GENERATION OF A USER FRIENDLY SPATIAL INFORMATION SYSTEM FOR THE REHABILITATION AND RESTORATION OF SMALL SCALE IRRIGATION SCHEMES IN SELECTED 5 DIVISIONAL SECRETARIAT DIVISIONS IN HAMBANTOTA DISTRICT

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ABSTRACT

This paper attempts at identifying, collection, and analyzing of small-scale irrigation systems and introduction of a spatial information system for small scale irrigation systems as an attempt to fulfill the requirement of many government and non governmental organizations.

For the first stage of SIS (spatial information system), 5 DS divisions were selected from Hambantota district namely Ambalanthota, Weeraketiya, Beliatta, Angunukolapelessa and Tangalle representing highly dense, highly cultivated and lower population dense areas. The selected area consisted with a good network of small scale irrigation schemes. However at present most of these tanks and irrigation systems are isolated while some have partly incorporated into major irrigation schemes like Lunugamvehera, Veheragala, and Walawe Left bank Development project. Remote sensing and GIS were used for the extraction of command area, water surface area of the tanks and the cascades from the satellite image IRS LISS 3captured on 2002.02.02. Different kinds of methods such as field visits, GPS survey, Publications of Divisional Secretariat's offices, Site visiting to local sub offices of different government bodies were used for data collection. The research was guided to understand water resources, cascades and their physical environments, socio economic and institutional environment.

A requirement was raised to identify what are the functioning and non functioning irrigation schemes in the area when newly rehabilitation projects are being introducing to the area. Thus using GIS technique as the main tool with the help of other software such as MySQL, PHP, and Dream Weaver, a complete MIIS (Minor Irrigation Information System) was created for the area. GIS helps in giving data with the spatial locations of irrigation systems while other soft wares used for creating the interface for the MIIS. The final out put gives information about irrigation schemes as well as important data of each DS division in GN division level with update facilities. The introducing MIIS is very user friendly thus, users without high computer literacy also will be able to access the system. In the next stage complete database will be created covering almost all small scale irrigation systems in Sri Lanka.

KEY WORDS
Data base, GPS survey, RS and GIS, Satellite images

INTRODUCTION

Although a large number of minor tanks are operational at present, a considerable proportion lies abandoned. Even with operational minor tanks overall capacity is very much lower when comparing with demand. Higher rate of evaporation too has adverse effects. To manage water accumulation during the rainy season existing drainage system is incapable. In the case of rehabilitation or future development works in the area proper understanding of problem domain is essential. In simple, Prioritization of area or irrigation systems, based on utilization purposes, demand, geology, litho logy, Rain fall, run off, should be carried out before any rehabilitation or implementations in order to result the best. The irrigation capacity of minor tanks varies at a great deal and is governed by the size relationship of the catchments, tank and command areas. It is to identify and to select cascades and also to identify the most recent land cover conditions

of the catchments area. Further Geographical Information Systems (GIS) area the results of many parallel developments in many separate spatial data processing disciplines such as remote sensing technology interpolation from point data spatial analysis surveying and photogammetry etc. Therefore the information derived through remote sensing topographical and landuse maps, literature and field visits can be analyzed using GIS to develop above sustainability indices and for the mapping of gathered information. Thus GIS is a tool for collecting, storing retrieving at will, transforming and displaying data from real world for particular set of purposes. Since GIS is capable of incorporating many layers of geographical information, this tool can be used to create proper spatial databases.

Nearly half of the demand for water in dry zone of Sri Lanka is fulfilled by more than 17,000 small-scale irrigation systems. These are dispersed all over in the island.

The Requirement for a central data management system is critical as there are no such data bases to serve requirements of researches, decision makers and general public as well. Although there is a ministry and few other government organizations to take care about small-scale irrigation schemes in Sri Lanka there is no central database to provide detailed data on these schemes. The existing data related to small-scale irrigation schemes have been collected to serve special purpose or isolated in rural offices, called only when a certain massive scale development schemes or any other major requirement occurs.

The different government institutes collect data to serve different purposes. For example irrigation department have only the estimates and bids of recent reconstructions and implementations as they provide financial and technical assistance for reconstructions and implementations of small schemes which recommended by Agrarian services department. Agrarian services department is the legal body to take care small-scale irrigation systems in Sri Lanka. The regional offices and sub-offices collect, store and maintain data locally. There is no standard format for data acquisition but all offices collect essential details and some additional factors depending on the region. Data have

been recorded in books in written format, isolated in regional offices and no proper centralized data management system.

