

BUILDING AN EDUCATIONAL MAPPING SYSTEM IN NEPAL

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ABSTRACT

The report contains details on the development of an Educational Mapping System in Nepal. The project is an initiation of Department of Education, Sanothimi, Bhaktapur, and has already been carried out as a pilot project in the three districts of Kathmandu Valley. The three months of Daayitwa Fellowship has been focused on the educational mapping of the rest of the country. The project engaged tasks from data acquisition to mapping and analysis. Creation of a well-structured database, integration of geospatial data with educational attribute data, visualization of the information on a digital map and development of tools for effective analysis and planning on a more scientific grounds through use of software have been the project milestones. These milestones have been achieved fully on a couple of districts and partially on a dozen of them. The overall system has been developed and what remains is the implementation of the same procedures in the rest of the districts. Department of Education now looks forward to extending the project in all the districts.

NOTES

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1. INTRODUCTION

Mapping is the science and art of visualizing objects in the world on a piece of paper or digital media by reducing the scale of their dimensions. The general concept of mapping is to locate the objects of concern so that a representation of the physical world can be obtained on a two dimensional plane. Mapping has evolved from simple static representations into sophisticated system for visualization in digital media with well-structured database in the backend. Today, mapping refers to not only mere visualization of objects in digital form but to a process that allows development of analytic tools, customization of maps according to user requirement, data extraction through query statements and publishing of the dynamic maps in the web.

The basic requirements of mapping, regardless the medium, are geographical location data: Easting (E), Northing (N) and Elevation (H), commonly referred to as Geographical Coordinates. These data are the values that tell how far an object is situated from the reference planes, both in the horizontal and vertical axes. The reference planes can differ and the E, N and H values can be different according to the reference planes used. But location of the object does not deviate from its actual position because all the values are relative.

1. 1. EDUCATIONAL MAPPING

Educational Mapping is the implementation of mapping techniques for the educational sector. It is the process of visualizing educational institutions according to their geographical locations. Educational institutions (schools, colleges, universities, etc.), like all other physical structures, can be located in terms of geographical coordinates and visualized in a map.

Educational mapping can have several advantages supporting the overall educational system and resource allocation methodology. But the purpose of developing educational maps is not only to visualize where educational institutions are but to have other data related to education and attributes of the institutions integrated into the location data so that complete information of a particular institution can be stuffed into the same database.

Educational Mapping Project in Nepal

In Nepal, the importance of educational mapping was realized more than half a century ago and initiations for locating schools all over the country were taken every once in a while. However, due to several reasons like lack of technology, manpower and inaccessibility to schools, projects have remained incomplete. Simple sketches without any scale or reference frames have been prepared by District Education Offices (DEOs) but those sketches are neither complete nor authentic. Mapping of schools in scaled sheets has also been carried out in some districts but with similar problems.

The recent concept of mapping schools of Nepal in a digital media with all the scientific procedures was realized and initiated by Department of Education (DOE). Educational Mapping Section has been established inside DOE with the responsibility of advancing the project forward. However, lack of resources, expertise, equipment and software had been delaying the project.

Recently, Department of Education has taken a considerable step by purchasing and distributing Geographical Positioning System (GPS) devices to all the districts of Nepal. Officers from all DEOs of Nepal have been provided trainings on the use of GPS device

and officers from Department of Education have been given trainings on Geographical Information System (GIS). Moreover, education mapping was carried out as a pilot project in the three districts of Kathmandu Valley through a private agency. Success of the pilot project opened the door to step into national level educational mapping.

As the next step, Department of Education has started the data collection through Resource Persons (RPs) in all the districts. The RPs are responsible of reaching all the schools in their respective areas and locating the schools in the GPS device. The data are collected in DEOs and then forwarded to Educational Mapping Section in DOE.

This is where the need of GIS expert was realized because the rest of the steps are totally software based. As a Daayitwa Fellow assigned of Educational Mapping Project in Department of Education, I was responsible for proceeding with the raw data collected from DEOs and designing a system of mapping the schools and an integrated database.

1. 2. PROBLEM STATEMENT

Despite the huge amount of financial resource allocated for the educational sector by the Government of Nepal and countless reform strategies incorporated by Ministry of Education, the results have not been satisfactory. Lack of proper quality improvement strategies, poorly qualified teachers, lack of infrastructures and resources, etc. have been recognized as the reasons behind the lag in progress in the educational sector and have been brought frequently into debates. Undoubtedly, these issues need to be addressed with concrete planning and implementation techniques. But the problem is not totally due to quality factors and lack of resources but also due to the lack of an effective system where information regarding all the schools in Nepal can be stored, analyzed, visualized and brought into consideration during planning and resource allocation.

