

**Western Carolina University**  
The School of Engineering + Technology  
College of Engineering and Technology

**ENGR 493– Special Topics**  
**Microcontroller Applications**

**Service Learning Project**

**Project Overview:**

This project is in collaboration with ART 132 2D Design (hereinafter referred to as “ART”) class taught by Dr. Mary Anna LaFratta, and two classes of students will mentor Full Spectrum Farm (hereinafter referred to as “Farm”) clients to help them create Touchboard projects. The clients at the Full Spectrum Farm are on the autism spectrum, and the project design is expected to be shared with the public after the course to benefit anyone on the autism spectrum. When the instructors met with the Farm clients in summer 2018, the clients have shown strong interests in the Touchboards projects and they have proposed many preliminary ideas. Many clients have gained incredible skills in painting and pottery and personal interaction competency through the activities at the Farm.

The students in this class are expected to have mastered the fundamentals of Arduino programming and will serve as mentors to bring about the clients’ ideas to life. The ART students would have also gained some familiarity on how to use Arduino IDE, and the students in both classes will consult with each other to come up the functional and design criteria for the projects.

Students will be assigned to teams to support individual Farm clients to design and construct a project that meets the design criteria. Teams will communicate with the Farm clients to understand their ideas, provide feasible improvement plans and/or critics if some task is out of scope.

Each team will make use of the engineering design process to develop their own set of assumptions, performance goals, and expectations for these designs. Each team will generate multiple candidate design solutions and select the most viable of these to construct and test. Selection of the final design solution should be based on solid considerations of technical analysis and design tradeoffs.

**Schedule:**

This project is expected to happen from mid-Feb to late-Mar in 2019, subject to revision due to the scheduling of the Farm clients. Students in this class will need to meet with the clients and the students in the ART class, and such meetings will be arranged to try to accommodate all people’s schedules, but the meetings can be outside of our class time. Students are expected to attend all meetings.

**Objectives:**

Students successfully completing this project will accomplish the following objectives:

1. Employ creativity, technical innovation and teamwork to critique on the feasibility and expandability of a design to attain a specific design goal.
2. Establish appropriate functional criteria.
3. Make use of the engineering design process to work toward a viable design solution, catering to the unique needs of the people on the autism spectrum.
4. Gain experience working as a productive member of a multidisciplinary team.
5. Conduct a formal team presentation in a professional manner.

### General Design Constraints:

1. The design will be on a 2D object in this course (expansions into 3D will be explored in a future course).
2. The design will be catered to the unique needs of the people on the autism spectrum.
3. The design must fulfill its intended purpose.
4. The design must comply with standards and regulations for safe user operation.
5. The user must be able to operate the design with comfort and efficiency.
6. Consider the materials, finish, color and shape to make the design desirable to the user.
7. The design must be at the least cost without compromising safety or other constraints.
8. The design should come with clear documentation to allow potential expansion or alteration by the Farm clients without the involvement of the students from this class or the ART class.

### Team Work Products:

1. Teams must plan for the successful completion of this project by completing any work organization, research, design, and preliminary testing needed. Each team must record their methods, processes, and procedures used to develop their designs. Teams must present their design for testing on schedule.
2. Teams must maintain documentation of the project development, including writings, sketches, voice recordings, other sound recordings, photos, and videos, at every stage of the project. The documentation should be dated and uploaded onto Blackboard as soon as possible.
3. Teams will conduct regular **reflections** on their interactions with the Farm clients, the students from the ART class, and their own interactions within this class. The **reflections** are in the form of oral discussions, surveys, or essays.
4. After the design has been tested, each team in this class must plan, prepare, practice and deliver a formal PowerPoint presentation of their project results. The presentation should discuss any research completed, details of project management (task assignments, schedules, etc.), all technical details including design alternatives that were considered, a decision matrix showing how the candidate design was selected, project testing data and lessons learned through the design process.

Teams will be limited to 10 minutes for their presentation. Each team member is expected to participate in the presentation. It is OK to have one team member assigned to advancing each slide.

### Grading:

As long as all team members participate in each team meeting during regular class time, then all members of a given team will earn the same grade for this project. The relative weights for each area of the project are given by the table below.

Table 1. Project Grading Distribution

Area	Possible Points
<b>Project Designing and Testing</b> Evaluate against design criteria and feedback from the Farm clients	50
<b>Reflections</b> Follow DEAL model	30
<b>Project Presentation</b> See attached grading rubric in Table 2	20

Table 2. Formal Presentation Grading Rubric

Area	Possible Points	Team Score
<b>Presentation Content</b>		
Title slide with team member names	5	
Problem definition including goals and constraints	5	
Applicable research completed (if any)	5	
Summary of possible solutions considered	10	
Analysis of possible solutions and decision matrix showing why the final solution was chosen over design alternatives	10	
Implementation process including problems encountered during assembly and their solutions	10	
Test results and explanation of any negative outcomes including lessons learned	10	
<b>PowerPoint Slide Quality</b>		
Ease of reading including appropriate text, animation and color combinations	5	
Facilitation of information flow	5	
Graphs and diagrams numbered and titled	5	
Correct in spelling, grammar and usage	5	
<b>Presentation Delivery</b>		
The speaker effectively presented without reading directly from personal notes or from the screen	5	
The speaker faced the audience, maintained eye contact	5	
The speaker spoke loudly enough and clearly	5	
The speaker avoided distracting gestures	5	
The team appeared to have adequate preparation for delivery of the presentation	5	
<b>Overall Presentation Grade</b>	100	

This is a team project. Therefore, all team members need to contribute to the benefit of the entire team. Individual team members who are absent from team meetings or from the final presentation will receive deductions as shown in Table 3. At the instructor's discretion, additional deductions may be allocated for non-participation.

Table 3. Grade Deduction for Absences

Infraction	Deduction from Project Grade
Absence from one team meeting	5 %
Absence from two team meetings	30 %
Absence from three or more team meetings	50 %
Absence from final presentation	50 %