PROJECT IDEAS · IEEE BASE PAPERS · ECE

IEEE base papers for *ECE* projects

These 24 IEEE base papers for ECE final year and M.Tech projects were published from 2023 to 2026, and all are open access, so you can read the full text free. They cover VLSI, wireless, signal processing, antennas, embedded systems and power electronics, and each card says **what to reproduce for B.Tech and what to change for M.Tech**.

Last updated 2026-11-06

Every paper below was checked against its DOI record on Crossref on 6 November 2026, so the title, journal and year are exactly as IEEE registered them. This page lists ECE papers; for computer science, AI and IoT software papers see our IEEE base papers list, and to judge a paper of your own, read how to select a base paper.

Which IEEE base papers for ECE are on this page?

The table lists all 24 with the area, the journal and the year. All are open access. Tap a paper to open its card, which names the data or tools, a B.Tech scope and an M.Tech extension.

24 IEEE base papers for ECE projects, with the area, journal and year

PAPER	AREA	JOURNAL	YEAR
Approximate floating-point multiplier for low-power signal processing	VLSI	IEEE Access	2025

PAPER	AREA	JOURNAL	YEAR
Error-compensated logarithmic multiplier for image filtering and digit recognition	VLSI	IEEE Access	2026
Approximate bilateral filter on an FPGA for real-time image denoising	VLSI	IEEE Access	2023
Low-cost FPGA accelerator for real-time YOLO object detection	VLSI	IEEE Access	2026
1D CNN channel estimation for OFDM on high-speed trains	Wireless and 5G/6G	IEEE Access	2025
Deep learning receiver for uplink NOMA-OFDM	Wireless and 5G/6G	IEEE Access	2023
Outage analysis of double-RIS-assisted NOMA for 6G	Wireless and 5G/6G	IEEE Access	2026
Compressed deep learning model for automatic modulation classification	Wireless and 5G/6G	IEEE OJ Communications Society	2025
Lightweight attention CNN for heartbeat arrhythmia detection	Signal and image	IEEE Access	2026
End-to-end CNN for epileptic seizure detection from raw EEG	Signal and image	IEEE Access	2023
Deep learning denoising of stethoscope heart sounds in noisy hospitals	Signal and image	IEEE Access	2023
Small drone classification from radar micro-Doppler signatures	Signal and image	IEEE Access	2026
Compact dual-band wearable antenna for body area networks	Antennas and RF	IEEE Access	2025
Four-port MIMO antenna for sub-6 GHz 5G and Wi-Fi	Antennas and RF	IEEE Access	2023
Machine learning-aided four-port MIMO antenna for vehicle communication at 5.9 GHz	Antennas and RF	IEEE Access	2025
Wearable LoRa antenna for long-range vital-sign monitoring	Antennas and RF	IEEE Access	2024
Atrial fibrillation detection on a low-power microcontroller	Embedded and IoT	IEEE Access	2024
Rice leaf disease detection on an Arm Cortex-M microcontroller	Embedded and IoT	IEEE Access	2024
Wi-Fi sensing of human activity on an ESP32	Embedded and IoT	IEEE Access	2026
LoRa wearable for elderly vital signs and fall alerts	Embedded and IoT	IEEE Access	2026
Adaptive Kalman filter for battery state-of-charge estimation	Power and EV	IEEE Access	2024

PAPER	AREA	JOURNAL	YEAR
Joint state-of-charge and state-of-health estimation with one LSTM	Power and EV	IEEE Access	2026
Solar off-grid EV charging station with sliding-mode control	Power and EV	IEEE Access	2025
Isolated DC-DC converter for 48 V EV battery charging	Power and EV	IEEE Access	2025

What does each ECE base paper solve, and what do you build from it?

Each card gives the problem the paper solves and the output you build and show. Open “The paper and what to change” for the full reference with its DOI link, the data or tools, what to reproduce for B.Tech and one change to measure for M.Tech.

Topic ideas, not delivered projects

Each card is built on a published IEEE paper, checked against its DOI record. The project around it is an idea to discuss with your guide. Our 8 delivered case studies are M.Tech and M.E. projects, each shown with its real paper pages, screens and results.

