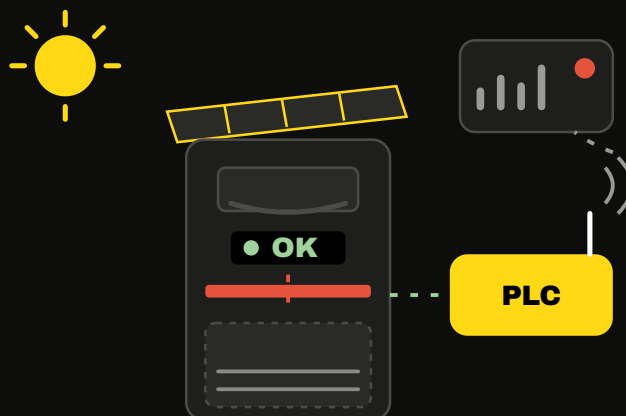


SMART CITY · ESP32 PLC

Compact in the street. Empty it only when it is full.

A solar compacting litter bin run by one ESP32 PLC: press, safety, weight, battery and alerts.

[Read the interactive case study online ›](#)


Schematic illustration

7

requirements in the brief of the customer

1

ESP32 PLC for the press, the sensors and the alerts

0

press strokes allowed with the emptying door open

4G

board on today's ESP32 PLC 21 FLEX, in place of GPRS

THE CHALLENGE

A machine in the street, on its own.

Waste management is one of the challenges that cities work on. The customer's project is a solar compacting litter bin for the street, a solution that is already spreading in some countries. In the street it faces intensive use and the risk of vandalism, so the bin is made entirely of metal. Inside there is a press and a trolley with wheels to make emptying easier, and a solar roof keeps it running on its own.

01

Compact at the right time

Capacity control: a presence sensor tells the PLC when the waste is high enough to start a compaction cycle.

02

Never press with the door open

The press must stop when the emptying door is open, to avoid accidents when the operator handles the trolley.

03

Count, weigh, measure

The system counts the compactions, weighs the waste and monitors the state of the batteries and their total charge.

04

Tell the control centre

Warnings, incidents and alarms go out by wireless remote communication, so an operator comes to empty the bin when it is needed.



Open, or clearly closed

When there is no incident, people can use the bin at will. Otherwise, the LED shows that the bin is not available and the waste flap is blocked.

HOW IT WORKS

Three parts of one program: press, power, alerts.

Part 1 · Compact

The sensor sees the waste. The press does the rest.

When the presence sensor detects that a compaction cycle is needed, the PLC runs the press down and back up and adds one to the compaction counter. In this example it also blocks the flap during the stroke. If the emptying door opens, the press stops at once and the LED shows that the bin is not available. Throw some bags, then open the door during a stroke.

- The presence sensor starts the cycle
- The door switch stops the press
- Flap blocked and LED during an incident

Part 2 · Power and weight

The sun charges, the press spends, the PLC keeps the count.

The solar roof charges the batteries, and the press is the big consumer. The PLC monitors the battery and weighs the waste. A typical way: the battery voltage and a load cell on analog inputs, and if the charge gets too low, the PLC blocks the bin before a stroke can stop halfway and sends a warning. Change the weather and the traffic of the street.

- Battery voltage on an analog input
- A load cell transmitter for the weight
- Low charge blocks the bin and sends a warning

