

REQUEST FOR PROPOSAL
FOR THE DESIGN OF A
MICROPROCESSOR-CONTROLLED
PRODUCT PLACING DEVICE



SCHOOL OF ENGINEERING & COMPUTER SCIENCE

Baylor University

Waco, Texas 76798

Fall 2006

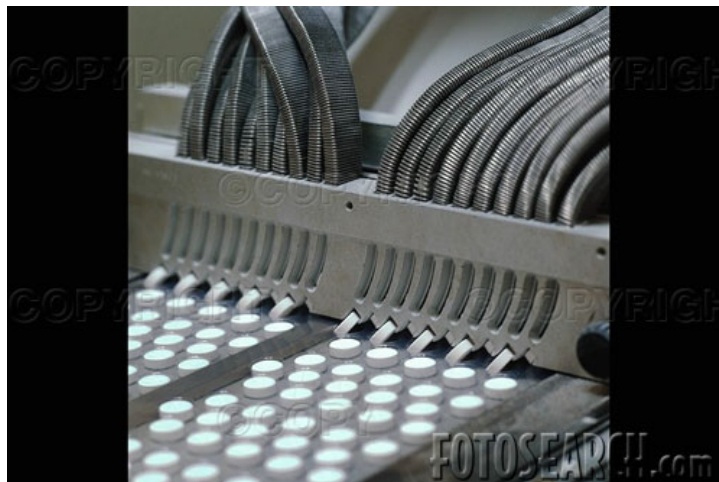
I. STATEMENT OF WORK

Qualified engineering design teams are invited to submit a technical proposal for the design of a **microprocessor-controlled product placing device**, hereafter referred to as the **PPD**, to the EGR 3380 instructors, hereafter referred to as the *owner*. Upon owner approval of the proposed design, each engineering design team, hereafter referred to as the *team*, shall build, test, and evaluate a prototype PPD, and shall provide the owner with final documentation of the prototype design.

Any specific instructions and schedules not included in this RFP, for completing design, presentation, construction, testing, and documentation milestones will be found in the course calendar and other specific milestone documents to be distributed at appropriate times during the project.

The design, construction, testing, and reporting of the **PPD** system is a requirement for completion of Engineering 3380 - Engineering Design I at Baylor University for the Fall semester 2006.

The PPD is representative of a wide variety of automated devices used to handle components/materials by taking them from and/or placing them in particular locations. “Pick and place” machines are used to place products from factory production lines into packaging containers. Similar devices are used for automated placement of electronic components onto printed circuit boards. In chemistry/biology laboratories, automated devices are used for the sampling/dispensing of liquids to or from arrays of vials or test tubes. Pharmaceutical companies use placement devices to handle and package pills, as seen in the photo below. These are just a few examples.



II. SPECIFICATION

1. General Description

The purpose of the PPD is automatically take pharmaceutical tablets (simulated using plastic beads) sequentially from a hopper and place each tablet into one of twelve possible output holes, in an order to be specified. The device will primarily be evaluated on the accuracy with which the tablets are placed in the designated output holes, the speed with which the task is completed, and the ease with which the information on output hole ordering is input to the device.

2. Design Requirements

2.1 Design Criteria

The design team shall design the device to meet or exceed all of the criteria listed below.

2.1.a. *Simulated Pharmaceutical Tablets:* The tablets will be simulated with plastic beads. The beads used will be Westrim Crafts® Style 3423 6x9 mm Pony Beads (can be purchased at Michael's craft store located at the intersection of Valley Mills & Waco Drive). Each team will be provided by the owners with an initial supply of approximately 50 beads. Any additional beads will need to be purchased by the team. Beads will be supplied by the owners for compliance testings.

2.1.b. *Output hole pattern:* The only specifications on the output holes are i) diameter, ii) the arrangement of their pattern, iii) each hole must be capable of receiving up to five tablets, and iv) following a test of the PPD, it must be clearly evident which hole a given bead passed into. See Figure 1 (attached) for details of i) and ii). An output hole numbering scheme is given in Figure 1. The design team shall mark hole numbers clearly on their PPD. The choice of material in which the holes are located, along with the overall size and shape of that material, are at the discretion of the design team. An additional design consideration should be the ease of removal of the beads from the system.

2.1.c. Power: All components/subsystems of the PPD shall be powered either with standard dry-cell batteries or by connection to a standard 110 VAC wall outlet. All power wiring, particularly any involving 110 VAC, must meet all applicable electrical safety codes/guidelines.

2.1.d. Size, Weight, & Setup: When set up for operation, the PPD must fit within a cube 18 inches on a side (excluding wiring/power cords). Total operating weight must not exceed 20 lbs. The PPD must be capable of sitting/operating on a classroom tabletop without damaging/marring the table surface. The design team will have 10 minutes from the beginning of their designated compliance test time in which to set up the PPD and ready it for operation.

2.1.e. PPD Operation: Prior to initiation of the PPD operation, the device will be “charged” with a load of 30 ± 5 tablets. The design team will be provided with the order in which a minimum of 10 and a maximum of 20 tablets will be placed in output holes (e.g., first tablet in hole # 8, second tablet in hole # 3, etc.). The device will then be started and must complete the designated sequence of tablet placements in one continuous operation. Figure 2 (attached) illustrates the concept of tablet placement in holes. The only operator input allowed during this period of operation is the input of the hole number information, possibly followed by a “triggering” input. The operation of the PPD will be timed. Upon completion of the tablet placement sequence, the PPD can be shut down if necessary and the accuracy of placement evaluated. The design team will then have three minutes to ready the PPD for a second trial (which will include removing tablets placed during the first trial, along with any resetting of the device that may be necessary).

