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

ENGR 493– Special Topics
Microcontroller Applications

Course Syllabus for Spring 2019
3 Credits

Instructor:	Yanjun Yan
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Meeting Periods:	Tue and Thu 9:30am – 10:45am in Belk 366
CoursEval Dates:	Apr. 7 – May 3, 2019
Course Description:	Study of Arduino programming language, the commonly used sensors and actuators, and special applications. Both analog and digital signals will be covered.
Course Goals:	Upon completion of the course, students will be able to: 1. Understand the basics of hardware wiring needed to build useful circuits involving Arduino board and breadboard. 2. Examine different classes of sensors and actuators and design the needed circuitry to interface with them. Create Arduino code to communicate with the sensors and actuators. 3. Implement common software libraries in an Arduino sketch to fully utilize advanced hardware and devices. 4. Gain understanding of client needs and social responsibility while proposing, developing, and implementing a project in community-based service, through collaboration, mentoring, and revising.
Prerequisites:	EE 200 Computer Utilization, or approval of the instructor.
This Year's Highlight:	In collaboration with **ART 132 2D Design** class taught by Dr. Mary Anna LaFratta, SET students will mentor **Full Spectrum Farm [1]** clients to help them create **Touchboard** (essentially Arduino with user-friendly interface and conductive paint, see Figures 1 & 2) projects as a service-learning project.

Figure 1. Touch-Board paint to create graphic sensors, objects as sensors, and sensing spaces [2]

[1] Full Spectrum Farm at Cullowhee, NC, http://fullspectrumfarms.org/index.html
[2] Touch Board Starter Kit Introduction, https://www.bareconductive.com/shop/touch-board-starter-kit/

Corequisites: None.

Required Text: None. The course materials will be shared on Blackboard.

Reference: Simon Monk (2017). Hacking Electronics: An Illustrated DIY Guide for Makers and Hobbyists, 2nd Edition. McGraw-Hill Education. ISBN: 978-1-260-01220-0.

Instructional Approach: Course material will be introduced during class time. Active participation and hands-on practices are major components of this course. Incremental mini-projects will be assigned to reinforce material covered in class. Regular quizzes will be given to ensure that students are maintaining pace with the assigned work.

Figure 2. An Honors SET freshman, James Nelson, made a midi-keyboard using Touchboard, in Fall 2018, used in Outreach to High-schoolers in Cherokee

The first major project in this course is to mentor the clients at Full Spectrum Farm ("Farm" henceform) to build projects that are both fun and useful for them. There are some sample projects out on the web that could be the basis of such projects, but to make the Farm projects truly unique and useful to the clients, a deep understanding on how the Arduino system works and how it interreacts with sensors and actuators is essential, that's what the students in this course need to learn.

Only when one understands the contents fully can s/he explain this to others plainly and clearly. The ideal outcome of the service learning project is that the SET students' mentoring of the Farm clients enables the clients to revise their projects without assistance in the future. Several Touchboard kits, purchased through external grant awarded to Dr. Yan, will be kept at the Farm and become part of the Farm environment.

The Touchboard kit is user-friendly, and we anticipate the Farm clients to be able to use it, and the mentoring provided by SET students can both deepen the SET students learning on projects and Arduino programming and help the Farm clients accomplish their design goals. The reflection will be carried out individually and in groups, in the forms of both oral discussion and written documentation following the DEAL (Describe, Examine, Articulate, and Learn) model (the project description is attached).

Meanwhile, SET students will interact with the ART 132 students to consider both the aesthetic and functional aspects of the projects and to learn from each other.

The second and the final major project in this course allows SET students the freedom to propose the project they want to accomplish, which could be an

extension of the Farm project, an Arduino Uno project, or using other Arduino boards (need to be purchased by the students themselves, though, and the students get to keep their final projects). What the students have learned through serving the Farm clients during the students' reflections on that experience will be consciously applied and assessed in this final project.

