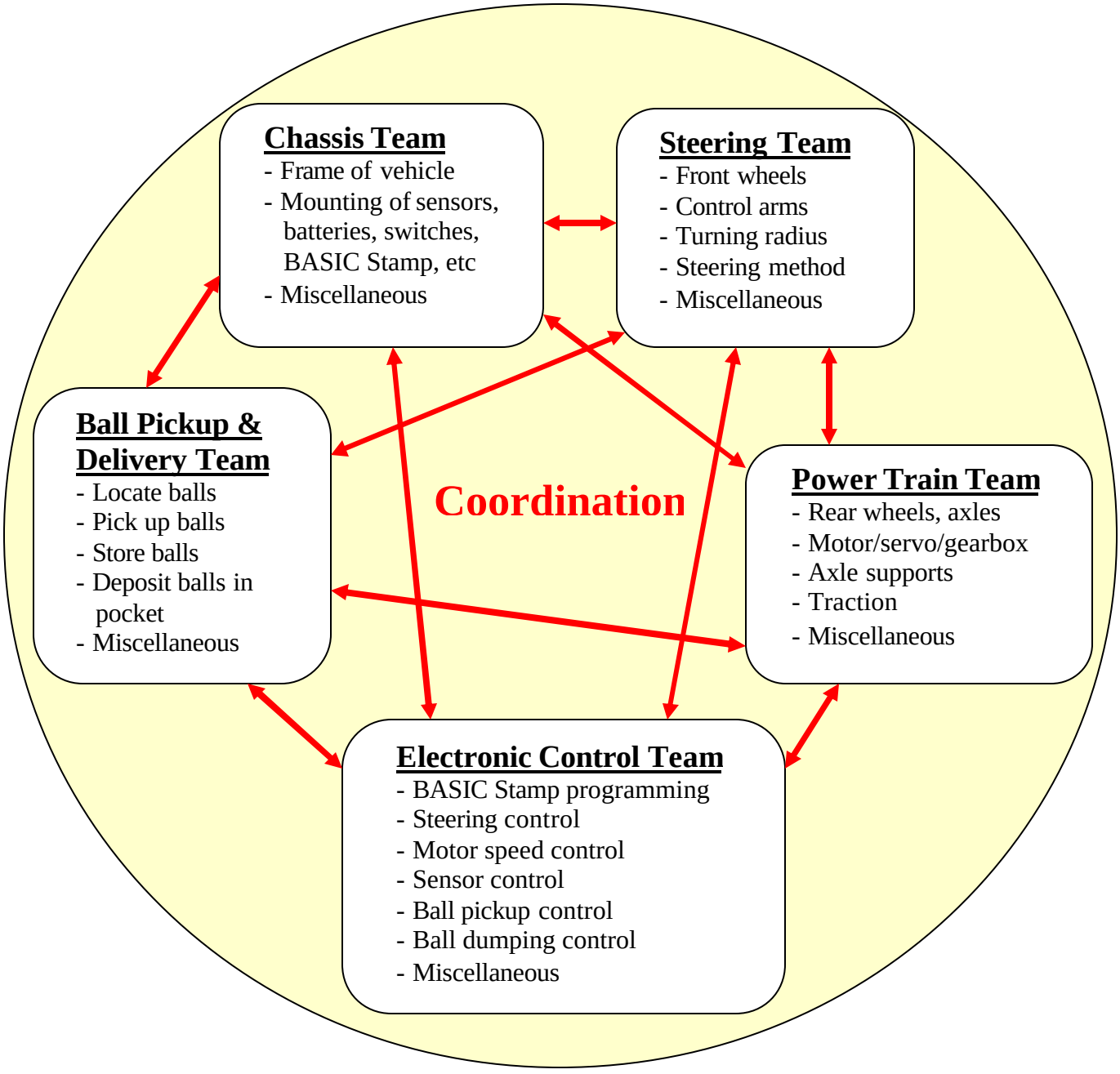
EGR 110
Engineering Graphics
File: N110G6

Group Design Project: ASEE Model Design Competition

Spring 2008

Reference: 2008 ASEE Model Design Competition Official Rules – available at:
http://www.tcc.edu/faculty/webpages/PGordy/ASEE/ASEE2008/index.html

The group design project will involve researching, designing, building, and testing a design that could be entered into the 2008 ASEE Model Design Competition. Detailed modeling of the design will be performed using Inventor and some basic analysis may be performed using MatLab. The class will be divided into teams that correspond to different portions of the robotic vehicle. The teams must coordinate with one another as the vehicle is designed. One possible arrangement of teams is shown below.



Teams

The class will be divided into teams for this project. The exact team responsibilities will depend on the robot design selected by the class. Team responsibilities may vary somewhat as the design develops. Note that a design change by one team may require a corresponding design change by another team. It is crucial that the teams coordinate and let other teams know of any design changes. One possible arrangement of teams is listed below (and illustrated on the previous page).

