15-348: Embedded Systems, Fall 2022
Final Project
Proposal Due: Tuesday, October 18th, 2022 at 10:00pm
Checkpoint Due: Tuesday, November 1st, 2022 at 8:30am
Final Submission: Sunday, November 13th, 2022 at 8:30am

1 Introduction

Your final project is meant as a way for you to showcase what you've learned this semester. The goal is for you and a partner to use a combination of sensors and actuators to accomplish something of your choosing.

1.1 MVP

A project will be considered MVP (minimum viable project) and its final submission receive a score of 70/100 if it meets the following criteria:

1. Usse at least one sensor
2. Uses at least one actuator or output device
3. The use of the sensors/actuators is coherent with the project
4. Implements an application with complexity approved by the course staff

1.2 Doing Better than MVP

If you want more than 70 points, you can earn up to an additional 30 points (your final submission grade is capped at 100) by implementing a selection of additional hardware and/or software features.

Your proposal should specify the features you want to implement and justify those claims.

Hardware Features	**Points**
Learning the usage of a new integrated circuit (IC)	5
Build (on a breadboard) a non-trivial custom circuit	5
Build and solder a non-trivial custom circuit	10
Use additional sensor, actuator, or output device	5
Aesthetics (the final project is professionally packaged)	5
Wireless connectivity	5

Software Features	**Points**
Implementing a novel algorithm (Uncommonly awarded. Most things aren't that novel.)	5
Design the system with a proper finite state machine	5
Interface with the PC with a graphical interface or data visualization	5
Use of properly tuned PID or Fuzzy Logic controller	5

This is just a recommended list. If you believe you have a feature worth additional points that isn't on the list, discuss it with the course staff. In addition, the points given above are an estimate: A poorly implemented feature would, of course, not receive full points. A features that goes above and beyond expectations might receive more points.

2 Deliverables

2.1 Project Proposal [15 points]

Deadline: Tuesday, October 18th, 2022 at 10:00pm on Gradescope

Your project proposal document should be submitted on Gradescope. Please work with the course staff to scope a project that is appropriate for the course.

The project description should include the following:

- Overall goal of the project
- Team Members
- Hardware components (including a discussion of things you intend to do beyond MVP, if any)
- Software components (including a discussion of things you intend to do beyond MVP, if any)
- What you intend to deliver for the checkpoint

Since each project is different, please consult with either Professor Ryan or Professor Eduardo regarding the checkpoint deliverables for your project.

2.2 Checkpoint [25 points]

Deadline: Tuesday, November 1st, 2022 at 8:30am

During class time, each team will give a brief checkpoint demo to the class. At this point you should have something substantial from your project working, which likely means having both some hardware and software functional and able to demo something significant. You will know what should be working because you will have written it into your proposal.

2.3 Video Demo [10 pts]

Deadline: Sunday, November 13th, 2022 at 8:30am

Before the live demo (see Section 2.4), you need to submit a video demo of your project. It should be about 5 minutes. We recommend that you upload your video to YouTube and submit the link.

Videos will be posted on the course website.

2.4 Final Demo and Presentation [100 pts]

Deadline: Sunday, November 13th, 2022 at 8:30am

You will present and demo your project to the class during our scheduled final exam slot. (That, of course, means everything needs to be working before that.) You should plan for a 10-15 minute presentation/demo.

3 List of Sensors, Actuators, and Output Devices Available

This is a non-exhaustive list of sensors/actuators currently available in the lab:

Sensor
Ultrasonic distance
Passive Infrared (PIR)
Temperature & Humidity
Soil Moisture
Potentiometer
Sound
Light
Flex
Magnometer
IMU (accelerator, gyroscope, etc)
Color
IR Distance
Magnetic Reed Induction Switch
Human Body Pulse
IR Receiver (and remote)
Laser Distance (complicated, but cool)

Actuator
Relay (turn on/off AC wall power)
Buzzer
Speaker
Car with motors
Standard DC motors (and motor driver circuits)
Servo Motors (various)
Pan-Tilt Servo Motors

Output Device
Various 7-segment displays
Various 4-digit, 7-segment displays
LCD Character displays (like from the beneater kit)
LED Matrix Display (64 LEDs in a grid)

Communication
ESP-01 WiFi device
HC-05 Bluetooth Modules

We can also order parts that are in-stock at Voltaat (https://www.voltaat.com/). Any requests to order parts from Voltaat should be made by the proposal submission deadline.

Due to time and shipping constraints, we won't be able to order parts from other suppliers that are outside Qatar.

4 Ideas

Having trouble coming up with ideas? Hit up YouTube. Here are some starting points.

https://www.youtube.com/watch?v=QUQta4f_87E

https://www.youtube.com/watch?v=9ItEPmwfBqg