



ENABLING THE USE OF SENSORS IN THE CLASSROOM THROUGH A MODULAR APPROACH

An interdisciplinary and economical approach to exploring data investigation technologies



Within SteamCity, we offer a connected learning approach through four complementary sensor-themed stations. Each station constitutes a starter technology module: the set of sensors we consider essential (but not exhaustive) for engaging classes in scientific investigation in an interdisciplinary manner.

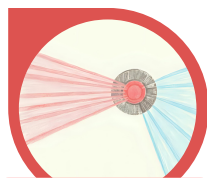
These sensors have been strategically selected to cover as many of our educational protocols as possible (available in our resources) while remaining financially accessible to educational establishments. This selection optimizes the price-quality ratio by allowing multiple experiments to be carried out with a reasonable hardware investment. To reinforce this accessibility, we also integrate the use of mobile tools (smartphones, tablets) as alternative sensors, thus avoiding the purchase of expensive specialized sensors while maintaining a measurement quality adapted to the educational objectives. Each module can be activated alone or in combination with others, allowing fine adaptation to pedagogical and budgetary constraints.

The approach prioritizes understanding of phenomena: the selected sensors offer sufficient precision for scientific learning, with simple calibration protocols that students can carry out themselves, thus transforming questions of measurement reliability into additional learning opportunities.

Each module focuses on a societal issue that represents SteamCity's commitment (environment, mobility, energy, artificial intelligence) and offers a coherent set of specialized sensors, practical activities, and specific educational objectives that you can find in our protocols. This approach allows teachers to begin technological exploration with their students, providing them with the essential tools to understand and act on the challenges of our time.



Environment, well-being



Mobility & Transport



Energy and thermal comfort



Artificial intelligence

Detail of elements by station

- **Programmable card:** 1 card per kit which itself includes a set of start sensors
- **Additional sensors:** 2-3 specialized sensors per station to explore complex phenomena further
- **Student equipment:** Smartphone/PC already available (camera, microphone, apps)
- **Accessories:** Cables, breadboard, resistors, LEDs



PRICE STRUCTURE FOR A CLASS OF 30 STUDENTS (10 KITS)

Station	Configuration	Technical elements	Price/kit	Classy price	Benefits
Environment and Well-being	Micro:bit	8 elements (DHT11, LDR, Soil sensor + Micro:bit 4 sensors)	40€	400€	Simplicity, block programming
	STM32 IoT Node	9 elements (Soil sensor + STM32 with 8 integrated sensors)	65€	650€	Professional sensors, precision
	Steam	9 elements + screen (Soil sensor + Steami 8 sensors + LCD + Jaccard)	50€	500€	Integrated display, Grove connectors
Mobility & Transport	Arduino Uno (required)	5 elements (HCSR04, Accelerometer + Arduino Uno)	35€	350€	Only 5V card compatible with HCSR04
Energy and thermal comfort	Micro:bit	8 elements (LDR, DHT11, Photodiode + Micro:bit 4 sensors)	30€	300€	Interface simple
	STM32 IoT Node	9 elements (Photodiode + STM32 with 8 integrated sensors)	55€	550€	Redundant sensors for comparison
	Steam	9 elements + screen (Photodiode + Steami 8 sensors + LCD)	40€	400€	Direct data display
	+ Thermal camera	+1 shared item		+250€	Professional thermal analysis
Artificial intelligence	Arduino Uno	6 éléments (Grove Color, APDS-9960 + Arduino Uno)	45€	450€	Mature AI Libraries
	Raspberry Pico	6 éléments (Grove Color, APDS-9960 + Raspberry Pico)	40€	400€	More memory for complex AI

Recommendations by budget

Budget/student	Recommended configuration	Stations included	Benefits
< 40€	Micro:bit + Arduino	Environment + Mobility	Economic start-up
40-60€	Steam + Arduino	4 stations without thermal	Optimal balance
> 60€	STM32 + Arduino + thermal	4 complete stations	Professional configuration



SHARING AND OPTIMIZATION OF RESOURCES

The modular approach naturally encourages the sharing of equipment between different stations, thus maximizing the effectiveness of educational investment. This optimization is based on three main axes: technical reuse, material sharing, and documentary capitalization.

On the technical side, several fundamental sensors are found in different stations (DHT11 for temperature/humidity, LDR for brightness, smartphone camera for vision), allowing teachers to create educational bridges between themes. This technical transversality strengthens the overall understanding of physical phenomena while reducing acquisition costs.

Hardware sharing optimizes the use of programmable cards according to specific needs: the same Arduino card can be used successively for the Mobility and AI stations, while a Micro:bit can be used alternately for Environment and Energy. This flexibility allows institutions to adapt their equipment to their specific educational organization.

Documentary capitalization ensures the sustainability and scalability of the project: the protocols developed, feedback and local adaptations constitute a base of reusable and enrichable resources, creating a sustainable educational ecosystem within the establishment.

Common Sensor Analysis

Shareable sensors	Affected stations	Unit price	Economy
DHT11	Environment + Energy	8€	8€/kit
LDR	Environment + Energy	3€	3€/kit
Micro:bit	Environment + Energy	22,5€	22,5€/kit
Light sensor smartphone	Environment + Energy + Mobility + AI	0€	0€ (already free)
Arduino Uno	Mobility + AI	23,9€	23,9€/kit
Camera smartphone	Mobility + AI	0€	0€ (already free)

Common Sensor Analysis

Combination of stations	Cost with pooling	Economy	Economy %
Environment + Energy	450€ - 650€ (45€ - 65€/kit)	250€ - 550€	36% - 46%
Mobility + AI	650€ - 700€ (65€ - 70€/kit)	50€ - 150€	7% - 19%
Environment + Energy + Mobility	750€ - 1000€ (75€ - 100€/kit)	300€ - 550€	29% - 35%
Mobility + AI + Energy	900€ - 1200€ (90€ - 120€/kit)	150€ - 250€	14% - 17%
4 complete stations	1100€ - 1400€ (110€ - 140€/kit)	350€ - 700€	24% - 33%
4 stations + camera	1450€ - 1750€ (145€ - 175€/kit)	350€ - 700€	19% - 29%