

SmartBin Pro

Automatic Sensor Dustbin – User Manual

Model: Arduino UNO + HC-SR04 + SG90 Servo | Firmware v1.0
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1. Product Overview

The SmartBin Pro is a hands-free, touch-free automatic dustbin powered by an Arduino UNO microcontroller. An ultrasonic sensor detects your hand or waste within 20 cm and commands a servo motor to open the lid automatically. After 3 seconds of inactivity the lid closes on its own — keeping the area hygienic and odour-controlled.

Key benefits:

- Completely touch-free operation — reduces germ transmission.
- Adjustable open/close angles to fit any bin-hinge geometry.
- Smart "person still present" detection — lid will not close while you are standing in front of it.
- Serial monitor output for real-time diagnostics (115 200 baud).

2. Technical Specifications

Microcontroller	Arduino UNO (ATmega328P)
Sensor	HC-SR04 Ultrasonic — range 2 cm – 400 cm, ± 3 mm accuracy
Actuator	SG90 Servo Motor (180° range, 4.8 – 6 V)
Detection Range	0 – 20 cm (configurable via openDistance constant)
Lid Open Angle	160° (configurable via openPosition constant)
Lid Close Angle	10° (configurable via closePosition constant)
Hold Time	3 000 ms / 3 s (configurable via holdTime constant)
Baud Rate	115 200 bps (Serial monitor)
Supply Voltage	5 V via USB or 7-12 V DC barrel jack
Loop Cycle	~50 ms (stability delay)

3. Hardware & Wiring

3.1 Component List

- 1× Arduino UNO R3
- 1× HC-SR04 Ultrasonic Distance Sensor
- 1× SG90 Micro Servo Motor
- Jumper wires, breadboard, USB cable

3.2 Pin Connections

Component	Pin / Wire	Arduino Pin
HC-SR04	VCC	5 V
HC-SR04	GND	GND
HC-SR04	TRIG	Digital 2
HC-SR04	ECHO	Digital 3
SG90 Servo	Red (VCC)	5 V
SG90 Servo	Brown (GND)	GND
SG90 Servo	Orange (Signal)	Digital 9 (PWM)

4. Software Installation

4.1 Prerequisites

- Arduino IDE 2.x (<https://www.arduino.cc/en/software>)
- Servo library — included with Arduino IDE by default.

4.2 Upload Steps

1. Connect the Arduino UNO to your PC via USB.
2. Open Arduino IDE → paste or open the firmware sketch.
3. Select Tools → Board → Arduino UNO and the correct COM port.
4. Click Upload (→). Wait for "Done uploading" confirmation.
5. Open Serial Monitor at 115 200 baud to view "Lid Opened" / "Lid Closed" messages.

5. Configuration

Four constants at the top of the sketch control all behaviour. Edit and re-upload to apply changes.

Constant	Default	Description
<code>openDistance</code>	20 cm	Hand/object must be within this distance to trigger lid open.
<code>openPosition</code>	160°	Servo angle for fully open lid — adjust to match your hinge.
<code>closePosition</code>	10°	Servo angle for fully closed lid.
<code>holdTime</code>	3 000 ms	Duration lid stays open before attempting to close.

6. Operation

6.1 Normal Use

- Power the Arduino — the lid initialises to the closed position.
- Hold your hand or waste within 20 cm of the sensor — lid opens automatically.
- Remove your hand — after 3 s the system checks whether the area is clear, then closes the lid.
- If you remain within range, the hold timer resets and the lid stays open.

6.2 Logic Flow Summary

The firmware runs a non-blocking 50 ms control loop:

```
Sensor read → distance ≤ 20 cm AND lid closed → Open lid, start timer  
Timer expired AND area clear → Close lid  
Timer expired AND person still present → Reset timer, keep lid open
```

7. Troubleshooting

Symptom	Likely Cause	Fix
Lid does not open	Wiring fault or wrong pin	Re-check TRIG/ECHO/Servo connections
Lid opens randomly	Sensor noise or reflective surface	Move bin away from glass/mirrors
Lid won't close	Person still in range	Step back > 20 cm from sensor
Servo jitters	Insufficient power	Use external 5 V supply for servo
No Serial output	Wrong baud rate	Set Serial Monitor to 115 200 bps
Lid angle wrong	Hinge mismatch	Adjust openPosition / closePosition

8. Safety & Maintenance

- Do not expose the electronics to moisture or cleaning fluids.
- Keep the sensor face clear of dust — wipe with a dry cloth monthly.
- Do not obstruct servo arm travel; ensure the lid can fully swing to 160°.
- Disconnect power before rewiring or modifying hardware.
- Use a current-limited USB port or a regulated 5 V adapter for the servo.

9. Quick-Reference Card

Action	Trigger / Condition
Open lid	Object $\leq$ 20 cm from sensor
Close lid	No object for 3 s
Keep lid open	Remain within 20 cm
Debug output	Serial Monitor @ 115 200 baud

For support, scan the QR code on the box or visit www.smartbinpro.com/support