

Robotics – Servo Motors

Robotic toys are very popular nowadays, largely due to advancement in the embedded controller, electric motor and drive technologies. These robotic toys require an actuator, which is an electro-mechanism to move the mechanical joints in the robot. An example a miniature walking robot with 10 joints is shown in Figure 1.

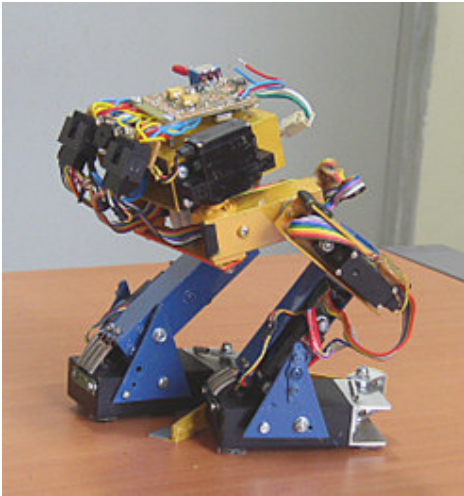


Figure 1 – A robotic toy.

The most popular actuators come in the form of electric powered rotational actuator. These actuators are originally used in radio controlled (RC) toys, such as toy cars, boats, helicopters and planes, and are called RC Servo Motors, or just *RC Servos*. A few examples of RC Servos are shown in Figure 2. The pen in the figure serves as a reference for the physical size of the RC Servos.

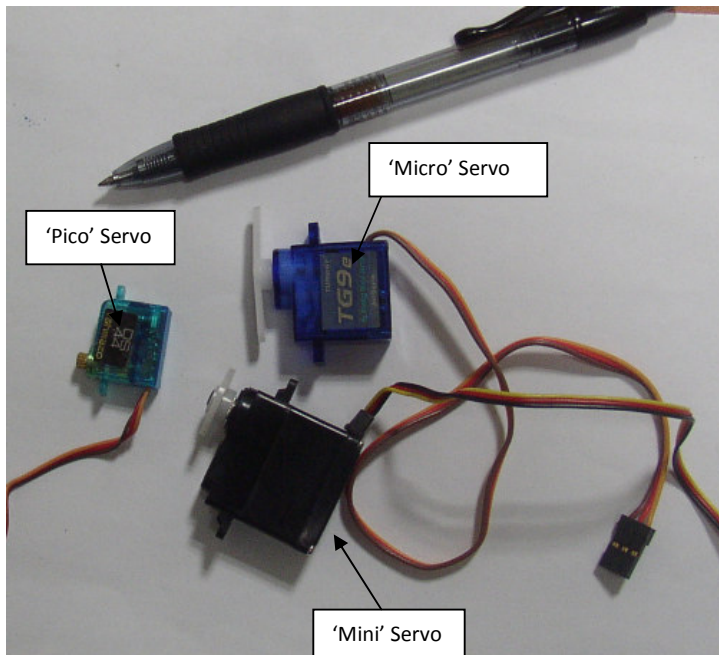


Figure 2 – Examples of RC Servos.

The term “servo” implies a mechanical system which uses feedback in its control. Figure 3 shows a simplified block diagram of an RC Servo Motor. The RC Servos contains a small DC electric motor, usually of permanent magnet brushed type. This motor drives the output shaft via a series of gears. The size or capacity of the DC electric motor and the ratio of the gears determine the maximum torque produced at the output shaft. A small potentiometer is connected to the output shaft; the voltage from the potentiometer indicates the angular position of the shaft. An input is fed to the digital control electronics on the RC Servos, this input signal can come in analog form. A favorite format is a rectangular pulse voltage, with the width of the pulse corresponds to the angular position of the output shaft. In its modern form, the on-board electronics digitize this input pulse, and compares it with the signal from the potentiometer, and using the error, to drive the motor. This turns the output shaft to the intended angular position. Thus we have a feedback or servo-mechanism.

