ENTS 669J: Internet of Things Laboratory Syllabus

Course Description
This course will take a practical, hands-on approach to the study, prototyping, and implementation of the Internet of Things. Students will construct devices and implement programming to perform tasks such as remote sensing and activation, automated response and control, and internet-based monitoring and alerts. While software (e.g. Arduino IDE, Python, Raspbian, etc) is available and open source, students will be required to purchase open source hardware kits to complete their projects. Students will use Python to program and interface with their devices.

Co-requisite: (or prerequisite) either 656 or 699M or permission of the instructor

Instructor Contact Information
Dr. Michael Dellomo
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Office hours:
1363 AV Williams Building
Days and times will be announced in class

Required Books
Python Programming for Arduino, by Pratik Desai

Course Policies

Attendance & participation
While I will not take attendance per se, homework and in-class problems and exams may be partially or wholly graded in class or in extra lab sessions. Attendance for work review is required. Students are responsible for making up any missed in-class work.

Assignments
1) Homework: There will be several assignments given as homework as well as in class assignments. These must be submitted for grading by deadlines given in class. Each student is expected to complete the assignment on their own. Plagiarism is neither permitted nor tolerated. It is each student's responsibility that the assignments are submitted in a timely manner so the professor can assess the assignment. In any event, all work must be completed by the end of the course.
2) Midterm and Final: These will be special lab assignments that will constitute a major part of the course grade (see below). While development of the prototypes wiring plans and code may be collaborative, each student is responsible for their own implementation and their own work. Unauthorized collaboration of any kind on these is NOT PERMITTED and will be considered a serious infraction of the honor code. Questions about the exams should be brought to the instructor.

Academic Integrity
The University of Maryland has a nationally recognized Honor Code, administered by the Student Honor Council. This code sets standards for academic integrity for all undergraduate and graduate students, and you are responsible for upholding these standards in this course. It

is very important for you to be aware of the consequences for cheating, fabrication, facilitation and plagiarism. For more information please visit: https://www.studentconduct.umd.edu/ .

Students who engage in academic dishonesty in this course will receive no points for the assignments and will be reported to the Honor Council and the Office of Judicial Programs for further action. There will be no warnings! Remember, it is not worth it!

<u>Persons with Disabilities</u>
Students with a documented disability should inform the instructor as soon as possible if academic accommodations are needed. Accommodations for individuals with disabilities can be arranged through the Disability Support Service (DSS), a division of the University Counseling Center. Please call 301.314.7682, visit https://counseling.umd.edu/ads , or visit Shoemaker Building for more information.

<u>Video Taping, Recording and Photographing</u>
It is against University and Program policy to video tape, record, or photograph lectures unless done in accordance with the procedures for Persons with Disabilities. Lecture material is considered to be copyrighted by the University and unauthorized reproduction is considered to be copyright infringement. The instructor will make available and distribute any necessary material which is too detailed for conventional note taking.

<u>Cell phones</u>
Any use of cell phones is not permitted during class time. Please turn off all cell phones prior to the start of class.

Grading
The course will consist of multiple hardware and software assignments, some in-class and some take home. There will be a midterm project and a final project to be completed as well. The point breakdown is given below.

Homework	40%	Multiple Assignments, varying point values
Midterm	20%	Date Announced in Class
Final	<u>40%</u>	Date Announced in Class
Total	100%	

<u>Tentative</u> Course Schedule (will be adjusted as the course progresses)

1. Introduction to the Internet of Things
   • What is IOT?
   • Ingredients and Parts list
   • Software Setup

2. Interfacing and Microcontrollers
   • Arduino and the Arduino IDE

- Hardware Setup
- Sketches: Controlling the Arduino
- Connections with Python
- Firmata and pySerial

3. Combining Hardware and Software
   - Simple Device Overview
   - Hardware Design
   - Software Design: Simple and Complex
   - Python Review

4. Prototyping
   - Controlling Different Hardware
   - Using Firmata
   - Using I2C protocol and PyMata

5. Python GUI and Tkinter
   - Using Tk
   - Useful Widgets
   - Creating Python GUI implementations

6. Data Storage and Graphical Display
   - Interfacing with Numpy and Matplotlib
   - Storing Data to Plot
   - Real Time Plotting
   - Interfacing with Tkinter and GUIs

7. Raspberry Pi and Standalone Devices
   - Raspberry Pi Setup and NOOBS
   - Controlling the TFT LCD
   - Interfacing with the GUI

8. Arduino Networking
   - Using the Networking Shield
   - Python Web Applications
   - REST, MQTT, paho-mqtt

9. IOT and the Cloud
   - Cloud Platforms for IOT: serving mosquito
   - Building Your Own with AWS

10. Building and Using an IOT Device
    - Using Arduino to Build a Device
    - Controlling with Python and Raspberry Pi
    - Web Application using Python and the Cloud