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Methodology for Monitoring the Qualitative and Quantitative Features of the Phenomenon of Vandalism in Open Spaces Using GIS

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Abstract. Residential urban spaces affect residents' behavior, and their reactions differ towards it according to inhabitants' classification and style of planning these spaces. Caring for urban spaces is translations for those who are caring for Architecture to find solutions for the city residents to improve the level and performance of spaces between the buildings and the nature of behavior of users within it. Urban spaces are bases for developing social relations among residents as without these spaces, it's difficult to develop these relations, which is reflected on no control giving an opportunity for vandals to practice criminal activities without control. Vandalism is one of the hostile behaviors in the urban environment. It's a reflection of many psychological, social, and economical and others. It also represents the satisfaction and engaging the space and its suitability for the users' needs with all their ages' stages.

So stating geographical information system mechanism, and mixed methods for quantitative and qualitative methods, and the possibility of integration of data to study vandalism phenomenon's variables to form decision making tool for policies and plans followed to avoid vandalism' s behavior.

Keywords: Urban design, quantitative and qualitative methods, open spaces, vandalism and geographical information system.

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Introduction

The open spaces are the medium in which all human activities take place, to satisfy different needs, which is considered as an essential part of the urban environment and the reaction between man and the urban space. Which are a group of needs from safety and security and the most important, which need a suitable medium to satisfy in specific time, open space affect people's behavior and reactions towards it differ according to classifications of residents and their cultural and social differences and the design style and specifications of the components' variables of planning these spaces, which make it difficult to decide the direct reasons of the vandalism behavior as a result of integrating the different variables from which result the reaction which is difficult to separate from the social component, and to analysis's behavior theories and the style to monitor and evaluate the behavior (Troman, 1983) explained, "that vandalism rises from simple activities, but when it changed to social activity turning it into dangerous problems." Many factors affect this phenomenon, whether relating to buildings exposed for vandalism in location, colours, and distribution, other factors relating users of different income's, ages and educational level. To Determining reasons for emerging a phenomenon as vandalism in open spaces needs the study of the residential nature and circumstances surrounding the location, from various aspects (space location inside the residential area, space area, its components, space entrances, ...) and other variables relating the space, on the other side studying variables relating users, ignoring qualitative variables, whether relating users or spaces opposes the nature of exchanging relations, any change in it directly or indirectly has an effect in the existence of this phenomenon or not.

Objective:

The aim of this paper is a study to put up a mechanism to monitor and study the phenomenon of vandalism in the open spaces within residential areas in an attempt to reach a model to predict the occurrence of vandalism inside the open spaces.

Hypothesis:

The possibility of raising the efficiency of the design and effectiveness of the open areas by understanding the motives and destructive behavior based upon the needs of the users and the psychological and material associated with open spaces.

Vandalism in open spaces:

Vandalism is ”the destruction with intention or bad intention, and spoiled of any public property or private without the consent of its owners or persons responsible for it”(Bessette, 1996). Vandalism has many definitions according to the scientific point of views which study the phenomenon (Cohen, 1964).

Psychological researcher and (conkilin, 1989) a researcher in crime scenes, they agreed on the same definition of vandalism “the Damage or destruction of property owned by a person or authority without the owner's consent," through definition are different (Ward, 1973), (Cohen, 1984), (Coffield, 1991), (Goldstein, 1996) they all participated on the hostility towards properties aimless.

To analyze the process of vandalism is conducted by one of two approaches theorists (Max, 2007). The first approach cares for studying the psychological and social reason for these persons and their objectives for this vandalism process trying to inquire reasons for vandalism (sometimes they are considered as criminals) due to social reasons. The second approach cares for studying elements that have been destroyed and exposed investigations in the destruction of these elements among the others.

GIS may be a convenient method for understanding the crime and spatial analysis (ESRI, 2008) it is used for planning and modeling the event, for tactical and strategic planning. The successful implementation protective programs from crimes depend on the availability of data and information about space’s specifications and nature, besides knowing space design, nature geometrically,

as well as the type and the number and distribution pattern of crimes and times of peak commit, and offender classification.

