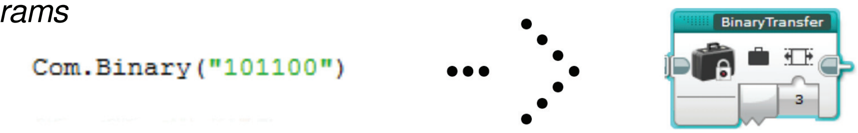
MindPi

Your Raspberry Pi to Mindstorms Connection

By Boston Abrams



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Com.Binary("101100")
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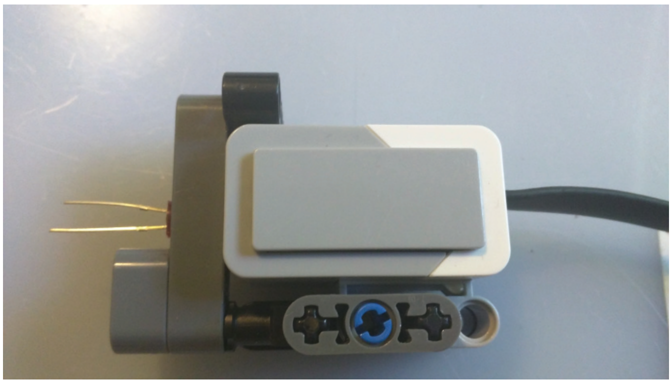
LEGO® MINDSTORMS is a great tool for easy building and programming, but to get the ease of use that LEGO® Products are known for they need to compromise features, like a web server.

I am sure some of you would say, “BrickPi – What about that…?” Well, BrickPi is another way of being able to control LEGO® MINDSTORMS motors and sensors with a Raspberry Pi (a small computer built for electronics tinkerers and hobbyists) through a board that sits on top of the Raspberry Pi. But after using the BrickPi I thought I could do something different. I wanted to get the LEGO® MINDSTORMS EV3 to communicate with the Raspberry Pi, not a MINDSTORMS Brick replacement as the BrickPi is. Furthermore, another upside of my design is that if you already have an EV3 and a Raspberry Pi – as I do – then it will only cost a few cents.

Well how does this work? With something as humble as an LED.

How it works:



In order to make the EV3 and the Pi communicate with each other they need to be able to exchange information. You can achieve this by connecting a red LED to the Pi: the positive leg needs to be connected to a GPIO pin on the Raspberry Pi and the negative leg to a ground pin. You can then put the LED in a Technic beam and secure it with some other parts in front of the color sensor (Pic to left: The silver pieces are the leads for the LED that would be connected to the Pi) so when the LED flashes, the Mindstorms Color Sensor can read that information! The program that I have written takes the data and sets up the flash pattern, then the MINDSTORMS brick reads that with the color sensor and returns you the data.

As an example, imagine you want to transmit a number of rotations of a motor (a number from 1 to 10). If for example you want to send the number 5, you input to Com.Numeral(), a function that will convert the number to binary and then make the LED Flash in the corresponding pattern. (Quick side note: I chose to use Python because it is preinstalled on the Raspberry Pi and I already have a basic knowledge of how it works!) This flashing can be read by an EV3 Color Sensor controlled by a ‘My Block’ (what EV3-G, the LEGO® MINDSTORMS Programing language, calls a function) called NumeralTransfer that is waiting for these flashes on the MINDSTORMS EV3 Brick. When the message has reached the length specified by the numerical input to the My Block, it stops recording and converts the binary to a decimal and returns that. In our example this would be 5. That would conclude the transfer of data from one system to another. You can then use this output to turn the motor on for 5 rotations.

This alone may not seem powerful but in conjunction with the strengths of the Raspberry Pi micro computer it can really do amazing things. For instance, it can get information from a website or run a Pygame control station for a MOC. (Pygame is a graphics interface/video game maker for Python.)

As an example, one thing that I have done is make a robot to open chests in the popular cell phone game Clash Royale. You enter some information on a website and it is used to move an arm that presses buttons on the phone screen, thereby opening the in-game chests.

Some other projects that could be built on a similar interface: A web server powered robotic arm, an App for a remote controlled car, or a Pygame powered LEGO® Crane.

Now that MindPi works I still have several goals to improve the project. These include a friendly user interface that accepts letters, increasing communication speed and making the communication go two ways.

For detailed instructions and to try it out for yourself:
https://github.com/BostonA/MindPi
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