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EVALUATION OF EDUCATIONAL SERVICES USING SPATIAL ANALYSIS AND GIS (AL HUSSAINYEH CITY AS CASE STUDY)

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Abstract: Geographical Information Systems (GIS) becoming useful and important tools for making strategic decisions whenever trusted data are found to have spatial distribution, finding suitable sites for educational areas are important, like Schools which are located in a strategic and safe area play an important role for buildup students' abilities in future. Therefore, the aim of the present work is to Study firstly, the evaluation of educational services in the two cities (Al Hussainyeh & Imam Oun) within their regional context and to recommend long term options for their development. Secondly, it aims to outline the necessary actions that shall ensure the orderly development of expansion of educational needs within urban limits, make a Spatial analyzing for educational services in Al Hussainyeh city, It was carried out by geographic information system (GIS) as a tool for multi-criteria spatial analyzing. the results with some implemented standards based on (GIS) using ArcGIS info-10.2.1 spatial and analysis tools and Excel office as statistical software.

Keywords: *Spatial analysis, GIS, Education, Al Hussainyeh city*

التحليل المكاني للخدمات التعليميه في مدينه الحسينيه باستخدام نظم المعلومات الجغرافيه

الخلاصة: اصبحت نظم المعلومات الجغرافيه اداة مفيده وفاعله لاتخاذ قرارات ستراتيجيه وخاصه عند توفر بيانات دقيقه لاستخدامها في التحليل المكاني , ايجاد مكان ملائم للخدمات التعليميه مهم جدا حيث ان المدارس المختاره في مكان ستراتيجي وامن تلعب دورا كبيرا في بناء قدرات الطلاب في المستقبل , الهدف من هذا البحث القيام بالتقييم و التحليل المكاني للخدمات التعليميه في مدينه الحسينيه وامام عون باستخدام نظم المعلومات الجغرافيه, ثانيا تحديد الخطوط الرئيسيه التي يمكن من خلالها تطوير هذا القطاع ضمن المحددات المعمول بها ولغرض القيام بالتحليل المكاني في مدينه الحسينيه وامام عون تم استخدام نظم المعلومات الجغرافيه كاداة للتحليل المكاني المتعدد الاحتمالات باستخدام ArcGIS info-10.2.1 software و برنامج Excel office كبرنامج احصائي للبيانات المدخله والنتائج المستخرجه.

1. Introduction

The development of Geographic Information System (GIS), spatial analysis and computer technology become an uncomplicated assignment for planners. Spatial

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analysis aims to identify the most appropriate spatial pattern for future site location according to specify requirements and preferences of some activities [1].
GIS used to understand, analyze, and manage data spatially. Although it started with the purpose of creating digital maps, it quickly became a valuable tool in the decision making process for various educational services. Systematic plan is one of the main factors that ensure a good quality in education development and well equipped school site. [2] However, locating the best school site is always a problem.[3] Educational services as it is meant to equip peoples with the basic skills of reading, writing and basic arithmetic. Therefore, it is clear to see that educational services are very important as it sets the pace of a person's educational career. Iraqi government made it a priority to provide basic education for all. Educational opportunity has become a social and political goal and this has led to declining quality.

The objectives of this Study will be firstly, evaluate the educational services in the two cities within their regional context and to recommend long term options for their development. Secondly, it aims to outline the necessary actions that shall ensure the orderly development of expansion of educational needs within urban limits.

2. Site Description

The City of Al Hussainyeh is located in Karbala Governorate, at 15 Km to the north east of Karbala and about 72 Km to the south of Baghdad (photo.1).

