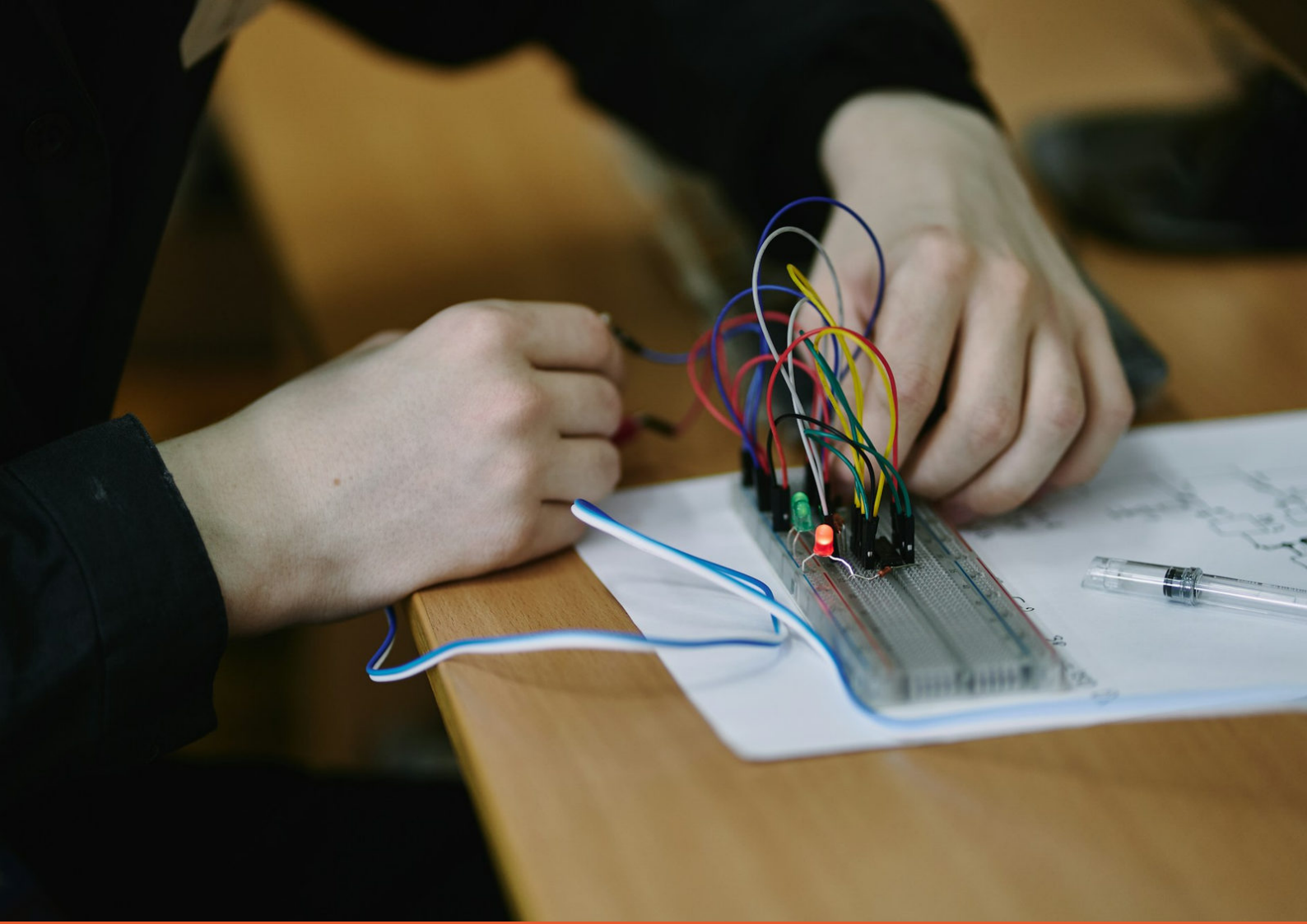




EduTrend Contents

EDUTECH · HANDS-ON ROBOTICS PROJECTS · HIGH SCHOOL

Servo Robot Arm

Build a card or 3D-printed arm driven by servo motors and program a pick-and-place task

Ages 14–18

Level: Advanced

2 × 75 minutes

Teams of 3

Activity 05

Inside: activity at a glance · step-by-step session plan · facilitator notes · 3 student worksheets · assessment checklist

ACTIVITY 05 · AT A GLANCE

Servo Robot Arm

Teams design and build a simple arm with a base, shoulder and gripper driven by servos. They program each servo to set angles, create a sequence to pick up a light object and place it in a target zone, then test ten times and measure how often and how accurately it succeeds. They discuss load and joint limits.

