Exploring the Use of Natural Lighting in Catholic Cathedrals Bori, Khana Local Government Area, Rivers State, Nigeria

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DOI: 10.56201/ijemt.vol.11.no10.2025.pg23.36

Abstract
The use of natural lighting in Catholic cathedrals has historically held both functional and symbolic significance, shaping architectural design and liturgical experience. This study explores the integration of natural light as a design element in Catholic cathedrals, focusing on its role in enhancing spiritual atmosphere, highlighting sacred symbols, and reducing reliance on artificial illumination. Natural light has long been associated with divine presence, and its controlled use in cathedral design—through clerestories, stained glass, rose windows, and skylights—creates an environment that fosters contemplation, reverence, and transcendence. Beyond its symbolic role, natural lighting contributes to environmental sustainability by reducing energy consumption, aligning historic architecture with contemporary ecological concerns. The review also identifies challenges in achieving optimal natural lighting, such as balancing illumination with thermal comfort, glare control, and preservation of heritage structures. The study concludes that the thoughtful application of natural lighting in Catholic cathedrals not only preserves spiritual and aesthetic traditions but also offers opportunities for sustainable innovation in modern ecclesiastical architecture.

Key words: *Catholic Cathedrals, natural lighting, light, liturgy, modern Architecture.*

INTRODUCTION

A Cathedral serves as a principal church that houses the bishops official seat known as the "Cathedra" meaning chair and it is the seat of the diocesan administration and a means of the celebration of divine liturgy where issues are also addressed to aid the smooth operation of the cathedral without defects. The term describes the presence and statue of bishops or Archbishops chair or throne that is elevated above both clergy and lay people and was historically positioned facing the congregation from behind the altar. The chair on the raised dais (dais is an elevated platform at the front of a room or hall, usually meant for one or more speakers or honored guests, (Wikipedia.org,2021). Which was used as a teacher or mentor distinguishing mark in the ancient world, represents the bishops function as a teacher. The cathedra also represents the bishop's function in governance because a raised throne within the basilica was a defining feature of a Late Antique presiding magistrate.

The episcopal throne symbolizes the idea that a cathedral can only exist because of a bishop and the idea is still valid in churches that no longer has bishops but nonetheless upholds the cathedrals dignity and functions in older churches where bishop once ruled. But the throne can also create an idea that a cathedral creates a bishop, both specifically in the sense that the bishop is chosen within the cathedral and installed by being enthroned from within the cathedral by acclamation of clergy and laity and more generally in the sense of the bishop's fundamental requirements of regular prayer, higher education, and musical worship were for many centuries primarily accessible through cathedral activities. The related spaces consist of the Narthex, Nave, and Sanctuary (Trisno and lianto 2018a; Siriandono 2012). The sanctuary which generally includes the Altar, tabernacle, cross, Sacred room, reading room and priests chair, facilitates the Eucharistic liturgy stage. It symbolizes the communication vessel between GOD and humans as the spatial center of the church therefore, it is considered a sacred area, which can only be accessed by the priests and eucharistic officers in most liturgical processions (strolk 2012; Trisno and lianto 2020). Furthermore, the sanctuary hierarchy is characterized by the higher floor surface than other rooms, the arrangement of structural elements or the use of ornaments, curtains (chanal)and altar railings (stroik 2012; Trisno and lianto 2020).

LITERATURE REVIEW

The catholic church is one of the oldest organizations in the world, the Catholic Church can trace its history back to the age of the apostles, or almost 2,000 years ago. A crucial component of the histories of Christianity and Western civilization is the history of the Catholic Church. The founder of the Catholic Church is its spiritual leader, Jesus Christ. According to Catholic belief, the Church was established at the time of Peter's Confession and is still in existence now. According to this interpretation, the Confession of Peter represents Christ's appointment of Apostle Peter and his Rome-based successors as the temporary leaders of his church. As a result, it declares that the Bishop of Rome is the only person with the right to invoke Petrine authority and the Roman Pontiff's primacy. The Catholic Church asserts the authority of the Pope and the validity of its bishops and priests through the theory of apostolic succession and the unbroken line of popes who follow Simon Peter. Therefore, the authority of the Apostle Peter and those who followed him is understood as an ongoing lineage from Jesus Christ. Over the centuries, the pope evolved into the institution that it is today. According to church tradition, Peter was the first Christian leader in Rome, the imperial capital. To establish the earliest Christian communities, the Apostles and many Christians journeyed to Greece, Rome, Asia Minor, Arabia, and northern Africa. The Roman Empire saw a rapid growth of Christianity, and by the second century, there were twenty bishoprics outside the empire, primarily in Armenia, and numerous established bishoprics within the empire, including Northern Africa, France, Italy, Syria, and Asia Minor. Irenaeus (2022–2022) upheld the apostolic legacy (History of catholic, 2023).

