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GIS FOR RURAL ADMINISTRTION

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ABSTRACT

Planners and decision-makers, have to depend upon spatial and aspatial data for effective planning and decision making. Hence, they need to have at their disposal a sophisticated data management system. Large volume of data is gathered whenever preparation of physical plan is taken up and a good number of maps as a part of the exercise on plan formulation are also prepared. The developments taking place in introduction of Information Technology as an operational tool have given chances for the availability of various software, GIS packages and computer databases in district Collectorates and major offices. Hence there is a need for an "Management Information System" to query and extract information from the GIS created, which should be capable of handling the massive aspatial data and spatial data, for taking decision for optimum utilization of available resources in the respective panchayat, townpanchayat, municipality or corporation. The main objectives of the study are creation of database on 1: 50000 scale for spatial and aspatial data and development of user interactive queryshell. Spatial database pertaining to natural resources were interpreted using IRS 1C LISS III imagery. Road/Railway network was taken from Survey of India toposheet. Administrative boundaries of district, taluk, panchayat villages were delineated using district, taluk and census village maps respectively. Aspatial data were collected from each panchayat village, town panchayat, municipality and corporation. The database pertains to the year 1998. Using ARCINFO workstation, maps were digitized. Aspatial data were fed using Microsoft Access 97. Customization was done using the modular design concept in ArcView application development environment to provide an easy interface for the user.

The Model MISRP(Management Information System for Rural Planning) created can be used for any district of Tamil Nadu. The study was carried out in the following aspects ; (i)for identifying the villages that are satisfying the norms for JGSY (Jawahar Gram Samridhi Yojana) and selecting the particular village for development in each block. Salem district with its 386 panchayat villages, 32 town panchayats,3 municipalities and 1 corporation were taken; (ii)for generation of land resources action plan for existing landuse by using the CLDU (Composite Land Development Unit which is an integration of various natural resources), Kariyapatti town panchayat of Attur block in Salem district was chosen. Based on the user needs, queryshell and user interactive menus are designed in the MISRP model.

1.0 INTRODUCTION

Recent technological advances in domain of spatial technology are making considerable impact in planning activities. This domain of planning is of prime importance for countries like India with varied geographic patterns, cultural activities etc. The purpose of using GIS is that, maps provide an added dimension to data analysis which brings us one step closer to visualising the complex patterns and relationships that characterize real-world planning and policy problems. Visualization of spatial patterns also supports change analysis, which is important in monitoring of social indicators. This in turn should result in improved need assessment.

More advanced spatial analysis may include the combination of different data layers. Health authorities, for example, may be interested in estimates of the number of children in a certain age group that may be exposed to malaria. Climatic and topographic data can be used to determine the range of malaria mosquitoes. This range in unlikely to follow the panchayat boundaries, but in GIS the two data layers can still be combined to derive the number of children living within the affected areas in a particular panchayat village. In short, the availability of statistical and other information in spatially referenced form and the functions provided by a GIS could allow analyses that were previously too expensive or impossible to perform. Many works have been carried out in this aspect as "Block level agro-regional planning integrating Remote Sensing and GIS technology, "Geographical Information System for planning rural development programmes" and "GIS approach to suggest landuse alternatives for sustainable rural development"(Arun Chaturvedi et al (2001); Baburajan K.B (1996); Murthy Y.V.S et al (1997)). Considering the various works,steps has been taken to include all these modular programmes into one unit as MISRP (Management Information System for Rural Planning)model.

