

45300: WeDo 2.0 - Bringing Science to Life

By Jetro

Pictures by Jetro and LEGO® System A/S



Over the last couple of years, HispaBrick Magazine® has published a series of articles and tutorials about WeDo, the LEGO® robotics platform targeted at children between the ages of 6-9. WeDo has been around since 2009 and at the start of this year LEGO® announced a renewed WeDo 2.0 product. HispaBrick Magazine® has had a close look at the renewed set and these are our findings.



For many AFOLs there are few secrets when it comes to what LEGO sets are available at any given time and how to get them. This isn't the case with LEGO Education sets. This department of the LEGO group caters to educational institutions (schools, colleges, academies etc.) and their products are distributed through dedicated channels. Even so, for LEGO robotics fans, the MINDSTORMS EV3 and NXT sets have put the spotlight on LEGO Education because of the different inventory their versions of these sets offer, as well as the software and models that go with these sets.

WeDo is also a robotics platform, but since it doesn't have a Retail version (i.e. it is only available through LEGO education) it is much less visible to the average AFOL. And although it is an excellent introduction to robotics, it is primarily oriented at a young age group and not an obvious choice for an AFOL. The response from the articles about WeDo that have been published in HispaBrick Magazine's prior editions as well as from and the use of this platform in a series of MOCs by builders like Sariel [1] show that there is an interest in this platform beyond the "standard" classroom use, and in this review we will have a close look at the new version of this platform launched in January under the name WeDo 2.0

Parts, parts, parts

Before opening the box, the first thing that draws our attention is the difference in size. WeDo 1 [2] comes in a small white plastic tub and includes a transparent plastic tray to sort the parts in the set. Although the number of parts isn't particularly large (154), it is hard to fit them in the tray, especially since there is no guidance as to how to sort them. The latter is not necessarily bad as each user has their own preferences, but with 4 compartments there aren't that many options.



WeDo 2.0 comes in a much larger blue box that contains a tray with no less than 13 compartments. The set also includes a sticker sheet with a label for each of the compartments, to indicate which parts go where. The number of parts has also experienced a dramatic increase to 280.



WeDo 1 is predominantly red and yellow (with a few bits of green, white and grey). WeDo 2.0 comes with a completely different palette that is predominantly blue, green and orange (with a little white, grey, black and red). The result is that the builds look "fresher". But there is more to the inventory than the addition of a few parts. At the base of this change is the new selection of electronic components, so let's have a look at those first.

Plug it in, hook it up

The core change of WeDo 2.0 lies, not in the parts, but in the electronics. Whereas WeDo 1 consists of a hub with a USB connector that uses Power Function connections to attach the motor and sensors, WeDo 2.0 has changed in two fundamental ways: (1) the hub is no longer attached via USB and (2) the cables use a new connector.

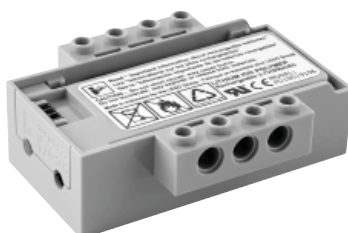
Since the hub is no longer physically connected to the computer, it requires a different power source, and so it includes a compartment for 2 AA batteries (LEGO Education also sells a rechargeable battery pack to substitute the battery compartment, but it is not included in the core set).



Of course this has both advantages and disadvantages: the models built with this set are no longer tethered to one spot – whether that is a pro or a con will depend on the kind of use you make of the set – and batteries drain, so you need to keep an eye on the power level.

The connection over Bluetooth Low Energy (BLE) also opens up new possibilities in terms of devices that can be used for programming, but more about that later.

The new connectors also leave us with mixed feelings. The Power Functions connectors used in the WeDo 1 set can be hard to separate for little hands, especially when you stack two or more.



The WeDo software didn't allow more than one PF element to be used on a single port, but the fact that the connectors could be stacked seemed to indicate the contrary. However, the PF connectors are compatible with all other PF elements LEGO produces – including lights. The new connectors remove the stacking issue as their new form factor means there can be only one connector to a socket. However, these new elements are not compatible with anything LEGO has on offer. On the plus side, this new system is marketed as LEGO Power Functions 2 and the wording in the WeDo 2.0 FAQs appears to indicate that in time LEGO will add to this new LPF2 system.



There are no other evident changes to the sensors in WeDo 2.0 (tilt and proximity, just like in WeDo 1), but there is a change to the motor. While the footprint and overall look is very similar to that of the current PF "M" motor, the new motor includes new attachment studs on top of the motor and one less pin hole in the front. Internally there appears to have been little or no change.

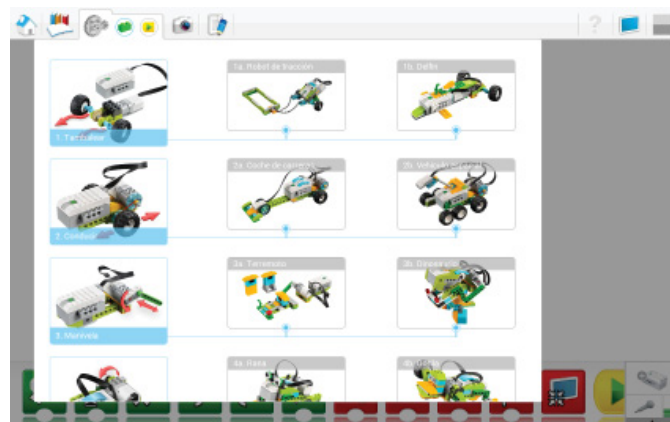
Building system

Many of the WeDo 1 models that come with the software and or have been developed by others use the large 8x16 brick from the set as a starting point. WeDo 2.0 doesn't include this element and the hub is now the core of any model. There are also more axles, axle connectors and gears [3]. This means that slightly more effort must be made to create a base when necessary, but the hub does provide a solid starting point for constructions and on the whole it may help kids (and older users) to more easily create sturdy mechanical constructions.