2.1.f. PPD Evaluation: An evaluation score will be computed as the total score for two trial operations. For each trial, the baseline score will be taken as the total time of operation to place all of the specified tablets. This baseline score will then be adjusted for errors as follows. Each misplaced tablet will add a 10 second penalty. Each extraneous tablet placed will result in a 15 second penalty. Failure to complete a trial will result in a 20 second penalty for each tablet not placed, along with a minimum 60 second baseline time. Failure to ready the device for operation in the specified time (10 minutes for first trial, 3 minutes for second trial) will result in a 60 second penalty.

3. Design Documentation

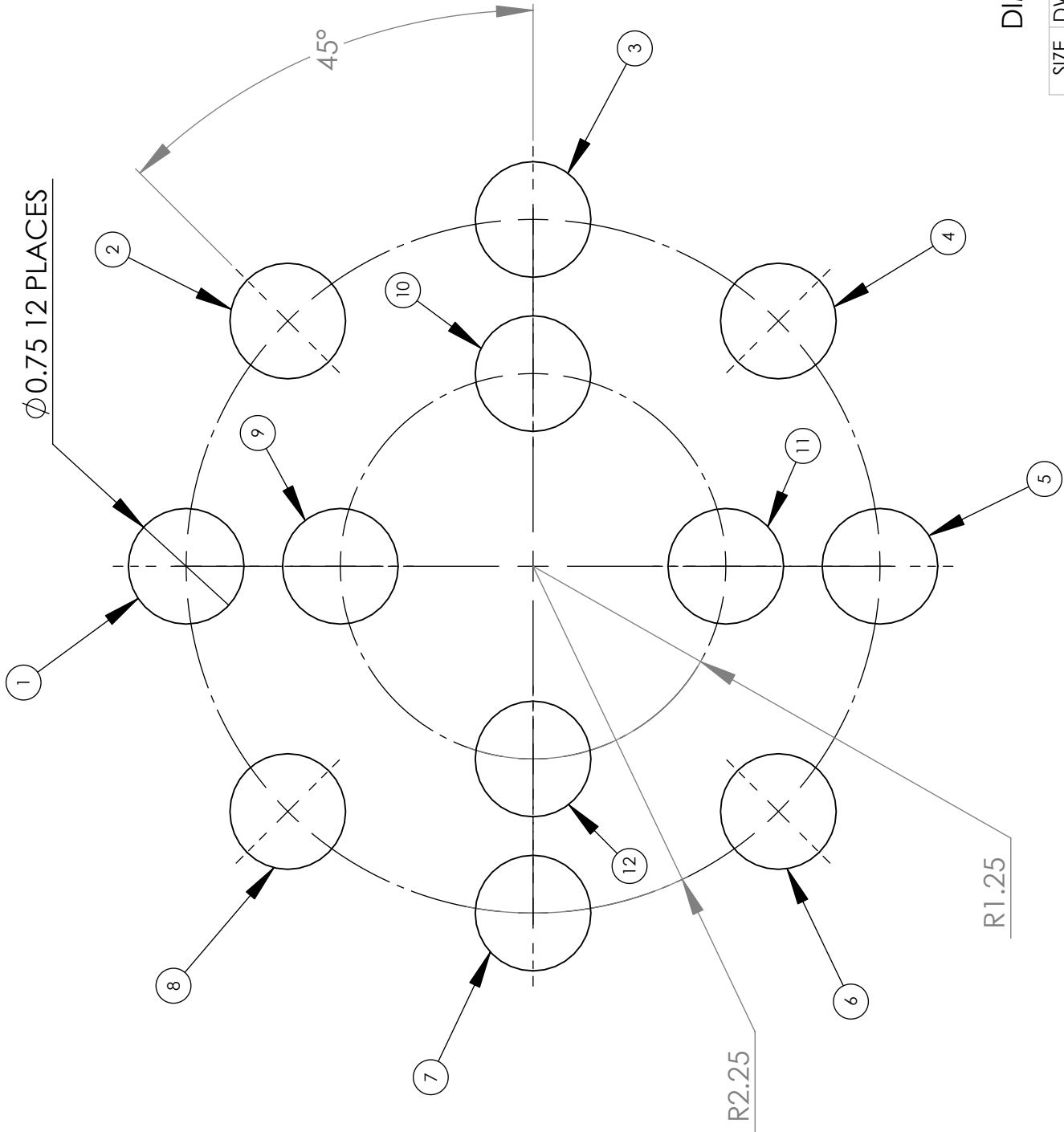
The design team shall document the project by use of manuscripts, calculations, and computer models/drawings. Specifications for required documentation and due dates are contained in the course calendar and/or will be distributed at appropriate points during the project.

4. Safety Requirements

The design team shall conduct all construction and testing with safety as the primary consideration. Failure to observe departmental workplace rules will lead to penalties in performance evaluation. Egregious or repeated safety violations, or disregard for Safety Officers, can result in dismissal from the course.

Cleanliness in the workplace is expected at all times and in all work areas. Failure to observe departmental workplace rules will lead to penalties in performance evaluation. *The design team shall clean all work areas with each use.*

FIGURE 1: HOLE PATTERN



DIMENSIONS IN INCHES

SIZE	DWG. NO.	REV
A	HOLE PATTERN	

SCALE: 1:1 SHEET 1 OF 1

FIGURE 2: TABLETS IN HOLES