BRIEF HISTORY OF CATHOLIC CATHEDRALS

The early Christian cathedrals were characterized by their longitudinal plans, with a central nave flanked by aisles, a transept, and an apse at the eastern end where the altar was placed. This layout would become a defining feature of cathedral architecture for centuries to come. The Church of the Holy Sepulchre in Jerusalem, built under the patronage of Emperor Constantine, is one of the earliest examples of a structure built specifically as a cathedral.

The influence of Roman architecture on early Christian cathedrals is undeniable. The use of the basilica form, the adoption of classical columns and capitals, and the Roman methods of

construction with brick and stone were all integral to the development of cathedral architecture. The Roman architectural vocabulary provided a sense of grandeur and authority to these new Christian buildings, aligning the emerging religion with the established power of the Roman state. Early Christian architects also borrowed the Roman technique of constructing large, open interior spaces that could accommodate growing congregations. The use of the triumphal arch, which in Roman times celebrated military victories, was repurposed in cathedrals to symbolize the victory of Christ. This fusion of Roman elements with Christian symbolism was a deliberate choice that helped to communicate the message of the Church and to establish its cultural dominance.

TRANSITION OF CATHOLIC CATHEDRALS AND THEIR ARCHITECTURAL STYLES.

Transition to Medieval Architecture

As the Roman Empire declined, the Church emerged as a dominant force in Europe, and cathedral architecture began to evolve in response to the changing social and religious landscape. The transition to medieval architecture saw the development of more complex structural systems, such as the use of stone vaulting to replace the flat wooden roofs of earlier basilicas. This transition also marked a shift from the classical emphasis on horizontal lines to a more vertical and heavenward orientation, foreshadowing the Gothic cathedrals of the later Middle Ages.

Romanesque Period

The Romanesque period, spanning approximately from the 10th to the 12th centuries, was characterized by a return to stone construction and the widespread use of the round arch, inspired by Roman precedents. Romanesque cathedrals were solid and imposing structures, with thick walls, sturdy piers, and relatively small windows. The interiors were often dimly lit, creating an atmosphere of solemnity and mystery.

Transition to Gothic Architecture

The transition from Romanesque to Gothic architecture was gradual and regionally varied. It was driven by a combination of technological advancements, evolving aesthetic preferences, and the changing needs of the Church. The desire for larger windows, higher ceilings, and more luminous interiors led to the development of the pointed arch, ribbed vault, and flying buttress, which are hallmarks of Gothic architecture.

Renaissance Period

The Renaissance period, beginning in the 14th century in Italy and spreading across Europe, marked a return to classical principles of architecture. Renaissance cathedrals emphasized symmetry, proportion, and order, drawing inspiration from the architectural treatises of ancient Rome, particularly the work of Vitruvius. The use of domes, arches, and columns followed strict mathematical ratios, and facades were often designed with a strong sense of balance and clarity.

Transition to Baroque Architecture

The transition to Baroque architecture in the late 16th century brought about a new level of dynamism and theatricality to cathedral design. Baroque architects sought to evoke emotional responses through the use of dramatic contrasts, grandiose scale, and elaborate ornamentation. The emphasis on light and shadow, the integration of sculpture, painting, and architecture, and the use of curved forms created a sense of movement and transformation within the cathedral space.

Neoclassical Period

Neoclassical cathedrals are marked by their grandiose scale, clean lines, and use of classical elements such as columns, pediments, and domes. The design of these cathedrals was influenced by the principles of symmetry, proportion, and harmony, which were seen as reflecting the rational order of the universe.

Transition to Modern Architecture

The transition to modern architecture in the late 19th and early 20th centuries was marked by a desire to break away from historical styles and to create buildings that reflected the technological advancements and social changes of the time. The use of new materials such as steel, concrete, and glass, along with new construction techniques, allowed architects to explore innovative forms and structural systems.