2.0 NEED FOR THE STUDY

Planning is now a widely accepted way to handle complex problems of resources allocation and decision-making. It involves the use of collective intelligence and foresight to chart direction, order harmony and progress in public activity relating to human environment and general welfare. In order to provide a more effective and meaningful direction for better planning and development necessary support of the organization has become essential. Hence the need for a suitable information system is increasingly being felt in all planning and developmental activities, whether these are for urban or rural areas. The void in handling spatial data is overcome by a Geographic Information System (GIS), defined as: Computerized information storage, processing and retrieval system that have hardware and software specially designed to cope with geographically referenced spatial data and the corresponding attribute information (Stan Aronoff (1989)). With the integration of geographically referenced data with attribute data, it then becomes possible for the resources planner to examine the interrelationship between various data and get answer to many "what if" situations. The most important feature of GIS is its analytical function, computer-aided mapping and database management support.

3.0 OBJECTIVES

The main objective of the study is to create a Management Information System for Rural Planning for decision making by the administrators. The above objective is proposed to be accomplished in the following steps

1) Creation of Database on Natural Resources, Aspatial data
2) Development of query shells for decision support system
3) Customize the query shell to provide interface to different databases
4) Synthesis and analyze the multi thematic information in conjunction with socio-economic data and spatial data.
5) Statistics and report generation at various levels of selected themes
6) Extract and present information on user specified decision rules and scale
7) Composite Land Development Unit for the user to derive his action plans

4.0 METHODOLOGY

Spatial Database Organization

The spatial data base has been created on ARC/INFO workstation and the total spatial database organization involved the process of identifying the contents of spatial data and also the actual process of creating the database in ARC/INFO. In order to obtain the information sets, Different types of primary input data sets have been identified most of which are on 1: 50000 scale are prepared using remotely sensed data and the ancillary data. The primary elements of spatial database are as follows :

1. **Administrative Map :** Administrative boundaries (district, taluk, panchayat village) were delieanated using district, taluk and census village maps cross verified with the adangal register of the village.
2. **Landuse / Landcover Map :**The term Landcover relates to the type of features present on the surface of the earth. Corn fields, lakes, maple trees and concrete highways are all examples of Land Cover types. The term Landuse relates to human activity or economic function associated with a specific piece of land. This theme was prepared from IRS IC LISS III imagery by Visual Interpretation . the classification was done upto second level.
3. **Geology or Lithology Map:** It involves the identification of landforms, rock types and rock structure (folds,faults,fractures) and the portrayal of geologic units and structure on a map or other display in their correct relationship with one another. This theme was also prepared from satellite data
4. **Geomorphology Map :** It depicts the landforms, It is an input layer to derive ground water potential map. It was prepared by using remote sensing data on 1: 50000 scale.
5. **Soil Map :** Shows the different soil types on 1: 50,000 scale. This was prepared in consultation with the district soil survey report apart from satellite data.
6. **Slope Map :** It shows the sloping categories at 1: 50000 scale. This derived module from contour and spot heights (Elevation map) taken from Survey of India topo sheets.
7. **Drainage Map :** Showing the details of drainage and the water bodies. Which are prepared from SOI topo sheets.
8. **Watershed Map :** It is a hydrological unit area draining the runoff into a river or reservoir or a pond or a common point having its own natural drainage system and respond more effectively to the various management techniques to maximize production. This map is a derived map from drainage theme delineated up to micro-level watersheds.

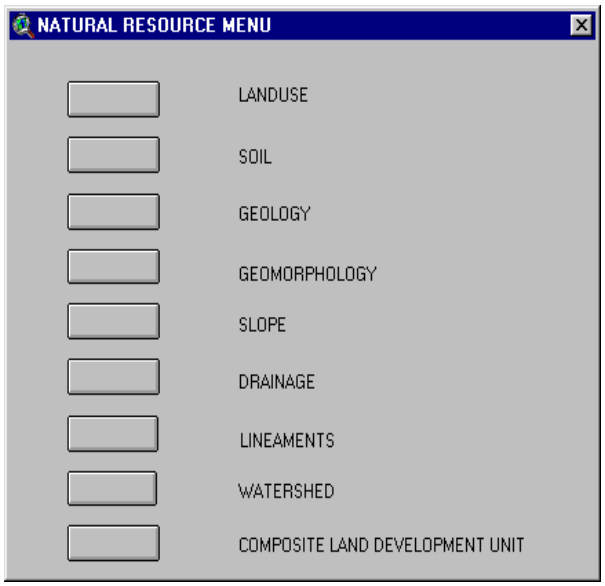
9. **Transportation Network Map :** At 1:50,000 scale the map shows the different road network available in each panchayat village. Details of national highways, state highways, major district roads, other district roads, panchayat union road and panchayat road are plotted on the map.
10. **Composite Land Development Unit :** The composite land development unit categorizes resources into one category for development of particular land use. This has been achieved by discussions with various resource scientists and the local officials for appropriate grouping of the polygons of different resources. The limitation factors are also considered for this purpose. This theme is prepared by the union of land use, groundwater potential, slope and soil map.

