LAND INFORMATION SYSTEM
AT THE SURVEY DEPARTMENT OF SRI LANKA

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ABSTRACT

Survey Department of Sri Lanka (SDSL) which has been empowered by the Survey act No. 17 of 2002 to provide land information on cadastre and other statutory surveys reaches a remarkable milestone in geo information production by launching of Land Information System(LIS). It is the key and national institution which leads all the national development projects while providing small and large scale land information.

With the commencement of the Bimsaviya Programme on Title registration in 2007, the SDSL being made attempt to achieve one of its main objective, i.e. to create LIS for the country using cadastral survey data. Digitally captured land survey data on land parcel boundaries and its related attributes are the base data in the LIS. The field surveyed data received at the LIS branch in CAD data format (spatial data) and tenementary information in personal database (attribute data) are processed in order to feed as input data to the cadastral database. After converting CAD data to ESRI format, it handled in the enterprise geo_database and visualize through web service in ESRI ARC Platform. In the LIS, it stores the surveyed parcel boundaries of the current cadastral survey data in a seamless form.

The established LIS was developed by the SDSL on ArcGIS Platform. LIS that created using Cadastral survey data (*Cadastral surveying* is the discipline of land *surveying* that relates to the laws of land ownership and the *definition* of property boundaries) is designed specifically to contain the spatial (Location related) information related to the defined Land area/plot called " land parcel".

In keeping with our mission as the best professionals in the field of geo-information production, SDSL opens its routes to geo information community for their dynamic approach towards land related information. The LIS has been designed to provide an up-to-date cadastral parcel base data to support the Title Registration related activities of the Bimsaviya Programme. In addition, the recent attempt; publishing of million (approximately) land parcel encourages in providing facility to general public for searching and viewing the surveyed land parcel under the Bimsaviya Programme. The LIS can also be used for plot level decision making by the local administrators. It could be used by the local authorities in a broad use at multi-purpose applications while facilitating to address for prevailing land related critical issues.

This Land information system provides the general public of Sri Lanka to access the details of their property and related information through the web. This is an important source of information to the public, which the ArcGIS platform provides users 24/7 access to their land information. The caption 'Land Information System' in the SDSL website; www.survey.gov.lk or direct link www.lis.survey.gov.lk privileges the users to navigate through LIS and search for desired information.

1.0 Background:

"***A Land Information System(LIS) is*** a tool for legal, administrative and economic decision-making and an aid for planning and development which consists on one hand of a database containing **spatially referenced land related data for a defined area**, and on the other hand the procedures and techniques for the systematic collection, up-dating, processing and distribution of the data. The base of a land information system is a uniform spatial referencing system for the data in the system, which also facilities the linking of data within the system with other land related data." [FIG commission 7]

The powers and functions of the Surveyor General is stated in the para 2 of the Survey Act No. 17 of 2002. The objective of the establishment of LIS at the SDSL is to accomplish three clauses specified at the para 2 (g), 2(i) & 2(j).

2(g) to receive, approve and maintain, cadastral surveying records so as to facilitate the production of cadastral survey plans and maps and to serve as a comprehensive base for integration of land information:

2(i) to be the principal authority responsible for receiving, storing and exchanging in any form all data for the purpose of Page 3 of 27 promoting the integration of surveying and mapping, geographically based information and land related information with land information system requirements;

2(j) to provide land surveying, land information and related services.

Therefore the base data for the National LIS is the digital cadastral data and we are responsible to do this.

The digital cadastral data in the LIS can be used by

a) General Public to view land information
b) Surveyors to deliver Quality assured products
c) Land Settlement officers to guarantee the land ownership and settle the land disputes
d) Registrar General to issue the Title certificate and register the land titles
e) Local authorities for broad use of multi purpose and prevailing critical issues can be attended
f) Local administrators for plot level decision making
g) Bankers to provide security for credits
h) Land administrators to develop and monitor land matters
i) Goverment to protect state lands
j) Land administrator to reduce land disputes
k) Policy makers to facilitate land reforms
l) Local administrators to improve land use planning
m) Environmentalists to Support environment management

Finally, in turn, the property right translates directly into economic development, social stability and physical well-being.

Establishment of LIS at the SDSL was initiated in 2007, with the idea of elaborating a user friendly information system among the spatial data community of the country. Since its inception, the cadastral survey data captured under the Title Registration ("Bim Saviya") program had been taken as the LIS input data source. The field survey data collected with electronic total station equipments and the tenement information as collected at field survey stage have been processed to develop the LIS.

