Assessment of Hydro-potential by using Remote Sensing & GIS Technology

Rajendra Kumar Patel, Jyoti Sarup, Ruchi Khare

Abstract: Now a days as the power or electricity is playing very important role in the human life, its create a very ease life for the human, the non-renewable energy such as coal energy, petroleum, natural gas depleting very fast, so we focus on renewable energy sources such as the solar energy, wind energy, thermal energy, hydropower plants etc. The objective of this study to discuss various methodology used for generating the power, hydropower plant is our focus area for the generating electricity and the site selection is done by using GIS (Geographic information system), hydropower plant is one of the most popular pant for the hilly region, it is very less polluting source which generating the energy in efficient manner. The GIS play a crucial role for the hydropower plant site selections; here in this paper we provide comparative study for the review various GIS based applications.

Keywords:- Geographic information systems, Hydropower plant, Renewable energy sources, data warehouse.

I. INRODUCTION

Geographic information systems provide for the archiving, retrieving, and manipulating of data and information that have been collected from the heterogeneous sources and then stored in a organized manner with having indexing value by given coordinate elements. A geographic information system can be used for storing, manipulating, and displaying a three dimensional model of a geographic area. The number of applications are covered under the Geographic information systems such as the renewable energy system plant locations like hydropower plant, in the field of agriculture like digital agriculture, for the generation and distribution of electricity like smart grid controlling system, in the managing of smart traffic management like highway disturbance system etc.Geographic information systems used the computer system to deal with the geographic data and information or any other map for store and process of data, it is provide the systematic management of large amount of databases or data warehouse system for the various databases.

The below figure provide the architecture of data warehouse in the geographic information systems. Here the sources of databases are heterogonous means we can collect the databases from any sources such as the internet or any other websites which contain the variety of databases.
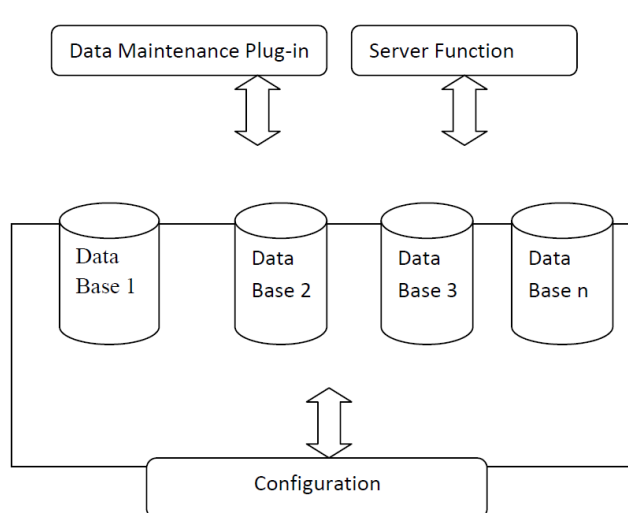

Fig 1: Geographic information system data warehouse architecture.

After the successful storage of databases in data warehouse, we extract the database as per requirements for the geographic information systems by using their architecture with geographic information systems middle ware and geographic information systems interface system.

II. RELATED WORK

In this section we discussed about the literature work already done by the various author in the field of renewable energy sources to generate the power specially using the hydropower plant, the selection of locations for the establishment of hydropower plant is done by using the geographic information system, which analysis and perform some criteria to select specific conditions for this hydropower plant.

[1] In this paper the purpose of study is to proposed a new locations analysis methodology for the hydropower plant using the geographic information system and spatial geographic information system. Here they proposed the selection of new locations on the basis of some performance parameters and the parameters meet their criteria in satisfactory manner.

[2] In this article author present the data warehouse mechanism for the storage of information and data which is used by the geographic information system interface with the external data store to select the best location for the hydropower plant establishments.

Here the author also presents the new techniques that builds a digital hydrology platform applications of geographic information system techniques in

hydrology industry in a more efficient and convenient manner.

[4] In this work author develop the method for the location selection first stage i.e. the estimation of hydropower plant potential favorable and unfavorable situations to the development of small hydropower plant. Moreover they also present the geographic information system and also using the hydrology and hydrological statics.

