Volume 9, Issue 3, March – 2024 International Journal of Innovative Science and Research Technology
ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24MAR2159

Implementation of a Real Estate Management System using Photogrammetry Method Allowing 3d Navigation of Buildings

Bikie Gerald Anicet[1*]; Dongmo Hile Bertrand[2]; Aba Nkasse Alain[2]; Elime Boubouama Aime[2]; Amboulou Okomba Bessemer[2]; Mohammed Achab[1]
[1]Geo-Biodiversity Laboratory Scientific Institut , Mohamed V University Rabat Morocco
[2]National Advance School of Public Works Yaounde Cameroon

Corresponding Author:- Bikie Gerald Anicet[1*]

Abstract:- The objective of this study is to evaluate how the use of virtual representations of buildings, created through photogrammetry, can improve the efficiency and effectiveness of the real estate management system. In this regard, investigations have been conducted with stakeholders in the real estate sector, such as real estate agencies and tenants, to gather valuable information on real estate management.

For illustration purposes, we have chosen to model the NASPW gymnasium. We have implemented a real estate management approach based on the photogrammetry method. To achieve our objective, we describe each step of the process, from the preparation of the photogrammetric mission (planning and simulating the mission) to data acquisition, carried out using a Phantom 4 Pro drone for aerial images and a Nikon D300 digital camera for interior shots.

The data processing phase is also crucial, and it was done using the Agisoft Metashape software. We provide detailed explanations of the different steps in this process, which include image quality estimation, image alignment, georeferencing, dense point cloud generation, 3D mesh creation, and orthophoto generation.

I. INTRODUCTION

Nowadays, the acquisition of real estate in Cameroon is a real obstacle course. Access to decent housing proves to be a burden for many people looking for housing. This booming sector is largely under the influence of the informal sector. The information brought to the attention of users is restricted in the sense that it generally only concerns the number of rooms available and vaguely the location. Indeed, if the Ministry of Housing and Urban Development (MINHDU) and the Société Immobilière Camerounaise (SIC) are hard at work in the development of an urban plan and the facilitation of access to housing, we must recognize that many factors slow down the achievement of their objectives.

Since the beginning of the 1990s, the attraction in the city of Yaoundé has led to a considerable rural exodus of populations coming from other localities (Antoine and Savané 1990). Added to this is the displacement of populations from the Central Africa sub-region which continues to increase. This population is added over time to that already present, thus creating a demographic boom.

Unfortunately, real estate agencies, which are the main players in the private sector in this very lucrative field, are taking advantage of the high demand to engage in unorthodox practices. They sometimes present unsuitable properties to applicants in exchange for exorbitant viewing fees, or they overestimate property prices to increase their rental commission. All this makes acquiring real estate at a reasonable price very difficult.

Furthermore, could the virtual representation of buildings improve the real estate management system, by including photogrammetric techniques?

With a view to presenting work focused on methodological rules, we have set a main objective which is aimed at evaluating how the integration of the virtual representation of buildings created thanks to photogrammetry can improve efficiency and the efficiency of the property management system?

II. METHODOLOGY

The proposed methodology consists of collecting the basic data necessary to create the model. This may include photographing multiple angles of the target.

Once the basic data is collected, the next step is to create a 3D model of the building using 3D modeling software. This model must take into account the different aspects of the building such as walls, doors, windows, stairs, decorative elements, etc.

This approach makes it possible to obtain precise and detailed measurements of objects as well as to easily visualize them through an online platform, which facilitates management and making informed decisions regarding modeled objects.

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24MAR2159

➢ *Choice of Site*

To carry out our study, it proved necessary to delimit a study area and choose a building to model. Our choice fell on the gymnasium of the Ecole Nationale Supérieure des Travaux Publics (ENSTP-Yaoundé), located in the 6th District of the city of Yaoundé, Mfoundi Department, Center region, more precisely in the Elig EFFA neighborhood.

➢ *Data Acquisition and Processing*

Data collection is the process of gathering information for the purpose of making direct observations to answer open-ended questions. Our data was acquired using a drone (external images) and a digital photo camera (internal images).

➢ *Choice of Software*

There is a variety of software for processing images acquired by the drone, and it depends on the types of results you would like to have.

For our case, we used Agisoft Metashape and Google Sketch up software. Therefore, to achieve our objective, these photos acquired by drone will be loaded and processed in photogrammetric processing software in order to produce precise and usable renderings for a better appreciation of the environment of the real estate property through a 3D model, its location and nearby amenities.

To process aerial data, the following steps will follow: loading images, aligning photos, georeferencing, generating a dense cloud, generating a 3D mesh and generating Orthophotography.

➢ *Data Modeling (MCD, MLD, and MDP)*

Data modeling is about coherently organizing the information we want to store in a database. Its main objective is to accurately represent the relationships between the different entities or different objects present in the application domain.

