GENERAL PROJECT REQUIREMENTS

WHAT WILL **NOT** BE ALLOWED

- "Hobbyist level" projects
- Single item "Instructables"-based projects (or Hackaday or similar online build tutorials)
- Projects that are functionally a lab
- Lab manuals
- "Hypothetical" projects, invented scenarios
- Multiple student projects with both students in the same or overlapping FOS (where both students share one of their two FOS – if one student has three or more FOS, may be allowed on a case by case basis)

PROPROSAL REQUIREMENTS

- Write and present for your audience. Your audience is the faculty and students in TECH 4943/4945.
    - Examples of words that you can expect everybody in the class to know:
        - Vernier, Ohm's law, micrometer, circuit, printed circuit board, CAD, resistor, rake angle, carbide, series, parallel, Norton equivalent.
    - Examples of words you should define:
        - Arduino, 3-2-1 workholding principle, takt time, CMM, SCR op-amp, PLC, CAM, S7, beam diagram, 5S, time study.
- A pre-defined and agreed upon scope that clearly delineates the limits of the project – in writing
- Must be unique (specific to a need)
- Must not already exist
- Must add value
- Project should be a cumulating experience – topics from multiple courses should be evident
- Clearly defined level of integration between multiple pieces of hardware
- Project should be clearly tied to fields of study
- Multiple participant projects must be across non-related FOS (e.g. two automation people are not allowed, but an automation person and a microcontroller person would be acceptable)
- A written plan on how to address topics necessary for the success of the project in classes not previously taken or currently enrolled in will be addressed – this plan needs to be signed off on by the professors responsible for the classes

General Report Requirements

- Lessons learned (list of unusual obstacles encountered and solutions)
- Log of all calls to tech support (include problem asked, solution(s) provided, web links received, etc.) including any web searches that resulted in information that was pivotal to the final solution

PROGRAM SPECIFIC PROJECT REQUIREMENTS

SOFTWARE

PROJECT REQUIREMENTS

1. Project Documentation
    - Initial project proposal – explain the goal you are trying to achieve
    - Process flowchart (high level, conceptual)
    - Reason for selection of programming language
    - If custom circuits are to be used, complete and correct schematics are required
    - Project plan / timeline (realistic estimates)
2. Hardware
    - Mac / PC / Raspberry Pi / Arduino / mobile phone for client application
    - Separate system for hosting the database (required)
    - Custom circuits
    - Use of University network
3. Software
    - Programming languages:
        1. C / C++
        2. Java
        3. C# .NET
        4. Other programming language that the student wishes to learn (requires advisors approval)
    - Third party software
        1. Any source code obtained online is limited to libraries only (.jar, .dll, etc.)
        2. Open source web servers (Apache, Tomcat, etc.)
        3. Open source databases (Mumps, MySQL, etc.)
4. Prototype development
    - Working prototype showing that the desired output is created and meets the goals stated in the project proposal

MICROPROCESSORS

PROJECT REQUIREMENTS

- Must be above “hobbyist level” in code and hardware.
- No “Instructables” (although combining multiple Instructables in a unique way will be considered)
- Must combine knowledge from multiple labs, classes etc.
- Must have multiple IO devices and multiple connection/interface types – integration of multiple devices is required.

Current Field of Study

- MUST be a standalone device
- Requires user interface
    - Push Buttons, Keypad, dials, etc for user input
    - LED indicators, LCD display etc for user output

New IoT Field of Study (Fall 2018?)

- Must include network communications (Blue Tooth, ZigBee, WiFi, Ethernet, Cellular etc) in a meaningful way (either in data collection/distribution, user interface, etc)

REPORT REQUIREMENTS

- Document reason/justification for processor/board used (e.g. why did you pick a Raspberry Pi for the project over an Arduino)
    - Should include I/O list vs capabilities of board
    - Should include reasoning behind using microcontroller or a microprocessor capable of running an OS.
- Diagrams
    - Block Diagram showing all interfaces (IO, A/D, I2C, SPI, BUS, Can, etc). Must be properly drawn as per industry standards
    - Wiring diagram for IO and hardware schematics for custom build circuits.
- A/D Calibration calculations (A/D to Real world measurement) REQUIRED
- Code
    - All code properly commented
    - For projects using Operating Systems (PI, Beagleboard,etc)
        - All scripts properly commented
        - All modified setup files
        - List of installed software over and above initial OS install
    - List of all libraries used, including source link

