Distributed GIS Based Decision Support System for Efficiency Evaluation of Education System: A Case Study of Primary School Education System of Bundelkhand Zone, Uttar Pradesh, India

Garima Srivastava, R. K. Srivastava, R. C. Vaishya

Abstract—Decision Support System (DSS), a query-based system meant to help decision makers to use a variety of information for decision making, plays a very vital role in sustainable growth of any country. For this very purpose it is essential to analyze the educational system because education is the only way through which people can be made aware as to how to sustain our planet. The purpose of this paper is to prepare a decision support system for efficiency evaluation of education system with the help of Distributed Geographical Information System.

Keywords—Distributed GIS, Web GIS, Spatial Decision Support System, Bundelkhand Zone, Efficiency, Primary School Education.

I. INTRODUCTION

DECISION Support System (DSS) is an interactive computer based system that helps decision makers to utilize data and models to solve unstructured problems [1]. These tools improve the performance of decision makers while reducing the time and human resources required for analyzing complex decisions. Distributed GIS concerns itself with GI Systems that do not have all of the system components in the same physical location. This could be the processing, the database, the rendering or the user interface. Examples of distributed systems are web-based GIS, Mobile GIS, Corporate GIS and GRID computing [2]. In this paper web based geographical information system (Web GIS) will be discussed. In a new technological era decision makers want to visualize every problem. After including spatial data in decision support system it becomes spatial decision support system which is able to handle spatial and non-spatial information. Combination of decision support system with distributed geographical information system produces a perfect package for solving real world problems. For this very purpose child education system is considered as a real problem. Education is necessary for all children till 14 years [3] and all the Districts of Bundelkhand Zone of Uttar Pradesh try to follow this act. The Bundelkhand Region of U.P. has been educationally backward as its literacy rate is 48.41 percent and literacy among woman is 34.98 percent. More

Garima Srivastava is a PhD Scholar in Motilal Nehru National Institute of Technology, Allahabad, Uttar Pradesh, India (e-mail: versatilegarima@gmail.com).
R. K. Srivastava and R. C. Vaishya are Professors in Motilal Nehru National Institute of Technology, Allahabad, Uttar Pradesh, India.

than half the population of the region is without any literacy skills. All the districts of the region have low level of literacy rates [4]. (This paper will confine to a consideration of primary school education system).

II. DESIGN METHODOLOGY AND APPROACHES

The study consists of four investigation phases which are as follows:

The first phase concerns the collection of 10- year background data with regard to primary school education system. These are followed by the discussion with various officials of Basic Education Department, as well as Development Department of Uttar Pradesh, India.

The second phase deals with Map Digitization with the help of ArcGIS and ERDAS IMAGIN.

The third phase deals with data organization, data analysis with the help of GIS (Geographical Information System) platform and SPSS for Decision making.

The fourth phase involved query making of the problem concerned on Local Host Server with the help of uDig, Apache- Tomcat Server, GeoServer and WampServer.

III. DATA COLLECTION

For the present study, District level educational data for the all primary schools has been collected for the year 2001 to 2010 from the Vikas Bhavan (Development Department), and Basic Education Department, Lucknow, Uttar Pradesh, India. Topographical maps of the study area have been collected from the Survey of India (SOI), Lucknow, Uttar Pradesh, India.

IV. PRACTICAL IMPLEMENTATION

Arc GIS 10.0, ERDAS IMAGIN 9.0, GeoServer 2.1.4, uDig 1.3.2, Apache-Tomcat 6.0, MS Access 2010, MS Excel 2010, SPSS 16.0, SQL and WampServer 2.4 has been used for storing, manipulating and analyzing all type of data for relevant decision making. [5].

V. STUDY AREA

All the Districts of Bundelkhand Zone which constitutes the southern part of Uttar Pradesh (India) have been consider for the study (Fig. 1). Bundelkhand lies between the Indo-

World Academy of Science, Engineering and Technology
International Journal of Computer and Information Engineering
Vol:8, No:3, 2014