However, vandalism is not a mere location and crime to monitor, there are many effective factors in space and user who may represent influential factors in vandalism, there is lots of criticism in using quantitative styles to study the crime, the need to show that the use of GIS as a quantitative method integrated with qualitative theories for criminology.

There are attempts to integrate geographical information systems and qualitative researches, which appeared in the recent years (Karin, 2010), (Xu J, 2007) as a part of caring for mixed research methods. The focus of these efforts to integrate qualitative data and techniques of qualitative analysis in the science of geographical information systems, and the search for methods of dealing with forms of qualitative spatial data thinking in a digital environment, to contribute in describing skeletons and posts of the qualitative geographical information system with computer-aided (Computer-Assisted Qualitative "CAQ" and GIS)

The possibility to develop methods for the qualitative evaluation indicators affecting reactions of users within the mechanisms of information systems, techniques will enable to provide an analysis for the potentialities of combining different levels by using mathematical models. Furthermore, geographical information systems are used as a means to manipulate the data spatially referenced (Tita, 2010). Making a contribution to an increased understanding vandalism and searching results explaining vandalism behavior, motive's qualitative and quantitative assessment methodology according to multiple variables, whether architecture, social, economical and ecological which affect in users' behavior nature inside open spaces to form a tool to support decision making and contributing in the remedy of what open spaces suffer inside the residential area of vandalism behavior aspects.

Materials and methods

Vandalism is the result of inappropriate design for the open spaces around the city or within residential areas. (Weinmyer, 1969) And confirms that the designers are the real destroyers of society. The design with a low level of quality or planning is the most important factors of vandalism. It emphasizes on improving standards of design and environmental spaces they relate to the motives for these acts.

As pointed out (Goldstein, 1996) that it should study the causes of vandalism during the investigation of a specific aspect of the physical environment or social motives and vandals.

Fig.1 physical convergence in time and space (Cohen, 1979)

Based on interpretations of The situational and motivational to the phenomenon of vandalism (Buck, 2003) it should seek the causes of vandalism at the level of the space and its constituent elements and the level of users and social and cultural backgrounds to them. For more information on the different variables related to space and user motivations leading to destructive behavior and measure its effect on the elements of softscape and hardscape has been used several of quantitative and qualitative tools (Fig.2):