Service Learning: Service learning combines community service, academic instruction, and structured reflection. Students who do service learning can develop a better understanding of course content, meet genuine community needs, develop career-related skills, and become responsible citizens.

WCU Center for Service Learning: Service Learning is a teaching and learning strategy that integrates community service with academic instruction and structured reflection in such a way that students gain further understanding of course content, meet genuine community needs, develop career-related skills, and become responsible citizens. The Center for Service Learning serves as an additional resource for the SL component of this course. The CSL staff are available Monday-Friday from 8:00 am – 5:00 pm. Location: Belk Building Room 273. Phone: 828-227-7184. Website: servicelearning.wcu.edu.

Evaluation: Each student will be evaluated based on performance in the following areas. Respective weights of each performance area are as noted. If any expected unit of this course or assignment cannot be fulfilled, the grading weight will shift to other activity units and assignments.

- Quizzes (on Blackboard, in class) 10%
- Assignments (mini-projects) 30%
- Midterms (on Blackboard, in class) 20%
- Service Learning project 20%
- Final project 20%

Grading Scale: The grading scale below will be used to determine final grades.

Numerical Course Average	GradeAssigned	Quality Points per Semester Hour
98 - 100	A+	4.0
92 – 98	A	4.0
90 – 91	A-	3.67
88 – 89	B+	3.33
82 - 87	B	3.0
80 – 81	B-	2.67
78 – 79	C+	2.33
72 - 77	C	2.0
70 – 71	C-	1.67
68 – 69	D+	1.33
62 – 67	D	1.0
60 - 61	D-	0.67
0 - 59	F	0

Attendance: Students must attend all the classes, although attendance will not be taken. Regardless of whether a student attends class, it is their responsibility to obtain any material or assignments from fellow class members.

In the service learning to help the Full Spectrum Farm clients in collaboration with the Art students, our class time may or may not be coinciding with the time when the clients or the Art students are available, and hence some specially arranged meetings not during the regular class time could happen. The two classes and the Farm clients will coordinate to find a time that suits all, and the students are expected to attend such specially arranged meetings.

Assignments: Timely and full completion of assignments is vital to student success in this course. To this end, the following policies will be in effect:

- The assignments will be Arduino mini-projects. The working circuits will be demonstrated to the instructor, and the code will be submitted on Blackboard.
- Students are expected to submit work on time.
- Any late homework will receive an automatic 30 points grade reduction out of 100 points. Any work which is not submitted prior to the next regular semester test will not be accepted. Work assigned after the 3rd regular semester test will not be accepted after the last regular class meeting of the semester.
- No makeup tests or quizzes will be given unless the instructor is notified prior to the absence and/or corroborating documentation of the reason for the absence is provided.

Weekly Lesson Plan: The table below gives an approximate week-by-week plan of topics and lab exercises. The actual duration of attention to each lecture topic may be altered as best meets the needs of the class.

Week #	Date	Content
1	1/14-1/18	Arduino Introduction with various Pin usages and LEDs
2	1/22-1/25	(1/21 MLK day, no class) Understanding the setup and serial communications
3	1/28-2/1	loop functions in an Arduino sketch and data types
4	2/4-2/8	For-loop in calculation and LED lighting patterns
5	2/11-2/15	Sensor introduction and for-loop exercise
6	2/18-2/22	Midterm 1. Start working with Full Spectrum Farm clients to define the project
7	2/25-3/1	(2/26 Advising day, no class) If-statement, pushbuttons/tilt sensors to control the circuit
8	3/4-3/8	Function definition, Arduino exercise using LM35 temperature sensor
9	3/11-3/15	Spring break – no classes
10	3/18-3/22	Ultrasonic distance sensor. Continue working with clients and Art students
11	3/25-3/29	Assist in prototyping of the Farm projects. Final project proposal
12	4/1-4/5	Switch-statement. Final project approval by instructor and start working on it
13	4/8-4/12	Midterm 2. Continue working on final project
14	4/15-4/16	LCD display and joystick control, Arduino exercise using photoresistor, phototransistor
15	4/22-4/26	(4/17-4/19 no class) IR LEDs and receiver apparatus
16	4/29-5/3	Arduino exercise using motors (DC, step, servo)
17, Final	5/6-10	See Registrar's website for final exam schedule. Final project demonstration

