<u>EGR 110 Robotic Car Design Project</u>

Team 1: Swanson, Krakowski
Team 2: Green, Smith, Riley, Bone
Team 3: Deibler, Bailey, McKetney, Gilliam
Team 4: Butler, James, Holderfield, Bennett
Team 5: Hartman, Price

<u>T, Feb 3:</u> ASEE Model Design Competition discussed.

Assignment: All Teams complete Team Assignment #1 (brainstorm on ideas for the robotic car and produce sketches)

<u>T, Feb 10:</u> Each team made a presentation on their design. We attempted to compare the strengths and weaknesses of each design. In order to have a good chance at building and testing a successful robot, it is best to select a single design. As a result:

- We selected the basic design from Team 3:
  - 2 robots
  - Dead reckoning
  - One robot pushes the blue balls toward the blue goal
  - One robot pushes the red balls toward the red goal
  - The collection device is still under consideration
- The teams above will essentially operate as subteams and will be given different responsibilities.
- Each team may not receive assignments on the same date, but as the robot develops.
- We determined that the blue robot will travel approx 19’ and the red robot approx 15’

Assignment – Team 5:

- Create an Excel spreadsheet calculating motor rpms required for wheel diameters from 1.5” to 6” in 0.5” increments in order to complete the course in 30, 25, 20, 15, 10, and 5 seconds.
- Search for DC gearhead motors with suitable rpms.

Assignment – Team 3:

- Program two BOE-BOTs to navigate the approximate paths chosen earlier.
- The instructor will build brackets that we can add to the front of each robot to see if we can simply push the golf balls or if we need more positive control in collecting the balls.

<u>T, Feb 17</u>: We tested the BOEBOTs on the track with brackets (felt lined) attached to the front. We determined:

- Team 3 successfully tested their BOEBOT programs. The golf balls easily roll away out of control from the robot at the slightest touch, so we clearly need positive control to collect them.
- The BOEBOTs seemed to navigate the desired paths well, although consistency is an issue. We will have to explore this more later, especially with the final design. We may need to correct with some line sensing or with better wheel revolution counting (such as an IR sensor that counts black and white patterns on the inside of a wheel).
- Team 5 produced a nice spreadsheet of motor speeds versus wheel diameter and time to complete the course. We didn’t initially realize all that was implied by Team 3’s original design, but now it

has become more clear that we must use large wheels so that the golf balls will have room to roll under the motors/servos as space will be tight. If a motor is 1.5" in diameter and a golf ball is 1.68" in diameter, then the minimum clearance is 1.25/2 + 1.68 = 2.43", so the diameter of the wheels must be at least 2R = 2(2.43") = 4.86". Using 5" diameter wheels may be dangerously close, so perhaps we should plan for 5.5" diameter wheels.

- It looks like motors with a max speed of 200 – 250 rpms are probably required.
- The length of the motor must also be carefully selected. If the vehicle is only 6" wide maximum, then the entire motor length (including shaft, electrical connects) must be under 3". Team 5 will search a bit more for suitable motors.

R, Feb 19: Results from prior classes to be discussed and further assignments made as indicated below. In general, try to complete all assignments in one week. As we are exploring new territory, feel free to ask for more time if a given task turns out to be more complex than anticipated.

Assignment – Team 1: Develop an assembly for a standard servo, which will probably be used to control some sort of gating mechanism. Specifically:

- The instructor will provide you with a Futaba S3003 standard servo and a horn.
- Measure the servo body, servo horn, and the screw as accurately as possible using rulers and calipers provided.
- Create a part for the servo body. Include the three wires as if they were cut off at 0.25". Produce a detail drawing.
- Create a part for the servo horn. Produce a detail drawing.
- Create an assembly with the three parts. Produce an assembly drawing, including balloons and a parts table. Note that the servo horn should turn in the assembly.
- Be sure to list the author's name on each part (one student) and list all team members on the assembly.

Assignment – Team 5:

- Discuss motor selection with the instructor. Once the motor selection is completed:
- Find a wheel hub that will fit on the motor shaft (check those provided by the instructor first).
- Find a motor mount if possible. If one is not available, design one and produce an Inventor part for the design. Be sure to specify the type of material (1/8" PVC, 1/8" aluminum, 1/16" sheet metal, etc.)

Assignment – Team 3:

- Continue working on the BOEBOT programs. Try to run both BOEBOTs at the same time so that timing issues can be addressed.
- The team members not directly involved in the programming of the BOEBOT should brainstorm for ways to start the two BOEBOTs using a single switch. Consider several ideas (both electrical and mechanical) and include sketches. Feel free to ask others (including the instructor) for ideas!

Assignment – Teams 2, 4, and 6:

- Brainstorm for ideas on different collection devices for collecting 5 golf balls.
- Select one idea and try to model it using Inventor.
- Create multiple parts in Inventor and put them together in an assembly.
- Assume that most parts will be made using 1/8" PVC.

- Keep in mind the space in which you have to work:
    - The robot is at most 5.75” x 11.75”
    - The robot will use two front 5.5” diameter wheels and motors that are approximately 1.5” in diameter. Note that the golf balls will have room to roll under the motors.
    - Assume that there is a trailing ball-type wheel as with the BOEBOT.
- Since this is a brainstorming exercise, no drawings need to be produced except the final assembly.
- Be sure to include 5 golf balls as parts inserted into the assembly.
- If a servo is used (such as to move a gate), assume that its size is roughly 1.6” x 0.75” x 1.4”(high) with an additional height of 0.4” needed for the servo horn (1.5” in diameter, but could be customized).