

Research Article

Using Geographical Information System for Developing Education Information System: A Case Study of Srinagar City, Jammu & Kashmir, India

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Abstract The purpose of this study was to collect appropriate data of Education facilities around Srinagar city using GPS and to store the data into the Geodatabase built to manage them more efficiently. The Education data pertaining to these Education facilities was classified into different classes such as: Primary, Primary with upper primary, Secondary, Higher Secondary and Schools operating together. A total of 352 Government Schools were mapped out of them 122 were Primary Schools, 138 primary with upper primary Schools, 52 were Secondary Schools and 29 were Higher Secondary Schools. During the study it was found 10 Schools were operating together at same place, so their single coordinates have been taken and few of the Schools couldn't be mapped due to some issues such as non-existence. The present study focuses on using Geographic information system and integrating with the Education information system to generate a baseline data for the planning, development and preservation of these Education facilities.

Keywords *Education information system; Geographic information system; GPS; Geodatabase; Education Facilities*

1. Introduction

Education information system is a GIS based information system that stores all information about Educational facilities – their Name, location, category, No. of class rooms, No. of boys, No. of girls, Total no. of students, No. of teachers (male, female), Qualification of Teachers, Geographic coordinates of education institutes, Availability of: playground, computer lab, library, physical teacher, sports goods, NT (Non-teaching staff) strength, canteen facility etc. The trend towards using Geographic information systems and to support decision making for educational facilities are becoming very significant for planning purposes (Okan, 2012). Geographical information systems (GIS) can be described as a set of integrated software programs designed to store, analyze, and display geographical data-information (Fitzpatrick & Maguire, 2000). According to Makino and Watanabe, (2002) Geographic Information system has become an important asset and plays a vital role in analyzing the school-planning situation. Besides several other significant steps such as

explanation of educational administration, and expansion of compulsory education, enforcing the clear school planning policies and guidelines, and creation of the digital database that can be used in GIS, will have more positive and progressive impact on improving school services and imparting quality education to current and future children .

The current study has tried to map each and every Educational institute located in the Srinagar city in a comprehensive Geodatabase format, where in within a single click of the mouse we can know attributes such as Pupil data (enrolment, age, repetition), Teacher data (Qualification, experience, placement), School inventory data (location, geographic co-ordinates, stories, type, number of classrooms, equipment etc.), Provisioning of materials (textbooks etc.), Performance Data, Monitoring of internal management initiatives (e.g. Special projects) etc. The study holds significance for the Educational department which will find it handy for planning various projects relating to the development & improvement of our Educational facilities in Srinagar City in the future.

2. Study Area

Summer capital of the state of Jammu and Kashmir, Srinagar and is located in the valley of Kashmir at an altitude of 1,730 m above sea level. The city lies on both banks of the Jhelum River, a tributary of the Indus River. Srinagar lies between the coordinates $34^{\circ} 01' N$ to $34^{\circ} 27' N$ latitude and $74^{\circ} 36' E$ to $75^{\circ} 30' E$, of over an area of 105 Sq. km (Figure 1).

Srinagar is surrounded by Budgam district in the west, district Pulwama in South and district Ganderbal in north. The city has the unique physiographic setup with steep hills in the east and north east, low lying paddy fields forming flood plain of Jhelum in the south and west and raised plateau lands in the south. The valley is surrounded by the Himalayas on all sides. Winters are cool, with daytime temperature averaging to $2.5^{\circ} C$ ($36.5^{\circ} F$) and drops below freezing point at night. Srinagar has Mediterranean type of climate with percentage humidity varying from 90% in winter to 78% in summer months. The average annual rainfall is around 720 millimetres (28 in). The highest temperature reliably recorded is $38.3^{\circ} C$ ($100.9^{\circ} F$) and the lowest is $-20.0^{\circ} C$ ($-4.0^{\circ} F$). Geologically speaking, the city lies in the middle of great rock depression, with a volcanic hillock of Takat-i-sulaiman formed during the carboniferous and Permian times when glaciers were crawling in some parts of North kashmir (Chadda, 1991).