Classroom Policies: The following policies will be in effect during class meetings:

- Cell phones must be turned off during class time. Cell phones must be turned off and out of view during tests.
- Students are expected to monitor their University email accounts on a daily basis for communication from the instructor.
- Drinks, food and tobacco are not permitted in classrooms or laboratories.

Honor Code: Students are expected to comply with the spirit and intent of the Code of Student Conduct: https://www.wcu.edu/experience/dean-of-students/student-community-ethics/wcucode.aspx**.** Evidence of academic dishonesty will result in a grade of F (numerically "0") for that assignment on the first infraction. A second infraction will result in a grade of F or for the course. See detailed academic integrity policy and reporting process attached at the end of this syllabus.

Writing and Learning Commons: The Writing and Learning Commons (WaLC), located in **BELK 207**, provides free course tutoring, writing tutoring, academic skills consultations, international student consultations, graduate and professional exam preparation resources, and online writing and learning resources for all students. All tutoring sessions take place in the WaLC or in designated classrooms on campus. To schedule tutoring appointments, visit the WaLC homepage (http://walc.wcu.edu) or call (828) 227-2274.

Accommodations for Students with Disabilities: Western Carolina University is committed to providing equal educational opportunities for students with documented disabilities and/or medical conditions. Students who require reasonable accommodations must identify themselves as having a disability and/or medical condition and provide current diagnostic documentation to the Office of Disability Services. All information is confidential. Please contact the Office of Disability Services at (828) 227-3886 or come by Suite 135 Killian Annex for an appointment.

Student Support Services: Student Support Services provides support to students who are either first-generation, low-income or those who have disclosed a disability with: academic advising, mentoring, one-on-one tutorial support, and workshops focused on career, financial aid and graduate school preparation. You may contact SSS at (828) 227-7127 or email sssprogram@wcu.edu for more information. SSS is located in the Killian Annex, room 138.

Mentoring and Persistence to Success (MAPS): Mentoring and Persistence to Success (MAPS) provides support to students who are first-generation (neither parent has a four-year degree), low-income, financially independent (emancipated youth, homeless or without consistent residence, or aged out of foster care), or those who have participated in the Academic Success Program (ASP) or Catamount Gap. For those who enroll, MAPS provides a variety of services, including academic advising, mentoring, and personal and social coaching. You may contact MAPS at (828) 227-7127 or email maps@wcu.edu for more information. MAPS is located in 205 Killian Annex.

Academic Integrity Policy and Reporting Process:

This policy addresses academic integrity violations of undergraduate and graduate students. Graduate students should read inside the parenthesis below to identify the appropriate entities in charge of that step of the process.

Students, faculty, staff, and administrators of Western Carolina University (WCU) strive to achieve the highest standards of scholarship and integrity. Any violation of the Academic Integrity Policy is a serious offense because it threatens the quality of scholarship and undermines the integrity of the community. While academic in scope, any violation of this policy is by nature, a violation of the Code of Student Conduct and will follow the same conduct process (see ArticleVII.B.1.a.). If the charge occurs close to the end of an academic semester or term or in the event of the reasonable need of either party for additional time

to gather information timelines may be extended at the discretion of the Department of Student Community Ethics (DSCE).

I. General:

This policy addresses academic integrity violations of undergraduate and graduate students. Students, faculty, staff, and administrators of Western Carolina University (WCU) strive to achieve the highest standards of scholarship and integrity. Any violation of this policy is a serious offense because it threatens the quality of scholarship and undermines the integrity of the community.

