# ERECTION OF INTERESTING GEOSPATIAL REGIONS IN THE CONTEXT OF ON-THE-SPOT LEARNING

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# ERECTION OF INTERESTING GEOSPATIAL REGIONS IN THE CONTEXT OF ON-THE-SPOT LEARNING

by

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# Certificate

The thesis entitled **Erection of Interesting Geospatial Regions in the Context of On-the-Spot Learning** being submitted by **Mr. Shivendra Prasad Tiwari** to the **Indian Institute of Technology Delhi**, for award of the degree of **Doctor of Philosophy** is a record of original bona-fide research work carried out by him. He has worked under my guidance and supervision, and has fulfilled the requirements for the submission of this thesis, which has attained the standard required for a Ph.D. degree of this institute.

The results presented in this thesis have not been submitted elsewhere for the award of any other degree or diploma.

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**Shivendra Prasad Tiwari**

# Abstract

The increasing requirements to handle more information on mobile devices are putting more demands on context sensitive computing and visualization than ever. Thus, it would require having a Location-based Information System (LBIS) that changes the level of granularity based on the user interest. Current Location Based Service (LBS) systems use lowest level of the Point of Interests (POI) details for information queries, which does not serve the next generation LBS requirements such as the storytellers, and on-demand information granularity. There is lack of digitization in remote areas, context aware selection of interesting objects, and the solutions must comply with the existing LBS infrastructure. The proposed research deals with the following problems:

*Lack of digitization* – several developing countries still do not have the digitized road network, and POIs. Mobile technology helps generating user movement footprints i.e. trajectory data. We have used trajectory patterns for automating spatial data collection, interesting region analysis, etc.

*Unrated POIs* – millions of POIs are still unrated due to the lack of awareness or interest on manual participation. The trajectory analysis is another way of estimating the popularity. We have proposed automatic popularity estimation based on the weighted user check-in and visit patterns.

*Erection and storage model of the ROI* – we have proposed a model that includes the erection of the ROIs along with storage and retrieval with weighting heuristic. The proposed storage methods include administrative boundaries, dynamic spatial chunking and a hybrid method that achieves the advantages of both the ROI creation and storage models.

*Erection of ROIs using POI clusters* – we have proposed an Adjacent Grid Block Selection (AGBS) method for efficiently finding boundary points of the POI clusters on the road network.

*Lack of organized information sources* – freely available web data, and e-Learning systems are extended to support the location based learning features. Fusion of navigation infrastructure and e-learning system is proposed in order to create information rich ROIs.

In order to validate the proposed solutions for the individual problems, we have implemented the prototypes using trajectory database provided by Microsoft Research, POI data collected from HERE Maps and freely available Wikipedia content as source of learning content associated with specific geospatial regions.

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# Acronyms

| | |
|---|---|
| AGBS | Adjacent Grid Block Selection |
| CLDC | Connected Limited Device Configuration |
| FC | Façade Content |
| GML | Geography Markup Language |
| GPS | Global Positioning System |
| GSM | Global System for Mobile Communication |
| HG | Hierarchical Grid |
| KML | Kilobyte Markup Language |
| kNN | k-Nearest Neighbor |
| LBL | Location Based Learning |
| LBS | Location Based Service |
| LDT | Location Determination Technology |
| LMS | Learning Management System |
| LSP | Location Based Service Provider |
| MIF | MapInfo Interchange Format |
| MMD | Multiple Multimedia Data |
| MMD | Min-Max Distance |
| NNQ | Nearest Neighbor Query |
| OGC | Open Geospatial Consortium |
| OMG | Optimal Meeting Grid |
| OSA | Open Services Architecture |
| OSM | Open Street Map |
| OTA | Over-The-Air |
| OTSL | On-The-Spot-Learning |
| PCA | Principal Component Analysis |
| POI | Point Of Interest |
| RkNN | Reverse k Nearest Neighbor |
| ROI | Region Of Interest |
| SAM | Spatial Access Method |
| SNN | Shared Nearest Neighbor |
| TBT | Turn-By-Turn |