The Internet of Things
CSCI 491 and 595
Fall 2017 Syllabus

> If we continue to develop our technology without wisdom or prudence, our servant may prove to be our executioner.
>
> –OMAR BRADLEY

Instructor Details

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Prerequisites

Students taking this course are expected to have:

- be competent with or able to quickly learn the C programming language,
- have had CSCI391, Architectures or the equivalent,
- be familiar with networking concepts such as ,
- intellectual maturity and a willingness to work.

Course Objectives

After taking this course, students will be able to do the following, withing the context provided by the Internet of Things:

- analyze a problem, and identify and define the computing requirements appropriate to its solution
- design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs
- function effectively on teams to accomplish a common goal
- communicate effectively with a range of audiences
- analyze the local and global impact of computing on individuals, organizations, and society potential social and economic consequences,
- recognize the need for and an ability to engage in continuing professional development

Textbook

Because you are free to chose the microcontroller platform you like, there is no single textbook for this class. However, you will need a solid reference for the microcontroller platform you decide on.

An example of the level of detail and type of book you should be acquiring as a reference, see Neil Kolban's text on the ESP32;

- https://leanpub.com/kolban-ESP32

Or, for the Texas Instruments MSP 430 architechture,

- MSP 430 Microcontroller Basics

Supplemental Text

To inform the debates and guide the class on the larger issues related to IoT, I will consult the following texts.

- **Building the Internet of Things** by *Maciej Kranz*, 2017 Wiley
- **Precision** by *Timothy Chou*, 2016 Crowd Story

Online Resources

There will be many online resources used in this class. In general, they will be link to on the course's Moodle page. However, three that are critical are

- with the exception of the textbook, all course material will be made available online, through the University of Montana's Moodle system,
- The PlatformIO extensions to the atom text editor.
- You will need to set up an account on Slack.
- You will need an account on github.

Hardware

You will have to buy about $100 of various hardware components. You will use these to complete the final project and the skills inventory.

Software

PlatformIO will facilitate your software development in C or C++. Some platforms provide extensions to Python, Lua, JavaScript, and other higher level languages. We will not be using them. It is important that you understand IoT at the most fundamental level possible. The same is true of the Arduino platform. You are not to use it!

Course Format

Lectures will form a small part of our time together in class. In their place, we will have debates, student presentations, and group work sessions. What lectures there are will be over the examples of IoT in businesses. A key feature of the course will be the rubrics, which define expectations. Be sure to study the rubrics well in advance of starting an activity.

Meeting Times/Place

Times: Monday, Wednesday, Friday 13:00–13:50
Place: Social Science 362

Final Exam Time and Place

This time will be used for final presentations.
Thursday, December 14, 2017
13:10–15:10
Social Science 362

Grading Policy

Grading scale

A	94-100
A-	90-93
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-82
D+	67-69
D	63-76
D-	60-62
F	0-59

Students taking the course pass/no pass are required to earn a grade of D or better in order to pass.

491 Assessments and Weights

The following assessments will be used and weighted according to the values in the table to determine final grades for 491 students.

Component	Description	Number	Weight
Skills Inventory	Demonstrations devised by the student to show mastery of one aspect of microcontroller programming. Evaluated in class during a session with the instructor.	6	30%
Debates	Teams of students will debate the issues surrounding the IoT. Topics such as privacy, security, and social significance will be debated. Each student will only participate in one debate. 25% of the debate grade will be awarded for attending and participating in all of the debates. The other 75% of this grade will be awarded for performance on one debate the student leads.	1	20 %
Final Projects	In depth application of microcontroller programming techniques to a IoT prototype. Developed throughout the semester and with a set of 6 milestones, each one occurring about every two weeks. 70% of this grade will be based on the group's performance, and 30% individual.	1	50%

595 Assessments and Weights

The following assessments will be used and weighted according to the values in the table to determine final grades for 595 students.

Component	Description	Number	Weight
Skills Inventory	Demonstrations devised by the student to show mastery of one aspect of microcontroller programming. Evaluated in class during a session with the instructor.	6	20%
Debates	Teams of students will debate the issues surrounding the IoT. Topics such as privacy, security, and social significance will be debated. Each student will only participate in one debate. 25% of the debate grade will be awarded for attending and participating in all of the debates. The other 75% of this grade will be awarded for performance on one debate the student leads.	1	10 %
Final Projects	In depth application of microcontroller programming techniques to a IoT prototype. Developed throughout the semester and with a set of 6 milestones, each one occurring about every two weeks. 70% of this grade will be based on the group's performance, and 30% individual.	1	50%
In depth project	Graduate students are required to develop a complete, online or bluetooth interface to at least one additional sensor. This may be done as part of the final project, but all development is their responsibility.	1	20%

Milestones for Final Project

Past experience has shown that students struggle to pace themselves on projects. For that reason, the following set of milestones are in place. Deadlines for these will occur approximately every two weeks.

