Smart methods

Robotic Arm project

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Prepared by:

Shaden Abaoud

An introduction to Robotic Arm Theory

A robot arm has a mechanical structure that alters its form using a group of electric motors that behave like servo motors, pneumatic, or hydraulic actuators. They attempt to reproduce movement similar to a human arm.

A common term that's used when a robot arm is designed is the DOF (degrees offreedom); it is related to roll, yaw, and pitch. Figure 11-2 shows a representation of these movements in 3D space.

Roll, pitch, and yaw movements in 3D space

For example, using you own arm and following Figure 11-2, try to reproduce the following movements:

- Shoulder pitch
- Shoulder roll
- Arm yaw
- Elbow pitch
- Wrist pitch
- Wrist yaw
- Wrist roll

Your arm, as it turns out, has seven DOF; the wrist alone has an amazing three DOF.

There are several factors you must consider when constructing a robot arm, including the maximum load weight, the stall torques of each one of the servos, how much weight each servo must support related to its position in the arm, and the weight each frame that constitutes the arm.

The Robotic Arm

Internet sites offer thousands of robot arm kits, instructions for building your own robot out of wood, 3D printing, scrap materials, and more.

This book uses a low-cost arm kit that has a good quality aluminum form. This kit is sold by elabpeers, which is located in California.

The arm offers five DOF and comes with a gripper that offers two DOF, totaling seven DOF. You can order only the mechanical parts or you can include the servos as well.

The whole kit, with servos in place, is shown in Figure 11-9; the equivalent parts of a human arm are marked.

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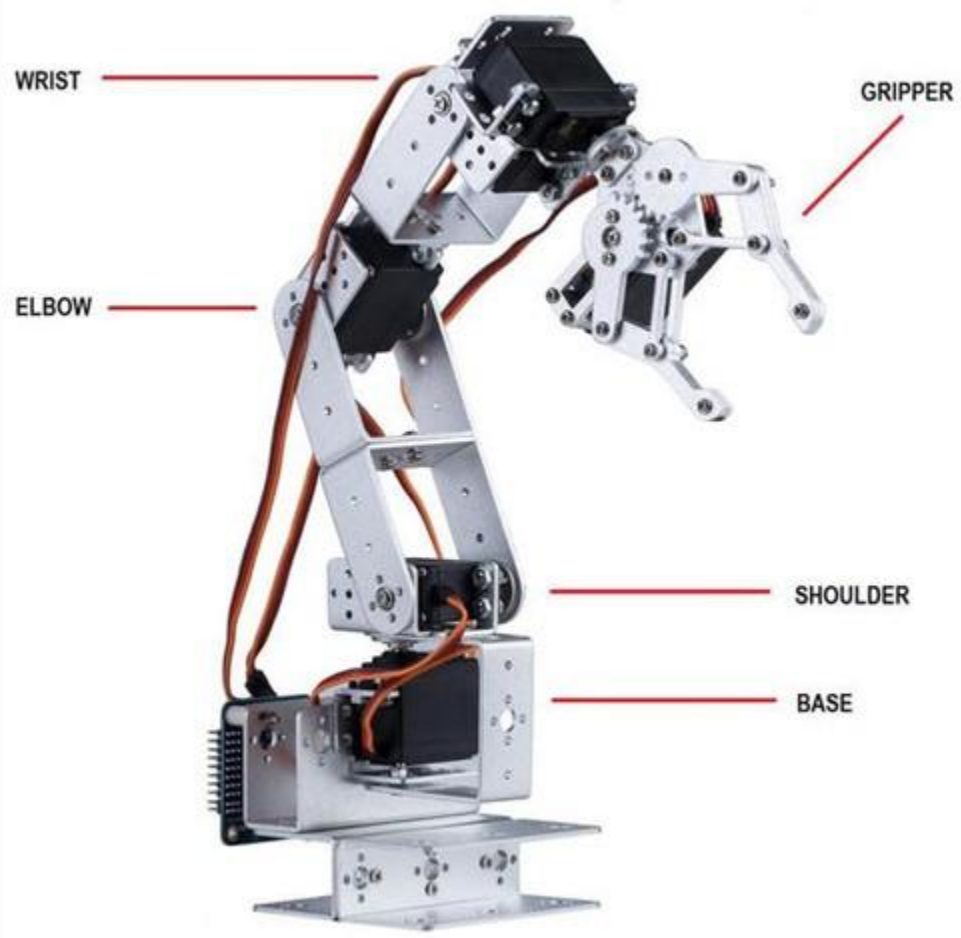