Gangetic Plain to the north and the Vindhya Range to the south. It is a gently sloping upland, marked by barren hilly terrain with sparse vegetation. It is geographically the central part of India covering some part of Madhya Pradesh and some of Uttar Pradesh. In this paper only those districts of Bundelkhand have been considered which is the part of Uttar Pradesh (Fig. 1). The population of this Zone is approximately 82.32 lakh with 280 per Sq Km. Population density. In spite of being rich in minerals, the Zone is underdeveloped and people are poor and backward. The Bundelkhand Zone of Uttar Pradesh lies between 23° 10' and 26° 27' N Latitude and 78°4' and 81°34' E Longitude. It comprises seven districts (Jhansi, Jalaun, Lalitpur, Hamirpur, Mahoba, Banda, Chitrakoot) of Uttar Pradesh with the total area of 29418 sq km. [6].
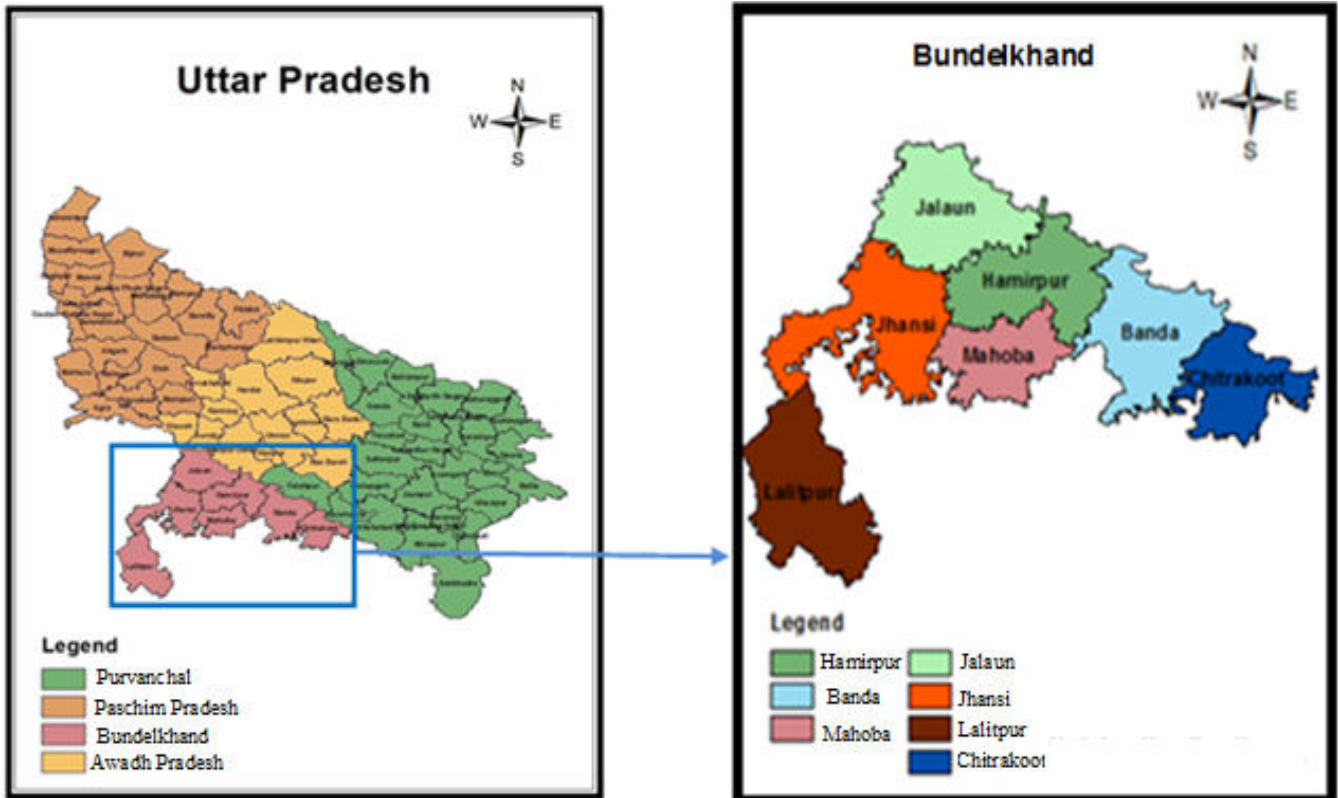
Fig. 1 Area Map of Bundelkhand Zone of Uttar Pradesh

