



MESA USA

NATIONAL ENGINEERING DESIGN COMPETITION (NEDC)

2019-2020

Arduino-based Solutions for Humans

Overview

In order to maximize each team's experience during this event, proper execution of all aspects of the judging process and event administration is very important. Although each MESA state may elect to present this event in different format(s), the MESA USA host site and the corresponding National Event Planning Committee will adhere to the processes outlined below. Please note that the following processes not only outlines the event but also the roles and responsibilities of student team members and advisors.

MESA USA Code of Sportsmanship

During the course of this event, MESA students, staff, advisors and supporting family members should act in a professional and courteous manner at all times. All judges' decisions are final. Staff, advisors and parents shall not engage judges during the event.

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Introduction:

There is an old saying that states, “Necessity is the mother of invention.” Humans have always been most creative, most inventive when they have had a need and lacked a way of resolving it. This idea is the basis for what we know as the field of Engineering.

As a way to find a solution to a need, engineers implement the **Engineering Design Process**. This process allows Engineers to systematically identify the need and any obstacles or challenges; draft ideas for a solution applying their knowledge of math and science; refine their ideas through testing; and ultimately develop a way to meet the initial need.

Human-Centered Design is an approach in engineering that focuses on people and their specific needs. According to IDEO.org (<http://www.designkit.org/human-centered-design>), “**Human-centered design is all about building deep empathy with the people you're designing for...**” IDEO further suggests that Human-Centered Design consists of three phases.

1. Inspiration - Engineers learn directly from their client in order to deeply understand their needs.
2. Ideation - Analysis of what is learned from the client leads to design ideas and possible prototypes.
3. Implementation - building of the final proposed solution knowing that it meets the needs of your client.

Competition Overview:

MESA USA presents the National Engineering Design Competition specifications for the 2019-2020 year. **Arduino-based Solutions for Humans** asks students to implement the Human-Centered Design approach to find a client in your community who has a need, engineer a solution for this need using Arduino as the key component, and present your solution and recommendation(s) for next steps at the MESA USA National Engineering Design Competition.

Each competing team must consist of 3- 4 students who are active members of a MESA program in a MESA USA state. The first place middle and high school teams from State events will travel to the national competition. This National Competition event is scheduled to occur in **June 16-20, 2020** hosted by Arizona MESA.

MESA states may choose to keep the event open-ended or may require teams to focus on a particular area of need (i.e. agriculture, physical disabilities) or provide a specific client for teams to focus on at their state competitions.

Competition Components

The components listed below will be used to assess the effective implementation of a Human-Centered Design approach, effective implementation of the Engineering Design Process, the functionality of the prototype, and successful integration of Arduino as the main component of the prototype.

High school and middle school teams selected to participate at the national event will compete in the four components below:

1. **Technical Presentation & Interview**- The objective is to provide an overview of the prototype functionality including a technical explanation of the mechanical operations, software operations, and integration of the two. Students will prepare a short presentation and demonstration of the functionality of the prototype followed by a question and answer session with judges.
2. **Poster & Symposium** - The objective is to provide an overview of their project, highlighting key points of the design process including relevant data, presenting the resulting prototype, and share conclusions and recommendations for further development. Students will prepare a printed academic poster, which will be

used during a public poster symposium to provide an easily understood overview of the project and the prototype.

3. **Project Report** - The objective is to provide an overview of the design process and demonstrate team's effective use of the Engineering Design Process. Students will write a 5-10 page report that contains their problem statement, summary of the design process, and description of resulting prototype supported by pictures, charts, tables, and/or graphs. The report should be a journey through the design process and demonstrate key points of the process and why design choices were made. The report must have an appendix.
4. **Prototype Pitch** - The objective is to convince investors or management that the design meets the client's needs, is superior to other options available, and has business value as a product. Students will prepare a creative, engaging presentation to pitch their prototype to an audience, including a group of judges. The presentation should define the problem; provide a detailed description of their client and their needs; discuss current solutions to the problem and their weaknesses; provide a demonstration of their prototype highlighting its advantages, and demonstrate the business value of the product including a market analysis and marketing plan.

