

FIRE PROTECTION ENGINEERING DESIGN CHALLENGE

Organized by the Department of Fire Protection Engineering, University of Maryland and
the Chesapeake Chapter of the Society of Fire Protection Engineers (SFPE)
Sponsored by ADT Commercial

Description: The challenge presented in this project is to create a design for a typical 2-room apartment that accomplishes 2 principal objectives:

- Provide early detection of the fire
- Suppress the fire so it does not spread

Evaluation Criteria: The Judging Rubric provided below identifies the categories that will be used to evaluate the performance of the design in each student group submittal. General considerations include:

- Cost is a driving factor in engineering. Detection and suppression systems only become viable if they are effective and affordable. Hence, the total estimated cost is considered, including the value of any donated materials.
- Livability is a category for judging the realistic nature of structure and furniture. For comfort, people prefer to have cushioned furniture and not have furniture comprised of steel and concrete that was placed in rooms with no windows. This is not representative of an apartment that most people would live in. While a fire protection engineer would generally be concerned about limiting the amount of combustible material, some combustible material is inherent in any bedroom.
- Response Time is included as faster detection and activation of suppression systems is typically desired as small fires are generally easier to suppress than large fires. Further, preventing a small fire from becoming a large fire is a basic fire safety strategy to limit the severity of the hazard to people or exposed objects.
- Time for Suppression considers the time it takes to stop the growth of the fire. Even though a system may activate quickly, if it is not capable of limiting spread or extinguishing the fire, the fire will continue to burn. All fires will be allowed to burn for a maximum of 7 minutes (experiments may be terminated sooner if judged to not be changing or if the entire model is involved in fire. Once the test is terminated, a staff member will manually extinguish the fire.
- Spread to other objects shows whether the fire is contained prior to spreading from the area of origin.

Judging Rubric

All designs will be evaluated using the following rubric. The best designs will be those with the *lowest score*.

Judging Rubric	Category Points	Points
Total Estimated cost	[\$]/10	
Livability	[1-5] (1=best)	
Detection Time	[seconds]*	
Notification Time	[seconds]*	

Suppression Activation Time	[seconds]*	
Suppression Effectiveness	[1-5] x 5 (1 = best)	
Spread to other objects	[# of objects involved in fire] x 5	
Creativity	[1-5] (1 = best)	

* If action was not achieved = 30.

Building Requirements

Requirement	Details
Money	Each team may spend up to \$50 for materials for the project. All materials must be accounted for, even if donated or free samples. Teams will be provided with an Arduino kit which need not be included in their budget.
Structure	The structure will be 18"x12", with a ceiling height of 12". A glass wall will be provided for 1 long wall, all other walls, floor and ceiling must be comprised of solid, opaque materials. There will be two rooms: one 12"x12", the second 6"x12". The ceiling MUST be removable, though when put in place should fit reasonably well. The interior must be accessible for inspecting the furniture and for igniting the fire. Systems that reach more than a foot above the roof must be approved prior to construction. Systems must remain within the footprint of the building.
Openings	There must be one doorway (6.5" x 2.5") leading out of the front room of the compartment (to outside) and one doorway of the same size connecting the two rooms by means of the interior wall. There must be one window on two exterior walls for the larger room (two windows.) Windows must be at least 3" wide and 2" high, not to exceed 9 in ² in area. Openings may be closed as part of the design, but must be open initially.
Furniture	See Furniture Requirements below. Furniture should be movable, to be put into position by the University team on the day of the test.
Wall & Floor Finishings	Carpet must be provided for the floors of both rooms. Curtains for the windows and at least one 3" x 3" "poster" must be included.

Furniture Requirements

Each team must build and furnish their room with the following furniture. The furniture must be representative of real furniture, i.e. materials selected for furniture must be similar to materials used in actual homes and incorporate materials such as foam plastic, cotton, wood, and cloth.

Qty.	Furniture	Size (LxWxH in inches)
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Back room (16" x 12")		
2	Bed	6 x 3 x 2, composed only of a polyurethane foam slab (no frame)
2	Desk	4 x 2 x 3
Front room (8" x 12")		
2	Chair	2.5 x 2.5 x 2