FUNCTIONS OF A CATHEDRAL

The functions of a Catholic Cathedral vary from religious to civil and social roles. The role of the cathedral is chiefly to serve God in the community, through its hierarchical and organizational position in the church structure. The building itself, by its physical presence, symbolizes both the glory of God and of the church. Apart from its organizational function as the seat of the bishop, and the meeting place for the chapter of the diocese, the cathedral has a liturgical function in offering daily church services. The formal cathedral services are linked to the cycle of the year and respond to the seasons of the Northern Hemisphere, Christmas falling in the winter and Easter in the spring. Cathedrals often hold a service of thanksgiving called Harvest Festival in the autumn.

EXPLORING THE USE OF NATURAL LIGHTING IN CATHOLIC CATHEDRALS

Natural lighting has historically played a central role in the architectural and spiritual design of Catholic cathedrals. Unlike artificial lighting, natural light is not merely functional but also symbolic, often associated with divine presence, enlightenment, and transcendence. The deliberate use of daylight in cathedrals reflects both theological meanings and architectural ingenuity, creating spaces that embody sacredness and elevate worshippers' spiritual experience.

From the Gothic period onwards, cathedral architects integrated natural light to achieve a profound spiritual atmosphere. The extensive use of stained-glass windows, rose windows, and clerestory openings transformed cathedrals into luminous environments filled with colored light that symbolized divine illumination (Bork, 2018). These windows were not only aesthetic but also narrative devices, illustrating biblical stories and saints' lives, thereby educating and inspiring the faithful through light-infused imagery (Robertson, 2020).

Architecturally, natural lighting was carefully manipulated to emphasize spatial hierarchy. The chancel and altar areas, considered the most sacred parts of the cathedral, were often oriented to maximize morning sunlight, reinforcing their symbolic role as the locus of divine presence (Crossley, 2021). The verticality of Gothic cathedrals, supported by ribbed vaults and flying buttresses, further facilitated the integration of large stained-glass windows, making light a structural and spiritual element simultaneously (Scott, 2019).

WHAT IS NATURAL LIGHTING

Natural lighting, often referred to as daylighting, is the intentional use of sunlight to illuminate indoor spaces through openings such as windows, skylights, clerestories, or other architectural features, natural lighting uses the sun's rays as a renewable and sustainable source of illumination

(Lechner, 2015). It is one of the oldest forms of architectural lighting and has been employed across different cultures and historical periods, not only for functional visibility but also for aesthetic and symbolic purposes. Furthermore, natural lighting is associated with cultural and symbolic meanings, especially in religious and monumental architecture. In such contexts, daylight is not only a functional necessity but also a metaphor for divine presence, enlightenment, or purity (Anderson, 2022). This dual role—practical and symbolic—makes natural lighting a central consideration in architectural design.

CHALLENGES OF LIGHTING IN CATHOLIC CATHEDRALS

While natural lighting has historically enhanced the symbolic and spiritual atmosphere of Catholic cathedrals, it also presents a series of architectural, functional, and conservation challenges. These issues often arise from the complex relationship between sacred symbolism, practical needs, and the preservation of historic structures.

One major challenge is glare and uneven illumination. Cathedral interiors are vast, with high ceilings, deep naves, and large stained-glass windows. These architectural features often result in uneven light distribution, where some spaces are excessively bright while others remain dim. Such imbalance can hinder visibility during liturgical activities and affect the comfort of worshippers (Boubekri, 2021).

Another significant challenge is the impact of ultraviolet (UV) and infrared radiation on stained-glass windows and interior artworks. Prolonged exposure to direct sunlight can lead to fading of pigments, thermal stress on glass panels, and the deterioration of paintings, fabrics, and stonework (Doehne & Price, 2010). This creates a tension between maintaining daylight as a spiritual and aesthetic feature while protecting the cathedral's artistic and cultural heritage.

Structural constraints also limit how natural lighting can be optimized in historic cathedrals. Unlike modern buildings where skylights and advanced glazing can be easily integrated, many Catholic cathedrals are heritage structures where modifications must adhere to strict conservation regulations. This makes it difficult to introduce modern daylighting technologies without compromising historical authenticity (Anderson, 2022).

Finally, there is the challenge of symbolic interpretation. While natural light symbolizes divine presence, the reliance on daylight makes cathedral interiors subject to weather and seasonal changes. Overcast skies, for example, may diminish the intended symbolic atmosphere of transcendence, leaving the space darker and less inspiring (Scott, 2019).