VLSI and low-power design

TOPIC IDEA · VLSI

Approximate floating-point multiplier for low-power signal processing

Problem: Floating-point multipliers take a large share of the power and area in DSP and AI chips, yet many of these tasks can tolerate small errors.

Output: Two approximate hybrid floating-point multipliers that mix radix-4 and radix-8 Booth encoding and apply approximation only to parts of the mantissa, with post-layout results on the open Sky130HD PDK in FP32, FP16 and FP8, and JPEG compression and FIR filtering as application tests.

The paper and what to change

Base paper: Design and Implementation of Approximate Hybrid Floating-Point Multipliers for Signal-Processing Applications, B. S. Gurucharan et al., IEEE Access, 2025

For B.Tech / for M.Tech: Tools: Verilog with an open-source synthesis and layout flow such as OpenLane on the free Sky130 PDK, which suits colleges without paid licences, and Python or MATLAB for the error metrics. B.Tech: build an FP16 Booth multiplier, add the approximate encoder, and compare MRED, power and delay with an exact design. M.Tech: take both designs through to layout, add a small neural network test beside JPEG and FIR, and show which mantissa bits can be approximated before quality drops.

TOPIC IDEA · VLSI

Error-compensated logarithmic multiplier for image filtering and digit recognition

Problem: Logarithmic multipliers replace multiplication with shifts and adds to save power, but the basic Mitchell method loses too much accuracy for many uses.

Output: A Mitchell-based logarithmic multiplier with a modified nearest-one detector, an optimised ripple-carry adder and two error-compensation variants, synthesised in 45–nm CMOS and tested on Gaussian filtering and LeNet-5 digit recognition.

The paper and what to change

Base paper: Design of a Novel Error Compensated Mitchell based Logarithmic Multiplier, P. Krishna Prashanth and V. Nithish Kumar, IEEE Access, 2026

For B.Tech / for M.Tech: Tools: Verilog for the multiplier, a 45–nm standard-cell library or an open PDK for synthesis, and Python with the public MNIST digits for a LeNet-5 test. B.Tech: code the basic Mitchell multiplier and one compensation variant, then compare NMED and the PSNR of Gaussian-filtered images. M.Tech: add both variants, model the multiplier bit for bit inside LeNet-5 in Python, and compare power-delay product with two other published logarithmic multipliers.

TOPIC IDEA · VLSI

Approximate bilateral filter on an FPGA for real-time image denoising

Problem: Bilateral filters remove noise while keeping edges sharp, but their weights are costly to compute in real time on small, cheap hardware.

Output: An approximate computing strategy for reconfigurable bilateral denoising filters that adapt to the noise level at run time, tested for PSNR and SSIM across image sizes, kernel sizes and noise levels, and implemented on a Xilinx Zynq FPGA.

The paper and what to change

Base paper: Design of Approximate Bilateral Filters for Image Denoising on FPGAs, F. Spagnolo et al., IEEE Access, 2023
For B.Tech / for M.Tech: Tools: Verilog or high-level synthesis on a Zynq-7020 board such as the PYNQ-Z2, standard 512 × 512 grayscale test images, and MATLAB or Python as the software reference. B.Tech: build a 5 × 5 bilateral filter in fixed point, compare its PSNR and SSIM with the software version, and report LUTs and frame rate. M.Tech: add run-time reconfiguration for different noise levels, stream camera video through the board, and compare power with an exact filter.

TOPIC IDEA · VLSI

Low-cost FPGA accelerator for real-time YOLO object detection

Problem: Traffic and security cameras need object detection on the device, but low-cost FPGAs have little on-chip memory and slow down when they fetch data from off-chip memory.

Output: A compressed YOLOv3-Tiny accelerator that combines step-by-step filter pruning, per-layer quantisation-aware training and an RTL memory controller that keeps data in on-chip BRAM and URAM, reaching 93.8% detection accuracy at 24.3 FPS and 2.13 W on a Kria KV260 board.

The paper and what to change

Base paper: Low-Cost FPGA-Enhanced CNN Accelerator for Real-Time YOLO Object Detection and Classification, J. S. Fata and W. M. Elmannai, IEEE Access, 2026
For B.Tech / for M.Tech: Tools: PyTorch for pruning and quantisation-aware training, a public detection set such as PASCAL VOC, and Vivado or Vitis on the Kria KV260 starter kit. B.Tech: prune and quantise YOLOv3-Tiny in Python, run it on the KV260 with the vendor's standard deep learning flow, and report accuracy, frame rate and power. M.Tech: write the on-chip memory controller in RTL, compare it with the vendor flow, and test on Indian road scenes from the public IDD dataset.