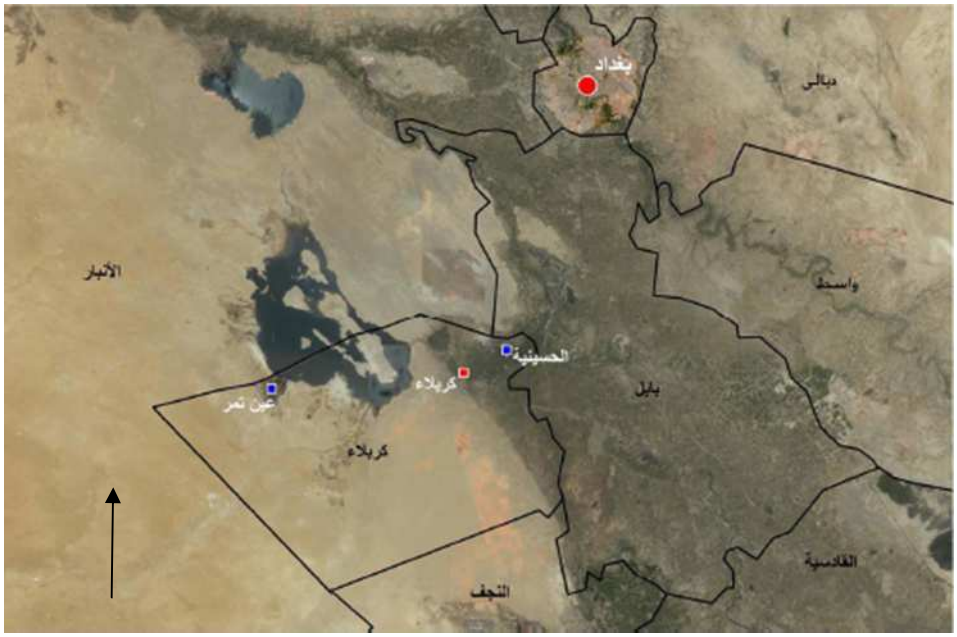


Photo 1: Location of Al Hussainyeh city

Region of Al Hussainyeh is located within the administrative boundaries of Karbala province, (Fig.1), away from the city of Karbala a distance of 20 kilometers, and Occupies the north-eastern part of the province. The region area of Al Hussainyeh is almost 335 km^2 with a percentage of 6.5 % of the total area of Karbala, which is 5030 km^2.

Figure 1: location of Al Hussainyeh Region

The city of Hussainyeh is located in the center of Al Hussainyeh district within the administrative borders of the governorate of Karbala and on the eastern side of it. It is about 10 km away from the governorate center and falls within the geographic coordinates (44 degrees and 9 minutes and 24 seconds) to the east and 32 degrees and 40 minutes and 22 Seconds to the north (Fig. 2).

Figure 2: Location of Al Hussainyeh City in Relation to Al Hussainyeh District

The total study area amounts to (373) hectares; it includes Al Hussainyeh and Imam Oun and presents (1.2%) of the total district area which is equal to (33,400) hectares. while the area of Imam Oun is about (28) hectares. The available statistics indicate that the majority of the city population is provincial; according to population estimates for

the year 2010, the population of Al Hussainyeh was 137,654 of which 113,812 inhabitants were rural, with the rest 23,842 inhabitants- being urban. [4]

3. Geospatial analysis

Spatial data analysis is concerned with that branch of data analysis where the geographical referencing of objects contains important information. In many areas of data collection, especially in some areas of experimental science, the indexes that distinguish different cases can be exchanged without any loss of information. All the information relevant to understanding the variation in the data set is contained in the observations and no relevant information is contained in the indexing. In the case of spatial data the indexing (by location and time) may contain crucial information. A definition of spatial analysis (of which spatial data analysis is one element) is that it represents a collection of techniques and models that explicitly use the spatial referencing of each data case. Spatial analysis needs to make assumptions about or draw on data describing spatial relationships or spatial interactions between cases.[5],[6]

The challenges that faced in provision of educational sites, there is need to be able to represent the information spatially. GIS will enable us to understanding the statues of education size and services sectors.

GIS as earlier mentioned is a great tool in planning activities. Apart from that it can be used for analysis. In educational services the focuses on this paper, it can be used to quantify the distribution of schools and the area of its served and therefore will be able to show areas of disparities.

The patterns, trends and relationships are clear through GIS, and this is truly where the power of GIS lies. Furthermore, GIS can be used as a management tool by the Government and other major players in the education sector. GIS can integrate georeferenced imagery as data layers or themes and link them to other data sets to produce geospatial representations of data. [7]

Data have been represented on maps to give a spatial view with minimum errors. The primary steps that any project of this kind ought to do is to study and evaluate the current Master Plan applicable by the Directorate of the city, as per the available information, the Master Plan of Al Hussainyeh was modified in 2001 and 2010.

No population statistics and educational services data were found for Al Hussainyeh city prior to the year 1997; depended on general estimations and speculations. Moreover, sources indicate that the population of the city amounted to about (19,477) inhabitants in 2005, while the general population census indicates a clear increase in the population in the year 2007 as it reached (21,020).