VI. DISTRIBUTED GIS BASED DECISION SUPPORT SYSTEM ARCHITECTURE FOR EFFICIENCY EVALUATION OF PRIMARY SCHOOL

Web based geographical information system (Web GIS) technologies provide the capability to integrate data from disparate sources and to make these available before, during and after the planning process [7], [8]. It is also a distributed system across a computer network to integrate, disseminate, and communicate geographic information visually on the World Wide Web (WWW) [9]. In performing the GIS analysis tasks, web GIS is similar to the client/server typical three-tier architecture. The geo-processing is breaking down into server-side and client-sides tasks. A decision maker or client typically is a web browser. The server-side consists of a web-server, application server map server and Database (Fig. 2). By combining concept of decision support system with distributed geographical information system (Fig. 2), a fully dynamic and generalized spatial decision support system (SDSS) is developed to check the efficiency of primary education system for Bundelkhand zone of Uttar Pradesh, India. The developed SDSS is capable of to evaluate the education system.

While developing the system, ten years background data regarding the school education are used. Fig. 3 shows the different maps generated by statistical ratio analysis on GIS platform for ten years (2001-2010). Fig. 4 shows the teacher-student ratio analysis for year 2010. Fig. 5 shows the efficiency evaluation map generated on GIS platform by analyzing the students enrolment, dropout and repetition rate of 2010 for all the seven districts (Banda, Chitrakoot, Hamirpur, Jalaun, Jhansi, Lalitpur, Mahoba) of Bundelkhand zone of Uttar Pradesh which depicts that in 2010 the primary education system of Mahoba district is only 57% efficient where as primary education system of Banda, Chitrakoot, Hamirpur and Lalitpur are 87%, efficient. Primary education system in Jhansi and Jalaun are 86%, 85% efficient. Fig 6 shows the combined efficiency evaluation for each district of Bundelkhand zone for four year (2007-2010) developed on GeoServer.

All the analysed data regarding efficiency evaluation (Figs. 5. and 6) developed on GIS platform and other ten years background data of schools are finally called on WampServer

World Academy of Science, Engineering and Technology
International Journal of Computer and Information Engineering
Vol:8, No:3, 2014

for GUI interface. By using these analyses, a generalized dynamic query (Fig. 7) and projection system are developed (Fig. 8) on WampServer which will improve the performance of decision makers while reducing the time and human resources required for analysing complex decisions.

The developed query system (Fig. 7) will display the present condition of the study area, while the projection system (Fig. 8) will predict the various ratios (teacher- student ratio, school- teacher ratio, school- female teacher ratio, school- student ratio, population- student ratio, boys population- boys student ratio, girls population- girls student ratio, female teacher- girls student ratio) status for the next several successive years.
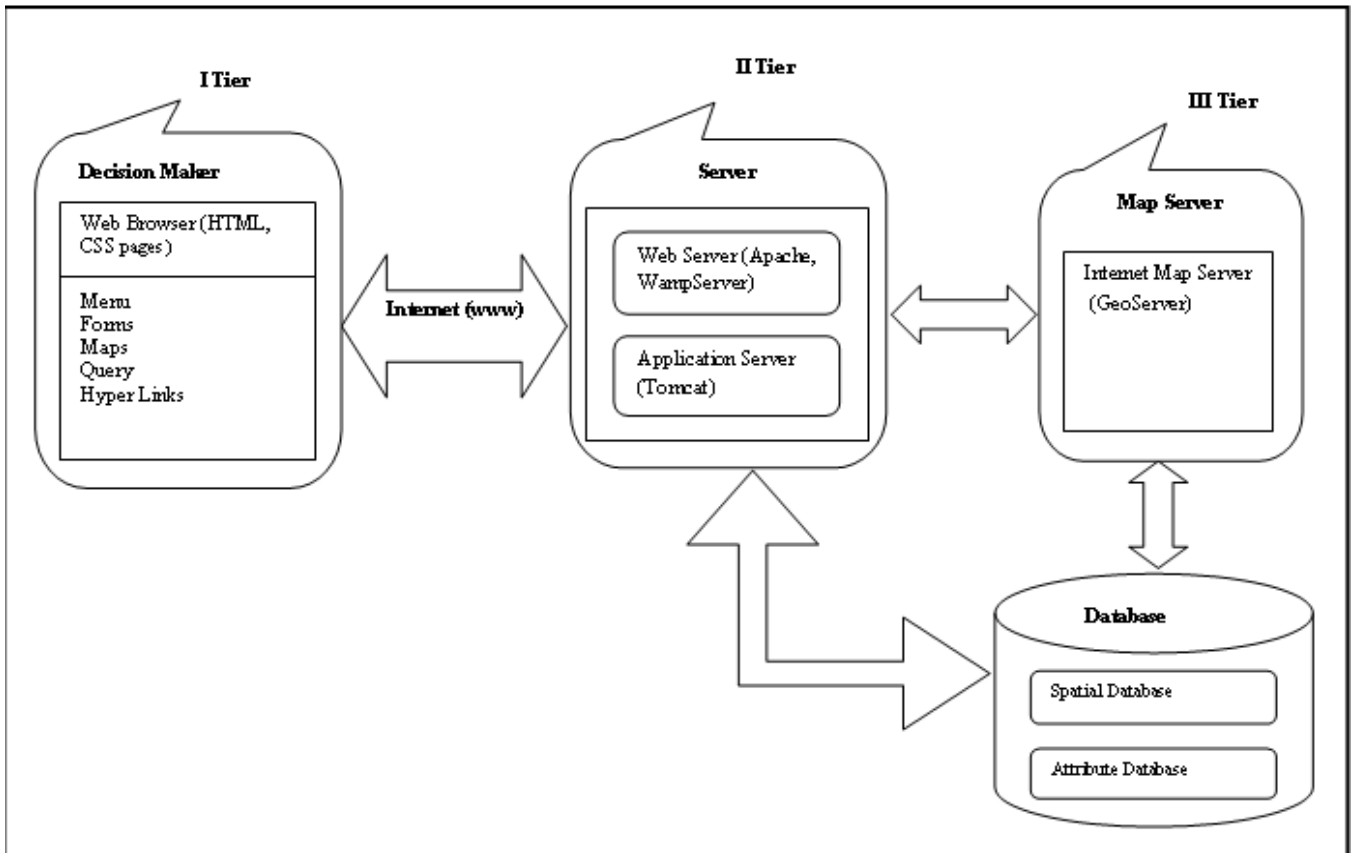
Fig. 2 Web GIS based Decision Support System Architecture

