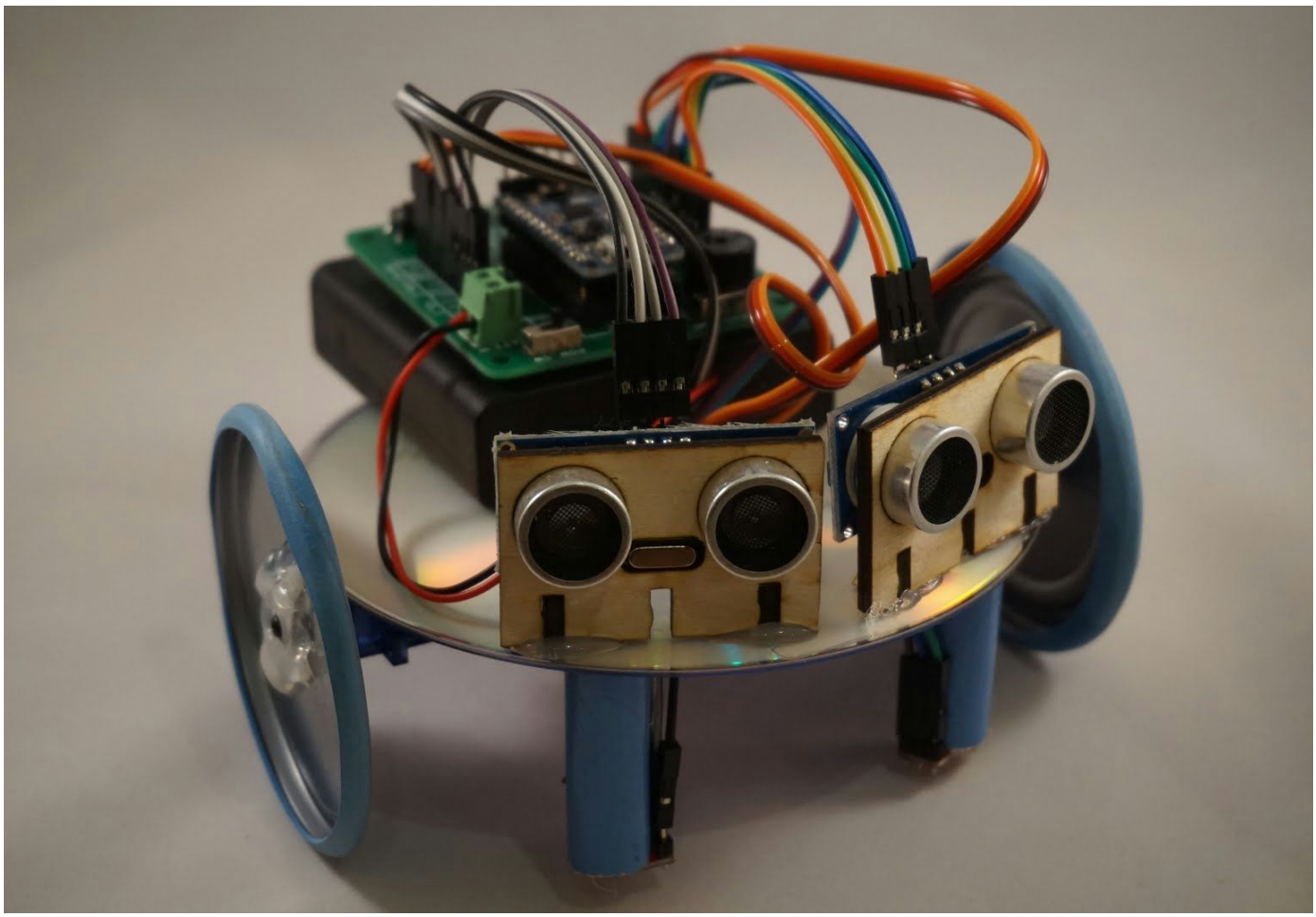
Chassis Designs

Intro

The chassis of MIYbot is the body of the robot. Looking at this simple robot's design, the minimum needed to make this robot functional is a body 'plate' to mount the servos, a place to hold the battery pack and the electronics and finally a castor wheel to keep the robot from tilting over. Also in this document we will discuss different types of wheels because the wheel design can dictate the overall chassis design.

Discussing each of these components with examples is important because it will give the teacher and student ideas how to build his or her robot. One of the greatest assets to this robot is that it is not a KIT and thus each robot will be unique and creative. The components I show in this document are ideas that should be mixed and matched by the student's imagination.

The photos contained in this document are of the MIYbot built during the design of this project. The photos are here for ideas, not exactly how to build the robot. Please be creative and make the MIYbot your own!