2.0 Input Data to the LIS:

In implementing the Bim Saviya programme under the Title Registration act, the Director General of the Land Settlement Department (LSD) is responsible to select the area for the Title Registration and gazette the area. The basic unit for the Cadastral Surveys is Divisional Secretariat Division (DSD) that refers the middle level administration unit in the country. After declaration of the DSD area, the request sent to the Surveyor General for Cadastral Surveys. The smallest administrative unit namely Grama Niladari (GN) Division is the area for one cadastral map and assign the numbers in sequential manner. GN area is sub divided into number of units (blocks) when carrying out the ground survey.

In executing the Bim Saviya programme, the preliminary investigation work is carried out by the LSD and the SDSL. Officers meet the land owners and obtain the relevant documents that make ease for the planning of the survey work. During the field investigation, they demarcate the boundary points that maintained by the land owners using permanent land mark.

Then do the field surveys using electronic total stations and collect the tenementary information to produce the Cadastral Maps. Those maps are prepared in digital form according to the specifications and guide lines given in the Departmental Survey Regulations.

Land Parcel in the Cadastral map will be numbered with 12 digits as follows

i. First two digits to identify the District.
ii. Next four digits to identify the Village/ GN division in the District.
iii. Next two digits for block number
iv. Next four digits for lot number

All Land Parcels within a block (part of the Village/GN) depicted in a Cadastral Map will be assigned with serial numbers starting from one and fractional numbers or characters should not be used.

The cadastral map prepared by the field surveyors is considered as the legal document for the land title registration. Thereafter, update the land records in the District Survey archives and dispatch the digital data of the land parcel information in CAD format and the related tenementary information in personal database to the LIS branch at the Surveyor General's office.

3.0 Data Processing for LIS

The data received through Survey Requisition Information Management System (SRIMS) at the LIS branch, then follow the internal work processes in order to incorporate field survey data to build a Corporate LIS. The figure 3.0 shows the process architecture that adopted currently at the LIS branch.

The data received at the LIS branch since 2007, being checked for the format, data content and also consistency with the adjacent block boundaries. The data were pre-processed in order to convert CAD data to ESRI coverage format with 7 different layers. The CAD to ESRI ARC coverage format conversion process was automated. At data processing stage parcel polygons, boundaries and nodes were created as identical spatial entities, and the land parcel is numbered with 12-digit unique number as the key attribute for all the references. The attributes related with land parcel are separately recorded in personal database files through an interface developed as TLDB. All the datasets collected from each DSD are then populated into the main TLDB database maintained in LIS branch.

In order to adopt in the current ARC Software updates, the direct data processing to the ESRI geo-database (GDB) format was introduced in 2015 to process the field survey data. The data conversion from CAD to GDB format is automated using tools developed on python scripting at ARCGIS environment. All the work processes being enhanced using the software privileges of the ARCGIS version 10.1. At this stage, three main feature classes being introduced instead of concept of layers of the old coverage format. Parcel polygon, parcel line and parcel point are those three major feature classes currently maintained.

In the Input Data model control survey point, building foot prints and roads feature classes must be maintained with reference to the land parcel boundary. Survey control point feature class needs to be included using control surveys in future. Associated feature classes such as building foot prints and the road centerline are also created while using the parcel boundaries as background reference. At the time of introduction of enterprise GDB format, the previous framework that used as DSD also upgraded to District level targeting to create corporate LIS with seamless data for the entire country. Hence, the preparation of seamless data for the administrative district leads the creation of seamless data for the entire country.

The current work environment at the LIS branch is based on ESRI ARC server enterprise solution. ESRI enterprise geo-database solution privileges to accommodate multiple versions at single database and proves the advantage in efficient data processing. In other words we could manipulate a single data base in multiple editing environment.

The clone copy of the country GDB is then push up to the on line server to link with the LIS website.

