HYDRAULIC SYSTEM DESIGN PROJECT

Overview:

The scope of this project is to design and build a hydraulic powered system to accomplish a task of your choosing. You will document your work, in both written and media formats, and present your final product.

Background:

Automation is a very fast growing industry. The development of new robotic devices (which use hydraulic principles) to accomplish tasks quicker and more efficiently than a human could has made many companies very wealthy, and has allowed for a drastic increase in the production of many products. Companies are constantly looking for new ways in which they can use automated systems in their production.

With industry driving the development of automated systems, it has led to a push in the development of the robotics industry. As more and more research has been put into robotics, it has helped make the use of robotics much more wide spread. Robotic systems are being used in areas such as health care and even toys.

Although we cannot build a robotic system, we will use hydraulic power to mimic a system that could be made to use robotics.

Task:

Your job, as a group of "robotics engineers," is to design a hydraulic powered "robotic" system that could be used to automate, simplify, or simply accomplish a task. You will then build a working prototype to use in a demonstration as part of a sales pitch to your target company/consumers.

- Decide on a task for which you would like to design a system
- Design your system, producing rough drawings of the components you will use, and drawings of how they will come together
- Build your design, making alterations as needed
- Take pictures of your progress on a daily or weekly basis, upload them to your group folder as a form of journal to document progress
- Take pictures of specific components/joining techniques/features, upload them to your group folder, labelling them appropriately
- Record a series of short videos documenting how you made different components of your system and how you made them work – how-to style videos
- Organize all of your digital files with appropriate names and folders
- Plan a presentation, in the form of a sales pitch, detailing how your system works and the benefits it will bring

The task you are designing your system to accomplish is open for you to choose. There are specific criteria (see evaluation section) that you are to meet in your final design, but the goal of the system is up to you.

Example Systems:

- A "robotic" arm to move an item from one location to another
- A dentist's chair
- A toy
- A component from a piece of construction equipment (e.g., excavator arm)

There will be specific content (see evaluation section) that you will need to include in your presentation (sales pitch), but you will have options for the style in which you present.

Example Presentation Methods:

- Infomercial – an extended commercial explaining the product
- News Report – interviewing the "inventor" or "company owner"
- "How-it's-Made" style video – shows production methods and the how it is used

Materials:

You will be provided with a variety of materials, and you may supplement those with other materials that you supply on your own. When choosing materials it is very important to consider that in the real-world you would be confined to a set budget, and additional materials bring additional cost. You must also consider the size of the project, and the fact that you will need to be able to carry your prototype.

Materials Supplied:

- 1 plywood base – 16" x 16"
- 6 pieces of jinx wood – 1 cm x 1cm x 40 cm
- 6 syringes – 30 cc
- Tubing to connect syringes
- Scrap wood
- Clamps to hold syringes in place
- Variety of nails and screws
- String
- Glue – hot glue, wood glue, craft glue
- Duct tape

Timeline:

We have seven weeks scheduled for this project, but you will find that time will pass quickly. Be sure to monitor your progress, as this is not the type of task that can be accomplished at the last minute. On top of that, the due date for this will be right at the time when report cards are coming due, meaning that late assignments cannot be marked. I will regularly be checking in with you, at which time I will be looking at your progress.

- Week 1 – Explain task, learn tool safety, design planning
- Week 2 – Finalize design ideas, including draft drawings, start build
- Week 3 – Continue build
- Week 4 – Continue build
- Week 5 – Continue build, brainstorm presentation ideas
- Week 6 – Finish build, start presentation
- Week 7 – Finish presentation, submit project

Throughout the duration of the project I will have nutrition breaks open for groups to come in for additional work time. Groups who are behind will be required to come in for these breaks.

Evaluation:

Your mark for this project will come from several different areas.

Documentation:

- Introduction
    - A brief summary paragraph about what you have designed and how it works
- Weekly Journal
    - One entry, completed at the end of each week
    - Very brief dot-jots indicating what was accomplished that week and how it was done
    - An image of your project at the end of the week
- Conclusion
    - A paragraph or two summarizing your experience with this project
        - What did you learn?
        - Was your design a success?
        - What would you alter if you were to complete another project like this?

Work Skills:

- Ongoing observations will be made to document student work. Things being considered include:
    - Neatness
        - Work station is to be kept clean during work and when complete
        - Tools/materials are to be returned to the proper locations
    - Handling of tools/materials
        - Tools are only to be used for the appropriate uses
        - Tools are to be used following the guidelines taught
    - Safety
        - Appropriate safety equipment is to be worn at all times
        - Tools and materials are to be used properly, in a safe manner, and only for their designed purpose
    - Time use
        - Students are to be focused on the task while in the science room
        - Timelines are to be followed, as outlined previously
        - Students are not to be socializing with other groups during build periods

Digital Components:

- Picture Journal
    - A series of images showing the build of your system, from plain piece of plywood right through to functioning system
    - These are to be kept in their own, labelled, folder
- How-to Videos
    - Short videos used to explain to others how you made specific features of your system
        - How did you build it
        - How does it work
        - What difficulties did you run into and how you overcame them
    - These should be like mini tutorials

- Safety Videos
    - You must include at least one video demonstrating and explaining the safe use or handling of a tool or material

Prototype:

- Specific criteria need to be met
    - The system is to be hydraulic powered (you may also use pneumatics if you would like)
    - The system needs to be able to move in three directions (up/down, left/right, forward/backwards, rotation, opening/closing of a clasping device). It must also be able to perform the reverse movements, i.e., it needs to be able to reset
    - The entire system, including control syringes, needs to be mounted on a 16" (40.6 cm) square base – parts can be docked/stored on the platform and moved during use
- Craftsmanship
    - The aesthetic appeal of your system will be considered
    - Quality of work will be noted
        - Neat/uniform work (cuts, joints, etc.)
    - Work will be analyzed for correct use of techniques (i.e., was an appropriate joining method used)
- Material use
    - Materials used in appropriate ways
    - Appropriate quantity of materials used
- Functionality
    - Movements are to be smooth
    - Should not require any human input other than pushing/pulling syringes
    - Accomplishes task for which it was designed

Presentation:

- There is specific content that is to be included in your presentation
    - Explanation of the task that your system is to accomplish (purpose)
    - List of components and their function
    - Description of how your system works (from input right through to output)
    - Advantages of/rational to having your system
- Style
    - Presentation style chosen is used appropriately
    - Presentation is completed in a professional looking manner
    - Presentation is suited to the target audience, in a persuasive manner

Participation Factor:

Much of the mark for this project is a group mark. As a result, individual participation will be taken into consideration, and will be used to determine each student's final grade. A student who works consistently and contributes to their full potential will receive a participation factor of 1.0. A student who does not contribute to their potential will receive a participation factor of less than 1.0. In rare cases, a student may go beyond expectation and receive a participation factor of more than 1.0. Once the group mark is determined, each individual student's grade will be determined by multiplying their group mark by their individual participation factor (for example, if the group receives 90%, but a student has a participation factor of 0.8, they will get a grade 0f 90% x 0.8 = 72%).

Participation factor will be determined by a combination of peer input and my observations.