Web Simulation of a Thymio Robot

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October 11, 2019

Declaration of Authorship

Management Summary

Contents

1 Introduction

2 Environment

2.1 Thymio

2.1.1 What is Thymio

Thymio is an educational robot that aims at improving early education (starting in primary school) in STEM (Science, Technology, Engineering and Mathematics), computational thinking, base computer science and researching the acknowledgment by kids of robots in their learning environment. The project also had technical aims, such as how to provide hardware modularity, fast reaction time amid perception and action, clear internal communication bus in a user-friendly way and streamline development for group robot, this includes direct changes to the robots' programs and parallel debugging wirelessly, transparently and cheaply.

The Thymio project is based on a collaboration between the MOBOTS group from the Swiss Federal Institute of Technology in Lausanne (EPFL) and the Lausanne Arts School (ECAL). MOBOTS being the Miniature Mobile Robots Group, they are mainly focused around system design for small robots of the kind. It started with a strange-looking pile of components, that were assembled on any kind of support and holt the name of "Monsieur Patate" (Sir Potato), most likely due to its appearance, that saw life during the first workshop between the two contributors. After what the first "Thymio" was developed, it was a four-block robot that could be self-assembled, but not self-programmed as it was coming with pre-programmed behaviours. It was used as a user study to gather feedback from clients to know what features needed to be implemented on the Thymio II.

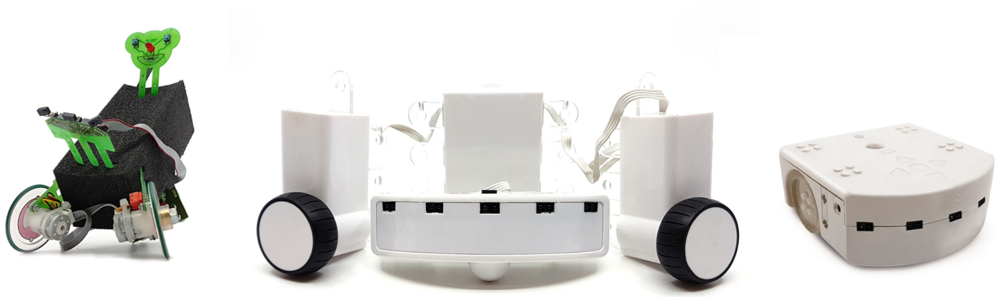

Figure 1: From left to right, "Monsieur Patate", Thymio, Thymio II

The result is a robot with a complex and complete set of sensors and actuators. The National Centre for Competence in Research (NCCR) Robotics research program supported the development of the robot whereas Mobsya, a non-profit organization that creates a robot, software, and educational activities to broaden young people's mind about technology and science, oversees the production, distribution, and communication of said robot. Every step of the Thymio project is open-source and has a non-profit aim to enhance the quality of it with the user's project and research, and reduce the cost and augment the lifetime for educational platforms and materials.

