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Investigation of the Growth Random Area Based on the Multiple Techniques, Photogrammetry, GIS and GNSS

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ABSTRACT

In this study, the damaging aspect of urbanisation is the stress it places on development processes of all kinds, making the proliferation of haphazard housing a problem in many nations throughout the world. While this problem has become worse in large cities and their suburbs for a variety of reasons, it has gotten increasingly concentrated in smaller towns and its environs, either in the form of haphazard housing clusters or as single-family homes interspersed throughout the urban fabric. The city of Al-Kut in the Wasit Governorate is a prototypical example of a tiny city hampered by the proliferation of this phenomena, which has substantially impeded urban development there. Al-Sawadah, Al-Wafideen, and other neighbourhoods are dispersed throughout Kut. After being divided into agricultural and military zones, the undeveloped land in between suffered from random invasion by new developments. Photogrammetry and geographic information systems from 2004 to 2021, researchers can use it to assess the pace of change and the variation between the survey area and the rest of the world.

1. Introduction

Research and academic research have focused on informal housing as the most important impediment to urban planning and its emergence coincided with the rapid expansion and renewal of cities that began dating back to after the Second World War. Instead, the stability of government services in cities and the emergence of many industries leads to frequent migration, such as the migration of people from rural to urban areas in search of work and their desire for urbanization [1]. In this way, they formed random gatherings that resembled human gatherings that lacked the basic services necessary for human life, or the cost of housing units in them was less than the cost of housing units within the administrative borders of the host city. Organizing activities of daily living [2]. The official sponsor of the effective and functional interaction of the City of Light, any activity beyond the relevant standards will help identify the decisive factors for the development of the city and the development movement witnessing the concept of urban planning to create a healthy and

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happy life environment for human beings. However, Negligence in countries where people have leaked and built homes is the size of the planning problems that they suffer from as societies in terms of material, economic, environmental, and other aspects, and the difficulties they face in dealing with them [3].

When material on the ground slides down a slope, it might fall, topple, flow, or creep, among other mass movements [4]. The suddenness and lethality of landslides and other forms of mass movement make them a serious threat on a worldwide scale. Volcanic activity, slope steepness, erosion, heavy rains, traffic vibrations, urbanisation, etc. all play a role in setting them off, in addition to tectonics and lithological factors. Researchers from all around the world have spent decades studying landslides in order to provide more accurate data for planners, geotechnical consultants, and governments to use when formulating landslide management plans to safeguard human lives and the planet's natural resources [5].

Recent developments in remote sensing and processing technologies have expanded the scope and potential applications of landslip monitoring research. Several studies have been conducted in this area, and all of them have used remote sensing data collected with a wide range of sensors and processed in various ways. Data collected by unmanned aerial vehicles (UAVs) in a timely manner and at a reasonable cost can help reduce the human and material losses that result from landslides. The earliest methods examined how to efficiently and accurately follow landslides and surface displacements via the use of UAV data and high-resolution airborne pictures [6]. In addition, orthophotos and digital elevation models (DSMs) obtained by UAVs were utilised to quantitatively monitor displacements [7]. Several varieties of UAVs were evaluated in different studies. In particular, images captured by a fixed-wing UAV and analysed with image analysis algorithms provide trustworthy information in areas prone to active landslides [8]. across addition, micro-UAVs were developed for photogrammetric surveys and landslip monitoring across a wide range of ecosystems. Standard photogrammetry and computer vision techniques were used to process and align the images captured during the flights [9].

Recently, the use of unmanned aerial vehicles (UAVs) for tracking landslides has won considerable support. In particular, UAV data and photogrammetric measures were used to evaluate the landslip monitoring and its association with weather conditions, with the former producing more accurate results than the latter. Accurate documenting and monitoring of landslides necessitates the use of additional geophysical methods, GNSS measurements, and products originating from processing of UAV data [8,9]. In reality, the orthophotos and DSMs that make up these UAV goods have a precision of less than 10 cm. Separate research [10] utilised UAVs to monitor unexpected landslides in forested areas. Analysis of landslip behaviour was shown to benefit from the high-resolution orthophoto-maps, digital surface models, and density point clouds that generated. On the other hand, some methods have taken a more technical approach, investigating things like the influence of fisheye distortion on the geometric accuracy of 3D models [12] or misalignment biases resulting from UAV data processing in the final products [11]. In addition, the high-resolution UAV-based outputs were merged with the COSI-Corr (Co-registration of Optically Sensed Images and Correlation) image correlation approach to map and quantify surface movements and finally establish the landslip dynamics [13].