[7] In this article author present the literature review for different methodology used for the generating the power. The generating of small power plant is selection by using the geographic information system and remote sensing techniques, the important things are here water, soil, rainfall data, land use and land cover etc.

[8] Hydropower plant is a clean renewable energy sources for the power generation, in this paper author discuss the applications of hydropower plant potential located in iran. The selection of plant location is done by using geographic information system. The all input data is analyzed and complied by using the geographic information system layers.

III. PROPOSED METHOD

In this paper we used the geographic information systems for the site selection in renewable energy sources like small hydropower plant for the specially hilly regions, as we know that the non renewable energy sources are depleted day by day and the nature also increasing the demand of renewable energy sources, the role of geographic information systems to collect the information geographically and stored in the data warehouse then process its according to needs, the small hydropower plants are developed in the world form the ancient time periods, in our country the hydropower plant till now reported as 16.2% of total energy has been reported as 25 5 of the country demand.
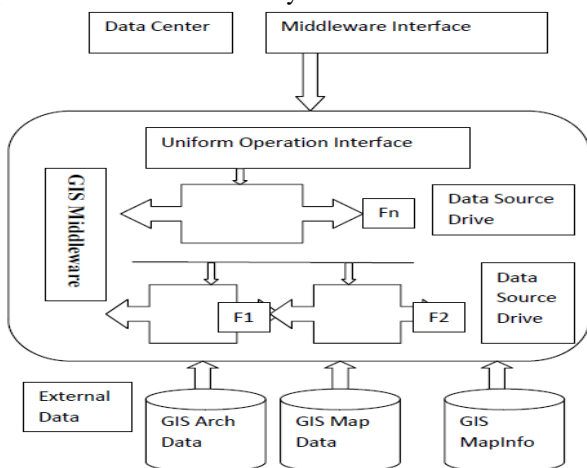

Fig 2: Proposed method block diagram.

The above figure shows the geographic information system mapping with the middle ware and the data warehouse system. The diagram shows the interfacing between the geographic information system and the geographic information system middle ware system. This architecture contain the geographic information system architecture databases, geographic information system mapping databases and the geographic information system mapping information with the conned via external data sources.

The need of power in everyday completely changes the human life in commercially application as well as in domestic applications also, the energy generation sources are classified into two different categories, one is non renewable energy sources and another one is renewable energy sources, as we know that the non renewable energy sources are exhausted very fast, so the another types of energy sources renewable energy sources play a very important role in modern day life demand for power generation. Renewable energy sources such as the wind energy, solar energy and hydropower energy, the hydropower plant energy is discussed in this paper with the geographical information system.

The small hydropower plant provide one of the most cleans forms of energy among all the types of renewable energy sources, the geographical information system provides the best location to create the hydropower plant system on the earth. The definition of the location analysis is the evaluation of a variety of need and demand of prospective locations of the assessment of the land. There is some techniques to for the creation of small hydropower plant are following:-