Individual states should encourage their respective teams to participate in all performance components at the statewide level. Although states may opt not to do all components or alter some requirements for their local and state events as needed. Individual states will determine the dates and location of their respective events. Teams participating in the National Competition must compete in all tasks listed above.

Continuing Projects

MESA USA realizes that there is both an interest and benefit for student teams to continue work on a project for the National Engineering Design Competition. However, in order to ensure a level comparison between new and continuing projects, continuing projects will need to show that significant new work has been completed over the current academic year beginning in August and ending in June, prior to the national competition. In order to help understand how the project has progressed teams need to submit the Continuation of Project Form to their state NEDC representative.

Teams must clearly describe how the continued project differs from the original project in all aspects of their submission to assist in distinguishing previous work from new work. This will also help in understanding how the project has evolved and improved over time.

The MESA USA National Engineering Design Competition rules committee will have the authority to disqualify a team from competition if, in their opinion a continuing project does not show substantive expansion from the original project. This will be determined by the information provided on the Continuation of Project Form (The form is attached to the end of this document).

Therefore, it is important that teams submit this form as early as possible for feedback from their state representative on the NEDC rules committee. States will determine a deadline for local and state competition and make the determination on whether a team can do enough new work to compete. This form will need to be signed by a state representative of the NEDC and submitted with the project report to confirm eligibility to compete at the National Event.

Plagiarism Policy

Academic honesty and personal integrity are essential to ensure future success as college students and STEM Professionals. As such, MESA USA expects that the work presented as a part of the National Engineering Design Competition will be solely the work of the students. If the work or ideas of another are used to further students' work then proper credit must be given to the owner (see resource documentation for information on citing sources). Failure to do so will result in an act of Plagiarism. If it is determined that a student committed plagiarism, they will be disqualified from the competition and they will be ineligible to receive any awards. They may also risk further sanctions from MESA USA and/or their MESA state organization.

Scoring Summary

At the National Competition, awards will be presented for each component of the competition. Overall ranking will be based on the total score, which is derived by adding the scores for each component. Below is a summary of the point values for each component:

Technical Presentation & Interview	100 points
Poster Symposium	50 points
Project Report	100 points
<u>Prototype Pitch</u>	<u>100 points</u>
Total	350 points

Technical Presentation and Interview:

Overall Objective

The Technical Presentation and Interview allows judges the opportunity to determine student knowledge of their project, gain information about the design process the students used during the project, and determine the viability of the design for the client. A technical presentation has a different focus than a pitch, and therefore, this presentation should be different from the Project Pitch component of the National Engineering Design Competition.

Students will organize and deliver a focused, coherent presentation to provide an overview of the development of their design (including research, experimentation, iterations, and conclusions), the technical components of their design, and demonstrate the functionality of the prototype. The presentation should provide an overview and demonstration of the prototype functionality as well as include an explanation of the mechanical operations, software operations, and the integration of hardware and software. After students present, judges will follow up with a Technical Interview. Students should use their poster, prototype, and other relevant materials as support during the Technical Presentation and Interview session. Displays and speeches must be the original work of the students.

The technical presentation is a summary of the technical aspects of the project and the interview is a discussion with the judge panel. Together, they should include:

1. Project Objective
 - a. Who is the client and what are the client's needs?
 - b. How does this project fulfill the client's needs?
 - c. How did interviews with your client(s) inform your design decisions?

2. Description of Design
 - a. How does the design function mechanically?
 - b. How is Arduino integrated into the design?
 - c. How does the software function?
3. Engineering Design Process
 - a. What was your team's methodology and process?
 - b. What were any major challenges and any correlating solutions?
 - c. What were the major design choices?
 - d. How did the iterations of the design evolve during the project?
4. Conclusion and Recommendations for their project
 - a. What is your final assessment/evaluation of your prototype?
 - b. What are the next steps for the implementation of your project?
 - c. Are there any suggestions for improvement and/or redesign?
5. Prototype Demonstration:
 - a. Teams should be able to adequately discuss their prototype design, chosen materials, chosen hardware, and rationale behind choices, as well as the flow of data from input to output.
 - b. Teams should be able to discuss any testing they did during development and how that testing informed their design choices. Teams should be able to discuss how the features that are unique to their design were developed through this process.
 - c. Teams should demonstrate the usability of the prototype and how it meets the needs of the client. Teams should have a working prototype. If not, some areas will not be able to be scored.

