MICROCONTROLLER DESIGN

OVERVIEW

Teams develop a working digital device (product) with real-world applications. Through product demonstration and documentation, the team demonstrates in detail its knowledge of microcontroller programming, simple circuitry, and product design and marketing. The project should have educational and social value, and conform to the theme for the year. The theme will be posted on the TSA website under Competitions/Themes and Problems. Teams demonstrate and promote their work in a timed presentation.

ELIGIBILITY

1. One (1) team per chapter may participate; a team of one (1) individual is permitted
2. No more than three (3) team members may participate in the presentation

TIME LIMITS

Teams will be allowed:

1. Five (5) minutes to set up for the presentation
2. Five (5) minutes for the actual presentation
3. Three (3) minutes for removal of any items used in the presentation

Time violation: a deduction of five (5) points will be incurred for exceeding the five (5) minute presentation time limit.

LEAP

A LEAP Response is required for this event and must be submitted at event check-in.

ATTIRE

TSA competition attire is required.

PROCEDURE

PRE-CONFERENCE

1. Participants develop a working digital device (product).
2. Participants create a portfolio, documenting their research and process.
3. Participants prepare an oral presentation.

PRELIMINARY ROUND

1. Participants check in the following at the time and place stated in the conference program:
   a. The device (product)
   b. The documentation portfolio
   c. A hard copy of the LEAP Response with no report cover, separated from the portfolio
2. Participants sign up for a presentation time.
3. Portfolios are reviewed by judges in advance of the presentations.
4. No more than three (3) team members report to the designed event area at the assigned time.
   a. These three (3) team members will:
      i. Present their research findings
      ii. An explanation of the value of their product
      iii. A demonstration of the product's functionality
5. Judges may ask questions after the presentation is finished.

SEMIFINAL ROUND

1. The LEAP Response will be judged for semifinalist participants.
2. Ten (10) finalists will be announced during the conference awards ceremony.

REGULATIONS AND REQUIREMENTS

PRE-CONFERENCE

A. Documentation materials (comprising a "portfolio") are required and should be secured in a clear front report cover (click here for a sample).

1. The report cover must include the following single-sided, 8½" x 11" pages, in this order:

   a. Title page with the event title, the conference city and state, the year, and the team identification number; one (1) page

   b. Table of contents; pages as needed

   c. A description of the team's project, including an explanation of the educational and/or social value of the project; pages as needed for each requirement.

   d. Research into the problem; three (3) pages maximum

   e. A Plan of Work log that indicates preparation for the event, as noted by date, task, time involved, team member(s) responsible, and comments (See Plan of Work log in the Forms Appendix); one (1) page.

   f. Circuit diagrams

   g. Source code

   h. Materials list

   i. Team's evaluation of its work

   j. List of references used for the project

B. Product

1. The device (product) must include a programmed microcontroller that controls the device functionality.

2. Aesthetics: The product must be well-designed and show good craftsmanship.

3. Functionality: The product must operate as intended; remote control technology may be used to operate the device.

4. Educational/Social Value: The product must have a level of educational and/or social value.

5. Marketability: The product should be marketable.

6. AC power and/or a dry cell battery may be used.

PRELIMINARY ROUND

A. Presentation

1. Participants are given five (5) minutes to set up their device.

2. Participants are given five (5) minutes to explain the problem their device solves, and demonstrate the functionality of the device.

3. A deduction of five (5) points will be incurred for exceeding the five (5)-minute presentation time limit.

4. Judges may ask questions after the presentation.

5. Participants will be allowed three (3) minutes for the removal of any items used in the presentation.

B. All portfolios and presentations become the property of TSA, Inc., and will not be returned after the event.

SEMIFINAL ROUND

A. The LEAP Response:

1. Participants document the leadership skills the team has developed and demonstrated while working on this event and on a non-competitive event leadership experience.

2. Find the specific LEAP Response regulations in the LEAP Program section of this guide and on the TSA website.

EVALUATION

1. The quality of work and overall benefit showcased in the participant portfolio

2. The team's ability to promote their device (product), both to expand end-user usage and attract future developers

3. The content and quality of the LEAP Response

Refer to the official rating form for more information.

ADDITIONAL RESOURCES

www.avr-tutorials.com

www.pictutorials.com/what_is_microcontroller.htm

www.newbiehack.com/MicrocontrollerTutorial.aspx

people.ece.cornell.edu/land/courses/ece4760/FinalProjects

www.circuitstoday.com/8051-projects-and-circuits

STEM INTEGRATION

This event has connections to the STEM areas of Science, Technology, Engineering, and Mathematics.