In conclusion, although natural lighting enriches Catholic cathedrals by embodying theological symbolism and enhancing aesthetic qualities, it also presents challenges related to glare, conservation, thermal comfort, structural limitations, and symbolic consistency. Addressing these challenges requires a delicate balance between preserving historical integrity and integrating modern sustainable solutions.

STRATEGIES FOR OVERCOMING THE CHALLENGES OF NATURAL LIGHTING IN CATHOLIC CATHEDRALS

Addressing the challenges of natural lighting in Catholic cathedrals requires solutions that balance heritage conservation, functional needs, and sustainable design principles. Since cathedrals are both sacred and historic spaces, interventions must preserve their symbolic value while enhancing their usability.

One effective approach is the use of protective glazing systems. Installing external or internal secondary glazing helps to reduce ultraviolet (UV) and infrared radiation, thereby protecting

stained-glass windows and interior artworks from deterioration while maintaining the visual and symbolic qualities of daylight (Doehne & Price, 2010). Modern glazing technologies such as low-emissivity (low-E) coatings can also improve thermal performance, reducing heat loss in winter and heat gain in summer (Lechner, 2015).

Another solution involves the application of light diffusers and shading devices. By integrating transparent or translucent panels, architects can reduce glare and achieve more even light distribution throughout the cathedral interior. This technique ensures that worshippers experience comfortable lighting conditions without disrupting the sacred ambiance (Boubekri, 2021).

In sum, overcoming the challenges of natural lighting in Catholic cathedrals requires a multidisciplinary approach that combines architectural innovation, digital technologies, conservation science, and theological sensitivity. When effectively managed, natural lighting continues to enrich these sacred spaces by preserving their historical character while supporting modern sustainability goals.

ROLES OF NATURAL LIGHTING IN CATHOLIC CATHEDRALS

Natural lighting plays a central role in the design and experience of Catholic cathedrals, shaping their spiritual, aesthetic, functional, and symbolic character. Its integration into sacred architecture demonstrates the intentional use of daylight not only as a practical source of illumination but also as a theological and cultural expression.

i. Spiritual and Symbolic Role

Light in Catholic cathedrals has long been associated with divine presence, purity, and enlightenment. Daylight entering through stained-glass windows transforms into radiant colors that symbolize the transcendence of God, creating an atmosphere of awe and reverence (Robertson, 2020). In theological terms, light functions as a metaphor for Christ as the “Light of the World,” reinforcing the liturgical and spiritual messages of the cathedral (Anderson, 2022).

ii. Aesthetic and Artistic Role

Natural lighting enhances the visual quality of cathedral interiors. Through stained-glass and rose windows, daylight becomes an artistic medium that illuminates biblical narratives and saints’ lives in a visually captivating way (Bork, 2018). The shifting patterns of colored light across walls and floors create a dynamic and immersive worship experience that changes with the time of day and seasons.

iii. Functional Role

Beyond symbolism, daylight provides practical illumination for liturgical activities, processions, and communal gatherings. In the medieval era, when artificial lighting was limited to candles and oil lamps, natural light was essential for visibility and safety within the vast cathedral spaces (Scott, 2019). Even today, daylight reduces reliance on artificial lighting, thereby lowering energy consumption while ensuring worshippers can participate fully in religious rituals.

iv. Psychological and Experiential Role

Exposure to natural lighting has been shown to positively impact human well-being by regulating circadian rhythms and enhancing mood (Boubekri, 2021). In cathedral spaces, daylight helps to foster a contemplative environment, encouraging meditation, prayer, and a deeper connection to

the sacred. The dynamic quality of light, shifting with weather and time, creates a spiritual rhythm that aligns worshippers with the cycles of nature.

THE SELECTION OF THE SITE

One of the most significant choices that the building committee must make is where to build the church. This choice will determine the maximum size and volume of the building, as well as greatly influence its character and future growth and development, as well as its significance to the parish and community, important things to think about are the following:

i. Proximity

The site has proximity to major transportation routes, e.g. highways, public transit enabling easy access by parishioners and visitors.

ii. Accessibility

The site is a prominent landmark visible from various parts of the city or region, symbolizing the church's presence.

iii. Space

The site is large enough to accommodate the cathedral, Auxiliary buildings such as the rectory, parish offices, community centers and future expansions if necessary.

iv. Safety and security

The area is secure and safe for worshippers with considerations for modern security needs.