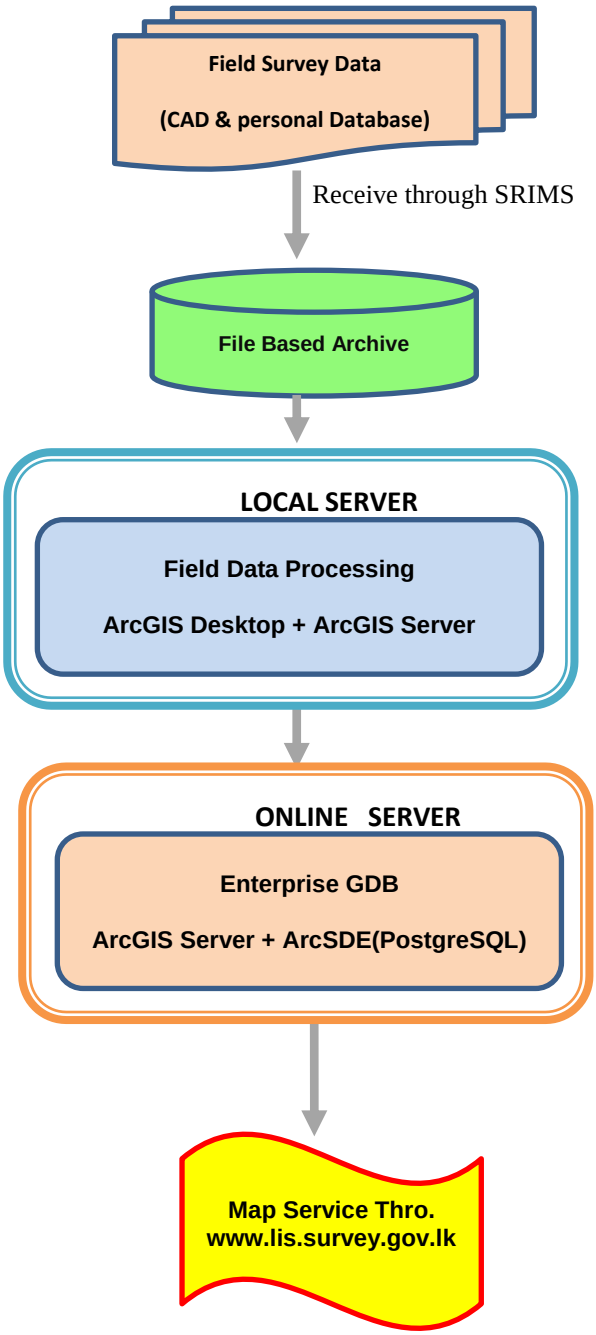

Figure 3.0 LIS Process Architecture

4.0 LIS Web Application

LIS web map service provides the general public and other interested parties, land parcel viewing facility and corresponding land information and supplements that information with ArcGIS based web mapping tools.

The application was established based on ArcGIS JavaScript API. Javascripting was used as client side scripting and PHP was used as server side scripting for development of LIS application. The application retrieves data based on specific request, through ArcGIS server and ArcSDE using the data source as PostgresSQL enterprise geodatabase. ArcGIS online basemap service is used to preform basemap feature. The application is hosted in Microsoft Internet Information Services (IIS) server.

In the LIS website users can get register and the site adminstrator will decide the users access level. There are different user levels and the registered user becomes a general user by default having lowest access rights (for eg; viewing only). Figure 4.0. shows the home page of the LIS site. The free map services such as Google Map, ESRI Images, Microsoft Bingmaps being integrated to use as a background map for convinient viewing of the parcel information in the LIS. Those free services facilitates the general user to locate the parcel of interest without any ambiguity. The intension of use of those data layers were directly depend on the current trends of information search by general internet users. It is possible to switch the user interested background data or can view only the parcel information by switch off all the background maps.