Wireless communication and 5G/6G

TOPIC IDEA · WIRELESS

1D CNN channel estimation for OFDM on high-speed trains

Problem: On fast trains, Doppler shift and quick multipath fading make standard least-squares channel estimates poor, a problem India's planned high-speed rail lines will also face.

Output: Two 1D CNN schemes that refine least-squares channel estimates, one using full pilot symbols and one using scattered pilots to raise transmission efficiency and cut complexity, compared with LS and a bi-GRU deep learning estimator.

− The paper and what to change

Base paper: Deep Learning-Based Channel Estimation With 1D CNN for OFDM Systems Under High-Speed Railway Environments, A. Siriwanitpong et al., IEEE Access, 2025
For B.Tech / for M.Tech: Data: simulated OFDM links over a high-Doppler fading channel, built in MATLAB or Python, so no radio hardware is needed. B.Tech: simulate LS estimation, train the scattered-pilot 1D CNN, and plot MSE and BER against SNR at several train speeds. M.Tech: add the bi-GRU baseline, test speeds outside the training range, and count operations per symbol to compare complexity.

TOPIC IDEA · WIRELESS

Deep learning receiver for uplink NOMA-OFDM

Problem: NOMA lets several users share one channel, but the receiver must separate them with successive interference cancellation, which fails when channel estimates are poor.

Output: HyDNN, a 1D-CNN followed by a BiLSTM that performs multiuser uplink channel estimation and signal detection together, trained offline on simulated channel data and compared with conventional estimation and detection for NOMA and with other deep learning models.

− The paper and what to change

Base paper: HyDNN: A Hybrid Deep Learning Framework Based Multiuser Uplink Channel Estimation and Signal Detection for NOMA-OFDM System, M. H. Rahman et al., IEEE Access, 2023
For B.Tech / for M.Tech: Data: simulated NOMA-OFDM signals generated in MATLAB or Python, so the whole project runs on a laptop. B.Tech: build a two-user uplink NOMA-OFDM simulator with LS estimation and SIC, then train the CNN-BiLSTM and compare symbol error rates. M.Tech: add more users and imperfect power control, repeat the paper's checks on minibatch size and learning rate, and compare with a transformer-based detector.

TOPIC IDEA · WIRELESS

Outage analysis of double-RIS-assisted NOMA for 6G

Problem: Reconfigurable intelligent surfaces can steer signals around buildings, but with two users and two surfaces each surface also adds interference to the other user.

Output: Closed-form outage probability for a two-user uplink with one RIS per user over Nakagami-m fading, derived with a moment-matched Gamma approximation and checked against Monte Carlo simulation for both NOMA and OMA.

− The paper and what to change

Base paper: Outage Analysis of Uplink Double-RIS-Assisted NOMA and OMA via Gamma Approximation, E.-H. Meftah et al., IEEE Access, 2026
For B.Tech / for M.Tech: Tools: MATLAB or Python for the Monte Carlo simulation and the closed-form expressions; no dataset or hardware is needed. B.Tech: reproduce the outage curves for NOMA and OMA against transmit power and number of RIS elements, and match simulation with the formulas. M.Tech: find the best split of elements between the two surfaces under different path losses, add phase errors at the RIS, and extend the analysis to three users.

TOPIC IDEA · WIRELESS

Compressed deep learning model for automatic modulation classification

Problem: Spectrum monitoring and cognitive radio need to name the modulation of an unknown signal in real time, often on hardware with little memory.

Output: A training strategy that reduces pruning and quantisation losses together while a compressed deep neural network is trained, tested on 24 modulation classes from OOK and BPSK to 256QAM, FM and GMSK.

− The paper and what to change

Base paper: A Novel Training Strategy for Deep Learning Model Compression Applied to Automatic Modulation Classification, M. A. Goldbarg et al., IEEE Open Journal of the Communications Society, 2025
For B.Tech / for M.Tech: Data: the 24 classes listed match those in the public RadioML 2018.01A set from DeepSig; Python with PyTorch or TensorFlow. B.Tech: train a small CNN on RadioML 2018.01A, prune and quantise it after training, and record the accuracy lost at each SNR. M.Tech: build the joint pruning and quantisation training, compare it with compression after training, and run the compressed model on a microcontroller or an FPGA.

