Project Choices – MECH4240 Summer 2017

The rules:

- Rank your top 4 choices, in order, giving a list with project number and project name, and email those by Sunday, 6 pm to Ross Lambert (trl0007@tigermail.auburn.edu) and Amanda Skalitzky (ams0110@tigermail.auburn.edu) ; any other information you want to provide as to capabilities, team members should be included in that email. All projects must fill up, in most cases students are most likely to get their first or second choice.
- It is permissible to form your own team, but add a comment stating all the students that you want to work with.
- If we don't hear from you, you will be assigned to a team.
- Some projects require American citizenship (GKN, AMRDEC).
- Don't worry about the project cost, that is not your responsibility.
- Generally a project team is 5 – 7 students
- This file is on the course website at http://www.eng.auburn.edu/~dbeale/MECH4240-50/

There are 3 people of interest: 1. (Industrial) Sponsor – the primary stakeholder and project review (midterm and final review) evaluator. You can contact them between now and Sunday at 6 pm. 2. Technical Advisor – the technical person with whom you meet periodically between reviews to monitor and offer technical advice (but not lead or manage!) as you proceed, and 3. Overlord – usually Dr. Beale unless otherwise stated, making sure that the whole system runs smoothly and course requirements are met by all student teams.

1. Teaching Laboratories Experimental Apparatuses

Technical Advisor/Sponsor: Dr. Jordan Roberts

The goal of this project is to design, build, and verify experimental setups for use in teaching laboratories in the department. Teams will have some say in which setups will be designed, built, and verified, and may include from but are not limited to the following:

- Fully instrumented beam deflection apparatus
- Fully instrumented beam strain apparatus including strain gages, load cell, and digital image correlation Photoelasticity apparatus (digital imaging with load cell integration)
- Miscellaneous beam measurement apparatus: 3&4 point bending stress measurement
- Torsion apparatus instrumented to measure angle of twist and torque
- Fluid flow rate apparatus: minimum of 3 sensors to measure flow
- Pump test stand: measure pump curves and effects of impeller geometry
- Electric motor test stand

I am also open to other ideas if appropriate. The number of setups chosen will be dependent on the number of team members and available resources. Ideally, each group would design, build, and verify two setups.

Each setup will require mechanical design, sensor integration and implementation, and software development. Full documentation will be required along with writing a user manual for chosen setups.

2. Passenger Seat Sensing and Reporting

Sponsor: Freedman Seating Company, Chicago Illinois, Michael Moffa, Mike.Moffa@Freedmanseating.com

To increase the safety of passengers on vehicles, seatbelts are provided by the manufacturers of multi place vehicles. Unfortunately supplying seatbelts will only increase passenger safety if they are used. In the airline industry, flight attendants perform a visual review of seatbelt usage during the flight. This is not a practical solution on buses due to labor cost and the fact that passengers are entering and exiting the vehicle on a random basis.

The goal of the project is to develop a seat based system that will alert the vehicle driver if an occupied seat does not have the seatbelt buckled. This system will inform the driver as to the seat location of the unbuckled passenger. The information will be visual by either a configurable screen or dedicated vehicle template. The visual will need to be readable during night time operation.

The sensing system on each seat will not require outside electrical power. Any power to run sensors or communicate with the display device should be contained within the seat. Batteries to provide power are strongly discouraged. Passive power generation systems are encouraged. The number of seated places can be as high as 56 and the range to the display device can be up to 50 feet. Dedicated wires to the display are not allowed unless for powering the display.

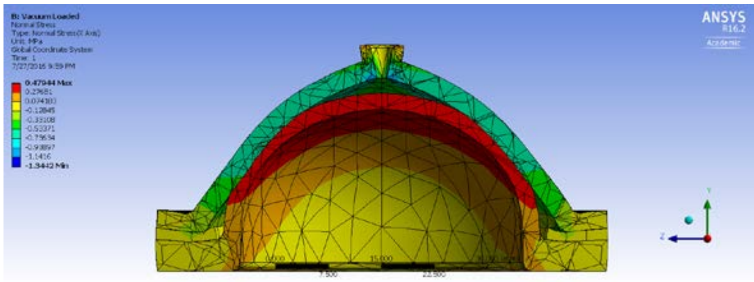
System should not exceed 1.5 pounds per seating place not including seatbelt. Cost for each seating position should not exceed $25 and the head unit/display to not exceed $250. The use of commercially available components is encouraged in lieu of inventing from scratch. Feasibility of the system is to be demonstrated by actual prototype breadboard simulations.