World Academy of Science, Engineering and Technology
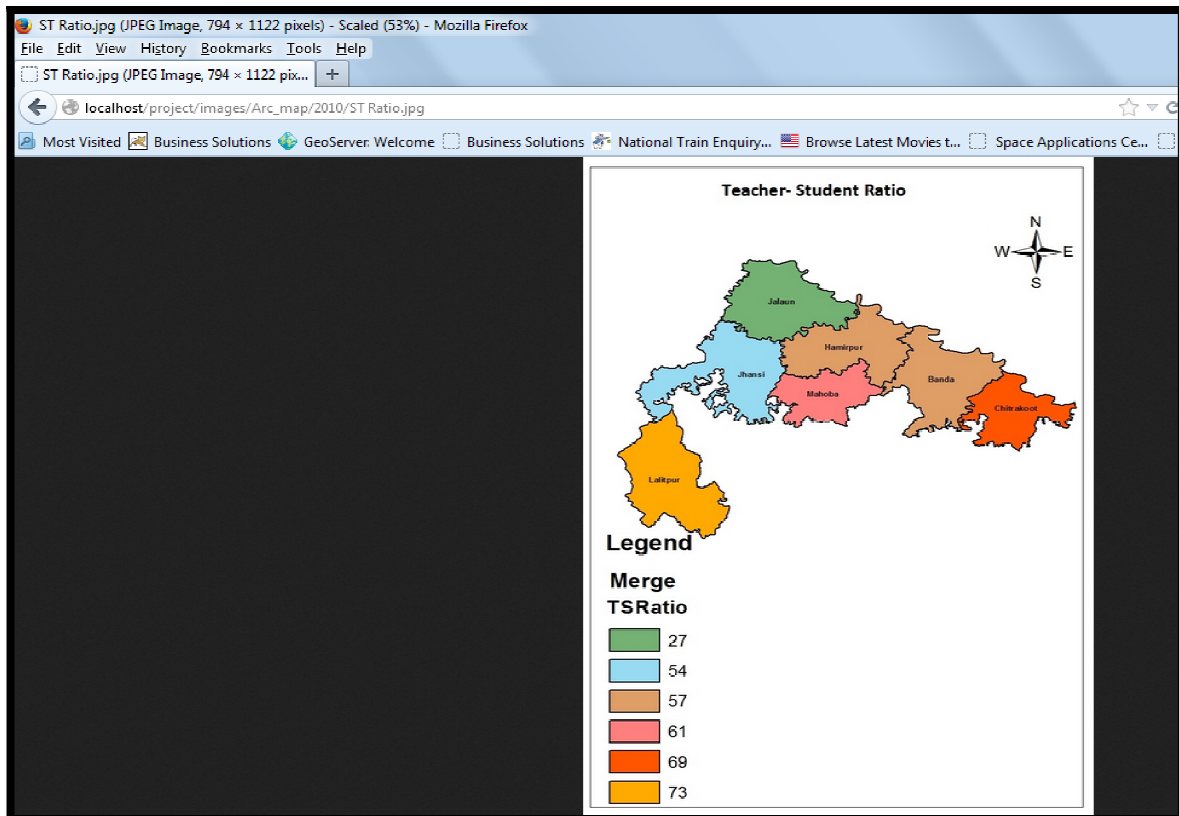International Journal of Computer and Information Engineering
Vol:8, No:3, 2014