Technical Presentation and Interview Rules

1. Teams will be randomly selected to determine order. Students must conduct presentations and interviews in the order drawn. No exceptions or late arrivals are allowed.
2. The Technical Presentation and Interview session will last a maximum of 20 minutes. Teams will have up to 10 minutes to deliver a technical presentation and demonstrate the prototype (presentation time). The remaining time will be used for a technical interview (interview time) with the judge panel.
 - a. Judges will notify teams when they have 1 minute remaining in the presentation time (at 9 minutes). At 10 minutes the presentation will be stopped. Teams are allowed to incorporate time for judges to interact with their prototype, but the interaction must be concluded within the time allotted for the presentation.
 - b. If the team is finished with their presentation before 10 minutes, the team will give an indication to judges that they are ready for the interview portion of the session to begin.
 - c. Judges will announce when there is 3 minutes, and 1 minute remaining in TOTAL time (at 17 minutes and 19 minutes).
3. Teams are to use support material during the technical presentation and interview.
 - a. Teams are highly encouraged to use support materials such as their poster, engineering notebook, Arduino code, or other visual aids as needed to supplement their technical presentation and interview.
 - b. Teams are not allowed to use electronic presentations during their technical interview.
4. Judges will be given a set of prompting questions to use during the technical interview. Questions will typically focus on gaining clarification about the team's project, gathering specific details about information the team presents, or will be in alignment with the major content areas of: Usability, Team Objective, Engineering Design Process, Materials and Technology, Data, Conclusions and Recommendations, and Support Materials.

Materials Provided

- Easel or ample wall space for poster.
- Table for display and/or demonstration.
- Electricity will be available for the Technical Presentation and Interview.
- Wireless Internet may be available, but is not guaranteed.

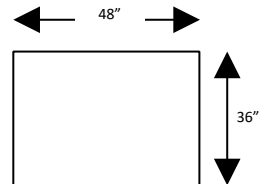
Poster & Symposium

Students will participate in a poster symposium at the National Event. Students will display their posters and prototypes and be available to present their designs and answer any questions to those attending the symposium. This event will be open to all event attendees and will provide an opportunity for student teams to interact with one another and learn more about each other's projects.

Poster Requirements

1. Size and Type. Teams must design and print a single poster for the National Event. The maximum size of the poster is 36" by 48". The minimum size is 24" by 36".

**State and local events may opt to allow tri-fold presentation boards with maximum dimensions of 36" x 48". Tri-folds brought to the National Event will receive zero points for their poster.



Poster example only

2. Posters should include a title at the top of their poster.
3. A team section must be present and should include:
 - a. School Name
 - b. Grade level representing (Middle School or High School)
 - c. State representing (Optional at State and Local Events)
 - d. Team members' names.
4. An Official MESA logo should be included (contact your state office for a logo).
5. Posters should include the following elements:
 - a. Problem Statement: This defines the problem to be addressed. This section could include:
 - i. Description of variables and how they are addressed.
 - ii. Description of problem(s) addressed by prototype
 - iii. Scope of the project and any priorities in design
 - b. Objective: This defines how the problem is being addressed. This section could include:
 - i. Specific variables addressed.
 - ii. Desired attributes of the design
 - iii. Design choices to fulfill client's needs
 - c. Prototype: A picture/schematic of the prototype. This section could include:
 - i. Short descriptions of important pieces of prototype
 - ii. Highlights of device
 - iii. Unique elements of prototype
 - d. Code: How the Arduino is coded. This section could include:
 - i. Pseudocode flowchart
 - e. Trade table: A comparison between the prototype and current products on the market. This section could include:
 - i. Cost
 - ii. Features
 - iii. Specifications

- f. Data: The relevant data that helped drive the prototype. This section could include:
 - i. Line graphs
 - ii. Circle graphs
 - iii. Bar graphs
 - g. Results/Conclusions: The end result of the prototype. This section could include:
 - i. Summary of results
 - ii. Next steps
 - iii. Future of prototype
 - h. Client Requirement List: The requirements the client requires in the prototype. This section could include:
 - i. Bulleted list of requirements
 - ii. Graphic illustrating requirements
 - i. Title & Tagline: Identifiers for your project. This section could include:
 - i. A take away for people who read the poster.
 - ii. An identifier for the project
6. The team's Engineering Design Notebook should be available so your team can refer to it during the Poster Symposium.
7. Electronic media is not allowed.