- Photographic documentation
- Monitoring lists
- Qualitative observation

- Questionnaire forms
- Clinical interviews with residents and space users

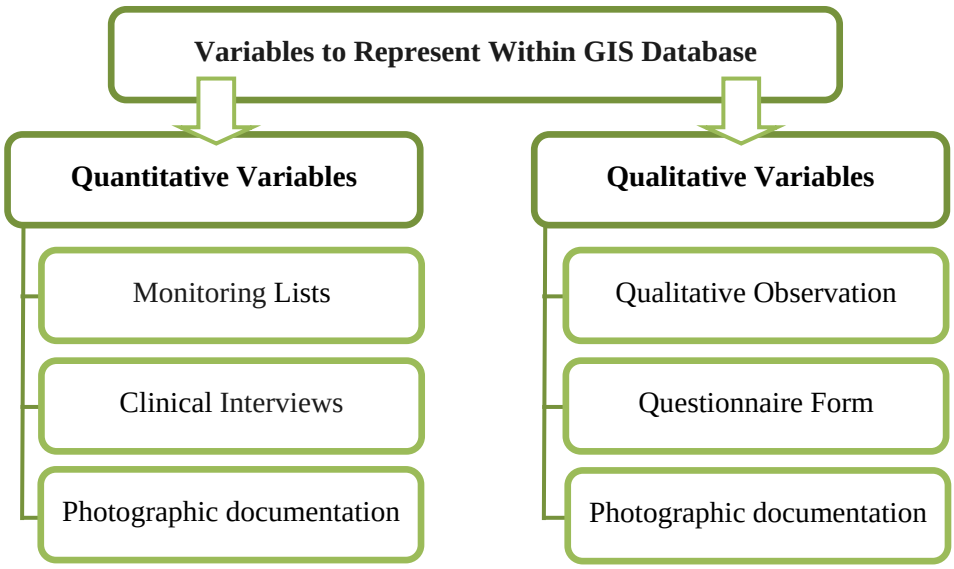


Fig.2 Method to collect variables of database

Photographic documentation

Photographs documenting the appearance and condition of the spaces, and their elements both soft scape and hardscape, and its site and environment must be submitted with the project plans and specifications. Photographs labeled with the following information: space number, code type (e.g., palm's code 1), and description (e.g., property damage, graffiti, post fly). Photographs keyed to a plan of the site, it's included:

- Overall views of each space
- Close-up views of basic features of each space, such as design concept, types of Softscape and hardscape elements
- Close-up views showing the condition and type of the vandalism feature on space elements

Monitoring Lists

Lists depend on monitoring design criteria of spaces, on the one hand, and the components of the space of softspace and hardscape on the other hand. It's various data from the data on the form and composition such as height, colors,

and other design criteria through the users' needs and returns on those elements down to monitor the features of vandalism and the kind and degree of impact on the elements.

Qualitative Observation

It's contain fieldwork descriptions of activities, behaviors, actions, conversations, interpersonal interactions, and any other aspect of observable human experience.

The Design of Questionnaire Forms and Clinical Interviews

This is completed by designing a Questionnaire form, and Clinical interview questions models. In order to determine the relative weight of the variables of each stage of work methodology phases and what follows of sub phases. And the component of each according to the importance of each variable and its effect on the expansion of vandalism' aspects of space elements, this is carried out at many levels to measure several variables as shown in (table 1).

Target sample

Age group

Age group started From 18 - 60 years to knowledge the different opinion and level of consciousness of space and its different uses.

Gender

To ensure the different motivations and trends in thought and how to deal with outside spaces.

Questionnaire

It used for users in the area of study, as they are the most affected by vandalism process, to help in the formulation of the methodology and to ensure that it conflict with what happens in reality. It includes:

Demographic data which relates to the user: as (gender, age, marital status, and culture). It also includes questions relating kinds of activities practiced inside spaces. And when and questions relating space description and different needs

that must exist in space as (the level of privacy and isolation and natural surveillance level existing in the area and other variables), and its validity affecting the occurrence of the phenomenon.

Clinical interviews

It's personal oral interviews based on a group of selected samples of users to take their opinions and monitoring their behavior and reactions with the different variables. It consisted of a group of questions, which depend on narrating to acknowledge opinions, feeling and perspectives of users about the phenomenon and latent reasons behind its occurrence and ranges of validity of the authorities concerned in facing such accidents.

Source	Variables	Goal	Scale
designer interviews researcher observation	• Scale of public space • Space for different groups	**Control**	**Zone level**
designer interviews user interviews researcher observation	• Natural surveillance • Feel of ownership • Formal surveillance • definition of limits between spaces	**Territoriality**	
designer interview	• Use barrier to change level • Unique design • space hierarchies	**Access control**	
designer interview	• Level • Material texture, light change	**Transitional**	
designer interview user interviews researcher observation	• Avoid large paved area • Restrict access • Unique element	**Image**	
user interviews researcher observation	• Traffic flow • Access to public space • Avoid creating enclaves	**Accessibility**	
designer interview user interviews researcher observation	• Proper functioning • Mixed use generates • All day activity • User needs and preferences	**Vitality**	
user interviews	• View from building	**Visibility**	