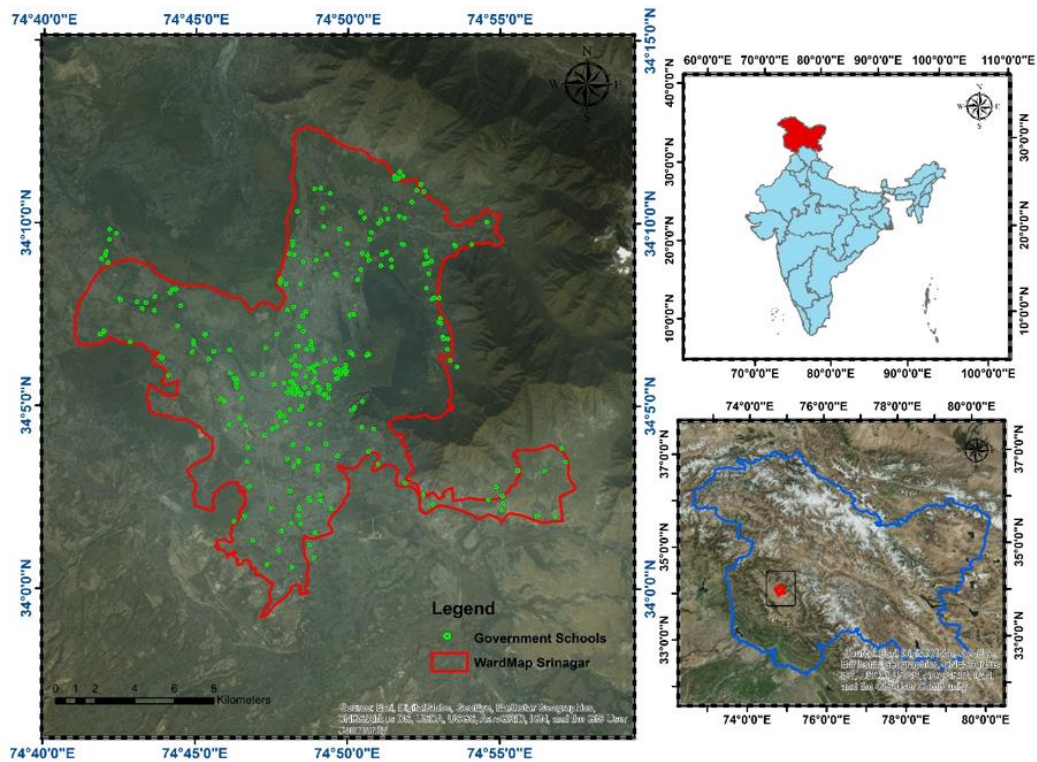


Figure 1: Ward Map of Srinagar City, showing all Government schools.

3. Methodology

In this Study, GPS was used to collect the location (geographic co-ordinates) of various Education facilities as per the data provided by Chief Education officer (C.E.O). These GPS points were then overlaid on high resolution GeoEye-1 image. The overall methodology adopted for the current study is shown in (Figure 2).

The Education data pertaining to these Education facilities was classified into different thematic maps or layers in Arc Map 10.1 GIS as given below:

1. Primary Schools.
2. Primary with Upper Primary Schools.
3. Secondary Schools.
4. Higher Secondary Schools.
5. Schools operating Together.

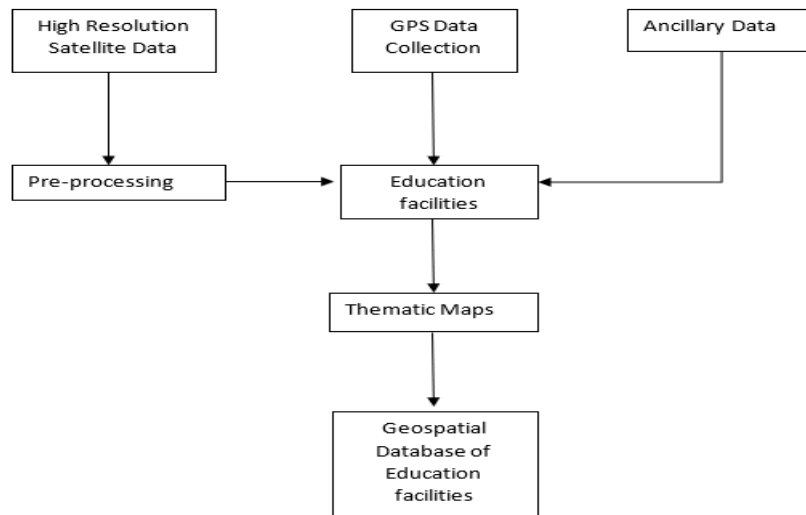


Figure 2: Flow chart of Methodology.

3.1 Data Sets

To carry out the study following data sets were used:

1. GeoEye-1.
2. Global Positioning System (GPS) data.
3. Ancillary data.

GeoEye-1 was launched on September 6, 2008 and is capable of acquiring image data at 0.46 meter panchromatic (B&W) and 1.84-meter multispectral resolution (<https://www.satimagingcorp.com/satellite-sensors/geoeye-1/>). The detailed sensor specification of GeoEye-1 is described in (Figure 3) below.

3.2 GPS Data Collection

In the present study an in-depth mapping of Srinagar city using handheld Juno SB GPS was carried out to generate the geospatial database of Educational facilities.

3.3 Ancillary Data

The ancillary data was generated from the data given at the C.E.O (Chief Education Office). The ancillary data in the form of hard copy format was then digitized to generate the database of Education facilities of Srinagar city in Excel format. It includes name and location of these institutes.

3.4 Pre-Processing

For the present study a high resolution GeoEye-1 of October 2008 was used as the satellite data source. Same data was first geo-referenced by field GCPs in order to make it reliable for the study. Also, the Education institutional data collected by GPS was processed in GPS pathfinder in order to make the data readable in Arc Map 10.1 and remove errors that had occurred during the field survey.

