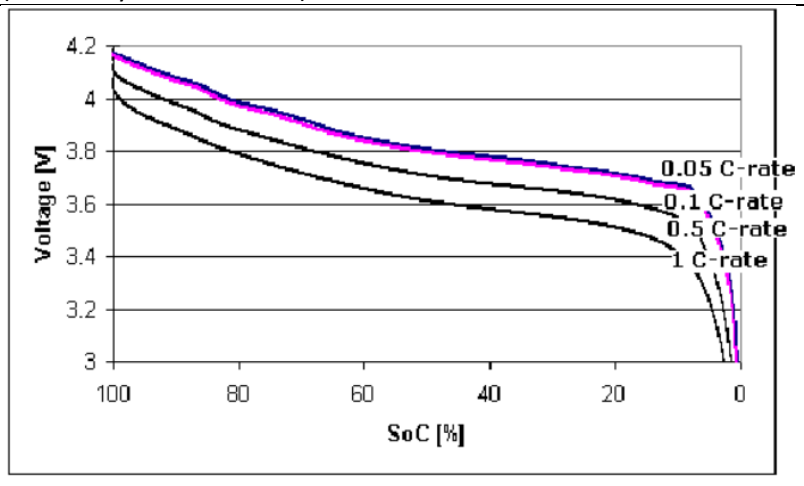
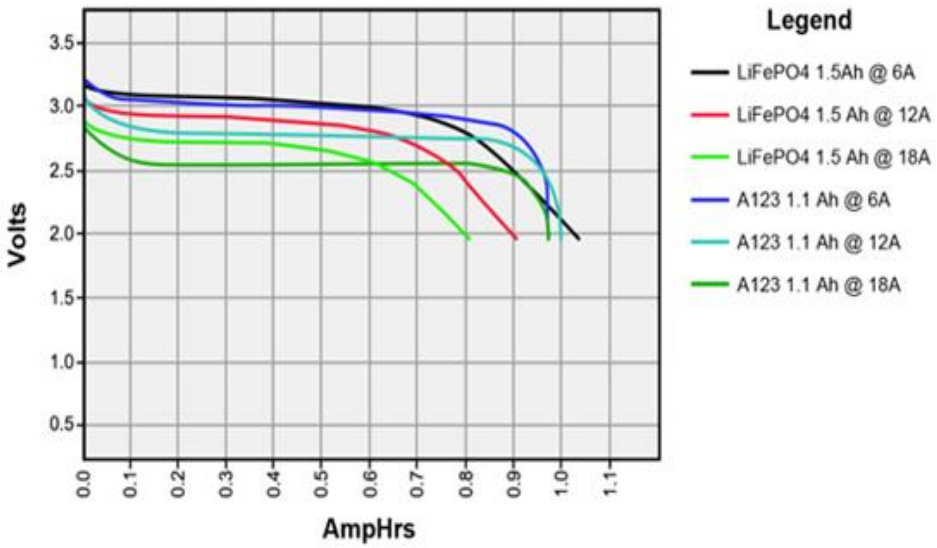
EE 344 Electronic Design Lab, 2021-22/II

List of Project Ideas Floated by Faculty

Project No. KT-1:

Project Title	State of Charge (SoC) Measurement for series connected Li-ian Batteries
Faculty Mentor	Kushal R. Tuckley
Application	For managing operations and applications of Li-ion battery bank
Brief Description	Battery Banks form the power sources for the 'uninterrupted power supplies (UPS)', electrical vehicles and many more applications. Many of modern battery banks are made up of Li-ion batteries/ cells. The operation of these battery banks are managed by 'battery Management Systems (BMS)'. One of the main functions of the BMS systems is controlling the charger operations, for which the SoC must be known in 'real time'. The SoC is a parameter giving the amount of the charge on the battery (or Cell) expressed as a fraction (or as percentage) of the full battery capacity. This project involves computation of individual values of the SoC of a string of 4 batteries (say) connected in series. For this purpose, it is required to perform the measurement of terminal voltages of all the batteries, string current and compute the SoC with suitable computing platform. The computations may be performed on microcontroller and posted on a PC.
Work expected	The students are expected to conceptualize the SoC measurement system, and come up with detailed design including the circuit diagrams, component part-numbers, cost estimates and engineering drawings of the system. Students are also expected to explain in details and defend their design. Depending on the practicality the students are expected to fabricate/ perform simulation of the said system.
Reference, if any	https://www.researchgate.net/figure/Li-ion-cells-voltage-curve-at-different-discharge-rates-at-25-o-C_fig8_4185795 (and Many other sources)
Remarks/other comments	 Above graph is from the above reference and expected to serve as a 'hint' for the design approach.