researcher observation	• Landscape and sight lines • Transparency of shop front • Visibility of building entrance		
designer interview user interviews researcher observation	• Bus station • In front of shops • Building • Distribution	**Lighting**	
designer interview researcher observation	• Balance social economic groups • Homogeneity	**Provide mixed status**	**Urban fabric**
user interviews	• Sense of neighborhood • Ownership	**Adequate urban**	
user interviews researcher observation	• Distributed of uses	**Intensity of land use**	
user interviews researcher observation	• Existing waste lands • Infrastructure between urban fabric	**Physical barriers**	
user interviews researcher observation	• Easy and safe • Clear orientation • Compatible with the surroundings	**Continuity**	
designer interview user interviews researcher observation	• Clear and seen • Good lighting • Parking lot and buildings • Separating flows	**Accessibility**	
user interviews	• People appropriation • Civic responsibility • A friendly character	**Attractiveness**	
designer interview researcher observation	• Robustness and attractiveness • Selection of material	**Quality of material**	
designer interview user interviews researcher observation	• Sufficient activities and surveillance • Location of public facilities • Commercial fronts along street • Contribution of pedestrian and other roots • Spontaneous activity	**Location of activities**	**Activity level**
designer interview user interviews researcher observation	• Time span of natural surveillance • Activities in building facing public space	**Time and calendar of activity**	

Table 1 Questionnaire variables at every level

Data processing and analysis

Phase of analyzing data is the main stage in the qualitative research, the stage in which the qualitative research differs from the quantitative qualitative research. Cleary, in quantitative research in which monitoring lists and questionnaire forms are presented. The analysis basically depends upon statistical processes, simple as the averages, Duplicates, or complex as analysis of variance by all its kinds, while analysis in qualitative research represented in texts of field interviews and observations and preliminary comments on it. To process data in a way to permit to enter the geographical database, all monitoring list's answers from the interviews and questionnaire in data tables. Into EXEL program to analyze the content and sorting the answers coding them into symbols, for user symbols are entered to reflect a certain formula used by the users, depending on names of variables previously explained in table 1, as a key factor in deciding and directing classification system according to users to describe their experience.

Methodology

The suggested methodology consists of groups of phases (Fig.3), describe a set of the processes followed by special tools for each to reach a model to represent the relationship between quantitative and qualitative variables for the vandalism phenomenon for urban spaces within the GIS.

First phase

It consists of two sub-stages.

- Studying space and its components to identify design criteria of space
- Monitoring users' behavior and their different needs inside space and its reflection on space

Studying space and its components

Collecting information and data relating to natural environment, which consists the form of the space and the aspects related to the length and frontiers, where the area is divided into a group of areas, also monitoring lists are prepared

consisting the declaring of the area and deciding elements and components of the coordination in details through design and functional standards and other standards, in this phase to decide a group of functional and architectural, environmental and visual for the elements forming the space using all description data from monitoring lists, and theoretical studies, spatial data from survey maps and satellite images.

Monitoring users' behavior classification

It relates to the users, and demographic specifications study, kinds of users, their classes, social and economic trends, their cultural patterns, prevailing nature of behavior exchanging relations among them under item of human contacts concerning space.

It also relates monitoring what relation to activities and behavior connected the study of functional interdependence between space and nature of activities in it. This is through questionnaires, personal observation of persons' needs and activities, to join it in the next phases with the database within the GIS depends upon the analysis of users' needs and their requirements inside a space.

Second phase

this phase cares for monitoring vandalism' aspects on natural and industrial spatial elements by using monitoring lists with qualitative research styles from researcher's observations and clinical interviews with users in an attempt to integrate between the approach used in studying the phenomenon, whether that which concerned with studying elements that have been destroyed, its specification's reasons for spoiled these elements among others, or, which considers vandalism as a social and psychological phenomenon represented in the hostile behavior and interested in analyses all resulted damage and who committed them styles followed by Focusing on the following:

- Case of infringement and material used.
- Analyze the types of infringement and vandalism on space elements.
- Motives related to vandalism kind.

