Technical White Paper – Locations Code

A Universal Geographic Coding System for E--commerce Logistics

Abstract

Address management inefficiencies are a major cause of e- -commerce delivery failure. Addressing errors account for approximately 45% of failed deliveries, generating significant direct and indirect costs for logistics operators and merchants .
This paper introduces **Locations Code** , a compact, stable, and universally applicable geocoding system designed to overcome the limitations of traditional postal systems and existing geocoding solutions. The system provides an eight-character alphanumeric code derived from geographic coordinates, optimized for operational use in modern logistics.

1. Introduction

The growth of e --commerce has exponentially increased the volume of urban deliveries, exposing the fragility of addressing systems based on toponymy, house numbers, and postal codes.
These elements, subject to administrative variations, typing errors, and linguistic ambiguities, are not designed to ensure operational accuracy in sorting and delivery processes.

In 2025, the estimated average cost of a failed delivery is **$17.78** , plus indirect costs such as:

- customer service management,
- reverse logistics activities,
- loss of customer loyalty.

In this context, the need for a stable, standardized localization system that is independent of administrative variables emerges.

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2. Definition of the Locations Code System

Locations Code is a geographic coding system that converts a pair of coordinates (latitude and longitude) into an **eight-character alphanumeric code** , designed to:

- ensure global univocity,
- maintain stability over time,
- reduce the risk of transcription errors,
- simplify logistics operations,
- be usable in any linguistic or administrative context.

The resulting code identifies an area of approximately **30 meters** , adequate precision for deliveries, building access and collection points.

3. Motivations and Application Context

The adoption of a universal geocoding system responds to concrete operational needs:

3.1 Instability of address-based systems

- variations in toponymy,
- linguistic differences,
- heterogeneous formats between countries,
- typos or incomplete address.

3.2 Postal code limits

Postal codes:

- they do not identify a precise point,
- require continuous updates,
- are not globally uniform.

3.3 Economic impact

The absence of a standardized localization system generates inefficiencies in the processes of:

- automatic sorting,
- route optimization,
- last mile delivery.

Locations Code is intended as an **operational standard** to overcome these critical issues.

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4. System Architecture

4.1 Input

The system uses geographic coordinates expressed in decimal degrees:

- latitude (φ),
- longitude (λ).

4.2 Normalization

To avoid negative values:

- $\varphi' = \varphi + 90$
- $\lambda' = \lambda + 180$

4.3 Conversion to arc seconds

The normalized coordinates are converted to seconds:

- $Lat\_sec = \varphi' \times 3600$
- $Lon\_sec = \lambda' \times 3600$

This choice defines the operational precision of the system.

4.4 Base 34 encoding

The values are converted to base 34 using an alphabet free of ambiguous characters (0 and 1), in order to:

- reduce reading errors,
- improve verbal communication,
- increase OCR reliability.

4.5 Character interleaving

The resulting strings are alternated to generate the final code.
This technique ensures **spatial consistency** : nearby points produce similar codes.

4.6 Code Properties

- fixed length (8 characters),
- global univocity,
- independence from languages and administrative borders,
- decodability ,
- operational robustness.

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5. Comparison with Existing Systems

5.1 Google Plus Code

The Plus Code combines an alphanumeric code with an administrative description.
Main limitations:

- not globally unique in the 8-character version,
- dependence on administrative boundaries,
- need for updates from Google.

Locations Code, on the contrary:

- it is always unique,
- does not require additional descriptions,
- always maintains 8 characters.

5.2 what3words

what3words associates three words with each point, which vary depending on the language.
Main limitations:

- non-uniform coding between languages,
- presence of non-standard characters,
- absence of spatial correlation between similar codes,
- dependence on proprietary databases.

Location Code:

- use standard characters,
- maintains a constant format,
- highlights geographical proximity,
- It does not depend on external languages or databases.

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6. Operational Applications

6.1 E--commerce logistics

- reduction of failed deliveries,
- greater efficiency in sorting ,
- route optimization.

6.2 Food delivery and on--demand services

- precise location of entrances, courtyards, and collection points.

6.3 Market analysis

- uniform georeferencing of orders,
- more accurate territorial clustering.

6.4 Automation systems

- integration with warehouse robots,
- automatic sorting based on stable codes.

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7. Implementation and Access to the System

The website **www.locationscode.com** offers two features:

1. code generation from coordinates,
2. decoding the code into geographic coordinates.

8. Conclusions

Locations Code represents an innovative and pragmatic approach to geocoding for modern logistics.
Its architecture, based on simple and verifiable mathematical transformations, guarantees:

- stability,
- universality,
- adequate precision,
- reduction of operational errors.

In a context where logistics requires reliable global standards, Locations Code presents itself as a **natural candidate for a new universal postal code** .