3.1. Population Sex Composition

A slight difference is noted between males and female's ratios; in year 2005 for instance, male's percentage was 50%, while that of the females amounted to 49%, this ratio then increased to become 52% for males and 47% for females in the year 2010. [4]

3.2. Population Age Composition

Regarding the distribution of age groups within the city of Al Hussainyeh and Imam Oun, it can be see that the community is mostly of the youth; where in the year of 2010, the percentage of individuals under the age of 15 years was found to be 48% of the total population. An illustration of the distribution of age groups in the city for the year 2010 is shown in (Table 1),[4].

Table 1 Population Distribution by Age Groups In Al Hussainyeh City And Imam Oun (2010*)

Residential Sector	Population (Persons)	Area (Hectare)	Population Density (person/ Hectare)
Hussainyeh 1	5786	105.1	55.05
2	4606	115	40.05
3	5179	94	55.1
Imam Oun 4	5431	112.6	48.23
Total	21002	426.7	49.22

*Ministry of Construction and Housing / Public Housing Authority

4. Analysis and Results of the Current Population Density of the City Al Hussainyeh

First of all, the total population density of Al Hussainyeh city was calculated, this was done through calculating the total area of the city and dividing it by the total population, the density came out to be 50 persons / ha, but this density is not representative, since the city area contains many empty uninhabited areas.

In order to obtain a more accurate density figure, the total density was calculated for the built up area only within the city, while disregarding the empty areas. The total population density of the city came out to be around 65 person / ha.

To get a more accurate, the population density of each residential neighborhood in the city was calculated separately, in order to get an accurate indication on population densities within fully developed residential neighborhoods, which are supposed to be high due to the nature of the distribution of prevailing housing units in Iraq, therefore, the average density of residential neighborhoods in the city of Hussainyeh amounted to about 80 people / ha, which is greater than the city's total density, this is because there are complete neighborhoods within the city, such as the industrial neighborhood and the neighborhood occupied by Karbala College of Agriculture, which are of low density and which would result in reducing the city's overall density.

5. Analysis and Results of Educational Services

The number of schools in 1997 within AL- Hussainyeh city (previously known as Municipality of Ateeshi) is 4, these occupy an area of 1.8 hectares, that is, 4.3 percent of

the study area then, however, the number of schools constructed based on 2010-2014 Plans of AL- Hussainyeh city has increased, bringing the number of schools in the city to a total of 12 schools, This is in addition to a set of schools which were designed within the first Master Plan of the year 2001 but were not yet implemented.

Numerous educational institutions that range from primary schools to agricultural colleges exist in the city of Hussainyeh and Imam Oun, with their services covering all areas within the city and amounting to a total of 15 schools and colleges. (Table 2) shows the number of educational institutions by educational level within each and every residential sector of the city. photoMaps (1,2) show the spatial distribution of educational services in the city, by their types and educational levels, as well as the existing schools and those which are designed but are still not constructed within the city's plans. photoMaps (3,4,5) shows the scope of services of all schools within Al-Hussainyeh city and Imam Oun .

Table 2: Distribution of Educational Institutions In Al Hussainyeh City And Imam Oun

Residential Sector		Type and Number of Educational Institutions					Total Residential Sector Level
		Primary School (s)	Elementary School (s)	Middle School (s)	Secondary School(s)	Colleges & Institutes	
Al Hussainyeh	1	2	2	2	1	1	8
	2	2	1	1	1	0	5
	3	0	0	0	0	0	0
Imam Oun	4	1	0	0	1	0	2
Total at the city level		5	3	3	3	1	15