Signal and image processing

TOPIC IDEA · SIGNAL

Lightweight attention CNN for heartbeat arrhythmia detection

Problem: Wearable ECG monitors need models small enough for a phone or watch, and rare but dangerous beat types are easy to miss because they make up few training samples.

Output: A two-layer 1D CNN with squeeze-and-excitation channel attention, working on per-beat ECG feature vectors with SMOTE applied only to the training data, tested on four public ECG databases with about 48K parameters and INT8 quantisation.

− The paper and what to change

Base paper: A Lightweight Channel-Attention CNN for Robust Beat-Level Arrhythmia Detection, M. S. Tahsin et al., IEEE Access, 2026
For B.Tech / for M.Tech: Datasets: the four public databases the paper names, MIT-BIH Arrhythmia, INCART-2, Sudden Cardiac Death Holter and MIT-BIH Supraventricular Arrhythmia, whose raw records are on PhysioNet; Python with TensorFlow or PyTorch. B.Tech: reproduce the model on MIT-BIH Arrhythmia with SMOTE on the training split only, and report precision and recall for each beat class. M.Tech: test an inter-patient split, quantise to INT8 and run it on a microcontroller, and check accuracy on the other three databases without retraining.

TOPIC IDEA · SIGNAL

End-to-end CNN for epileptic seizure detection from raw EEG

Problem: Neurologists read long EEG recordings by eye to find seizures, which takes hours, and detectors built on hand-made features are complex.

Output: An end-to-end CNN with inception and residual modules that reads raw EEG at several scales without feature extraction, tested in subject-dependent and subject-independent settings on the Bonn and CHB-MIT datasets.

− The paper and what to change

Base paper: Less Parameterization Inception-Based End to End CNN Model for EEG Seizure Detection, K.-K. Shyu et al., IEEE Access, 2023
For B.Tech / for M.Tech: Datasets: the public Bonn EEG set and the CHB-MIT Scalp EEG Database on PhysioNet; Python with PyTorch or TensorFlow. B.Tech: reproduce the model on the Bonn set, then try it on a few CHB-MIT patients. M.Tech: run the subject-independent CHB-MIT test, where the paper reports an average F1-score of 37.31%, and try to raise it with class balancing or fine-tuning for each patient.

TOPIC IDEA · SIGNAL

Deep learning denoising of stethoscope heart sounds in noisy hospitals

Problem: Digital stethoscope recordings in crowded outpatient wards pick up hospital noise and lung sounds, which hide murmurs and lower the accuracy of automatic diagnosis.

Output: LU-Net, an encoder-decoder network that removes lung sounds and hospital ambient noise from heart sound (PCG) recordings, tested on unseen noise and on the noisy part of the PASCAL heart sound dataset, with an average SNR gain of 5.575 dB using 1.32 M parameters.

− The paper and what to change

Base paper: An End-to-End Deep Learning Framework for Real-Time Denoising of Heart Sounds for Cardiac Disease Detection in Unseen Noise, S. N. Ali et al., IEEE Access, 2023
For B.Tech / for M.Tech: Datasets: the paper mixes a large benchmark PCG set with lung sounds and hospital noise, and tests on the public PASCAL heart sound data; a preprint is on TechRxiv. B.Tech: mix clean heart sounds with lung-sound noise at set SNRs, train LU-Net, and compare its SNR gain with a plain U-Net. M.Tech: test on noise recorded in a local clinic, then feed the denoised signals to a murmur classifier and measure the change in accuracy.

TOPIC IDEA · SIGNAL

Small drone classification from radar micro-Doppler signatures

Problem: Cheap drones are hard to spot with cameras at night or in haze, and security radars must tell them apart from birds with little computing power.

Output: A compact CNN that combines binarised layers with attention modules to classify micro-Doppler spectrograms of small UAVs, reaching 97.83% accuracy on DIAT-μSAT and 99.17% on a second dataset, RRN_ATR_NET.

