Digital Postal Index Number (DIGIPIN):

National Level Addressing Grid

Technical Document

Ministry of Communications

Department of Posts

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1. Introduction

The Department of Posts is undertaking a project to establish a standardized, nationwide geo-coded addressing system by developing a National level Grid known as DIGIPIN.

The implementation of this Digital Addressing system would ensure simplified addressing solutions for citizen centric delivery of public and private services. A standardized geo-coded addressing system would enhance India's geo-spatial structure. It would add to the geospatial knowledge stack of the country in line with the National Geospatial Policy 2022, which seeks to strengthen the geospatial sector to support national development, economic prosperity and a thriving information economy.

This document contains the technical details of the **DIGIPIN**, the National Level Addressing Grid.

2. Design Approach

2.1 Core Concept:

Department of Posts have collaborated with IIT Hyderabad for developing a grid based addressing system which has been designated DIGIPIN. DIGIPIN is visualised as an alpha numeric offline grid system that divides the geographical territory of India into uniform 4-meter by 4-meter(approx.) units. Each of these 4m X 4m units (approx.) is assigned a unique 10-digit alphanumeric code, derived from the latitude and longitude coordinates of the unit. This alphanumeric code serves as the offline addressing reference for any specific location within the DIGIPIN system. DIGIPIN 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.

2.2 DIGIPIN layer:

DIGIPIN layer will act as the addressing reference system which will be available offline and can be used for locating addresses in a logical manner with directional properties built into it due to the logical naming pattern followed in its construction. DIGIPIN can be also used for emergency rescue operations, national disasters like flood. DIGIPIN is proposed to be fully available in public domain and can be easily accessed by everyone. Since no private address data is stored against DIGIPIN grid value, there is no privacy concern associated with DIGIPIN being in public domain. DIGIPIN Grid system being an addressing referencing system, can be used as the base stack for development of other ecosystems where addressing is one of the processes in the workflow.

3. DIGIPIN : Code Architecture

The Detailed structure is such that the DIGIPIN is essentially an encoding of the latitude and longitude of the address into a sequence of alphanumeric symbols using the following 16 symbols: 2, 3, 4, 5, 6, 7, 8, 9, G, J, K, L, M, P, W, X.

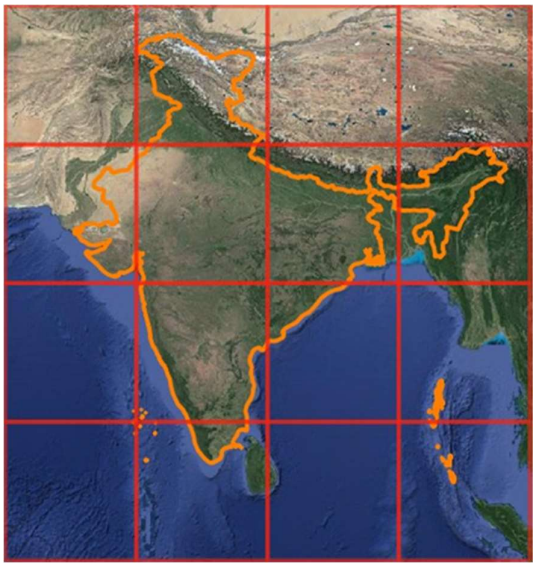
The process of identifying the cells is done in a hierarchical fashion. The encoding is performed at various levels, and the basic idea is the following:

- A bounding box is used that covers the entire country.
- The bounding box is split into 16 (i.e., 4x4) regions. Each region is labeled by one of symbols 2, 3, 4, 5, 6, 7, 8, 9, G, J, K, L, M, P, W, X. The first character in the code would identify one of these regions. This is called the *level-1* partition.
- Each region is then subdivided into 16 subregions in a similar fashion. Each of the 16 subregions are labeled by the 16 characters. For a given region, the subregion is identified by the second character of the code. Therefore, the first two characters of the code uniquely identify one of the 16^2=256 subregions. This is called the *level-2* partition.
- The encoding of successive characters, and therefore the next 8 levels is done in an identical fashion. The 10-symbol code therefore uniquely identifies one of the 16^10 cells within the bounding box.