Scheduled Launch Date	2008		
Camera Modes	<ul style="list-style-type: none"> • Simultaneous panchromatic and multispectral (pan-sharpened) • Panchromatic only • Multispectral only 		
Resolution	0.41 m / 1.34 ft* panchromatic (nominal at Nadir) 1.65 m / 5.41 ft* multispectral (nominal at Nadir)		
Metric Accuracy/Geolocation	CE stereo: 2 m / 6.6 ft LE stereo : 3 m / 9.84 ft CE mono: 2.5 m / 8.20 ft These are specified as 90% CE (circular error) for the horizontal and 90% LE (linear error) for the vertical with no ground control		
Swath Widths & Representative Area Sizes	<ul style="list-style-type: none"> • Nominal swath width - 15.2 km / 9.44 mi at Nadir • Single-point scene - 225 sq km (15x15 km) • Contiguous large area - 15,000 sq km (300x50 km) • Contiguous 1° cell size areas - 10,000 sq km (100x100 km) • Contiguous stereo area - 6,270 sq km (224x28 km) (Area assumes pan mode at highest line rate)		
Imaging Angle	Capable of imaging in any direction		
Revisit Frequency at 684 km Altitude (40° Latitude Target)	Max Pan GSD (m)	Off Nadir Look Angle (deg)	Average Revisit (days)
	0.42	10	8.3
	0.50	28	2.8
	0.59	35	2.1
Daily Monoscopic Area	Up to 700,000 sq km/day (270,271 sq mi/day) of pan area (equivalent to about the size of Texas)		
Collection Capacity	Up to 350,000 sq km/day (135,135 sq mi/day) of pan-sharpened multispectral area (equivalent to about the size of New Mexico)		

Figure 3: Sensor Specification of GeoEye-1.

3.5 Data Integration

The Educational facilities database developed in Excel format was converted to .dbf format (Table 1) and integrated with the point locations of Educational institutes through a joining process in Arc Map 10.1.

Table 1: Type of Data sets collected from various Government schools operating in Srinagar city

Name of School	Category	Class Rooms	No. of Students	Location	Type	Latitude	Longitude
	No. of Teachers	Computer Lab	Library	Playground			

4. Results and Discussions

During this Study, an extensive field Survey was carried out to map the Education facilities of Srinagar City using GPS. From a total of 410 Education institutes, 352 were mapped to make a Geodatabase containing the Spatial & Non-Spatial information of each institute. Total of 352 Sites were mapped to make a Geodatabase containing the Spatial & Non-Spatial information of each institute. The government Schools were divided in 5 different categories (Table 2(a), 2(b)): Primary schools, Primary with upper primary, Secondary, Higher Secondary and schools operating together.

Table 2(a): (Attribute date); Total of 10 Sites taken from each Category, showing EIS for Primary, Primary with upper primary, Secondary, Higher Secondary and Schools operating together.