Data from UAVs could be used with terrestrial laser scanning surveys to track and monitor active processes in landslides. Both sensors can produce similarly detailed topographic maps, which improves our understanding of the kinematic behaviour [14,15]. In this case, multiscale model-to-model cloud comparison (M3C2), a new method for change detection analysis across point clouds, has been proven to be effective in areas with complex terrain [16]. There have been previous attempts to investigate how landslip research can benefit from combining different forms of earth

observation data. Therefore, several case studies with varying characteristics investigated high-resolution optical and radar data, as well as data obtained by UAVs photogrammetry, ground-based InSAR, terrestrial laser scanning, and infrared thermography [17]. Multi-source datasets comprised of historical aerial photographs, UAV images, and terrestrial photographs were used to generate a landslip library, identify landslip boundaries, geomorphologically describe the area, and estimate the deformation rate [18]. Furthermore, a multidisciplinary strategy has been used to keep an eye on an ongoing landslip, proving the value of integrating high-resolution satellite mission data, air photos, unmanned aerial vehicles (UAVs), and satellite radar with GNSS and inclinometer measurements to lessen the danger [19].

In terms of time and money, the most cutting-edge systems for landslip monitoring today are those based on more resilient and automated operations. Using automated methods, 3D points clouds obtained from UAV time series are used to detect old or newly-shaped landslide scarps, evaluate landslide evolution, extract displacement rates, understand landslide mechanism, and estimate the volume of the sliding material [20,21]. These automated approaches are taking into consideration morphometric features and geomorphological factors (surface roughness, slope, etc.) of the 3D point clouds. Ultra-high-resolution products were collected using UAVs, and semi-automated object-based image analysis was utilised to diagnose, characterise, and simulate landslides in a separate study [22,23].

The organization's prior preparation for basic design modernization, given the limited alternatives in countries, especially in LDCs and developing countries, will provide a coercive factor for development decisions in unplanned national communities. Providing services following the available resources and according to the plans set [24]. The study area is characterized by a random nature of the concept of housing mixed with the concept of organization that it enjoys, as the city was previously allocated secretly to a part of the community, but due to circumstances deviated from the planning concept of the city, it becomes an area of a random nature determined by its context, the city in the normative concept of functional interaction within City [25]**.** The research relied on a series of spatial changes by using satellite images of successive periods for the study areas and analysing them using photogrammetry software, the ERDAS program**.** The research aims to shed light on the areas of growth of some random in the city of Kut to address this phenomenon and its non-growth and to develop appropriate solutions to address it and limit its spread [26] **.**

In this paper, random urban areas and different patterns are studied. The characteristics of these slums and unplanned areas are also studied, including environmental, social, and urban features. For this purpose, photogrammetric techniques were relied upon to calculate and quantify growth random-based aerial photograph

2. Research Methodology

2.1 The Nature of Random Housing

Cardboard cities, shanty towns, randoms, messy construction, and other names have all been used to describe areas where people live outside of the purview of the state's authority and on land that does not belong to them. Typically, these communities lack access to basic social services and infrastructure because the state does not recognise them. According to research undertaken by the Arab Institute for metropolitan Development in 1997, around 60% of random Arab communities are located on the outskirts of cities, 30% of them are located outside metropolitan regions, and only 8% are located in urban centres. The nation's capital should be located in a city. Seventy percent of these items were created by individuals, while the remaining 22 percent were created by groups, according to the study. Slum areas rarely have more than 70 percent of their housing stock occupied by renters.

The survey also found that most Arab slums lack access to basic amenities like sanitation and clean water, and are plagued by issues including food insecurity, high unemployment rates, criminal activity, drug usage, and abuse of private property.