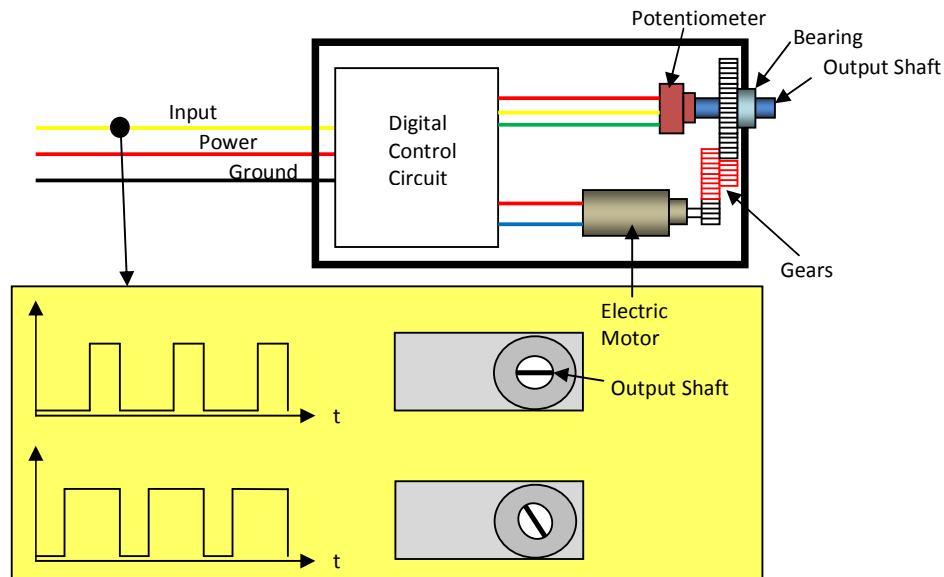


Figure 3 – Block diagram of a RC Servos.

Figure 4 shows the actual internal construction of a high performance RC Servos. More expensive RC Servos use brushless DC motors for higher output torque, some even have output line where they can report the status of the Servo to the main control circuit. Lower cost RC Servos usually employ Nylon gears and bearing. Do a search on the Internet, and you would be amazed by RC Servos of all shapes and sizes, and the ingenious ways these are used in many interesting projects.

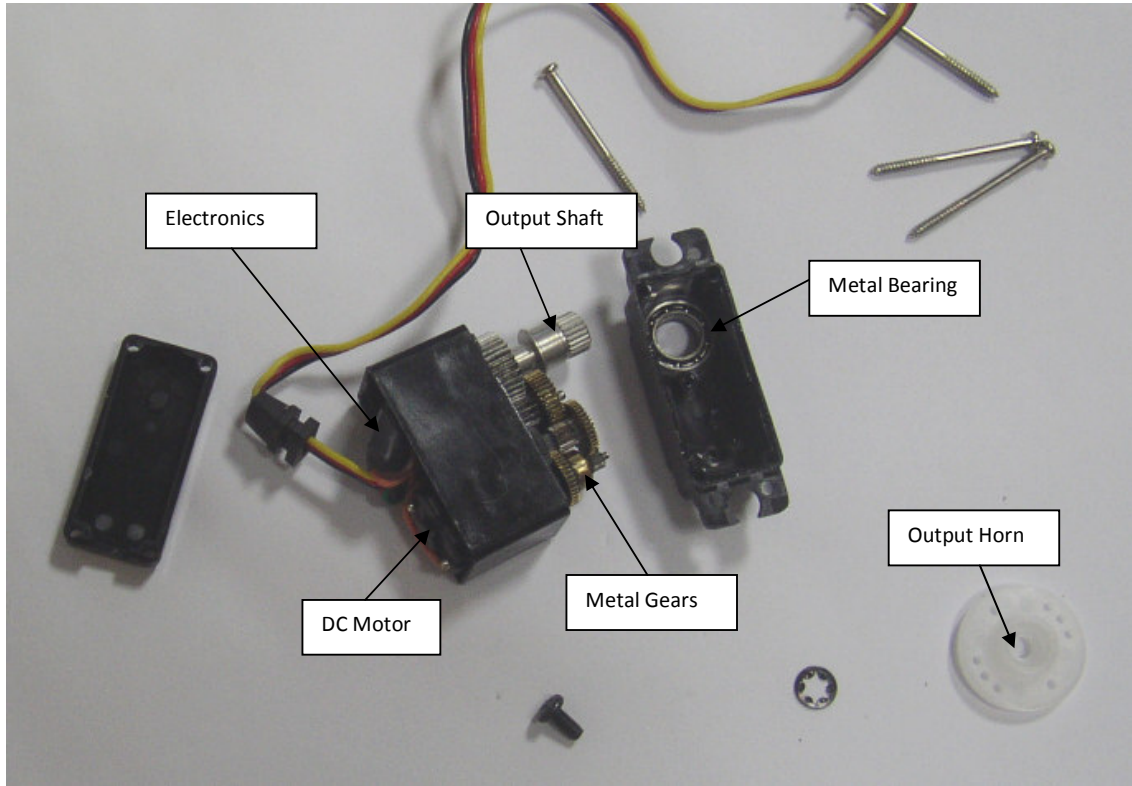


Figure 4 – The construction of a high quality RC Servos.

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