List of Project Ideas

Project No. : 1

Project Title	Pulsed eddy current (PEC) based infrastructure health monitoring system
Faculty Mentor	Prof Siddharth Tallur (stallur@ee)
Application	Determining extent of corrosion of steel rebars embedded in concrete infrastructure
Brief Description	While several non-destructive testing (NDT) methods are commercially employed for monitoring health of infrastructure in civil engineering, determining extent of corrosion of rebars in concrete remains an unsolved problem. While some research exists that shows that ground penetrating radar and pulsed eddy current techniques can be used to estimate the extent of corrosion to a reasonable extent, commercial instruments developed using these technologies are extremely expensive (>Rs. 50 lakhs) and not very accurate at predicting incipient corrosion. The goal of this project will be to develop a custom PEC probe and instrumentation to solve this problem, using a portable FPGA based embedded system to target a price point < Rs. 20,000.
Reference	Interested students may check out the product Lyft manufactured by Eddyfi (https://eddyfi.com/en/product/lyft)
Status	

Project No.: 2

Project Title	Portable potentiostat for biosensors
Faculty Mentor	Prof Siddharth Tallur (stallur@ee)
Applications	Various electrochemical sensing and biosensing applications
Brief Description	Portable potentiostats have been demonstrated by many groups in recent years. Interested students may check out Cheapstat, DStat, Simplestat, KAUSTat etc. A good reference is https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0140349 (DStat). The idea is to use these references and build our own portable potentiostat for water quality assessment and exploring other biosensing applications.
Reference	Students may use EVAL-CN0428-EBZ and EVAL-CN0409-ARDZ reference circuits from Analog Devices to baseline their instrument.
Status	

Project No. : 3

Project Title	Battery-less water pollution monitor
Faculty Mentor	Prof Siddharth Tallur (stallur@ee)
Applications	
Brief Description	The challenge presented to student teams interested in tackling this project is to develop an autonomous wireless sensor node, not requiring any batteries or power supplies to function in the field. Energy harvesting from NFC radios to power up an ultra-low power microcontroller has been shown to be feasible with newer microcontrollers from NXP, TI, Analog Devices and many other suppliers. The problem statement is to use such a system along with a suitable sensor to develop a system to monitor pollution of a water sample. The system should be powered up solely from a smartphone using NFC. The pollution level should be displayed on the smartphone screen. Students are free to use the sensing mechanism of their choice (pH, conductivity etc.) A few sensors are available with my group and will be made available to interested students.
Reference	
Status	

Project No. : 4

Project Title	Smart Water Heater
Faculty Mentor	Prof Pramod Murali (pramodm@iitb.ac.in, pramodm@ee)
Applications	
Brief Description	Problem: We are not sure of wait time for a water heater or if the water is hot enough. Possible solution: Build a device that will measure water temperature and wirelessly transmit it. The temperature should be displayed on a mobile app for the user to see.
Reference	
Status	

Project No. : 5

Project Title	Pigeon repellent
Faculty Mentor	Prof Pramod Murali (pramodm@iitb.ac.in, pramodm@ee)
Applications	
Brief Description	Problem: Pigeons nest in false ceilings and poop on the corridors. Possible solution: Design a smart camera that can detect pigeons and make some noise or light-flash that will repel the pigeons away.
Reference	
Status	

Project No.: 6

Project Title	Hacking a Fit-Bit
Faculty Mentor	Prof Pramod Murali (pramodm@iitb.ac.in, pramodm@ee)
Applications	
Brief Description	Problem: Raw health data acquired by health monitors like fit-bit or apple watch is unavailable to users. Solution: Develop a device that will tap-into sensor signals and transmit raw data for subsequent use.
Reference	
Status	

Project No. : 7

Project Title	Electronic violin
Faculty Mentor	Mukul Chandorkar (mukul@ee)
Application	As a music instrument
Brief Description	This instrument implements a precise measurement of wire resistance to generate tones. The wire plays the part of a violin string. When pressed at different points against a base-plate, the wire presents differing resistance to a sensitive analog op-amp circuit. The circuit converts this to a voltage signal, which is converted by an ADC to a 12-bit number and given to a processor. Depending on the number, the processor generates a digital sinewave representing a tone. This is converted to an analog signal by a DAC and given to an amplifier/speaker. The concept can be extended to more than one string. The project would involve building the analog and digital parts, including the processor board. Should be self-contained: designed as a well-functioning and attractive consumer product.
Reference	IEEE Spectrum, October 2019
Status	