Fig. 3 Distributed GIS based Decision Support System (Various Ratio Analysis, 2001-2010)

Fig. 4 Distributed GIS based Decision Support System (Teacher- Student Ratio Analysis, 2010)

World Academy of Science, Engineering and Technology
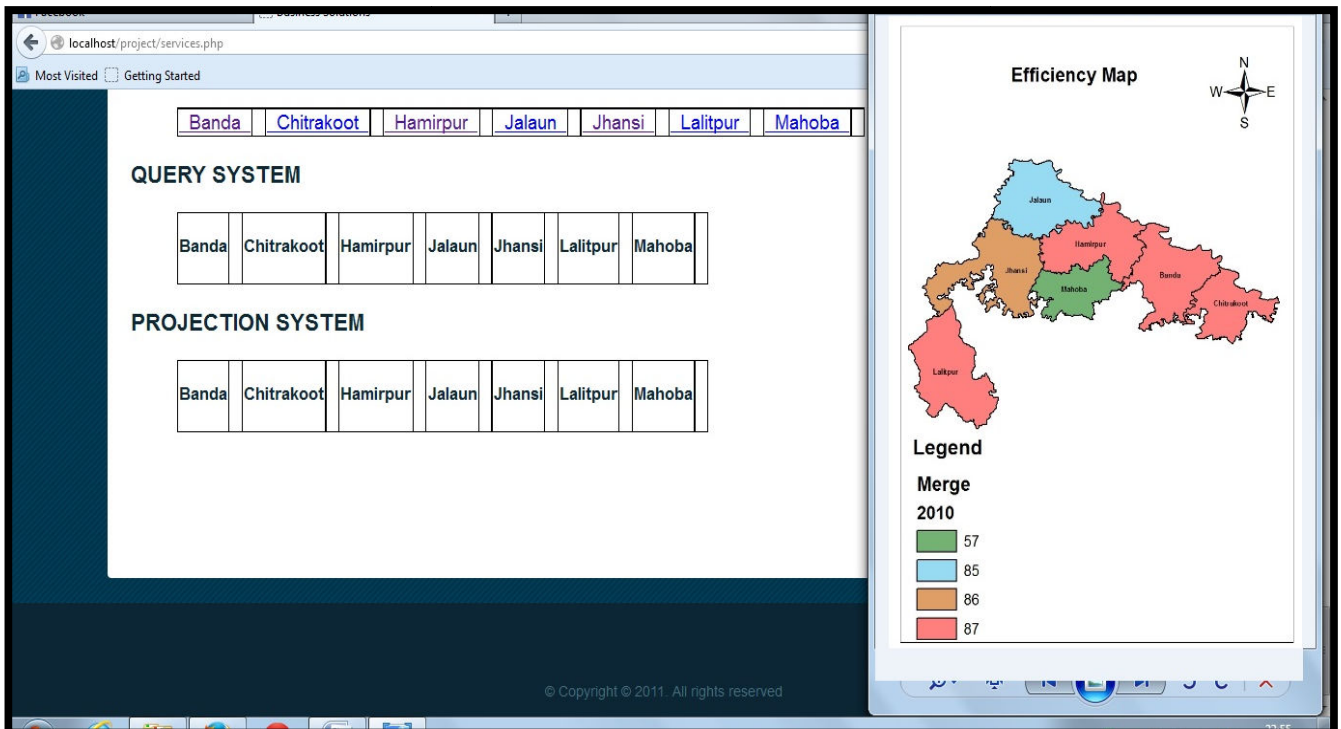International Journal of Computer and Information Engineering
Vol:8, No:3, 2014