Aspatial Database Organization

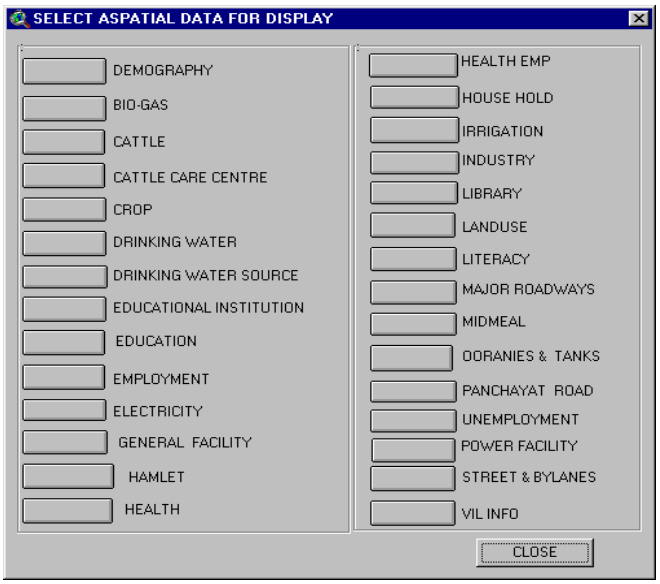
The aspatial data is organized on Microsoft Access 97. It consists of demography, health, drinking water, cattle, education, employment, electricity, irrigation, house hold, industry, roads , collected from each panchayat village by circulating a questionnaire.

Customization Of MISRP

Application development environment to program the user requirement and bundle the application with the user specific functionalities is supported by Arc View's programming interface, Avenue, a compiled language is a versatile environment to develop and distribute applications. Avenue is fully integrated with Arc View and the work done will run on any of the platforms for which Arc View is available. It provides the necessary customization and language environmental tools in an easy to use framework to see the results right away. The graphical user interface (GUI) provides some graphical controls that the user will interact with, fine tune the behavior and appearance of those controls provided by the MISRP.