Nepal has a diverse geography, socio-economic variations, unevenly scattered settlements and different ethnicity with difference in geography. These variations should be considered primarily before any reform strategy is formulated or before resources are allocated. Till now, schools in Nepal have been recorded in the database at DOE but their physical existence cannot be checked easily. This has led to the establishment of schools with records entered in the government database but without any physical existence. They cannot be monitored properly nor can their progress in academic performance be tracked.

Geographical factors play vital role in the educational sector in Nepal because most areas in Nepal are inaccessible. Schools have been established without consideration of geographical and demographic conditions. Presence of geographical barriers like rivers, steep terrains and forests have made going to schools difficult in rural parts of Nepal. Moreover, some schools are overpopulated whereas some are running with only a few dozen students. Resources are being allocated with very less consideration of geography, ethnicity and population.

Deciding on applications for establishment of new schools requires some scientific tool which can consider geographical and demographic statistics, proximity from other schools and requirement of school in the particular area. Merging and relocation of schools should also be decided on some scientific and factual grounds.

Corruption in the educational sector is not due to lack of professional ethics or proper monitoring but also due to lack of technology in procedures that need to be carried out. A highly automated system provides minimum space for such activities. So, educational system has to be made more automated and software oriented.

All these problems can be solved if a system that locates all the schools and stores data related to them in the same database can be developed. Educational Mapping is the tool

that can help significantly in solving the above mentioned problems.

1. 3. ADVANTAGES OF EDUCATIONAL MAPPING

Major advantages of this project can be highlighted as follows.

Effective monitoring: As this project focuses on creating a central database storing details associated with every schools of Nepal, all the schools will now be under the direct supervision of DOE.

Elimination of data duplication: All the data related to a school will be stored digitally along with the location data so that the problem of data duplication and redundancy will be eliminated.

Easy data retrieval and better visualization: Mapping refers to the process of visually representing the data and details. Concerned authority after the successful completion of this project shouldn't go through several papers with hundreds of list and data to access the required information. Visualization of educational status, results and other thematic data will also be easier and better when done in a map. Database and maps which are the major outputs of this project will help in easy information retrieval and better visualization.

Scientific planning and evidence based decision making: Another major advantage of this educational mapping project is that future planning can be made in scientific and effective manner. For e.g.: DOE wants to build some new government schools in a district. Construction of new schools would require analysis of information like location and spatial distribution of existing schools, access of infrastructures to the possible locations. All these analysis can now be easily done with spatial analysis function of ArcGIS .Thus, the decision of merging schools, establishing new ones and dissolving the existing ones will be easier when visualized in GIS along with demographic data. In this way an evidence based decision making can be achieved.

Adequate Resource Allocation: Allocation of resource to the individual schools can also be done in a proper manner. Such activities will now be based on the geographical difficulty, accessibility, number of students and teachers and other supplementary data of the school.

2. EDUCATIONAL MAPPING IMPLEMENTATION

2.1. PROJECT OBJECTIVES

The major objective of this project is to develop an educational mapping system with integrated statistical data using Geographical Information System for equitable access to education in the entire country.

For achieving this major objective following sub-objectives had to be met:

- Capacity Building of the staff at DEOs and DOE
- Collection of location data of all schools using GPS devices
- Correction and verification of the data obtained from districts
- Importing location data into Arc GIS and integration with DOE EMIS data
- Preparation of thematic maps using the integrated data

Project Prerequisites

Following are the prerequisites for educational mapping project:

- A Powerful Desktop Computer
- Arc GIS Software (Version 10.1- Licensed)
- GPS devices
- Coordinates of schools to be mapped
- Digital Base Map of Nepal (Ward level)
- Thematic map layers (Rivers, Roads, etc.)
- Attribute data archived by DOE

2.2. METHODOLOGY

This section discusses the overall flow of the project.

Project Phases

The project comprised of the following overall phases:

Capacity Building: This phase involved tasks like briefing the staff at all District Education Offices and training them on the use of Geographic Positioning System (GPS) devices for data collection. Some project members at Department of Education were provided training on the use of Arc GIS, the software used for mapping.

Data Collection: During this phase, every Resource Person (RP) in all the districts were handed over with a GPS device and given the task of locating every school in his/her assigned area. The coordinates of schools in every district were collected at the Educational Mapping Section in DOE through e-mails from respective District Educational Offices.