School Name	School Category	Class rooms	Boys	Girls	Total Teachers	Library	Computer Lab	playground	physical Teacher	Building/stories
PS CHEKI HARGOPAL	Primary	2	18	18	2	N/A	NO	N/A	N/A	1
BPS LALOO	Primary	5	60	60	4	N/A	NO	N/A	N/A	1
GPS PEERBAGH	Primary	2	4	6	6	N/A	NO	N/A	N/A	1
PS GORIPORA	Primary	3	9	8	5	N/A	NO	N/A	N/A	1
BPS BAGAT BARZULLA	Primary	2	6	3	3	N/A	NO	N/A	N/A	1
GPS CHECK NAJIRGUND	Primary	1	7	7	2	N/A	NO	N/A	N/A	1
BPS RAWALPORA	Primary	2	31	30	12	N/A	NO	N/A	N/A	1
GPS WATTAL PORA RAWALPORA	Primary	2	18	24	3	N/A	NO	N/A	N/A	1
GPS CHECK RAWALPORA	Primary	3	30	30	3	N/A	NO	N/A	N/A	1
PS PARBAGH RAWALPORA	Primary	1	4	9	3	N/A	NO	N/A	N/A	1
MS ALLOUCHI BAGH	Primary with Upper Primary	5	35	30	6	N/A	NO	Available	Available	1
GIS AMIRA KADAL	Primary with Upper Primary	9	35	165	17	N/A	NO	Available	Available	1
BHS TULSI BAGH	Primary with Upper Primary	8	28	13	16	N/A	NO	Available	Available	1
GIS TULSI BAGH	Primary with Upper Primary	9	24	11	13	N/A	NO	Available	Available	1
BHS KUSHIPORA	Primary with Upper Primary	10	47	0	7	N/A	NO	Available	Available	1
GIS UMERABAD	Primary with Upper Primary	7	16	23	6	N/A	NO	Available	Available	1
GIS KHUSHIPORA	Primary with Upper Primary	4	0	83	5	Available	NO	Available	Available	1
GIS ZAINAKOTE	Primary with Upper Primary	7	102	119	12	Available	NO	Available	Available	1
BHS BEMINA	Primary with Upper Primary	5	40	63	10	Available	NO	Available	Available	1
GIS BOAT COLONY	Primary with Upper Primary	7	59	90	24	Available	NO	Available	Available	2
GIS BATHALOO	Secondary	15	28	65	24	Available	Yes	Available	Available	2
GIS SHALTENG	Secondary	8	50	39	17	Available	Yes	Available	Available	2
GIS CHATTABAL	Secondary	12	20	18	10	Available	Yes	Available	Available	2
BHS LAWAYPORA	Secondary	7	19	36	12	Available	Yes	Available	Available	2
BHS BARTHANA	Secondary	14	194	159	24	Available	Yes	Available	Available	2
PS RAMBAL GARH	Secondary	7	100	139	13	Available	Yes	Available	Available	2
GIS BARZULLA	Secondary	7	28	28	15	Available	Yes	Available	Available	2
BHS HYDERPORA	Secondary	8	62	47	12	Available	Yes	Available	Available	2
GIS CHATTERHAMA	Secondary	8	42	101	17	Available	Yes	Available	Available	2
KGBV GASOO	Schools operating Together	8	0	22	6	Available	NO	Available	Available	2
KGBV GORIPORA	Schools operating Together	3	0	38	6	Available	NO	Available	Available	2
GPS OLD PAMPOSH COLONY	Schools operating Together	2	37	35	2	N/A	NO	N/A	N/A	1
GPS PANZINARA	Schools operating Together	3	6	19	4	N/A	NO	N/A	N/A	1
BPS PARIMPORA	Schools operating Together	3	10	12	2	N/A	NO	N/A	N/A	1
GPS PARIMPORA	Schools operating Together	2	10	10	2	N/A	NO	N/A	N/A	1
GPS TALI MOHALLA UMARHAIR	Schools operating Together	1	14	10	2	N/A	NO	N/A	N/A	1
BPS UMERHAIR	Schools operating Together	6	41	0	3	N/A	NO	N/A	N/A	1
PS KHOJA BAGH	Schools operating Together	1	5	9	2	N/A	NO	N/A	N/A	1
PS HANAN ABAD MALOORA	Schools operating Together	1	4	6	2	N/A	NO	N/A	N/A	1
BHSS Hazratbal	Higher Secondary	NA	305	0	11	Available	Yes	Available	Available	3(4)
BHSS Zainakote	Higher Secondary	NA	82	80	16	Available	Yes	Available	Available	3(4)
BHSS Batmalbo	Higher Secondary	NA	401	0	22	Available	Yes	Available	Available	2(3)
GHSS Amirakadal	Higher Secondary	NA	0	1915	16	Available	Yes	Available	Available	2(3)
GHSS Khanyar	Higher Secondary	NA	0	569	19	Available	Yes	Available	Available	3(3)
GHSS Kothibagh	Higher Secondary	NA	0	1561	28	Available	Yes	Available	Available	2(3)
BHSS Jawahir Nagar	Higher Secondary	NA	1081	0	10	Available	Yes	Available	Available	2(3)
S. P.Hr. Sec	Higher Secondary	NA	3470	0	20	Available	Yes	Available	Available	4(2)
GHSS Sec	Higher Secondary	NA	0	626	13	Available	Yes	Available	Available	2(4)
GHSS Nawaladial	Higher Secondary	NA	0	1543	15	Available	Yes	Available	Available	2(3)

Table 2(b): (Attribute date); Total of 10 Sites taken from each Category, showing EIS for Primary, Primary with upper primary, Secondary, Higher Secondary and Schools operating together

