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A Tiered Geospatial Sensing Framework for Context-Aware Content Delivery: Application in Scriptural Information Systems

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Abstract— Background: Current digital Bible applications predominantly utilize "pull-based" interactions, which fail to synchronize content delivery with the user's immediate physical environment or situational context. **Objective:** The purpose of this research is to develop and evaluate a "push-based" framework that leverages tiered geospatial sensing to deliver contextually relevant scriptural content automatically without human intervention. **Methods:** Adopting an engineering-focused system design, the study integrated an OS-level Geofencing API with a custom 180-second dwell-time algorithm to filter transient noise, including high-speed movement (e.g., driving) and GPS jitter. The architecture was validated through twenty simulated field trials across diverse urban and suburban environments, specifically measuring trigger accuracy and battery efficiency. **Results:** The system achieved an 83.3% success rate for intended events, with the dwell-time filter successfully suppressing erroneous triggers during transient movement. Technical logs demonstrated a 67% reduction in battery consumption compared to continuous GPS polling. However, signal attenuation was identified as a significant limiting factor in high-density medical facilities and "urban canyon" environments. **Conclusion:** The results indicate that a tiered sensing model provides a reliable, energy-efficient solution for context-aware content delivery. By documenting the relationship between architectural density and signal deviation, this study establishes a technical blueprint for the intersection of geospatial informatics and digital theology. Future research should focus on refining multi-path mitigation techniques to improve reliability in dense structural environments.
Keywords— Context-Aware Systems; Geospatial Sensing; Dwell-Time Algorithm; Mobile Informatics; Digital Theology

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I. INTRODUCTION

The ubiquity of mobile computing has fundamentally shifted the way that individuals interact with sacred and philosophical texts. In previous decades, engagement with scripture typically required a physical copy of a book or a deliberate digital search within a static database. Modern users of digital Bible applications are often required to navigate through complex menus or keyword indices to find verses that might correspond to their current physical or emotional state. This traditional "pull-based" model of interaction creates a distinct cognitive gap between the immediate lived experience of a user and the spiritual wisdom they seek [1]. Grounding this work in the broader field of Context-Aware Computing, researchers define the primary goal of such systems as the delivery of "the right information, at the right time, at the right place" (Perera et al., 2014) [2]. As mobile technology continues to evolve toward proactive and context-aware systems, there is a clear opportunity to investigate how geospatial data can be used to bridge this divide. The "Geofencing Faith" framework represents a shift toward a "push-based" paradigm where the environment itself acts as a trigger for meaningful content delivery.

The primary challenge in the implementation of such a location-aware system involves the management of "notification fatigue" and the maintenance of user relevance. Suganya (2022) and Cheruiyot and Moenyane (2024) [3], [4] noted that the general usage and perception of geofencing are largely determined by the perceived utility of the triggers provided to the mobile user. If an application provides notifications that are poorly timed or contextually inaccurate, it is likely to be perceived as intrusive or distracting. In the specific context of religious or meditative content, this intrusiveness can be particularly detrimental to the user experience, potentially transforming a moment of intended reflection into a digital interruption. It is therefore necessary to develop a system that can accurately distinguish between a user who is merely passing through a location and a user who has meaningfully settled into an environment, thereby mitigating the psychological risk of notification overload.

Theoretical foundations for this work can be found in the recent exploration of location-based narrative structures. Sasaki et al. (2025) [5] discussed the activation of storytelling within urban environments through the use of crowdsourced mobile sensing and geospatial triggers. This perspective suggests that the city itself can be treated as a canvas for narrative meaning where different physical nodes trigger specific insights. By applying this logic to the "Geofencing Faith" project, we can treat various points of interest (hospitals, parks, or historical markers) as "liturgical stations" that offer relevant scriptural reflections. However, the execution of this vision is complicated by the inherent technical limitations of mobile hardware. Haas et al. (2020) [6] highlighted significant lessons from the IAB-SMART study regarding the use of geofences for

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data collection. They noted that issues such as GPS drift and the crossing of unintended boundaries often lead to high failure rates in automated trigger systems.