Materials Provided

- Easel or ample wall space for poster – or cafeteria-style table (approximately 30" x 72" x 29").
If a table is provided, teams will need to provide their own poster stand.

Project Report

Objective: Demonstrate the successful development of a prototype through implementation of the Engineering Design Process. This report should be a summary of your project that leads judges through each stage of the Design Process. You should provide an assessment of the problem you are addressing; examination of your client(s) and provide an evaluation of the needs that informed your design choices; investigation of prototype development including results of design experimentation through testing and data analysis of at least two iterations; and summarizes the progress or results of your work and describes the final prototype.

Required Elements:

The report should include the following sections:

1. Title Page - Include authors/team members, school, MESA state, and date of publication.
2. Problem Statement – Include, at minimum, a detailed assessment of the client(s) and a list of their needs, a discussion of the specific need(s) addressed by the proposed solution, and any criteria/constraints that influenced the project.
3. Design Process: Discuss prototype development showing an iterative process with a minimum of two iterations. Include, at minimum, the following:
 - a. Exploration Phase: Discuss how initial design choices account for clients' needs and are justified by prior knowledge and research of client and other information related to the design process. Include a discussion of relevant STEM concepts researched and/or needed to understand the project or process
 - b. Design Phase: Discuss the design of the initial prototype with a clear link to the exploration phase
 - c. Creation Phase: Provide an overview of the creation of the first prototype and the integration of Arduino
 - d. Testing Phase: Discuss the details of the testing process, data collection, evaluation of results, and related data graphs/tables

- e. Improvement Phase: Discuss how data from testing phase informed design changes for each iteration. Include a description of the final prototype.
4. Appendices
 - a. Data (Charts, Graphs, Tables).
 - b. Bibliography or Citation of Sources.
 - c. Detailed Budget Sheet (see examples in the resource document).

Length:

The report should be no less than five pages and no more than ten pages in length not including the Title Page or Appendices. Thorough but concise reports are encouraged.

Conventions (Format, Language, Grammar, etc.)

Each of the standards listed below, though they are scored at a lower level, make an enormous difference in your team's ability to create a well-organized, compelling report. Do not forget to check your report length, make sure all sections are included, and adhere to the font, spacing, layout, and grammar standards below:

1. The report length should be 5 to 10 pages not including the title page, appendices or bibliography.
2. Remember to include the key sections in your report (listed above).
3. Your title page must include authors/team members, school, MESA state, and date of publication.
4. Be sure to use 1" margins and double-space your text using 12 pt. Times New Roman font.
5. Remember to use spelling, sentence, paragraphing, and transition conventions that are appropriate to standard business English throughout the paper.

Written Presentation

The report should be typed, double-spaced, and have a cover sheet. When possible, graphics should be computer-generated. The above conventions should be followed. Readability will help your report achieve a higher score during judging.

Deadline:

- *Local/State.* Check with your local MESA office for the procedure for local/state competitions.
- *National Competition.* For teams advancing to the national competition, the project report must be submitted via e-mail to Arizona MESA on or before 4:00 pm in your local time zone, on **June 5, 2020** (subject to change). Reports should be submitted by a student team member. The reports will be judged and scored prior to the National Competition. Late reports will be assessed a 25 point deduction from their report score, and no reports will be accepted after **June 8, 2020** (subject to change).
- Technical reports **MUST** be submitted in Portable Document Format (.PDF). Teams shall ensure the submitted final report can be read using Adobe Reader (10.0 or newer) and that it matches your original, printed document. The maximum file size for submission will be 9MB. A PDF version of the final report must be e-mailed to: Arizona MESA, Head Judge at azmesa@email.arizona.edu. Check the MESA USA national website at mesausa.org for further information. Reports submitted in a format other than PDF or larger than 9MB will be assessed at 10 point penalty. No exceptions.
- **Please note that the host and Head Judge are not responsible for any Internet service delays or misdirected reports. It is the responsibility of the student team members to ensure that the report is delivered successfully in the proper format and proper size prior to the deadline. Therefore, submission of materials in advance of the above-listed deadline is highly recommended.**