There is another, even more fundamental change to the building system that has to do with how models are presented in the software.

While the core mechanism for each model is presented in the usual step by step way, the Curriculum pack contains models built around those core mechanism for which only a few additional images are provided, inviting the user to "reverse engineer" the model, or come up with their own solutions. As a result, it becomes much easier for young users to create their own models based on mechanical ideas and have a more actively creative part in the construction of their own ideas.



While the Curriculum pack was originally offered as a classroom solution for around \$300USD, it is now available as a free download (for a limited time). For the Windows 7 version you need a LEGO ID (which you can create for free if you don't already have one).

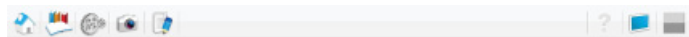
Software and platforms

The change from USB to BLE has a profound impact on the devices that can be used to program WeDo 2.0. WeDo 1 required a USB connection, meaning that only desktop and laptop computers (Mac and Windows) could be used for programming. BLE means no physical connection is required and programming can be done on handheld devices – iPads and Android tablets. The software developers of WeDo 2.0 clearly saw these devices as their primary targets and the Android and iOS versions of the software were given priority. As a result, when the product was launched the tablet versions of the software were well developed, but the Windows 7 version in particular are still unfinished. Officially Windows 7 is fully supported, but there are still some issues, and there is no Windows 10 version yet. An important fact to keep in mind is that the Windows 7 version will only work with one specific BLE dongle (the Bluegiga BLED112). No such restrictions apply to the Windows 8.1 version. In Android, devices need to run version 4.4 or higher and the minimum screen size is 8". If either of these conditions are not met, the software will not install.

So with the preliminaries out of the way, what is the software like? In part it is very similar to WeDo 1 – almost all of the programming blocks are the same, and some of the new options that are related to the sensors (e.g. seeing if an object is coming closer or going away) were already available in Scratch for WeDo 1. There is a new block to set the colour of the LED on the hub, which adds new debugging (and decorative) options to the set. Like in the previous version you can also record one additional sound, but so far it is not possible to import more sounds or backgrounds as in WeDo 1.

The fact that the hub is no longer connected to the computer comes at a price though. Not only do you need to watch the battery level, it takes time to send commands back and forth between the device the code runs on and the hub. This means that commands have a minimum execution time (approximately 0.3 seconds). While that may not seem like much of an issue, it can result in some pretty strange behaviours, especially since several of the programming blocks have similar effects. No less than three different blocks will start the motor, in addition to the task you would expect them to carry out (change the direction of the motor, change the power level, set the duration of the motor) [4] so if you were to try to change the direction of the motor and the power level at the same time, these two actions would be applied at a small interval.

At this time Scratch is only available for Mac, but in a couple of months the Windows version should also be ready.



Time to move forward?

WeDo 1 will still be sold for about another year and whether or not you want to upgrade to or get started with WeDo 2.0 is a matter of convenience as much as of taste. Looking purely at the functionality of the hardware, if you plan on using it in a classroom full of Windows computers, your best bet for now is WeDo 1. If, on the other hand, you want to use handheld devices, WeDo 2.0 is your only option.

Looking at the curriculum, the WeDo 2.0 curriculum pack is definitely a much more powerful tool. Also, the software (of any version) includes a documentation tool – including options like adding screenshots of the program and pictures taken with the camera of the device – that make it much more attractive.



As for the price, considering that the base software is free, the price of a working kit (box + software) of the WeDo 2.0 set is more attractive, and if you add in the (for now) free curriculum pack the numbers are clear.

	WeDo 1	WeDo 2.0
Operating Systems	Windows & Mac	Windows, Mac, iPad, Android [5]
Software	Programming	Programming and documenting
Connection	USB	Bluetooth Low Energy
Storage	Small white box	Large blue box
Elements	158	280
Models	12	4 + 16 projects in the Curriculum Pack
Extra parts	Resource set (326 elements) + 4 additional models	No resource set

If you have more questions about WeDo 2.0 or want to show of your creations, don't forget to visit the facebook group for WeDo: <https://www.facebook.com/groups/letsdowedo/>
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[1] <http://sariel.pl/tag/wedo/>

[2] For clarity, in this article we will call the WeDo set 9580 (launched in 2009) "WeDo 1"

[3] For a detailed description of the differences in the inventories of the WeDo 1 and 2.0 set the review by Robocamp is a very good read <https://www.robocamp.eu/lego-education-wedo-2-0-core-set-the-ultimate-review-by-robocamp-team/>

[4] It turns out the same odd behaviour was present in the WeDo 1 software, but because the hub is tethered the commands are executed without any noticeable interval.

[5] LEGO is working on a version of the app for Chrome Books.