Instructors have the right to determine the appropriate academic sanctions for violations of the Academic Integrity Policy within their courses, up to an including a final grade of "F" in the course in which the violation occurs.

II. Definitions:

1. Cheating – Using, or attempting to use, unauthorized materials, information, or study aids in any academic exercise.
2. Fabrication – Creating and/or falsifying information or citation in any academic exercise.
3. Plagiarism – Representing the words or ideas of someone else as one's own in any academic exercise.
4. Facilitation – Helping or attempting to help someone to commit a violation of the Academic Integrity Policy in any academic exercise (e.g. allowing another person to copy information during an examination).

III. Undergraduate and Graduate Academic Integrity Process:

1. Within five (5) business days of the instructor's knowledge of the alleged violation of the Academic Integrity Policy, s/he will inform his/her department head (or associate Dean of the graduate school when applicable) in writing of the allegation and proposed sanction(s).
2. Within ten (10) business days of the instructor's knowledge of the alleged violation of the Academic Integrity Policy, the instructor will inform the student of the allegation, including the proposed sanction(s), in writing. In the written notification, the instructor will inform the student of his/her right to request a meeting with the instructor. During the meeting, the instructor shall complete the Academic Integrity Violation Faculty Resolution Form. If the student does not request a meeting with the instructor within five (5) business days of receipt of the written allegation(s), the student shall be deemed to have mutually resolved the matter and shall be bound to the sanction(s) outlined by the instructor in the written allegation. If the student does not request a meeting, the alleged violation of the Academic Integrity Policy shall not be subject to further review and/or appeal.
3. Within five (5) business days of meeting with the instructor, the student shall either appeal the decision to the department head or mutually resolve the matter by accepting the allegation and proposed sanction(s). No action by the student within five (5) business days of the meeting with the instructor shall constitute a mutual resolution and waiver of the student's rights to appeal pursuant to the Academic Integrity Policy. If the student does not respond within five (5) business days of meeting with the instructor, the alleged violation of the Academic Integrity Policy shall not be subject to further review and/or appeal.Within five (5) business days of receiving a student's appeal, the department head must schedule a meeting with the student. The instructor may be present during the meeting. During the meeting, the department head shall complete the Academic Integrity Violation Department Head Resolution Form. Only information submitted during the meeting with the student, or in the meeting between the instructor and the student, may be

considered by the department head. The evidentiary standard for making a decision shall be preponderance of the evidence. The department head may agree or disagree with the allegation(s) of the instructor. The department head may also approve, overturn, or modify the sanction(s) proposed by the instructor. If the student does not attend the scheduled meeting with the department head, the matter will be heard in absentia and shall not be subject to further review and/or appeal.