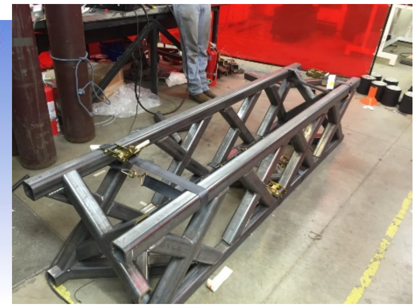
I have been noodling out the problem and have determined that it will have six technology areas that will need to be figured out. They are:

1) Whether the seat is occupied or not and where it is located in the vehicle
2) Whether the seat belt is worn correctly and buckled
3) Communication of the above conditions to the driver display
4) Power supply to make this communication
5) Driver display and power source for same
6) Control logic at seat and display and any interface programing required for multiple seat floor plans

Each of these sections have mechanical, electrical and programming requirements. Since it would be nice to use off the shelf components if possible, substantial vendor sourcing and interfacing will be needed. In a nut shell this is a project that a typical engineering team will be tasked to solve. I don’t believe students will be able to solve this in one Senior Design semester and for see it extending to the next academic year.

3. AMRDEC Acoustic and Vibration Transmission Reduction





Sponsor: Jeremy Belcher, AMRDEC, jeremy.a.belcher.civ@mail.mil, US ARMY RDECOM
Aviation and Missile RDEC, RDMR-WDP-I Building 5400 D373, 256.313.5836 – Desk, 256.975.4647 - BB
256.876.1687 - Fax

Technical Advisor: Beale

This is a continuing project from last semester. Abstracts from the final reports are presented below. You can look over and have access to copies of these reports.

The objective of this project is ultimately to design a packaging system for an inertial measurement unit within a hellfire missile, specifically to isolate the device from interference from the 30mm cannon mounted nearby. In order to design the packaging, the interference must be characterized using a testing structure, which has been the sole focus to this point. This structure was designed in an attempt to approximate the dynamics of the aircraft. Gunfire vibrations and noise were characterized using information from the military standard MIL-STD-810. These vibrations were to be transmitted to the testing fixture through a jackhammer, which is mounted within a specially designed fixture. The fundamental issue in our design was to create a test structure base such that its dynamics did not affect the testing between the vibrational input and the IMU itself, and that the base did not introduce any extraneous and unwanted frequency responses into the system. The final design that was chosen is discussed further in this report; however, due to time constraints and delayed funding the project fabrication and testing portion was different than originally planned. Over the course of the past few months the team has completed the frame subsystem, gotten the gun mount subsystem ready for fabrication, and performed testing with the IMU subsystem on a shaker. Though not the initial goals of the team, the team did overcome multiple obstacles and was successful in producing a portion of the testing fixture and leaving the project with significant progress so that another team can complete the final portions.

4. CanSat http://www.cansatcompetition.com/

Technical Advisor: Ross Lambert (1 semester).   2 or 3 students needed.

5. Band Member Assist Device

Objective:
Design/Modify wearable assistive technology intended to increase autonomy for blind member of the Auburn University Marching Band.
Background:
Thus far, he has been able to participate in shows that require little to no movement. However, this still requires another member to hold his shoulder to help with his placement on the field. Ideally, the designed product will allow maneuvering a marching sequence without a personal assistant and, upon full development, should allow him to perform an entire halftime show autonomously.
Although this project is geared specifically to the marching band setting, it has the potential for many other applications that will help members of our community with vision impairments participate more fully in professional and recreational activities.

6. Scaled Eiffel Tower

Sponsor: Highland Industries (Dr. Branscomb) Design and build a 15’ tall representation of the Eiffel Tower to display in France at JEC World Conference next year. The project will involve designing a method to connect O-ACS tubes to build the iconic structure.

7. Low Cost Universal Mechanical Testing Machine

Sponsor: Highland Industries (Dr. Branscomb) Design and Build a universal testing machine to handle 5000 pounds in tension.

8. O-ACS Bike Design

Sponsor: Highland Industries (Dr. Branscomb)
Work with Highland Composites who will supply O-ACS tubing to build 5 road bikes. The process will be iterative and collaborative with an industrial partner to provide manufacturing support.

9. NASA Robotic Mining Mechanical Systems

Sponsor: Dr. Thad Roppel, Electrical Engineering
Technical Advisor: Grant Apperson

Description: NASA Robotic Mining Competition is for university-level students to design and build a mining robot that can traverse the simulated Martian chaotic terrain, excavate Martian regolith and deposit the regolith into a Collector Bin within 10 minutes. Robots include a digging system, on board storage, a drive system and a dumping system. There exists 6 motors, sensors TBD. There is particular relevance to NASA's mission of pioneering a human presence on Mars through resource mining and utilization. The unique physical properties of basaltic regolith and the reduced 3/8th of Earth gravity make excavation a difficult technical challenge. *Features: Robotics, mechanical systems, composites?, 3-D printing, controls, sensors and motors, competition at KSC which you will not attend.*
http://www.nasa.gov/offices/education/centers/kennedy/technology/nasarmc/about

10. GKN Port Washing Apparatus

Sponsor: GKN Vacuum port assembly design for improved performance. See website for description. Contact Margie Godwin Margaret.Godwin@USA.GKNAEROSPACE.COM

11. Brake Dynamometer

Industrial Sponsor: Dr. Jones
The subject is a Brake Dynamometer (torque/speed measurement for disk brakes). Donovan Johnson would be a principal student. Alex Conrado would help advise.

12. Brigand Arms Project

You will be working with Austin Gurley, arg0007@tigermail.auburn.edu See course website for description.