School Name	School Category	Class rooms	Boys	Girls	Total Teachers	Library	Computer Lab	playground	physical Teacher	Building/stories
MPS BANIPORA	Primary	3	5	3	4	N.A	NO	N.A	N.A	1
PS MAHARAJ PORA	Primary	1	6	11	2	N.A	NO	N.A	N.A	1
PS SHEIKH DAWOOD COLONY	Primary	1	10	9	2	N.A	NO	N.A	N.A	1
BPS PARIMPORA	Primary	3	10	12	2	N.A	NO	N.A	N.A	1
GPS PARIMPORA	Primary	2	10	10	2	N.A	NO	N.A	N.A	1
PS GHAT PARIM PORA	Primary	1	18	14	2	N.A	NO	N.A	N.A	1
PS DAR MOHALLA	Primary	1	16	14	2	N.A	NO	N.A	N.A	1
BPS SHALTENG	Primary	3	16	10	2	N.A	NO	N.A	N.A	1
PS ABAN SHAH	Primary	2	12	15	2	N.A	NO	N.A	N.A	1
PS KUMAR MOHALLA KHUSHIPOORA	Primary	2	11	15	2	N.A	NO	N.A	N.A	1
BMS MALOORA	Primary with Upper Primary	8	111	48	10	Available	NO	N.A	Available	1
MS KOJABAGH MALOORA	Primary with Upper Primary	3	37	56	3	Available	NO	N.A	Available	1
GMS CHEK MUJGUND	Primary with Upper Primary	3	31	22	4	Available	NO	N.A	Available	1
GMS MUJGUND	Primary with Upper Primary	5	84	126	12	Available	NO	N.A	Available	1
BMS TENGPOORA	Primary with Upper Primary	5	26	26	10	Available	NO	N.A	Available	1
GMS BARTHANA	Primary with Upper Primary	4	11	11	5	Available	NO	N.A	Available	1
MS FIRDOUSABAD FRUIT MANDI	Primary with Upper Primary	3	24	24	4	Available	NO	N.A	Available	1
BMS S K COLONY	Primary with Upper Primary	5	85	93	11	Available	NO	N.A	Available	1
BMS PANZINARA	Primary with Upper Primary	7	25	23	13	Available	NO	N.A	Available	1
GMS BARZULLA	Primary with Upper Primary	4	13	19	14	Available	NO	N.A	Available	1
GHS RAIBAGH	Secondary	9	3	105	24	Available	Yes	Available	Available	2
BHS SONWAR	Secondary	10	63	48	22	Available	Yes	Available	Available	2
BHS PANITHACHOWIK	Secondary	13	51	47	23	Available	Yes	Available	Available	2
BHS BADAMI BAGH	Secondary	8	6	3	15	Available	Yes	Available	Available	2
GHS PANIRETHANI	Secondary	7	20	21	18	Available	Yes	Available	Available	2
GHS LASJAN	Secondary	10	0	109	15	Available	Yes	Available	Available	2
BHS NATIPORA	Secondary	10	114	108	22	Available	Yes	Available	Available	2
GHS R.N.MANDIR	Secondary	9	26	32	21	Available	Yes	Available	Available	2
GHS ZAINDAR MOHALLA	Secondary	3	20	12	17	Available	Yes	Available	Available	2
BHS G G. MOHALLA	Secondary	4	7	13	12	Available	Yes	Available	Available	2
GOVT.HSS GUND HASSI BHAT	Schools operating Together	7	17	23	13	Available	Yes	Available	Available	2
GHS HYDERPORA	Schools operating Together	10	10	3	15	Available	Yes	Available	Available	2
BHS BARZULLA	Schools operating Together	6	14	14	16	Available	Yes	Available	Available	2
BHS TAKENWARI	Schools operating Together	8	66	40	20	Available	Yes	Available	Available	2
BHS NANIPORA	Schools operating Together	3	43	53	15	Available	Yes	Available	Available	2
BHS NEW THEED	Schools operating Together	6	26	0	19	Available	Yes	Available	Available	2
BHSS NOWPORA	Schools operating Together	8	8	7	23	Available	Yes	Available	Available	2
BHS RAINAWARI	Schools operating Together	11	50	0	22	Available	Yes	Available	Available	2
GHSS RAINAWARI	Schools operating Together	6	0	53	34	Available	Yes	Available	Available	2
BHS LASJAN	Schools operating Together	9	14	0	16	Available	Yes	Available	Available	2
BHS GASSI MOHALLA	Higher Secondary	11	123	124	21	Available	yes	Available	Available	3
BHS CHANDIHAR	Higher Secondary	9	56	86	16	Available	yes	Available	Available	2
GHS NARWARA	Higher Secondary	9	0	39	20	Available	yes	Available	Available	2
BHS NARWARA	Higher Secondary	9	35	0	18	Available	yes	Available	Available	2
GHS GOORIPORA	Higher Secondary	8	39	27	13	Available	yes	Available	Available	2
BHS SANGUM	Higher Secondary	10	78	64	19	Available	yes	Available	Available	2
GHS HARWAN	Higher Secondary	7	0	184	19	Available	yes	Available	Available	2
BHS HARWAN	Higher Secondary	12	165	0	20	Available	yes	Available	Available	2
GHS DRUGJAN	Higher Secondary	9	38	150	20	Available	yes	Available	Available	2
BHS BRANE	Higher Secondary	11	38	0	18	Available	yes	Available	Available	2

4.1 Primary Schools

The term primary school is derived from French *école primaire*, which was first used in 1802. The primary schools are those type of elementary institutes in which children between the age group of 4-10 years of age receive first stage of compulsory education. In India schools having classes up to V (Starting from Play schools, Nursery, LKG, UKG) are categorized as primary school or elementary schools. In the current study a total of 112 Primary Schools (Figure 4) were mapped using GPS and the generated point theme was then stored in the Geodatabase.