1. Chassis Team (3-5 students)
2. Steering Team (3-5 students)
3. Power Train Team (3-5 students)
4. Ball Pickup and Delivery Team (3-5 students)
5. Electronic Control Team (Instructor + volunteers with BASIC Stamp experience)

Parts

The instructor will provide parts for the design within certain limitations as noted below:

- Some parts are available for team use in the H-151 storeroom, including:
  - Servos (standard and continuous)
  - Wheels
  - Motors
  - Gearhead motors
  - Motor/gearbox assemblies
  - Hubs
  - BASIC Stamp Board of Education (BOE)
  - 3mm and 6mm thick PVC and glue (works well for frames, mounting brackets, etc)
  - Hardware (nuts, bolts, washers, collars, brackets, rods, etc)
- Some parts can be ordered (if sufficient justification is presented)
- Mr. Ezzell has volunteered to machine some parts (out of aluminum, for example)
- We have access to a 3D printer that can be used to make some plastic parts directly from Inventor models
- Students can provide their own parts

Tools

The storeroom in H-151 can be used with instructor guidance. The storeroom contains many useful tools, including:

- Bandsaw
- Drill press
- Vice
- Soldering irons
- Dremel
- Assorted hand tools

ASEE Model Design Competition

If the class is successful in building a complete design during the semester, it can be entered into the 2008 ASEE Model Design Competition to be held in Pittsburgh, PA on June 23, 2008. The TCC Engineering Club will be entering the competition, but the college can submit multiple entries. If it appears that this class will have a design capable of competing, we will discuss how to proceed near the end of the semester.

Tentative Schedule

The group project will involve several milestones in order to make sure that progress is being made on the project throughout the semester. Dates and assignment descriptions are provided below.

Date	Assignment
R, 1-24	**Step 1: Introduce ASEE Model Design Competition** The rules of the competition will be discussed in class in detail. Possible approaches for navigation, power train, ball pickup, sensing, etc., will be discussed.
T, 1-29	**Step 2: Basic Design Approach/Team Formation/Research** Since the class will attempt to design and build one robotic vehicle, a basic strategy for accomplishing the design objectives must be determined. Should the vehicle follow lines, follow walls, climb over walls, etc? These issues are critical as they will affect sensors, steering, ball pickup methods, etc. Discuss possible ***allocation of space*** for various parts of the design (for example, perhaps balls will be picked up front-center, so the steering can't get in the way and the chassis should be at least 2" high). Once a basic strategy has been selected, the class will be divided into teams, perhaps using subcategories like the ones illustrated on page 1. Teams will begin meeting to decide how to accomplish their particular subtasks.
R, 2-7	**Step 3: Preliminary Design Review 1** – A brief report and presentation is due for each team. A team grade will be assigned. **Report**: Each team should submit a brief report to the instructor with the following elements: A) Cover Page – include title (above), team name, team members, course, & date. B) List and briefly describe possible designs for ***your group*** (for example, the Power Train Team might include designs using motors, gearboxes, gearhead motors, servos, 1-wheel drive, 2-wheel drive, chains drives, etc.) C) Detailed sketch on graph paper of your top designs (include at least two views for each). **Presentation:** - All members of each team should make the presentation from the front of the classroom. - Students can use PowerPoint and/or the document camera. Provide a printed copy of your sketch for each of the other teams. They may need your details for their design. - Present the material from your report to the class in order to gain feedback and resolve any conflicts. - Designate someone in your group to take notes. If another team indicates a conflict or suggests an improvement or concern, it should be recorded. - Your team will need to make a follow up presentation in one week showing more details and showing how any conflicts were resolved.
R, 2-14	**Step 4: Preliminary Design Review 2** – A brief report and presentation is due for each team. A team grade will be assigned. **Report**: Each team should submit a brief report to the instructor with the following elements: A) Cover Page – include title (above), team name, team members, course, & date. B) Discuss modifications made to your previous design. Discuss any conflicts that were resolved with other teams. C) Detailed sketch on graph paper of your refined design (include at least two views for each). Include dimensions. **Presentation:** Similar to the previous presentation.

R, 2-21	**Step 5: Collect Parts** – The instructor will provide each team with a box in which to store parts. Put your team name and course number on the box. Place any parts obtained from the instructor in the box as well as any parts that you have gathered on your own. Show the parts to the instructor and he will check off your group.
Ongoing	**Step 6: Construction & Testing** – You should be working on building and testing portions of your design during the semester. For example, you may need to cut out mounting brackets and drill holes in them, mount wheels on hubs, etc. Do not wait until late in the semester to begin fabricating parts. You should also be drawing your parts in Inventor (see next step).
Ongoing	**Status Reports** – Teams will be asked on occasion to give informal status reports. It is critical that your team coordinate with the other teams concerning any design changes or problems. If you are having trouble with a design, ask for help.
R, 3-27	**Step 7: Detail Drawings** – Drawings for each part must be produced using Inventor. Include the student's name authoring each drawing as well as the team name. Use good dimensioning practices. The majority of the parts should be modeled by this date and printouts should be submitted to the instructor for part of the team grade.
T, 4-22	**Step 8: Performance Test** – Whether the robotic vehicle is fully functional or not, we will evaluate its performance on this date. Note that the robotic vehicle does not need to be fully functional to receive a good grade on this project.
R, 4-24	**Step 9: Team Assessment** – The instructor will provide each student with a form that will be used to rate the performance of each member on your team.
R, 4-24	**Step 10: Final Design Presentation/Report** – As part of the presentation, team members must use Inventor (and the classroom projector) to display their final assembly drawings (either the entire vehicle or just the team's subassembly). Also use PowerPoint as you discuss: - the original design objectives (for your subassembly) - different designs considered - design changes - design difficulties encountered - difficulties related to coordinating with other teams - how your design performed - possible future improvements **Report:** Turn in a report to the instructor consisting of: - Title Page - Printed copy of the PowerPoint presentation - Drawing of your team's subassembly (with balloons and a table identifying each part). - Detail drawings for each part (the same ones submitted earlier plus any updates or drawings that were missing at the first submission). - Calculations using MatLab (if applicable)