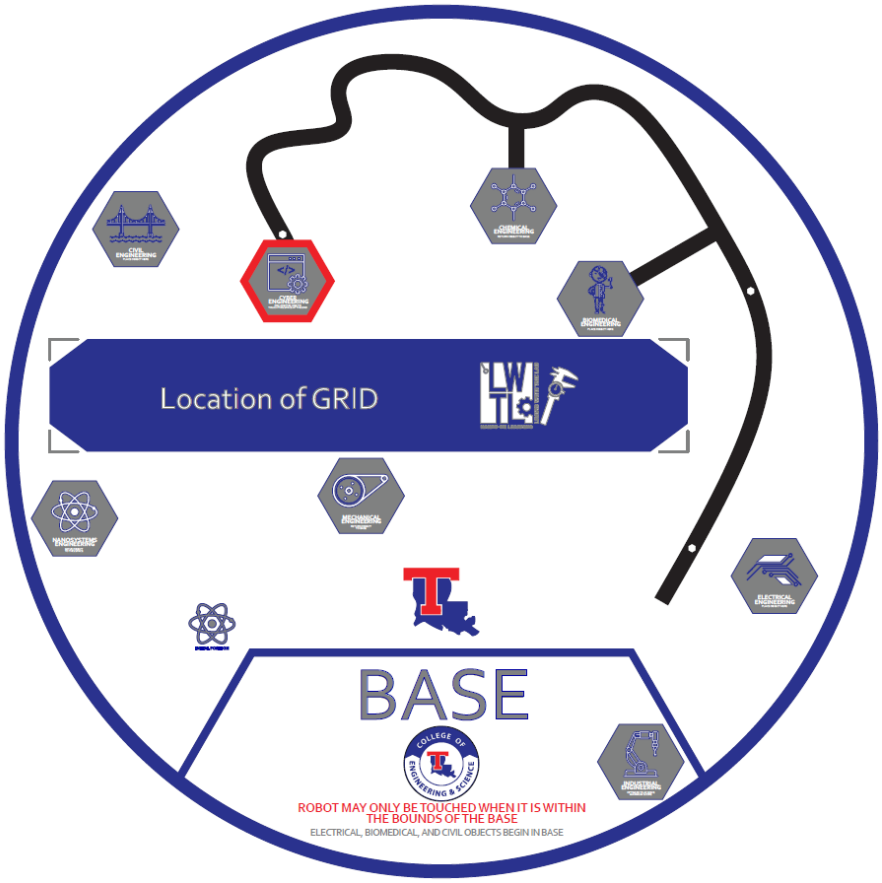
Robot Challenge: Navigating the Engineering Disciplines

This challenge involves programming your robot to "navigate the engineering disciplines" by completing six individual missions. Your robot will operate autonomously on a 47 inch diameter playing field.



The missions and their point values are provided below. All students, regardless of major, should attempt to successfully complete as many challenges as possible. The difficulty of a given mission is not related to the difficulty of the corresponding major. ☺

Biomedical Engineering (20 points) – deliver insulin pump to child: *move duck from base to child*

Chemical Engineering (20 points) – pump chemicals from reactor to base: *move duck on field into base*

Civil Engineering (20 points) – install beam on bridge: *move duck from base to hexagon region*

Electrical Engineering (20 points) – energize a resistor: *move duck from base to resistor*

Mechanical Engineering (20 points) – transport high-mileage car to vehicle test area: *move duck from hexagon region to base*

Nanosystems Engineering (20 points) – deliver photoresist to photolithography station to fabricate a microdevice: *push duck on field into hexagon region*

Cyber Engineering (70 points) – track down the secret code: *use photoresistors to follow the entire line segment from the first star to the second star (30 points) and from the second star to the third star (40 points); park the robot so that some part of it is directly above the cyber hexagon.*

Industrial Engineering (10 points) – optimize your robot's plan to achieve maximum score: *points awarded if four or more missions are successfully completed; strategy is important*

A perfect score is 200 points.

The rules for the challenge are provided below:

Logistics:

- Each round will last two minutes; the goal is to achieve maximum points within this time
- Each student may compete in two rounds
- The instructor will provide a schedule for the rounds

Field Rules:

- Robots can be handled when they are completely inside the boundaries of the base
- Students will be penalized 10 points each time they touch their robot when all or part of it is outside the base
- Robots must be brought back to the base and restarted after they are touched
- Students may not reset a playing piece after a round begins. For example, you can't bring a duck back to base if you push it to the wrong place
- Students may set up their own playing field (three ducks on field and three in base)
- The ducks must be upright, but can be rotated to face in any direction
- The center of the ducks and car must coincide with the center of their intended position

Lighting:

- The competition will be held in the classroom on the odd numbered tables
- All of the lights in the classroom will be left on during the competition
- The window blinds will remain closed during the competition
- Adding LEDs to the robot to make the light levels more consistent is allowed, including clear/white LEDs (the clear LEDs in your kit are IR LEDs and probably won't help)

Robot Rules:

- Students must use the basic robot design adopted for ENGR 120; you are not allowed to change wheels, servos, or microcontroller
- Students may utilize any of the parts in their kits (IR pairs, photoresistors, switches, whiskers)

- Students can install attachments on their robot; however, the entire robot and all attachments must be inside the base when a robot at the start of a round and when a robot is being handled. You can't build an attachment so long that it reaches a duck from the base since part of the attachment would extend beyond the base
- This challenge is intended to be more of a programming challenge than an attachment design challenge. Any fabrication of attachments is at your own risk and should be completed outside of class. Stiff cardboard segments clipped to the chassis should work well for attachments.
- Attachments may be left on the playing field with no penalty.
- Robots must be autonomous while on the playing field; no remote control is allowed, including shining flashlights onto the playing field.
- Robots may be rescued from the playing field with a 10 point deduction for each rescue. Robots must immediately be returned to base after being rescued. During a rescue, the robot or the student may not interact with a playing piece in any way.
- Robots may be reprogrammed while in base (but the clock will continue to run)
- Students must program and prepare their own robot. Talking about programs with others is OK, but direct copying of code from the screen or sharing of files is cheating.

Scoring:

- The highest score from the two rounds will be used to rank robot performance
- The robot may be left on the playing field when time expires with no deduction
- The score will be determined by . . .
    - the condition of the field at the end of a round
    - whether or not the robot followed the entire black line segment between the stars
        - the photoresistors must continuously sense the black line and cause the robot to drive along the black line
        - multiple photoresistors may be used
        - after the matches are finished, the instructor may ask to verify that a robot can in fact navigate along the black line before final scores are recorded
    - the number of times a student handled their robot outside of base
- In the event of a tie, the student with the highest average score will be declared the winner. If a tie still remains, a championship round will determine the winner (highest score then shortest time if a tie still remains)
- The instructor will serve as the head judge

Navigating the Engineering Disciplines Scoring Sheet

Student Name: _____

Section and Instructor: _____

Names of Two Judges:

_____ and _____

engineering challenge	possible points	point tally	
		round 1	round 2
biomedical	20		
chemical	20		
civil	20		
nanosystems	20		
electrical	20		
mechanical	20		
cyber	70		
industrial	10		
(1): point total from successful missions			
number of touches outside base			
(2): penalty points = 10 x # touches			
final score = (1) – (2) *negative scores are possible*			**highest score**
Time used			

Comments:

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