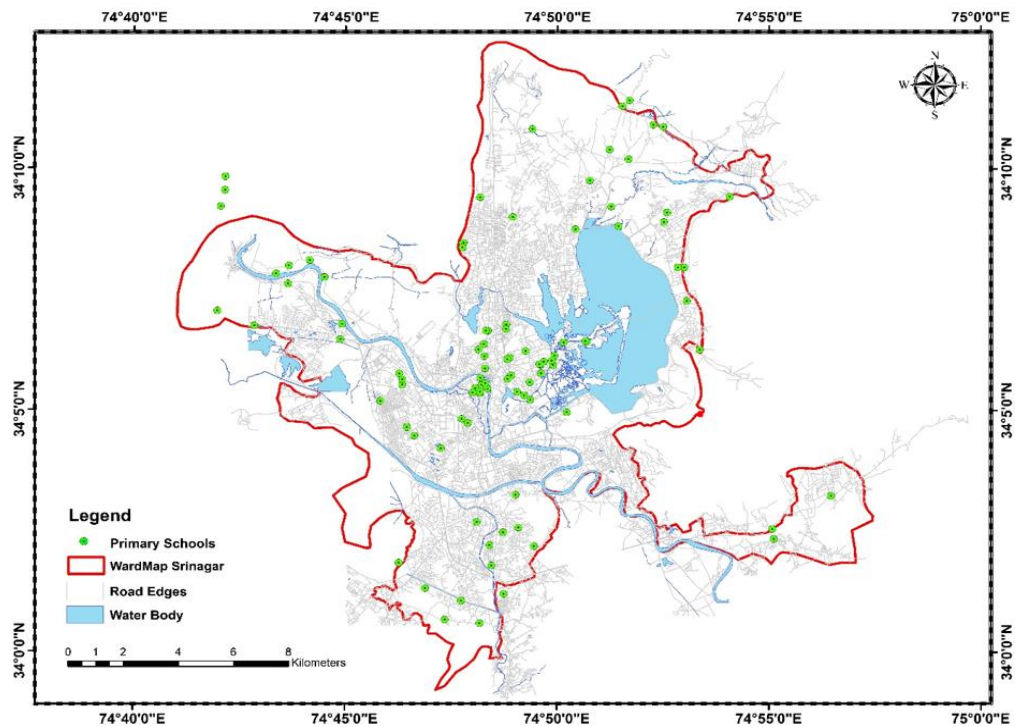


Figure 4: Total number of Government Primary Schools in Srinagar city (J&K).

4.2 Primary with Upper Primary School

Primary with upper primary or Middle schools are those type of elementary institutes in which children between the age group of 11 – 14 years of age receive second stage of compulsory education. In India schools having classes from VI – VIII are categorized as primary with upper primary school or middle schools. It is important to mention here Government of India made education free for children for 6 to 14 years of age or up to class VIII under the “Right of Children to Free and Compulsory Education Act 2009” (Ministry of Law and Justice Legislative Department). A total of 138 Government middle Schools (Figure 5) mapped using GPS and the generated point theme was then stored in the Geodatabase.

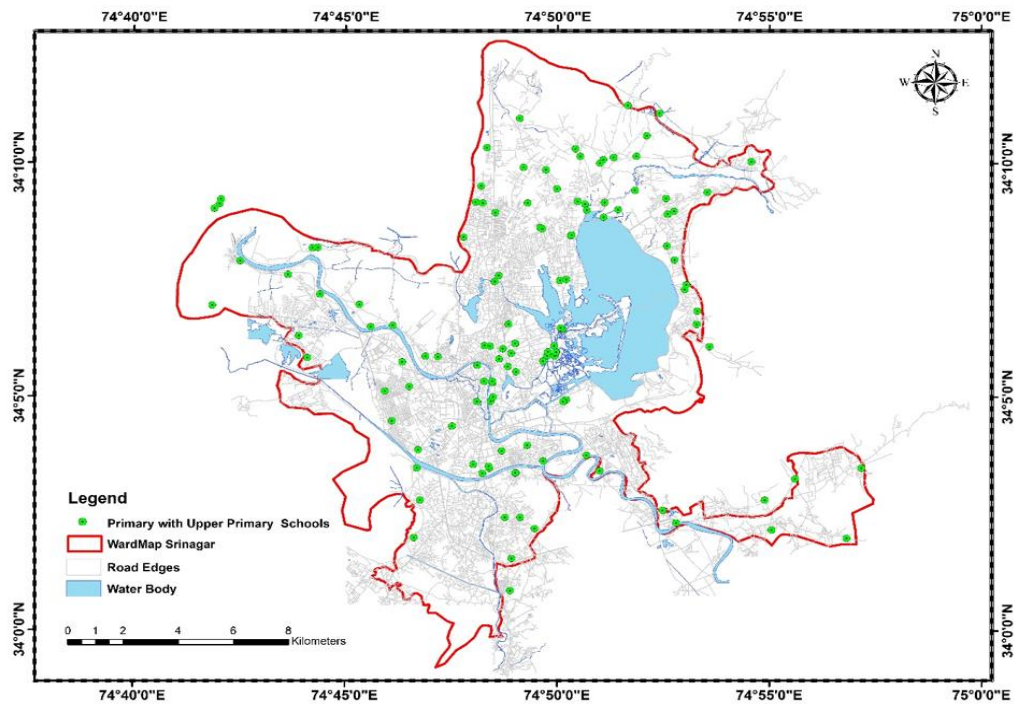


Figure 5: Total number of Government Primary with upper primary Schools in Srinagar city (J&K).