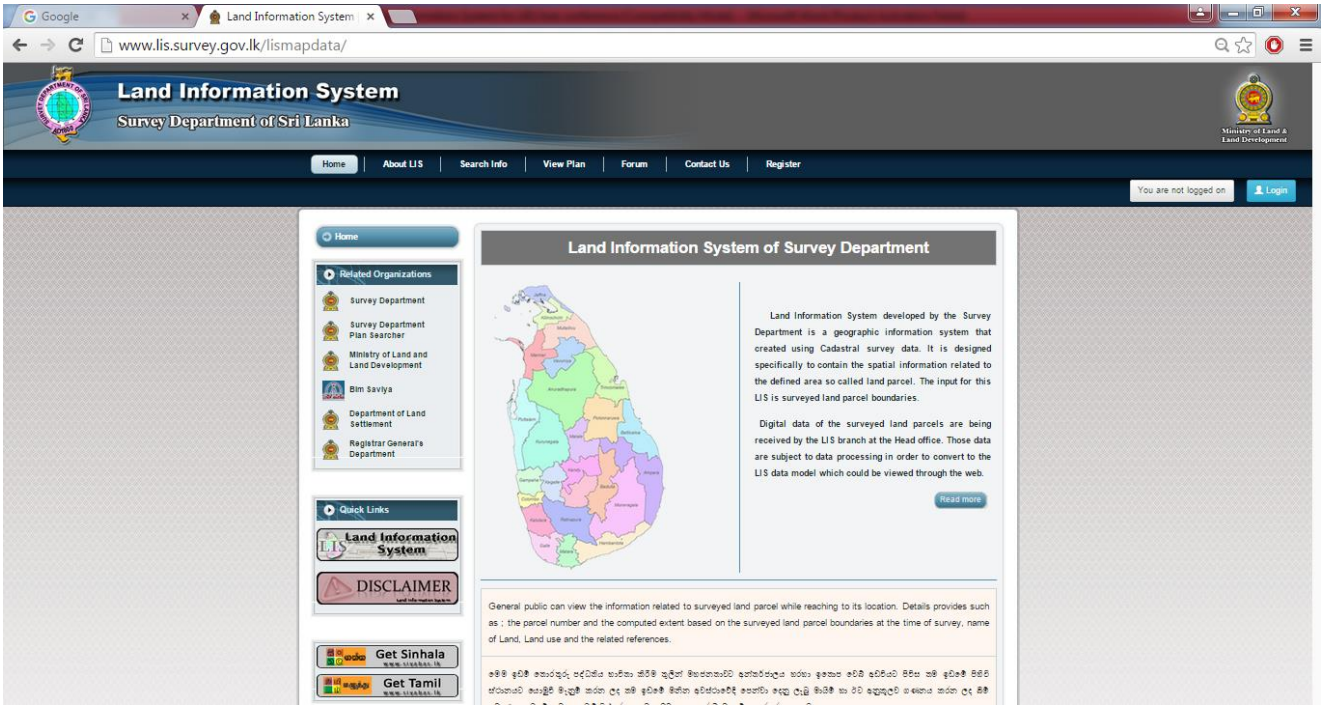

Figure 4.0 Home Page of the LIS web site

5.0 Use of LIS for Information Search

One of the objectives of the development of LIS is to share the land parcel locations and associated parcel information with the general public. The standard search option that developed in the site was targeted to find the information using specific known data fields by general user. Developing advance search facilitates the search by formulating queries. Advanced search option allowed the land administrators to use the available information for the better service delivery in transparent manner. It covers the broader objective of the development of LIS as it could be used indirectly to uplift the economic development of the country. There are about one million land parcel information is published in the LIS website.

Any user can do the information search by inserting the parcel number or by inserting the name of District, town, village, city and name of the road or nearest location. It is possible to zoom the screen view and find the detail of interest while using the known secondary information (for eg; name of the road). After reaching the location of the selected land parcel, the information related to the parcel of interest can be viewed. The figure 5.0 shows the case of simple search on parcel number.

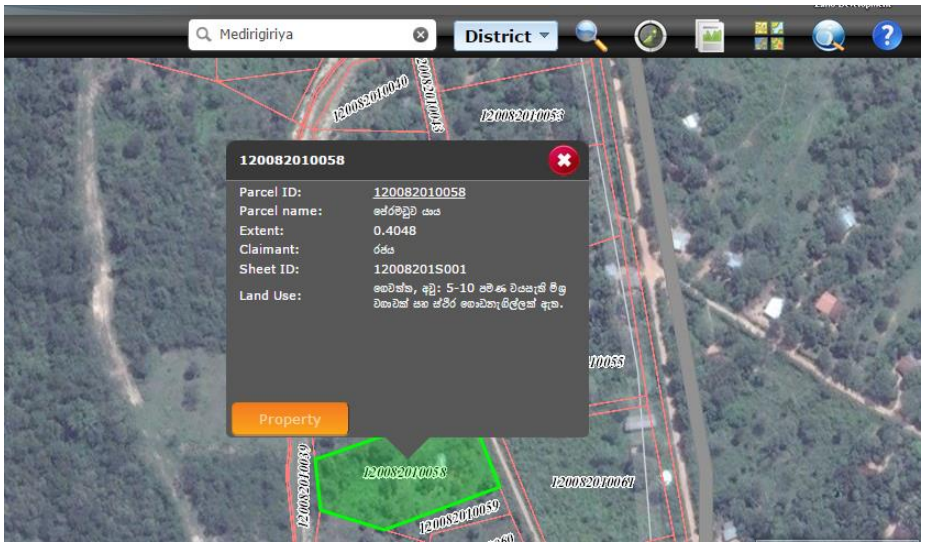

Figure 5.0. Search information of the parcel of interest.