Random areas are irregular residential areas that were built without a permit and may lack the necessities of life such as water, electricity, and other necessities of living. Where random housing is meant to be the phenomenon of free population growth, from a neutral standpoint. It arose with the complete will of the people and grew according to specific, repetitive, and almost unchanging patterns. Whether concerning its planning, the width of its streets, or the dimensions of its plots of land, the informal expression was used for being without a license

Some vital factors helped the growth and spread of informal housing, which can be summarized as follows:

i. Increasing population growth rates.
ii. The shortage in the number of housing units and the increase in demand for them as a result of the rapid migration from the countryside to the city.
iii. The main cities became very attractive as a result of the centralization of services. In contrast, the rural cities became very expelled as a result of the scarcity of services and capabilities.
iv. High prices of lands and apartments in official areas that enjoy public utilities (pure water - sewage - electricity - suitable streets).
v. Weak government and private sector investments in low-cost housing.
vi. Complacency with law violators and land usurpers by the official authorities as a result of the lack of other suitable alternatives, so these areas became a fait accompli and formed pressure groups that forced governments to extend facilities to them.
vii. Increasing the rental value of the housing supply.
viii. The parents desire their children and relatives to live next to them.
ix. Limited public housing.

2.2 Reasons for the Emergence of Random

Indiscriminate housing is an inevitable result of the phenomenon of population growth and its needs due to internal or rural migration, natural increase, and the development and change of some social concepts among the Algerian family, such as the phenomenon of individual housing, the nuclear family, instead of housing within the family, and this is due to several reasons, the most important of which is the high cultural level, weakness and disintegration Social ties, this is on the one hand, and on the other hand, this development in the composition of the population and their interests was not matched by a development in the economic growth of the state, which made it unable to provide all their needs, including housing and work, which led to the emergence of the phenomenon of chaotic housing as compensation for the registered deficit In housing programs, it was embodied on the ground through the emergence of random housing centres in addition to the factors mentioned above [8]. Natural disasters (earthquakes, floods...) can have an impact on the emergence and development of random housing centres, not to mention another factor that is no less important. It is the legal system for housing in Algeria, which excludes many groups of society from benefiting from housing programs subsidized by the state (rental social housing, social contributory housing, residential housing, and rural housing), which prompts them to pursue various ways to provide housing, often housing random is the easiest and available solution [9].

2.3 Types of Random

The random are divided based on their location in the city into two main parts: the random that are located inside the cities, and those that are located outside them.

i. Indiscriminate housing areas within cities: These are areas consisting of buildings that are not suitable for housing, and it is not possible to make repairs on them. They are often located in the old neighbourhoods of the city, and their residents are poor or have a limited material level. These areas are the subject of removal and rehabilitation through state intervention, urban improvement, and renewal projects [10].
ii. Indiscriminate housing areas outside the cities: located on the outskirts of cities and outside the scope of urban services or what is termed within the boundaries of the master plan for development and reconstruction.

The state is marginal agricultural lands or on the fringes of industrial areas. Divided in turn into two types. Temporary areas: often with fragile and deteriorating buildings, they are demolished and removed to be replaced by new planned areas that benefit from the advantages of the site. Permanent areas: They are often built with solid and habitable buildings, which makes them capable of growth and development to integrate with parts of the city.

2.4 Study Area

The study area is part of Wasit Governorate and is located in eastern Iraq and is characterized by the presence of some random area in it. Therefore, it is important to study such a phenomenon because of the risks it poses directly to human beings and the general planning of the details of the area. The study area is located astronomically between two latitudes (¯32.20°–¯32.59°N) and longitudes (45°46 to 53°45E) and (27°32 to 42°32N) as shown in Figure 1. It is about 5,700 km2 and it is viewed as the managerial focus of Wasit Governorate, and it is considered the largest city in Wasit Governorate in terms of population and the area it covers. The Tigris River passes through the city from northwest to southeast.

