The Society of Manufacturing Engineers and the Education and Training Division of Robotics International of SME are pleased to present...

A Robotics CONTEST for Students

Sunday
May 7, 1989
Holiday Inn
Gaithersburg, Maryland
INTRODUCTION

The contests are educational activities organized by the Society of Manufacturing Engineers and sponsored through the Robotics International Association of SME and special industry sponsors. The contests are designed to complement classroom instruction by giving the students the opportunity to apply classroom knowledge in competitive situations. Each contest has been specifically developed to test skills and knowledge of students in a particular area of robotics/automation.

GENERAL INFORMATION

The 1989 National contest will be held Sunday, May 7, 1989 at the Holiday Inn, Gaithersburg, Maryland. Contest entry forms are to be sent to: Bonnie E. Tew, Society of Manufacturing Engineers, Technical Committee Projects, One SME Drive, P.O. Box 930, Dearborn, MI 48121 and are to be postmarked no later than April 1, 1989.

Lodging information and other relevant information will be sent to the contestants upon receipt of their entry form.

Spectators will be allowed to view the contests during the judging from behind the barrier. After the contests have been completed, an open house will be held during which the teams will be required to demonstrate their procedures to interested conference participants and other individuals.

All award winners will sign a release allowing the use of their photos and descriptions of their contest activity.

CONTEST CLASSIFICATIONS

<table>
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<th>Contest</th>
<th>Level</th>
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<tr>
<td>Robotic Work Cell</td>
<td>High School</td>
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<tr>
<td>Robotic Work Cell</td>
<td>Two Year College/University</td>
</tr>
<tr>
<td>Pick and Place Programming</td>
<td>High School</td>
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<tr>
<td>Pick and Place with Vision</td>
<td>Two Year College/University</td>
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</table>
INSTITUTION DEFINITION

High School: A public or private school offering instruction between and including grades nine, ten, eleven, and/or twelve.

Two Year College: A public or private supported school providing instruction at less than baccalaureate level.

University: A public or private school offering program at or above baccalaureate level.

TEAMS

Each school/university can only enter one team in each contest in which the institution is eligible to participate. A team will consist of one or more students along with the faculty advisor.

ELIGIBILITY OF TEAM MEMBERS

The team members must be enrolled in school during the period in which the contest is being held or in the previous academic term.

JUDGING

The "Pick and Place Contest" teams will be ranked in numerical order based on the criterion listed on the "Pick and Place" description and regulations. Awards will be presented to the top three scores.

The "Pick and Place/Vision Contest" teams will be ranked in numerical order based on the criterion listed in the "Pick and Place" description and regulations. Awards will be presented to the top three scores.

The "Robotic Work Cell" teams will be ranked on the basis of first, second, and third place. A "Best of Show" will be selected from the first place winners from each Division.

The "Maze" teams will be ranked in numerical order based on the criterion listed in the "Maze" contest description and regulations. First, second, and third place awards will be presented to the top three time scores. The plaques and certificates will be distributed to the participants at the award program following the completion of the contest.

NOTE: Accessibility for Handicapped Students:

Contestants must submit special requests for handicapped students indicating the type of handicap and requirements when submitting the entry form.
SAFETY

The Contest Coordinator may stop any contestant if it is determined that the operation is hazardous either to themselves or others. Such stoppage shall disqualify the team from that portion of the contest.

Each contestant will be responsible for all personal safety equipment.

ADVISORS

Advisors shall not be allowed in the pick and place, pick and place/vision, or maze area in which their team is competing.

DIVISIONS

Division One: High School Students
Division Two: Undergraduate Students
Division Three: Graduate Students

CONTEST SCHEDULE

May 7, 1988 - Holiday Inn - Gaithersburg, Maryland

Arrival and Set Up: 9:00 a.m. - 12:00 noon
Contest/Judging: 1:00 p.m. - 3:00 p.m.
Demonstrations: 3:00 p.m. - 4:00 p.m.
Awards Presentation: 4:00 p.m. - 4:30 p.m.
OBJECTIVE

The object of the Robotics/Automation Work Cell Contests is to allow students to demonstrate their knowledge, skill, and creativeness in designing, building, and operating a robotic/automation work cell.

PURPOSE

To determine if students can utilize one or more aspects of robotics/automation into a functioning work cell.

RULES

1. Each work cell to include one or more robots plus other additional units, such as vision, conveyors, programmable controllers, personal computers, to comprise the work cell.

2. Each team is to supply their own work cell components. The complete unit shall fit on top of a 30 inch by 60 inch table.