Prototype Pitch:

Objective:

The objective of the Prototype Pitch is to convince investors or management that the design meets the client's needs, is superior to other options available, and has business value as a product. Students will prepare a creative, engaging presentation to pitch their prototype to an audience, including a group of judges. The presentation should define the problem; provide a detailed description of their client and their needs; discuss current solutions to the problem and their weaknesses; provide a demonstration of their prototype highlighting its advantages, and demonstrate the business value of the product including a market analysis and marketing plan. The pitch should differ from the Technical Presentation and be a complete presentation as questions will not be allowed.

Pitch Rules

1. Teams will have 10 minutes to present. A 5 point deduction will be assessed for each minute over the allotted time. Judges will provide time signals to presenters at 1 minute before the 10-minute limit and every minute thereafter. After +2 minutes (a total of 12 minutes), judges will stop the presentation.
2. The pitch will be open to the public. States may opt for private sessions at state and local events.
3. Teams will present a prototype pitch to the audience, which will include a group of judges.
4. Teams are encouraged to bring additional audio and visual aids to enhance their presentation.
5. The pitch must include and will be assessed on the following:
 - a. Client Introduction and Problem Definition
 - i. Describes the client base
 - ii. Describes the problem they are solving and its impact on the client
 - iii. Describes how design requirements keep target users in mind
 - iv. Discusses how client input supported design choices.
 - v. Discusses how client feedback supported design changes.
 - b. Product
 - i. Defines the proposed solution through the prototype
 - ii. Explains the originality and innovativeness of their design.
 - iii. Presents the advantages of the presented prototype
 - c. Demonstration of the prototype
 - i. Explains key features and functions
 - ii. Explains how design meets client's criteria for look, feel, and functionality
 - iii. Explains how Arduino is integrated using non-technical terms.
 - d. Business Value
 - i. Provides a market analysis
 - ii. Describes current market solutions and how the proposed design is an improvement
 - iii. Considers the price point and pricing strategy
 - iv. Includes a marketing and communications plan
 - v. Provides examples of marketing materials
 - vi. Describes the potential of the design including steps to bring it to market and possible product scalability and design improvements.
6. Teams will also be assessed on the quality of the presentation, including:
 - a. Effectiveness of speech organization and delivery
 - b. Quality and creativity of any visual aids
 - c. Audience Interaction – ability to hold audience's attention
 - d. Communication – effective presentation as measured by flow, clarity, volume, and pace of speakers



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- e. Eye contact and Body language
 - f. Introduction & Participation of team members
7. Teams will be randomly selected to determine the order of presentations. Teams must give their pitches in the order drawn. No exceptions or late arrivals.

Materials Provided:

- A projector and laptop with PowerPoint and internet access.
- Wireless Presentation Remote
- Access to electricity for prototypes
- Cafeteria-Style Table (approximately 30" x 72" x 29")
- Special Requests for other materials will be considered but are not guaranteed.



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Technical Presentation and Interview Rubric:	LEVEL OF MASTERY					
	Exceptional (5 points):	Excellent (4 points)	Met Criteria (3 points)	Fair (2 points)	Poor (1 point)	Not Present (0 points)
Design Overview: The client is well defined and the design meets all of the requirements and the needs of client.						
Design Knowledge: Team demonstrates adequate knowledge of project. All design elements are intentional and thought out.						
Usability: The team can adequately articulate prototype instructions and purpose. Judges can understand how the prototype is used by the client.						
Prototype Demonstration: During the presentation time, the prototype is working and can be demonstrated effectively and with ease.						
Project Impact: The presentation, without additional clarifying questions, highlights the importance of the project and future impact as it relates to their client.						
Materials: All materials are appropriate for design and for use by the client. Team is logical in material usage and budget consideration. Team can articulate and is knowledgeable about the rationale and purpose for materials used.						
Mechanical Design: The team can articulate and is knowledgeable about details, reasoning, and purpose for the mechanical components of the design.						
Technology Usage: Sensors, Wiring, Breadboard, Applications, 3D Modeling/Printing, Etc. All technology is appropriate for the design. The team can articulate and is knowledgeable about all technology used. Rationale for selection of hardware components used is conveyed adequately.						
Arduino Hardware: The use and integration of Arduino hardware and sensors is innovative, effective, and relevant to project. The input and output functions are specifically designed and appropriately utilized to meet client's needs.						
Arduino Software: Programming Logic Flow The team's Arduino code is unique and logical. The team can explain, with adequate detail, their programming logic, their coding choices, and any modifications they made to existing code.						
Data Collection: Input The selected Arduino hardware and/or sensors efficiently and effectively collect input data. The prototype is able to process input data appropriately. The team can convey what data the device collects and/or what variables are used to result in an output. This includes knowledge of input code and hardware.						
Data Response: Output The selected Arduino hardware and/or sensors respond to data efficiently and effectively. Output is appropriate. The team can convey the output process and what happens during use of the prototype. This includes knowledge of output code and hardware.						