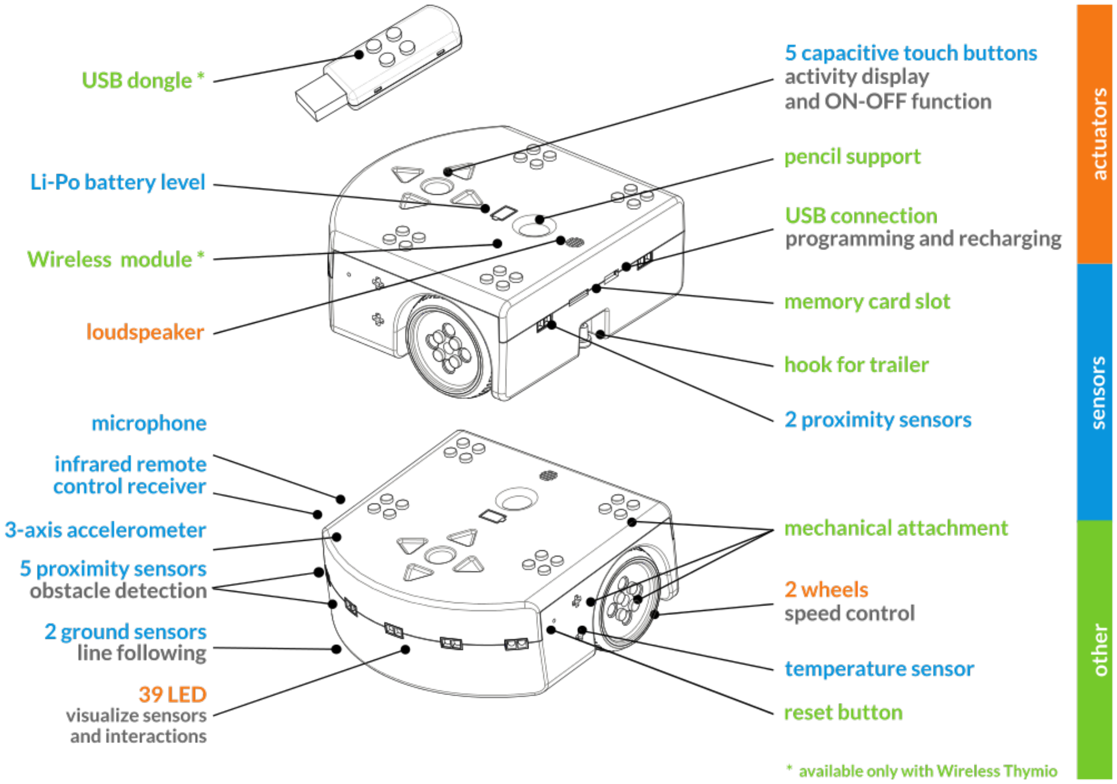
USB dongle *
Li-Po battery level
Wireless module *
loudspeaker
microphone
infrared remote control receiver
3-axis accelerometer
5 proximity sensors obstacle detection
2 ground sensors line following
39 LED visualize sensors and interactions
5 capacitive touch buttons activity display and ON-OFF function
pencil support
USB connection programming and recharging
memory card slot
hook for trailer
2 proximity sensors
mechanical attachment
2 wheels speed control
temperature sensor
reset button
* available only with Wireless Thymio
actuators
sensors
other

Figure 2: Thymio II sensor and actuator

2.1.2 How does it works

As seen in the figure above there exist two Thymio models, Thymio and Wireless Thymio. The difference between them lies in the ability of the second one to be programmed wirelessly, as its name suggests. To begin the creation of a program for the robot there exist two possibilities. The first one, and the most common one for the public is done by using the software Aseba and a connected Thymio. In this case, the robot needs to be plugged in via USB cable or USB dongle (possible only if it is the Wireless Thymio) and powered on. Then the software can be used to connect to said robot and start to program in one of the four different programming languages, that are: VPL, Blockly, Aseba, and Scratch. Once the program is ready and sent to the robot it will be available to play.

The second option is to use the work-in-progress Thymio Suite version. This software doesn't require a Thymio robot to be connected physically (or wirelessly) at all times as it has its own simulator built-in. The four said languages are still available, and one need to be chosen. After what comes the choice of connecting a physical Thymio or starting a simulation to emulate the programmed behaviour.

2.1.3 The different programming languages

VPL

Blockly

Aseba

Scratch

2.1.4 What already exist

WeBots / Aseba logiciel

2.2 TypeScript

2.3 Three JS

For that we read the article book of **Jerald:2015:VBH:2792790** which is very interesting, much more than the article **Diniz:2017:UGO:3100317.3100324**

3 Conclusion and future work

4 Appendices

4.1 Requirements Documentation

4.1.1 Vision

4.1.2 Objectives

4.1.3 System Boundaries

4.1.4 Requirements

4.2 Virtual Machine Configuration

Step by step Guide on how to set it up and use it.

4.3 Version control

4.4 Meetings

Date	Content
17.09.2019	**Kick Off meeting** Documentation/Management Technology to use : ThreeJS and Typescript Setting up the goals
24.09.2019	**Second meeting** Documentation language : English Thymio model Base talk about riks management
08.10.2019	**Third meeting** Workplace Discussion on the choice of Windows as the Virtual Machine Create a configuration file with the information of the VM

List of Figures

List of Tables

5 Problems encountered

javascript not refreshing properly due to cache -> disable cache 3d Model not loaded on the webserver -> still looking into it