4.3 Secondary Schools

Depending on the system, schools for this period, or a part of it, may be called secondary Schools or High schools. In India children between the age group of 15 – 16 years of age are enrolled and cover two year of study of classes IX & X. The exact boundary between primary and secondary education also Varies from country to country and even within them. Here comes the main stage for a student's Career and that is Board exams of class X, till this period every student has same subjects to follow if they are from same Board of School Education (BOSE) or Central Board of Secondary Education (CBSE). A total of 52 Government Secondary Schools (Figure 6) mapped using GPS and the generated point theme was then stored in the Geodatabase.

4.4 Higher Secondary Schools

Higher secondary schools are those type of institutes in which children between the age group of 17 – 18 years of age are enrolled. These two years of study are the compulsory and important stage for which a pass certificate is needed to carry out further studies (College or University). In India schools having classes from XI – XII are categorized as Higher secondary schools. A total of 29 Government Higher Secondary Schools (Figure 7) mapped using GPS and the generated point theme was then stored in the Geodatabase.

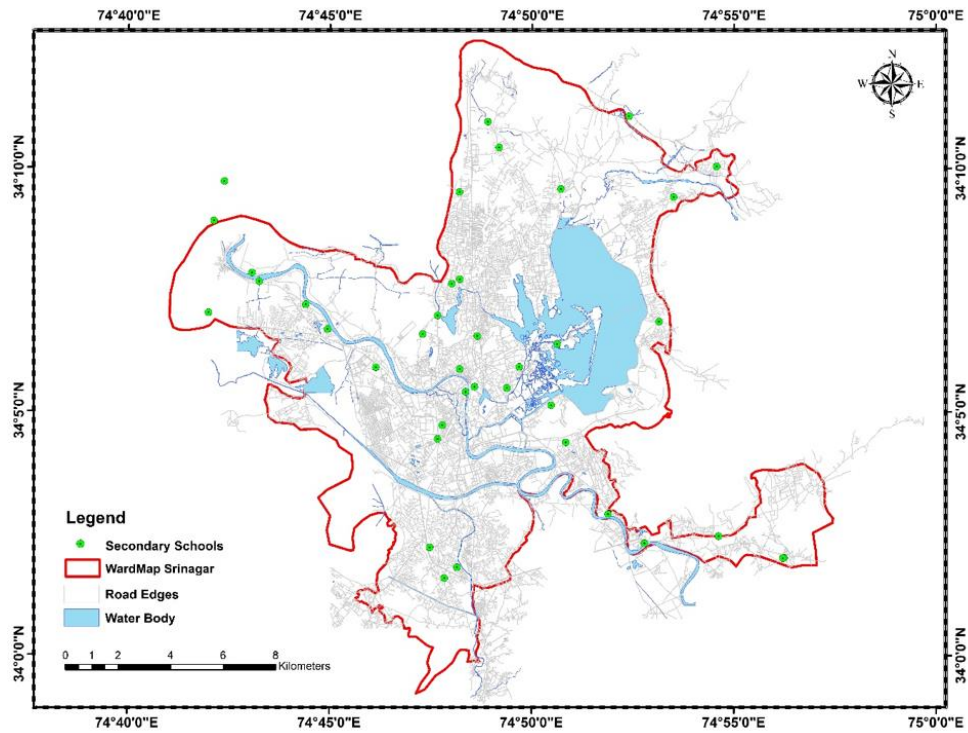


Figure 6: Total number of Government Secondary Schools in Srinagar city (J&K)

