Term Project Guidelines

Mechatronics (ROB-GY 5103) — Fall 2023 — **Section A**

Term projects are to be completed in groups of three (or more upon instructor approval). For full credit, each group must deliver the following:

1. **Functioning prototype** that fulfills the following design requirements:
   a. Controlled by a microcontroller (BS2 is preferred but *not required*)
   b. Instantaneous shutdown mechanism in case of incorrect/unsafe operation.
   c. Other safety feature(s) in the software and/or hardware to prevent damage to the microcontroller, system components, and/or the user.
   d. At least one digital sensor and at least one analog sensor required for core feature(s) other than for safety or powering on/off the device.
   e. At least one actuator/transducer that is controlled by sensor feedback (e.g., alarm/haptic device to alert a human user and servomotor to position robotic arm).
   f. At least one core feature (other than for safety or powering on/off the device) can be *controlled* and *monitored* by a human through a user interface (e.g., potentiometer/buttons as controls and LED indicators/LCD displays as monitors).
2. **Comprehensive project report** that is well-organized, professionally written/proofread, and contains the following elements:
   a. Instructions to operate/maintain the system.
   b. List and description of all main features in the software and hardware, including for safety.
   c. Description and explanation of mechanical designs and electronic circuits with relevant theory and background.
   d. Bill of materials and rationale for part selection (specific sensors, actuators, ICs, mechanisms, etc.).
   e. Prototype cost (can include cost analysis for mass production).
   f. Analysis of advantages and disadvantages.
   g. Proper citation of sources used.
   h. Include all source code related to the project in the report. Code should be well-written and thoroughly commented.
   i. **Professionalism:** Standard technical writing style must be used (see BS2 related technical papers on the course website). The entire report must be prepared electronically (no hand-drawn diagrams etc.). **PLAGIARISM WILL NOT BE TOLERATED AND WILL RESULT IN A GRADE OF 0 FOR THE ENTIRE GRADE OF THE TERM PROJECT.**
3. **Final presentation.**
   a. Prepare and deliver a ~7-10 minute presentation with slides.
   b. Presentation should include demonstration of core features described in the report on a working prototype.

Extra credit will be granted at the instructor's discretion of **up to 10%** for creativity, practicality, aesthetic design, cost-effectiveness, and fabrication quality.

For inspiration to guide your project selection process, you may see previous submissions at
http://mechatronics.engineering.nyu.edu/projects/mechatronics.php and explore the sample ideas below:

1. Integrate mechanisms with sensors and actuators (smart elevator, smart exercise equipment, smart physical therapy equipment for rehabilitation, smart sports equipment/trainer, smart medical/surgical equipment, robotic manipulator, biologically inspired robotics, wheeled/legged robot behavior, etc.).
2. Develop smart sensors by incorporating signal conditioning using hardware and signal processing using software.
3. Utilize microcontrollers, sensors, and actuators to automate the characterization/demonstration of diverse physical phenomenon (enhance laboratory education in Grade K-12).
4. Perform self-calibration of sensors.
5. Smart kitchen aids, smart power tools, smart home appliances, smart security system, etc.
6. Ethernet-enabled microcontroller for sensing, actuation, control, communication, etc.
7. Projects that respond to societal needs (research a need and then address it).
8. Mechatronics-enabled pre-college level science experiments (physics, biology, etc.).

It is recommended that you carefully determine the scope of your project. If your project is too simple and does not fulfill the minimum requirements set above then your grade will be impacted negatively. Alternatively, if your project is too complex and you do not have a prototype that demonstrates the minimum requirements set above then that also will negatively impact your grade.