UBC DESIGN LEAGUE

DESIGNATHON 2023

Semi-Technical Engineering Prompt

Background

With the increased demand of staff and servers in the restaurants, and rapid decrease of staff, the food industry will have to opt for an alternative solution to keep a certain level of customer satisfaction and timely service provided at restaurants. Generally, with the significant development in the automation industry, robots have become a part of the majority of manufacturing units as well as certain high-end restaurants.

Challenge

With this emerging problem of understaffed restaurants and unsatisfactory customer service in mind, the ideal solution would be to utilize the rapid development of the automation industry in the food industry. Therefore, **you are challenged to create an affordable robotic meal serving system that is scalable, mass-manufacturable, and can carry efficient load.**

Challenge Objective & Constraints

Design a robot which could effectively serve customers at busy restaurants following the guidelines as listed below:

- The robot must be able to carry about 8 lbs or 3.6kg of dishes including the weight of the robot tray. Provide stress analysis calculations. Bonus points (5) - FEA analysis.
- Mechanism to ensure dishes do not slide off the tray while the robot is in motion (manual/automatic mechanism).
- Design the serving tray of the robot to be a minimum size of 12”x16” or 30cm x 40cm.
- Include enclosures for the motor, battery, mechanisms used to fasten them in place.
- Ensure the assembly weight is considered, weight of nuts and fasteners are to be ignored.
- Provide material cost and weight analysis for parts of the robot.
- The robot should be mobile, conveyor belt systems will NOT be accepted.
- Choose your own motor(s) and batteries, CAD files of these can be sourced externally, with appropriate references and reasoning provided in the presentation.
- Assume that the robot is completely autonomous and is capable of taking commands from staff. Electrical wirings and connections are to be ignored for the sake of simplicity.
- Bonus points for including a collision detection mechanism (has to be validated within the mechanical design). Provide calculations to prove that the robot can be balanced at the height 1m above the ground and calculate the maximum force it can withstand - 1 bonus point per 10N.

Considerations

- Consider ease of charging and storage when not in use.
- Ease of assembly and maintenance.

- Consider and evaluate a good material selection such that there is minimal to no carbon footprint.
- Creative freedom is given for the design of the robot. These designs can be non-traditional and innovative, do not need to follow a certain structure or a specific number of wheels, etc.

Necessary Calculations & Data

- Stress analysis.
- Price and weight breakdown (include material selection). Include material specifications and prices for parts via the McMaster-Carr website
- Functionality analysis (demonstration of how the mechanisms and system will work).

Submission

Go to the folder ___. Make a folder with your team number and name in the following format: **1 - Team Name**

Please submit the following:

- Final assembly file (full product) of your CAD design in .STEP format.
- Renders or screenshots of your product from various angles (5-10 pictures).
- A ZIP folder containing the parts and assemblies of your CAD design in the format that your 3D modeling software operates with. For example, if you used Solidworks, upload the parts (.sldprt) and assemblies (.sldasm) all ZIPPED in one folder.
- A presentation justifying your problem statement, your solution, and the rationale behind it (10 minutes for presentation MAX). You may use any platform to create your presentation.
- All part files used with an appropriate material selected, the material and weight must be assigned for each part, each part missing a material property or has a material property that can not be justified will be deducted a mark
- A screenshot of your screen that includes your assembly and the assembly weight
- **Please note: all calculations will be verified and if there are any alterations made to the calculations that give you an unfair advantage you will be disqualified.**
- **Plagiarism of designs from online sources apart from the parts specified in the challenge is prohibited and will result in disqualification.**

Reminders

- You are not allowed to use any parts from any sources except SolidWorks Toolbox except the parts specified to be sourced externally - Motor(s) & batteries.