Figure 11-9.
Parts of a robotic arm and gripper offering six DOF

The kit includes an arm with:

- Four U-shaped long brackets
- Three U-shaped brackets used for the base
- One mechanical gripper
- Six metallic servo wheels
- Four cup bearings
- Several screws and nuts (more than you need)

If you decide to get the whole kit, it includes:

- Four servos MG996R that provide a stall torque of 9.4kg/cm @ 4.8V and 12kg/cm @ 6V
- Two servos 5521MG with a stall torque of 17,25Kg/cm @ 4.8V and 20.32 Kg/cm @ 6V
- Three servo extension wire cables
- Servo accessories packages with rubber rings, horns, and fittings

Figure 11-10 shows the whole kit and all its components.

This configuration is enough to keep your servos running smoothly; however, if you have better servos you can order only the arm body with gripper for $68.

If your budget permits, I recommend replacing the MG996R servo with the HEXFLY servo.

The MG996R or MG995R servo are considered the worst available in the market. There are many clones of such servos in the market don't match the promised specification. Using these servos to work the base, wrists, and gripper is fine, but the elbow and shoulder need something better. These servos can't even handle the weight of the arm without a load in the gripper.
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Figure 11-10.
Components of the six DOF robotic arm kit

The other required components for building this arm are listed in Table 11-1.

Table 11-1.
Materials List for the Robotic Arm

Quantity	Description
1	Robotic arm kit with servos (only if you do not have the servos recommended; otherwise, order the armor kit).
4	Servo extension wire cables.

Quantity	Description
1	Piece of wood around 7 x 12 x 0.5 inches (at least).
1	C-clamp if you are using the arm body in a table.
4	M6-30mm hex-head cap screw with nuts and flat washers or equivalent.
3	Dupont jumper cables, male-to-male, or pieces of 1/4 watt wires.
1	Five-inch nose plier.
1	Screwdrivers for M3 and M4 screws.

The piece of wood is used to create a base for the arm body. If you'll be using this arm over a table (mostly), it's best to use a c-clamp in order to hold the arm to the table. You can find c-clamps for $2.26.

The 1/4 x 2 inch screws with nuts are used to hold the arm body to the piece of wood and the flat washers are used to help the horizontal equalization of the arm body in relation to the wood.

ABOUT THIS PROJECT

The LittleArm 2C is designed to be the kit that kids can easily use so that STEM classes can implement more robotics curriculum. It has been made more rugged and much easier to put together, so that it is easy for kids to use.

All the parts can be easily 3D printed, and are designed to keep the arm sleek and simple. The entire design has less than 15 screws.

To control the arm you can either use our Windows application (which was originally written in Python code here) or through Bluetooth with the Android App that we made for it.

requirements

PyMySQL==0.7.4

psycopg2==2.6.1

robotframework==3.0

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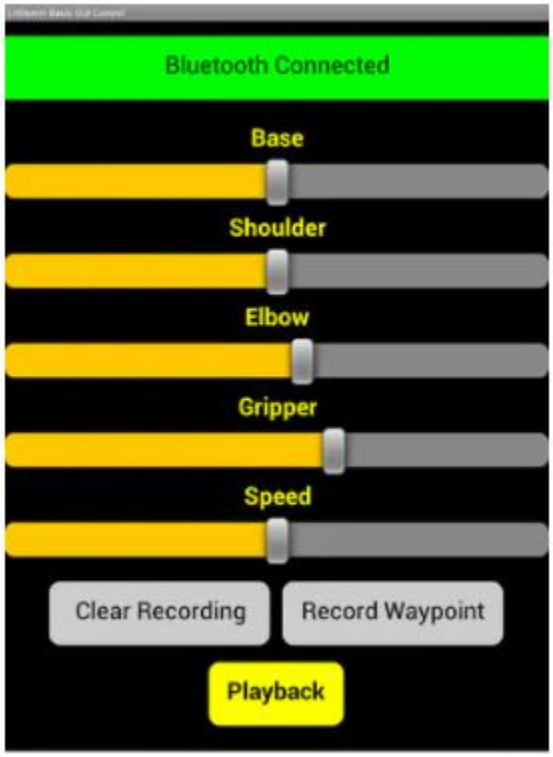
#psycopg2==2.6.1