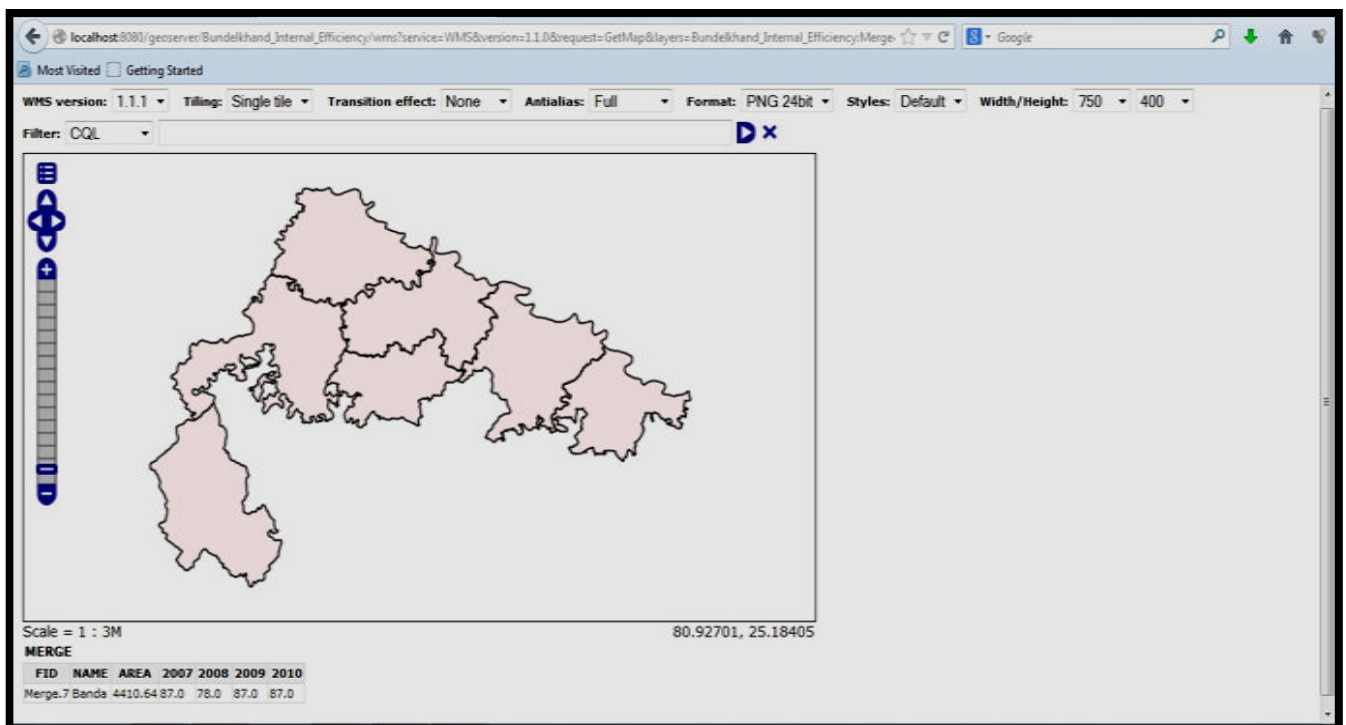Fig. 5 Distributed GIS based Decision