METHODOLOGY

This study adopts a qualitative research design, supplemented by architectural analysis, to explore the role and application of natural lighting in Catholic cathedrals. The choice of a qualitative approach is informed by the interpretive nature of the subject, which requires understanding both the symbolic and functional dimensions of light within religious architecture (Creswell & Creswell, 2018). Case study analysis is employed to investigate selected cathedrals where natural lighting is a prominent architectural feature, allowing for in-depth examination of spatial qualities, design strategies, and user experience. The research focuses on Catholic cathedrals in Nigeria and selected international examples for comparative purposes. Cathedrals were chosen purposively based on criteria such as historical significance, architectural prominence, use of stained glass, clerestories, rose windows, and their reliance on natural light to define spatial and liturgical atmosphere. This comparative approach ensures that both traditional Gothic/Romanesque cathedrals and modern designs are represented. Collected data are analyzed using thematic content analysis, focusing on recurring patterns such as the symbolic role of light, technical design strategies, sustainability benefits, and experiential impacts.

DISCUSSION

The use of natural lighting in Catholic cathedrals has historically served both functional and symbolic purposes. This study reveals that natural light is not merely a design element but a vital medium of spiritual expression, architectural beauty, and environmental performance. In traditional cathedral architecture, light has often been perceived as a divine presence, representing purity, holiness, and the illumination of faith. Gothic and Romanesque architects skillfully

integrated clerestory windows, stained glass, and rose windows to create luminous interiors that evoke transcendence and connect worshippers to the sacred. Findings from the study indicate that natural lighting strongly influences the emotional and spiritual atmosphere within Catholic cathedrals.

CASE STUDY 1- OUR LADY QUEEN OF NIGERIA CATHOLIC CATHEDRAL

Before the creation of the Pro-Cathedral, the Catholic Church in Abuja was relatively small, as the region was not highly populated. When Nigeria moved its capital from Lagos to Abuja in 1991, there was a need to establish religious centers for the growing population. The Catholic Church quickly recognized this and began plans to build a central place of worship for the Catholic faithful in the new capital. The construction of the Our Lady Queen of Nigeria Catholic Pro-Cathedral began in the early 1980s, with support from both the local Catholic community and international partners. It was officially dedicated in 1989, two years before Abuja officially became the capital of Nigeria. The church's name, "Our Lady Queen of Nigeria," was chosen to honor the Virgin Mary, who holds a central place in Catholic devotion. Architecturally, the Pro-Cathedral is notable for its modern design, featuring a circular layout, stained glass windows, and a large dome, symbolizing the universality of the Catholic faith. The church can accommodate a large congregation, reflecting its role as a center of worship for Catholics in Abuja and beyond.

Fig 1: Landscape facade of Our Lady Queen of Nigeria cathedral
(Source: Wikipedia, 2025)

CASE STUDY 2- CATHEDRAL OF CHRIST THE LIGHT

The cathedral of Christ the light is an amazing structure with wooden glass skin that creates an interior full of light. An AIA honor award-winning structure in Architecture. The cathedral provides a sanctuary in the broader sense of the word located in down town Oakland. This house of worship offers a sense of solace spiritual renewal and respite from the secular world. The cathedral employs a non-linear approach to honor the church 2000 year history without forcing a specific point of view by stripping away received iconography, the design positions symbolic meaning within contemporary culture as its name suggests ,the cathedral draws on the tradition of light as a sacred phenomenon, through its poetic induction, indirect daylight ennobles modest materials -primarily wood, glass and concrete entirely lit with daylight creating an extraordinary level of evening luminosity.

Fig 3: Landscape facade of cathedral of Christ the light
(Source: Arch daily, 2025)

CASE STUDY 3 -THE CHRIST CATHEDRAL

Christ Cathedral in Garden Grove, California, is a landmark with a rich and unique history. Originally known as the Crystal Cathedral, it was a megachurch built by televangelist Rev. Robert H. Schuller for his congregation, the Reformed Church in America. Design and Construction: As his ministry expanded, Schuller commissioned the renowned architect Philip Johnson to design the Crystal Cathedral. Construction began in 1977 and was completed in 1980. The structure is made of over 10,000 panes of glass, giving it a distinctive and iconic look. It became one of the largest glass buildings in the world and could seat nearly 3,000 people.