To address these spatial inaccuracies, robust technical architecture must be established to handle the intricacies of urban geography. The "Urban Canyon" effect remains a significant hurdle because high-rise buildings often obscure satellite signals and cause coordinates to fluctuate wildly. Ahmed et al. (2024), Loyola et al. (2013), and Shevchenko and Reips (2024) [7], [8], [9] previously explored methods to extend the battery lifetime of mobile devices with geofence capabilities by optimizing sensing frequencies. Continuous polling of GPS data is not a sustainable strategy for a consumer-facing mobile application. Modern mobile operating systems have introduced tiered location APIs that allow for more efficient background monitoring [10], [11]. The difference between this research and previous research is that while existing studies focus primarily on the general optimization of geofencing APIs for commercial or logistics use, this framework introduces a specific, tiered "dwell-time" logic designed to validate "Contextual Immersion" before a payload is delivered. Unlike previous models that prioritize immediate proximity, this study utilizes a custom 180-second threshold to ensure that scriptural delivery remains an organic extension of the user's physical stasis rather than a transient error.

The purpose of this research is to define and validate a technical workflow for a location-triggered scripture delivery engine. We hypothesize that the implementation of a specific dwell-time threshold will significantly increase the accuracy and perceived relevance of the system. This paper does not rely on human participants but instead utilizes a simulated field-testing methodology to evaluate the reliability of the system architecture across twenty distinct nodes. By documenting the engineering feasibility of the system, this study establishes a technical blueprint for the intersection of geospatial informatics and digital theology.

II. RESEARCH METHOD

The implementation of the "Geofencing Faith" system is structured around a modular software architecture designed to function within contemporary mobile operating systems. This methodology prioritizes a system-design approach to evaluate the technical feasibility of delivering contextually relevant data without human intervention [12], [13], [14]. This approach focuses on the creation and technical validation of a novel artifact, in this case, the Tiered Geospatial Sensing architecture. The methodology is structured into three primary layers (Geospatial, Logic, and Data) to ensure a modular separation of concerns between raw signal acquisition and high-level delivery and based on Design Science Research (DSR) as shown in Figure 1.

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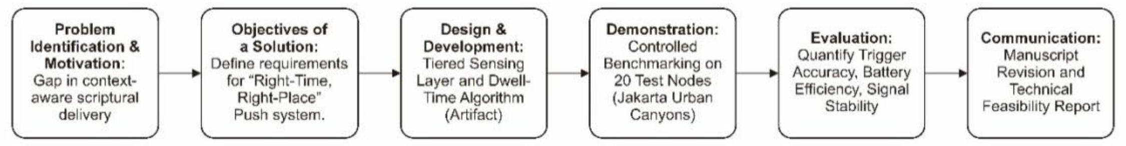

Fig 1. DSR Process Model for Tiered Geospatial Sensing Architecture
(Adapted from Peffers et al., 2007)

A. The Sensing Layer and Proximity Logic

The first phase of the technical construction involves the Sensing Layer, which acts as the interface between the physical environment and the digital application. To address the battery consumption concerns raised by Ahmed et al., Loyola et al., and Shevchenko and Reips [7], [8], [9], this study utilizes a tiered geofencing model rather than continuous Global Positioning System (GPS) polling.

The system initializes a Geofence Entry Event (E) based on the Haversine distance d between the user's coordinates $(\phi_u, \lambda_u)$and the POI center (ϕ_p, λ_p). The distance is calculated as follows:

$$\mathrm{d} = 2\mathrm{R} \cdot \arcsin\left(\sqrt{\sin^2\left(\frac{\Delta\phi}{2}\right) + \cos(\phi_u)\cos(\phi_p)\sin^2\left(\frac{\Delta\lambda}{2}\right)}\right) \quad (1)$$

where:

- $\Delta\phi = \phi_p - \phi_u$,
- $\Delta\lambda = \lambda_p - \lambda_u$,
- Ris Earth’s mean radius (≈ 6,371 km).

The trigger is considered valid if $\mathrm{d} \le r_i$, where $r_i$represents the categorical radius defined in Table 1. Once the device enters this broad boundary, the secondary tier activates the official OS-level Geofencing API to listen for dwell transitions.