MATERIALS AND METHOD

In the context of rehabilitation and restoration programs of small tank cascade systems, the donors and government are concerned with making best use of their limited funds. Thus the following steps describe the methodology of MIIS for one click view of the required data for above organizations.

Study Area

Figure 1. **The study area is situated in Hambantota district of Southern Province of Sri Lanka**

The study area is situated in Hambantota district of Southern Province of Sri Lanka. For this research 5 DS divisions were selected considering the time duration for the research and accessibility to small tanks in the area. The selected cascades are from DS divisions of Angunukolapelessa, Weeraketiya, Tangalle, Beliatta and Ambalantota.

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Materials/soft wares used

1. IRS PANCHROMATIC image (14.02.2002)
2. IRS LISS III MSS image (02.02.2002)
3. Topographical Map sheets covering the selected area (No. 87,88,91,92)
4. GPS data
5. Ancillary data collected from divisional secretariat's offices
6. Field in-situ data
7. GIS soft wares
   - Arc view 3.2a
   - Arc GIS 9.0 (Arc Map)
8. Remote sensing soft wares
   - ERDAS Imagine 8.7
9. Other soft wares
   - MySQL, Dream weaver, PHP

Methodology

Figure 2 describes the methodology in nutshell

Role of RS and GIS

- Geometric correction was done for two satellite images and for the topographical map sheets covering the selected area to remove the distortions and to give the local Transverse Mercator coordinate system to source data.
- Resolution merge was carried out to join IRS PANCHROMATIC image with MSS image to get a better resolution to MSS image
- The study areas; 5 DS divisions and all Grama Niladhari (GN) divisions were demarcated with the help of GPS data and topographical map shhets
- Tanks in each GN division were identified and located with the help of insitu field data, GPS data and topographical map sheets
- Two types of databases were created to give important information about each GN division (GN Name, Code, Area, databases in GIS and PHP and Dream Weaver supplies the better format to access to maps.
- Total Population, etc) and tanks(Tank Name, Location, Code, Area,

Present Condition, etc) in each GN division separately to gain the clarity of data presenting in MIIS

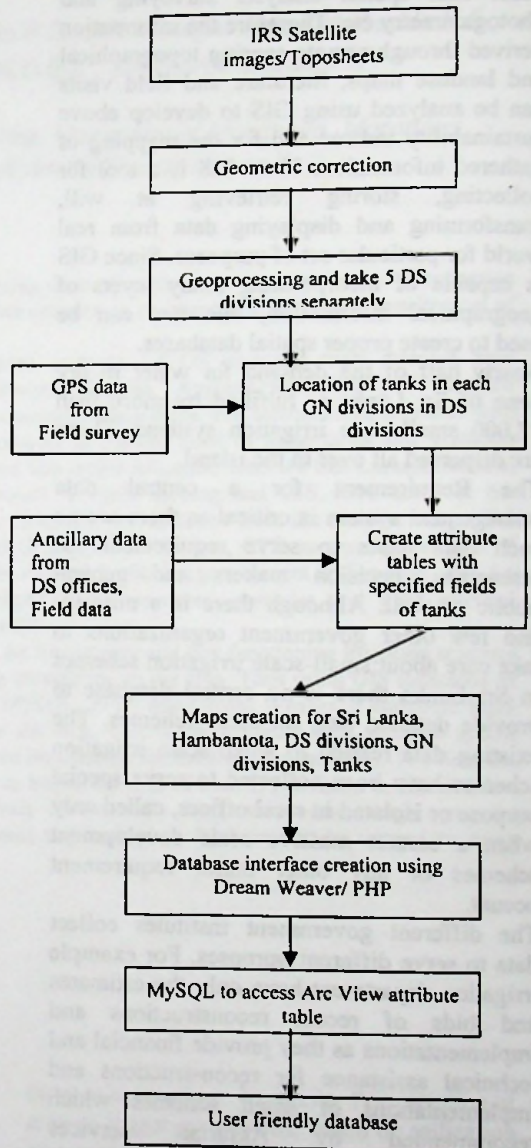Maps were created to show the spatial location of tanks in each GN

Figure 2. complete flow chart of methodology

- division separately to support with the database.

Role of other software

After creating all necessary maps and two databases for the MIIS, the interface for the better access to the data in MIIS was created using MySQL, PHP and Dream Weaver. MySQL supplies the interface to access to the

RESULTS AND DISCUSSION

This database has been designed in a way that, it can be making available in internet, easily accessible and can be updated easily. Updating and modification of the data can be done online. The interface contains two types of logins.

1. administrator login
2. normal user login

Only the administrator has privileges for updating. Normal users only can access the available data and no any updating privileges.

