Student-Led Design Challenge

Overview

The objective of this class has been to involve you in the creative use of technology, and this project is the culmination of that effort. In this project, you will have the opportunity to exercise all that we have learned this semester. Your design presentation will require 3D drawing skills as well as writing skills, and your creation itself will draw on your work with the Arduino.

In this project, you are asked to use what you have learned to create an original design and to write a ***design brief*** discussing the motivations, rationale, and principles underlying your design. As is the case for all engineering designs, your design must adhere to ***constraints*** and be evaluated according to predefined ***criteria***.

Design Brief

A *design brief* is a written plan that describes the objectives of a design, and how it satisfies its criteria, and meets its constraints. A design brief is used to encourage thinking about all aspects of a design before attempting to create it. The elements that must be included in your design brief are listed below; make sure that your composition addresses all of these points.

In this writing assignment, you do not need to organize your composition around a single thesis statement presented in the first paragraph. Instead, you may use separate section headings for each major bullet listed below, but you must adhere to the writing standards used throughout this semester. Specifically, there must be unity and coherence in the organization of each section, and you must also strive to use clear and concise wording.

- Design principles/rationale

    - What problems/interests are you addressing
        - What activities do you want to support
    - What guides your design
        - Examples: foster creative expression, provide entertainment, perform some function
- Design
    - Describe your design and **include a sketch created using Google SketchUp**
        - Illustrate and list key features
    - How will you meet the design constraints
    - How will you satisfy the design criteria
    - Design process: how will your design evolve/develop to completion
        - Describe your incremental development and test plan
- Existing approaches
    - How have existing approaches informed your work
    - How and why is your design different than existing approaches
- Scenarios
    - Provide a concrete example (or two) of how people could use your design
- Evaluation
    - How novel is your design?
    - How functional and aesthetically pleasing is your design?
    - What will you learn as you build it?
    - How will you test it?
- Future directions
    - Suggest possible next steps for your project

Design Constraints

A *design constraint* is a limitation on the conditions under which a design is developed, or on the requirements of that design. In this project, we have both types of constraints.

Limitations on the design development:

- You may use any of the materials provided in class:
    - Arduino boards
    - Breadboards
    - Wires
    - Components (e.g., speakers, sensors, LEDs, switches, etc.)
    - Stuffies (donated by my daughter)
    - Construction paper (donated by my daughter)
    - Paints (donated by my daughter)
    - Sewing kits
- You may spend no more than $10 on materials that you acquired outside of class

Design Requirements

Our in-class Arduino projects have demonstrated both the hardware and software aspects of each "function" listed below. Each function is given a complexity rating. Your final

design must have a **cumulative complexity rating of 5 or higher**. This can be accomplished by incorporating multiple functions and/or multiple instances of a single function. (**Note**: You can **not** gain additional complexity points by reading or writing multiple messages on the serial port, or by playing multiple songs on the speaker.)

- Flashing a single LED (complexity rating 1)
- Reading a single switch (complexity rating 2)
- Using a single potentiometer (complexity rating 2)
- Using PWM to fade a single LED (complexity rating 2)
- Writing and reading from the serial port (complexity rating 1)
- Using a single light sensor (complexity rating 3)
- Using a single distance sensor (complexity rating 2)
- Using a single pressure sensor (complexity rating 3)
- Playing music on a speaker (complexity rating 2)

If you are interested, there are exercises (that we have not worked) available for the following:

- Using PWM to control a single DC motor (complexity rating 6)
- Sending and receiving infrared light (IR) signals (complexity rating 4)
- Controlling a single servo (complexity rating 5)

Design Criteria

Design criteria are the explicit goals that a design must achieve in order to be successful. In this project, the design criteria are also the grading criteria; they are listed below. **You must describe how your design satisfies these criteria both in your design brief and during the demonstration of your design on the day of our final.**

Technical complexity (40%):
- Your design must be distinct from any single in-class exercise. It should be a composite of functions presented in different exercises.
- Your design must satisfy the design constraints.
- Design complexity ratings over 5 will be awarded extra points.

Aesthetics (20%)
- Your design must be visually interesting.
- Its appearance must be consistent with its function.

Originality (20%)
- Your design must be distinct from any other design in the class.
- There should be some aspect of your design that is completely original.

Functionality (20%)
- Your design must perform some function consistently and without error.

Due Dates

Design Brief: Dec 2 by the end of class (Our last class meeting.)
Demo of Completed Design: Dec 11 at 8:00am (Our designated final exam time.)

Grading

Design Brief: 20 points
Completed Design: 25 points

Helpful Hints

If you stuck for ideas, check out the Arduino examples on these electronic resources:

Arduino Playground
Instructables
Makezine
Tod Kurt's spooky Arduino
Tod Kurt's Bionic Arduino
YouTube