3. SME will provide the table and one dual 115 volt power female plug.

4. Students will be admitted to the contest area four hours prior to the start of the contest for the purpose of setting up the equipment.

5. The work cell operating sequence shall not exceed 15 minutes.

6. Scoring will be based upon:
   
   Design procedures and techniques, quality of the work, safety procedures, final operation solution to the problem, workmanship, and functionality.
# SCORE CARD

**Contestant Name**

**Classification**

<table>
<thead>
<tr>
<th>Items Evaluated</th>
<th>Possible Points</th>
<th>Contestant Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design procedures and techniques</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Quality of the work</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Safety procedures</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Final operation</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Solution to the problem</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Workmanship</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Functionality</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Descriptive Report</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>300</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Signature**

* (Contest Official)
OBJECTIVE

To program a table-top robot to pick up designated objects and place the designated objects in a specific location and order.

PURPOSE

To determine if student can:

1. Construct a program.
2. Enter the program into the robot's memory.
3. Have robot run program in automatic mode.

RULES

1. Each team is to supply their own table-top robot, and teach pendant. Supplement computers will not be allowed.

2. SME will provide the table, dual 115 volt power female plug, objects* and grid sheet. The "to scale" grid indicating the size of the work envelope, the location of the objects to be picked will be provided to each team.

3. Students will be admitted to the contest area four hours prior to the start of the contest for the purpose of setting up the equipment.

4. Each team will have a contest official assigned to the table for the purpose of recording scores.

5. Contest time shall be limited to two hours.

6. Scoring will be based upon:

   a. The elapsed time from start of the task to when a designated team members tells the contest official that automatic mode has operated satisfactorily.

   b. The accuracy of the placement of the blocks within the designated location(s).

   c. In the case of a tie, students will make a presentation utilizing a pre-designed flow chart which should demonstrate the logic upon which the solution to the pick and place problem was based.

*Objects will be ABC Blocks..1" square. . . . .
SCORE CARD

Contestant Name ____________________________________________

Starting Time ________________________________________________

Ending Time _________________________________________________

Elapsed time in minutes/seconds _________________________________

Accuracy: Deduct 1 penalty minute for each block touching or outside the designated area.

Total Score: Elapsed time plus penalty minutes ___________________

Signature: ________________________________________________ (Contest Official)
Society of Manufacturing Engineers
RI/SME Education & Training Division

Robotics Pick and Place/Vision Contest
College and University

Rules and Regulations

OBJECTIVES

To program a table-top robot to pick up designated objects and place the designated objects in a specific location and order using a vision system.

PURPOSE

To determine if students can:

1. Construct a program using vision.
2. Modify the program to meet object size and location.
3. Have robot run program in automatic mode.

RULES

1. Each team is to supply their own table-top robot, vision system, and computer.

2. SME will provide the table, dual 115 volt power female plug, objects* and grid sheet. The "to scale" grid indicating the size of the work envelope, the location of the objects to be picked and the location of the objects to be picked will be provided to each team.

3. Students will be admitted to the contest area four hours prior to the start of the contest for the purpose of setting up the equipment.

4. Each team will have a contest official assigned to the table for the purpose of recording scores.

5. Contest time shall be limited to two hours.

6. Scoring will be based upon:
   a. The elapsed time from start of the task to when a designated team member tells the contest official that automatic mode has operated satisfactorily.
   b. The accuracy of the placement of the blocks within the designated location(s).
   c. In the case of a tie, students will make a presentation utilizing a pre-designed flow chart which should demonstrate the logic upon which the solution to the pick and place problem was based.

*Objects will be ABC Block...1" square. . . . .
SCORE CARD

Contestant Name

Starting Time

Ending Time

Elapsed time in minutes/seconds

Accuracy: Deduct 1 penalty minute for each block touching or outside the designated area.

Total Score: Elapsed time plus penalty minutes

Signature: ________________________________  (Contest Official)
OBJECTIVE

The object of the Robot Maze Contest is to allow students to create a "mouse" which will successfully navigate a maze under its own sensory control.

RULES

1. The maximum physical size of the mouse is 7 inches in diameter

2. Any type of sensor may be mounted on the mouse and it may have an umbilical cord attached to a power supply and/or a computer for memory capacity.

3. The mouse CANNOT be programmed to navigate the maze.

4. HIGH SCHOOL contestants may purchase and assemble kits to accomplish the task.

5. College and University contestants must fabricate the mouse from miscellaneous components and sensors but CANNOT purchase and assemble "mouse" kits.

