3D Models of littleBits Educational Robotics components
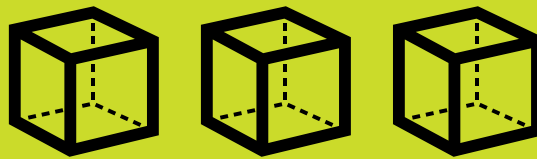
Authors: Petros Amanatidis, Abbas Jafari, Dimitris Karampatzakis, and Mikhail Fominykh

Asset supplement

3D Models of littleBits Educational Robotics components

Authors by contribution

3D modeling: Petros Amanatidis and Abbas Jafari

Educational robotics expertise: Dimitris Karampatzakis and Petros Amanatidis

Editor: Mikhail Fominykh

Acknowledgement

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Asset library summary

The Asset library is a key component of the Augmented Reality Enhanced Universal Educational Robotics Framework[1], developed in the eROBSON project[2]. Conceptually, it represents a platform-independent collection of digital assets that are required by any Augmented Reality system to simulate an Educational Robotics kit. An asset library may contain various digital resources necessary for an Augmented Reality - enhanced educational experience. The two essential elements of the Asset library are specific to Educational Robotics and are designed after the physical Educational Robotics kit components. These elements are (a) 3D models that should be designed with low polygon count to be applicable in Augmented Reality applications and (b) behavior description of each Educational Robotics kit component with the defined level of selective exposure.

More details about the eROBSON asset library and the Augmented Reality Enhanced Universal Educational Robotics Framework are presented by Karampatzakis et al[3].

Educational Robotics 3D models

The Educational Robotics 3D models define the visual appearance of the Educational Robotics component to be simulated in the Augmented Reality system. The 3D models of Educational Robotics components should have some physical properties that can be utilized in Augmented Reality interaction, such as movable parts (e.g., buttons, motors, flexible wires), output indicators (e.g., light and sound sources), and input reactors (e.g., collision detection). Finally, the Asset library may contain Other assets that might be required to create an educational Augmented Reality experience, such as poster images, video instructions, 3D models of objects other than Educational Robotics components, and similar.

Asset 1: Basic 3D models of littleBits components

The resource presented here contains a collection of 3D models designed after the 13 most used Sphero littleBits[4] components, in GLB format.

Input components:

- i3 Button
- i5 Slide Dimmer
- i11 Pressure Sensor
- i18 Motion Trigger

Output components:

- o2 Long Led
- o6 Buzzer

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[1] https://e-robson.eu/ar-uer-framework/

[2] https://e-robson.eu/

[3] Dimitris Karampatakis, Mikhail Fominykh, Nardie Fanchamps, Olga Firssova, Petros Amanatidis, Giel Van Lankveld, Thomas Lagkas, Avgoustos Tsinakos, and Roland Klemke: "Educational Robotics at Schools Online with Augmented Reality" in *the 15th IEEE Global Engineering Education Conference 2024 (EDUCON2024)*, EDUCION2024 Proceedings.

[4] https://littlebits.com/welcome

- o9 Bar Graph
- o13 Fan
- o25 DC Motor

Power components:

- p3 Usb Power
- Usb Power

Wire components:

- w2 Branch
- w7 Fork

Asset 2: 3D models of littleBits components

The resource presented here contains a collection of 3D models designed after the 30 Sphero littleBits[5] components, BLEND format.

Input components:

- i3 Button
- i5 Slide Dimmer
- i6 Dimmer
- i8 Proximity Sensor
- i11 Pressure Sensor
- i12 Temperature Sensor
- i13 Light Sensor
- i18 Motion Trigger
- i20 Sound Trigger

Output components:

- o2 Long Led
- o6 Buzzer
- o9 Bar Graph
- o11 Servo
- o13 Fan
- o25 DC Motor
- o26 Speaker

Power components:

- p3 Usb Power
- Usb Power

Wire components:

- w1 Wire

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[5] https://littlebits.com/welcome

- w2 Branch
- w4 AND
- w14 Makey Makey
- w15 NOR
- w16 NAND
- w17 XOR
- W19 Split
- w21 Wireless Receiver
- w22 Wireless Transmitter
- w29 Perf
- w34 microBit adapter

Educational Robotics behavior description

The Educational Robotics behavior description defines the logic for the behavior of each Educational Robotics component. These behavior descriptions are required (in addition to the 3D models) to simulate the Educational Robotics kit with any software, including an Augmented Reality system. In different ER kits, depending on the Maker's Box approach ('black box' or 'white box'), this may include different features of the Educational Robotics kit's input/output ports and standardization, tangible user interface buttons/switches, color-coded or text labeling visual information, displays, and power systems.

The assets presented here were operationalized in two educational Augmented Reality apps. Asset 1 was used to design a new content type in the eROBSON app[6] (based on the open-source MirageXR[7]). Asset 2 was used to design educational materials[8] using the AR Tutor app[9].

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[6] https://e-robson.eu/erobson-app/
[7] https://wekit-ecs.com/
[8] https://e-robson.eu/materials/
[9] https://aetma.ihu.gr/?page_id=5674