− The paper and what to change

Base paper: UAV Classification Using Attentive Binarized CNN for Micro-Doppler Spectrograms, I. Paul and M. Bandyopadhyay, IEEE Access, 2026
For B.Tech / for M.Tech: Dataset: DIAT-μSAT, recorded with an X-band radar at DIAT Pune and listed on IEEE DataPort, with access by request to its authors; Python with PyTorch or TensorFlow. B.Tech: train a full-precision VGG-style CNN on the spectrograms, then binarise it and compare accuracy and model size. M.Tech: add the attention modules, test how well the model carries over to a second dataset, and run the binarised model on an edge board such as a Jetson Nano.

Antennas and RF/microwave

TOPIC IDEA · ANTENNAS

Compact dual-band wearable antenna for body area networks

Problem: Body-worn health sensors need small antennas that work at 2.45 and 5.8 GHz, keep working when bent, and stay within India's SAR limit of 1.6 W/kg.

Output: A 35 × 25 × 0.787 mm³ patch with a hexagonal inlay and a tree-shaped slot on semi-flexible RT/duroid 5870, resonating at 2.45 GHz and 5.8 GHz, with simulated and measured bending and SAR results.

− The paper and what to change

Base paper: A Compact Tree-Shaped Dual-Band Wearable Antenna With Enhanced Far-Field Performance for WBAN Applications, R. Sandhya and A. Chandra, IEEE Access, 2025
For B.Tech / for M.Tech: Tools: CST Studio Suite or HFSS, with a layered body model for SAR; an FR4 version can be designed for a cheaper first prototype. B.Tech: simulate the patch and slot, match S11 in both bands, and check gain and radiation patterns. M.Tech: run bending and SAR studies on a voxel body model, fabricate the antenna and measure it on a VNA, and try a textile substrate.

TOPIC IDEA · ANTENNAS

Four-port MIMO antenna for sub-6 GHz 5G and Wi-Fi

Problem: Phones and routers pack several antennas into a small space for MIMO, and closely spaced antennas couple to each other, which cuts data rates in bands such as the 3.3–3.67 GHz n78 band used by Indian 5G networks.

Output: A quad-port MIMO antenna of 0.28λ0 × 0.28λ0 covering 2.42–7.45 GHz, using a tapered feed and ground stubs for bandwidth and isolation, checked with ECC, diversity gain, MEG, TARC and channel capacity, an equivalent circuit and a measured prototype.

− The paper and what to change

Base paper: High Isolated Four Element MIMO Antenna for ISM/LTE/5G (Sub-6GHz) Applications, S. K. Mahto et al., IEEE Access, 2023
For B.Tech / for M.Tech: Tools: CST or HFSS for the antenna, ADS or the free Qucs-S for the equivalent circuit, and MATLAB or Python to compute ECC and capacity from S-parameters. B.Tech: design one element, build the four-port layout, and compute ECC and diversity gain from simulated S-parameters. M.Tech: add a decoupling structure to raise isolation above the paper's 15 dB average, fabricate on FR4 and measure, and fit the equivalent circuit to the measured data.

TOPIC IDEA · ANTENNAS

Machine learning-aided four-port MIMO antenna for vehicle communication at 5.9 GHz

Problem: Tuning antenna dimensions by repeated full-wave simulation can take days, and vehicle-to-everything links at 5.9 GHz need good gain and isolation between ports.

Output: A tapered four-port MIMO antenna with a defected ground on FR4 for 5.9 GHz V2X, where XGBoost, random forest and DNN models, combined by stacking, predict performance from design parameters to cut simulation time, with ECC, DG, CCL and TARC checked on a fabricated prototype.

− The paper and what to change

Base paper: Machine Learning Aided Tapered Four-Port MIMO Antenna for V2X Communications With Enhanced Gain and Isolation, N. Kallollu Narayanaswamy et al., IEEE Access, 2025
For B.Tech / for M.Tech: Tools: CST or HFSS parametric sweeps to build the training data, and Python with scikit-learn and XGBoost for the models. B.Tech: sweep three or four dimensions of a single element, train a random forest to predict resonant frequency and gain, and check the predicted best design in the simulator. M.Tech: add the stacking ensemble, extend the design to four ports, and compare total simulation time with a plain parametric search.

