Automation with Crickit and Capsela

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Overview

Open any toy closet and you’ll find them. Building blocks from your childhood or your children’s childhood. Be they Lego, Duplo, Mindstorms, Erector, Tinker Toys, or Capsela, they are a staple of creative building that never age. They just might go into hibernation as other things come along (like dating, working, cooking, life). But they are there waiting for discovery!

This project takes some of those boxes out of the closet to get a new makeover with Adafruit Circuit Playground Express and Crickit, the new Creative Robotics & Interactive Construction Kit.

It turns out that it is SUPER easy to interface Crickit to the motors that come with Capsela kits. Time to build some of those kits and see how Crickit gives them a breath of fresh air.

Capsela, a blast from the past!

Capsela is a toy construction set that provided a generation of kids (and future engineers) a motorized and pool friendly building set. From the mid-1980s through the early nineties, to even today (https://adafruit.it/BD6) you can find Capsela toys available with a bit of hunting.

Capsela consists of gears and motors in spherical plastic capsules that can be connected to form various toys suitable for land or water. The capsules typically have six hollow octagonal connectors and sleeve pieces bridge two capsules. The connection pegs on a capsule can have electrical or rotary adapters inside, reaching into the next capsule.
There are electric motor capsules, gear capsules, switch capsules, pontoon capsules, and others; there are also battery holders, wheels, propellers, impellers, lights, wires, and miscellaneous supporting pieces.

Best of all, the motorized, mechanical capabilities mesh perfectly with automation today with Crickit!

And nothing says you cannot use some modern tricks, like including some NeoPixel RGB lights or other bling.

Go check out your attic or basement, and follow along to breathe life into your dusty old toys

**Wait...what's Crickit?**

I'm glad you asked! We have a guide all about our Creative Robotics KIT that has tons of details, getting started info and walkthroughs. Click the button to check it out and/or refer to it as you read thru this guide.

[All About Adafruit Crickit Guide](https://adafruit.it/BD7)
The first demonstration will use the Capsela 1000 kit. This was a larger kit with 108 parts, marketed to build 100 projects, pretty much top of the line except for the remote control add-ons. The kit also includes a booklet "See how it works" in which Dr. Clifford Swartz demonstrated mechanical and electrical concepts using the Capsela pieces. Which is good, as some people (like me that are not natural mechanical prodigies) can learn what various combinations of gears can do.

What You'll Discover

- The motor comes in its own capsule and that can connect to the capsules that have gears in them. You need to consider what you are building to select the correct geared pieces in an order where the spinning will be done where you want it.
- The interconnections are mostly straightforward but not as flexible as Lego.
- For adding Crickit (without a tether), some sort of platform or flat space is ideal for mounting both Crickit and the battery pack.

Construction

For this build, I decided on a classic four-wheeled car type design.
The body has the following spheres (front to back):

- Transmission (straight through)
- Crown Gear or empty
- Worm Gear

The standard Capsela motor spins fast but does not produce much torque, which is required to move some weight. The worm gear capsule provides enough force to the wheels to get the bot going, especially on carpeted surfaces. The worm gear slows the speed of the motor by a factor of 49:1 to gain the torque.

If you put other mechanical capsules in, they introduce more friction which drags the motor power down even more. Be sure to use the B button to get the motor to 100% for the best grip or just code the bot to start at 100%.

The chassis uses three spheres with long yellow braces on each side. The motor capsule is placed on the top rear connecting to the worm gear capsule at the bottom rear.

For the second deck, an empty capsule is mounted on front with a short yellow brace between them. The Capsela 1000 switch is connected to the brace forming a flat space between the motor and the front capsule. The battery is layered on with some double-sided tape then the Crickit on top.
The top view shows the stacking of pieces in the middle: the Capsela 1000 switch is used vertically as a base for the battery pack and Crickit.

Some double sided tape or Blu-Tack holds the battery pack on the switch and the Crickit on the battery pack in a stack. Your adhesive should probably be easy to remove but strong enough that the vibration of use does not shake Crickit off the bot.

For the front, the 3 volt battery pack is mounted to the front sphere and a short yellow crossbar. The Capsela light is mounted on top with an L connector. Wires are tucked into the empty capsule. If you plan to use the light for a long period consider the 1.5 light as the bulb doesn’t like 3 volts for long periods of time. 1.5 volts will be dimmer but make the bulb last.

The original design had the green impeller placed on the front, giving the vehicle a Star Trek like appearance. That addition makes ground clearance lower and I found a misaligned sidewalk can stop the bot.

If you want the light to blink, you can change out a capsule for the Rotary Switch Capsule.
Detail of the back, the motor driver leads are connected to the two power leads on the Capsela motor. I used a couple of screws jammed in to the power connections make the alligator clip to motor connections easier.

