

## Design Challenge – Butler Robot

As an engineer at a major design firm in Austin, and you have been commissioned to design a Butler Robot to help high school students take their finished work from their desk to the correct bin at their teacher’s desk. You will design, create, and program a Butler Robot that holds an assignment securely while maneuvering through the classroom and up the ramp onto the teacher’s desk, and then places the assignment into the correct bin (homework, class work, quiz bins). The Butler Robot should complete this task as quickly as possible. A schematic of the classroom is shown in Figure 1.

(insert schematic of your classroom here)

Figure 1: Schematic of Classroom

In this lab, using the vehicle you have constructed, you will program the Butler Robot device to travel a path to the teacher’s desk. Access to the desk is by way of a ramp.

The challenge will be completed in two phases:

1. Phase I: Negotiate through the classroom entirely by timing or motor control (number of rotations or number of degrees) to determine when to turn your vehicle. The Butler Robot will enter the classroom through the door and negotiate the path provided (marked with painter’s tape) to get to the teacher’s desk, travel up the ramp provided and deposit the assignment in the appropriate bin. You will be timed for this task.

To complete this phase of the challenge, develop a procedure and / or flowchart to assist you in solving the challenge. You should also create a small data table and plot of the distance traveled by your mobility assistance chair as a function of the number of rotations of your motor(s). You should include at least three values for motor rotation, e.g., 5, 10, and 25 rotations. Plot the distance traveled by the chair as a function of the motor rotations, assuming a given (constant) power setting. You can use this result to plan (e.g. with a procedure or flowchart) how you will negotiate the Butler Robot path.

2. Phase II: Negotiate through the classroom entirely under sensor control. Do not use timing or motor control (number of rotations or number of degrees) to determine when to turn your vehicle. The Butler Robot will enter the classroom through the door and negotiate the path (marked with painter’s tape) provided to get to the teacher’s desk, travel up the ramp provided and deposit the assignment in the appropriate bin. You will be timed for this task.



### Scoring:

The challenge will be scored based on a rubric and 100 points possible per phase. A portion of the score for each phase will be assigned based on the team's ability to describe a systematic approach they used to solve the challenge (including procedures, flowcharts, or mathematical relationships or plots); observations and insights of the team regarding automation, mathematics principles, and science principles; and the creativity employed by the team. Be willing to discover interesting physical phenomena, opportunities for mathematics, and cooperative learning effects as you solve this challenge.