TOPIC IDEA · ANTENNAS

Wearable LoRa antenna for long-range vital-sign monitoring

Problem: Patients in villages may live kilometres from a clinic, and sub-GHz LoRa can carry heart rate and temperature that far, but sub-GHz antennas are usually too large to wear.

Output: An 80 × 60 mm² U-slot patch on Rogers RO3003 for the 868 MHz and 915 MHz LoRa bands, designed in CST, checked for bending and SAR, with ensemble regression to predict resonance and an open-field test with an SX1276 transceiver at distances up to 1 km.

− The paper and what to change

Base paper: Optimization of a Compact Wearable LoRa Patch Antenna for Vital Sign Monitoring in WBAN Medical Applications Using Machine Learning, M. I. Waly et al., IEEE Access, 2024
For B.Tech / for M.Tech: Tools: CST Studio Suite as in the paper, Python for the regression model, and an SX1276 LoRa module with a heart-rate sensor for field tests. B.Tech: retune the patch to India's 865–867 MHz LoRa band, check S11 and gain, and train a regression model on the sweep results. M.Tech: fabricate the antenna, simulate SAR on a body model, and compare RSSI and range with a stock antenna on a campus link.

Embedded systems and IoT hardware

TOPIC IDEA · EMBEDDED

Atrial fibrillation detection on a low-power microcontroller

Problem: Atrial fibrillation often comes and goes, so a short ECG in a clinic can miss it, and a wearable that detects it on the device needs a model small enough for a microcontroller.

Output: An improved Variable Step Dynamic Threshold Local Binary Pattern method cut to 44 features with an SVM classifier, tested on 15-second and 60-second segments from the MIT-BIH Atrial Fibrillation Database and run on an STM32F413 Arm Cortex-M4 at 100 MHz.

The paper and what to change

Base paper: Atrial Fibrillation Detection From Electrocardiogram Signal on Low Power Microcontroller, M. Yazid et al., IEEE Access, 2024
For B.Tech / for M.Tech: Dataset: the MIT-BIH Atrial Fibrillation Database on PhysioNet; Python for feature selection and training, and embedded C in STM32CubeIDE on an STM32 Nucleo board. B.Tech: extract the LBP features, train the SVM in Python, and port inference to an STM32 board, reporting accuracy, flash use and inference time. M.Tech: add an ECG front end such as the AD8232 for live signals, compare with a small quantised CNN, and test on a second PhysioNet AF database.

TOPIC IDEA · EMBEDDED

Rice leaf disease detection on an Arm Cortex-M microcontroller

Problem: India is one of the world's largest rice growers, and farmers need early warning of leaf diseases in the field, where there is often no internet for cloud models.

Output: Five CNNs, MobileNet V1, MobileNet V2, FD-MobileNet, ResNet and SqueezeNet, trained on 5,932 images of rice leaves with bacterial blight, blast, brown spot or tungro, then quantised for an ARM-M microcontroller, with FD-MobileNet reaching 98.44% accuracy.

The paper and what to change

Base paper: Effective Edge Solution for Early Detection of Rice Disease on ARM- M Microcontroller, Chew Jing Xan et al., IEEE Access, 2024
For B.Tech / for M.Tech: Dataset: the public Rice Leaf Disease Image Samples set on Mendeley Data has the same 5,932 images and four classes; TensorFlow Lite for Microcontrollers on an Arm Cortex-M board such as an STM32 board with a camera or an Arduino Nano 33 BLE Sense. B.Tech: train and quantise MobileNet V2 and FD-MobileNet, deploy the better one, and report accuracy, RAM use and inference time. M.Tech: add live camera capture, test on photos taken in local fields, and compare all five networks on the board.

TOPIC IDEA · EMBEDDED

Wi-Fi sensing of human activity on an ESP32

Problem: Watching elderly people at home with cameras raises privacy concerns, and Wi-Fi channel state information can sense movement without cameras or wearables.

Output: CSI-based activity recognition run directly on an ESP32-WROOM-32 without external PSRAM, comparing classical classifiers, small CNNs and larger networks on UT-HAR and CSI-HAR for accuracy, INT8 conversion, memory, inference time and energy, with a 30-minute live test.