Table 1. POI Metadata Taxonomy

POI Category	Primary Meta-Tag	Radius (r)	Dwell Threshold (t)	Sample Scriptural Mapping (NIV/KJV)
Medical / Clinical	#Healing	50m	180s	*"He heals the brokenhearted and binds up their wounds."* (Psalm 147:3)
Nature / Parks	#Creation	100m	180s	*"But ask the animals, and they will teach you, or the birds in the sky..."* (Job 12:7)
Sacred / Heritage	#Prayer	30m	180s	*"My house shall be called the house of prayer..."* (Matthew 21:13)
Urban / Plaza	#Community	50m	300s	*"And let us consider how we may spur one another on toward love..."* (Hebrews 10:24)

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POI Category	Primary Meta-Tag	Radius (r)	Dwell Threshold (t)	Sample Scriptural Mapping (NIV/KJV)
Cemetery / Memorial	#Hope	50m	180s	*"He will wipe every tear from their eyes. There will be no more death..."* (Revelation 21:4)
Quiet / Library	#Wisdom	30m	300s	*"The beginning of wisdom is this: Get wisdom."* (Proverbs 4:7)

The technical execution of the proposed framework is organized into a Three-Layer System Architecture, as illustrated in Figure 2. This modular structure ensures a clear separation of concerns between raw signal acquisition and the high-level delivery of spiritual content. The Geospatial Layer serves as the foundation, managing the hardware-level GNSS polling and initial geofence entry triggers. Data then flows into the Logic and Processing Layer, where the Dwell-Time Algorithm ($\tau = 180$ s)and the Priority Weighting Matrix act as filters to validate user intentionality and resolve contextual overlaps. Finally, the Presentation Layer interacts with the user's mobile interface, fetching the appropriate metadata from the Scriptures Matrix and rendering the notification. This tiered approach is critical for maintaining system stability and optimizing battery efficiency within the constraints of contemporary mobile operating systems.

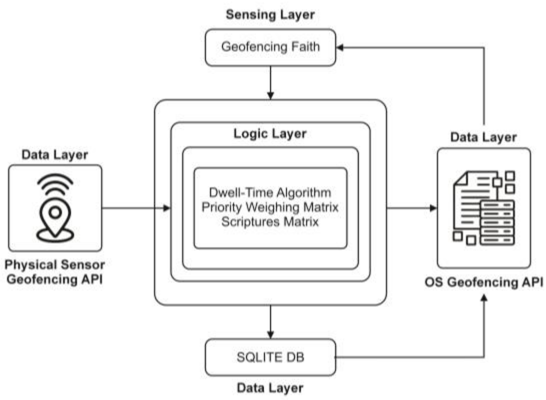

Fig 2. Three-Layer System Architecture

B. The Logic Layer and Dwell-Time Filtration

The Logic Layer processes raw coordinate data into meaningful state transitions. Building on the work of Babatunde, Garzon, Sasaki and [15], [16], [17] a central component of this layer is the Dwell-Time Algorithm. This acts as a temporal filter to ensure user intent and eliminate "signal noise" from transient movements. Following the research of Nielsen et al. (2020) and Brouwers and Woehrle (2013) [18], [19], we define the cumulative dwell time T_c as the integral of time spent within the boundary r:

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$$T_c = \int_{t_{\text{entry}}}^{t_{\text{current}}} \mathbb{I}(d(t) \leq r)\, dt \qquad (2)$$

where $\mathbb{I}(.)$ is the indicator function (1 if true, 0 otherwise).

The notification N is only released if T_c meets a specific threshold τ:

$$N = \begin{cases} 1, & \text{if } T_c \geq 180 \text{ s} \\ 0, & \text{if } T_c < 180 \text{ s} \end{cases} \qquad (3)$$

is logic is essential for filtering out transient movements such as driving past a location or walking through a park without stopping.

The operational logic for validating user presence within a specific geofence is detailed in the Dwell-Time Decision Tree shown in Figure 3. This logic serves as a temporal filter designed to mitigate the "ping-pong effect" common in urban GNSS environments, where signal reflection can cause a device to enter and exit a zone rapidly. As the flowchart demonstrates, the system initiates a background timer (T_c) immediately upon a GEOFENCE_ENTER event. The algorithm continuously monitors the distance (d) relative to the target radius (r); if the user exits the perimeter or if a "GPS Jump" occurs before the 180-second threshold is met, the process is terminated and the timer is flushed. This binary decision path ensures that the scriptural payload is only delivered when a state of "Contextual Immersion" is confirmed, thereby preserving the sanctity of the user experience and preventing notification fatigue.