In the advanced search, it is possible to specify the search criteria and perform the search to find the details that required. Figure 5.1 shows the results obtained after applying advanced search on the "claimant"as "state".

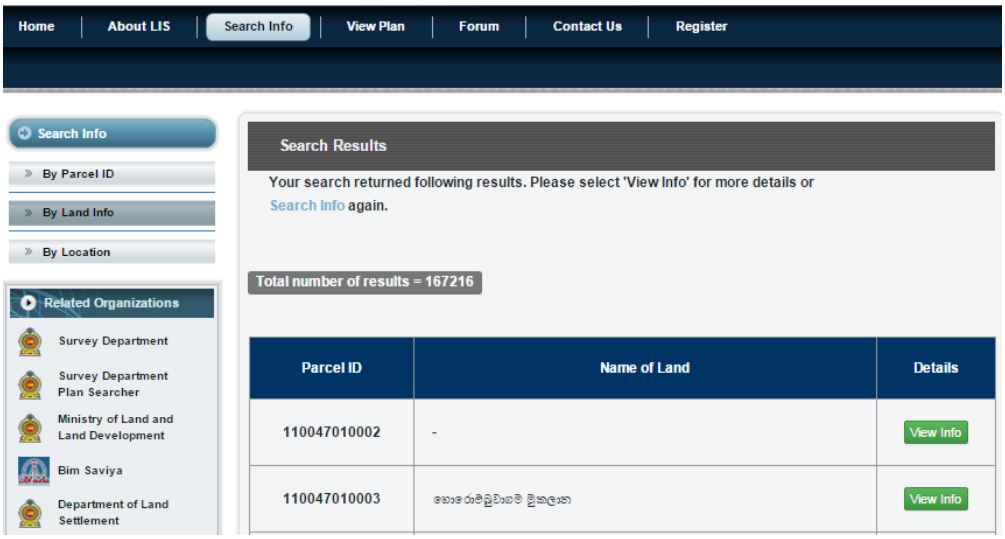

Figure 5.1. Advanced Search on "Claimant" information.

6.0 Current Issues and Future Developments

The LIS, its definition itself defines the benefits and advantages towards the betterments of modern land administration. Achieving the system benefits is merely depends on system performance. Each and every components of the system should be efficiently managed to result the ultimate system goal.

Surveyors are now being asked to generate intelligent electronic records to populate databases that will generate the electronic model of the cadastre for administration and operations management. Therefore, the LIS, as an information provider should possess numerous entities related with non-spatial attributes to satisfy the system users. In the prevailing context, the database that used by the field surveyors; the main info provider to LIS at field survey stage, has been developed aiming to archive the conventional Tenement List electronically. It has been resulted towards an ambiguous situation in LIS data analyzing and manipulation. Therefore, sharing of parcel related information among client organizations may be affected with critical drawback in inconsistency of non-spatial information. Hence, Tenement information related to each land parcel should be re-classified in order to elaborate an effective LIS. So that the LIS system itself will be capable of manage and update those associated data.

Another issue is the users of the system need frequent and real time updates. In order to maintain the timely information in the LIS, the subsequent surveys are currently processed in the versioned GDB and maintained the history of the changes. However, it could not directly translate into the web map to view the history record of the land parcel. Therefore, there is no proper method to track the current status of land parcels in the LIS system. It is one drawback in the existing data structure that used in the SDSL LIS and need to solve in future.

There are limitations in the use of the system for data analyzing and the classification on the site and need to be improved advance land information search facility with more comparison operations.

The parcel boundary layer in the LIS is not properly coinciding with the base map due to the two different accuracies of the parcel information and the basemap.

The current information available in the LIS needs to be shared with the client organization who worked on parcel base activities. The identified major stakeholders in government sector are Land Commissioners Department, Registrar General's Department, Local Authorities, Land Settlement Department and the Valuation Department and the Registered Licensed Surveyors, Real Estate Managers in the private sector.

It is required to add more tools and develop necessary application interfaces for providing services such as the identified stakeholders to upload/update facility of their custom data, improved navigation using coordinate information and information sharing with the authorized users in order to serve the efficient land administration.
However, within improved LIS, it will represents spatial and more non- spatial parcel information as the foundation of modern electronic land administration which underpin good governance and decision making in public and private domains.

References:

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