Building Technic cradles for non-LEGO® devices

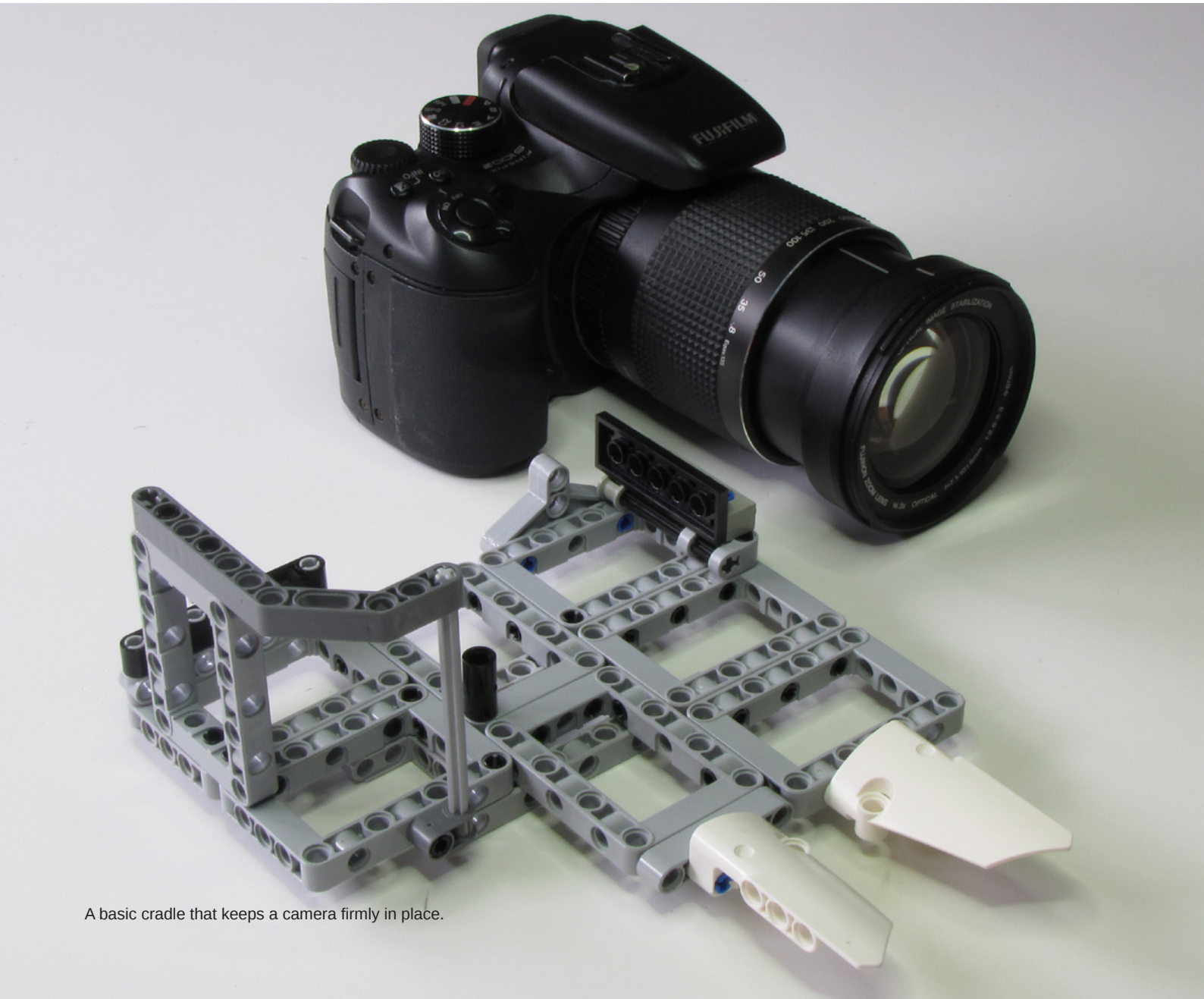
By Oton Ribic

For LEGO® Technic and MINDSTORMS builders, integrating some sort of a consumer device into a model is not uncommon. Usually it is a camera or a mobile phone, although sometimes other devices such as flashlights or loudspeakers are used. In order to have these devices fastened to their surrounding LEGO, one needs to build a dedicated cradle — and these cradles are exactly what we will be having a look at in this article.