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<u>Technical Presentation and Interview Rubric:</u>	LEVEL OF MASTERY					
	Exceptional (5 points):	Excellent (4 points)	Met Criteria (3 points)	Fair (2 points)	Poor (1 point)	Not Present (0 points)
Engineering Design Process: The team adequately conveys their methodology and process, including the research, planning, creation, testing, and improvement phases.						
Challenges and Solutions: The team adequately conveys their project challenges and correlating solutions through presentation or interview. The team is able to incorporate how the Engineering Design Process informed their solutions						
Testing: Design Choices/Iterations Multiple tests were conducted, documented, and used to improve the design. The team is able to convey testing conditions, variables, and results of most tests. All testing was appropriate for their project. The team can convey how the tests helped to inform their design choice(s).						
Conclusions and Recommendations The team is able to effectively present their final product and discuss conclusive findings, limitations, next steps, and recommendations for further development through presentation or interview. The team is able to incorporate how their tests resulted in their conclusions and discuss the future impact of their project.						
Presentation Skills: The team displays relaxed, self-confident nature and is mostly free of fidgeting and/or nervous movement. Body language was appropriate and did not detract from presentation. The team uses direct eye contact and holds the audience's attention. The team shows enthusiasm and can verbally convey knowledge about the topic during the presentation and interview session. Team members speak in clear voices and use technical terms correctly.						
Support Material: The team is able to effectively use support materials (e.g., poster, logic diagrams, engineering notebook, etc.) to increase the audience's understanding of the project.						
Response to Questions: The team's responses to technical questions demonstrate adequate technical knowledge of the concepts and processes used in the project.						
Team Contribution: All members contribute equally to the presentation and to answering questions. The team has shown that all members have contributed to the overall project equally by showing adequate skill and knowledge.						
Column Totals:						
TOTAL:						

Judge Name: _____



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Poster Rubric	LEVEL OF MASTERY					
	Exceptional (5 points)	Excellent (4 points)	Met Criteria (3 points)	Fair (2 points)	Poor (1 point)	Not Present (0 points)
Problem Statement: The team adequately defines the problem being addressed and the client being served by the team in 50 or fewer words						
Objective: An adequate describes how their project address the problem and may include information about the variables addressed, desired attributes, and/or design choices made in 50 words or less						
Prototype: A visual graphic of the prototype is present and highlights innovations and/or important components of the design						
PseudoCode: Includes an adequate description or example of the processes that run the Arduino and the prototype that can be understood by most observers.						
Trade Table: Provides an adequate comparison between the prototype and current products on the market. Includes at least two points of comparison						
Data: Provides graphs or tables that present relevant information from the results of testing to increase the observers understanding of the project.						
Results/Conclusions: Includes an adequate summary of design process including final results and discussion about the next steps of the project to improve design or bring it to market						
Client Requirement: A graphic or list of requirements that the client has identified to be addressed by the team						
Readability: The poster is easy to read and has a balanced amount of graphics vs. text			Graphics: About half Text: Concise	Graphics: Some Text: About half	Graphics: A few Text: More than half.	Mostly text
Title/Tagline: Includes a title and takeaway line for the poster.			Creative & Memorable	Sufficiently Explanatory	Simple Summarization	None
Size: No more than 36" x 48" and no less 24" x 36"					Yes	No
School Name included					Yes	No
Team Member's Names included					Yes	No
Official MESA logo included					Yes	No
Column Totals:						
Total:						