4. Within five (5) business days of meeting with the department head, the student shall either appeal the decision to an Academic Integrity Board or mutually resolve the matter by accepting the allegation and proposed sanction(s). The student must submit an appeal to the academic Dean listed on the Academic Integrity Violation Department Head Resolution Form. No action by the student within five (5) business days of the meeting with the department head shall constitute a mutual resolution and waiver of the student's rights to appeal pursuant to the Academic Integrity Policy. If the student does not respond within five (5) business days of meeting with the department head, the alleged violation of the Academic Integrity Policy shall not be subject to further review and/or appeal.
5. Within seven (7) business days of receiving a student's appeal, the appropriate academic Dean must schedule an Academic Integrity Board hearing with the student. The Academic Integrity Board shall consist of a minimum of two (2) currently enrolled students and/or faculty members (with a minimum of one faculty member). A faculty member will serve as chair of the board. The instructor may be present during the hearing. Only information submitted during the hearing, or in the meetings between the instructor/department head and the student, may be considered by the hearing board. The evidentiary standard for making a decision shall be preponderance of the evidence. The hearing board may agree or disagree with the allegation(s) of the instructor. The hearing board may also approve, overturn, or modify the sanction(s) proposed by the instructor and/or department head. If the student does not attend the scheduled hearing, the matter will be heard in absentia and shall not be subject to further review and/or appeal. Within ten (10) business days of the hearing, the appropriate academic Dean shall review pertinent records and send the student written notification of the decision of the Academic Integrity Board.
6. Within five (5) business days of receiving written notification of the decision of the Academic Integrity Board the student may accept the findings and sanctions of the board or submit an appeal to the designated academic Dean. No action by the student within five (5) business days of the meeting with the department head shall constitute a mutual resolution and waiver of the student's rights to appeal pursuant to the Academic Integrity Policy. If the student does not respond within five (5) business days of meeting with the Academic Integrity Board, the alleged violation of the Academic Integrity Policy shall not be subject to further review and/or appeal.
7. If the student elects to file an appeal of the decision of the Academic Integrity Board, she must submit a written appeal within five (5) business days of receiving written notification of the decision of the Academic Integrity Board to the designated academic Dean. An appeal to an academic Dean must be limited to the following grounds; 1) a violation or due process or 2) a material deviation from Substantive and Procedural Standards by the UNC Board of Governors (as set forth in the UNC Manual 700.4.1).
8. If an appeal is heard by an academic Dean, s/he shall review pertinent records within ten (10) business days of receiving a valid appeal. The academic Dean may

agree or disagree with the allegation(s) of the instructor. The academic Dean may also approve, overturn, or modify the sanction(s) proposed by the instructor, department head, and or Academic Integrity Board. Within five (5) days of making a decision, the academic Dean shall provide the student with a written decision. The decision of the academic Dean shall be final.

9. The student must remain enrolled in the course related to the case, and may not be permitted to withdraw from the course related to the case, until all hearing timelines, notifications, and/or appeals have been completed.
10. Upon resolution of each level of the case (no matter the outcome), the instructor, department head, and academic Dean must provide the Department of Student Community Ethics with all materials and documents related to the case (i.e. course syllabus, materials in violation of the Academic Integrity Policy, Instructor Resolution Form, Department Head Resolution Form, Academic Integrity Board decision letter, academic Dean decision letter, etc…). The Department of Student Community Ethics shall serve as the repository for all records associated with allegations and violations associated with the Academic Integrity Policy.

IV. Academic Integrity Board:

The Academic Integrity Board shall consist of a minimum of two (2) currently enrolled students and/or faculty members (with a minimum of one faculty member). A faculty member will serve as chair of the board. Students and faculty members serving on boards for each college will be selected by each college Dean. The Department of Student Community Ethics will train all board members prior to their service on a hearing board. Each academic Dean will convene hearing boards as necessary, and will determine a faculty member to serve as chair prior to a hearing.

V. Sanctions:

The instructor, department head, Academic Integrity Board, and/or academic Dean may impose academic sanctions permitted by the institution (not to exceed receiving a grade of "F" for the course). The instructor, department head, Academic Integrity Board, and/or academic Dean may not permanently remove the student from the course or suspend/expel the student from a program or the University. Student behavior of the magnitude to warrant consideration for permanently removal from the course or suspension/expulsion from a program or the University must be referred to the Department of Student Community Ethics.

VI. Habitual Violations of the Academic Integrity Policy:

Upon receipt of materials associated with violations of the Academic Integrity Policy, the Department of Student Community Ethics will determine if a student has previous violations of University policies. Students with a prior record of violations, or who commits a gross and/or egregious violation of the Academic Integrity Policy, will be referred to the Department of Student Community Ethics for consideration of being subject to hearing proceedings as a habitual violator. Students with three or more violations of the Academic Integrity Policy will automatically be subject to hearing proceedings as a habitual violator. Students in this category are subject to course-related sanctions imposed by the instructor, department head, Academic Integrity Board, and/or academic Dean and University-level sanctions imposed by the Department of Student Community Ethics for habitual violations of University policies.

Additional information is available on the Student Success website under Student Community Ethics.