Project No. KT-2:

Project Title	State of Charge (SoC) measurement for LiFePO4 Batteries connected in series
Faculty Mentor	Kushal R. Tuckley
Application	For managing operations and applications of LiFePO4 battery bank
Brief Description	Battery Banks form the power sources for the 'uninterrupted power supplies (UPS)', electrical vehicles and many more applications. Many of the modern battery banks are made up of LiFePO4 batteries/ cells. The operation of these battery banks are managed by 'battery Management Systems (BMS)'. One of the main functions of the BMS systems is controlling the charger operations, for which the SoC must be known in 'real time'. The SoC is a parameter giving the amount of the charge on the battery (or Cell) expressed as a fraction (or %) of the full battery capacity. This project involves computation of individual values of the SoC of a string of 4 batteries (say) connected in series. For this purpose, it is required to perform the measurement of terminal voltages of all the batteries, string current and compute the SoC with suitable computing platform. The computations may be performed on microcontroller and posted on a PC.
Work expected	The students are expected to conceptualize the SoC measurement system, and come up with detailed design including the circuit diagrams, component part-numbers, cost estimates and engineering drawings (sketches) of the system. Students are also expected to explain in details and defend their design. Depending on the practicality the students are expected to fabricate/ perform simulation of the said system.
Reference, if any	https://batteryuniversity.com/article/bu-903-how-to-measure-state-of-charge) (and Many other sources)
Remarks/other comments	 Above graph is from the above reference and expected to serve as a 'hint' for the design approach.

Project No. KT-3:

Project Title	Temperature controller using heating element and PWM control
Faculty Mentor	Kushal R. Tuckley
Application	Temperature controller for an industrial/ laboratory operation
Brief Description	Many industrial / laboratory processes require a temperature control of a certain unit/ object/enclosure. This project involves realizing a 'temperature controller' system for a typical user requirement.
Work expected	The students are expected to conceptualize a practical situation where temperature control action is required; (e.g. soldering iron, oven, incubator etc.) The students are expected to come up with the detailed temperature controller system design for the application. This design must involve components selection with part numbers, circuit design, cost estimates and engineering drawings (sketches) of the product. Subsequently the students are also expected to explain in details and defend the their design. Depending on the practicality the students are expected to fabricate/ perform simulation of the said system.
Reference, if any	https://www.electroschematics.com/pwm-automatic-heater-controller/
Remarks/other comments	Control algorithm development considering thermal parameters, to achieve certain temperature accuracy is desirable

Project No. : KT-4

Project Title	Temperature control using current reversing drive on Peltier-element
Faculty Mentor	Kushal R. Tuckley
Application	Temperature controller for an industrial/ laboratory operation
Brief Description	Many industrial / laboratory processes require a temperature control of a certain unit/ object/enclosure. This project involves realizing a 'temperature controller' system for a typical user requirement.
Work expected	The students are expected to conceptualize a practical situation where temperature control action is required. (e.g. micro-refrigerator, oven, incubator etc.) The students are expected to come up with the detailed temperature controller system design for the application. This design must involve components selection with part numbers, circuit design, cost estimates and engineering drawings (sketches) of the product. Peltier elements heat or cool a particular surface depending on the direction of the current. The drive to the Peltier sensor may be given using 'H-bridge' of some equivalent method. Subsequently the students are also expected to explain in details and defend their design. Depending on the practicality the students are expected to fabricate/ perform simulation of the said system.
Reference	
Remarks, other comments	Control algorithm development considering thermal parameters, to achieve certain temperature accuracy is desirable

Project No.: KT-5

Project Title	A walker with obstacle detection and locating capability using ultrasonic sensors to aid the visually impaired person.
Faculty Mentor	Kushal R. Tuckley
Application	A walker with indications of obstacle location for visually impaired person. Similar unit could be used for a large vehicle in reverse motion.
Brief Description	Ultra sonic sensors have been in use for detection and gross ranging. However, deriving additional information like determining bearing could be derived by using an array of such sensors. This capability requires additional computations. This project prompts the students to develop some gadgets for specific applications.
Work expected	The students are expected to conceptualize a practical situation where the capability ultrasonic location estimation may be used; (e.g. walker for the visually impaired person. Intrusion localization application etc). - The students are expected to come up with the detailed ultrasonic system design for obstacle detection. This design must involve components selection with part numbers, circuit design, cost estimates and engineering drawings (sketches) of the product. The computations required for achieving the expected results may also be presented. Subsequently the students are also expected to explain in details and defend their design. Depending on the practicality the students are expected to fabricate/ perform simulation of the said system.
Reference	
Remarks, other comments	Presentation of product design details is desirable.

Project No. : KT-6

Project Title	Obstacle detection, ranging to offer navigational guidance for shop-floor vehicles using ultrasonic sensors
Faculty Mentor	Kushal R. Tuckley
Application	Navigation guidance for automobile vehicles using ultrasonic sensors
Brief Description	Ultra sonic sensors have been in use for detection and gross ranging. However, deriving additional information like determining bearing/ positioning could be derived by using an array of such sensors. This capability requires additional computations. This project prompts the students to develop some gadgets for specific applications.
Work expected	The students are expected to conceptualize a practical situation where the capability ultrasonic location estimation may be used; (e.g. Navigating the service vehicle in shop-floor environment, estimating the availability of parking space for automobile vehicle etc.). The students are expected to come up with the detailed ultrasonic system design for obstacle detection. This design must involve components selection with part numbers, circuit design, cost estimates and engineering drawings (sketches) of the product. The computations required for achieving the expected results may also be presented. Subsequently the students are also expected to explain in details and defend their design. Depending on the practicality the students are expected to fabricate/ perform simulation of the said system.
Reference, if any	https://nuwaveproducts.com/h-bridge.html
Remarks/other comments	Presentation of product design details is desirable.