− The paper and what to change

Base paper: Feasibility and Deployment Analysis of Wi-Fi-Based Human Activity Recognition on a Memory-Constrained Microcontroller, A. W. Malik et al., IEEE Access, 2026
For B.Tech / for M.Tech: Datasets: the public UT-HAR and CSI-HAR sets; an ESP32-WROOM-32 board with Espressif's CSI tools and TensorFlow Lite for Microcontrollers. B.Tech: train a small CNN on UT-HAR, convert it to INT8, run it on the ESP32, and report accuracy, memory and inference time. M.Tech: collect your own CSI with two ESP32 boards, test on people left out of training, where the paper reports a drop of about 25–33 percentage points, and try domain adaptation to close the gap.

TOPIC IDEA · EMBEDDED

LoRa wearable for elderly vital signs and fall alerts

Problem: Older people living alone, in villages or on large campuses with patchy mobile data, need a wearable that sends heart rate and fall alerts over long range on battery power.

Output: A wearable node with a MAX30102 sensor and an SX1262 LoRa link that sends routine readings as DATA packets and falls or SOS presses as ALERT packets, with Google Sheets logging, a web dashboard and LINE alerts to carers, tested for vital-sign error, fall detection, range, battery life and alert delay.

− The paper and what to change

Base paper: LoRa-Based Wearable Monitoring System for Elderly Vital Signs and Emergency Alerts, N. Pukrongta et al., IEEE Access, 2026
For B.Tech / for M.Tech: Hardware: a microcontroller with an SX1262 LoRa module, a MAX30102 pulse-oximeter sensor, an accelerometer and a LoRa gateway, all cheap and easy to buy, with the radio set to India's 865–867 MHz band. B.Tech: build the node and gateway, send DATA and ALERT packets, and measure packet delivery at several distances. M.Tech: replace LINE with SMS or WhatsApp alerts, improve fall detection with a small on-device model, and measure battery life against reporting interval.

Power electronics and electric vehicles

TOPIC IDEA · POWER

Adaptive Kalman filter for battery state-of-charge estimation

Problem: An EV's battery management system must estimate state of charge online, and a standard extended Kalman filter loses accuracy when its noise settings are wrong or the temperature changes, as it does through an Indian summer.

Output: RMAEKF, a modified adaptive EKF that corrects the process and measurement noise covariances at each time step, compared with the EKF and a forgetting-factor adaptive EKF on LA92, US06 and mixed drive cycles at different temperatures, with an OPAL-RT real-time test.

The paper and what to change

Base paper: A Noise Covariance Regulated Robust Modified Adaptive Extended Kalman Filter for State of Charge Estimation of Lithium-Ion Battery, S. Rout and S. Das, IEEE Access, 2024
For B.Tech / for M.Tech: Tools: MATLAB with a public drive-cycle battery dataset such as the Panasonic 18650PF data, which includes LA92 and US06 at several temperatures. B.Tech: fit a first-order RC battery model, code the EKF and the adaptive version, and compare SOC error on LA92 and US06. M.Tech: test against a wrong initial SOC, current offset and voltage bias as the paper does, and run the filter in real time on a

TOPIC IDEA · POWER

Joint state-of-charge and state-of-health estimation with one LSTM

Problem: Battery management systems often run separate models for charge and health, which costs memory on the small processors used in EVs and home storage.

Output: A shared-body, dual-head LSTM that predicts SoC and SoH together from voltage, elapsed time, temperature and a coulomb-counted charge feature, trained on seven cells of the Oxford Battery Degradation Dataset and tested on a fully unseen cell.

The paper and what to change

Base paper: Joint Estimation of State of Charge and State of Health for Lithium-Ion Batteries Using a Dual-Head LSTM with Coulomb-Counting Feature Integration, N. Tiwari et al., IEEE Access, 2026
For B.Tech / for M.Tech: Dataset: the public Oxford Battery Degradation Dataset; Python with PyTorch or TensorFlow. B.Tech: rebuild the four input features, train the dual-head LSTM, and report SoC and SoH errors on the held-out cell. M.Tech: test dynamic load profiles and current-sensor error, which the paper says it did not evaluate, then quantise the model for a microcontroller.

run the filter in real time on a microcontroller.