Chassis

In its simplest form, the chassis of this robot is simply a small plate the size of an index card made out of cardboard, wood or another non-conductive material. On this small plate, the servos can be mounted on the bottom using double-stick tape, hot-melt glue, velcro or some other adhesive. On the top of the plate, the batteries and electronics can be mounted using the same techniques.

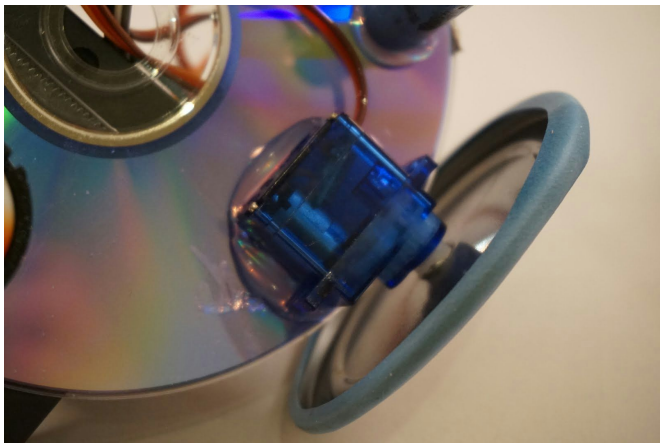
Getting a little more creative, the plate can really be any shape and size (within reason). The plate could be a CD, a small box, an electrical outlet plate, a flat LEGO plate, popsicle sticks glued together or a coaster. It is important to realize that as long as the electronics, battery pack, and servos can be mounted to the plate it will work! Students need to look around their house, school, stores and think about what might make a good chassis plate. If one design does not work, they should be encouraged to try and try again.

It is also possible to use the battery holder as the plate for a very minimalist robot, but it might be difficult to change the batteries or reconfigure the robot.

Another option is to use a 3d printed design like the ones found on thingiverse.com. 3D designs can be created using tinkercad.com or other 3d design software.

Servo Mounting

The servos need to be mounted on the bottom of the robot. The easiest way to do this is to simply attach the servo on the bottom of the plate with double-stick mounting tape. If this method is used it can be difficult to remove the servo if that is needed. Another option is to use hot melt glue. With hot melt glue you can remove the servo if needed and pick off the remaining glue. You can also use stronger glues like 5 minute epoxy, but those may never be removable.



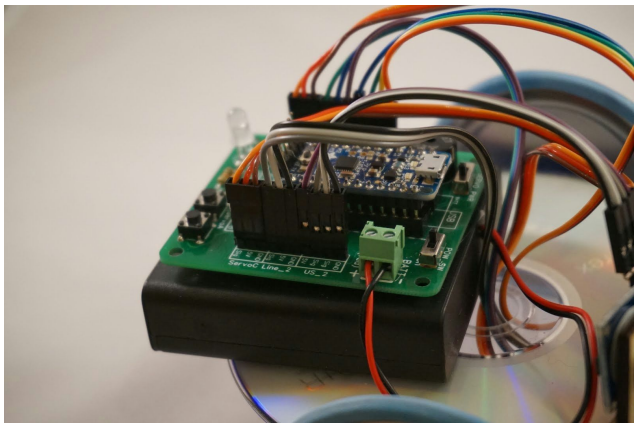
Another way to mount a servo on the robot is to screw the servo onto a servo mount or directly on the chassis. Servos come with the screws needed for this type of mount. There are 3D printed servo motor mount designs on thingiverse.com that could be adapted if needed.

There is a small adjustment screw on the bottom of the servo that needs to be set prior to installing the servos. To adjust this screw, load the MIYbot software and run the pink() program. This will tell the servo to go to its center position. Adjust the screw on the bottom of the servo right or left using a jeweler's screwdriver until the servo stops moving. Now you can attach the servo to the body plate.

Battery Pack Installation

The battery pack needs to be mounted on the top or bottom of the chassis plate. It is helpful to have the battery pack located directly over the servos because the weight of the batteries will help the servos and wheels gain traction. Because of the weight of the battery pack, often the pack is the main component that governs the center of gravity for the robot. This is the main reason some robots are built with the batteries under the chassis plate. If the battery pack is mounted too high on the robot, then the robot might tip easier and fall over, especially when the robot is on an incline.

Generally double stick tape, velcro, or hot melt glue is used to attach the battery pack to the plate.

