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# Coordinate-Based Message Encoding Utility

**BIP:** 8675

**Layer:** Application (potentially Interface if standardizing storage/transmission format)

**Project Name:** iAHSADF

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**Type:** Standards Track (potentially Interface)

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**Status:** Draft

**Requires:** None

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## Abstract

This BIP proposes **iAHSADF**, a utility and encoding scheme for representing text-based messages as spatially indexed coordinate data. iAHSADF introduces a format and associated Python implementation that encodes a message into `(x, y, char)` tuples written line-by-line to a plain-text file. This design allows messages to be visualized as 2D grids, facilitating novel display methods, secure message handling, or embedding in structured spatial systems.

The decoding process reverses the transformation by reconstructing the grid from coordinates and extracting the original message content. The system ensures round-trip integrity, allowing reliable encoding, storage, visualization, and decoding.

This BIP outlines the format, rationale, implementation, and usage of the iAHSADF utility, with the goal of standardizing lightweight, visually structured message encoding across Brown-related tooling and applications.

## Rationale

Traditional text storage methods are purely linear, making it difficult to visualize or structure data in spatially aware systems. For scenarios like spatial text rendering, instructional programming examples, or lightweight steganographic storage, a 2D coordinate-based encoding system offers advantages in terms of clarity, simplicity, and modularity.

iAHSADF fills this gap by encoding any string into a grid of coordinates that preserves the order of characters while offering flexibility in layout. Because the format is both human-readable and machine-parseable, it becomes a natural fit for inclusion in pipeline-based applications, CLI tools, or teaching environments.

Additionally, this approach aligns with the BIP philosophy of modular, independently reviewable enhancements that can be adopted across multiple implementations. iAHSADF may also be relevant in meta-use cases like toolchain development, documentation visualization, or specification validation.

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# Specification

## 1. Format

A message is encoded into a set of `(x, y, character)` tuples, laid out in row-major order with an optional maximum row width (default: 50 characters).

Each line in the encoded file contains:

`x y char`

Where:

- `x`: Integer column position.
- `y`: Integer row position.
- `char`: Single character (ASCII or Unicode-safe).

Whitespace and special characters are supported in encoding/decoding.

## 2. Reference Implementation (Python)

The provided script includes:

- `encode_message_to_coords(message: str)`: Converts a string into coordinate tuples.
- `save_coords_to_file(coordinates, filename)`: Persists encoded coordinates to disk.
- `load_coords_from_file(filename)`: Loads and parses coordinate data from a file.
- `build_grid(coordinates)`: Reconstructs a character matrix from coordinate tuples.
- `decode_grid_to_message(grid)`: Reads the grid row-wise to regenerate the original message.
- `print_grid_to_console(grid)`: Renders the grid for human-readable CLI viewing.

The sample message encoded and validated for round-trip fidelity:

"This is a highly confidential corporate policy directive. Unauthorized disclosure is strictly prohibited. All personnel must adhere to these guidelines by 2025-08-01."

Temporary file handling and cleanup is included for testability.

### 3. Applications

- Spatial message visualization.
- Teaching text parsing and matrix-based representations.
- Embedding in CLI or low-level UI renderers.
- Lightweight obfuscation for secure environments (with extensions).

### 4. Extensions and Recommendations

- Variable-width wrapping or dynamic row sizing.
- Unicode-aware alignment and cell sizing.
- Integration into editor-based tools for visual validation of encodings.

## Editor(s)

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