Project No. : 8

Project Title	Class D audio power amplifier
Faculty Mentor	Mukul Chandorkar (mukul@ee)
Applications	Very high efficiency audio amplifier; amplifier for hardware-in-loop real-time emulation
Brief Description	We would like to build a high-fidelity switching (as opposed to linear) audio power amplifier using switching power MOSFETs. The MOSFETs are switched according to a pulse width modulated signal. This pulse train is modulated by the audio signal which needs to be amplified. Demodulation is done by a combination of an external filter and the speaker's dynamic impedance.
Reference	
Status	

Project No. : 9

Project Title	Ground Fault Detector
Faculty Mentor	Prof Anil KG (anilkg@ee)
Applications	For protecting sophisticated instruments from damage due to earth faults
Brief Description	Several Microelectronics Labs (CEN, NCPRE, SAIF, etc) face quite a few issues with ground faults in sophisticated instruments that are worth a few crores each. Earthing requirements in many of these cases are quite stringent. However, regular monitoring of earth resistance is a challenge and is not done in most cases, leading to failure of electrical components when the earthing fails the specs. Very often the earthing faults are detected too late (after a very costly instrument has gone bad). Some reasons are: theft of copper strips from earthlings which is rampant on campus. The objective of the project is to develop a solution for this, which would provide well connected monitoring of every earth pit using voltage or resistance as the sensed parameter. Also a hooter can be integrated. Digitally storing the values of the monitored parameter could help to analyse the situations under which the earthing fails and take long term remedial measures. A good system could find immediate deployment at SAIF and many other labs in the institute with huge savings in maintenance.
Reference	
Status	

Project No. : 10

Project Title	Smart Solar based LED Flood Light (Standalone solution)
Faculty Mentor	Prof Joseph John (jjohn@ee)
Applications	As a standalone reliable LED light for all weather conditions
Brief Description	Today all over our country Solar based LED Flood lights are installed all along the roads and also in remote villages as a reliable source which works even when the villages do not have reliable electricity supply. However, most of these lights do not work very long (though LED has a life of at least 10 years). The primary reason is the poor battery power management (charging and discharging). Major problem appears to be battery discharge below the allowable limit resulting in permanent battery damage. The aim of the project is to: Have a standalone smart LED flood light system where a microcontroller very closely monitors battery charging and discharging cycles, and accordingly takes intelligent control decisions regarding LED intensity levels. This is a hardware-based solution with no wireless or mobile connectivity.
Reference	
Status	

Project No.: 11

Project Title	Smart Solar based LED Flood Light (IoT based solution)
Faculty Mentor	Prof Joseph John (jjohn@ee)
Applications	As a reliable LED light for all weather conditions with wireless/mobile connectivity. This can be implemented in Gram Panchayats as a start-up idea.
Brief Description	Today all over our country Solar based LED Flood lights are installed all along the roads and also in remote villages as a reliable source which works even when the villages do not have reliable electricity supply. However, most of these lights do not work very long (though LED has a life of at least 10 years). The primary reason is the poor battery power management (charging and discharging). Major problem appears to be battery discharge below the allowable limit resulting in permanent battery damage. The aim of the project is to: Have a Smart Solar Light with IoT/mobile connectivity for battery Health Monitoring and intelligent lighting control.
Reference	
Status	

Project No.: 12

Project Title	Measurement of Opamp Parameters using DSO
Faculty Mentor	Prof Joseph John (jjohn@ee)
Applications	Testing of Opamps
Brief Description	Project objective is to test opamp parameters such as bias currents, offset voltage, open loop gain as well as open-loop and closed-loop frequency response using Agilent DSO and NI USB data acquisition card interfaced to a Labtop/PC with LabVIEW software as the programming environment.
Reference	
Status	