

ESP32 and C++ Level 1 Teacher Course Map

Four classroom-ready lessons that move from desktop C++ foundations to a safe first ESP32 upload

This course is designed for middle- and high-school robotics students. Lessons 1-3 establish the edit, compile, run, and debug habits students need before hardware. Lesson 4 transfers those habits to an ESP32 using USB power only.

Course outcomes

- Explain source code, compiler, executable program, syntax, and the edit-compile-run cycle.
- Read a simple C++ program and use string, int, and double variables.
- Collect terminal input and make a decision with if and else.
- Safely connect an ESP32, upload a sketch, and interpret Serial Monitor output.
- Explain that setup runs once and loop repeats.

Prerequisites and equipment

CATEGORY	REQUIREMENT
Students	Basic typing and file-navigation skills; no prior programming required.
Laptop	Windows laptop with administrator support available for initial software installation.
Desktop software	VS Code, C++ extension, and g++ compiler for Lessons 1-3.
ESP32 software	Arduino IDE, ESP32 board package by Espressif Systems, and the correct USB driver when required.
Hardware	One ESP32 development board and known-good data USB cable per student or pair for Lesson 4.
Safety boundary	Lesson 4 uses USB power only: no motors, robot battery, external power, sensors, or loose wiring.

Level 1 Sequence

Suggested classroom time includes instruction, guided practice, student work, and a skill check

LESSON	FOCUS	TIME	STUDENT PRODUCT
1	What Is C++	60-75 min	A compiled Hello World program with edited output and one corrected error.
2	Program Structure and Variables	60-75 min	A readable robot profile using string, int, double, comments, and labeled output.
3	Input and Decisions	60-75 min	A robot readiness checker tested with passing and failing inputs.
4	Hello ESP32	60-90 min	A USB-powered ESP32 sketch that demonstrates setup, loop, and Serial Monitor.

Recommended lesson rhythm

- Begin with a prediction or short readiness question.
- Use the two-minute video to introduce the model and vocabulary.
- Demonstrate one complete workflow before students type.
- Move through guided practice, then require an individual change or skill check.
- Record evidence: terminal output, code, test cases, or Serial Monitor observations.
- End with a brief explanation in the student's own words.

Lesson 4 safety and setup gate

STEP	CHECK
1	Inspect the board and cable. Do not use a damaged board, connector, or cable.
2	Keep the ESP32 on a clear, dry, nonconductive surface.
3	Connect only the USB data cable. Do not add external power or wiring.
4	Select the intended board and the port that appeared when the board was connected.
5	Upload the known starter sketch before students modify it.
6	If the board becomes hot, smells unusual, or behaves unexpectedly, disconnect USB and notify the teacher.

Assessment and Tuesday Review

Use observable evidence to decide what should be adjusted before expanding the course

Level 1 completion checklist

DOMAIN	STUDENT CAN	CHECK
Workflow	Create, save, compile, run, edit, and recompile a C++ source file.	[]
Structure	Identify include, main, braces, statements, comments, and semicolons.	[]
Variables	Choose and use string, int, and double with meaningful names.	[]
Input	Read a numeric value with cin.	[]
Decision	Use a comparison with if and else and test both outcomes.	[]
ESP32	Choose board and port, upload, and open Serial Monitor at 115200 baud.	[]
Execution	Explain that setup runs once and loop repeats.	[]
Safety	Uses USB only and stops immediately for heat, odor, damage, or unexpected behavior.	[]

Review questions for October 13

- Can students install and use the required tools without losing most of the first lesson?
- Do the videos match the pace and vocabulary of the class?
- Are student PDFs readable and easy to print?
- Can students find only the files they need without seeing answer keys?
- Does Lesson 4 work with the exact ESP32 board and cable the program purchased?
- Which students are ready for digital output, and who needs another desktop C++ practice lesson?

Decision after the review

Keep Lessons 1-4 as the Level 1 foundation if students can independently complete the workflow and explain their evidence. After the review, plan the remaining ESP32 sequence around digital output, digital input, analog sensors, PWM, servos, and a small sensor-controlled project.