

RYSERA INTERMEDIATE COURSE

# Curriculum Overview

4 Modules • 1 Project: The Medibox

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Course on Integrated System Design • 2026

Electronics	Breadboarding, sensors, protocols
PCB Design	KiCad, etching, soldering
Computer Science	C++, Arduino, Wi-Fi, AI/ML
3D Design	TinkerCAD, enclosures, printing

**Curriculum Updates:** OLED and LED components have been removed. **AMS117 5V** voltage regulator added to Electronics. CS Day 3 removed — replaced with **Day 10 Workshop: AI & Teachable Machine**. PCB practical sessions flagged for extended days within the same week.

## Module 1 | Electronics

Core electronic components, communication protocols (SPI, I2C), the AMS117 5V voltage regulator, HTU21D sensor, buzzer, push buttons, and ESP32 interfacing.

### You will be able to:

- ✓ Wire push buttons, buzzer, and HTU21D sensor on a breadboard
- ✓ Use the AMS117 5V voltage regulator module
- ✓ Implement I2C communication with the HTU21D sensor
- ✓ Build the complete Medibox electronics assembly

### DAY 1 Icebreaker

- Course overview & project introduction
- Medibox requirements walkthrough
- Push buttons — GPIO 34 & 35 breadboard wiring
- Keeping time — NTP sync over Wi-Fi
- Software setup: Arduino IDE, KiCad, 3D tools

### DAY 2 Putting It All Together

- Push buttons — debouncing & GPIO input
- Buzzer — PWM alarm system
- HTU21D Temperature & Humidity Sensor (I2C)
- AMS117 5V voltage regulator module
- OLED Display — multi-menu navigation
- IoT connectivity — Wi-Fi & NTP time sync

## Module 2 | PCB Design

KiCad schematic capture, PCB layout optimisation, Gerber file generation, FeCl<sub>3</sub> etching practical, and manufacturing-ready design.

**You will be able to:**

- ✓ Create professional schematics in KiCad
- ✓ Design a PCB layout with proper trace routing
- ✓ Etch a real PCB using FeCl<sub>3</sub> chemical process
- ✓ Solder SMD and through-hole components

### PCB DAY 1 Schematic Capture in KiCad

- KiCad 7 workspace & schematic editor
- Adding ESP32, AMS117 5V, peripherals
- Net connections and labels
- Running ERC — fixing warnings
- Footprint assignment

### PCB DAY 2 PCB Layout & FeCl<sub>3</sub> Etching ★ Extended

- KiCad PCB layout editor
- Component placement strategies
- Trace routing, vias, ground plane
- FeCl<sub>3</sub> chemical etching practical
- Soldering and continuity testing

*Note: This session may extend across additional days within the same week.*

## Module 3 | Computer Science

C++/Arduino programming on ESP32, real-time hardware-software integration, Wi-Fi & cloud connectivity, plus AI/ML concepts including Teachable Machine.

### You will be able to:

- ✓ Program ESP32 with C++ and Arduino framework
- ✓ Integrate all sensors into a unified firmware
- ✓ Connect to the cloud via Wi-Fi
- ✓ Apply AI concepts and build a Teachable Machine model

### CS DAY 1 Programming the Medibox

- C++ and Arduino framework on ESP32
- Digital I/O, PWM, Serial debug
- Real-time clock and alarm logic
- Wi-Fi & ESP32 web server
- Full system firmware integration

### DAY 10 WORKSHOP AI & Teachable Machine [NEW]

*Replaces former Day 3 (removed)*

- Regression trees vs neural networks
- Generative AI — ChatGPT, DALL•E, Sora
- Building a Teachable Machine classifier
- Pill/tablet image classification
- Group presentations & reflection

## Module 4 | 3D Design

TinkerCAD for functional enclosure design, ergonomic & human-centred design principles, STL export, and 3D printing applications.

### You will be able to:

- ✓ Design a functional enclosure using TinkerCAD
- ✓ Apply CAD principles for ventilation and fit
- ✓ Export STL and use a slicer for 3D printing
- ✓ Design assistive devices with human-centred principles

### 3D DAY 1 Designing the Medibox Enclosure

- TinkerCAD workspace & tools
- Enclosure design requirements
- Modelling walls, vents & cutouts
- Peer design review
- STL export & slicer setup

### 3D DAY 2 Applications of 3D Printing

- Real-world 3D printing applications
- Tools, assistive devices, machine parts
- Material selection & print methods
- Group brainstorming — Top 5 ideas
- Feasibility analysis

### 3D DAY 3 Assistive Device Design

- Human-centred design principles
- User needs assessment
- Ergonomics & accessibility
- CAD modelling workshop
- Prototype preparation & peer review