6. Students will be admitted to the contest area four hours prior to the start of the contest for the purpose of setting up the equipment.

7. Judging will be based on:

   Elapsed time for completion of the maze from starting line to finish line will be used to determine the winner in each division that competes in this category.

   In the event of a tie, a second run through the maze will be used to determine the winner. If the results of the second run are also a tie, contestants will be asked to make a presentation showing the logic used to develop the mouse and how the mouse uses information received by the sensors to determine the path through the maze. The decision of the judges will be final.

MAZE SPECIFICATIONS

The maze will be assembled from gator foam components which have been painted white. The portion of the floor of the maze that the "mouse" navigates has been coated with 600 grit silicone carbide paper to allow for maximum friction between the wheels and the floor. The accompanying maze drawing shows the configuration of the walls, which are six (6) inches high, and with distances between them as shown on the drawing.
I. DIVISION (Check One)  
High School  
Undergraduate  
Graduate  

II. FACULTY ADVISORY/INSTRUCTOR:  
Name  
School  
Address  
City, State, Zip  
Work Phone  
Home Phone  

III. NUMBER IN TEAM  

IV. STUDENT TEAM LEADER  
Name  
Grade/Level  

V. Please list the names and grade/level of each team member who WILL be attending the contest:  
1. Name  
Grade/Level  
2. Name  
Grade/Level  
3. Name  
Grade/Level  
4. Name  
Grade/Level  
5. Name  
Grade/Level  

VI. Please indicate the categories/tasks in which your school will be participating.  
A. PICK AND PLACE  
_____ High School  
_____ Undergraduate  
_____ Graduate  
B. ROBOTICS/AUTOMATION CELL  
_____ High School  
_____ Undergraduate  
_____ Graduate
C. ROBOT MAZE

_____ High School
_____ Undergraduate
_____ Graduate

VII. ENTRY FEE

A non-refundable fee of $20.00 is required of all entries. Please make
checks payable to the Society of Manufacturing Engineers. Please staple
payment to registration form.

VIII. TRANSPORTATION

The transportation to and from the contest site, and the set-up/removal of
equipment is the sole responsibility of the contestant/teams.

VX. MURPHY'S LAW

Anything that can go "wrong" will go "wrong", be sure to bring spare parts
and tools!

NOTE: Registrations must be POSTMARKED no later than March 15, 1988. This form
may be reproduced.

Please Return To:

Bonnie E. Tew
ROBOTICS INTERNATIONAL OF SME
One SME Drive
P.O. Box 930
Dearborn, MI 48121-0930

Direct Questions To:

Bonnie E. Tew
(313) 271-1500, ext. 343
I ______________________, hereby grant the Society of
(Name, please print/type)
Manufacturing Engineers nonrestrictive use of photographs and/or video tape
footage taken throughout the course of the Student Robot Contest to be held
on May 7, 1988

_________________________________________
Signature

_________________________________________
Date

NOTE: Please return this form with your registration form. Please duplicate to
correspond to the number of Students/Advisors who will attend the contest,
complete for each attendee and return.
DON'T LET A LIMITED BUDGET STOP YOU FROM ENTERING THE 1989 ROBOT CONTEST!

FACT #1: STUDENTS HAVE LIMITED FINANCIAL RESOURCES

FACT #2: Educational Institutions have limited financial resources

FACT #3: You're probably thinking that you have no way to finance your trip to the 1989 Student Contest

FACT #4: There are a number of potential solutions to the problem of financing your trip if you ACT NOW!

Your financing options include one or more of the following:

1. **INSTITUTIONAL SUPPORT**
   
   Request financial support from your school or university department. Your advisor can help you determine if the institution can/can not pay a portion or all of your expenses. **ASK YOUR ADVISOR FOR HELP!**

2. **FUND RAISERS**
   
   This requires real team effort but its a good resource from which to obtain a portion or all of the funds. Students and communities are willing to "pitch-in" for a good cause! What's your cause? A challenging educational experience which helps you prepare for our future and a chance to represent your school!

Some ideas include:

- Donut, Bagel, Bake Sales
- Car Washes
- Candy Sales
- Read-A-Thons/Pledging related Activities
- Community Yard Service
- Snow Shoveling (where applicable of course)
- Senior Citizen Services
- Robot Assembly/Races (via pledges)
- Your own ideas
3. **LOCAL SERVICE ORGANIZATIONS**

You may check with your advisor to determine whether any community service organizations would be willing to help you obtain a portion of the needed funds.

