

Introduction to Electronics Artisan Case Studies

Introduction to Electronics – Artisan Case Studies

Designed as a quick-reference guide for hobbyists, makers, and early-career engineers.

1. Why Study Artisan? Level Cases?

Benefit	What It Means for You
Practical problem-solving	Real-world constraints (budget, space, parts availability) replace textbook idealisations.
Design intuition	Seeing how seasoned builders make trade-offs sharpens your own decision-making.
Reusable patterns	Many solutions recur (e.g., power-rail filtering, PCB layout tricks). Recognising them speeds up future projects.
Portfolio material	Documented case studies become proof of competence for jobs or client work.

2. Common Elements in Artisan Projects

1. Project Definition

- Goal statement (e.g., “portable FM transmitter”)
- Success criteria (range, battery life, cost ceiling)

2. Component Selection

- **Active devices:** microcontrollers, op-amps, transistors, RF modules.
- **Passive parts:** electrolytic vs. ceramic caps, SMD vs. through-hole resistors, inductors.
- **Supply considerations:** voltage rails, battery chemistry, regulator type.

3. Schematic Architecture

- Block diagram ? detailed netlist.
- Signal flow: power ? control ? I/O ? output.

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4. PCB Layout Strategies

Studies

- Layer count (1?layer, 2?layer, 4?layer).
- Ground?plane stitching, star?ground vs. ground?plane.
- Trace width/spacing calculations (current, impedance).

5. Prototyping & Testing

- Breadboard/stripboard ? perfboard ? prototype PCB.
- Test points, oscilloscope/logic?analyzer checkpoints.

6. Enclosure & Mechanical Fit

- 3?D printed vs. off?the?shelf cases.
- Heat?sink integration, vibration mounting, EMI shielding.

7. Documentation & Revision Control

- Bill of Materials (BoM) with part numbers, suppliers, and cost.
- Revision history (schematic, PCB, firmware).

3. Representative Case Studies

3.1. Portable Solar?Powered Weather Station

Aspect	Details
Goal	Measure temperature, humidity, and barometric pressure; log data to SD card; run on a 5?W solar panel.
Key Components	• MCU: ESP32 (Wi?Fi, low?power) • Sensors: BME280 (I²C) • Power: MCP73831 Li?Ion charger, 3.3?V LDO • Storage: micro?SD breakout

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Aspect

Details

Studies

Design

Highlights

Lessons

Learned

- **Power budgeting:** 300mA average draw @ 5W panel + 2000mAh LiPo gives >48h autonomy.

- **Energy harvesting circuit:** MPPT not needed; simple diode OR with a Schottky diode to prevent backflow.

- **PCB:** 2-layer, 1mm FR4; ground plane on bottom, signal on top.

- **Enclosure:** 3D printed rain shield with a clear window for the solar cell.

- Keep the regulator close to the battery to minimise voltage drop.

- Use decoupling caps (