Unless you are extremely lucky, dimensions of a chosen non-LEGO device will not match LEGO stud metrics, i.e. they will not be divisible by 8 mm. Therefore, for a device to fit snugly and securely, its cradle usually needs to resort to some tricks. Let us focus primarily on what is possibly the most difficult type of a device, yet a frequent one: cameras, particularly large ones, whereas the principles used for their cradles can be similarly applied to most other devices. The main challenge with heavy cameras is their curvy shape intentionally designed for a comfortable manual use, but inconvenient for being held by bricks with fixed-size units.

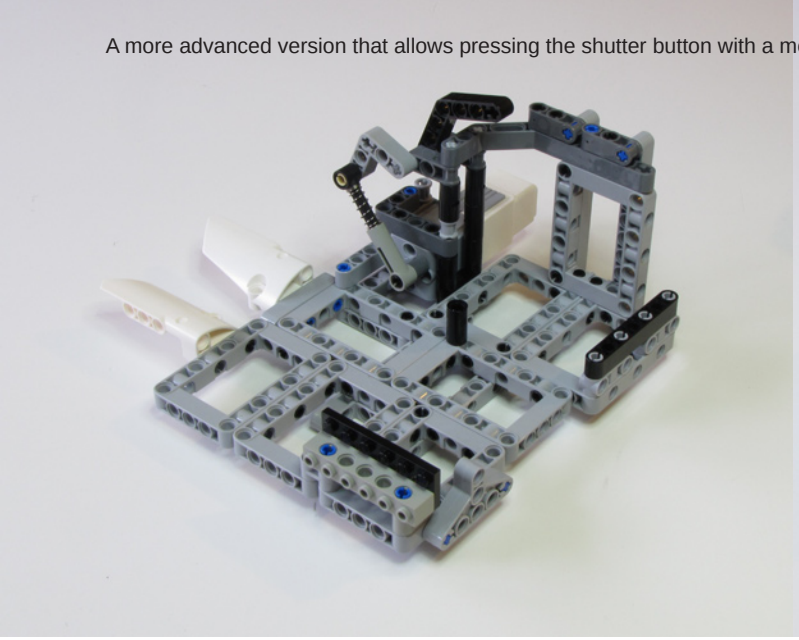
Among many techniques you can go for, I suggest starting with a cradle floor built as a grid of sturdily connected Technic frames roughly matching the footprint of a camera, and slightly overlapping it. Frames are strong, very common and easily obtainable, and offer many convenient connection points.

Once the floor is “tiled” in this manner, the second step



A basic cradle that keeps a camera firmly in place.

A more advanced version that allows pressing the shutter button with a motor, through a crank and a shock absorber.



involves building small walls and various vertical structures atop it that will keep the camera in place. Note that it is not necessary to surround the camera's entire outline, but just a couple of opposing corners. Again, Technic frames positioned vertically can be of use, but the main task of this step is to identify points where curvy parts can be placed to exactly match the shape of the camera.

Wheels and gears, bent liftarms, panel fairings, round pin connectors, studded Technic bricks and plates, Bionicle teeth, slopes and many other rounded, curvy parts can be used for this purpose, and some of those can be seen applied in this role on the example photo. Note that it is not necessary to strive for absolute accuracy, even if it was possible every time: matching the shape down to about one millimeter should be more than enough, as the underlying frames will imperceptibly bend to compensate (this does not damage them in any way).