4. **LOCAL COMPANIES**

Are there local manufacturing companies which may be interested in sponsoring your trips? Ask your advisor who these contacts may be. It is possible - it happened in 1988!

5. **ROBOTICS MANUFACTURERS**

These are excellent contacts who often are more than willing to get involved in a project of this type! Again, ask your advisor how to make this contact and who to submit your request to.

6. **YOU**

You and/or your advisor may have additional ideas in relationship to how to finance your trip. If so, please contact Bonnie E. Tew at SME Headquarters and share your ideas! (313) 271-1500, ext. 343

7. **CONTACT SME**

We may have some additional ideas by the time you're preparing your "plan of attack". Please do not hesitate to call (313) 271-1500, ext. 343.
ROBOTS 13
CALL FOR
STUDENT PAPERS

ATTENTION STUDENTS!

YOU ARE INVITED TO SUBMIT A PAPER ON ROBOTICS AND/OR AUTOMATION
WHICH MAY WIN YOU A TRIP TO GAITHERSBURG, MARYLAND
AND/OR A PLACE IN THE ROBOTS 13 CONFERENCE PROCEEDINGS!

The Robotics International Association's Education and Training Division of
the Society of Manufacturing Engineers will highlight student technical
papers resulting from student projects, research and/or development.

0 WHY SHOULD I ENTER THIS COMPETITION?

1. If you're planning to enter the robotics field, this is your
prime opportunity to obtain exposure.

2. Should you win the first prize, you will have the opportunity
to personally meet representatives of leading companies from
across the United States. Now is your chance to make career
contacts!

3. If your paper is one of the six papers chosen for publication,
major companies and universities will see your work in print!

4. If you're the first prize winner, you'll be able to attend
technical sessions with top professionals and to obtain state-
of-the-art information on the robotics industry.

5. If you win the first prize and if you plan to attend a
university to pursue a Masters Degree or Ph.D., you'll have
the opportunity to personally meet research and development
researchers/educators from around the WORLD!

6. If you're published you automatically have an excellent piece
of information to place on a resume or vita.

0 WHO CAN PARTICIPATE

Students currently in an undergraduate or graduate manufacturing
related program at a college or university.
WHAT AM I COMPETING FOR?

1. The first prize award will include round trip coach airfare, hotel accommodations for two nights, limited expenses, and a two-day full conference registration to ROBOTS 13 for the winning student.

Although formal presentation of the paper will not be required at ROBOTS 13, the student will be recognized at the RI/SME President's Reception also held at ROBOTS 13.

2. The top six papers will be published in the ROBOTS 13 Conference proceedings and those students will receive complimentary copies of this document.

HOW DO I ENTER THE COMPETITION?

Simply complete the attached entry form and mail it to:

Bonnie E. Tew  
RI/SME Education & Training Division  
STUDENT PAPER CONTEST  
One SME Drive, P.O. Box 930  
Dearborn, MI 48121-0930 USA

After your entry form is received, you will be forwarded an authors manual. This packet of information will assist you with the final preparation of your paper.

WHEN IS MY PAPER DUE?

To be eligible for review, your paper must be submitted NO LATER than January 1, 1989. Your paper will then be judged by a panel of Education & Training Division members. The first prize winner will be notified in writing no later than March 1, 1989.

WHERE WILL ROBOTS 13 BE HELD?

The ROBOTS 13 Conference will be held in conjunction with the WORLD CONFERENCE ON ROBOTICS RESEARCH: THE NEXT FIVE YEARS AND BEYOND in GAITHERSBURG, MARYLAND at the Holiday Inn on May 7-11, 1989.

If you have additional questions, please contact Ms. Bonnie Tew at SME Headquarters at (313) 271-1500, ext. 343.

SEND IN YOUR ENTRY FORM TODAY  
TO START CARVING YOUR SUCCESSFUL CAREER PATH TOMORROW!
STUDENT INFORMATION

Name ____________________________________________
Address ____________________________________________________________________________
City, State, Zip _____________________________________________________________________
Phone Number ( ) _____________________________________________________________________ (during school year)

Home Address ________________________________________________________________________ (if different from above)
City, State, Zip _____________________________________________________________________
Home Phone Number ( ) _____________________________________________________________________

COLLEGE/UNIVERSITY ____________________________________________
Advisor:

Name ____________________________________________
Address __________________________________________________________________________
City/State/Zip ______________________________________________________________________
Phone ( ) ________________________________________________________________________

OFFICE HOURS: M T W TH F

PAPER TITLE: ____________________________________________