CAREERS RELATED TO THIS EVENT

This competition has connections to one (1) or more of the careers below:

- Manufacturing
- Software engineer
- Technical writer

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2020 & 2021 OFFICIAL RATING FORM

MIDDLE SCHOOL

Judges: Using minimal (1-4 points), adequate (5-8 points), or exemplary (9-10 points) performance levels as a guideline in the rating form, record the scores earned for the event criteria in the column spaces to the right. The X1 or X2 notation in the criteria column is a multiplier factor for determining the points earned. (Example: an "adequate" score of 7 for an X1 criterion = 7 points; an "adequate" score of 7 for an X2 criterion = 14 points.) A score of zero (0) is acceptable if the minimal performance for any criterion is not met.

Go/No Go Specifications

- Before judging the entry, ensure that the items below are present; indicate presence with a check mark in the box.
- If an item is missing, leave the box next to the item blank and place a check mark in the box labeled ENTRY NOT EVALUATED.
- If a check mark is placed in the ENTRY NOT EVALUATED box, the entry is not to be judged.

☐ Project portfolio is present
☐ Product is present
☐ Completed LEAP Response is present
☐ ENTRY NOT EVALUATED

DOCUMENTATION (20 points)

Record scores in the column spaces below.

CRITERIA	Minimal performance	Adequate performance	Exemplary performance	
	1-4 points	5-8 points	9-10 points	
Portfolio components See Regulation A (X1)	Portfolio is unorganized, missing three (3) or more of the required components (such as circuit diagrams, source code, and marketing plan, etc.), and/or components are of poor quality.	Portfolio is somewhat organized, contains most components, and is of adequate quality.	Portfolio is organized and includes all required components.	
Research (X1)	Research is inadequate, and/or very few credible sources are referenced.	Research is adequate, and mostly credible sources are included.	The research is comprehensive, and credible resources are included.	
			DOCUMENTATION SUBTOTAL (20 points)	

PRODUCT (90 points)

Record scores in the column spaces below.

CRITERIA	Minimal performance	Adequate performance	Exemplary performance	
	1-4 points	5-8 points	9-10 points	
Complexity (X2)	Product is not complex, or not very complex; it includes little or no code, and/or circuit design and control technology complexity.	The product exhibits some degree of complexity; it includes code, circuit design, and control technology complexity.	The product is complex and highly functional; it includes code, circuit design, and control technology complexity.	
Creativity (X2)	The product lacks creativity; very little original thought in developing the project is evident.	Some elements of creativity are expressed; the product is somewhat original.	The work exudes creativity; the product is highly original.	
Technical skill (X2)	Little technical skill is exhibited in the code and circuit design.	A beyond-basic degree of technical skill is exhibited in the code and circuit design.	A level of mastery of coding and circuit design is exhibited.	

PRODUCT (100 points) – continued

Effectiveness (X1)	Product does not appropriately provide a solution to the problem.	Product loosely provides a solution to the problem.	The solution to the problem is clear in the product.	
Educational and/or social value (X1)	Product does not have any, or has very little, educational and/or social value.	The product has adequate educational and/or social value.	The product has high social and educational value.	
Design principles (X1)	Product demonstrates little to no use of design principles.	Product demonstrates adequate use of design principles	Product demonstrates exceptional use of design principles	
			PRODUCT SUBTOTAL (90 points)	

PRESENTATION (40 points)

Record scores in the column spaces below.

CRITERIA	Minimal performance	Adequate performance	Exemplary performance	
	1-4 points	5-8 points	9-10 points	
Organization (X1)	Participant(s) seem unorganized and unprepared for the presentation; the presentation is illogical.	Participant(s) are generally prepared for the presentation; explanation of the product is communicated and generally organized.	The presentation is logical, well organized, and easy to follow; explanation of the product is communicated in an organized and concise manner.	
Delivery (X1)	The participant(s) is/are verbose and/or uncertain in presenting; participants' posture, gestures, and lack of eye contact diminish the presentation.	The participant(s) is/are somewhat well-spoken and clear in presenting; participants' posture, gestures, and eye contact are acceptable in the presentation.	The participant(s) is/are well-spoken and distinct in presenting; participants' posture, gestures, and eye contact result in a polished, natural, and effective presentation.	
Product demonstration (X2)	Participant(s) is/are unable to successfully demonstrate the product, and/or the product does not work, or barely works, as intended.	Participant(s) is/are able to partially demonstrate the functionality of the product; the product somewhat works as intended.	Participant(s) is/are successful and effective in the product demonstration; the product works exactly as intended.	
			PRESENTATION SUBTOTAL (40 points)	

Rules violations (a deduction of 20% of the total possible points for the above sections) must be initialed by the judge, coordinator, and manager of the event. Record the deduction in the space to the right. Indicate the rule violated: _____	
Time violation (a deduction of five points total will be incurred for exceeding the five-minute presentation time limit). Record the deduction.	

