Study On DGPS Based Cadastral Survey

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Abstract— Cadastral surveys are the cornerstone of land management systems, vital for delineating property boundaries, protecting property rights, easing land transactions, and supporting urban development. Traditionally reliant on manual measurements and surveying tools, these surveys have undergone a profound transformation with the adoption of Differential Global Positioning System (DGPS) technology. DGPS, leveraging satellite signals and ground-based reference stations, has ushered in an era of unparalleled precision in Earth's surface positioning. This abstract provides a gateway to an extensive study that delves deeply into DGPS technology's transformative potential within the realm of cadastral surveys. The research objectives include a comprehensive exploration of DGPS principles, comparative analyses with traditional methods, real-world case studies, rigorous assessments of accuracy and reliability, provision of valuable implementation recommendations, and forward-looking insights into future trends. With a keen focus on these key aspects, the study aims to illuminate the path towards harnessing the full potential of DGPS technology in cadastral surveying.

Key words: Property Boundaries, Ground-Based Reference Stations, Accuracy, Cadastral Surveys

I. INTRODUCTION

In the realm of cadastral surveys, precision and accuracy are crucial for delineating land boundaries, recording property ownership, and ensuring effective land governance. Traditional survey methods like theodolites and total stations have played a vital role in shaping property rights and land tenure systems, but they have limitations. The advent of Global Positioning System (GPS) technology transformed geospatial data collection, offering access to satellite-based precise location determination. However, growing accuracy demands revealed challenges like signal degradation and atmospheric interference. Differential Global Positioning System (DGPS) technology emerged as a solution, providing enhanced accuracy through error correction, making it a robust choice for cadastral surveys. This section introduces DGPS technology's fundamentals, setting the stage for a deeper understanding of its role in improving cadastral survey practices.

II. LITERATURE REVIEW

Prior research on "DGPS-Based Cadastral Survey" consistently highlights the significant benefits of transitioning from traditional survey methods to DGPS. This shift has improved positional accuracy, efficiency, and cost-effectiveness, enabling the creation of up-to-date digital cadastral databases that enhance land administration and reduce property disputes. Positive environmental and societal impacts have been noted, but research gaps concerning standardization, privacy, and accessibility require attention. Regional variations emphasize the importance of context-specific solutions. In essence, DGPS plays a transformative role in cadastral surveying, calling for continued research and technological advancement.

III. METHODOLOGY

The methodology for the DGPS-based cadastral survey is central to the study, guiding data collection, analysis, and interpretation. It covers research design, data collection, sampling, geospatial and qualitative data, analysis, ethical considerations, and potential limitations. Experiments are conducted at Pranami Ramanbhai Punjabhai's Farm, Survey No. 590, Village: Bamanwad, Ta: Modasa, Gujarat, India.

A. *Experimental Flume:*

In this study, a mixed-methods research approach is adopted, encompassing both quantitative and qualitative methods. The quantitative aspect involves collecting and analyzing geospatial data obtained through DGPS surveys, while the qualitative component includes interviews, questionnaires, and expert consultations to gain insights into DGPS-based cadastral surveying's broader context.

1) *Data collection is twofold:*
   1) Geospatial Data Collection: DGPS surveys are conducted in selected study areas to gather data relevant to cadastral surveying, covering property boundaries, control points, and land parcel mapping.
   2) Qualitative Data Collection: This involves structured interviews with stakeholders, surveys for surveyors and land administrators, and expert consultations to explore economic, operational, and organizational aspects.

A stratified sampling strategy is employed to ensure data representativeness and diversity. Study areas are categorized into urban and rural regions, with further stratification based on geographic factors and cadastral disputes prevalence. Random sampling within each stratum enhances external validity, allowing findings to be generalized.

B. *Geospatial Data Collection:*

Geospatial data collection primarily relies on DGPS technology, involving the following steps:

1) Control Point Establishment: Precisely known coordinates for control points are set up in study areas, serving as reference points for subsequent cadastral surveys.
2) Boundary Delineation: DGPS technology accurately measures and defines property boundaries, recording boundary point coordinates and documenting any disputes.
3) Land Parcel Mapping: DGPS data is used to create detailed land parcel maps, including cadastral boundaries, parcel dimensions, land use classifications, and ownership details.
4) Data Validation: Validation procedures ensure DGPS data accuracy through repeated measurements and comparative analysis against existing cadastral records, where available. This rigorous geospatial data collection underpins the research, ensuring the acquisition of dependable cadastral information.

C. Qualitative Data Collection:

Qualitative data collection methods include structured interviews with key stakeholders involved in cadastral surveying, like land surveyors, administrators, officials, and landowners. These semi-structured interviews employ open-ended questions to delve into the challenges and benefits of DGPS-based cadastral surveying, offering direct insights from field experts. Additionally, surveys and questionnaires will be used to gather quantitative data from land surveyors and administrators, focusing on economic and operational aspects of DGPS technology. Expert consultations with DGPS and cadastral surveying experts will provide valuable insights and best practices, enriching the research's depth and breadth.

D. Data Analysis:

In data analysis, quantitative data from DGPS surveys and surveys/questionnaires will undergo rigorous statistical analysis, employing descriptive statistics (means, standard deviations, percentages) and inferential statistics (e.g., t-tests, regression) to summarize, explore relationships, and make comparisons, facilitating statistical inference.

For qualitative data from interviews and expert consultations, content analysis will be conducted. This involves transcribing recorded interviews, identifying recurring themes, patterns, and key findings, and organizing the data systematically to interpret and discuss qualitative insights, providing a structured approach to qualitative data analysis.

E. Ethical Considerations:

The research will uphold ethical standards, encompassing informed consent, data confidentiality, and unbiased conduct. Approval from the institutional review board will ensure ethical integrity.

IV. CONCLUSIONS

In conclusion, DGPS-based cadastral surveying offers enhanced precision and efficiency in land parcel demarcation and mapping. It provides accurate geospatial data, reducing boundary disputes and facilitating better land management. Embracing this technology can significantly improve land administration and promote more effective land-use planning and development.

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