1. **Define a need**
2. **Do background research**
3. **Establish design criteria**
4. **Prepare preliminary designs**
5. **Build and test a prototype**
6. **Test and redesign**
7. **Present final result**

The final report on the project will be comprehensive documentation for the IoT product developed in class. The group will be responsible for this. Groups will also be required to deliver a 10–15 minute final presentation on their project. Shorter presentations, with more time for feedback will follow each of the milestones.

There is no page requirement on the final project, but it should be a substantial piece of work.

Co-convening course

Special accommodations must be made for the fact that this course co-convenes, or involves both graduate and undergraduate students. Graduate students are expected to provide leadership and additional explanations to the undergraduates that are taking the course. Undergraduates are expected to engage in the challenging material that is presented, and work towards mastery. The course is organized in such a way that these interactions should be more natural, through the groups. More specifically, in this course

- the final project will promote interaction between graduate and undergraduate group members.
- use of online development tools such as git and slack will foster communication.
- time for interaction in class will allow groups to interact in a structured way.
- assignment of 'roles' to members of groups, with graduate students taking on more leadership roles.

Tentative Schedule:

MONDAY	WEDNESDAY	FRIDAY
Aug 28th **1**	30th **2**	Sep 1st **3** Introduction, overview of syllabus and course. Quick buyers guide.
4th *Labor Day*	6th **4** Group Assignments. IoT framework. Selection of a microcontroller, sensors, and supporting material.	8th **5** Begin case histories of IoT applications: Precision Mailing
11th **6** Debate I: IoT, Market hype or transformative technology	13th **7** IoT Solutions: Precision trains and mining	15th **8** Skills Inventory I: GPIO
18th **9** Group Presentation I: Define need	20th **10** IoT Solutions:Gene sequencing	22nd **11** IoT Solutions:Agricultural machines
25th **12** Debate II: Trade privacy for benefits?	27th **13** IoT Solutions: Buildings and Construction	29th **14** IoT Solutions: Healthcare, Oil and Gas
Oct 2nd **15** Skills Inventory II: Serial Communication	4th **16** Group Presentation II: Background Research	6th **17** IoT Solutions: Power, Farming, and Water

MONDAY	WEDNESDAY	FRIDAY
9th **18** Debate III: What regulatory policies engender the IoT we want?	11th **19** Iot Solutions: Cooling Tower and Race Car	13th **20** *Group work and targeted technical lectures*
16th **21** Skills Inventory III: I2C	18th **22** Group Presentation III: Design Criteria	20th **23** *Group work and targeted technical lectures*
23rd **24** Debate IV: Can the security hazards be managed?	25th **25** *Group work and targeted technical lectures*	27th **26** Skills Inventory IV: Bluetooth
30th **27** *Group work and targeted technical lectures*	Nov 1st **28** Group Presentation IV: Preliminary Design	3rd **29** *Group work and targeted technical lectures*
6th **30** Debate V: What does IoT mean for the average person's life?	8th **31** *Group work and targeted technical lectures*	10th *Veteran's Day*
13th **32** Skills Inventory V: Internet Capabilities	15th **33** *Group work and targeted technical lectures*	17th **34** Group Presentation V: Built and Tested Prototype
20th **35** *Group work and targeted technical lectures*	22nd *Travel Day*	24th *Thanksgiving Break*
27th **36** Debate VI: What will the cities of tomorrow be like?	29th **37** Skills Inventory VI: Student's Choice	Dec 1st **38** Graduate project presentation I
4th **39** Graduate project presentation II	6th **40** Group Presentation VI: Test and Redesign	8th **41** Wrap up/Course evaluation

Attendance Policy

Attendance is required and enters your grade as part of the in debate and final project assessments. The policy for excusing absences is identical to that of late assignments.

Late Assignments

Other than in in exceptional circumstances, such as family or medical emergencies *late homework will not be accepted* unless an extension was agreed upon *well in advance* of the due date.

Academic Integrity

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. I will follow the guidelines given there. In cases of academic dishonesy, I will seek out the maximum allowable penalty. If you have questions about which behaviors are acceptable, especially regarding use of code found on the internet or shared by your peers, please ask me.

Disabilities

Students with disabilities may request reasonable modifications by contacting me. The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. Reasonable means the University permits no fundamental alterations of academic standards or retroactive modifications.