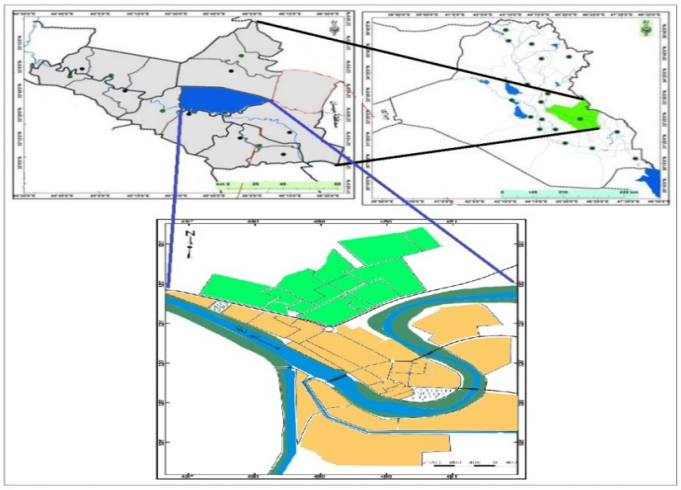

Fig. 1. Study area

2.5 Basic Designs of the City

The city saw numerous essential plans for itself in various phases of time, and Figure 2 shows that until 2021.

Fig. 2. The basic design in 2021

2.6 Random Expansion within the City

Al-Kut city saw a huge random urban expansion movement after 2004 (the year of regime change), as this led to the removal of huge areas of orchards and green areas located in the city, which are orchards owned by individuals and not to the state, as these individuals divide the plot of land that they own into Small plots of 100 square meters for each residential plot, and then they sell them to citizens at very profitable prices and in the absence of state procedures in terms of accountability and removal. After a while, the number of these random housing units becomes large, and their owners submit requests to the state to supply them with water and electricity, and this area becomes like any other area Other regular housing. The researcher believes that one of the most important reasons for this is (the improvement in the economic situation of families, attractive immigration, the lack of plots of land allocated to citizens compared to the increase in their numbers, the weakness of the oversight of the official authorities, ...) and Figure 3 show these areas.

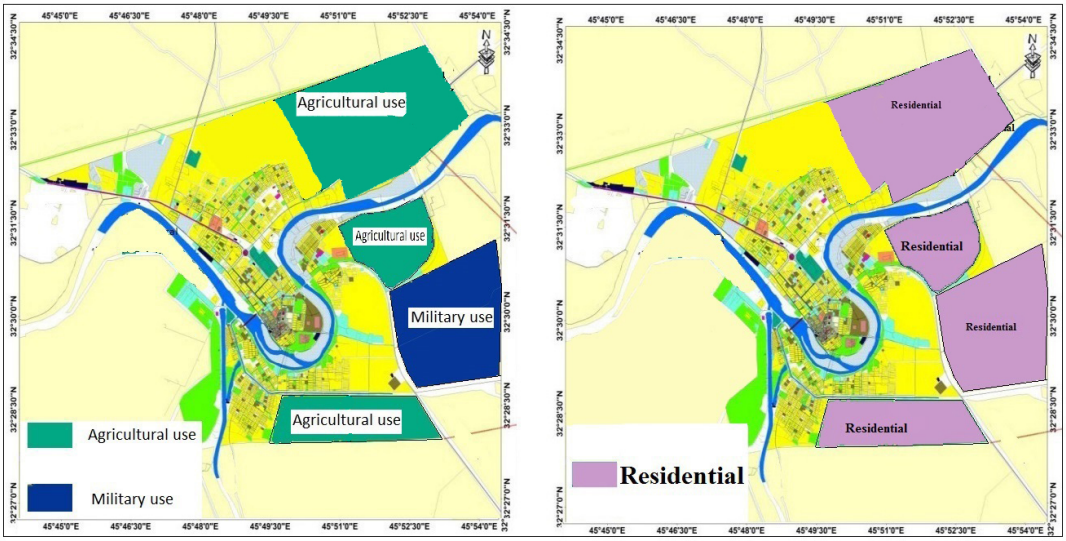

Fig. 3. land use (A) before 2004 and (B) after 2004

3. Result and Discussion

3.1 The Expansion in 2004 and 2021

In the year 2004, the area of land chosen at random was 3.23 square kilometres, but by the year 2021, that number had climbed to 27.53 square kilometres. Figure 4 illustrates the time span from 2004 to 2021, during which there was a discernible increase in the number of random occurrences. Additionally, the cause for this expansion is due to the several power groupings who are chasing and striving to put a stop to this invasion in the residential areas. The rise can be directly attributed to these organisations.

