ENME 304 Fall 2025 –Lift Platform Challenge Rules
(project created by Dr. Janelle Clark)

Overview: The semester team project requires design, construction, and demonstration of a device that will lift a weight on its platform to a specified height. The performance of the lifting device will be judged based on time (from "Go" to reaching the platform above the finish line), efficiency of design (weight), and adherence to the underlined specifications. Therefore, it is critical that you create a time and weight efficient device through proper analysis and innovative design. All specifications will be assessed in the final report.

1) Dimensions

a. Each putting device shall be no taller than 8" in its starting state and should be able to extend to a height of at least 12".

b. The device and its load must fit within a footprint of 8" x 8" square (see Figure 1) for the entirety of the task and be self-standing.

c. The lifting device cannot be attached to the surface underneath it.

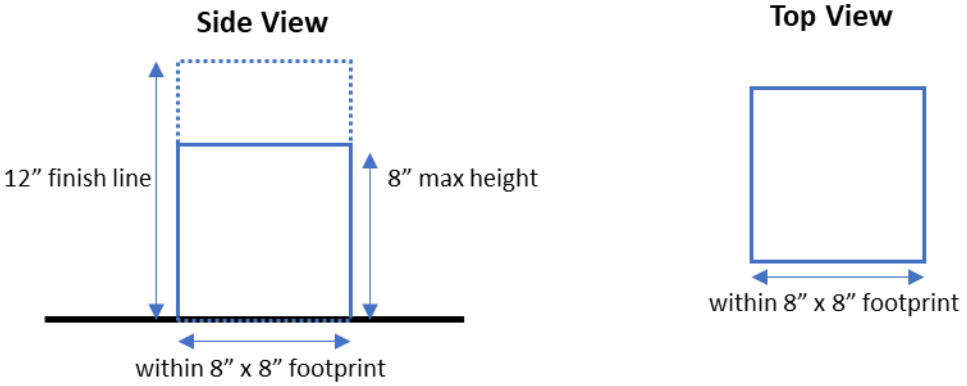

Figure 1 – Side and top view of lifting device envelope and finish line.

2) Electrical/Power

a. Each team will be supplied with one motor (Mabuchi RS-555PH-3255) and a 12VDC battery, the only allowed power and actuation sources. The specification sheet for the motor is posted on Blackboard in the Project folder.

b. The battery pack is rated for 1400mAh and is rechargeable. However, you will not be able to recharge the battery once the competition starts.

c. To protect the motor and battery, a replaceable 2A slo-blo fuse must be included in the circuit between the battery pack and the motor.

d. The device must only include electronics for the outlined DPDT circuit to the right, allowing forward and backward movement of the motor. The circuit can

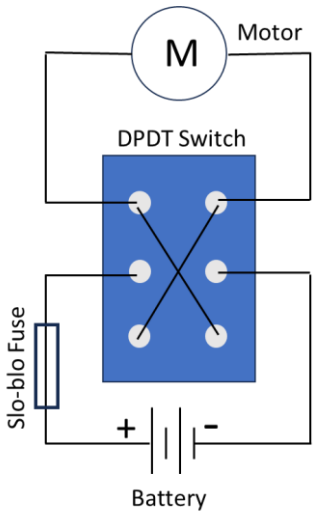

Figure 2 - Forward/reverse circuit for motor with a protective fuse and a DPDT switch.

only contain the motor, battery, and fuse mentioned above, with a protective diode and DPDT switch.

e. Switches must be appropriately mounted with robust electrical connections. Simply twisting wires together (without wire nuts or other attachment means), or dabbing a little solder on the wires is not sufficient. Soldering stations are available upon request in ENGR117. See the circuits guide on Blackboard in the Project folder.

3) Drive System

a. All rotating components (i.e., shafts) must be supported by bearings.

b. All bearing must only experience forces only forces in directions they are designed for.

c. A gear, belt, chain, or pulley drive is required capable of controlling the device to lift 3.1 lbs above the 12" finish line from the initial 8" maximum initial device height. A bonus is available for team capable of completing the task with 5 lbs.

d. Gears, pulleys, etc. must be secured to their respective shafts using setscrews, pins, keys, clamps, splines, etc. Press fits or epoxy and other adhesives are not acceptable for this purpose.

e. Devices must be built from scratch. Teams are not permitted to use pre-built or commercially available gear trains, kits, Vex parts, etc. Please ask if you are in doubt!

f. No type of stored energy (e.g., pre-tensioned springs, compressed air, elevated counterweights, etc.) is permitted except the battery.

g. Note that alignment more than anything else determines success, take sure to measure and assemble the device to be sure the shafts are level and meshing components are aligned.