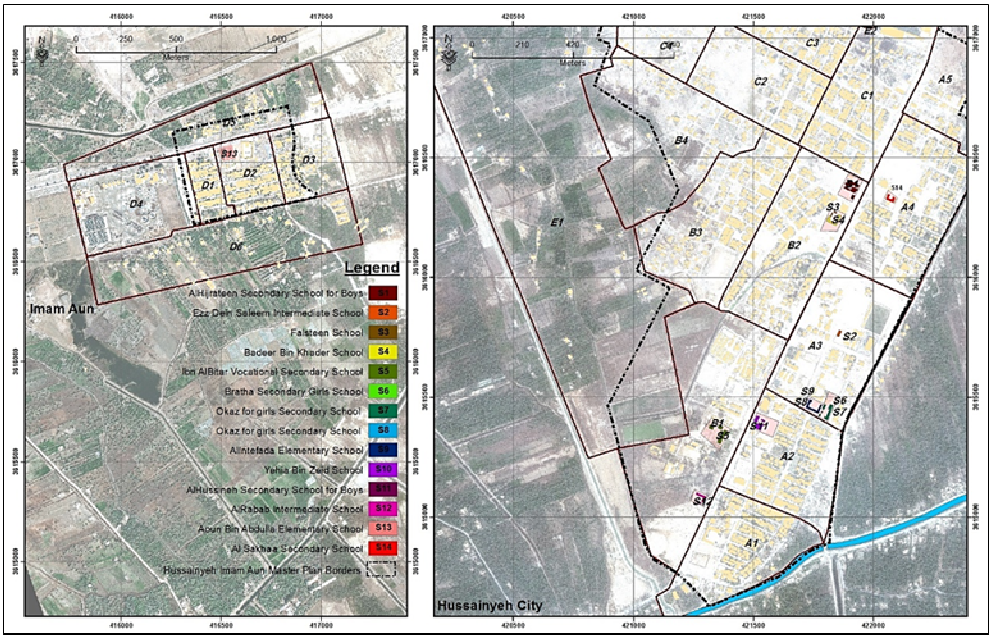


Photo Map 1: Educational Services- Schools Names -Hussainyeh City

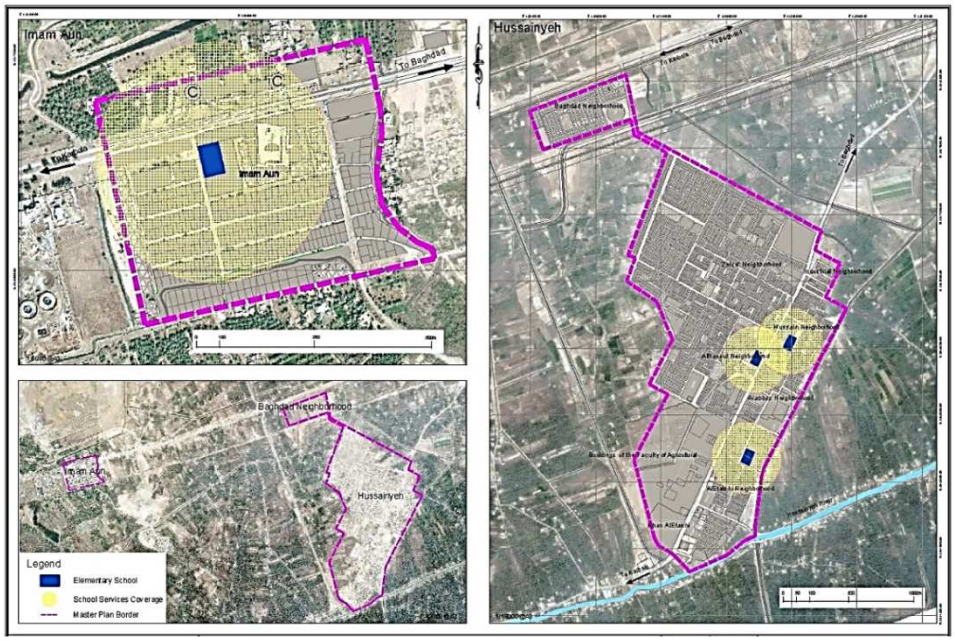


Photo Map 2: Elementary Schools Services Coverage in Hussainyeh and Imam Oun

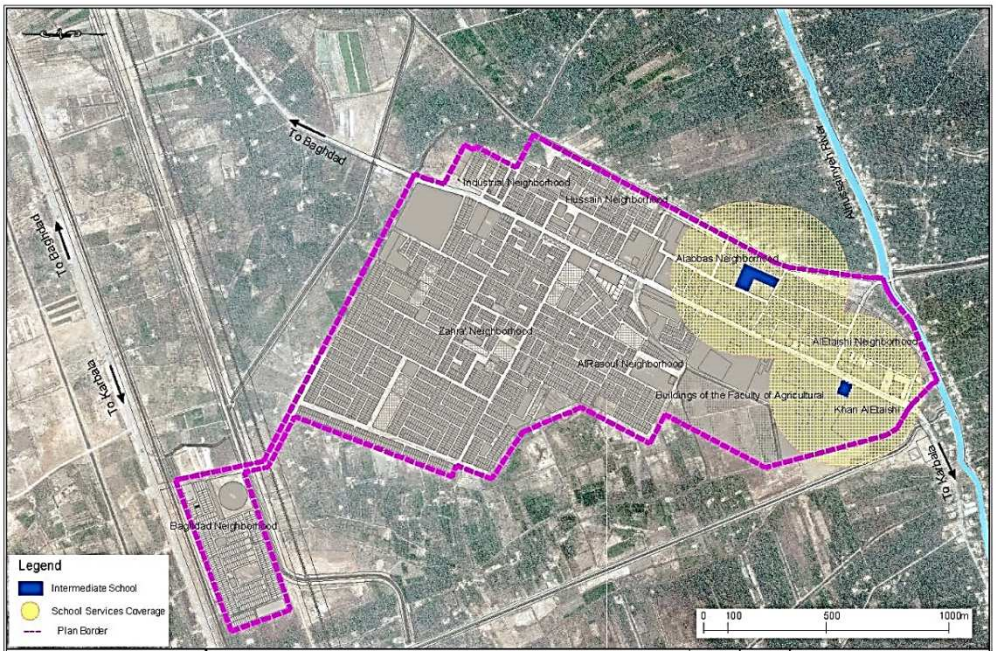


Photo Map 3: Intermediate Schools Services Coverage in Al Hussainyeh

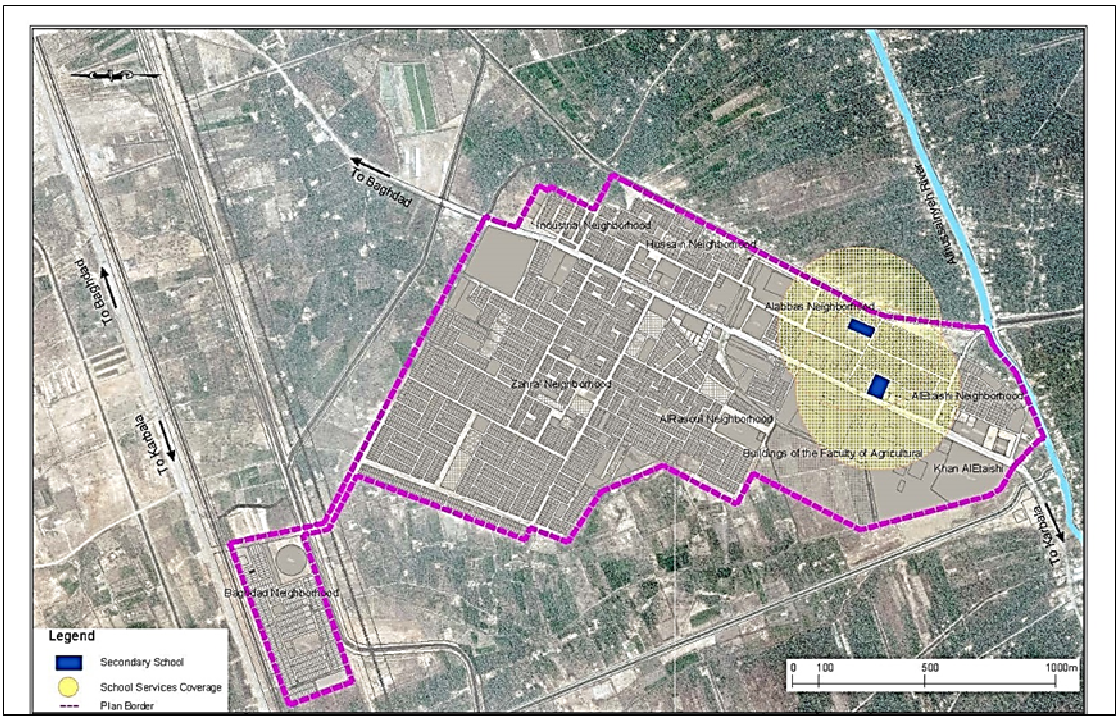


Photo Map 4: Secondary Schools Services Coverage in Hussainyeh

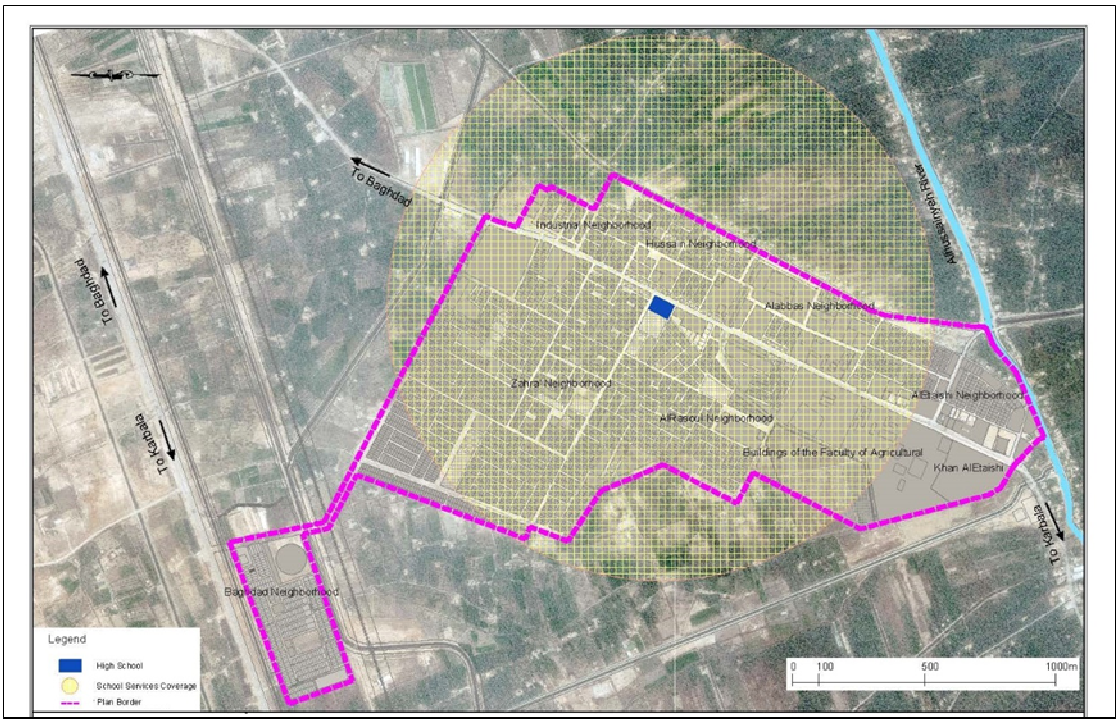


Photo Map 5: High Schools Services Coverage in Hussainyeh

Schools descriptive information in Al Hussainyeh city and Imam Oun is set out in (Table 3).

Table 3. Schools Descriptive Information In Al Hussainyeh City and Imam Oun

Educational Stage	Number of Schools	Total Area (m^2)
Al Hussainyeh		
Primary	4	5,244
Middle	3	6,500
Preparatory	3	13,700
Secondary	2	10,500
Imam Oun		
Primary	1	4,000
Secondary	1	3,800

