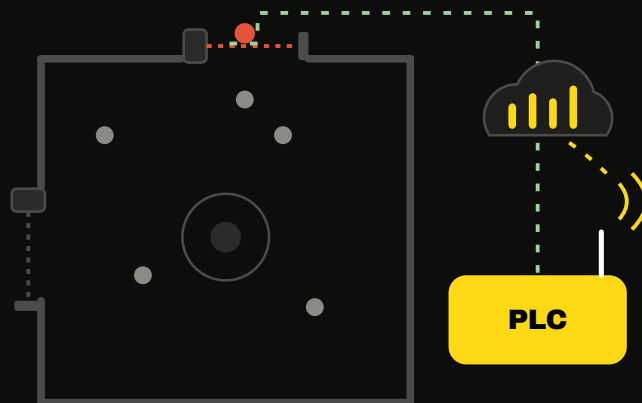


PUBLIC SPACES · ESP32 PLC LORA

Count the square. Plan the next event.

Photocells at the accesses, an ESP32 PLC with LoRa, and a history in the cloud.

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


Schematic illustration

3

photocells in the scheme of the case, at the accesses

+1

on the counter of an access for each pulse of its photocell

13

inputs on the ESP32 PLC 21, 7 of them isolated digital inputs

1%

duty cycle on the EU868 LoRaWAN sub-bands

THE CHALLENGE

Know how many people come, before the next event.

The people who manage a big square want to know in advance how many people will come to a public event or a demonstration. Then they can decide, for example, how many police officers or ambulances they need. The way to anticipate is to analyse the data of the past events.

01

Count at every access

Several photoelectric sensors at the accesses of the square detect each person who passes. Each pulse adds one to a counter in the PLC.

02

Keep the data safe

The counters are the registers of the system. The PLC sends them on a fixed cycle, so that the data is stored safely in a general register.

03

No data cable to the office

The PLC sends the counters by LoRa radio to the cloud, so the square needs no network cable or Wi-Fi.

04

From counts to plans

The history shows trends and preferences, such as which events are the most crowded. Per access, it also shows where people come in.



A simple signal, a lot of data

A pulse per person is a small signal. Months of pulses per access and per hour become the patterns that a planning model needs.

HOW IT WORKS

Three stages: count, send, plan.

Stage 1 · Count

A beam breaks. The counter of its access adds one.

Each access has a photoelectric sensor with its reflector. When a person crosses the beam, the sensor gives a high voltage level to a digital input of the PLC. The PLC sees the pulse and adds one to the counter of that access. Send people through the accesses, then try two people side by side.

Stage 2 · Send

The totals go to the cloud by LoRa, on a fixed cycle.

The PLC packs the counters into a small frame and sends it on a fixed period. A typical way to reach the cloud is LoRaWAN: a gateway receives the frame and a network server passes it on. Send totals, not increments: if a frame is lost, the next one carries the full count. Change the interval and the spreading factor, then lose a frame.