SOFTWARE

SOFTWARE (DESKTOP OR MOBILE DEVICE) MUST AT A MINIMUM

- Include testing plan
- Include database integration (can be an on-device db for mobile devices) with enforced relationships as appropriate
- Allow for user configuration and persistence
- Be modular in design
- Make use of an external SDK/API (e.g. ZXing bar code decoder library for mobile, Alien RFID reader SDK for desktop)
- Include some sort of integration with “external” devices (e.g. gyroscope for mobile, bar code/RFID reader for desktop)
- Include a list of non-standard libraries used and specific parts used (e.g. ZXing for mobile, Alien RFID SDK for desktop apps, OpenCV – open source machine vision library) and discussion of why the specific libraries and associated libraries were selected
- Include properly documented database scheme
- Include discussion of database selection logic
- Include block diagram of finished solution
- Include complete software requirements specification as a separate appendix, including documentation for all student developed functions/modules
- Include a user manual

ROBOTICS

ROBOTIC-CENTRIC PROJECTS MUST AT A MINIMUM

- Expand beyond what was covered in class when the student had robotics
- Include end effector design and build
- Feedback/sensor integration with robot or PLC
- Include as-built prints of all user designed components (tooling, end effectors, etc.)
- Include print(s) of cell/area used and mounting/location of all integrated items
- Include complete BOM (including components that were found in the lab)
- Include block diagram of finished system
- Include all programs with comments/documentation (including screen captures of all settings for any machine vision programs, PLC ladder logic, robot programs, etc.)

PLC-BASED PROJECTS

PLC-CENTRIC PROJECTS MUST AT A MINIMUM

- Include data logging of some sort (alarms are acceptable)
- Include inter-PLC communications
- Tie multiple components together (e.g. multiple conveyors, sensors, machine vision, robots, etc.)
- Include HMI component
- Full electrical prints for all PLCs included using proper wiring notations (such that the solution could be rewired in the future)
- As built mechanical drawings of any components manufactured for the project (regardless of who did the manufacturing)
- Complete BOM (including components that were found in the lab)
- Block diagram of finished system
- All programs with comments/documentation (including screen captures of all settings for any machine vision programs, PLC ladder logic, robot programs, etc.)
- Network diagram of finished system

PRODUCT REALIZATION PROJECTS

The following are the typical minimum requirements for a product development project:

1) Working drawings for components

- Properly dimensioned
- Material specs

2) Tooling & documentation required for prototype

- Assembly Fixtures
- Welding Fixtures
- Molds
- Dieset

3) Product realization pathway

- Production estimate
- What production processes would be used
- What tooling would be required
- Prospective supplier list
- Capital required to begin production from scratch
- Capital required to begin production from existing enterprise.

3) Computer-aided manufacturing data (if applicable)

- CAD Model (if applicable)
- CAM (or developed software, e.g., spreadsheet)
- CNC Program

4) Prototype and or working mockup

OPERATIONS STRATEGY & LEAN PRINCIPLES PROJECTS

Operations or Lean based projects must be real projects (no hypothetical projects) that can be documented. The proposed project and solutions the student develop do not have to be adopted by the customer. However, the student must have, at a minimum, a properly executed simulation of the solution showing the potential improvements.

Proposals must include

1. Written approval from the company/entity where the project is being performed. Approval must be by someone who is of a sufficient level that they are able to approve not only the project but any associated expenditures that would arise from implementing the improvements.
2. List of tools and methods to be used
3. A discussion of the skills (classes) currently in the student's arsenal and a plan for how missing skills will be obtained in order to complete the project. This includes a demonstrable understanding of the machines, operations and processes that will be under review.

The following are the typical minimum report requirements for an operations or lean project:

1. Full description of current problem and need for improvement
    a. Current state diagram
    b. Time studies/production data showing current state data – data should be statistically sound (e.g. correct number of samples, appropriate descriptive statistics, etc.)
    c. Future state diagram(s) – multiple solutions are encouraged
2. Quantified evidence of improvements gained through changes via
. actual data (e.g. time studies, production records, etc.)
a. simulated data (e.g. Monti Carlo simulation results) from an accepted simulation package
3. Summary analysis of the achieved (or potentially achieved) improvements. This should be in an executive summary type format that would be of a sufficient quality to present to the company executive who sponsored (approved) the project.