TOPIC IDEA · POWER

Solar off-grid EV charging station with sliding-mode control

Problem: Charging points on highways and in villages may have a weak grid or none, so solar panels and a battery must charge EVs smoothly through the constant-current and constant-voltage stages.

Output: An ANFIS maximum power point tracker for the PV array and a conditioned super-twisting sliding-mode controller with gains tuned by grey wolf optimisation, simulated in MATLAB and validated on a Delfino F28379D hardware-in-the-loop setup against conventional super-twisting control.

− The paper and what to change

Base paper: Optimized ANFIS-Based Robust Nonlinear Control of a Solar Off-Grid Charging Station for Electric Vehicles, B. T. Gul et al., IEEE Access, 2025
For B.Tech / for M.Tech: Tools: MATLAB/Simulink with Simscape Electrical, and a TI LaunchPad with the F28379D for hardware-in-the-loop. B.Tech: model the PV array, boost converter and EV battery in Simulink, then compare perturb-and-observe MPPT with a PI charger against the ANFIS and sliding-mode design. M.Tech: add grey wolf gain tuning and the anti-windup condition, check stability, and run the controller on the F28379D LaunchPad.

TOPIC IDEA · POWER

Isolated DC-DC converter for 48 V EV battery charging

Problem: E-rickshaws and many electric two-wheelers in India use 48 V battery packs, and their chargers need isolation, low ripple and low losses.

Output: An isolated converter that pairs a phase-shifted H-bridge with an input-parallel output-parallel bridgeless Luo converter, analysed mode by mode, simulated, and built as a 100 W prototype with SiC devices that charges a 48 V lithium-ion battery.

− The paper and what to change

Base paper: Analysis, Design, and Hardware Implementation of Phase Shifted Isolated DC–DC Converter for Low Voltage Electric Vehicle Battery Charging Applications, P. Srikanth and G. Arunkumar, IEEE Access, 2025
For B.Tech / for M.Tech: Tools: LTspice or MATLAB/Simulink for the converter, with device models from the manufacturer; a 100 W build needs only standard power parts. B.Tech: simulate the phase-shifted H-bridge and the Luo output stage, and plot output ripple and losses against phase shift. M.Tech: build the 100 W prototype, add closed-loop constant-current and constant-voltage charging, and compare SiC with silicon MOSFETs on efficiency.

KEY POINTS

- **24 IEEE papers from 2023 to 2026,** four in each of six ECE areas.
- **All open access,** so you and your guide can read the full paper free.
- **Checked against Crossref,** so every title, journal and year matches the DOI record.
- **Most run in simulation or on low-cost boards,** and each card names what you need.

Picked an ECE paper?

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How do you choose an ECE base paper from this list?

- **Start from what you can run.** Simulation papers (VLSI, antennas, wireless, signal processing) need only software; hardware papers need the board or parts named on the card.
- **Check the data.** Signal processing and embedded papers use public datasets such as PhysioNet ECG or the Bonn and CHB-MIT EEG sets; confirm you can download them.
- **Plan one change for M.Tech:** a hardware prototype of a simulated design, a new band or dataset, or a lighter model on a microcontroller.
- **Reproduce first.** Match one result from the paper before you change anything; see how to implement a base paper.

Where can you read these papers for free?

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Frequently asked questions

Are these IEEE papers free to read?

Yes. All 24 are open access: 23 in IEEE Access and one in the IEEE Open Journal of the Communications Society, so the full text is free on IEEE Xplore through the DOI link on each card. For computer science and AI papers, see our IEEE base papers list.

Which ECE base paper is easiest for a B.Tech project?

Pick one that runs in simulation or on a cheap board: the signal processing papers on public ECG, EEG or heart-sound data, the antenna papers in CST or HFSS, or the microcontroller papers on an STM32 or ESP32. Avoid hardware you cannot buy before your first review.

What should an M.Tech student change in an ECE base paper?

One measurable change: a new dataset or band, a hardware prototype of a simulated design, a lighter model for a microcontroller, or a test under harder conditions. Compare your result with the paper's on the same metric. Our guide on how to implement a base paper walks through the reproduction.

Do I need expensive hardware for these papers?

Most do not. VLSI designs can be simulated with free tools and many run on low-cost FPGA boards, antennas can be simulated before fabrication, and the embedded papers use common microcontrollers. Each card names the data or tools so you can check before you commit.

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