For our illustration, data modeling is used to structure and represent the links between the lessor, the real estate agent, the client and the real estate placed on the real estate market.

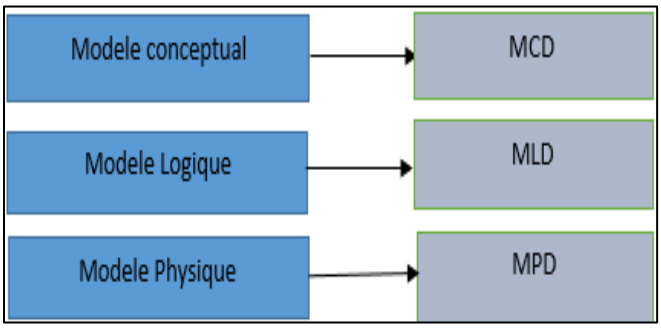

Fig 1 Data Modeling (MCD, MLD, and MDP)

➢ *Data Integration in Web Mapping App*

After carrying out all these steps, it is necessary to link the various useful data to the web-mapping.

This step allows geographic data to be integrated into an online environment, thus facilitating their use and visualization. To achieve this connection, there are different approaches and tools available. Some geospatial database management systems offer integrated web-mapping functionalities, allowing data to be published directly on the web. All you have to do is configure the appropriate parameters to establish the connection between the database and the web application.

➢ *Creation of the Website*

A website is a set of web pages that is published on the Internet and accessible to all Internet users. It can consist of text, images, videos and other types of content.

III. PRESENTATION OF THE RESULTS

➢ *Presentation of the Study Area*

Located in Yaoundé, the capital of the central region and the Mfoundi department. Yaoundé is the headquarters of public institutions and is home to nearly 4,337,000 million inhabitants (BUCREP, 2022). It has a very rugged terrain with plateaus ranging from 600 to 800 m above sea level and mountain ranges reaching up to 1200 m above sea level as well as valleys. Yaoundé's climate is temperate subtropical with two dry seasons alternating with two wet seasons and rainfall exceeding 1,600 mm in total per year. Temperatures vary between 18°C and 28°C during wet seasons and between 16°C and 31°C during dry seasons.

Placed under the authority of a government delegate following Law No. 87-015 of July 15, 1987 creating urban communities, the city of Yaoundé extends to over 304 km² including an urbanized area of 183 km². It is divided into 7 districts, each headed by a sub-prefect.

Fig 2 Location Plan of the Building to be Studied

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24MAR2159

➢ *Result after Generation of the Point Cloud*

In addition to the scatterplot, we also generated a shaded representation without the color values removed. This resulted in the creation of thousands of points. This large number of points can provide a more accurate and detailed representation of our building.

Fig 3 3D Model Result

➢ *Result after Generation of the 3D Mesh*

After 3D modeling, we generated the orthophoto which offers a three-dimensional environmental view. It allows you to have an overall overview of the property as well as nearby amenities. This functionality allows researchers to have a detailed view and make informed decisions.

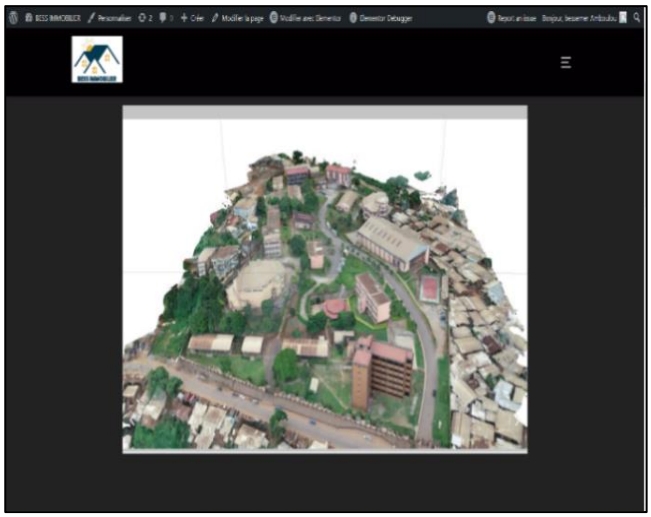

Fig 4 Illustration of the Orthophoto

➢ *Restoration of the 3D Model*

The restitution of the existing building is a process aimed at creating a precise and realistic visual representation of the building from photographs, surveys or 3D modeling. This technique is frequently used in fields such as architecture, town planning, topography or heritage conservation. In addition, it offers the possibility of generating photorealistic images, animations, simulations.

