STeaMi: A Classroom-Oriented Development Board

Sébastien Nedjar
Les émulsionneurs
La Rochelle, France
contact@labaixbidouille.com

Charly Olivier
Les émulsionneurs
La Rochelle, France
charly.olivier@labaixbidouille.com

***Abstract*—The STeaMi board is an educational microcontroller platform specifically designed to provide students and teachers with hands-on experience in programming, electronics, and IoT within the classroom environment. It integrates a wide array of sensors, programmable components, and wireless communication features into a single, easy-to-use device. Designed to be affordable, extensible, and compatible with existing educational ecosystems such as micro:bit and Jacdac, the STeaMi board enables interdisciplinary learning experiences that bridge science, technology, engineering, arts, and mathematics (STEAM). While currently supporting Arduino and MicroPython environments, development is ongoing to expand functionality and ensure robust MakeCode integration. This paper presents the motivation, technical architecture, development context, and envisioned educational applications of the STeaMi platform, as well as its alignment with responsible innovation principles.**

I. Introduction / Background (Sytle: Heading 1)

Contemporary education increasingly emphasizes hands-on and cross-disciplinary learning approaches to foster creativity and technological fluency. However, a major barrier in delivering such experiences lies in the availability of accessible, scalable, and educationally targeted hardware. The STeaMi board was conceived as a response to this gap. Initiated by Les Émulsionneurs, the project aims to deliver a microcontroller-based platform tailored specifically for the classroom, with ease of use, safety, and pedagogical versatility at its core.

The board targets teachers and students in middle schools, high schools, and early university settings. It promotes collaborative learning experiences through programmable experiments in physics, environmental science, mathematics, computer science, and art. At the heart of the board lies an STM32WB55RG microcontroller from STMicroelectronics, which facilitates dual-core operation and integrated Bluetooth Low Energy. The project is informed by real classroom needs and co-developed with input from initiatives like TheDexterLab and Let's STEAM.

II. Related work

Several educational platforms have paved the way for microcontroller use in schools—Arduino, micro:bit, and Raspberry Pi Pico being the most notable. However, these platforms often require additional components, external wiring, and setup complexity that can be prohibitive for classroom adoption. Moreover, many lack direct integration with school pedagogical resources or cross-disciplinary capabilities.

STeaMi aim to differentiates itself by combining advanced sensor integration, plug-and-play compatibility, and software adaptability with robust support for educational workflows. Resources from TheDexterLab provide real scientific protocols, while Let's STEAM offers pedagogical pathways for interdisciplinary teaching. These partnerships make STeaMi not just a piece of hardware, but part of an educational ecosystem.

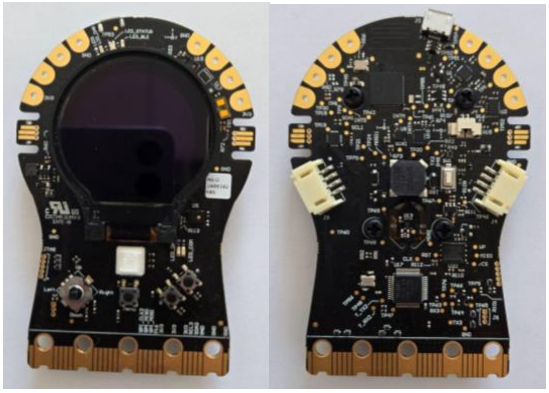
III. Existing prototype sketches/drawings/photos

The STeaMi board integrates multiple subsystems into a compact and robust package. The majority of its development has been carried out by Sébastien Nedjar and Jonathan Baudin, with firmware contributions, hardware integration, and architecture decisions made to ensure educational usability.

A. The STeaMi board incorporates

- TCore MCU: STM32WB55RG with dual-core architecture (Cortex-M4 + Cortex-M0), BLE 5.2
- Storage: 64 Mbit Winbond Flash memory via USB Mass Storage
- User Interface: RGB LED, 7 tactile buttons, circular OLED display (128x128)
- Audio: Transducer speaker (500 Hz to 10 kHz)
- Connectivity: Bluetooth LE, USB-MicroB, Jacdac, Qwiic/STEMA, micro:bit edge connector
- Sensors:
    - VL53L1X (ToF distance, up to 4m)
    - ISM330DLCTR (6-DoF IMU)
    - LIS2MDL (3-axis magnetometer)
    - WSEN-HIDS (humidity and temperature)
    - WSEN-PADS (barometric pressure)
    - APDS-9960 (ambient light, RGB, gestures)
- Power Management: Lipo charging via BQ2407x, battery gauging with BQ27441-G1
- Expansion: GPIO expander MCP23009, 8 crocodile-clip pins source explain where you got them from. Explain how you built or intend to build the prototype.

B. *The STeaMi board*



C. *Current development status*

Arduino and MicroPython environments are available but still under active development. Some features such as joystick support, Jacdac communication, and full sensor abstraction layers are not yet implemented.

Integration with MakeCode is underway and requires extensive customization due to the board's specific hardware configuration.

IV. Responsible innovation

The STeaMi project is built on principles of equitable access, open-source philosophy, and educational relevance. By leveraging open standards and reusing well-documented hardware components, the platform ensures long-term sustainability and ease of maintenance. Its cost-effective design (<€50) makes it accessible to schools with limited budgets while offering features comparable to more expensive development kits.

The board's compatibility with micro:bit peripherals and MakeCode encourages reusability of classroom resources. By supporting both block-based and textual programming languages (MakeCode, MicroPython, Arduino), it serves a broad spectrum of student skill levels.

In terms of ecological responsibility, the board promotes longevity and reuse. The hardware is designed to be repairable, with parts that are readily available. In addition, educators are provided with open-source resources to extend the product's educational lifespan.

V. Author bio(s) / experiences

Charly is an engineering student and a work-study apprentice at Les Émulsionneurs, where he joined the team a year ago during the development of the STeaMi project. Coming from a background in web and software development, he has transitioned into embedded systems with a growing interest in digital pedagogy. His primary contributions focus on adapting the MakeCode platform to support the STeaMi board and creating educational resources in MicroPython. His work bridges the gap between technical implementation and classroom usability, ensuring that the platform remains approachable for students and teachers alike.

VI. Acknowledgements

This project was made possible through the efforts of Sébastien Nedjar and Jonathan Baudin, who led the technical development of the STeaMi platform. We also thank the educators and collaborators involved in the Let's STEAM and TheDexterLab projects for providing critical pedagogical guidance and testing feedback. Finally, our gratitude extends to the open-source hardware community and the documentation provided by component manufacturers including STMicroelectronics, Wurth Elektronik, Adafruit, and SparkFun.

VII. Refernces

[1] STMicroelectronics, STM32WB55RG Datasheet
[2] TheDexterLab Project – www.thedexterlab.eu
[3] Let's STEAM Project – www.lets-steam.eu
[4] Microsoft Jacdac Documentation – https://microsoft.github.io/jacdac-docs/
[5] SparkFun Qwiic – https://www.sparkfun.com/qwiic
[6] Adafruit STEMA QT – https://learn.adafruit.com/introducing-adafruit-stemma-qt
[7] STMicroelectronics, LIS2MDL, ISM330DLCTR, VL53L1X datasheets
[8] Wurth Elektronik, WSEN-PADS, WSEN-HIDS datasheets