LESSON 97

Understanding Embedded Components and Planning

200 minutes (5 periods) | Applied Learning Tasks (ALTs) | Outcome 3.14 | Outcome 2.14 | Outcome 1.11 | Outcome 1.20 | Outcome 2.5 | Outcome 2.1 | Outcome 1.3

WHAT THIS LESSON DOES

In this lesson, you'll learn about embedded systems by exploring components like sensors and actuators. Follow steps to design a system, discuss ethical impacts, assign team roles, and create a detailed plan for your project.

CURRICULUM OUTCOMES

Outcome	What the specification asks for
3.14	design automated applications using embedded systems
2.14	describe the difference between digital and analogue input
1.11	discuss the complex relationship between computing technologies and society including issues of ethics
1.20	collaborate and assign roles and responsibilities within a team to tackle a computing task
2.5	use pseudo code to outline the functionality of an algorithm
2.1	use abstraction to describe systems and to explain the relationship between wholes and parts
1.3	solve problems by deconstructing them into smaller units using a systematic approach in an iterative fashion

WHAT STUDENTS SHOULD BE ABLE TO DO

- Understand the core components of embedded systems, including microcontrollers, sensors, and actuators.
- Apply computational thinking to design embedded systems step by step.
- Evaluate ethical implications of embedded systems on privacy, safety, accessibility, and the environment.
- Develop a comprehensive plan for an embedded system project, integrating design and ethical considerations.
- Collaborate effectively by assigning and refining team roles for project implementation.

BEFORE THE LESSON

- This is planning and discussion, not coding. Confirm students can open and edit their existing plan document (Google Docs, Word or similar) and that the file from earlier work is saved where they can reach it.
- Decide which hardware the class will target, Micro:bit or Arduino, so component discussion stays concrete. Have a board and cable available to show even if no code is written today.
- Have example embedded devices in mind (smart thermostat, plant watering system, motion sensor) to anchor the abstract discussion.

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HOW THE LESSON RUNS

- Introduction
- Exploring Embedded Components
- Step-by-Step System Design
- Ethical Discussion
- Developing Your Plan Document

TEACHING MOVES

- 2. Exploring Embedded Components. Pin down the sensor versus actuator distinction with physical examples: a temperature sensor reads the world in, an actuator acts on it out. Link analogue (continuous) versus digital (on/off) back to inputs students already know.
- 3. Step-by-Step System Design. Make them define the problem in one sentence before touching components. Reject vague aims like "a smart home thing" and push for "waters plants when soil moisture drops below a threshold".
- 4. Ethical Discussion. Keep this spoken and turn it on their own designs. Ask each team who could be harmed, what data their system collects and where it goes. Privacy, safety, accessibility and environment, one concrete example each.
- 5. Developing Your Plan Document. Have them expand the existing plan, not restart it. Insist ethical considerations and a system sketch are added sections, not afterthoughts. Two to four pages is the target.

WHAT TO WATCH FOR

- Students treat a sensor and an actuator as interchangeable, or think the microcontroller itself senses the environment. Draw the input, process, output chain on the board. Sensor in, microcontroller decides, actuator out. Have them label their own design against it before writing.
- Ethics is seen as a box to tick rather than something specific to their chosen system. Refuse generic answers. Make each team name a real person affected by their specific device and one concrete data or safety risk.

DIFFERENTIATION

- Emerging: If a student cannot pick a problem, offer the plant watering or room temperature example directly and let them adapt it. Give a one-line template for the problem statement so they can fill the blank rather than face empty page.
- Developing: Have them justify each component choice out loud: why this sensor for this problem, before it goes in the document.
- Proficient: Push toward Higher Level treatment: ask them to specify analogue versus digital handling, thresholds and how the microcontroller stores or compares readings. Point out that a well documented plan with design decisions and ethical analysis is exactly the kind of evidence an Applied Learning Task rewards.