Learning outcomes

By the end of the session students can:

- build a jointed mechanism;
- program servo angles;
- sequence a pick-and-place task;
- measure repeatability.

KEY WORDS

servo · joint · degree of freedom · gripper · sequence · repeatability

CURRICULUM LINKS

Maths: angles and geometry.

Physics: levers and torque.

Industry: automation.

1**SENSE**

What can it detect?

2**THINK**

What should it decide?

3**ACT**

What should it do?

4**TEST**

Run it

5**DEBUG**

Find and fix

6**IMPROVE**

Make it better

Materials (per team)

- Three hobby servo motors
- Microcontroller and servo board
- Card or 3D-printed parts, screws
- Light objects (foam cubes)
- Device
- Worksheets 1, 2 and 3

Before the session

- Test servos.
- Prepare templates or printed parts.
- Provide suitable power supply.
- Print worksheets.

SAFETY

Use a separate power supply for servos if needed. Keep fingers clear of joints when powered.

ACTIVITY 05 · SESSION PLAN

Step by step

Light, short arms work better; long card arms bend and overload servos.

Time	What happens	Say or ask
Lesson 1: 0–15 min Design	Sketch arm and joints.	<i>“How many degrees of freedom?”</i>
15–75 min Build	Assemble and mount servos.	<i>“Is it rigid enough?”</i>
Lesson 2: 0–25 min Program	Set servo angles.	<i>“What angles reach the object?”</i>
25–55 min Sequence	Pick and place.	<i>“Does it grip?”</i>
55–75 min Test	Ten runs, measure success.	<i>“How repeatable is it?”</i>

CHALLENGE CARD (print or copy onto the board)

Build and program a servo robot arm that picks and places an object, and measure its success rate and accuracy over ten runs.

ACTIVITY 05 · FACILITATOR NOTES

The project know-how in brief

A hobby servo turns to a commanded angle, usually within about 180°. Each servo adds a joint, or degree of freedom, letting the arm reach different positions.

Longer arms increase the turning effect of a load on the servo, so light, short links work best. Repeatability measures how consistently the arm returns to the same position.

Common ideas to listen for

- “Servos can lift anything.” Load and arm length matter.
- “The arm goes exactly to the angle.” There is some error.
- “More joints are always better.” They add complexity.

Adapting the activity

Support

Build a two-joint arm with a fixed gripper.

Stretch

Calculate reach using trigonometry.

WORKSHEET 1

Servo angles

Name: _____

Class: _____ Date: _____

Record positions.

Servo angles

Position	Base	Shoulder	Gripper
Home			
Above object			
Grip			
Above target			
Release			

WORKSHEET 2

Repeatability test

Ten runs.

Repeatability test

Run	Success?	Distance from target (cm)
1-2		
3-4		
5-6		
7-8		
9-10		

WORKSHEET 3

Evaluation

Evaluate your arm.

Performance, limits and improvements

FOR THE TEACHER

Assessment checklist

Use during the session. One sheet covers up to eight students; copy as needed.

Student	Builds mechanism	Programs sequence	Measures repeatability

Suggested codes: W = working towards · E = expected · G = greater depth

ABOUT THIS ACTIVITY

Servo Robot Arm is a sample activity from the EduTrend Contents Edutech Hands-On Robotics Projects programme (high school, level: advanced). Every activity in the programme follows the same format: a practical challenge, a clear session plan, facilitator notes and ready-to-print worksheets, so that teachers, club leaders and parents can run it without extra preparation.

Full 15-, 20- and 32-week programmes are available from EduStore at edutrend.org.

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