h. Each machine element should have a full analysis from the course material to back up your design choice, including deflection, stress, strain, static and fatigue failure. Components include shafts, gears, belts, chains, fasteners, plates, bearings, and other framing elements. CAD simulations are good supplemental material but do not replace your analyses. **These analyses must be approximately evenly distributed between team members.**

4) Construction

a. The devices may be constructed using any material except wood. The only exception is the base of the device that sits on the floor.

b. If you use a base plate, it is recommended you use a rigid material that will allow for sturdy attachment and sustained alignment of the drive train. If opting for wood, be sure to choose a hardwood of adequate thickness.

c. The device must include at least two components fabricated using rapid prototyping and one machined part. **Their design must be approximately evenly distributed between team members.**

   i. Parts must be fully fabricated using a mill or lathe to be considered a "machined" part and must be a functional component of the device

design. Modification of a part is not sufficient to meet this requirement.

ii. Configurable machined parts (e.g., shafts) ordered from a vendor (e.g., Misumi, PBC Linear, etc.) qualify as machined parts.

iii. Rapid prototyped parts must be functional components of the device design and may be fabricated using 3D printing or laser cutting.

d. Each device must have its team number clearly displayed.

e. Only inelastic fishing line, string, cord, or similar materials may be used in the device, and not in ways that store potential energy.

f. Devices may include adjustment capabilities, but this may not alter the weight or size of the device in any way. For example, turning an adjustment screw or changing motor speed would be acceptable, but adding or removing a part would not.

g. A full CAD model is required complete with fasteners. Design of parts should be approximately evenly distributed between team members.

5) Safety

a. The safety of all participants is of paramount concern.

b. Spectators must stand a minimum of 6' from the side of the devices being tested. Cones or other markings will be used to define this area.

c. Teams must follow standard shop safety practices during the fabrication and assembly of their devices and must complete a shop safety course where available.

6) Demonstration

a. Before the competition, each device will be evaluated for adherence to the underlined specifications and will be weighed.

b. The finish line will be a reference frame extending 12" from the table. A sample finish line will be provided for testing prior to the competition.

c. The device is able to complete a successful task: lifting a 3.1 lb weight, approximately 3" x 5", until the platform is up to the finish line from the initial position. Bonus points will be provided to teams able to lift a total of 5 lbs to the finish line.

d. Each device must be able to return to the starting configuration (i.e., ready to putt) in less than 2 minutes.

e. Each device will then demonstrate that it can lift the weight to the finish line. Teams will be given up to two practice attempts and then a measured attempt. The elapsed time from "Go" to the platform stopping will be recorded.

f. The instructor has final authority in determining the outcome of each match.

g. The battery may not be recharged once the demonstration matches begin.

7) **Time & Date**:

a. The project demonstration will take place on Monday, December 8, 2025 at the classroom and time reserved for the course.

b. All members of each team should bring their demo to class on Wednesday, December 3, 2025 to have each device evaluated for compliance with the underlined requirements and weighed.

8) Budget:

a. The ME Department will provide the ENME 304 Laboratory Fees to cover up to $50/team-member for project components and raw materials.
b. All purchases must be placed through the RT Ticket system (instructions on Blackboard) and be approved by the instructor.
c. A detailed bill of materials (BOM) is required in the final report. Working within a budget is part of professional engineering practice.
d. Costs for rapid prototyping must be included in your budget. See the guide on blackboard for current costs and procedures in the MechFab Lab. Use of private printers requires material costs per roll, and third-party use requires full cost of services.

9) Sustainability:

To promote sustainable design, all devices must be designed for disassembly at the end of the semester and all components suitable for reuse (i.e., not damaged during testing or demonstration) plus any spare materials should be returned. All waste materials should be disposed of in a proper manner.

10) Deliverables

a. Each project team will be required to provide the following, on the date specified in the course schedule:
    i. Preliminary Design Review presentation
    ii. Design Updates 1, 2, & 3
    iii. Final report
    iv. Demonstration

11) Grading:

a. Detailed course grading, including assignments related to the project, can be found in the course syllabus and schedule.
b. An individual's project grade will be calculated from the overall project grade for the team and weighted by their CATME teamwork assessments. Do your part and work as a team!
c. Grading for demonstrated performance will be as follows:

Criteria	System Performance Score (Maximum 50 points + 5 Bonus Points)
Team shows up, the device meets all size and underlined requirements and is capable of lifting the 3.1 lb weight a quarter inch upward.	25 points
Team participates in the entire competition regardless of the result	15 points
Team is able to reset within 2 minutes	3 points
Team completes the task within 2 minutes, not counting the return.	3 points
Team completes the task within 30 seconds and is able to repeat.	4 points
Bonus: Team is able to complete the task with a 5 lb weight within 2 minutes	5 points

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