6. Analysis of the Current Educational Areas in AL- Hussainyeh City and Imam Oun

Areas designated for educational services within Al- Hussainyeh municipality of year 2001 amount to 37 hectares, which is almost 14 % of the total area.[4] Constructed educational areas can be observed by projecting the corrected satellite image (landsat-2012) can be noted that there aren't any nurseries or kindergartens within the city, although areas were allocated for such services in the sectors designs. Additionally, a site of Agricultural Preparatory School was allocated within the city for Karbala. the total educational areas amount about 56 hectares, representing a percentage of 16 % of the total area, and among which about 28 hectares are constructed areas.

Given the fact that AL-Hussainyeh city is located within an agricultural area and palm filled groves, the estimation from the analyzing and GIS mapping area of 40 hectares for farms and research fields for Al- Hussainyeh Preparatory School of Agriculture, located near Al- Ateeshi archaeological hill. Such areas represent 11 % of the total area of the city. However, an area of 8.5 hectares, that is 22% of the area of the Preparatory School of Agriculture was utilized for military purposes due to the current circumstances through which Iraq and the holy city of Karbala pass. We believe that such use may be temporary, as the size of the area and its location are not suitable for such military use and shall eventually be used for educational purposes in the future.

From the spatial analyzing of the study area we can see clearly that areas designated for educational purposes (schools) within the city about 13 hectares of the total area allocated for such use, that is, about 56 hectares of the total area of the city of Hussainyeh and representing 16% of the total area.