- The impact of design dimensions of space elements of users' behavior.

zone no.	vandalism level	zone characteristic							vandalism type	gtaffiti type	flyposting type	lettering type	vandalism motive	vandalism tools
		poor lit	quiet and lonely	teenager hangout	low maintenance	medium maintenance	risk of harressment	feel insecure						
zone 01														
zone 02														
zone 03														
zone 04														
zone 05														
zone 06														
zone 07														
zone 08														
zone 09														
zone 10														
zone 11														
zone 12														
zone 13														
zone 14														
zone 15														

Table 2 Monitoring Lists of vandalism in zone level

Third phase

It consists of two sub-stages:

1- Design and create a database for space through coordinating data and variables.

2- Representing the vandalism phenomenon for urban space and its relation to space variables.

Design geographical database

Through the above, stages have been reached several forms of data, which will be represented inside GIS to reach the database relating the location, and entering variables relating the place and different furnishing elements and what relate it from shape, size, color, texture, and other of design's dimensions and representing behavior patterns, kind of users and their needs inside spaces, vandalism aspects on space's elements and it's drives, and their relation with variables connected with space. The data are divided into:

Tabular data: They are lists of records, which attained through previous phases of the study methodology, whether for spaces and Softscape elements, and hardscape elements of the space and vandalism's aspects on all spaces and their components considering entering all users' data (Table.3).

zone_no	shape	condition	enclose	privacy	isolation	hierarchy	accessibility	visibility	lighting	surveillance	activity	management	vandalism_level	maintenance	suit_with_activity
zone_1	1	3	2	2	3	2	1	2	3	3	2	2	1	3	3
zone_2	1	2	2	2	2	2	1	1	1	1	2	2	2	3	1
zone_3	1	3	2	2	2	2	1	3	3	3	3	3	1	3	3
zone_4	1	3	2	2	1	2	1	2	2	3	3	3	1	3	3
zone_5	1	2	2	2	2	2	1	1	2	1	2	2	2	3	1
zone_6	1	2	2	2	2	2	1	1	2	1	2	2	2	3	1
zone_7	1	2	2	2	2	2	1	1	2	1	2	2	2	3	1
zone_8	1	2	2	2	1	2	1	2	2	3	3	2	2	3	3
zone_9	1	3	2	2	2	2	1	2	2	2	2	3	1	3	3
zone_10	1	2	2	2	2	2	1	1	2	1	2	2	2	2	2
zone_11	2	2	2	3	2	3	1	1	2	1	2	2	2	3	1
zone_12	1	2	2	2	2	2	1	1	2	1	2	2	2	3	1
zone_13	1	2	2	2	2	2	1	1	2	1	2	2	2	3	1
zone_14	2	1	2	3	3	3	1	1	1	1	1	1	3	2	1
zone_15	2	2	2	3	2	3	1	1	2	1	2	2	2	3	1
zone_16	1	3	2	2	1	2	1	2	2	3	3	3	1	3	3
zone_17	2	1	3	3	2	1	1	1	1	1	1	1	3	2	1
zone_18	1	3	2	2	3	2	1	2	3	2	2	2	1	3	3
zone_19	2	3	2	3	3	3	1	1	1	1	2	2	1	3	3
zone_20	2	3	2	3	2	3	1	2	2	2	2	3	1	3	3

Table.3 variables of zones in study area

Geographic data: All the data that is represented to geographically include:

Vector data

Points are represented in the same style, and lines consist of these points; Polygons are represented by geographical and informational lines, written in the form of maps and paper photo or digital. It stores actually coordinates for each element.

- Graphical information of points represents softscape, hardscape element, vandalism activities and the number of users and their description.
- Graphical information for lines represents kinds and numbers of paths and roads.
- Graphical information for polygons represents land uses, building heights, Softscape elements, which have an area.

