



# MICROCONTROLLER DESIGN

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## OVERVIEW

Teams develop a working digital device (product) with real-world applications. Through a multimedia presentation, 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 ([www.tsaweb.org](http://www.tsaweb.org)) under Competitions/Themes and Problems. Teams demonstrate and promote their work in a timed presentation.

## ELIGIBILITY

- One (1) team of three to five (3-5) members per chapter may participate.
- Up to three (3) team members may participate in the presentation

## TIME LIMITS

Teams will be allowed:

- Five (5) minutes to set up for the presentation
- Five (5) minutes for the actual presentation
- 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 team LEAP Response is required for this event and must be submitted at event check-in (see LEAP Program).

## ATTIRE

TSA competition attire is required.

## PROCEDURE

### Preliminary Round

1. Teams submit their documentation portfolio and LEAP Response at the time and place stated in the conference program and sign up for a presentation time.
2. Portfolios are reviewed by judges in advance of the presentations.
3. Teams report to the designated event area at the specified time in the conference program.
4. Teams must bring with them the device (product) and multimedia presentation.
5. Products are judged during the presentation.
6. No more than three (3) team members are allowed to participate in the presentation in which they will:
  - a. Explain their research
  - b. Explain the value of their product and its marketability
  - c. Demonstrate their product's functionality
7. Judges may ask questions after the presentation is finished.



8. A list of twelve (12) semifinalist teams (in random order) will be posted.

### **Semifinal Round**

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

## **REGULATIONS**

### **Preliminary Round**

- A. Documentation materials (comprising a "portfolio") are required and should be secured in a clear front report cover. (Click [here](#) for a sample.)
- B. The report cover must include the following single-sided, 8½" by 11" pages, in this order:
  1. Title page with the event title, the conference city and state, the year, and the team identification number; one (1) page
  2. Table of contents; pages as needed
  3. 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.
  4. Research into the problem; three (3) pages maximum.
  5. 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
  6. Circuit diagrams
  7. Source code
  8. Product marketing plan
  9. Print out of multimedia presentation
  10. Materials list
  11. Team's evaluation of its work
  12. List of references used for the project
- C. 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.
- D. Presentation
  1. Teams are given five (5) minutes to set up their device and multimedia presentation.
  2. Teams are given five (5) minutes to explain the problem their device solves, demonstrate the functionality of the device, and describe their marketing plan.
  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. Teams will be allowed three (3) minutes for the removal of any items used in the presentation.
- E. All portfolios and presentations become the property of TSA, Inc., and will not be returned after the event.



## Semifinal Round

F. The LEAP Response:

1. Teams 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

Evaluation is based on:

1. The quality of work and overall benefit showcased in the participant portfolio
2. The team's multimedia presentation
3. The team's ability to promote their device (product), both to expand end-user usage and attract future developers
4. The content and quality of the LEAP Response

Refer to the official rating form for more information.

## PROJECT IDEAS AND MICROCONTROLLER TRAINING

<http://www.avr-tutorials.com>

[http://www.pictutorials.com/what\\_is\\_microcontroller.htm](http://www.pictutorials.com/what_is_microcontroller.htm)

<https://www.newbiehack.com/MicrocontrollerTutorial.aspx>

<http://people.ece.cornell.edu/land/courses/ece4760/FinalProjects/>

<http://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 or more of the careers below:

- Manufacturing
- Software engineer
- Technical writer



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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

- A. 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 judges/assistants 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.
- B. Preliminary Round
  - 1. Check-in the entries at the time stated in the conference program.
  - 2. Anyone reporting who is not on the entry list may check in only after official notification is received from the CRC.
  - 3. Late entries are considered on a case-by-case basis and only when the lateness is caused by events beyond the participant's control.
  - 4. Requirements for attire do NOT apply during check-in only on the first day of the conference.
  - 5. Each entry must include the participant's identification number in the upper right-hand corner of the entry.
  - 6. Assign students a five (5)-minute time frame for their presentation at check-in.
  - 7. Judges independently review each static entry.



8. 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.
  9. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and CRC manager to determine either
    - to deduct twenty percent (20%) of the total possible points in this round or
    - to disqualify the entry
    - The event coordinator, judges and CRC manager must all initial either of these actions on the rating form.
  10. Judges determine twelve (12) semifinalists and discuss and break any ties.
  11. Complete and submit the semifinalist results and all related forms in the results envelope to the CRC room.
  12. Manage security and the removal of materials from the area.
- C. Semifinal Round
1. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and CRC manager to determine either
    - to deduct twenty percent (20%) of the total possible points in this round or
    - to disqualify the entry
    - The event coordinator, judges and CRC manager must all initial either of these actions on the rating form.
  2. Judges determine ten (10) finalists and discuss and break any ties.
  2. Complete and submit the finalist results and all related forms in the results envelope to the CRC room.
  3. Manage security and the removal of materials from the area.



