ME 285 - Term Project Information — Spring 2001

The term project is a chance for you to apply what you have learned about Mechatronics to design and build a device to solve a particular problem.

This semester the project will entail designing an autonomous device to deliver small foam balls to each of three baskets within a finite time. The project is adapted from Stanford University's ME 118 "March Madness" project (http://cdr.stanford.edu/DD/Courses/me118/PDFs/Materials/118projectW98.pdf). The course and rules are described below.

You will work on the project in teams of 2 to 4 people. You may choose your team members, but you must do so before February 14, 2001. After this date, Prof. Furman will assign students to groups.

Robo-Basketball™

The playing field is shown below in Figure 1.

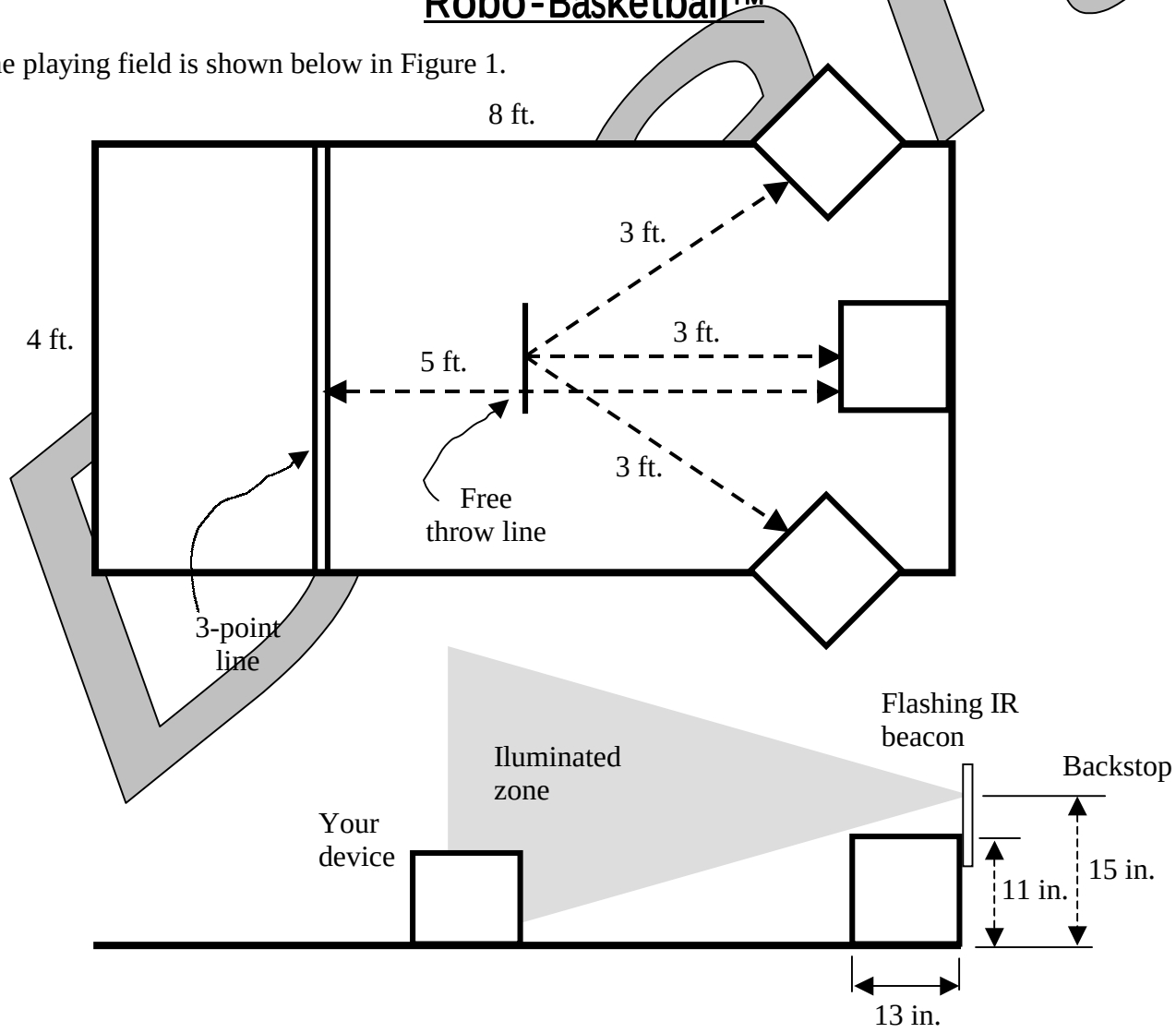

Figure 1. Top and side view of Robo-Basketball court. The autonomous device must start behind the free-throw line in a random orientation. A flashing IR beacon behind the backstops will indicate which basket is active.