3.1 Bounding box:

Following are the details of the bounding box used:

- Longitude 63.5 - 99 degrees east
- Latitude 1.5 - 39 degrees north
- The Coordinate Reference System (CRS) used in the proposed code design is EPSG:4326. Using EPSG:4326 (also known as WGS84) has several advantages like wide recognition and adoption, simplicity and global coverage.



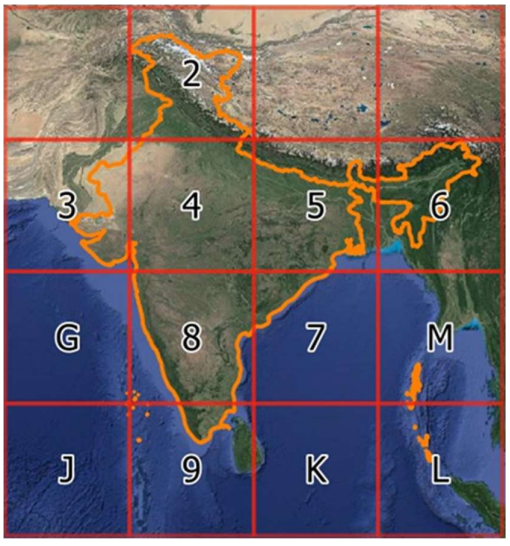
The choice of the corner points of the bounding box are based on the following considerations:

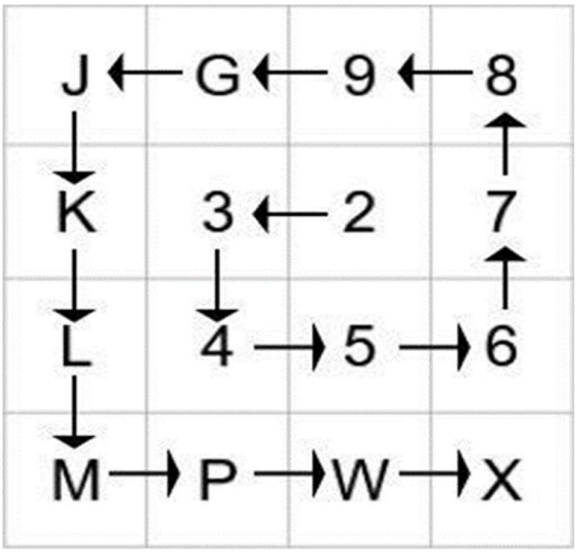
- This includes the entire territory of India.
- Includes the maritime Exclusive Economic Zone (EEZ), and therefore DIGIPIN allows to provide addresses to Indian assets in the sea (oil rigs, future man-made islands, etc.), or even potentially be used to locate regions in the sea by the maritime sector. The maritime EEZ is computed assuming 200 nautical miles extent from the coastline.
- The Indian mainland is covered by only 8 regions, and therefore can be labeled with the digits 2-9 at level-1.
- Level-1 grid lines do not cut through cities with very large population
- The level-10 cells would be almost rectangular, but the dimensions would vary based on the latitude. This would translate to a cell of size smaller than 3.8m x 4m if measured at the equator, and this is reasonable given the accuracy of most current commercially available Global Navigation Satellite System (GNSS).

3.2 Properties of DIGIPIN

- DIGIPIN contains the geographic location of the area. It is possible to extract the latitude and longitude of the address from the DIGIPIN with low complexity.
- DIGIPIN has been designed for the Indian context. All points of interest to India (including maritime regions) can be assigned codes, and it is possible to assign unique digital addresses even in areas that are very densely populated.
- The format of the DIGIPIN is intuitive and human-readable. Effort was made to infuse a sense of directionality within the format of DIGIPIN.
- DIGIPIN is independent of the land use pattern and the structure built. Note that DIGIPIN is designed as a permanent digital infrastructure, that does not change with changes in the names of state, city or locality, or with changes in the road network in an area. The DIGIPIN is designed to be robust to accommodate future developments and changes. The arrival of a new building in a community, or even a new village or city in a district, or changes in the name of a road or locality will not affect the underlying DIGIPIN.
- The length of the DIGIPIN is designed to be as small as possible in order to provide an efficient digital representation of addresses.

3.3 Labelling of regions at various levels





Level 1:

- Level-1 labelling ensures that the mainlandis labelled using only the digits 2-9.
- Codewords starting with P, W and X are reserved for future or special uses.