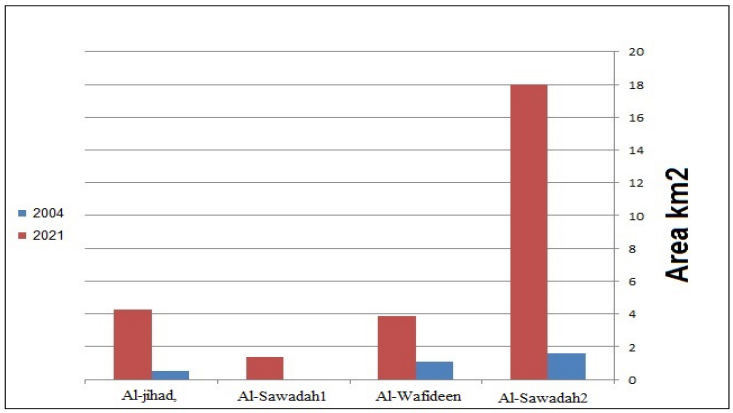

Fig. 4. The expansion in 2004 and 2021

3.2 Random Areas in 2004 and 2021

It is possible to gain an understanding of the exponential growth of residential areas in the cities of Al Jihad, Al-Sawadah1, Al-Wafideen, and Al-Sawadah2 by making use of Figure 5. In the year 2004, the area of Al-Sawadah was equal to 1.6 square kilometres, the area of Al-Wafideen was equal to 1.1 square kilometres, and the area of Al-jihad was equal to 0.53 square kilometres. In comparison, the area of Dawr-Al-Khaleej was equal to zero square kilometres. In 2004, the large land that belonged to Al-jihad consisted of 4.26 square kilometres, 1.35 square kilometres belonged to Al-Sawadah1, 3.89 square kilometres were given to Al-Wafideen, and 18.03 square kilometres were allotted to Al-Sawadah2. In addition, the territory that belonged to Al-Sawadah2 included 18.03 square kilometres.

Table 1
Random areas in 2004 and 2021

Name of the neighborhood	Al-Jihad	Al-Sawadah 1	Al-Wafideen	Al-Sawadah 2
Year/ 2004	0.53	0	1.1	1.6
Year/ 2021	4.26	1.35	3.89	18.03