Site Verification

In order to obtain the optimum site for the nuclear power plant, the integrating of Analytical Hierarchy Process (AHP) with the Geographical Information System (GIS) has been done. Before proceed to the AHP approach, all the results obtained by using the Geographic Information System GIS) will be reviewed by visiting the proposed site. The aim of this process is to ensure that the results obtained are valid and can be used without any obstacles, cost and time [3]. Classification according to weight value Determination of the criteria's weight was depending on the importance of each criteria in comparison with the others in the same factor group. The weight value obtained will be use in calculating the final analysis in order to determine the optimum site for nuclear power plant. The weights value may be applicable if the consistency ratio is less than 0.1. If the consistency ratio is exceeding 0.1, the Analytical Hierarchy Approach (AHP) process needs to be done again. The purposes of this application are to facilitate users in computation and obtain results more quickly.
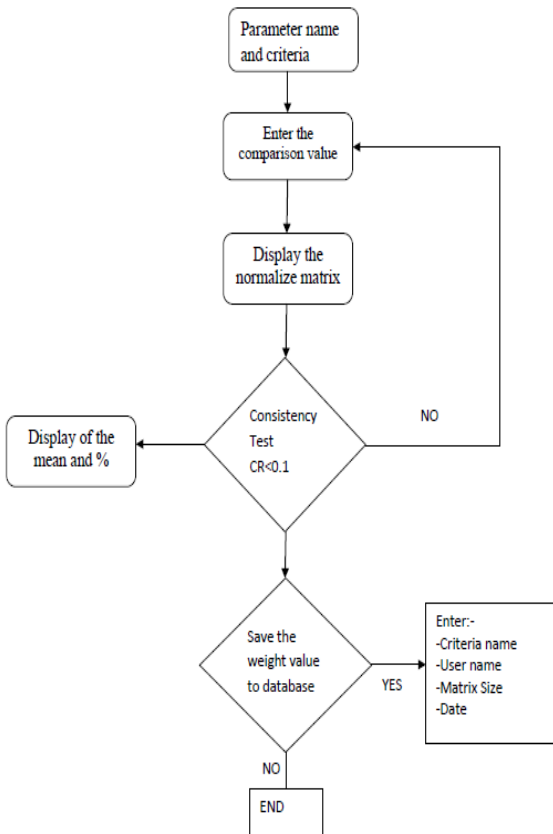
61	34	28	7.9
68	37	27	8.2

Fig 4: Performance graph for the Head value and Mass flow data.
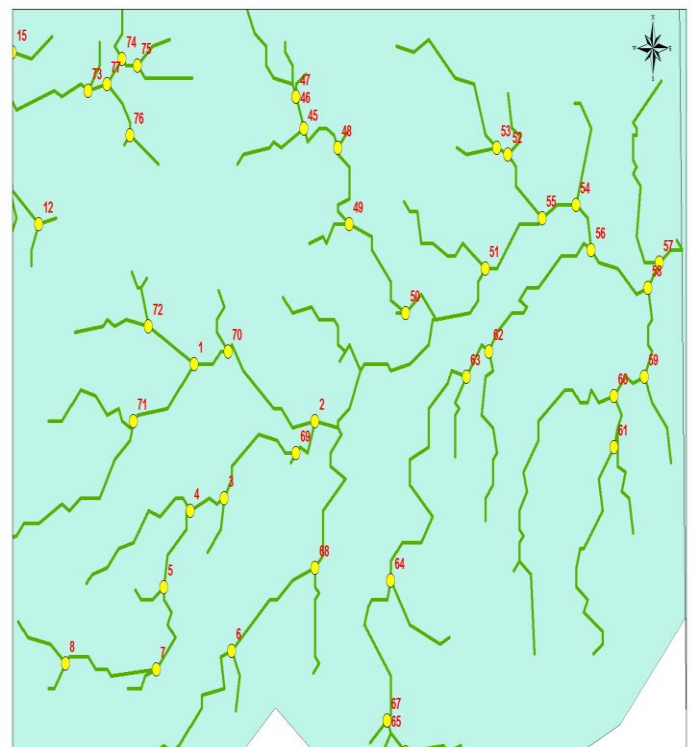
Fig 5: The proposed possible plant location.

Fig 3: Proposed method flow graph.

The above graph shows the procedure of site selection in a specific place using the geographic information system techniques, this techniques will select the hydropower plant site by using some analysis and evaluation of the parameters such as water, soil etc. this process will select the best value for specified criteria i.e. weight value.

IV RESULT ANALYSIS

In this section we describe the result analysis for the hydropower plant potential assessment in hoshangabad district in Madhya Pradesh. The proposed geographic information system and remote sensing technique suggested us to establishment of new hydropower plant potential in these locations. Here the analysis pertaining to various parameters such as the land use, land cover, location map, water study map, soil condition, boundary map, contour map, satellite based image map, slop map, drainage map etc. all these factors are evaluated through with the map prepared in geographic information system and remote sensing technique. The proposed hydropower plant suggested in the hoshangabad district in Madhya Pradesh.

Table 1: Performance evaluation for the site location.