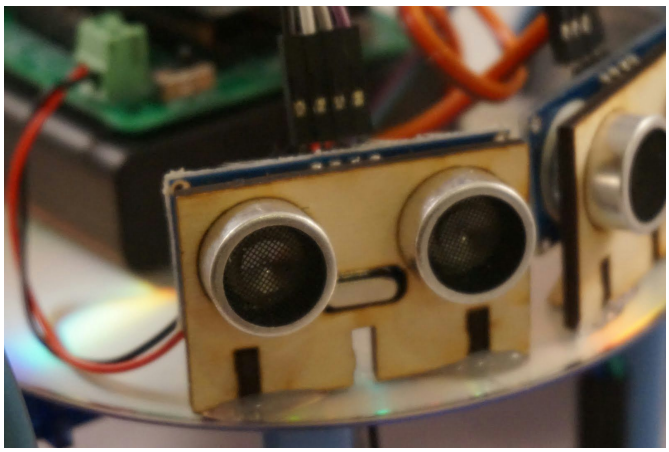


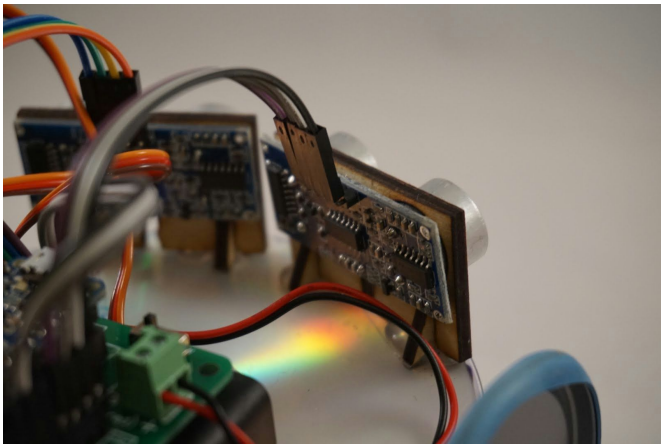
Electronics Installation

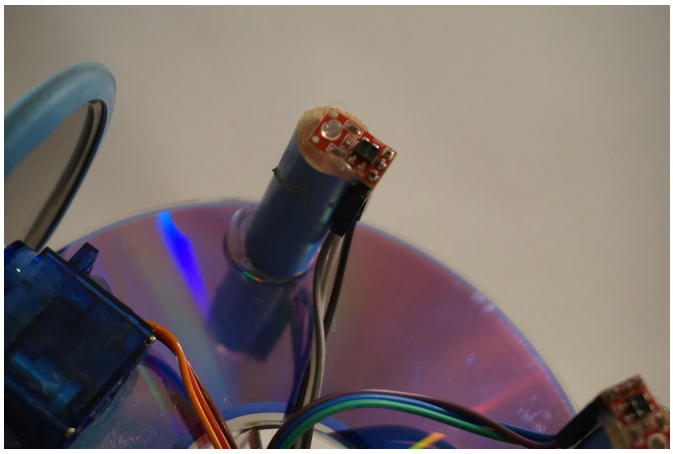
The electronics is a small circuit board that needs to be installed on the plate. Again, the easiest way to install this is to attach with double stick tape, velcro, or hot melt glue to the plate or the battery holder. May sure the mounting of the electronics will make it easy to replace the batteries of your robot. There are also screw holes on the circuit board that can be used with standoffs and small machine screws. Make sure the bottom of the board is not touching metal. The soldering point could short out if this is the case.

On top of the electronics board there are headers (connectors) to connect the servos, sensors and the batteries to the board. There is also a usb connector that should not be blocked or it will be difficult to program your robot.

Line and ultrasonic sensors are connected to the circuit board using dupont wires connected to the headers. The sensors are then routed to mounting locations and glued in place. The line sensors need to be mounted in such a way that the sensor is 3-5 mm above the ground. Use your creativity to mount these sensors. Below are some suggestions. The ultrasonic sensor mount design is included in the MIYbot files.