Part 3 · Alerts and routes

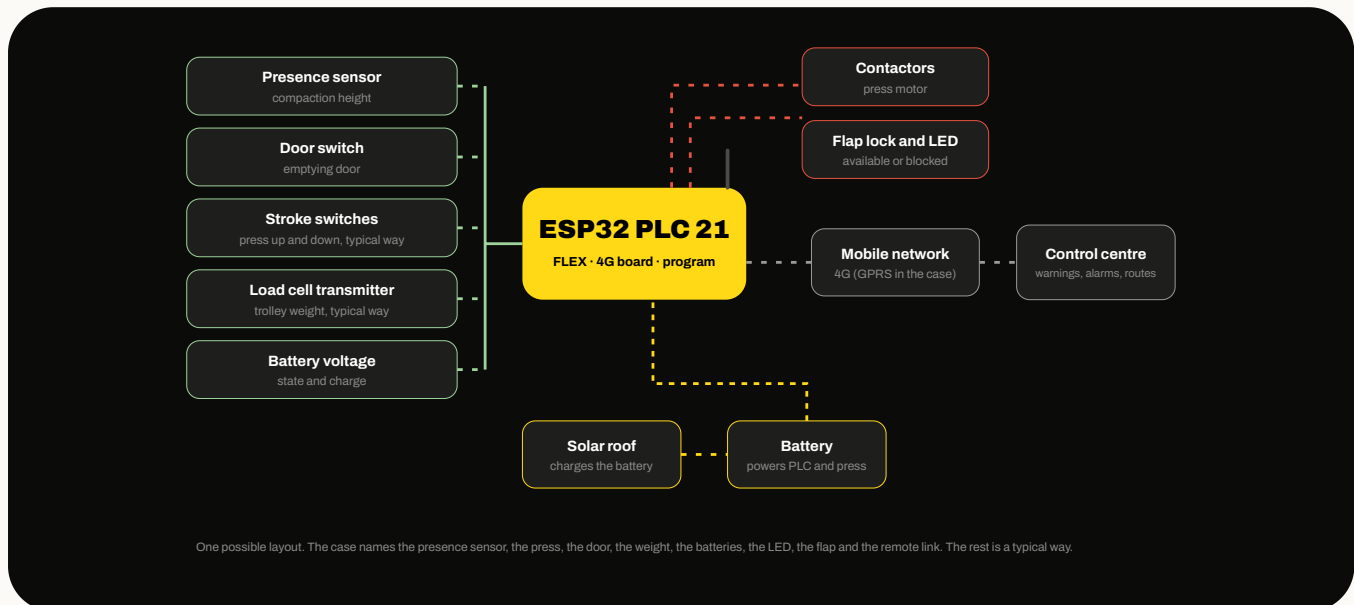
Only the bins that need it get a visit.

Each bin sends its events over the mobile network: full, door open, low battery. In the control centre, the messages become a list of bins to empty and a route.

- Events, not a constant stream
- One message per warning, incident or alarm
- Fill and weight per bin for the route

How does a PLC control a solar compacting litter bin?

An ESP32 PLC 21 FLEX with a 4G board reads the presence sensor, the door, the press position, the weight and the battery. It drives the press through contactors, sets the LED and, in a typical way, blocks the flap. Warnings, incidents and alarms go to the control centre over the mobile network. The solar roof charges the battery that powers the PLC and the press.



Inputs to the PLC Outputs and safety Power Mobile network

Signals

Signal	Between	Type	Purpose
Waste at compaction height	Presence sensor → ESP32 PLC 21	Digital in	Starts the compaction cycle
Emptying door open	Door switch → PLC (and safety relay, typical way)	Digital in	Stops the press and blocks the bin
Press up, press down	Stroke switches → PLC (typical way)	Digital in	Ends each stroke
Press motor	PLC → contactors	Digital out	Moves the press down and up
Flap lock and LED	PLC → lock and status panel	Digital out	Bin available or blocked
Weight of the waste	Load cell transmitter → PLC (typical way)	Analog in	Kilograms in the trolley
Battery voltage	Battery → divider → PLC (typical way)	Analog in	State and charge of the battery
Warnings, incidents, alarms	PLC → control centre	4G	Empty, check or repair the bin

One ESP32 PLC with a 4G board inside the bin.



ESP32 PLC 21 FLEX

An industrial controller built on the dual-core ESP32, for DIN rail, programmed with the Arduino IDE. The FLEX version takes one communication board: here, 4G (M1)-NB1 IoT LTE, for the alerts to the control centre.

Role	Press, interlocks, counts, weight, battery and alerts
Processor	ESP32 dual core, up to 240 MHz
Inputs	13: 6 analog/digital (0-10 V, 11-bit), 7 digital optoisolated (5 to 24 Vdc), 2 of them with interrupt
Outputs	8: 3 analog/digital/PWM (0-10 V, 12-bit), 5 digital optoisolated (5 to 24 Vdc)
Option board	One: 4G (M1)-NB1 IoT LTE (Ublox), LoRa or CAN
Communications	Ethernet, Wi-Fi, Bluetooth LE, RS-485, RS-232

The case used an ESP32 PLC with GPRS and does not publish the exact model. GPRS runs on 2G networks, which some operators have already switched off.

[See the ESP32 PLC 21 FLEX ›](#)

Sensors decide, not the calendar

The press runs when the presence sensor sees waste at the compaction height, and the operator comes when the bin reports that it is full.

Safety before the cycle

The door switch stops the press and blocks the bin. A typical way adds a safety relay, so the interlock does not depend on the program alone.

Clear state for the public

The LED and the blocked flap tell people at once that the bin is not available. Nobody forces a full or open bin.

SIMILAR PROJECT?

Tell us about your machine. An engineer will answer.

Tell us what your machine does, which sensors and actuators it has, how it is powered and where the alerts must go. We will tell you which controller and which link fit, and how to wire the safety part.

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