest comes from. This article in specific dives deeper into the designing process more than anything else which significantly helps in determining my own design project for my hexapod since I need to give the project its purpose and do not have a base or reference to build from. (4) To begin, the article establishes an end goal for the project, to develop a prototype for an experimental model of a hexapod using wheels. Outside of that, they defined a measurable value to measure if they achieved what the purpose of the end goal was. Since the purpose of the end goal was to see if having a wheel configuration would make the process of moving the hexapod faster, the measurable value was speed. After this, the article dove into some example of innovative hexapods which gave some more background information that could be used to compare the prototype against. Once gaining a complete understanding of the background of hexapods, the article moves onto the process of selecting the best design model. First, eight design sketches are made with different placement of the wheels, sensors, and various shapes of the robot. Then, to determine the best design to make out of the eight, the article makes a table of features that describe each design's specifications and uses those in the House of Quality. The House of

Quality is a system used to determine the best idea based on design and customer requirements in a non-biased way. In this scenario, the authors used speed, quality, stress/pressure, shape, number of parts, and cost as their requirements. After categorizing each design on the model, the authors determined that the best idea would be design #8. This lead them to the CAD modeling step where they would create the robot in Solidworks and stress test it in simulations to determine what material would need to be used. Finally, a prototype was built and tested on these specifications. This article introduced a lot of detailed knowledge in the design process of an experimental hexapod robot. Firstly, it helped introduce the process of having an end goal and measurable value. Secondly, it helped determine the steps prior to modeling in CAD which I had not previously considered. Third and finally, I had not considered doing stress tests of the parts which would be needed to determine the material used for the item. (5) To begin, I want to use what I have researched to better develop an end goal and have a measurable value for my own research project. One aspect that stood out to me in the article was the value of speed in hexapods. Generally speaking, speed is an important aspect to consider in mobile robots due to the direct relationship between speed and being able to complete a task in the shortest amount of time. In hexapods and other mobile legged robots, speed is always a weak point due to wheels being significantly faster on even terrain and being viable on uneven terrain. This leads me to define my end goal more specifically as the following: design, build, and test a hexapod that is able to travel fast over all types of terrain, uneven and even. This will help in finalizing a design to be modeled in CAD and simulated it against stress. As stated, I plan on also incorporating stress simulations in order to determine the material the robot will be made out of to be able to travel as fast as possible over variable terrain. (6) To finish off, this information has been very helpful in deciding what objective my hexapod should be building towards which will be

significantly helpful in determining my future research and goals. The information has been very motivating in showing that experimental robots have a framework that can be crudely followed to make a prototype and test which I'm sure I will refer to multiple times in the future.

Annotated Article Link: [Development of Hexapod Robot with Manoeuvrable Wheel.pdf](#)