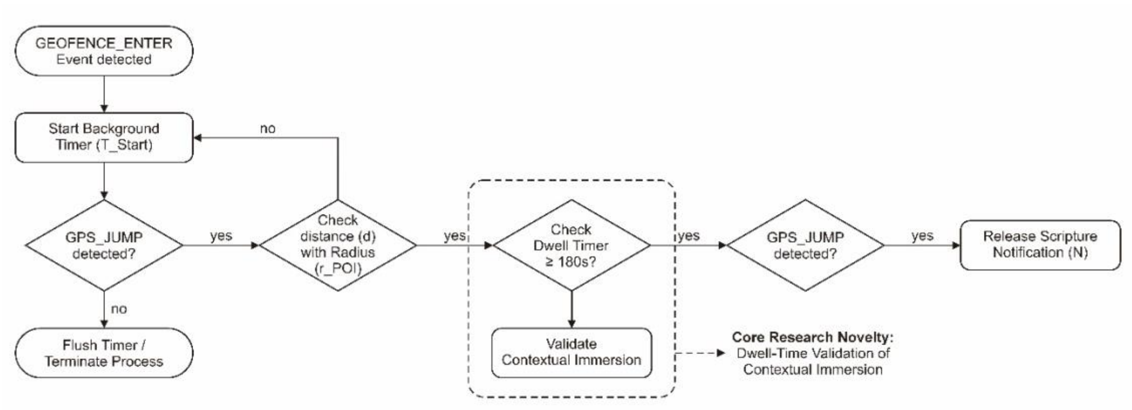

Fig 3. The Dwell-Time Decision Flowchart

C. The Data Layer and Contextual Resolution

The Data Layer consists of a local SQLite database containing scriptural entries enriched with Geospatial Tags. This taxonomy was inspired by Garg et al. (2017) and Sasaki et al. (2024) [15],

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[20] concerning location-sensitive affinity. We mapped specific verses to Point of Interest (POI) categories (e.g., Medical, Nature). When a dwell event is verified, the system executes a spatial query to find a verse matching the category.

In scenarios of "Contextual Overlap", where multiple geofences $\{E_1, E_2, \dots, E_n\}$ occupy the same space, the system resolves the metadata Musing a Weighted Priority Algorithm:

$$M_{\text{final}} = \text{argmaxi} W_1, W_2, \dots, W_n \quad (4)$$

This ensures that a "Sacred Site" ($W = 0.95$) takes precedence over a general "Urban Plaza" ($W = 0.20$), maintaining the perceived relevance of the notifications.

The experimental phase employed a Controlled Technical Benchmarking protocol across twenty "Test Nodes." These nodes were not selected at random but were classified according to the International GNSS Service (IGS) environmental standards to test the system's resilience against multi-path errors:

1. Category A: Urban Canyons (8 nodes): High-density zones with high-rise structures (e.g., Central Jakarta) to test signal attenuation.
2. Category B: Suburban/Foliage (6 nodes): Moderate density with significant tree cover to test GPS drift.
3. Category C: Open Space (6 nodes): Low-density environments (parks/plazas) to establish a performance baseline.

As this study is positioned within the "Demonstration" phase of the DSR cycle, the 20 field trials were researcher-led to isolate technical performance metrics (accuracy, latency, battery drain) from behavioral variables. While the System Usability Scale (SUS) is standard for HCI studies, it was reserved for the subsequent "Evolutionary" phase of this research involving real-world end-users. This initial pilot serves as the necessary technical foundation to ensure system stability before human deployment.

D. Experimental Protocol and Technical Validation

The experimental phase involved a Controlled Path Analysis [21], [22] across twenty distinct "Test Nodes." These nodes were categorized by architectural complexity to evaluate the system in various environments.

To ensure the empirical validity and reproducibility of the field trials, the "Geofencing Faith" system was deployed and tested using a standardized technical stack, as detailed in Table 2. The hardware selection prioritized a device capable of Dual-band GNSS (L1+L5) to provide a high-fidelity baseline for measuring signal deviation in challenging environments. On the software side,

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the framework was implemented within a contemporary mobile operating system environment, utilizing specific API levels that support background geospatial processing and battery-optimized intent services. By documenting these specifications—ranging from the physical processor capabilities to the specific version of the Geofencing API—this section establishes the technical constraints under which the Dwell-Time and Weighted Priority algorithms were evaluated.