Plotting: The third phase involved plotting the data collected from all the districts in Arc GIS. The errors in coordinates due to instrumental and human reasons were checked and corrected. A ward level base map of Nepal was purchased from Survey Department to overlay the schools in.

Data Integration: This phase involved steps like creation of Geodatabase and relating statistical and demographic data tables with the schools information table. Every school

was given a unique code number and used as a primary key in the database. Formatting the data tables to make them ready to be fed into GIS was a tedious job.

However, the last three steps were running concurrently because obtaining complete data from all the districts before the deadline was not possible due to geographical and weather difficulties in some rural districts.

2. 3. RESULTS

During the duration of the Fellowship, I was able to finish the mapping of 14 districts. 12 of these districts now have all the schools plotted in maps. The remaining two districts have the schools plotted along with the attribute data integrated with the system. This means that in Chitwan and Nuwakot, data extraction and filtering can be done along with the map. The map can be customized according to the required thematic data.

Due to delay by DEOs in the rest of the districts, the plotting and data integration has not started. Among these districts, four districts have not started data collection yet. Rest of the districts are on the verge of GPS data collection and will soon send the data.

The progress statistic of the project is as follows:

Mapping and Data Integration:	2 Districts
Mapping:	12 Districts
Previously finished during pilot project:	3 Districts
Data collection going on:	54 Districts
Data collection not started:	4 Districts