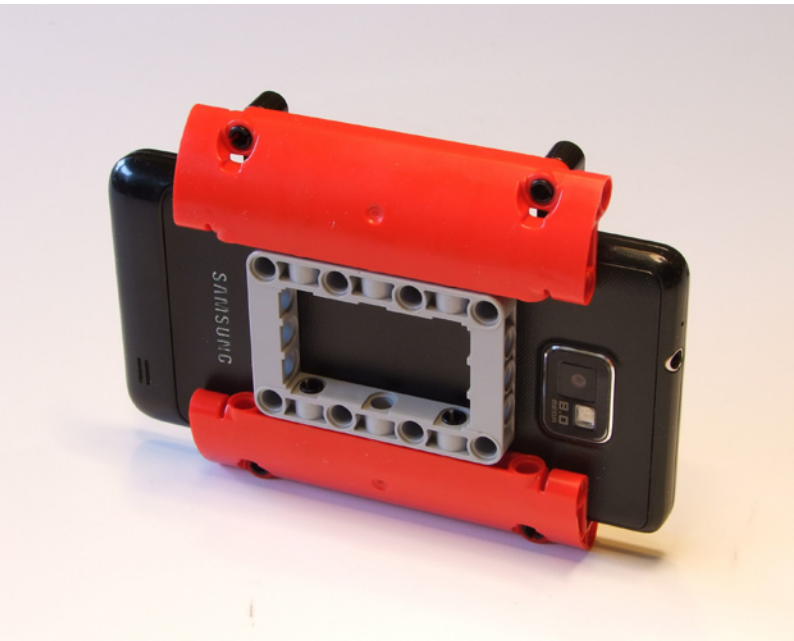
Of course, how high and how elaborate these structures need to be mostly depends on what movements the entire structure will be subjected to. Keeping camera in place for a simple panorama-shooting robot will require no more than just a dozen parts. However, keeping a camera steady on a, for example, rotating platform atop an off-road car asks for much more.

In addition, pay attention to the camera controls: if some of them are obscured by the cradle, not only may they be inaccessible to you when needed, but even pressed unintentionally, possibly ruining your shooting. Furthermore, cameras typically change their dimensions as they are zoomed in or out, and a good cradle should accomodate the camera tightly regardless of the zoom magnification. This can be done using parallel "rails" made from Technic panel fairings over which the lens can slide freely.

A cradle alone will suffice if manually starting video recording or shooting photos is all you need. However, more advanced constructions may ask for cradle that allows a LEGO-controlled way to press a shutter button or operate some other control. In this case, the cradle structure can often conveniently serve as a scaffolding for a pusher mechanism. Typically, a well-judged liftarm is all one needs, aligned and hinged in a way to press the desired control as flat as possible. The other side of the liftarm is attached to a motor or some other actuator part.

As shown on the photo, it is a good idea to add a shock absorber in the pusher mechanism, for multiple reasons. It will let the button be pushed with a well-controlled force, and should bear any extra force itself, rather than putting strain on its surrounding parts or, even worse, the camera itself. It also allows the pusher to be manually pulled back, often required for the camera to be simply removed from the cradle without any disassembly.

Instead of linear actuators or racks and pinions as mechanisms that transfer the motor motion to the pusher, for the camera shutter buttons it is often very practical to go for a simple beam attached off-center (i.e. "cranked") from the output motor axle. This allows the motor to spin constantly in a single



Smartphones can be easily secured using Technic panels and frames.

direction and repeatedly shoot photos, with the rotation speed controlling the shooting frequency. Of course, as shown in the example, one can take advantage of a MINDSTORMS motor that performs an accurately controlled single turn, shooting exactly one photo each time.

If a force required to push a button is large, pressing it repeatedly with a LEGO® liftarm may produce wear marks. This can be avoided by using a rubber wheel, or even a flexible rubber connector (part no. 45590), as a final part that pushes the button. Even more advanced manipulation can be done, e.g. operating a zoom lever or dials. If the cradle is, however, a part of the larger automation system, sometimes these camera controls can be operated remotely through a USB cable connected to a computer and synchronized to the rest of the system — probably MINDSTORMS bricks. However, this may require some advanced programming.

Whereas the cradle for a large SLR-style camera may just be among the most complex, sometimes the opposite is possible. For example, if the only requirement is to keep a mobile phone in place, the cradle may be absurdly simple, consisting from only a few parts. A couple of Technic frames and flaps that hold the phone using friction can suffice. Conveniently, many modern smartphones tend to be around one stud thick, therefore allowing relatively simple cradles. Note that keeping their rubber protection covers on may actually help the cradle, as it produces additional friction against the LEGO parts around.
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A very simple approach with just a few parts, that works with smartphones approximately one stud thick.