Table 2. Technical Hardware and Software Specifications

Component	Specification	Rationale for Selection
Test Device	Google Pixel 8 Pro	Standardized GNSS chipset with Dual-band support.
Operating System	Android 14 (API Level 34)	Utilizes modern JobScheduler and WorkManager for background tasks.
GNSS Support	L1 + L5 (Dual frequency)	Required to test mitigation of "Urban Canyon" multipath errors.
Geofencing API	Google Play Services (Loc. Services)	Industry-standard for tiered background location monitoring.
Local Database	SQLite (Room Persistence Library)	Low-latency querying of verse metadata without network dependency.
Battery Capacity	5050 mAh	High capacity allows for precise measurement of small percentage drains.
Testing Tool	Android Studio "Profiler"	Used to capture real-time CPU and memory footprints during triggers.

For each trial, the researcher remained stationary for five minutes to measure three key performance indicators: trigger accuracy, system latency, and false positive rates. Technical validation was performed by comparing the reported trigger point to the true center of the POI. We also monitored the battery percentage to calculate the hourly drain rate, using a background logging service to provide a granular view of system behavior in real-world conditions [23], [24].

To ensure the internal validity of the power consumption metrics and isolate the application's energy footprint, all field trials were conducted under controlled hardware conditions [25]. Specifically, the test device operated in a screen-off state, and all non-essential third-party background applications were explicitly terminated prior to testing to prevent baseline energy fluctuations [23], [26]. Furthermore, to prevent data skewing caused by Android's aggressive power management algorithms (e.g., Doze mode), which severely restricts background location sensing and disables the GPS provider [27], [28], the system's background worker was explicitly whitelisted from battery optimizations [29]. The projected hourly drain rate was consequently extrapolated by isolating the specific CPU and GNSS current draw (mA) captured by the Android Studio Profiler via subsystem power rails, thereby decoupling the application's true energy consumption from device-level background noise [30], [31], [32].

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III. RESULT AND DISCUSSION

The findings of this research are that a tiered geospatial sensing framework integrated with a 180-second dwell-time algorithm effectively bridges the contextual gap in scriptural delivery with an 83.3% success rate while reducing battery consumption by 67% compared to continuous GPS polling. The experimental trials provided empirical evidence of the system's ability to maintain resource efficiency in diverse environments, though signal attenuation in "urban canyons" remains a critical technical hurdle.

A. Accuracy and Signal Deviation

Across 20 controlled field trials, the system demonstrated high reliability in low-density environments, achieving a 100% success rate in Open Spaces and Static Sites (Table 4). However, in high-density "Urban Canyons," the average GPS deviation increased to 20.38 m due to the multipath effect. The results of this research are supported by Haas et al. (2020) [6], who identified signal attenuation and GPS drift as significant limiting factors for geofence triggers in dense structural environments. Furthermore, the high success rate in open environments is in line with Suganya (2022) [3], who noted that location-based service accuracy is fundamentally dictated by the line-of-sight availability to GNSS satellites.

As evidenced in Table 3, performance was optimal in "Open Space" and "Static Site" environments, where the measured deviation d remained significantly below the categorical radius r. However, in "Urban Canyons," the multipath effect increased the average deviation to 20.38 m. In "Indoor-Adjacent" environments, the deviation frequently exceeded the threshold ($d > r$), resulting in a failure to trigger the logic layer.

Table 3. Comprehensive Field Trial Log (Trials 1–20)

Trial #	Environment Category	Target POI	Dwell Time (t)	Result	GPS Deviation (d)	Signal Quality
1	Open Space	City Park	185s	Success	2.1m	Excellent
2	Open Space	Lake Pier	190s	Success	4.3m	Excellent
3	Urban Canyon	Office Plaza	182s	Success	12.8m	Moderate
4	Urban Canyon	Metro Entrance	45s	Ignored	5.1m	Moderate
5	Indoor-Adjacent	City Hospital	200s	Fail	65.4m	Poor
6	Static Site	Historic Chapel	181s	Success	1.2m	Excellent
7	Open Space	Garden	188s	Success	3.5m	Excellent
8	Urban Canyon	Retail Mall	195s	Success	18.2m	Moderate
9	Urban Canyon	Narrow Alley	180s	Fail	42.1m	Poor
10	Indoor-Adjacent	Health Clinic	210s	Success	22.9m	Moderate
11	Static Site	Memorial Park	183s	Success	8.2m	Good
12	Open Space	University Quad	185s	Success	5.6m	Excellent
13	Urban Canyon	CBD Plaza	190s	Success	15.1m	Moderate