Dialog box showing the spatial information

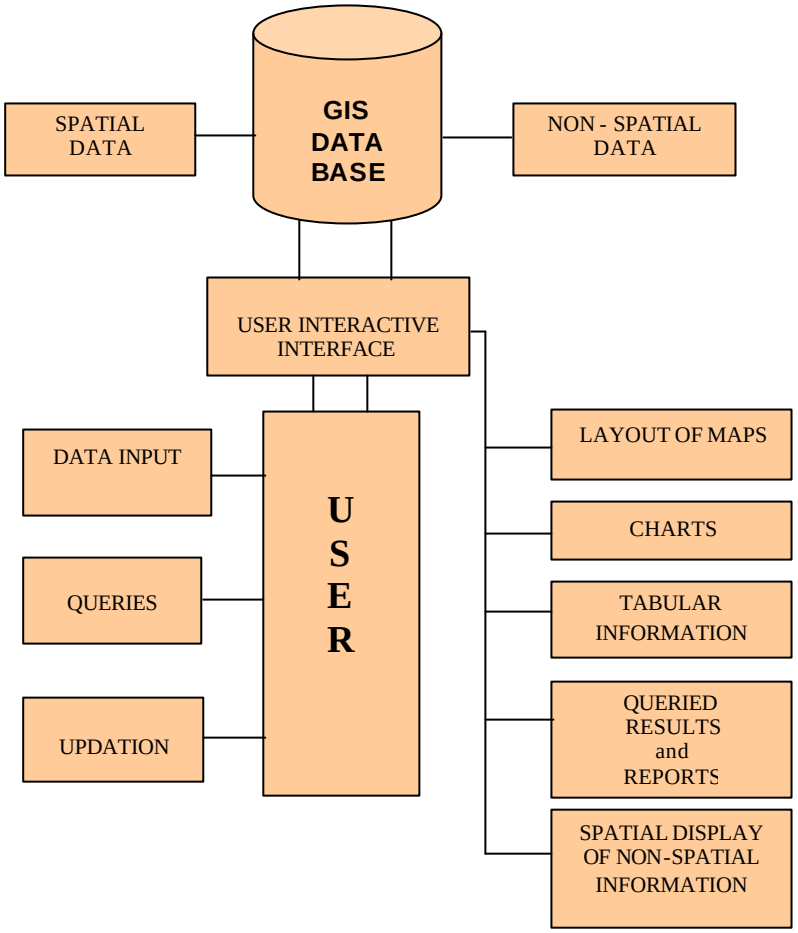


Dialog box showing the aspatial information

4.0 CASE STUDY

The Model *MISRP(Management Information System for Rural Planning) created can be used for any district of Tamil Nadu.* The case study was carried out in 3 aspects for Identifying the villages that are satisfying the norms for JGSY (Jawahar Granm Samridhi Yojana) and selecting the particular village for development, for this case study *Salem district with its 386 panchayat villages, 32 town panchayats,3 municipalities and 1 corporation was taken.* The second case study is to generate action plan for suitable landuse by using the CLDU (Composite Land Development Unit which is an integration of various natural resources), *Kiriyapatti town panchayat of Attur block in Salem* district was chosen for action plan generation for suitable landuse

ORGANISATION OF MISRP MODEL



4.1 Jawahar Gram Samridhi Yojana

Jawahar Gram Samridhi Yojana (JGSY) is the restructured, streamlined and comprehensive version of the erstwhile JawaharRozgar Yojana (JRY). It has been launched on 1st April, 1999. It has been designed to improve the quality of life of the rural poor by providing them additional gainful employment. The primary objective of Jawahar Gram Samridhi Yojana is the creation of demand driven village infrastructure including durable assets to enable the rural poor to increase the opportunities for sustained employment. The secondary objective is the generation of supplementary employment for the unemployed poor in the rural areas. SCs/STs, families living below the poverty line and physically handicapped persons of the villages are the target group .

