ME 213: Introduction to Engineering Design  
Spring 2022  

Course Project Description  
The Absurdly-Complicated Ovoid Extraction Rally  

The Overall Goal  
You and your team must design, build, and drive a remote-controlled vehicle that can climb up two flights of stairs, acquire an egg (uncooked), and deliver it safely back to the starting point in the fastest time possible.

Course Details & Definitions  
Your vehicle will be navigating a combination of stairs and landings within a single, randomly-chosen stairwell in the Holmes building (Fig. 1). The starting position will be behind a line marked on the cement floor of Level 1, placed 1 m away from the first step. The egg will be placed upright at the center of the second landing from the starting level on a three-legged pedestal resting loosely (i.e., without adhesive or other anchoring) on the landing (Fig. 2).

During the final competition, your team will be given three timed attempts to complete the overall goal, with the single best score retained. An attempt will be considered complete/terminated if:

- The egg is delivered completely over the starting line.
- The vehicle is unable to move for a period of more than 30 sec.
- The time from start exceeds 6 min.
- The vehicle, egg, or pedestal are touched by a team member.
- The team or judge declares the attempt is complete without meeting any other condition above (e.g., due to an obvious fatal malfunction).

The total distance traveled by your vehicle in each attempt will be determined by the location of the point of your vehicle furthest along the course route in contact with the floor.
Each level portion of the course (starting area, landings) will be considered “crossed” when no portion of your vehicle remains in direct contact with the floor of that portion of the course.

Each step will be considered “crossed” when the location of the point of your vehicle furthest along the course route in in contact with the floor passes the corner/edge of the step.

The egg will be considered “acquired” when it (with or without the pedes\t) is lifted intact off of the floor for at least 1 second.

**Scoring**

<table>
<thead>
<tr>
<th>Completed Task</th>
<th>Points Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete crossing of level portions of the course</td>
<td>20</td>
</tr>
<tr>
<td>Ascending Steps - Per Step</td>
<td>5</td>
</tr>
<tr>
<td>Descending Steps - Entire Shorter Flight</td>
<td>10</td>
</tr>
<tr>
<td>Descending Steps - Entire Longer Flight</td>
<td>20</td>
</tr>
<tr>
<td>Egg Acquisition</td>
<td>300</td>
</tr>
<tr>
<td>Total Attempt Time, Per Second Below 3 Min.</td>
<td>2</td>
</tr>
<tr>
<td>Egg Delivered Intact Across Finish Line</td>
<td>2 x Total Points</td>
</tr>
</tbody>
</table>

**Rules**

1. **Your vehicle must have a total mass less than 10 kg.** This total does *not* include the mass of your control device.
2. **Your vehicle must fit within a volume of 0.5 m x 0.5 m x 0.5 m at the start of each attempt.** Once an attempt starts, your vehicle may deviate from the required starting volume and shape.
3. **Your total budget for the project must not exceed $TBD.** This includes all raw materials, parts, and any external manufacturing. If a phone/laptop is used as your control device, it will *not* count against your budget total. Reclaimed materials (from previous classes) will count as new (no depreciation).
4. **Your vehicle and control device must be battery powered.** Laptop computers and cell phones are acceptable.
5. **Your vehicle must be wirelessly controlled.** You will use the Bluetooth (BLE) control protocol (*via* an Arduino) for wireless control. Specifics of the implementation is up to you, but the TA is working on a suggested solution.
6. **During each attempt, you may not touch your vehicle, the egg, or the pedestal at any time.** You and your teammates may walk along the course with the vehicle to aid in guidance, if desired.
7. **Your vehicle must maintain direct contact with the floor at all times and cannot leave pieces behind.** This primarily means that you may not use any aerial vehicles (*e.g.*, quadcopter drones).
8. **You may not use any existing chassis kits or building systems for the construction of your vehicle.** Example companies include: LEGO, VEX Robotics, Lynxmotion, Dagu Electronics.
9. **You break the egg, you clean up the egg.**