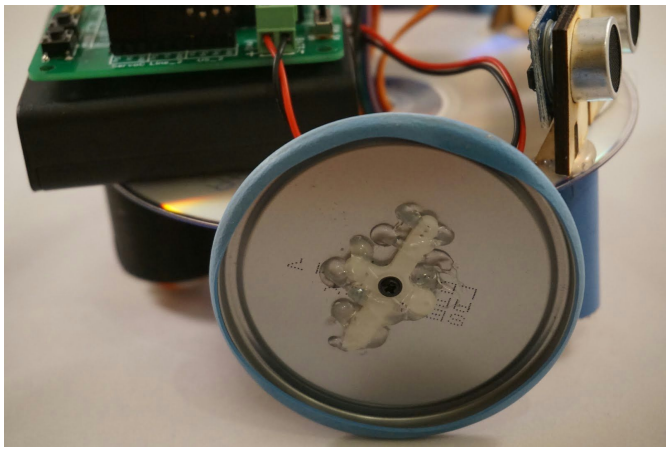




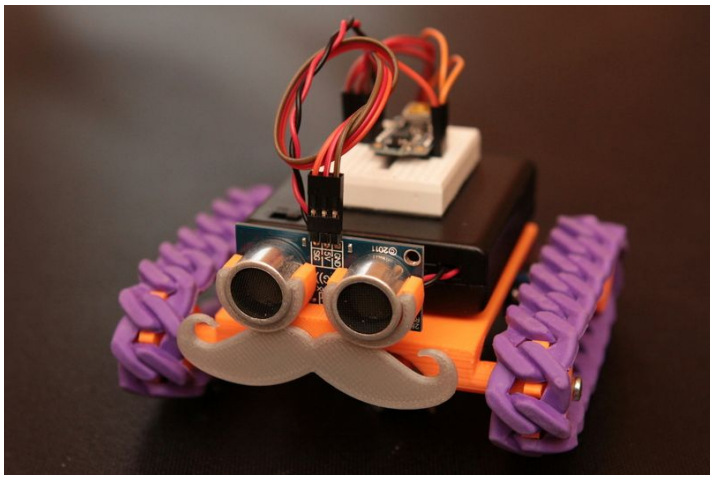
Wheels

Wheels can be made from just about anything that rolls. Anything from toy wheels, to can and drink lids to laser cut wheels can be used. The center of the wheel needs to be found (a good exercise for a student to discover) and a hole the size of the inner connector for the servo horn needs to be drilled. The servo horn needs to then be press fitted into the hole and glued into place with hot glue or 5 minute epoxy. The servo horn can also be screwed into the wheel but that can prove more difficult. The small black screw that connects the servo horn to the servo should be used to keep the wheel from falling off.

Traction for wheels can be made by installing a wide rubber-band over the wheel's diameter. The rubber band that is usually found on a bunch of broccoli works well for this purpose! Silicone caulk or RTV sealant could also be applied around the outer diameter of the wheel to create a traction surface.



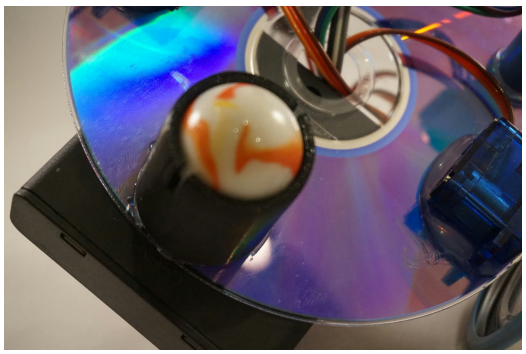
Finally silicon chain-style bracelets could be used to create a tank tread on a robot. This has been documented on the Red Rover instructions on the Adafruit website (https://learn.adafruit.com/trinket-powered-rover/red-rover). Adafruit is the manufacturer of the Pro Trinket and has served as an inspiration for this project.



Castors
A castor acts as a third (or fourth) wheel for this robot. The castor keeps the robot from falling over as it is driving around. Two types of castors exist, those that roll and those that do not. The simplest castors can be made from half of a ball mounted on the bottom of the robot chassis. Then the robot will slide around on this ball. Anything can really be used to do this as long as it slides easily. A half of a ping pong ball might work well. So might a small furniture leg slider or perhaps a dowel rod end that has been sanded into a half dome.

Rolling castors are a little more involved. The simplest castors are rolling wheels that can be purchased at a hardware store. Other rolling castors can be made from marbles or steel ball bearings housed in 3d printed enclosures or other fashioned housings that allow the ball to roll freely. There are several 3d printed castor designs at thingiverse.com.

The 3D castor design below has been included in the MIYbot files.



Once a castor design has been decided upon, the castor is then attached to the bottom of the robot using hot glue or similar.

Tank type robots will not need a castor because they are already supported.

Useful Materials
⅛ inch Baltic Birch plywood

Foamboard

Acrylic

Cardboard

Chipboard

Recycled materials

Cutting boards

Circuit board standoffs and machine screws

dupont wires

Silicon bracelets

100% silicon caulk

RTV automotive sealant

Marbles (large and small)

Steel ball bearings (½ inch or greater)

Large broccoli rubber bands.

Adhesives

Hot glue or hot melt glue and a glue gun

Double Stick mounting tape

Superglue

Velcro

5 minute epoxy

Duct Tape