Fig 5 Approximate Illustration of the Building

➢ *The Functional Architecture of Web Mapping*

The functional diagram of the web mapping will have that of client/server/database architecture. The client makes a request (viewing, creating, modifying, deleting and updating new buildings) to the server which, in turn, does it in the form of an SQL query to the database. Then the database interprets this SQL query and returns a result to the server, which most of the time is usually data. This data is read and processed by the server which then returns the results obtained to the client.

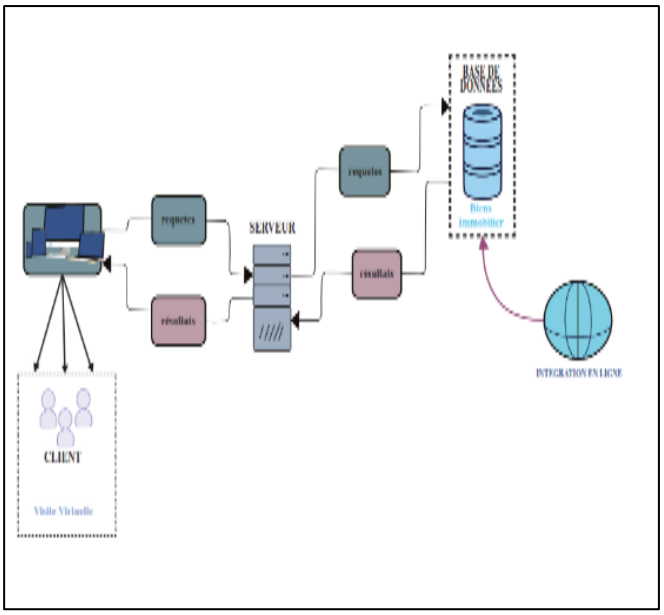

Fig 6 Web Mapping App Functional Diagram

➢ *Archiving and Documentation*

To make our 3D model accessible to potential customers, we were able to make them available on the Wed website. The latter will serve as a platform to present our work and will allow visitors to learn about our various achievements. Additionally, we plan to include interactive features on the site so that customers can interact with the models and view them from different angles. They will thus be able to explore the different rooms and have an immersive experience without physically moving through the link below (https //Sites.google.com/view/bess-immobilier).

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24MAR2159

Fig 7 Website Interface Diagram

IV. LIMITATIONS AND IMPROVEMENTS

➢ *Like any Project, 3D Real Estate Modeling has Certain Limitations. We have Listed a few that we Encountered during Processing to Consider:*

- *Accuracy:*

Real estate 3D modeling can have limitations in terms of accuracy, although 3D modeling technology has advanced significantly, some details may not be reproduced with absolute accuracy.

- *Cost:*

3D real estate modeling requires a significant financial investment, with the necessary equipment and software being expensive.

- *Accessibility:*

Not all users necessarily have access to devices such as computers, smartphones to view real estate 3D models.

➢ *To Improve the Limits of Real Estate 3D Modeling, we will List some Suggestions:*

- *Project Planning:*

Before starting to model, it is important to plan the project and identify the objectives you want to achieve. This may include considerations such as accuracy needed, features required, target audience;

- *Accurate Data Collection:*

To create a realistic and accurate 3D model, it is essential to collect accurate baseline data. This may include high resolution photographs, laser scans.

➢ *Outlook*

To make our property management system more efficient, it is important to register with the Cameroonian telecommunications regulatory agency (ART), in order to be able to secure our data that we put online from our website.

V. CONCLUSION

Since the beginning of the 1990s, the attraction in the city of Yaoundé has led to a considerable rural exodus of populations coming from other localities. This population is added over time to that already present, thus creating a demographic boom.

The problem that arises is that this metropolis was not built with the aim of welcoming so many populations in the space of barely three decades. There then arises a vast deficit in terms of housing to accommodate these different populations. The real estate sector is very lucrative, so access to housing in Yaoundé remains an obstacle course.

This work aimed at the creation of the 3D visualization model in the real estate sector by including photogrammetry techniques. Indeed, it was a question of implementing a solution for real estate management through three-dimensional modeling in order to resolve the problems linked to the real estate sector.

This implementation of a photogrammetric visualization system is a valuable tool that will facilitate the search for real estate. By using photogrammetry and 3D navigation technologies, it is therefore possible to create a 3D model that will allow users to view real estate in a complete and detailed manner without the need to physically travel.

This template can be used by real estate professionals and individuals to assist in the search for real estate. In addition, a virtual tour will help tenants to plan ahead. It is produced from photos of the property being highlighted and offers the candidate tenant the possibility of carrying out a pre-visit remotely, which avoids unnecessary travel in the event of a crippling problem immediately identifiable on the visual. The second visit, “in the flesh” this time, will only aim to ratify a decision that is already partially matured, especially since a geolocation of the property will have already confirmed the interest of the location. of the premises.