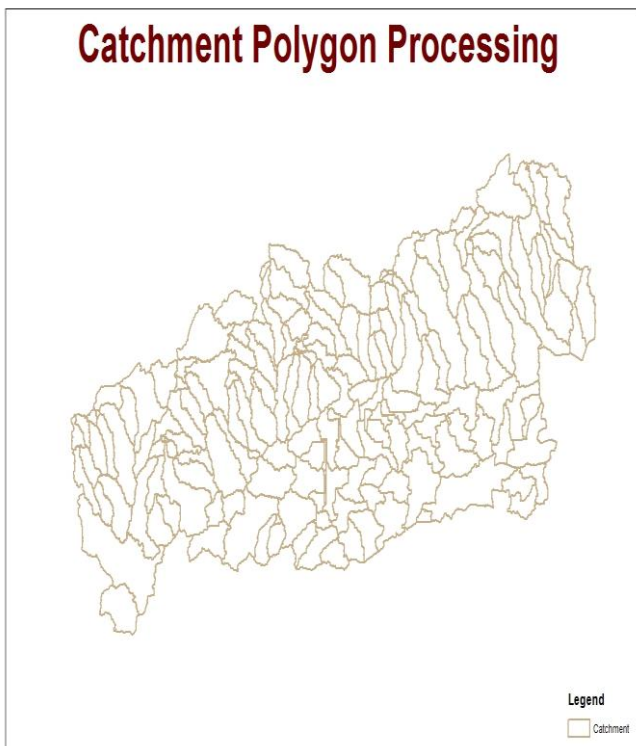| Site Location Point	Head (m)	Mass Flow(m³/s)	Power (MWa)
7	89	75	46.5
57	45	126	45.6
71	30	177	41.4

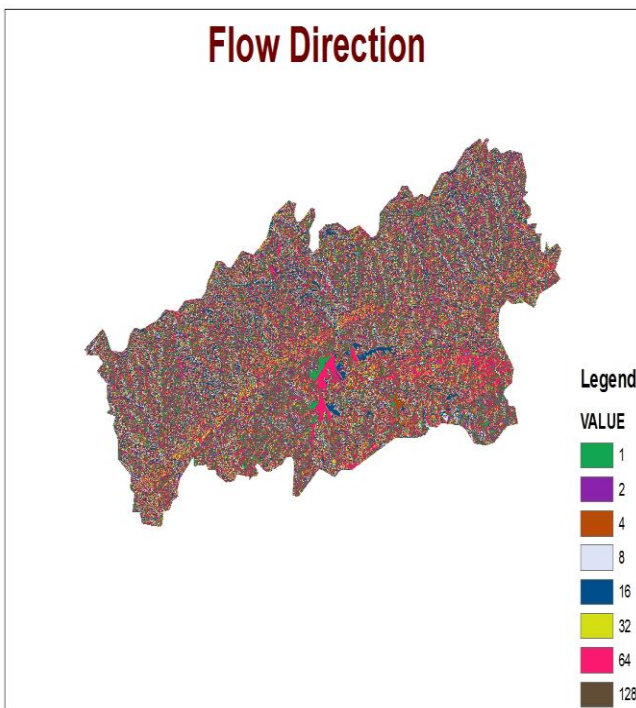**Fig 6: The proposed catchment polygon processing.**

Fig 7: The proposed flow direction.

V CONCLUSION AND FUTURE SCOPE

This paper gives the overview of small hydropower plant development and comparative study for the various geographic information system (GIS) applications and demonstrates the location selection of proposed hydropower plant by using some selected performance criteria. Here the hydropower plant provide the less green house effects for the environment and it is economically feasible for such types of project in these locations assess by various number of parameters and multi-objective analysis. In this study different methods and analysis, available in the comparative study sections, the potential locations were detected by suing the geographic information system. Since the feasibility of hydropower plant need to be confirmed by the data that were collected in the field, and the geographical conditions of each locations are unique therefore the deployment of each locations need different technical solutions every time.

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Rajendra Kumar Patel is currently pursuing PhD from MANIT Bhopal, he completed his M.Tech, from MANIT Bhopal in Remote Sensing & GIS, he has 4 years of teaching experience and 3 years industry experience.He has published 07 research papers in reputed journals and conferences.

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