MAPS AND DATA FROM MAPPING EDUCATION SYSTEM OF NUWAKOT

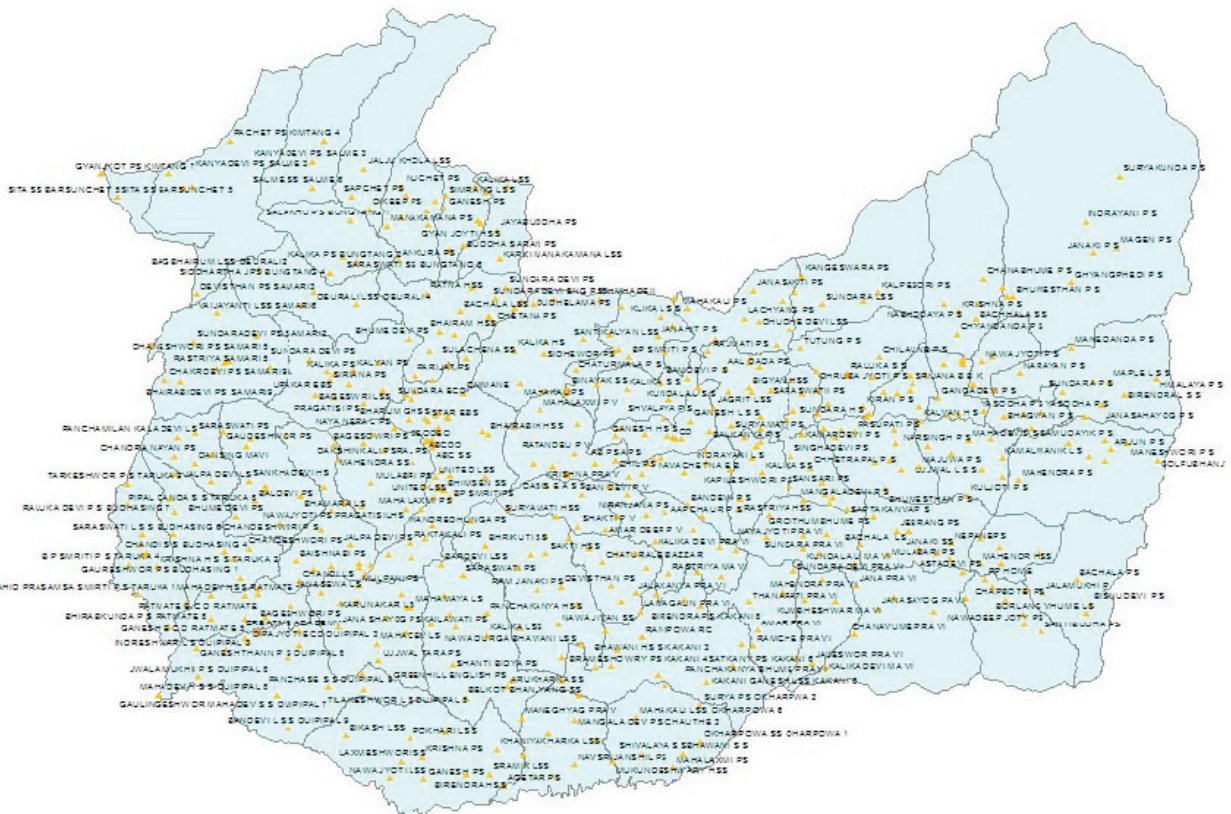


Figure 1: Distribution of schools in Nuwakot district

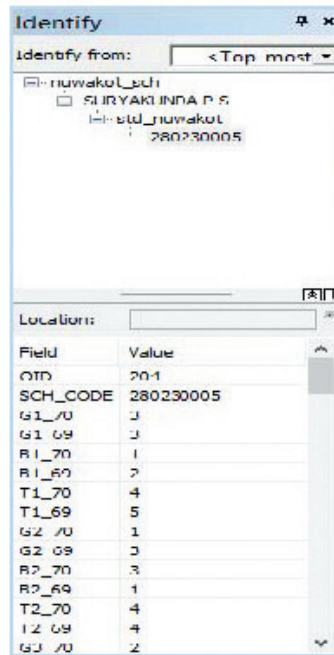


Figure 2: Student information stored in Arc GIS

FID	Shape*	SNO	SCH_CODE	SCH_NAME	H	N	E
403	Point: ZV	41	28020001	NARSINGH P S	1355.43261	27.910081	85.372107
447	Point: ZV	449	28020002	LJJWAL L S S	1489.93903	27.893668	85.396867
597	Point: ZV	599	28020003	NAHADEV S S	1329.72644	27.911195	85.591417
486	Point: ZV	483	28020004	BALKALYAN P S	1581.84497	27.905899	85.383004
157	Point: ZV	159	28020005	KALWAN H S	857.249634	27.920262	85.363143
543	Point: ZV	545	28020006	DHALLAGRI P S	1208.73913	27.91243	85.401572
546	Point: ZV	543	28020007	KULJOT P S	1815.38977	27.883643	85.390586
159	Point: ZV	161	28030001	SAPTAKANYA PS BARSUNC-ET 9	863.124084	28.02507	84.990039
590	Point: ZV	592	28030002	SITA SS BARSUNC-ET 5	1307.32324	28.015157	84.99713
591	Point: ZV	593	28030002	SITA SS BARSUNC-ET 5	1307.32324	28.015157	84.99713
376	Point: ZV	373	28030001	KALKA LSS	1281.34643	27.834293	85.166672
116	Point: ZV	117	28030002	EARDEVI LSS	707.044739	27.863859	85.146424
360	Point: ZV	362	28030003	BAL KUMARI PS	1251.94921	27.839353	85.141152
34	Point: ZV	35	28030004	ARUKH NIMAV	555.542542	27.914321	85.133679
491	Point: ZV	493	28030004	ARUKHARKA SS	1608.88679	27.813162	85.175675
256	Point: ZV	253	28030005	NIRANJANA -SS	1029.22443	27.851097	85.147538
126	Point: ZV	127	28030006	SARASWATI PS	745.08606	27.859454	85.165045
595	Point: ZV	597	28030007	SHANT EDEYA PS	1322.21972	27.82224	85.151067
181	Point: ZV	183	28030008	KALAWATI PS	901.748352	27.833151	85.152679
520	Point: ZV	522	28030010	EE.KOT BHANJYANG SS	1679.70227	27.803784	85.166722
247	Point: ZV	249	28030011	PANCHAKANYA -SS	1014.22625	27.843622	85.166791
505	Point: ZV	507	28030014	GREENHILL ENGLISH PS	1636.60681	27.81553	85.177571
567	Point: ZV	569	28030001	GOLFUEHAN, YANG S S	2135.34633	27.902765	85.473693
501	Point: ZV	503	28030002	SAMUDAYK P S	1633.69274	27.911206	85.454269
507	Point: ZV	509	28030003	ARUN P S	1642.29943	27.907663	85.45715

Figure 3: Geographical coordinates of schools in Nuwakot after assigning school codes

