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Title of Thesis: Designing of Uniform Model for Multipurpose Cadastral System in India

ABSTRACT

The challenges that grip the maintenance of Land Records in the Country are poor record keeping, non-updation, unclean titles, non-synchronization of common data sets and increased complaints of irregulates, corruption. The Multipurpose Cadastral System (MPC) ensures the integration of various processes of Land records and arranges them in common & accurate framework. The Blockchain Technology is bringing disruption across different industries such as finance, banking, supply chain, asset management etc. Blockchain Technology can securely integrate land records processes to ensure transparency, efficiency & restore peoples' confidence in the system. Blockchain which is a distributed ledger will enhance data security & authentication and will reduce chances of fraud and corruption. The copy of transactions will be validated by all the organizations and blocks of transaction stored thereof.

The proposed uniform model for Multipurpose Cadastral System using Blockchain was successfully designed and POC developed taking into consideration all the requirements of land records system. As maps are not being updated along with records of rights. The Object based Image Analysis (OBIA) approach is used to prepare updated maps and Land Management Software is developed to update the maps at time of mutation. The datasets of all related departments namely, Revenue, Registration, Survey and Settlement, Land acquisition, Revenue Courts, Banks are aligned in MPC architecture. The enterprise based open source Hyperledger Fabric framework, permissioned blockchain is used to ensure proper access control, consensus, and replication across nodes of different departments. All the changes done using chaincode are stored in Land Records database as well as in the

decentralized databases of related departments.

The solutions are also evaluated for quality and performance. Both the models a) extracting cadastral boundaries using OBIA b) design of uniform model for multipurpose cadastral system using Blockchain Technology are evaluated using qualitative and quantitative methods for accuracy, performance & usability. The extracted features and cadastral boundaries are assessed using confusion matrix for image classification accuracy. The results are very encouraging as more than 90% of boundaries & features are matching the reference data. Quality assessment of segmented boundaries is also done using AssesSeg tool, which finds the potential segmentation errors based on Euclidean Distance (ED). It is revealed that better results of segmentation can be achieved when ED value is less, and numbers of reference objects are more.

The Blockchain based MPC design is tested using Hyperledger Caliper tool. Hyperledger Caliper provides dashboard of performance metrics and resource consumption. The dashboard shows HTML page containing performance parameters and their values which include success rate, failed transactions, send rate, maximum latency, minimum latency, average latency, and throughput. We can also find out resource consumption, process type (read/write), node name, memory, CPU max, CPU average, traffic in and out. With this design of 6 & 16 peers, the insert operation could get end-to-end throughput of 140 & 360 transactions/sec and for query/search operation, the system gave throughput of 20 & 30 transactions, respectively. The field staff working on existing NLRMP scheme was made aware of these systems and both the systems were demonstrated to them. There was overwhelming response with more than 95% staff eager to use the model to ease their work and provide better services.

In this research the existing datasets and processes of individual land related departments are transformed, re-engineered & integrated to design uniform model for Multipurpose Cadastral System using Blockchain Technology for the country.