From4

National Level Addressing System

Technical Document

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Introduction

We with collaboration with IIITDM Kurnool has undertaken an initiative to establish a Geo-Coded addressing system in India. As a part of this initiative, we are releasing final version of From4. This initiative seeks to provide simplified addressing solutions for seamless delivery of public and private services and to enable "Address as a Service" (AaaS) across the country.

From4 will be an open-source national level addressing grid developed by us in collaboration with IIITDM Kurnool and is a key component of the digital address ecosystem.

Design Approach

The From4 layer is the cornerstone of the entire digital address ecosystem. From4 is visualised as a wording offline grid system that divides the geographical territory of India into uniform 10-meter by 10-meter(approx.) units. Each of these 10m X 10m units (approx.) is assigned a unique 4 words code known to be as From4 code, derived from the latitude and longitude coordinates of the unit. This From4 code serves as the offline addressing reference for any specific location within the From4 system. From4 is thus strictly a function of the latitude and longitude of the location represented as a grid value. The system is designed to be scalable, adaptable, and integrated with existing GIS applications.

Code Architecture

The detailed structure is such that the **From4 code** is essentially an encoding of the latitude and longitude of a location into a sequence of **alphanumeric words**. Unlike traditional numeric grids, From4 uses

dictionary-based encoding that maps cells into meaningful, human-readable identifiers.

The process of identifying the cells is done in a hierarchical fashion, and the encoding is performed at successive levels as follows:

- **Bounding Box**:
  A bounding box is first defined that covers the entire globe (or chosen region, e.g., India).

- **Level-1 Partition (Base Grid)**:
  - The bounding box is divided into a uniform grid of 36 x 36 cells.
  - Each cell is assigned a unique word from a predefined dictionary.
  - The first word in the code identifies one of these Level-1 regions.

- **Level-2 Partition (Sub-Grid)**:
  - Each Level-1 cell is subdivided further into 36 x 36 subcells.
  - Again, each subcell is assigned a unique word.
  - The first two words in the code uniquely identify one of the Level-2 subcells.

- **Higher-Level Partitioning**:
  - The process of subdivision continues recursively for successive levels.
  - At further level till level 3, the cell is split into 36 x 36 smaller subcells, and each is mapped to a dictionary word.
  - The number of words in the code indicates the depth of precision.

- **Final Code Precision**:

  - A code of 4 words (hence the name *From4*) uniquely identifies a location up to a high level of accuracy (10 m x 10 m approx.).

Bounding Box

Following are the details of the bounding box used for **From4**:

Extent of From4 bounding box
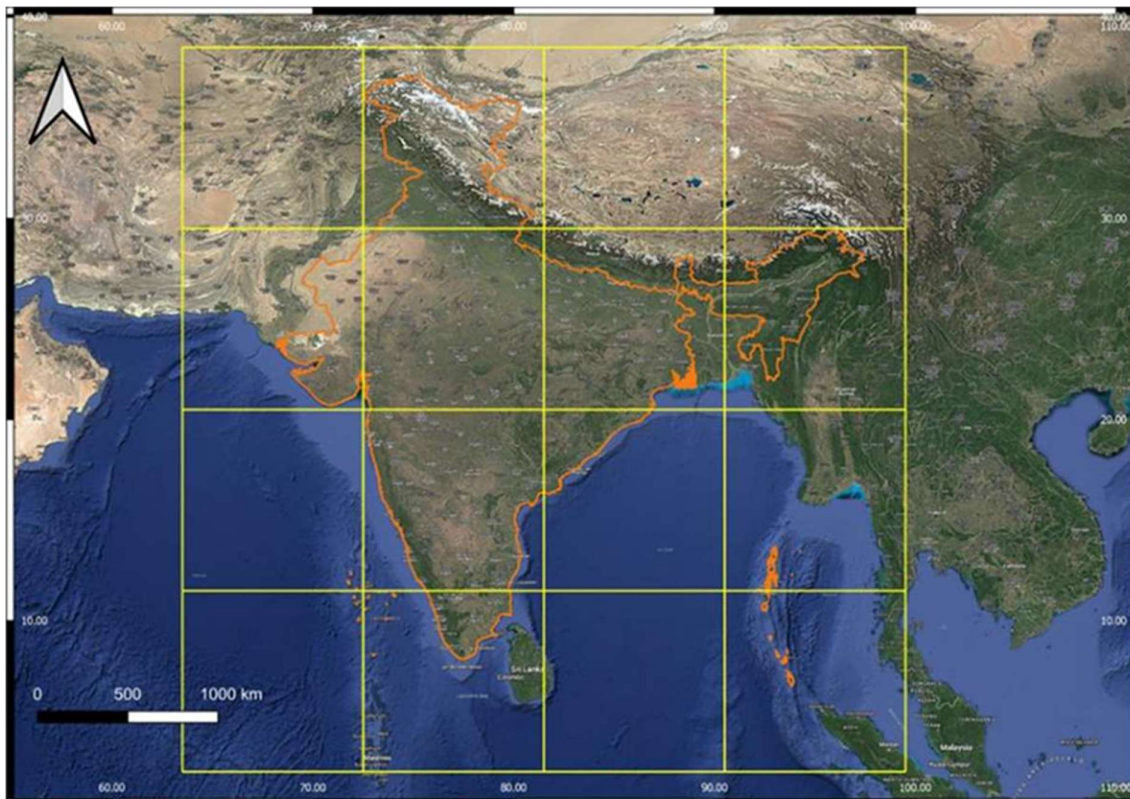
- **Longitude**: 63.5° – 99.5° East

- **Latitude**: 2.5° – 38.5° North

- **Coordinate Reference System (CRS)**: EPSG:4326 (WGS84 datum at epoch 2005), chosen for its:

  - global acceptance and interoperability,

- o simplicity of representation,

- o wide use in mapping and navigation systems.

Rationale for bounding box selection:

- Covers the entire territory of India, including the Andaman & Nicobar Islands and Lakshadweep.

- The chosen extent provides a rectangular bounding area, which allows easy subdivision into grids at successive levels.

- Ensures alignment with existing Survey of India's 1° × 1° and 0.25° × 0.25° grid frameworks, enabling compatibility with traditional mapping.

- Includes the Exclusive Economic Zone (EEZ), ensuring From4 codes can also represent offshore assets like oil rigs, sea routes, and man-made islands.

- The latitudinal span (~36°) and longitudinal span (~36°) are designed so that after multiple iterations of subdivision (up to 4 words), the final cell resolution is 9.5–10.3 meters, sufficient for navigation and address-level accuracy.

- Unlike DIGIPIN, From4's word-based addressing avoids purely symbolic codes, making it easy to remember and share.

- The final cells are nearly square-shaped (small variation by latitude), consistent with the accuracy of modern GNSS systems.

Grid Sizes at Various Levels

As explained above, the From4 code generation is also an iterative procedure.

At level-1, the bounding box is divided into 36 × 36 cells. Each cell is assigned a unique dictionary word.

At level-2, each of these cells is further subdivided into 36 × 36 smaller subcells, again mapped to words.

At level-3, each of these cells is further subdivided into 36 × 36 smaller subcells, again mapped to words.

At level-4, each of these cells is further subdivided into 8 × 8 smaller subcells, again mapped to words.

This results in a final precision of about 9.8 – 10.3 meters (depending on latitude).

The table below shows the relationship between From4 code length (number of words), the corresponding grid size, and approximate linear distance at the equator:

Level	Grid Width (approx.)	Approx. Distance
1	~1°	~111.32 km
2	~0.027°	~3.09 km
3	~7.71 x 10^{-4}°	~85 m
4	~9.64 x 10^{-5}°	~10.73 m

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