Participant/Team ID# \_\_\_\_\_

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2018 & 2019 OFFICIAL RATING FORM

MIDDLE SCHOOL

## 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 blank and place a check mark in the box labeled ENTRY NOT EVALUATED. This will disqualify the entry and it will not be judged.

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

## Criterion Performance Levels

CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
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Evaluators: Using minimal (1-4 points), adequate (5-8 points), or exemplary (9-10 points) performance levels as a guideline, 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.

## Documentation (20 points)

<b>Portfolio components</b> See Regulation A (X1)	Portfolio is unorganized, missing three 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.
<b>Research</b> (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 (100 points)

CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
<b>Design principles</b> (X1)	Product demonstrates little to no use of design principles.	Product demonstrates adequate use of design principles	Product demonstrates exceptional use of design principles
<b>Complexity</b> (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.
<b>Creativity</b> (X1)	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.
<b>Technical skill</b> (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.
<b>Effectiveness</b> (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.
<b>Educational and/or social value</b> (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 extreme social and educational value.

Record scores in the column spaces below.



<b>Product continued (100 points)</b>			
<b>CRITERIA</b>	<b>Minimal performance 1-4 points</b>	<b>Adequate performance 5-8 points</b>	<b>Exemplary performance 9-10 points</b>
<b>Design principles</b> (X1)	Product demonstrates little to no use of design principles.	Product demonstrates adequate use of design principles	Product demonstrates exceptional use of design principles
<b>Marketability</b> (x1)	Product is not marketable or not very marketable, and/or there is no plan, or only a minimal plan, for marketing of the product.	The product is somewhat marketable as defined; there is a plan for marketing the product, but it is incomplete.	The market for the product is well thought out; the product itself is very marketable.
<b>PRODUCT SUBTOTAL (100 points)</b>			

<b>Presentation (60 points)</b>			
<b>CRITERIA</b>	<b>Minimal performance 1-4 points</b>	<b>Adequate performance 5-8 points</b>	<b>Exemplary performance 9-10 points</b>
<b>Organization</b> (X1)	The team seems unprepared and unorganized for the presentation.	The team is prepared but somewhat disorganized in its presentation to judges.	The team's presentation is logically organized and effectively presented.
<b>Knowledge</b> (X1)	Team members seem to have very little understanding of the concepts in their project; they provide vague answers to questions.	Team members have a general understanding of the concepts in their project and answer questions adequately.	There is clear evidence that all team members have a thorough understanding of the concepts presented in their project; they answer questions well and confidently.
<b>Articulation</b> (X1)	The team's presentation is not logical or articulate.	The team's presentation is logical, and generally articulate.	The team provides a concise, logical, and clear explanation of the product.
<b>Team participation</b> (X1)	Only one team member communicates with judges; there is no participation from other team members.	Team members participate equally, but only one member seems to fully understand the concepts.	All team members seem to fully understand the concepts and share an equal role in the presentation.
<b>Delivery</b> (X1)	The team is verbose and/or uncertain in its presentation; participants' posture, gestures, and lack of eye contact diminish the presentation.	The team is somewhat well-spoken and clear in its presentation; participants' posture, gestures, and eye contact are acceptable in the presentation.	The team is well-spoken and distinct in its presentation; participants' posture, gestures, and eye contact result in a polished, natural, and effective presentation.
<b>Product demonstration</b> (x1)	Team members are unable to successfully demonstrate their product, and/or the product does not work, or barely works, as intended.	Team members are able to partially demonstrate the functionality of their product; the product somewhat works as intended.	Team members are successful and effective in their product demonstration; the product works exactly as intended.

<b>PRESENTATION SUBTOTAL (60 points)</b>			
Rules violations (a deduction of 20% of the total possible points for the sections above) must be initiated by the evaluator, 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.			
<b>PRELIMINARY SUBTOTAL (180 points)</b>			



Semifinal LEAP Response (18 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
<b>LEAP</b> (10% of the total event points)	The team's 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's efforts are adequately communicated, include some detail, are clear, and are generally convincing; identification and incorporation of the SLC Practices are satisfactory.	The team's efforts are clearly communicated, fully-detailed, and convincing; identification and incorporation of the SLC Practices are excellent.
<b>SEMIFINAL LEAP RESPONSE SUBTOTAL (18 points)</b>			
Rules violations (a deduction of 20% of the total possible points for the semifinalist section) must be initiated by the evaluator, coordinator and manager of the event. Record the deduction in the space to the right.			
Indicate the rule violated: _____			
<b>SEMIFINAL SUBTOTAL (18 points)</b>			
(To arrive at the TOTAL score, add the PRELIMINARY SUBTOTAL and the SEMIFINAL SUBTOTAL.)			<b>TOTAL (198 points)</b>
Comments:			
I certify these results to be true and accurate to the best of my knowledge.			
<u>Evaluator</u>			
Printed name: _____		Signature: _____	