Support System (Efficiency evaluation)
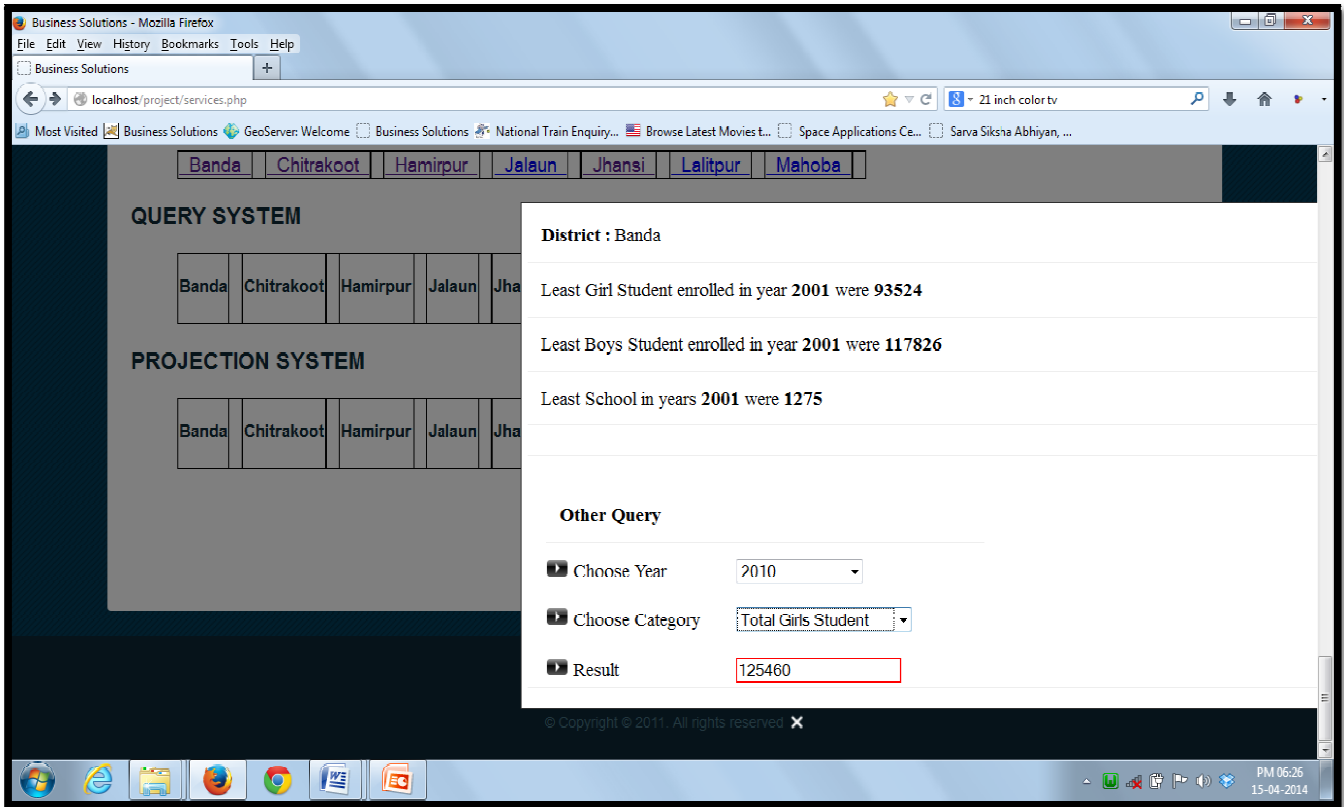