PRELIMINARY SUBTOTAL (150 points)	

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SEMIFINAL LEAP RESPONSE (15 points)				
CRITERIA	Minimal performance	Adequate performance	Exemplary performance	
LEAP Response (10% of the total event points)	The team/individual efforts are not clearly communicated, lack detail, and are unconvincing; few, if any, attempts are made to identify and incorporate the SLC Practices.	The team/individual efforts are adequately communicated, include some detail, are clear, and are generally convincing; identification and incorporation of the SLC Practices are satisfactory.	The team/individual efforts are clearly communicated, fully-detailed, and convincing; identification and incorporation of the SLC Practices are excellent.	
			SEMIFINAL LEAP RESPONSE SUBTOTAL (15 points)	

Rules violations (a deduction of 20% of the total possible points for the above sections) must be initialed by the judge, coordinator, and manager of the event. Record the deduction in the space to the right. Indicate the rule violated: _____	

SEMIFINAL SUBTOTAL (15 points)	

To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary. **TOTAL (165 points)**	

Comments:

_____

I certify these results to be true and accurate to the best of my knowledge.

JUDGE

Printed name: _____ Signature: _____

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EVENT COORDINATOR INSTRUCTIONS

PERSONNEL

A. Event coordinator

B. Judges:

1. Preliminary round, two (2) or more

2. Semifinal round, two (2) or more

MATERIALS

A. Coordinator's packet, containing:

1. Event guidelines, one (1) copy for the coordinator and for each judge

2. TSA Event Coordinator Report

3. List of judges/assistants

4. Results envelope with coordinator forms

B. Chairs, one (1) per participant

C. Stopwatch for timing presentations

RESPONSIBILITIES

AT THE CONFERENCE

1. Attend the mandatory coordinator's meeting at the designated time and location.

2. Report to the CRC room and check the contents of the coordinator's packet.

3. Review the event guidelines and check to see that enough personnel have been scheduled.

4. Inspect the area(s) in which the event is being held for appropriate set-up, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.

5. At least one (1) hour before the event is scheduled to begin, meet with your judges/assistants to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.

PRELIMINARY ROUND

1. Check-in the entries at the time stated in the conference program.

2. Teams are required to bring:

   a. The device (product)

   b. The documentation portfolio

   c. A hard copy of the LEAP Response with no report cover, separated from the portfolio

3. Each entry must include the participant's identification number in the upper right-hand corner of the entry.

4. Late entries are considered on a case-by-case basis and only when the lateness is caused by events beyond the participant's control.

5. In order to compete, participants must be on the entry list or must have approval of the CRC.

6. Requirements for attire do NOT apply during check-in, only on the first day of the conference.

7. Assign students a five (5)-minute time frame for their presentation at check-in.

8. Judges independently review each static entry and conduct presentations at the designated time for each team.

9. Presentations:

   a. Inspect the area in which the presentations are to be held.

   b. There must be seating for at least five (5) people at a table with space for a computer and a display.

   c. Conduct presentations.

   d. Judges may ask questions after the presentation.

   e. Time violation: a deduction of five (5) points will be incurred for exceeding the five (5) minute presentation time limit.

10. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and the CRC manager to determine either:

- To deduct twenty percent (20%) of the total possible points in this round
- To disqualify the entry

The event coordinator, judges and CRC manager must all initial either of the violations on the rating form.

11. Judges determine twelve (12) semifinalists and discuss and break any ties.

12. Submit the semifinalist results to the CRC room.

13. Manage security and the removal of materials from the area.

SEMIFINAL ROUND

1. Discuss rule violations (e.g. 20% deduction, disqualification) and have all relevant parties initial the rating form.

2. Judges determine ten (10) finalists and discuss and break any ties.

3. Submit the finalist results and all related forms in the results envelope to the CRC room.

4. Manage security and the removal of materials from the area.