# MICROCONTROLLER DESIGN

## OVERVIEW

Applying leadership and 21st century skills, participants design 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 *Themes & Problems*. Teams demonstrate and promote their work in a timed presentation.

## ELIGIBILITY

One (1) team per chapter may participate; individual entries are permitted

## TIME LIMITS

Participants are allowed:

A. Five (5) minutes to set up for the presentation.
B. Five (5) minutes for the presentation.
C. Three (3) minutes for removal of any items.
D. A deduction of five (5) points will be incurred for exceeding the five (5)-minute presentation time limit.

## ATTIRE

TSA competition attire is required.

## PROCEDURE

### PRE-CONFERENCE

A. Participants concentrate their efforts in the design and development of a working digital device (product).
B. Participants create a portfolio, documenting their research and process.
C. Participants prepare an oral presentation.

### ON-SITE CHALLENGE

A. No more than three (3) team representatives report at the time and place stated in the conference program with:
    1. The device (product)
    2. The documentation portfolio
B. Participants are assigned a presentation time upon check-in.
C. One (1) to three (3) team representatives present the following at their assigned time:
    1. Research findings
    2. An explanation of the value of their product
    3. A demonstration of the product's functionality
D. The device will be taken by the team at the completion of the presentation or will be picked up by the team at the time and location posted in the conference program.
E. Judges score the entries and presentation.
F. Ten (10) finalists are announced during the conference awards ceremony.

## REGULATIONS AND REQUIREMENTS

Students will work to develop their leadership and 21st century skills in the process of preparing for and participating in this TSA competitive event. The development and application of those skills must be evident in their submission, demonstration, and/or communication pertaining to the entry.

### PRE-CONFERENCE

A. Documentation Portfolio:
    1. Documentation portfolio is required and must be secured in a clear front report cover with 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 theme; pages as needed
        d. Research into the problem; three (3) pages maximum
        e. Work Log (see Forms Appendix); pages as needed
        f. Circuit diagrams; pages as needed
        g. Source code; pages as needed
        h. Materials list; pages as needed
        i. Team's evaluation of its work; pages as needed

j. References and resources list in a professional citation style of the competitors choosing; pages as needed. Failure to use a professional citation style will result in a rules violation of 20% (twenty percent). Some examples of professional citation styles include MLA, APA, Chicago, and IEEE.

B. The Device (product):
   1. The device (product) must include a programmed microcontroller that controls the device functionality.
   2. Aesthetics: The product must be well-designed, design elements are incorporated, and show good craftsmanship.
   3. Functionality: The product must operate as intended; remote control technology may be used to operate the device.
   4. The product must be relevant to the given theme.
   5. Coding and Circuit Design: The product must show proper and effective use of coding and circuit methods.
   6. AC power and/or a dry cell battery may be used.
   7. The device may be no larger than 18" x 12" x 12".

### ON-SITE CHALLENGE

A. The Presentation:
   1. Participants are given five (5) minutes to set up their device and five (5) minutes to explain the problem and demonstrate the functionality of the device.
   2. A deduction of five (5) points will be incurred for exceeding the five (5)-minute presentation time limit.
   3. Judges may ask questions after the presentation.
   4. Participants are allowed three (3) minutes for the removal of any items used in the presentation.

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

C. The device will be taken by the team at the completion of the presentation or will be picked up by the team at the time and location posted in the conference program.

## EVALUATION

A. The product

B. The documentation

C. The presentation

Refer to the official rating form for more information.

## ADDITIONAL RESOURCES

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.

## LEADERSHIP AND 21ST CENTURY SKILLS DEVELOPMENT

This event provides opportunity for students to build and develop leadership and 21st century skills including but not limited to:

- Communication
- Collaboration/Social Skills
- Initiative
- Problem Solving/Risk Taking
- Critical Thinking
- Perseverance/Grit
- Creativity
- Relationship Building/Teamwork
- Dependability/Integrity
- Flexibility/Adaptability

## CAREERS RELATED TO THIS EVENT

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

- Manufacturing
- Software engineer
- Technical writer

Participant/Team ID# _____

# MICROCONTROLLER DESIGN

## 2024 & 2025 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.

☐ The documentation portfolio is present
☐ The device (product) is present
☐ ENTRY NOT EVALUATED

| **DOCUMENTATION PORTFOLIO** (30 points) | | | | |
|---|---|---|---|---|
| **CRITERIA** | Minimal performance | Adequate performance | Exemplary performance | Record scores in the column spaces below. |
| | 1-4 points | 5-8 points | 9-10 points | |
| **Portfolio Components** (X2) | Portfolio is unorganized and/or is missing three (3) or more components. | Portfolio is missing one (1) or two (2) components and/or is loosely organized. | Portfolio has all required components in order and is well organized. | |
| **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 PORTFOLIO SUBTOTAL** (30 points) | |

| **DEVICE** (80 points) | | | | |
|---|---|---|---|---|
| **CRITERIA** | Minimal performance | Adequate performance | Exemplary performance | Record scores in the column spaces below. |
| | 1-4 points | 5-8 points | 9-10 points | |
| **Complexity** (X2) | Product lacks complexity; 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. | |
| **Connection to the Theme** (X1) | Product does not have any, or has very little, connection to the theme. | The product has adequate connection to the theme. | The product has high connection to the theme. | |
| **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** (80 points) – continued | |
|---|---|
| **PRODUCT SUBTOTAL** (80 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. | |
| **Articulation** (X1) | Communication of the product functionality and design process is unclear, unorganized, and or illogical; leadership and/or 21st century skills are not evident. | Communication of the product functionality and design process is somewhat logical and clear; leadership and/or 21st century skills are somewhat evident. | Communication of the product functionality and design process is clear, concise, and logical; leadership and/or 21st century skills are clearly evident. | |
| **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.<br><br>Indicate the rule violated: _____ | |
| Time violation (a deduction of five [5] points total will be incurred for exceeding the five [5]-minute presentation time limit). Record the deduction. | |

| | |
|---|---|
| **PRELIMINARY SUBTOTAL** (150 points) | |

| | |
|---|---|
| **To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary.** **TOTAL** (150 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. Presentation, 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

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

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

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

D. 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.

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

### ON-SITE CHALLENGE

A. No more than three (3) team representatives report at the time and place stated in the conference program with:

   1. The device (product)
   2. The documentation portfolio

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

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

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

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

F. Judges circulate to review documentation and entry prior to the presentation.

G. Presentations:

   1. Inspect the area in which the presentations are to be held.
   2. There must be seating for at least five (5) people at a table with space for a computer and device (product).
   3. Conduct presentations.
   4. Judges may ask questions after the presentation.
   5. A deduction of five (5) points will be incurred for exceeding the five (5)-minute time limit.

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

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

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

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

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

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