Normal user login

Three types of data groupings were organized in the database for normal users.

1. data as an entire table view (DS division, GN division, Codes, No. of tanks, etc)
2. data for GN divisions (GN name, code, area, population, etc)
3. data for each tanks in each GN division (tank name, code, area, condition, etc)
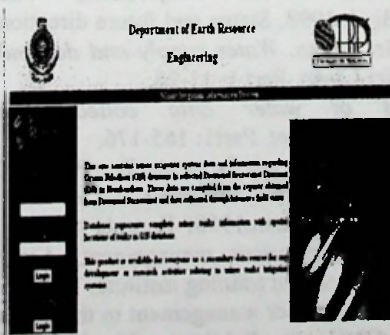
Following steps describes the normal user interface

Figure 3. Login Interface of The Database.

By clicking on the selected GN division, user can access to the database representing

important information about the selected GN division. From the link "Tank information" of the above Gn information interface, user can
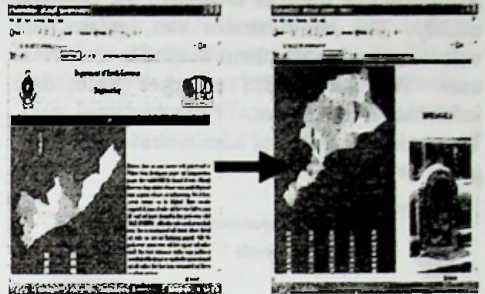

Figure 4. Interfaces for the Access to GN Divisions

DS DIVISION	TANGALLE
DIVISION ID	8309
CODE	8309
DISTRICT	HAMBANTOTA
GN CODE	238
GN NAME	GURUPOKUNA
AREA (ACRES)	779.928
PERIMETER (m)	8266.8
TOTAL POPULATION	456
POPULATION (MALE)	213
POPULATION (FEMALE)	243

Figure 5. GN Database

VILL_NAME	VILL_CODE	TANK_NAME	TANK_ID	TANK_
GURUPOKUNA	238	UDAWEWA	238 1	2734
GURUPOKUN	238	UDAWEWA	238 1	2734
KARANDAMODARA	239	ALIYAMALAMULLA	239 7	4163
KARANDAMODARA	239	THILLAWATANA 1	239 2	3951
KARANDAMODARA	239	THILLAWATANA	239 5	1431
KARANDAMODARA	239	JAMBUGASMULLA	239 3	4053
KARANDAMODARA	239	ISKOLEOODA	239 4	1845
KARANDAMODARA	239	BOYARA	239 6	1716
KARANDAMODARA	239	BOWENDA	239 7	1854
NIDAHASGAMA_E	240	KOTIYAGE	240 1	1269
NIDAHASGAMA_E	240	GALPOTHUMULLA	240 2	3014
NIDAHASGAMA_E	240	ELAYAN ALLU	240 3	1715
WELLODAYA	242	HATHUTITIYA	242 1	7013
WELLODAYA	242	PINWEWA	242 2	5573
WELLODAYA	242	LANDE WEWA	242 3	3297
WELLODAYA	242	PINGAMMULLA	242 4	2475
WELLODAYA	242	WEKADA WEWA	242 5	3429
WELLODAYA	242	GINIKULU WEWA	242 6	2156

Figure 6. Complete Database

access to the database representing all the information of tanks in the GN division with the spatial representation of tanks. This will be more time effective when the user knows exactly which GN division he wants to check in detail. To view all the information of

selected DS division user has a separate interface.

Administrator login

Administrator login is to update the database mainly. The administrator can update data with time and make them available to normal user. Thus the MIIS supplies upto date information to the user.

The main interfaces of administrator login has given below.

Figure 7. Interfaces for Administrator Login

CONCLUSION

Remote Sensing and GIS is important for spatial data extraction and creation. However GIS is a spatial database, it can be used only for professionals in GIS, thus for the advantage of normal users, another option has to be used. Thus MIIS filled that shortage, since without any knowledge about GIS packages; user can acquire the information of tanks with correct spatial locations of tanks. Further MIIS causes to gather the information which was isolated in several local authorities to save the time of user to collect information.

RECOMMENDATIONS

Following recommendations are proposed for the future studies.

- Use of high resolution satellite images (IKONOS/ QUICKBIRD) for the accurate demarcation of cascades and non cascades irrigation schemes will make the database more systematic
- It is recommended to check quality of water to identify the tanks with the water quality base (for direct drinking, drinking after boiling, for bathing, for other purposes, etc)
- Expansion of MIIS to whole country will gather all the spreaded data into one simple format

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