Judge Name: _____



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Project Report Rubric	LEVEL OF MASTERY					
	Exceptional (5 points):	Excellent (4 points)	Met Criteria (3 points)	Fair (2 points)	Poor (1 point)	Not Present (0 points)
Identify the Problem - Client Description - provides a detailed description of the client and adequately examines the challenges they face						
Identify the Problem - Client Needs - Adequately assesses the client's needs and includes at least three specific needs that could be addressed						
Identify the Problem -Criteria and Constraints - Identifies and examines at least three specific criteria and/or constraints to be considered during the design phase.						
Explore -Research about client - evidence of at least three resources (i.e. prior knowledge, client interviews, websites, books, articles) that provided client information						
Explore -Other research - evidence of at least three resources (i.e. interviews, websites, books, articles) that assisted in the design process (i.e. other solutions, unfamiliar math/science concepts, Arduino components or coding assistance)						
Explore -Initial Approach choice with Rationale - Provides a detailed description of their approach to a solution and adequately justifies the rationale for choosing this approach.						
Explore -Relevant STEM concepts - information provided about at least two math or science concepts related to design development, testing, or data analysis						
Design -Discussion of Brainstorming - compares and contrasts at least two initial ideas for a prototype						
Design -Discussion of first Prototype selection - Defends design with at least three reasons why this design was selected utilizing findings from their research.						
Create -Description of functionality of Prototype - Illustrates in detail how the prototype works and what it does						
Create -Evidence that Arduino is essential to prototype functionality - Discussion of prototype includes at least two references to Arduino integration that is essential to functionality.						
Create - Build successes & failure - Evaluation of each build includes discussion of at least two success or failures						
Try It Out -Explanation of the testing process - details include process used, how data will be collected, and what data will be collected.						
Try It Out - Evaluation of testing results assesses effectiveness of prototype using specific data from testing for at least two iterations						
Try It Out -Shared data graphs/tables - at least two graphs/tables are included and support evaluation of prototype testing						



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Project Report Rubric	LEVEL OF MASTERY					
	Exceptional (5 points):	Excellent (4 points)	Met Criteria (3 points)	Fair (2 points)	Poor (1 point)	Not Present (0 points)
Make It Better -Design changes with rationale based on data - design changes are clearly justified by data, including analysis from testing and user feedback. A summary of all design changes is included.						
Make It Better -Comparison of at least two iterations is present throughout the report						
Make It Better -Description of final prototype - supports effectiveness of specific functions and assesses the ability to effectively meet client's needs						
Spelling & Grammar				No errors	Minor errors	Many errors
Title Page - includes authors/team members, school, MESA State, and date of publication				Complete	Incomplete	Missing
Budget				Complete	Mostly Complete	Inadequate
Bibliography				Complete includes all sources. Consistent format.	Most sources Consistent format.	Missing many sources. Inconsistent format
Length (Not Including Title Page or Appendices)				5-10 pages	4-11 page	<4 or >11
Column Totals						
Total						

Judge Name: _____



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National Engineering Design Competition
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School: _____ MS HS State/Center: _____