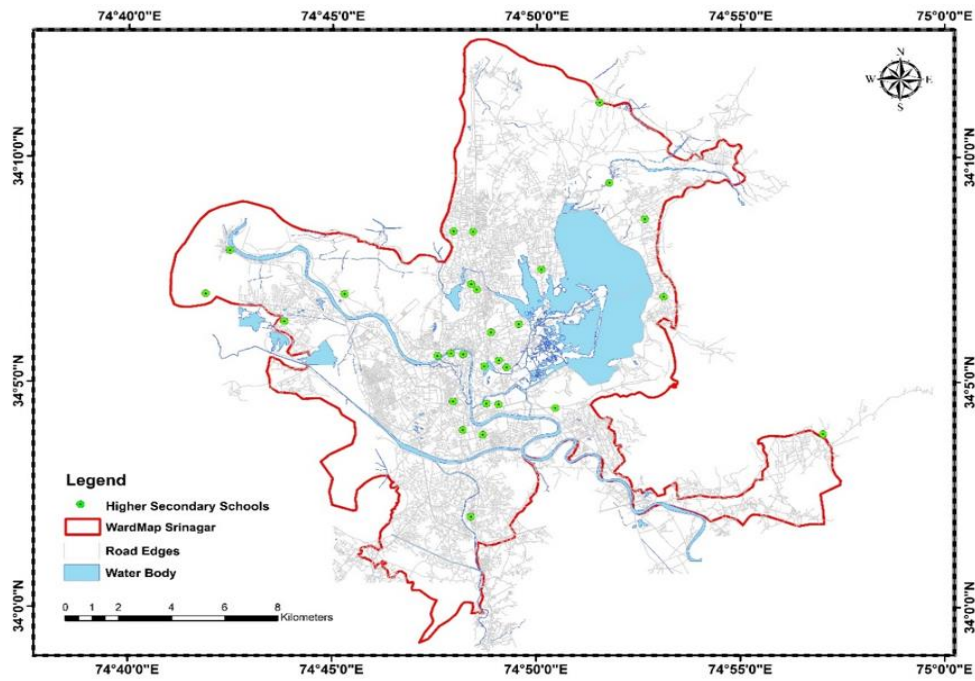


Figure 7: Total number of Government Higher Secondary Schools in Srinagar city (J&K)

4.5 Schools Operating Together

Schools of different blocks which are operating together at same place e.g. Ps Kushipora and Bms Kushipora HMT etc. So, these Schools constitute same geographic Location. A total of 10 such schools (Figure 8) were mapped constituting primary & primary or Primary & primary with upper primary schools.

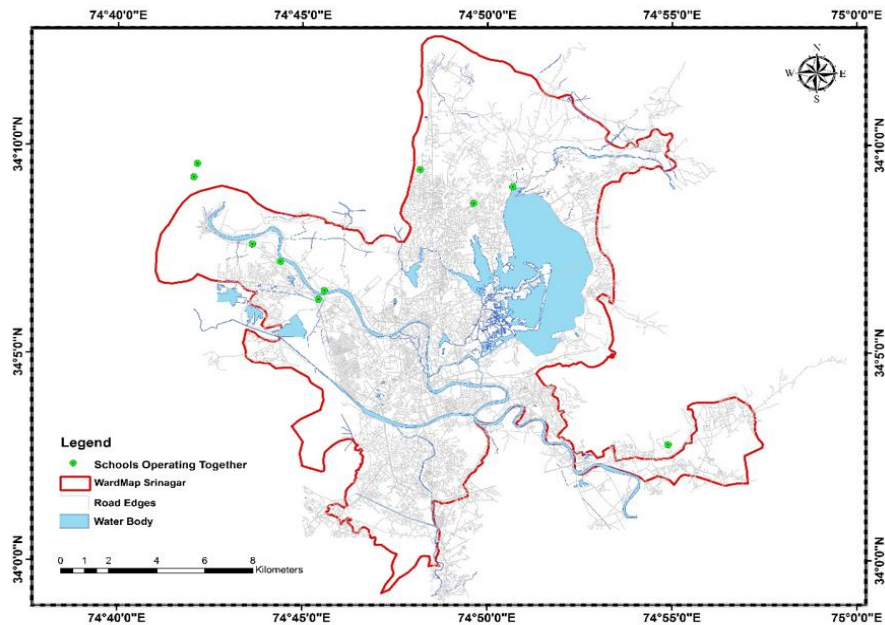


Figure 8: Total number of Government Schools operating together in Srinagar city (J&K)



Figure 9: Snapshots of Different Education facilities in the Srinagar City, J&K taken during field survey. (A, B) Showing Government Primary Schools. (C, D) Government Primary with upper primary Schools. (E, F) Government (G, H) Government Higher secondary schools. (I, J) Government Schools Operating together

5. Conclusion

During the study it was found that majority of schools lacked basic facilities like Toilets, Playgrounds, libraries, labs, etc. Most of the Schools are located in rented buildings and most of the primary schools operate in one or two rooms. These schools lack basic infrastructure. The classes are crowded and teachers are not able to give proper attention to children's. Most of the Primary with upper primary is also operating from rented accommodations lacking proper facilities. Most of the Secondary and Higher Secondary schools lack facilities like playground, Sports equipment, Lab equipment, Computer facility etc. In addition to this, the quality of education provided is not up to the standard. Many areas have unequal distribution of Schools, with some areas having more than two schools in their vicinity and others don't have even single school. The participation of Government Schools in various academic and extracurricular activities is negligible thus preventing Students from having a healthy exposure.

This study led to the vision for the generation of EIS for Srinagar City using GIS and would be used as a baseline data to improve planning, organisational efficiencies, data collection and analysis, information sharing & transparency in the education sector, especially as these activities may relate to helping meet objectives relate to Education for its development goals.

Authors Contribution

Each author contributed to the research in terms of conception, research design, cross-checking data analysis and co-writing the paper. Both authors read and approved the final manuscript.

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