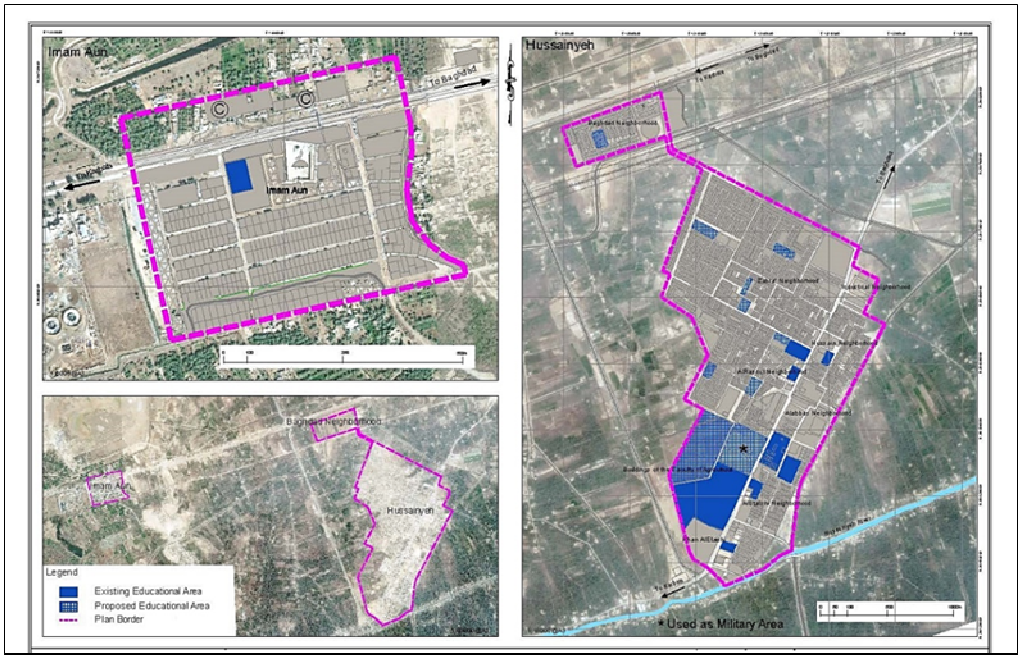
The built up area of educational sites, apart from the Preparatory School of Agriculture and the College of Agriculture, amounts to 5.9 hectares in addition to an area of 1 hectare of a preparatory school currently under construction (within "AL Rassul" neighborhood). The educational areas that are still not constructed amount to 6 hectares distributed among the low density population residential areas, including a school within Baghdad Neighborhood which still contains no construction so far.

The school sites are mainly concentrated within the city center and the main axis of the city, as well as "AL- Abbas" neighborhood, which is located in the center of the city

provided that these educational sites provide service to the villages and residential areas located within the fields scattered along Al- Hussainyeh River.

(PhotoMap 6) shows analysis and spatial distribution for educational Areas in Hussainyeh and Imam Oun. In light of the above, the built up educational areas represent 49.6% of all educational area that amounts to 56 hectares. (table 4). Detailed analysis of existing educational services can be seen in (table 5).

The presence of the Preparatory School of Agriculture with its large fields, along with the Faculty of Agriculture will be a future academic focus within the city due to the agricultural nature of the region and its need for human resources with agricultural engineering background to participate in the development of the agricultural sector across the region of the central Euphrates of Iraq.



photoMap 6: Educational Areas in Hussainyeh and Imam Oun

Table 4. Educational Areas in Al- Hussainyeh City as per the Master Plan of year 2010 after adding Baghdad Neighborhood and the full changes made as per resolution 117 and a comparison with actual conditions* and a comparison with actual conditions*

Educational Use Area (ha)	Percentage of Educational Use as per the Master Plan**	Constructed Area (ha)	Percentage of Constructed of Master Plan	Percentage of Constructed of Designed
56.2	16.29%	27.9	8.09%	49.64%

This table includes areas of schools and colleges of higher education. *
This percentage is the percentage of educational use of the total area in 2001 (345 hectares.) **

Table 5. Detailed Analysis of Existing Educational Services in Al- Hussainyeh City

School	Standard**	Existing (2010)		
	m^2/ person	Schools Currently Required	Areas Currently Required (ha)	Current Number of Schools
Primary	1.00	3	1.73	4
Middle	0.36	1	0.62	3
Preparatory	0.44	1	0.76	3
Secondary	0.44	1	0.76	2
Total		6	3.87	12

The previous table does not include areas designated for agricultural colleges, because the standards include only schools, and there is no standard that addresses areas of higher education. *
Iraqi planning standards/ planning standards of the Public Directorate of Urban Planning**

As for Imam oun area of educational services about 0.3 hectares, represented by only one school location, and representing 1.1% of the total area, however, the area actually occupied by the school is less than that figure. (Tables 6,7) shown Analysis of Existing Educational Services in Imam Oun. From data analyzing (Table 8) noted that the shortage in educational services in Imam Oun is not a shortage in quantity, but rather a shortage in the areas allocated for educational services offered.