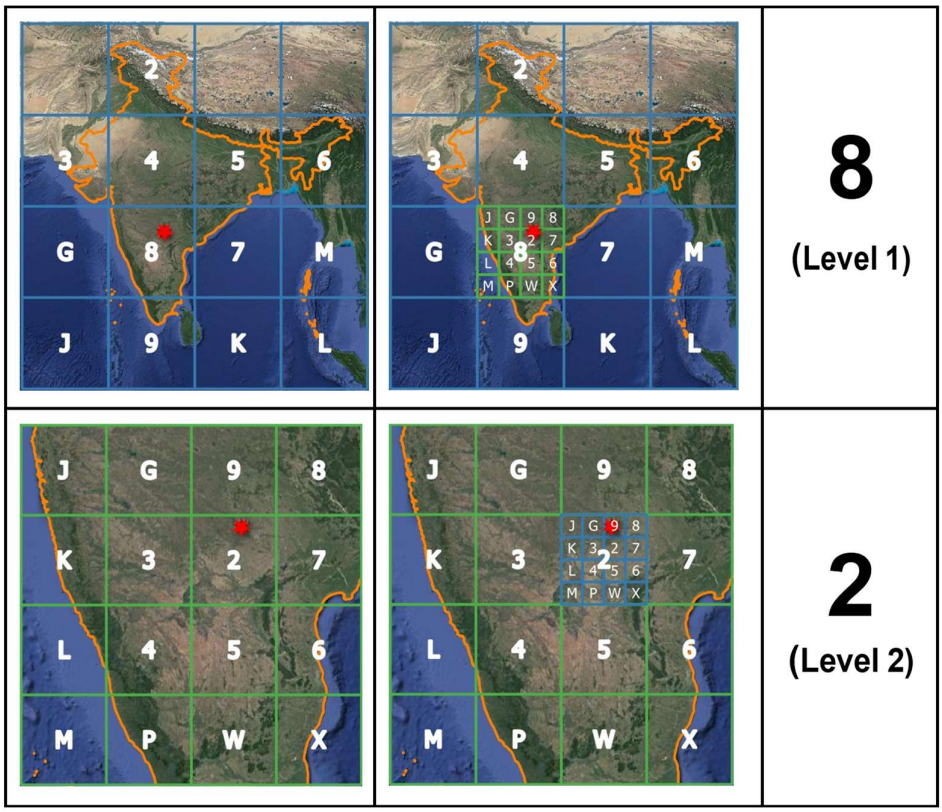
Level 2:

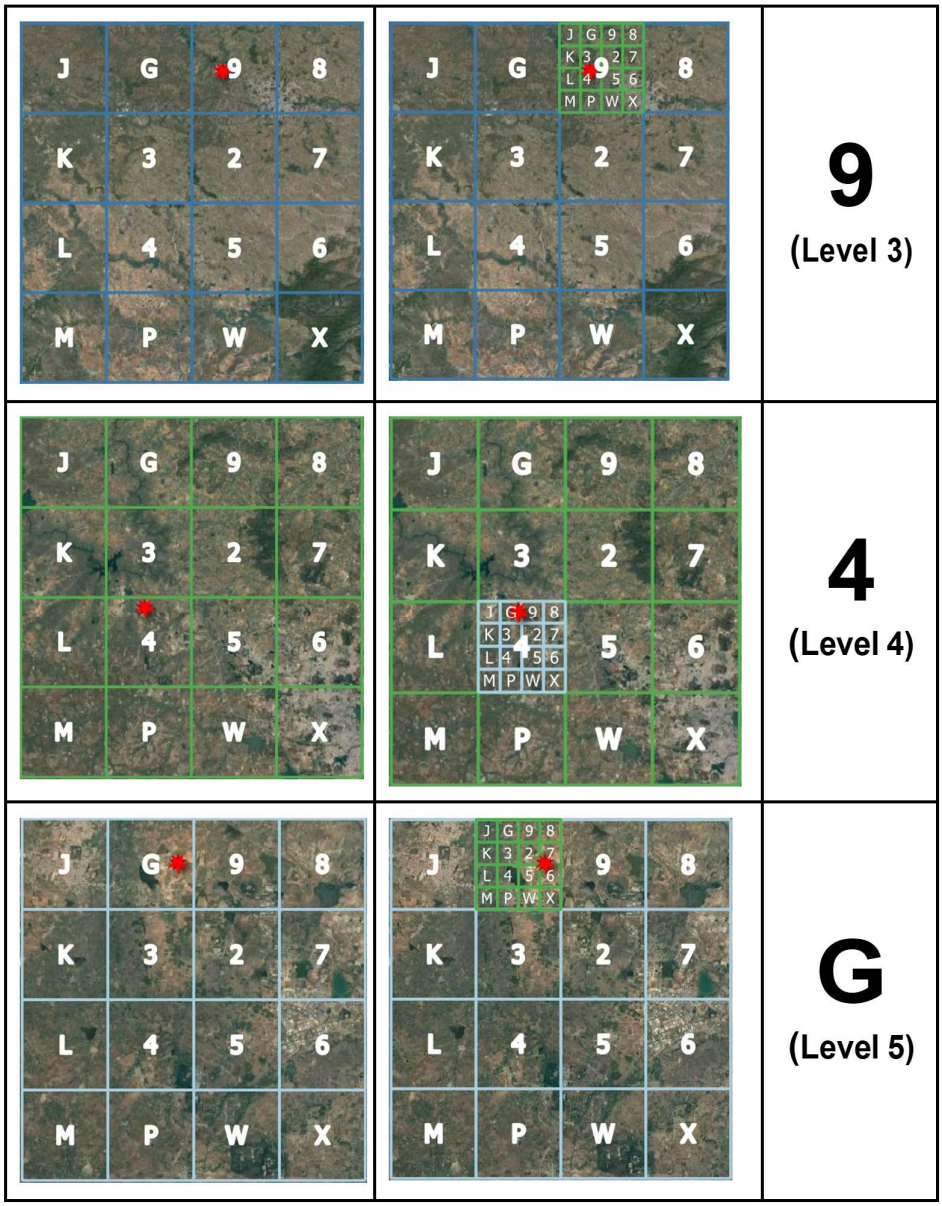
- Each Level-1 region is further split into 16 sub-regions called Level-2 regions as illustrated in the figure below. The regions are hierarchically partitioned into sub-regions in an identical fashion.
- For Levels 2 to 10 the same labeled grid is used, with the labeling performed in a hierarchical fashion.
- Symbols are assigned in anticlockwise fashion, spiraling outwards. Note that this labeling grid is different from the grid used for level-1. The grid used for levels 2-10 provide some sense of directionality and adjacency: cells labeled by consecutive symbols (such as 6 and 7) are geographical neighbors.