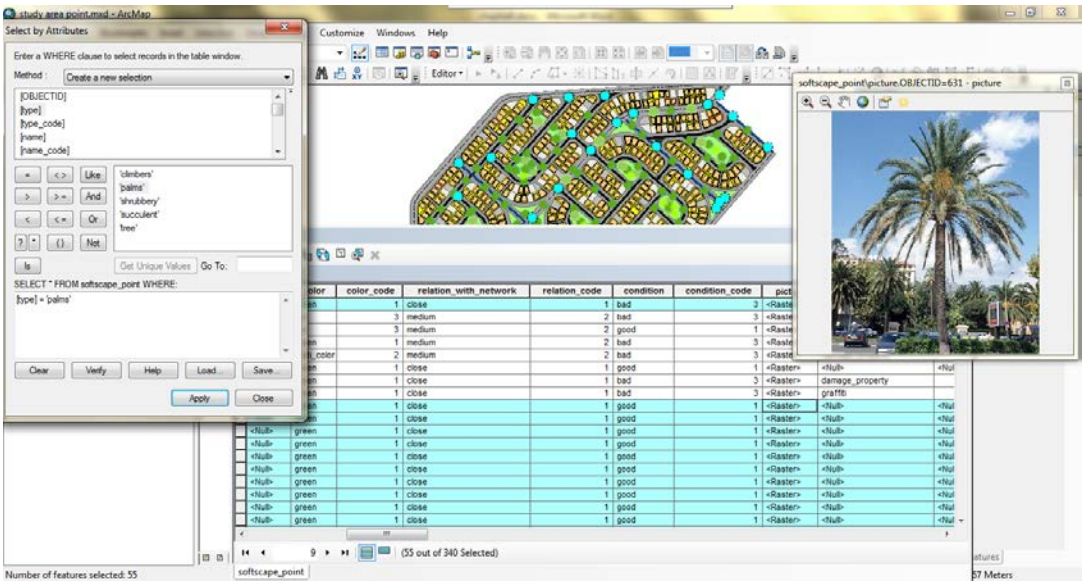


Fig. 3 point feature presented palms in Geo database

Fig. 4 descriptive feature class of (1) softscape (2) hardscape
(3) Vandalism accident on space features

Raster data:

It consists of satellite images, where it is divided into small cells, each of which symbolizes the type of information and limiting column and line number in which the net cells located in systematic shape line and net information bases are connected to form a group of geographical data, where points lines and polygons represent (building - roads - service networks). Locations and road names are known and paths' number by joining graphic and geographical information by using a single ID number, where each geographic element has the graphic information relating to it, and it's possible to acknowledge each one from the other to get the necessary studies and analysis.