4.!.1 Criterion for JGSY

SQL design to find the villages eligibile to implement the JGSY Scheme

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SELECT [VILLAGE NAME].BNAME, [VILLAGE NAME].VNAME, [HOUSE HOLD].TNO_ST_HH_POV,
[HOUSE HOLD].TNO_SC_HH_POV, UNEMPLOYMENT_INFO.TNO_HANDICAP, [VILLAGE
NAME].VCODE, [VILLAGE NAME].TNAME
FROM ([HOUSE HOLD] INNER JOIN [VILLAGE NAME] ON [HOUSE HOLD].VCODE = [VILLAGE
NAME].VCODE) INNER JOIN UNEMPLOYMENT_INFO ON [VILLAGE NAME].VCODE =
UNEMPLOYMENT_INFO.VCODE
GROUP BY [VILLAGE NAME].BNAME, [VILLAGE NAME].VNAME, [HOUSE HOLD].TNO_ST_HH_POV,
[HOUSE HOLD].TNO_SC_HH_POV, UNEMPLOYMENT_INFO.TNO_HANDICAP, [VILLAGE
NAME].VCODE, [VILLAGE NAME].TNAME
HAVING ((([HOUSE HOLD].TNO_ST_HH_POV)>0) AND (([HOUSE HOLD].TNO_SC_HH_POV)>0) AND
((UNEMPLOYMENT_INFO.TNO_HANDICAP)>0));
```

4.1.2 Results of JGSY

Among the 386 panchayat villages,72 panchayat villages were selected for implementing the JGSY scheme using the MISRP model. The selected panchayat villages covers 18 blocks out of 20 Blocks of Salem district as shown in Fig 4.1 depicting the spatial distribution of the villages selected for the implementation of the JGSY scheme. Fig 4.2 depicts the no of panchayat villages where JGSY is to be first implemented in each block.

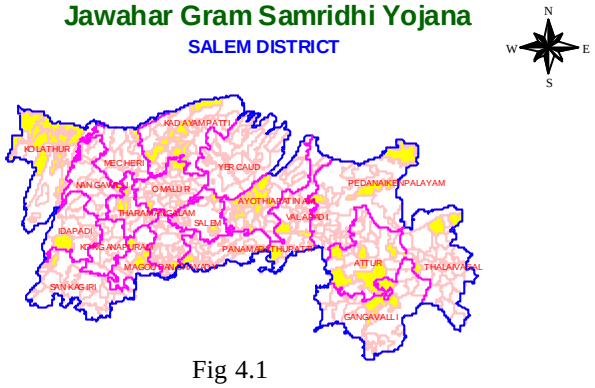

Fig 4.1

Panchayat Villages satisfying the criteria for JGSY scheme, Salem District

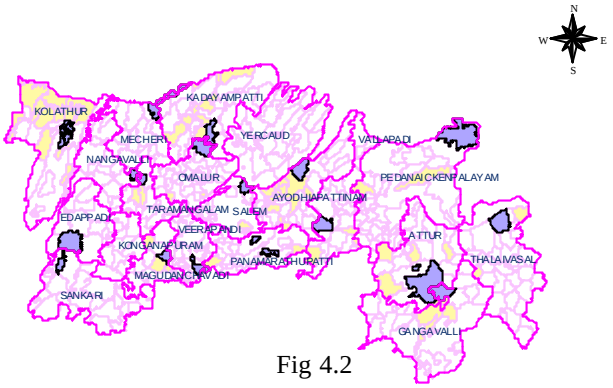

Fig 4.2

Panchayat Villages where JGSY is to be first implemented , Salem District

4.2 GENERATION OF LAND RESOURCES ACTION PLAN

The farmers are unaware of the potentiality of their land, due to general agricultural practices,which they do not yield much, and their land is kept idle. A scientific approach to the problem may yield better to the farmer with respect to cultivation and income. In MISRP using the natural resources information from satellite data a composite land development unit were created by integrating the various thematic layers like landuse, soil, groundwater potential and slope maps. A criterion table was developed for GIS integration and presented in the table 6.2. On substitution of the criterion with the CLDU an action plan was generated. Kariyapatti Town Panchayat of Attur block in Salem district having a geographical area of 2399.9 Hectare, has been chosen for this study **.** The Various themes used for integration of CLDU are discussed below :

Geomorphological map: Six kind of landforms were observed as, burried pediment deep, pediment, pediment inselberg, residual hill, structural hill and settlements.**Ground water potential map:**This is derived map from geomorphological map, four type of ground water potential zones identified as , good, moderate to poor, poor and nil.**Slope map:** Kariyapatti town panchayat has varying slopes like, mild slope (1 to 2%),very gently sloping (2 to 3%), moderately sloping (5 to 10%), moderately steep (15 to 35 %) and very steep slope (> 35%) . **Soil map :** Texture wise classification has been done, only two categories are observed , in the study area viz., clay loam and clay loam - sandy loam. **Landuse map:**Under this theme five categories of landuse was classified as, barren land, forest, settlements, rainfed crop and rock out crop.

4.2.1 Present Landuse

The present landuse was interpreted from LISS III, satellite imagery dated february 1996.Classification has been done upto second level. Major part of the landuse contributes to rainfed crop as 61.91%, Forest area is covered upto 18%,15.27% is the area covered by the barren land, Rockout crop contributes to about 4.37% and settlement area is about 0.45%.

4.2.2 Proposed Landuse By Misrp Model

After integrating the natural resources as CLDU, with the necessary criterion using the criterion of MISRP The action plan is generated.The results of the action plan are as, dry farming with soil conservation measures is proposed for 40.02%, afforestation / forest regeneration with suitable species adaptable to the ecology is proposed for 34.52%, agro horticulture (predominately agriculture) is proposed for 6.84%, horticulture / fruit bearing trees is proposed for 6.84%, and social forestry (fuel wood & fodder) is proposed for 5%.

