



Tech Ramp Engineering Challenges

1. We need a system to count and record the revolutions a freely rotating body. As the body rotates in open air, the revolutions are counted, to a resolution of $\frac{1}{2}$ revolution, and displayed on the device. The trial device should be cylindrical in shape, about a foot long, about 1 inch in diameter, weigh only ounces, and count as many as 100 revolutions.
2. We need a wearable system to provide auditory or tactile directions for the visually impaired to walk to a desired urban location. The trial system should model the use of GPS signals to direct and track the user to the input destination providing left, right, and end of journey signals.
3. We need a system to provide directional auditory awareness, sound recognition, and annunciation for driverless vehicles, such as a passenger car. The system would sense and identify emergency sounds in the audio environment and cause the car to take appropriate defensive driving maneuvers and alert the passengers. The trial system should model the following: identify an emergency vehicle siren, establish that the vehicle is approaching from the rear, and if so, give signals to the passenger vehicle to slow down and yield the right of way, and alert passengers of the ongoing events. Upon sensing the safe passing of the emergency vehicle, the system will cause the car to return to its predetermined driving route.
4. We need a local air hazard warning system to detect the occurrence, severity, and diffusion of harmful pollutants in an urban setting. The system will capture and analyze air samples continuously and throughout a city using passenger vehicle-mounted units. The units will send the air quality information, including the time and location provided by GPS, to a central monitoring system for analysis, display, and developing community alerts and action as necessary. The trial system should model the air quality sample capture for at least one gaseous airborne substance, demonstrate central monitoring requirements, and scalable data analysis and display.
5. A proposal to pursue a business-sourced problem of the team's choosing is acceptable upon approval of the Tech Ramp Leadership Team.

Judging Criteria – Tech Ramp 2019

Judges will have a detailed scoring rubric with descriptive words for each level of achievement under each competition criterion, per classical rubric design.

Design Process (80%)

The team has maintained an engineering design notebook to record and demonstrate that they have:

1. Defined clearly the engineering problem to be solved or new opportunity to be created.
2. Performed thorough and adequate research of potential end-user needs and preferences to identify the most important product design characteristics, constraints, and performance specifications.

3. Created multiple alternative solutions to the chosen problem or new opportunity, having studied and learned from existing designs, methods, and applications.
4. Chosen and implemented the best solution among the alternatives using appropriate engineering decision making tools.
5. Measured, collected, and analyzed critical performance data at every design iteration, demonstrating continuous improvement and refinement of the prototype design.
6. Provided adequate and well-supported justification for end-user requirements that were not modeled or tested in the prototype design.
7. Provided a full description of the final product that included consideration of health, safety, and environmental concerns and regulations; sustainable manufacturability; applicable industry standards; and other design requirements and constraints, to assure the marketability of the final product.

Design Presentation (20%)

The team has used visual presentations, computer displays, and individual team member interviews to demonstrate that they have:

1. Provided a clear and complete presentation of their prototype design process and methodologies.
2. Communicated persuasively the merits of the final product and the process to be followed to achieve it.

The presentation will include a table on which the team will provide:

1. A standard 36 x 48 tri-fold poster that displays:
 - a. Project name, team (school) name, and student names with grade levels
 - b. Problem statement or opportunity proposal
 - c. Engineering Design Process
 - d. Samples of performance data
 - e. Final Product Description
2. A running computer slide presentation of the design process, including, for example, narratives, photographs, drawings, data displays, videos, etc.
3. The prototype design with opportunity for hands-on performance demonstrations.

For more details about the TECH RAMP program or to sign up a high school a TECH RAMP competition, contact;

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