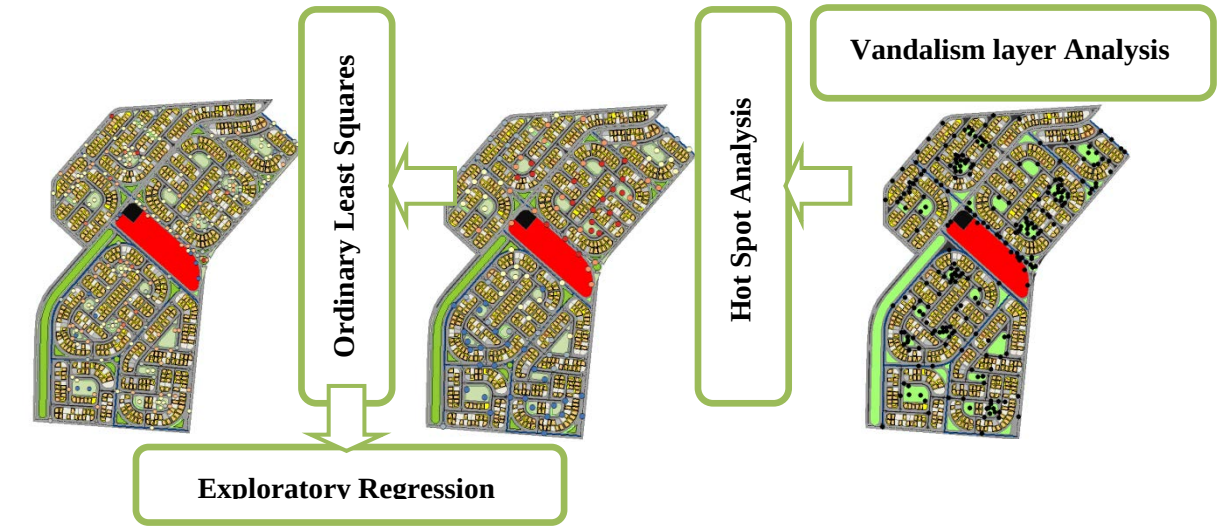
Fourth phase

To reach a model represents the relation between vandalism and users' behavior and aspects of space elements as a result of the previous phase it is possible to identify areas' features and the analysis of elements' variables forming spaces and the types of activities within these spaces, percentage of vandalism on the elements but it doesn't explain:

- Why vandalism has a high ratio in certain spaces, and not including others?
- What are the specifications of space exposed to vandalism?
- What is the relation between softscape and hardscape elements and vandalism proportion on it?

- What is the relation between the increase of a cretin kind of users and increase the proportion of vandalism?

To answer those questions is by using a group of analytical means within a geographical information system to attain a model for the relations and the variables affecting the phenomenon under the study.



AdjR2 AICc JB K(BP) VIF SA
0.79 490.59 0.00 0.00 2.42 0.20
Model
+Vandalism_Motive_Code*** -Vandalism_Time_Code***
+Easy_Maintenance** -Vandalism_Actor_Code*** +Height***
AdjR2 AICc JB K(BP) VIF SA
0.78 499.79 0.00 0.00 2.49 0.11
Model
+Vandalism_Motive_Code*** -Vandalism_Time_Code***
-Vandalism_Actor_Code** -Vandalism_Size_Code**+Height***
AdjR2 AICc JB K(BP) VIF SA
0.77 507.54 0.00 0.00 2.39 0.35
+Vandalism_Motive_Code*** -Vandalism_Time_Code***
-Vandalism_Actor_Code** +Low_Cost** +Height***

Geographically Weighted Regression (GWR)