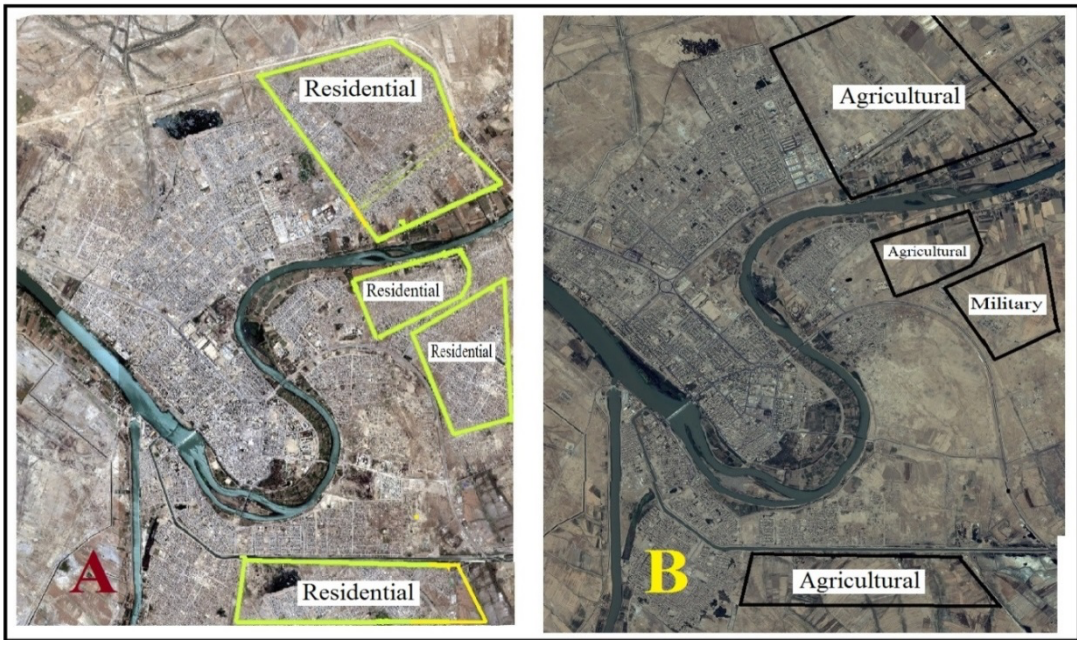

Fig. 5. The areas of neighborhood (A) in 2021 and (B) in 2004

3.3 The Vacant and Random Land

It was seen through the percentages that were presented in Figure 6 that the percentages of vacant agricultural and military lands have declined in very huge proportions during these years as a consequence of the strong relocation of families to them and the rise in random growth. This was seen as the result of the strong relocation of families to them and the increase in random growth. One of the possible explanations for this is that there has been an increase in the amount of random growth. It was decided that four percentages should be looked at, and the following is what was discovered as a result of this investigation: 77, 85, 92, 97 % of all the land in random locations. whereas undeveloped land makes up 10, 1, 8, and 14% of the total.

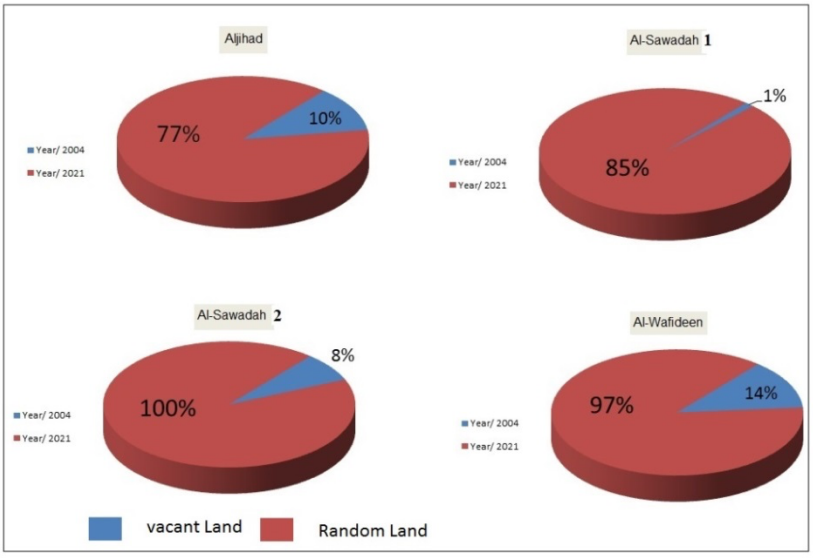

Fig. 6. Illustrate the vacant and random land

4. Conclusion

Through the axes that the research was able to discuss, the following conclusions were reached**:**

i. The random housing phenomenon is one of the problems directed by the planning process in different countries, including Iraq, which constitutes an additional obstacle to the process of development and development**.**
ii. The dominant feature of entering the random housing areas is the visual pollution in all its planning dimensions in terms of the clear difference in the style and arrangement of the buildings, as well as the building materials used in construction, and the inconsistency of protected roads and streets that build an accumulation of waste and pools for bilge water**.**
iii. Residents of random often resort to self-reliance in managing municipal affairs and developing immediate, temporary solutions.
iv. The study area is characterized by the fact that it has become a stable that possesses some societal elements for the exchange of functional relationships for residential shops, with a difference from the official municipal organization.
v. The random areas may be located outside the basic design, which requires treatment with social and urban planning dimensions according to the alternatives decided by the urban administration.
vi. The study area witnessed floundering and unprogrammed planning stages based on personal relationships in signing services, including generalization.
vii. The housing market suffers from a scarcity in supply, and the offered housing stock does not meet the demand with the available cash alternative.
viii. There is a clear shortcoming in the governmental and non-governmental housing policies, as well as the shortcomings of the loan performance of the Housing Bank and banks.

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