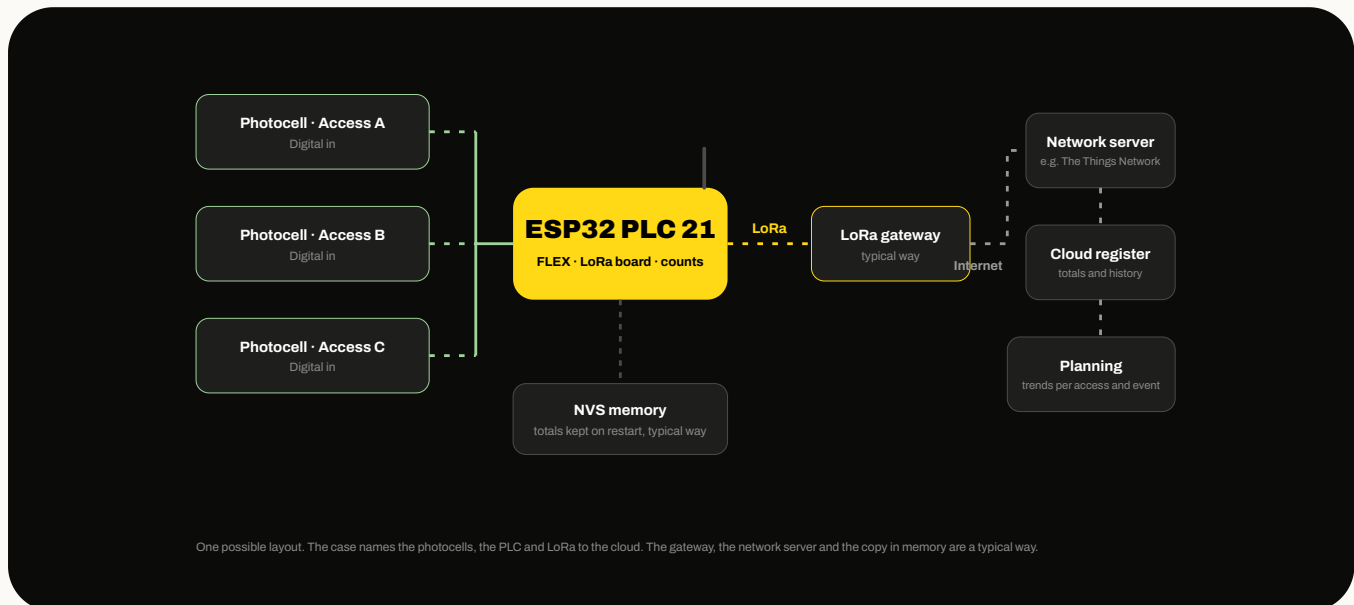
Stage 3 · Plan

Past events of the same type give the next forecast.

In the cloud, every frame adds a point to the history of each access. Grouped by hour and by event type, the history shows the pattern of each kind of event: when people arrive, how many, and through which access. Pick an event type.

How does a PLC count people in a public square?

Photoelectric sensors at the accesses of the square give a pulse to the digital inputs of an ESP32 PLC 21 FLEX with a LoRa board. The PLC keeps one counter per access and sends the counters by LoRa on a fixed cycle. A typical way to reach the cloud: a LoRaWAN gateway and a network server, which pass the decoded counts to a database. There the counts become a history for trends and forecasts.



— Digital inputs — LoRa radio — Internet

Signals and data

Signal	Between	Type	Purpose
Pass at access A, B, C	Photocells (×3) → ESP32 PLC 21	Digital in	A high level on each beam break: one pulse
Counter of each access	Inside the PLC	Register	Adds one on each pulse. The case calls it the register
Saved totals (typical way)	ESP32 PLC 21 → NVS memory	Memory	Totals that survive a restart or a power cut
Counts frame	ESP32 PLC 21 → gateway	LoRa	Totals of all the accesses, on a fixed cycle
Decoded counts	Network server → cloud	MQTT or webhook	The general register of the case (typical way)
History and forecast	Cloud → planning team	Dashboard	Trends per access, hour and event type

One ESP32 PLC with LoRa for the accesses of the square.



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, LoRa for the EU868 band, with a module that has the LoRaWAN stack inside. In this case it reads the photocells, keeps the counters and sends them to the cloud by LoRa.

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: LoRa (EU868, US902 or Asia band), 4G LTE-M/NB-IoT or CAN
Communications	Ethernet, Wi-Fi, Bluetooth LE, RS-485, RS-232
Clock	DS3231 real-time clock with backup battery

The original case used an M-Duino 21 with LoRa (the "M-Duino PLC Arduino Ethernet & LoRa 21 I/Os Analog/Digital PLUS"). Today, the equivalent that you can buy with LoRa is the ESP32 PLC 21 FLEX with the LoRa (Europe - EU868) board, or the US902 board in America. It has the same count of inputs and outputs, and it is also programmed with the Arduino IDE. According to the family datasheet, the LoRa board uses a Microchip RN2483 module (RN2903 for US902) with the LoRaWAN stack inside: the program sends commands such as join and send over UART. Three accesses with one beam each use 3 of the 7 isolated digital inputs; with two beams per access, three accesses use 6. A typical way to wire the photocells: 24 Vdc sensors with a PNP output on the isolated inputs. The PLC goes in a cabinet (IP20, no condensation); outdoors, choose a cabinet for the local climate and photocells rated for outdoor use. If the accesses are far apart, a typical way is one PLC per access group, each with its own LoRa board.

[See the ESP32 PLC 21 FLEX ›](#)

A pulse is enough

The photocell gives a high level when a person crosses the beam. The PLC turns each pulse into one count. No camera and no image processing.

Radio where there is no cable

LoRa carries the counters from the PLC to a gateway, with no network cable from the square and no SIM card in the PLC.

History first

The case starts from the data of past events. A forecast is only as good as the history behind it, so the counting starts long before the event.

SIMILAR PROJECT?

Tell us your accesses and your data. An engineer will answer.

Tell us how many accesses you want to count, how far apart they are, which network reaches the site, and where the data must go. We will tell you which controller and which radio fit, and how to wire the sensors.

READ IT ONLINE

industrialshields.com/case-study-public-space-people-counting-lora

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