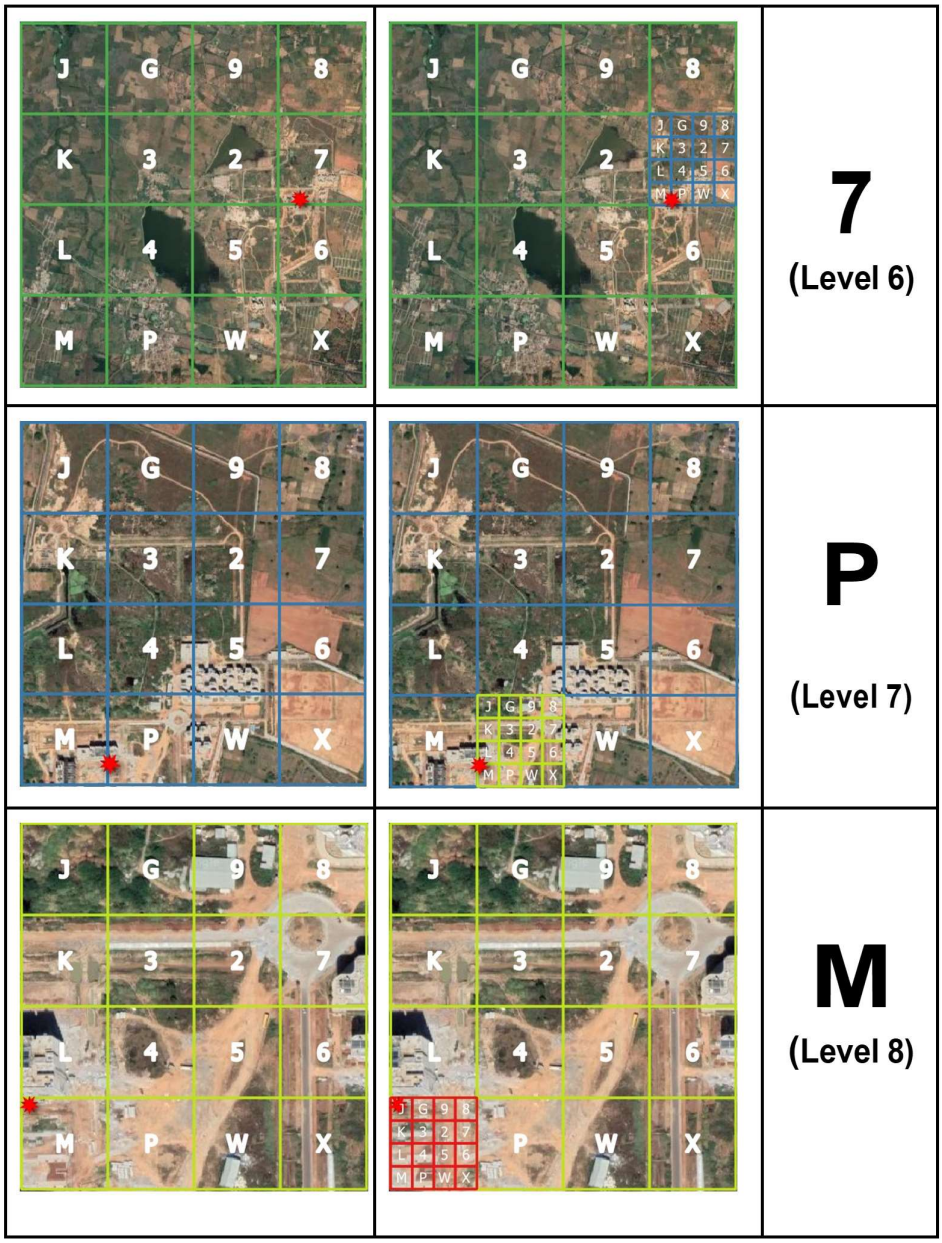
The level-1 grid, on the other hand, is designed to use numerals 2-9 for mainland India. Further, using two different grids at level-1 and levels 2-9 avoids inadvertent labelling of locations outside India using the symbols P, W and X at level-1.

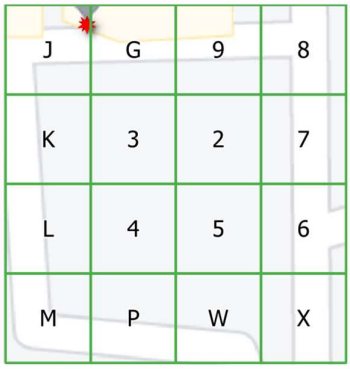
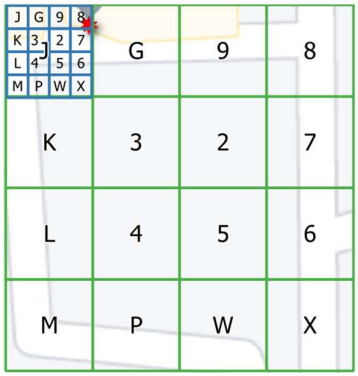
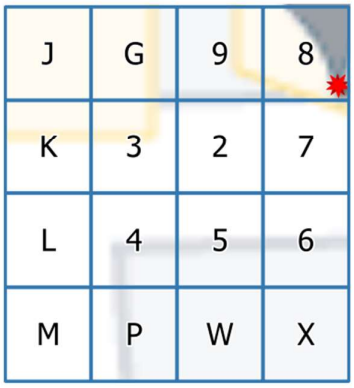
4. Code Architecture explanation through illustration:

XYZ Cafeteria, IIT Hyderabad (Location indicated by ‘star’ on the map) Located at 17.59551 degree north, 78.12351 degree east with underlying DIGIPIN : 829-4G7-PMJ8 :




J G 9 8
K 3 2 7
L 4 5 6
M P W X
9
(Level 3)
4
(Level 4)
G
(Level 5)


J G 9 8
K 3 2 7
L 4 5 6
M P W X
7
(Level 6)
P
(Level 7)
M
(Level 8)

		**J** **(Level 9)**
	**-**	**8** **(Level 10)**