Fig. 6 Efficiency evaluation on GeoServer (2007-2010)

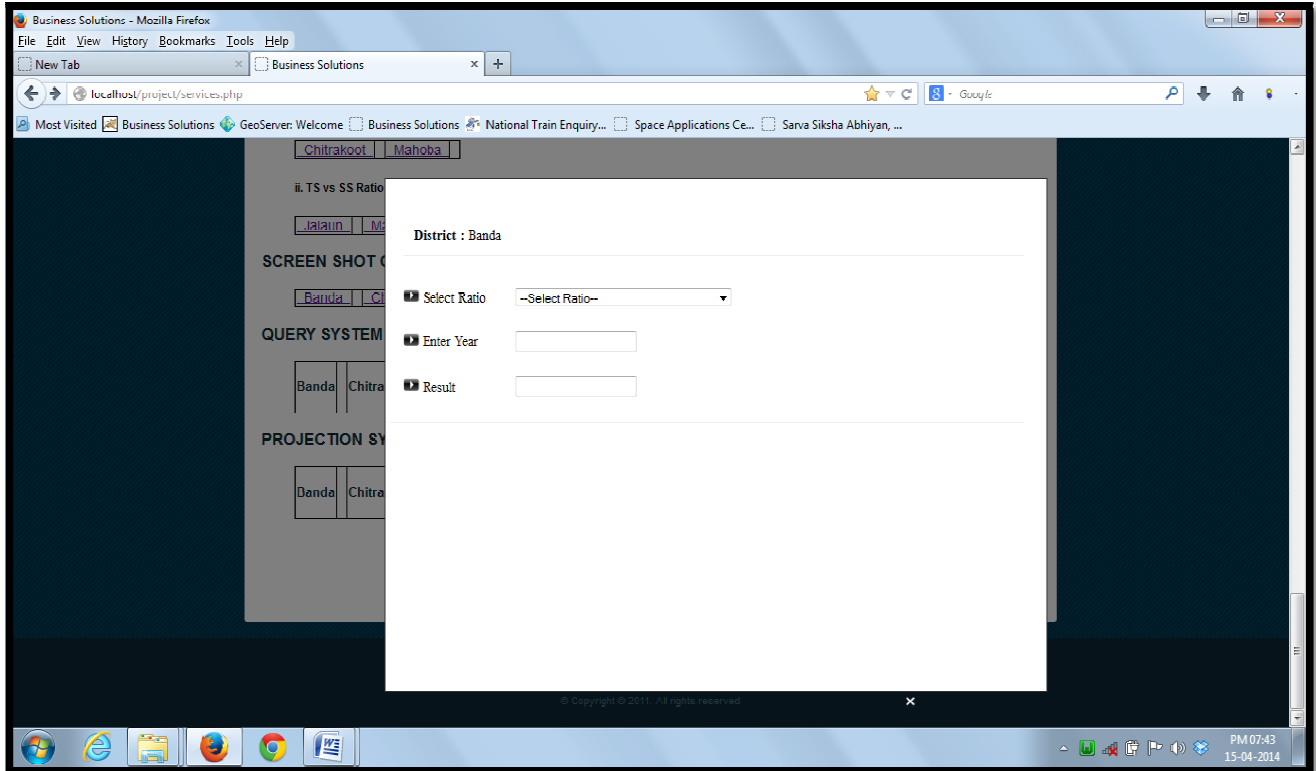Fig. 7 Distributed GIS based Decision Support System (Query System)

Fig. 8 Distributed GIS based Decision Support System (Projection System)

World Academy of Science, Engineering and Technology
International Journal of Computer and Information Engineering
Vol:8, No:3, 2014

VII. Conclusion

The developed distributed GIS based decision support system for efficiency evaluation of education system is the good solution for decision makers. Decision maker can graphically visualize those areas which have an education problem with the help of several maps and graphs as well as can find out the sustainable solution without spending so much time to analyze such a complex problem. It is dynamically generalized system which can successfully be used for any institution, region or country for evaluating their education system with the help of various maps, graphs and tabulated data/result.

While developing the distributed GIS based DSS, Bundelkhand zone of Uttar Pradesh is considered as a case study. In Bundelkhand zone, Government should give more focus on Mahoba district as the efficiency of its primary education system is only 57%. The efficiency percentage of other districts are good as compare to Mahoba but still it is not 100% which shows in Bundelkhand child literacy is very low. With the help of this decision support system, decision maker can also analyse the condition of each district for several years and can take a sustainable action.

References

[1] E Turban. *Decision support and expert system*. Prentice Hall , USA. 1995.
[2] P. S. Roy, Harish Karnatak and Sameer Saran (2012), CSI Communications, vol. 35.
[3] Right to Education Act report, 2009.
[4] Manju Narula, "Education, Gender, Access and Participation to Elementary Education in Bundelkhand Region of Uttar Pradesh," Department of Educational Administration, NUEPA. 2009.
[5] Garima Srivastava, R.K. Srivastava & R.C. Vaishya.(2013). Web GIS Based Child Education Analysis For Sustainable Growth Of Bundelkhand Zone Of The State Of Uttar Pradesh, India. *International Journal Of Technology Enhancements And Emerging Engineering Research*.vol1.
[6] Nagendra Kumar Maurya and Ankita Pandey. (2011). Women Development in Bundelkhand Region of Uttar Pradesh. *Journal of Economic and Social Development*.vol 7.
[7] M. Angelides and MC Angelides. (2000). Using multimedia database information system over the internet for enhancing the planning process for dealing with the built heritage. *International Journal of Information Management*, vol 20, pp. 349-367 .
[8] S. Dragicevic, "Development of collaborative Web-based GIS tools for environmental modelling", *Proc. GIScience,* Boulder, Colorado, USA, September 25-28, 2002.
[9] A. Alesheikh, H. Helali and H. A. Behroz. "Web GIS: Technologies and Its Applications", *95th Annu. Geomatics Conf.* of the Canadian Institute of Geomatics (CIG). 2002.