a) Proposed landuse for rainfed crop

Among the proposed landuse for rainfed crop, about 57% of rainfed crop is proposed for dry farming with soil conservation measures, 18 % is proposed for agro horticulture (predominantly agriculture),10% is proposed for

afforestation or forest regeneration with suitable species adaptable to ecology, 8% is proposed for horticulture or fruit bearing trees, 4% is proposed for agro forestry (predominantly agriculture), 2% is proposed for social forestry(fuel wood and fodder)

b) Proposed landuse for barrenland

About 15 % of landuse of Kariyapatti town panchayat constitutes of barren land .This barren land can be put into use as, afforestation or forest regeneration with suitable species adaptable to ecology for 48%, agro horticulture (predominantly agriculture),for 24%, agro forestry (predominantly agriculture) for 12%, horticulture or fruit bearing trees for 9% and dry farming with soil conservation measures, for about 6 %

c) Proposed landuse for rockout crop

The rock out crop has poor ground water prospects and it constitutes to about 4% in the total landuse of Kariyapatti town panchayat.Social forestry (fuel wood and fodder) is proposed for the entire rockout crop.

5.0 CONCLUSION

The need for cost effective PC- based GIS solution for developmental activities are met by the system. The GUI of the system proves to be a user friendly interface for spatial and aspatial information retrieval which supports users with minimal computer knowledge for access of spatial information. The system also serve line departments such as Agriculture department, Agriculture Engineering Department, Highway department etc., in retrieval of base map which is a pre-requisite for any field survey that has to be carried out in the area. The topological-querying feature of the system helps the user to make analysis on multiple themes, such as integrated analysis on soil and slope map for erodability nature of the area of interest.

The primary utilization of the system rest with the user in retrieving information, querying information on spatial and aspatial data, print output of the maps at user defined scales and extent, make an integrated analysis on spatial and aspatial data, in order to carry out topological query such as define a buffer region around user point of interest, perform query on multiple themes simultaneously. The strong point of the system is the ability to display tabular data spatially on the theme, which is a prime utility for planners in making structured decisions based on the geography of the area.

6.0 RECOMMENDATIONS

The MISRP model can be interconnected through the internet by connecting all the blocks (panchayat union) , since all of them are computerized . This facility would enable the end user to serve maps on the internet allowing them to do updation and querying sitting at one place. Frequent updation of the aspatial database has to be done once in a year to keep the system alive. Updation of the landuse is recommended for once in two years.The scale of spatial data can be improved on large scale for microlevel planning, as the data products become easily available along with a less cost. Hamlet wise information can be built up to strengthen the database for microlevel planning. The MISRP model is developed on a stand alone system, this can be further developed for multi-user environment with distributed databases. Thus, keeping in mind the requirements of planners' need of spatial and aspatial data, the ***Management Information System for Rural Planning (MISRP)*** has been systematically designed such that the MISRP becomes a handy tool for arriving at concrete decisions for governmental administration.

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