Also, there exists a legal dispute over the area adjacent to the school and there are attempts to join it to the shrine, which is built on an area of 0.5 hectare and which presents a special visual point in Imam Oun, provided that part of the site overlaps with the street right of way, and hence such condition requires both architectural and planning treatment.

Table 6. Educational Areas in Imam Oun

Educational Use Area (ha)	Percentage of Educational Use as per the Master Plan*	Constructed Area (ha)	Percentage of Constructed of Master Plan	Percentage of Constructed of Designed
0.3	1.1%	0.15	0.55%	50%

This percentage is the percentage of the educational use of the area of the Master Plan (27 hectares.) *

Table 7: Analysis of Existing Educational Services in Imam Aun

Area as per Master Plan (ha)	Current Population	Standard ($m^2$of Educational Use/Person)	Existing Educational Area (ha)	Area Required as per Standard (ha)	Designed unconstructed Areas (ha)
27	2,250*	2.2	0.15	0.5	0.15

Population figures based on the results of the Population statistical forecasts for Imam Oun*

Table 8. Current Educational Services in Imam Oun

School	Standard	Existing (Iraqi Ministry of Education,2014)		
	m^2/ person	Schools Currently Required	Areas Currently Required (ha)	Current Number of
Primary	1.00	1	0.6	1
Middle	0.36	0	0.2	0
Preparatory	0.44	0	0.27	0
Secondary	0.44	0	0.27	1
Total		1	1.34	2

7. Conclusions and recommendations

The study shows, average density of residential neighborhoods in the city of Al Hussainyeh amounted to about 80 people / ha, which is greater than the city's total density, this is because there are complete neighborhoods within the city, such as the industrial neighborhood and the neighborhood occupied by Karbala College of Agriculture, which are of low density and which would result in reducing the city's overall density.

Areas designated for educational services within Al- Hussainyeh municipality about 37 hectares, which is almost 14 % of the total area amount about 56 hectares, representing a percentage of 16 % of the total area, and among which about 28 hectares are constructed areas. can be noted that there aren't any nurseries or kindergartens within the city. the estimation from the analyzing and GIS mapping area of 40 hectares for farms and research fields for Al- Hussainyeh Preparatory School of Agriculture, located near Al- Ateeshi archaeological hill. Such areas represent 11 % of the total area of the city. From the spatial analyzing of the study area we can see clearly that areas designated for educational purposes (schools) within the city about 13 hectares of the total area allocated for such use, that is, about 56 hectares of the total area of the city of Hussainyeh and representing 16% of the total area. The built up educational areas represent 49.6% of all educational area that amounts to 56 hectares.

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However, there are the existence of several schools which are located in risky areas such as an industry area, main road, highway, or other hazardous areas that threaten the health and safety of children and school workers. It should be noted that the college is continuously active and attracts many students from outside the city of Hussainyeh and is a future epicenter for the creation of an academic complex for agriculture purposes

due to its close connection with the agricultural environment surrounding it. It recommends that some schools were over staffed and there is need for the use of GIS in the educational sector for planning.

4. References

1. Mohammad A. Rob. (2003). " *Applications of Geographical Information Systems in Understanding Spatial Distribution of Asthma "*. Informing Science Journal Vol. 6.
2. Bukhari , Z., Rodzi A. M., Noordin A.(2010)."*Spatial multi-criteria decision analysis for safe school site selection".* International Geoinformatics Research and Development Journal Vol. 1, Issue 2.
3. Church, R. L., & T.Murray, A. (2009) "*Business Site Selection, Location Analysis, and GIS ".* Willy books
4. Ministry of Municipalities and Public Works (2010) *"Regional Context and Major Development issues- Hussainyeh City ".*
5. Chorley, R.J., (1972). "*Spatial Analysis in Geomorphology"*. London: Methuen.
6. Haining, R.P., (1994). "*Designing spatial data analysis modules for GIS*. In A.S. Fotheringham and P. Rogerson, editors, *Spatial Analysis and GIS*, pp. 45-63. London: Taylor and Francis.
7. Nyambura NJUGUNA (2008)."*Distribution and State Of Primary Schools in Kenya*". Kenya Kenyatta University journal 00100 GPO Nairobi
8. Ministry of Construction and Housing Baghdad-Iraq / Public Housing Authority / Division of Studies - urban housing standards Notebook, Page 6.(2010)