REFERENCES

[1]. **American Society of Photogrammetry (1984)** ‘Close-Range Photogrammetry & Surveying.’ American Congress on Surveying, San-Antonio.
[2]. **Andre, Q. and Van-iseghem, P. (2019)** ‘Programmation d ‘un drone pour la photogrammétrie, pp. 1–28.
[3]. **Baker J. (1985)** ‘Traffic-Accident Investigation Manual. Northwestern University Traffic Institute.’
[4]. **BARAZZETTI, L., L. MUSIO, F. REMONDINO ET M. SCAIONI. (2011)** ‘Targetless camera calibration, ISPRS-International Archives of photogrammetry, Remote sensing and Spatial Information Sciences’ pp. 300-360

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/IJISRT24MAR2159

[5]. **Chris Totten (2012)** "Game Character Creation with Blender and Unity" P13-17.
[6]. **Darrell Young (2015)** "Mastering the Nikon D750" P20.
[7]. **Dubois, S., Vanhellemont, Y. and de Bouw, M. (2019)** 'Les drones au service de la construction Technologies, enjeux et perspectives', (August)
[8]. Photogrammetry & Surveying: State-of-the-Art. In ASP, ad.: American Congress on Surveying, San Antonio, 1984.
[9]. **Jean-Yves Labbé and F. Bretar (2015)** "Practical Photogrammetry: Principles and Applications" P21-33.
[10]. **Julie Adair King (2018)** "Canon EOS Rebel T7/2000D for Dummies" P10.
[11]. **Mâzouz, A., Des, L. E. and Civils, D.** 'L'envol des drones civils : Appréhension par le droit français d'une pratique émergente'.
[12]. **Michael I. Shortis (2010)** "Photogrammetry and 3D Imaging: An Introduction" P11-13.
[13]. **Murtyoso, A. (2016)** 'Protocoles d'acquisition d'images et de traitement des données par drone Modélisation 3D de bâtiments remarquables par photogrammétrie', pp. 1–82.
[14]. **Roland Hess (2019)** "Blender Foundations: The Essential Guide to Learning Blender 2.8" P10-15.
[15]. **Scott Kelby (2013)** "The Digital Photography Book" P10-12.

➢ *Revue Scientifiques*

[16]. **Adam Juniper (2016)**, Drone Pilot's Handbook P30-33
[17]. **Aswath Damodaran (2012)**"Investment Valuation: Tools and Techniques for Determining the Value of Any Asset" P21-23
[18]. **Christian Adams (2018)** "mastering rone Photography: The Definitive Guide for Photographers" P40-42
[19]. **Derkx F., Dumoulin J., Sorin J.-L., Legeay V. (2003)** 'Inspection des ouvrages d'art : intérêt des drones.'Journées Scientifiques de l'Ingénieur, pp. 481-486
[20]. **Derkx F., J., Sorin J.-L. (2005) '**Présentation du drone et des premières instrumentations. '*Journées Ouvrages d'art, Lyon France*. Pp. 9
[21]. **Droneflight (2019)** "Drone Operator's Logbook: The Essential Tool for Professional Drone Pilots" P82-84
[22]. **Edward M. Mikhail, James S. Bethel, and Jilkunn Lee (2001)** "Introduction to Modern Photogrammetry"P58-64
[23]. **Elizabeth Cline (2017)** the Droner's Guide: Everything You Need to Know About Drones and How to Fly Them" by P20-25
[24]. **Ferrandez F. (1995)** 'L'étude détaillée d'accidents orientée vers la sécurité primaire. ' Presses de l'école nationale des ponts et chaussées, Paris.
[25]. **IFEI**. « Charte de l'Expertise Immobilière ». 5e Edition, Mars 2017. 89 pages, 2017.
[26]. **Karl Kraus (2007) '**Photogrammetry: Geometry from Images and Laser Scans» P33
[27]. **Metni N., Derkx F., Sorin J.-L. (2004)** 'The Current Use of UAV for Civil Applications: Bridge Inspection and Traffic surveillance, 4th Unmanned Vehicle System.' *UVS Tech*.
[28]. **PELIGNAC, MONCEAU et CUSSAC**. « Expertise Immobilière, le Guide Pratique », Groupe Eyrolles, 4 -ème édition, Paris. 518 pages, 2007
[29]. **Robert C. Kyle and Floyd M. Baird (2012)** "Property Management" P28-42
[30]. **Theo Moons, Luc Van Gool, and Maarten Vergauwen (2010)** "3D Reconstruction from Multiple Images" P82-86
[31]. **Wilfried Linder (2016)** "Digital Photogrammetry: A Practical Course" P17-20
[32]. **Wolfgang Förstner and Bernhard P. Wrobel (2003)**"Photogrammetric Computer Vision: Statistics, Geometry, Orientation and Reconstruction» P80-102