

HOW TO BUILD THINGS THAT WORK

A 9-week hardware course – electronics, code, and 3D design.

W0

PRE-WORK (ASYNC, 2H)

Everyone shows up with a working toolchain instead of losing an hour to installers.

- Install Arduino IDE 2, ESP32 boards, VS Code, Git
- Blink on Wokwi simulator
- Publish an empty documentation page

W1

ELECTRICITY YOU CAN MEASURE

Instruments before components: you measure a circuit before you believe it.

- Ohm, Kirchhoff, dividers, pull-ups, current limiting
- Multimeter, bench PSU, breadboard
- Choosing an MCU · toolchain options
- Blink → button → debounce

W2

SWITCHING REAL LOADS, AND SOLDERING YOUR BASE BOARD

Students solder one permanent board and use it for the remaining seven weeks.

- Decoupling caps, flyback diodes, level shifters, 3.3V vs 5V
- BJT and MOSFET as switches
- Reading a datasheet
- LDO vs buck · current budget
- PWM and ADC
- Soldering lab → build the Node Base Board

W3

SENSORS AND BUSES (+ CAD SEED)

Protocols stop being magic the moment you decode a real one by hand.

- Analog sensing, noise, filtering
- UART · I2C · SPI · 1-Wire
- Logic analyzer session
- Sensor families · libraries · address conflicts
- OLED display
- CAD seed (90 min) + weekly drills begin

W4

ACTUATORS AND POWER ENGINEERING

The week the project moves, and the week batteries stop being an afterthought.

- Relays, MOSFETs, servos, H-bridge, steppers, WS2812
- Stall current, inrush, back-EMF, brownout
- LiPo, TP4056, battery safety
- Deep sleep, μ A measurement, battery life math
- Final project proposal due

W5

FIRMWARE ARCHITECTURE

The week that separates this from a tutorial series — professionals will judge you here.

- `delay()` is a bug → `millis()` scheduling
- Finite state machines, drawn before coded
- Interrupts, ISRs, volatile
- Watchdog and defensive firmware
- FreeRTOS tasks and queues
- Git, versioning
- AI as an engineering assistant — and how to verify it
- Spec review — scope gets cut here, not in Week 9

W6

CONNECTIVITY, INTERFACES & EDGE AI

Sixteen separate devices become one system on one screen.

- WiFi, provisioning, reconnection
- Web server, REST, LittleFS
- MQTT and dashboards
- ESP-NOW · BLE basics
- OTA updates
- Security minimums
- Edge AI: collect → train → deploy on-device

W7

PARAMETRIC CAD AND DESIGN FOR 3D PRINTING

Four weeks of drills mean this block runs at double speed.

- Sketches, constraints, timeline, parameters
- Calipers and tolerance
- Layer adhesion, overhangs, warping, orientation
- Fits and the fit-test coupon
- Slicer as an engineering tool
- PLA vs PETG vs ASA vs TPU
- Printer failure modes

W8

ENCLOSURE DESIGN + PCB LITERACY

Half the day makes it wearable in the real world, half makes it manufacturable.

- Bosses, ribs, draft, gaskets, cable routing
- Heat-set inserts vs screws vs snap-fit
- Designing around a board · exploded renders
- KiCad: schematic → footprints → layout → ground pour → DRC → Gerbers
- Fab houses, cost, lead times, local fallbacks

W9

INTEGRATION, VALIDATION, DEMO DAY

It either survives contact with reality in front of guests, or it doesn't.

- Test plans and failure modes
- Strain relief and final fit
- BOM cost at qty 1 / 100 / 1000
- Demo Day — 5-min live demo each, filmed
- Certificates + published portfolios

Tesla School — How to Build Things That
Work

Tuition: 40 000 DZD · 2 000 DZD reserves your
seat