Fig.5 spatial statistics analysis tools used in phase four

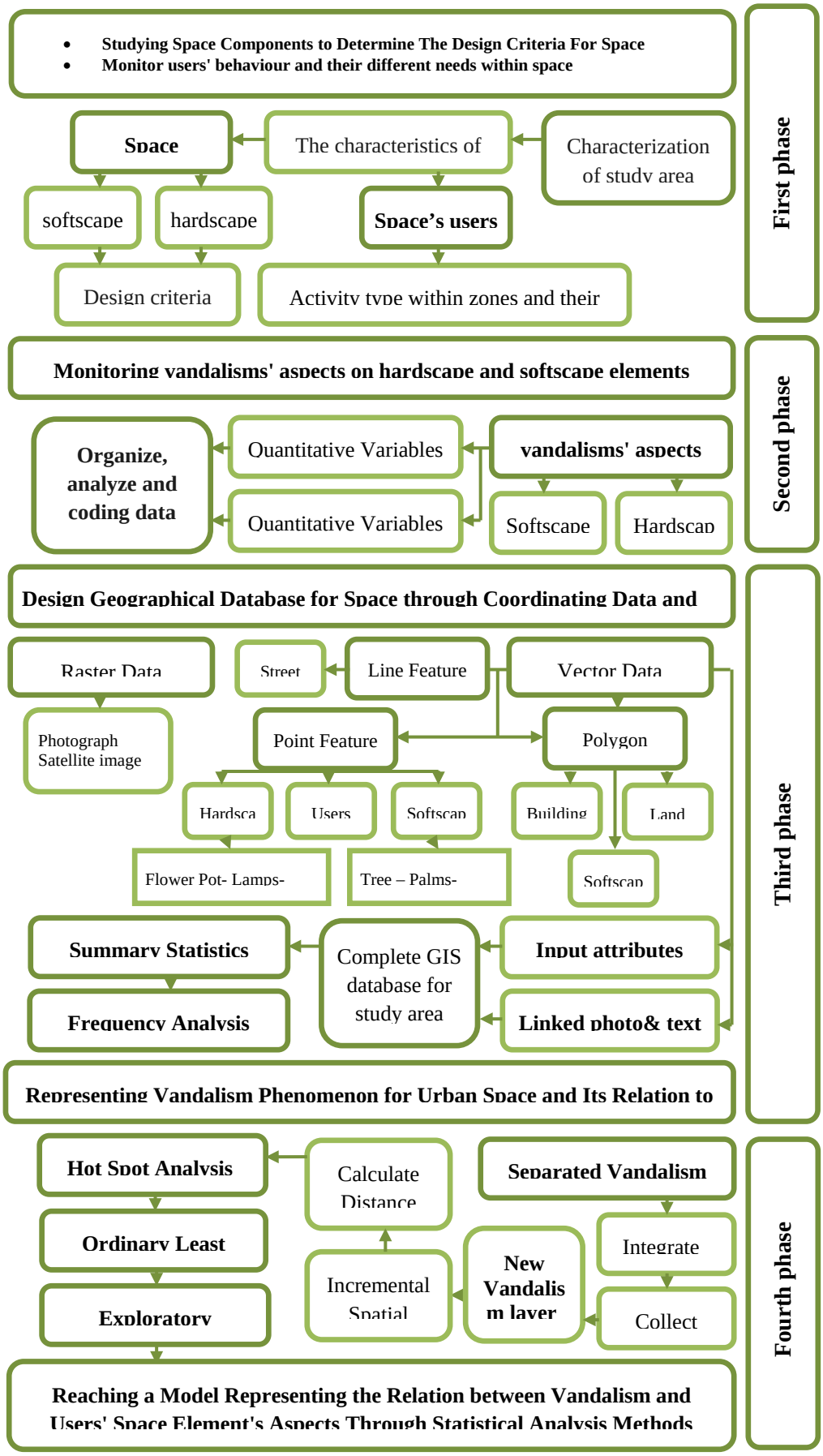


Fig.6 phases of suggested methodology

Discussion

To get a sophisticated methodology which can be applied, to understand vandalism behavior, motives and the effective factors in its expansion, through a group of stages to integrate the special quantitative and qualitative dimensions in each of the spaces and its users in an integrated mechanism by using the geographic information system through a group of key points.

- Confirm and determine design standards relating element forming the space.
- Assure about the validity of mutual relations between variables and users and their different needs inside spaces.
- Study variables of space elements and its relation to vandalism behavior patterns.
- Monitor the impact of the community aspects of vandalism processes within the geographic information systems.
- Use geographic information system technologies to reach variable's weights.
- Predict the impact of various factors influencing in vandalism through resulting relations. (Fig.8)

Fig.8 predicts the effect of change maintenance level of vandalism using Geographically Weighted (GWR) Regression(GWR).

Conclusions

To use a geographic information systems as a tool to monitor and analyze vandalism phenomenon requires the integration of data at several levels of requirements and variables of open spaces and users, whether quantitative or qualitative to determine mutual relations for the different variables for vandalism's aspect inside residential areas.

Each of the methods, quantitative or qualitative have different models to offer contributions for urban planning strategy, the quantitative model assists in describing "what," where as the qualitative model can give an answer to "why."
The qualitative model refers to the interaction between humans and how to collect data from these interactions, to guide the planning process.

The field of monitoring and fighting crime, is one if the main fields using spatial analysis techniques and methods of analysis and forecasting geographic information system (Chainey, 2005).
A number of criminology scientists and sociologists, Anthony Bottoms & Robert Sampson & John Laub. They claimed for the use of both quantitative and qualitative techniques, for pioneering researches in criminology (Bottoms, 2008)

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