robotframework>=3.0

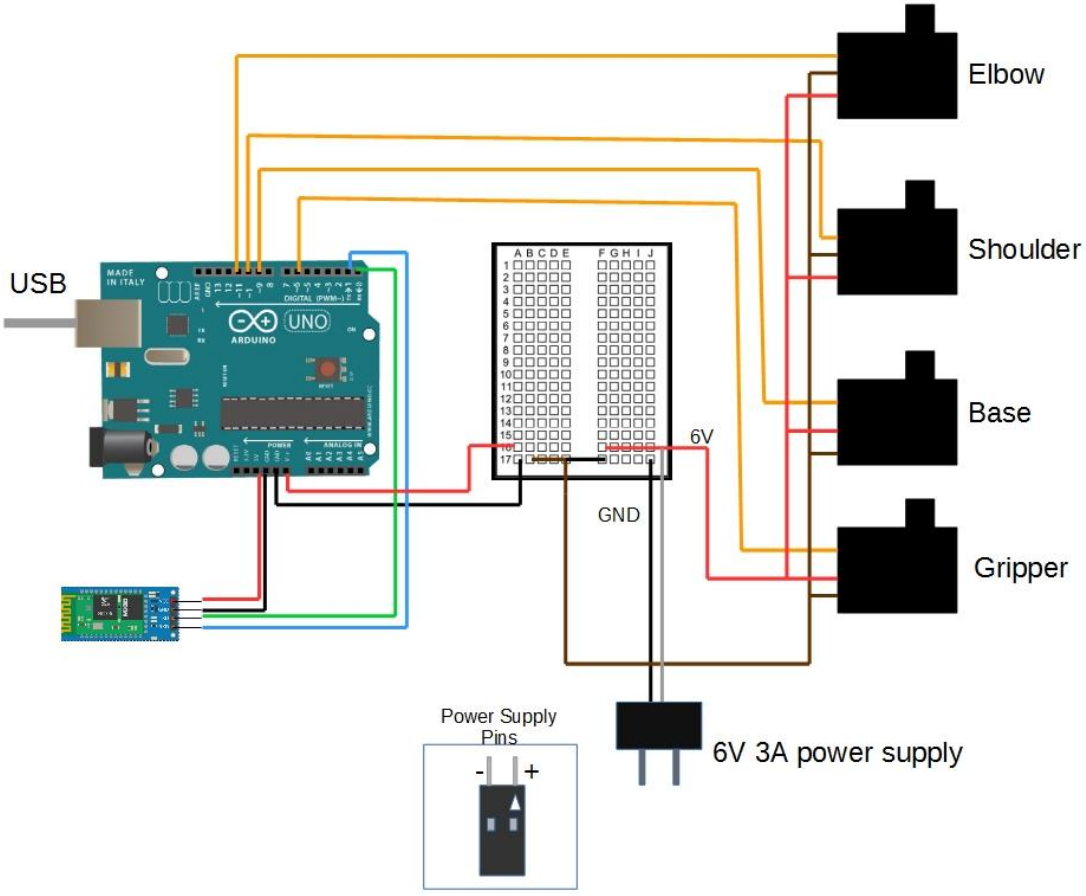
interface:



COMPONENTS AND SUPPLIES

	LittleArm	×	1
	Arduino UNO	×	1

	HC-05 Bluetooth Module	×	1
	Android device	×	1
	LittleArm - Full Kit	×	1


Elbow
Shoulder
Base
Gripper
USB
6V
GND
Power Supply
Pins
-
+
6V 3A power supply