Specifications

Your device must be a stand-alone entity, capable of meeting all specifications while connected only to power and ground. Battery operation is allowed, but not required.

The "court" consists of a 4 ft. by 8 ft. sheet of plywood painted white with a border of black lines approximately 1 inch wide. Within the court, there is a double black line, 5 ft. away from the front of the center basket, which is labeled the "Three-Point Line". Each of the two black lines and the white space between them are 1/2 in. wide. There is also a single black line 1/2 in. wide, 3 ft. away from the front of the center basket, labeled the "Free-Throw Line". All three baskets are 3 ft. from the center of the free throw line. Each basket is a 13 in.x13 in.x11 in. box with an open top. Positioned behind each crate, 15 in. from the floor is a flashing infrared beacon. Each beacon is centered behind the crate when viewed from the free throw line. A rectangular backstop is mounted above the back edge of the basket. Black, non-reflective tape will be placed on the floor surrounding the baskets 3 in. outside the edge of the baskets.

Your machine is required to occupy a volume not to exceed 13 in.x13 in.. in horizontal dimensions and 12 in. in height when initiated. Your machine must contain the complete supply of foam balls to be used during the event. At least three are required, but there is no upper limit, except that imposed by the total volume of the machine.

Your machine will be placed behind the free throw line in a random angular orientation relative to the line at the start of the game. The beacon behind the center basket will be the only illuminated beacon at the beginning. Once a ball is delivered to the center basket, the center beacon will be turned off, and the beacon on the left or the right will be illuminated. Your machine is then required to deliver a ball to the newly-illuminated basket. Once successful, the beacon will be turned off, and the remaining basket's beacon will be illuminated. Your machine is then required to deliver a ball to the remaining basket. All of this must be completed within 2 minutes.

Balls launched from behind the Free-Throw Line are worth a single point, Balls delivered or launched from any location inside the 3-Point Line, but not at the Free-Throw Line are worth 2 points. Balls launched from behind the 3-Point Line are worth 3 points. Scoring does not affect grading, but will be used as the basis of a competition at the Public Presentation.

Once the machine has been activated, the operator may not touch the machine until the entire sequence is complete. During operation, the machine is required to stay within the boundaries of the court. If the machine makes contact with a basket, it is required to back away at least 3 in. before continuing with any other activities.

A report describing the technical details of the machine will be required. The report should be of sufficient detail that a person skilled at the level of ME 285 could understand, reproduce, and modify the design.

Safety

The machines should be safe, to the user, the lab, and the spectators. For this project, high-velocity delivery is not going to result in successful delivery, and must be avoided.

Evaluation

Grading of the project will be carried out using the following criteria:

- **Concept** (20%) Your device will be judged on its technical merits, including, innovation, appropriate use of hardware and software, and application of physical and engineering principles in the design.

- **Implementation** (20%) Your device will be judged on how well it is presented at the project evaluation session. The focus here will be on the quality of workmanship and finished appearance.
- **Performance** (20%) Your device will be judged on how well it performed during the project evaluation session.
- **Report** (20%) This aspect focuses on the completeness and quality of your written documentation of the device. A key feature will be, "How easy would it be for someone acquainted with Mechatronics to understand, reproduce, and/or modify this design as documented?"
- **Individual Contribution and Milestone Reviews** (20%) This aspect will address the quality of each group member's contribution to the outcome of the term project. It will also include an evaluation of the quality of the deliverables.

Notes on the assignment:

1. Each team will be loaned a Handyboard for the project.

Milestone Dates	Deliverables
2-14-00	Team formation and submission of the team information sheet (ME 285 Vital Information Sheet). After this date, Prof. Furman will assign students who have not placed themselves into a group
2-28-01	Concepts (at ***least*** 10) with sketches and description. Indicate your prime and backup concepts. Hand sketches of the essential features are preferred. Your descriptions should be complete enough for one of your classmates to understand the design. The idea here is to generate many alternative solutions to the design challenge. Force your self to think in broad terms, and do not limit your creativity. I suggest brainstorming individually, then with your group. You will present your concepts along with individual task assignments to the rest of the class on this day. Turn in your presentation to Prof. Furman
3-14-01	System block diagram, calculations, preliminary test results, etc.
4-12-01	Demonstration of functioning subsytems in lab. Specific plans for completion.
5-10-01	Robo-Basketball Tournament
5-14-01	Project report