It is more convenient to use two of the Capsela wires to connect to the motor and to use the alligator clips to connect to the end of the wires. In that case, you have to tuck the wires out of the way before using the bot, perhaps by wrapping them around the capsule joint.

Wiring

Here is a diagram of the wiring for the project:

Code

You can start MakeCode on PC, Mac, Linux, or Chromebook at [https://makecode.adafruit.com/](https://makecode.adafruit.com/). Start a new project. In the groups of colored blocks, you will need to go down the list until you get to ADVANCED. Click it and then click EXTENSIONS. Click on the Crickit extension and you'll then have a new green block group named CRICKIT which has the Crickit blocks this project uses.
Create the following program in MakeCode. Save to disk. Plug your Circuit Playground Express into your computer via a known good USB cable. You should see a new flash drive pop up. Click the MakeCode Download button and save the code file to the new flash drive which is called CPLAYBOOT. If you don't see the flash drive, press the Circuit Playground Express reset button and see if it pops up now.

When the code (in the form of a .UF2 file) is placed on the CPLAYBOOT drive, the Circuit Playground Express reboots and runs your code. You'll know when the code is running as a rainbow pattern is displayed on the Circuit Playground Express NeoPixel LEDs.

Use

Looking at the code, you can see several ways to alter the bot's functions. The slide switch on Circuit Playground Express (not the on/off on Crickit!) switches the direction the wheels turn. The A Button speeds up the motor, the B button slows the motor down.
You'll need to pick the bot up to change parameters, then put it back down. When Crickit is available with a microcontroller that allows radio control, it would be great to change things to use radio commands.

## Robo-Vehicle Builder Bot

The Capsela Robo-Vehicle Builder kit stems from 2003 when Capsela was working with Scholastic in branding and Toys-R-Us on distribution. It has 47 pieces, which is more limited than the Capsela 1000 kit. I find the fewer the pieces, the limited combination they can be put together. With this kit, adding Crickit is just as easy as with the larger system - they have essentially the same motor and gear system. And they do come in colors :-) 

### Construction

With only four capsules, the configurations cannot be too big. I really wanted to use the chain drive though. I have built a handheld unit which gears down the motor and then has the torque to drive the chain and to spin a propeller type piece.
Code

You can use the same MakeCode used in the CapselaBot 1000 build with this project. This allows you fine motor control, changes of direction, and rainbow colors.
Scholastic Capsela Kits

Around 2003, the licensees of Capsela inked a deal with Scholastic (famous for childrens book sales in schools). New Capsela designs were issued with distribution by Toys-R-Us.

I decided to buy on eBay the Capsela Bug Builder and the Capsela 90 Weather Station (still in a factory sealed box). The box says (C) 2003, Educational Insights, Inc. (C) 1997 VTECH, Licensed by: Mitsubishi Pencil Co. LTD. Made in China.

The Bug Builder

I chose this bit of Capsela as the bug looks a bit like a cricket. Also I was hoping to get it hopping so to speak. It turns out the motor is encased in the body which makes it difficult to provide Crickit motor control.

Popping in the batteries, there is an on-off switch near the back. The legs then move in a circular track. the eyes move back and forth. and the wings "flap".

I really wanted to see about putting pieces from other Capsela kits onto the motor as it is already geared down to move things. But there are no gear meshings in the legs. You can put standard connectors on the legs but they just spin. So I failed at being able to put wheels on the back legs.
The bug body has a screw where the wheel has gear meshing. Oh well, we tried.

So this is a cute set but it doesn’t lend itself well to either controlling the motor or adding on via either Capsela sets.

The Capsela Weather Station

The final Capsela build is the Capsela 90 Weather Station. The wind items will move when it is windy but not measure anything other than wind direction. The temperature measurement is not great as it is a color changing strip on one pontoon. The compass is accurate but hidden in a capsule.
The default build, shown on the box, omits two features as they don't fit. You can measure rain if you change the build and take something off, freeing a connection point. The sundial, likewise, doesn't fit without taking some other things apart. The supplied parts make several projects, but not all the useful things, all at once (see the items circled in yellow).
Actually Measuring Weather

The Circuit Playground Express actually can measure weather and report it back to your computer. Three things may be measured as is with more if you add on various Adafruit parts (which would be a more involved build). The Circuit Playground Express temperature sensor is great at providing real readings on temperature. Also, if there is a loud sound like thunder, it alerts. If shaken, like in an earthquake, it also gives an alert.

As with all outdoor items, it is highly suggested you weatherproof things and ensure they are nice and tight. As many Makers have found out, projects that work great for days on a bench wither quickly with temperature changes, humidity, vibration, and grit.

Overall Thoughts

If you plan to do some modern control of Capsela, stick to the older, general sets. They give excellent access to connections, are clear (literally) and provide lots of learning opportunities along the way.

The newer, specialized kits may have been well-intentioned but for modding, they miss the mark. We recommend sticking with the older sets for the best experience.