Pitch Presentation Rubric	LEVEL OF MASTERY					
	Exceptional (5 points):	Excellent (4 points)	Met Criteria (3 points)	Fair (2 points)	Poor (1 point)	Not Present (0 points)
Client Focus and Problem Definition (Total 25 Points)						
Client description - Client base is identified and an adequate profile, including information on population size and location is provided so that observers have few questions about the client base.						
Problem Description and Impact - Team describes the problem, who it affects, how it impacts their life, what their life would be like if this problem did not exist.						
Human Centered Design - While keeping the target user(s) in mind – teams adequately explain the design requirements needed for the solution to succeed.						
Client Input - The team adequately describes how client input supported initial design choices						
Client Feedback - Team describes how client input in follow up interviews supported prototype changes.						
Product (Total: 15 points)						
Define Proposed Solution - The team adequately defines their proposed solution through use of their prototype and is able to sufficiently articulate how their research, design, and testing led to the prototype.						
Originality and Creative Ability - The team adequately explains how their design and approach to solving the problem is mostly original and/or somewhat innovative and are able to sufficiently explain how their research helped to design a solution in a creative way.						
Advantages of solutions - The team suitably describes advantages of prototype over other solutions for client - citing a few reasons for being the best solution for client.						
Prototype Demo (Total: 15 points)						
Demonstration – The team sufficiently explains key features and functions of the prototype. Team provided adequate evidence that the client(s) was able to use it with no assistance from team. It was functional, mostly smooth, with few pauses or bugs.						
Product look, feel and functionality - The team adequately explain how their design met the client(s) criteria for functionality, elegance, aesthetics, and cost effectiveness. The product is suitably safe to build, use, store and dispose of.						
Arduino Integration - The team adequately demonstrates how Arduino is integrated using non-technical terms.						
Business Value (30 points)						
Market Analysis - Team assesses the potential market for their product. Assessment Considers market size, buying patterns, competition and possible barriers.						
Current Market Solutions – Team describes current solutions explains how their product is an improvement over existing products.						



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<u>Pitch Presentation Rubric</u>	LEVEL OF MASTERY					
	Exceptional (5 points):	Excellent (4 points)	Met Criteria (3 points)	Fair (2 points)	Poor (1 point)	Not Present (0 points)
Price Point Considerations - Team identifies a retail price for their product and explain their pricing strategy.						
Marketing and Communications Plan - Teams adequately identify their target markets and the value and benefit to potential customers. Teams are able to articulate their strategy for reaching each of their target markets. This includes their message and delivery method for each.						
Marketing materials - Team provides example(s) of marketing material(s). They explain why they chose the example they did and why they think it will be meaningful to the customer. Examples could be a print ad, packing materials, flyer, online ad etc.						
Potential of Design - Team sufficiently describes the next steps they need to undertake to bring prototype to the client and/or the market –Explaining their forward thinking of product scalability and design improvements.						
Presentation (Total: 15 points)						
Speech Organization & Delivery - Presents ideas and information effectively and includes an Intro, Body and Conclusion. Introduction is suitable and inviting, body is mostly focused and suitably arranged, and closing is adequate in unifying entire presentation. Overall presentation shows sufficient evidence of creativity, enthusiasm, value and believability.						
Visual Aids/Creativity - Adequately demonstrated the use of relevant and appropriate equipment, materials, and props to provide a solid, convincing and interesting presentation.						
Audience Interaction - The team can adequately hold the audience's attention throughout most of the presentation. Audience is sufficiently interested, engaged, entertained and impressed with the teams approach to the problem.						
Communication - Presentation flows well with minimal distracting pauses, speakers are mostly clear and loud and not going too quickly or too slowly.						
Eye Contact & Body Language - Most team members used natural movements and gestures, looks poised and confident. Keeps eye contact with audience most of the time & rarely uses notes or slides.						
Intro of team members Adequately introduced all team members					Yes	No
Participation All team members speak and present equally.					Yes	No
Time 5 point deduction for every minute over the allotted 10 minutes.						
Total						

Judge Name: _____



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Continuation of Project Form

This form is required for projects that are a continuation or progression of the previous year's NEDC entry at any level.

School: _____

Name: _____

Team members (at least one team member must have worked on the project last year):

Repeating Team Member(s): _____

Abstract (Provide an overview of the previous year's project, including the status of the project at the end of 2018-2019, and discuss reasons for continuing the project including any change in direction or design for 2019-2020):



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Component:	Current Project (2019-2020) Describe how the project differs from last year	Previous Year's Project (2018-2019) Provide an overview of last year's project
1. Title		
2. Overall objective of project:		
3. List the technical components and describe the functionality of the design		
4. Client information about their needs or how the product meets their needs		
5. Additional information		

We, the undersigned team members and advisor, confirm that the continuation of the above referenced project is being done to better meet our client's needs. Furthermore, we intend to produce a significant amount new work through additional research, design development, testing, and data analysis to accomplish this goal.

Advisor Signature: _____

Team Members Signatures: _____

NEDC Committee Member Signature: _____

Date Submitted: _____

Date reviewed by NEDC Committee Member: _____