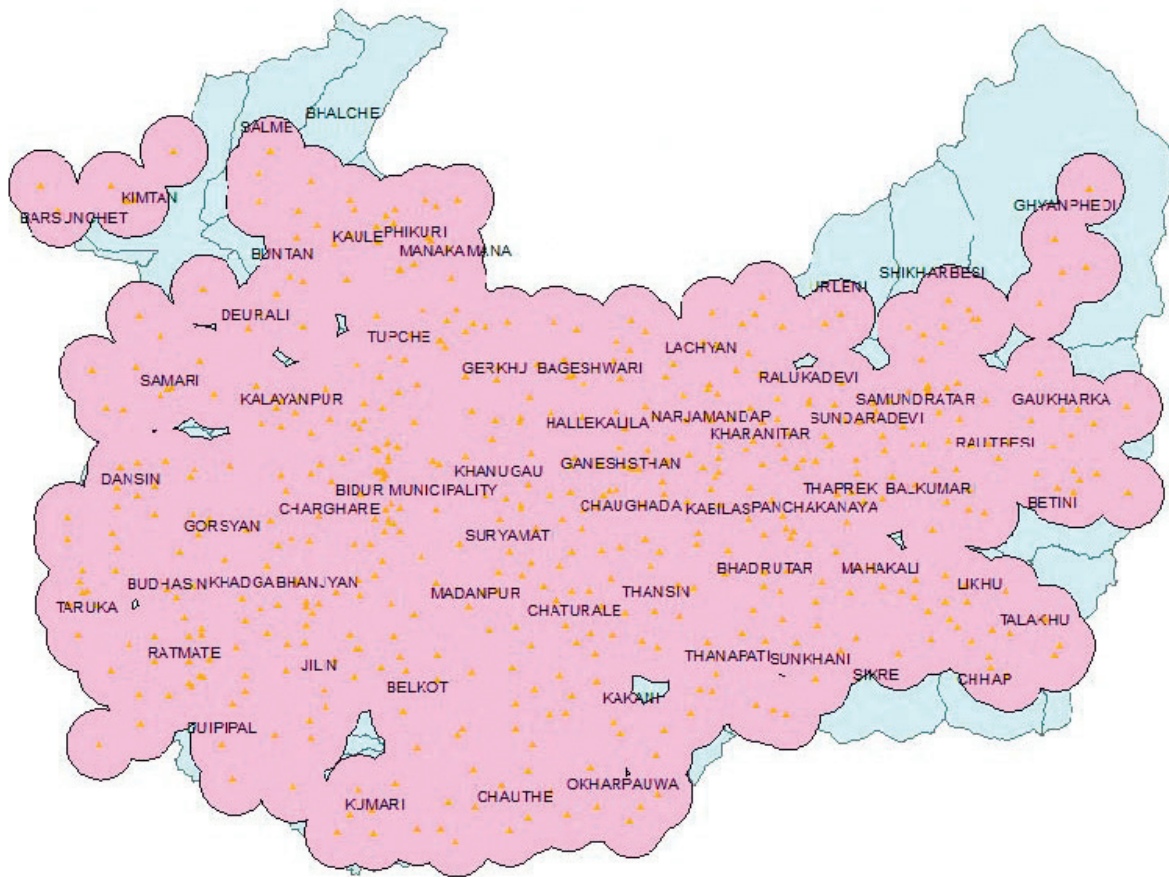


Figure 4: An analytic tool (Buffering) used in Nuwakot district

3. RECOMMENDATIONS

Following are some major recommendations for the continuity of this project in an effective manner.

Formation of a group of technical professionals: Government should recruit some professionals with good knowledge of geospatial technology, mapping and programming. People with knowledge of geospatial technology and mapping can well supervise every associated works and activities of this project. A demerit that the present system has illustrates the requirement of such professionals. Looking at the existing data, one can see many errors and faults. This project had to give more time to data preparation during the fellowship period. If experienced manpower in the related fields were hired and appointed as trainee forming a standard in data collection, then large amount of time could have been saved during mapping.

Interactive Web Mapping: Current project focuses on the creation of static maps locating every schools of Nepal. Since this is the initial stage, first focus is being given to the creation of complete database of every school with integrated data and details. After the creation of complete and updated database with proper database schema, this can be used later to create a web portal where all these information and maps are easily accessible to every schools. Thus created online system allows everyone from everywhere to access the maps and data through internet.

Data Integration: The database can be populated with more and more data so that different kind of analysis in future can be carried out easily. ECDs and CLCs can be included into the system.

Scientific planning and Proportional Budget Allocation: Budget and program allocation should be done on the basis of need assessment. For that a detail breakdown of every associated activity needs to be carried out after a detail study of every influencing factors.

4. CONCLUSION

During the fellowship period, it was felt that there was willpower in government officers to improve and change the system. They bear the positive interest to do so. But they have not been able to come up with plans and policies realizing the power in technology. If people with innovative ideas can inject their ideas into government officers, make them realize that the same job can get more efficient, accurate and smartly done, there is already enough resource to implement the ideas.