Fig 5: Landscape facade of The Christ cathedral
(Source: Archdaily)

CONCLUSION

Natural lighting in Catholic cathedrals embodies both symbolic and functional dimensions. Historically, architects employed elements such as clerestory windows, stained glass, rose windows, and skylights to channel light as a metaphor of divine presence and spiritual illumination (Jones, 2020). Beyond symbolism, natural lighting enhances spatial quality, influences worshippers' emotional experiences, and contributes to energy efficiency by reducing dependence on artificial lighting (Baker & Steemers, 2014). In contemporary cathedral design, the integration of natural light reflects a balance between heritage values and modern sustainability goals (Lehman, 2018). However, challenges remain, including the control of glare, preservation of delicate stained-glass works, and balancing illumination with thermal comfort (Chamilothori et al., 2019). The

study concludes that natural light, when intentionally designed, strengthens the liturgical, aesthetic, and ecological functions of Catholic cathedrals, linking historical tradition with modern architectural innovation.

RECOMMENDATIONS

i. Preservation and Adaptation of Heritage Structures

Restoration of historic cathedrals should prioritize maintaining the symbolic and functional role of natural light through careful conservation of stained glass and original window placements (Markus, 2019).

ii. Integration of Sustainable Design Principles

Modern Catholic cathedrals should incorporate daylighting strategies that optimize energy savings, such as light shelves, reflective surfaces, and high-performance glazing, without undermining spiritual atmosphere (Baker & Steemers, 2014).

iii. Context-Specific Design

Cathedral designs in tropical regions, such as Nigeria, should adapt natural lighting strategies to account for high solar intensity, using shading devices, perforated screens, and orientation-sensitive designs (Olusanya, 2021).

iv. Use of Simulation and Digital Tools

Architects should employ daylight simulation software (e.g., Radiance, DIVA) during the design phase to predict light distribution patterns, ensuring both aesthetic and thermal comfort are achieved (Chamilothori et al., 2019).

v. Interdisciplinary Collaboration

Architects, theologians, and conservation experts should collaborate to ensure that lighting design decisions respect liturgical requirements while meeting contemporary environmental standards (Lehman, 2018).

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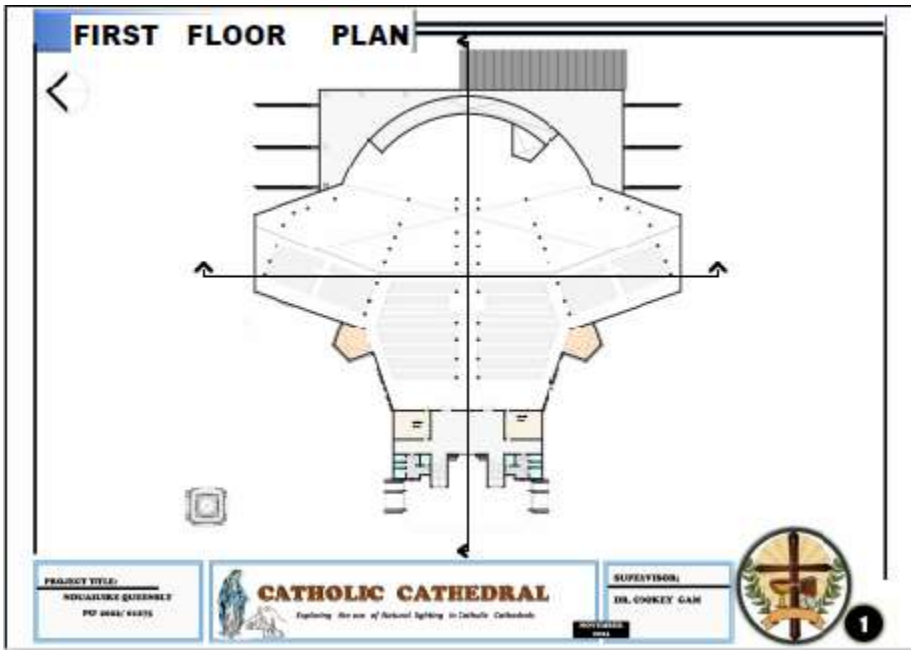
W. H. Auden, "Cathedrals, Luxury liners laden with souls, Holding to the East their hulls of stone"

APPENDIX

Appendix: A Site plan
(Source: Author,2025)

Appendix B: Ground floor plan
(Source: Author,2025)



Appendix C: Upper plan
(Source: Author,2025)

Appendix D: Perspective
(Source: Author,2025)