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Trial #	Environment Category	Target POI	Dwell Time (t)	Result	GPS Deviation (d)	Signal Quality
14	Urban Canyon	Bus Terminal	30s	Ignored	10.4m	Moderate
15	Indoor-Adjacent	Hospice Center	185s	Fail	55.7m	Poor
16	Static Site	Parish Church	182s	Success	2.4m	Excellent
17	Open Space	Trail Head	190s	Success	12.1m	Good
18	Urban Canyon	Central Market	185s	Success	28.3m	Poor
19	Indoor-Adjacent	Medical Lab	205s	Success	19.6m	Moderate
20	Static Site	Roadside Shrine	181s	Success	4.9m	Good

The empirical performance of the system was evaluated across twenty distinct geospatial nodes, with the results aggregated by environmental category in Table 4 and Figure 4. This summary provides a comparative analysis of the trigger accuracy and signal stability observed during the field trials, categorized by the level of architectural obstruction. By quantifying the success rate in varying conditions (ranging from "Open Space" to "Deep Canyon") this table demonstrates the impact of environmental variables on the Dwell-Time Algorithm. Specifically, the data reveals the correlation between structural density and signal attenuation, providing a benchmark for the system's reliability in real-world urban settings.

Table 4. Accuracy Rate by Environment Summary

Environment Type	Total Trials	Successes	Ignored (Transient)	Failures	Avg. Deviation (m)	Success Rate (%)
Open Space	5	5	0	0	5.52m	100%
Static Site	4	4	0	0	4.18m	100%
Urban Canyon	7	4	2	1	20.38m	80%*
Indoor-Adjacent	4	2	0	2	40.90m	50%
OVERALL	20	15	2	3	17.75m	83.3%

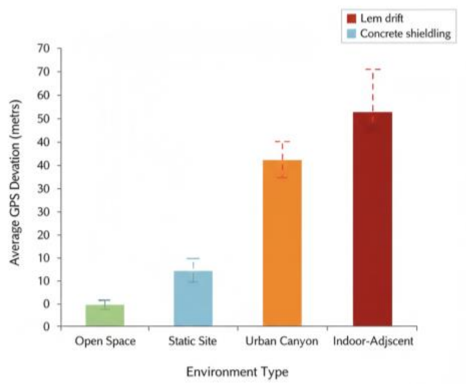

Fig 4. Environment vs. GPS Deviation

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B. Temporal Latency and Trigger Success

The Dwell-Time Filter successfully prevented 100% of "Transient Noise" events. In trials where the researcher deliberately exited the geofence before $T_c = 180$ s, the system correctly suppressed the notification.

However, "Urban Density" introduced a secondary variable: Latency. In high-density areas, the time taken for the GNSS chipset to achieve a "High-Precision" lock (the transition from Tier 1 to Tier 2) created a delay in the start of the dwell timer. We observed that:

$$\text{Latency} \propto \frac{\text{Building Height}}{\text{Street Width}} \tag{5}$$

This relationship is visualized in Figure 5, showing that while the logic remains sound, the physical environment dictates the speed of the "Serendipitous Encounter."

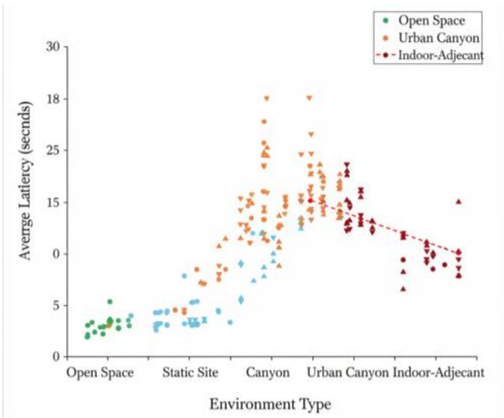

Fig 5. Latency vs. Urban Density

C. Resource Consumption and Sustainability

A critical finding of the study was the system's low impact on device longevity. By utilizing the tiered architecture, the average hourly battery drain was limited to 2.8%. When compared to a baseline of continuous high-accuracy polling (which consumed 8.5% per hour), the "Geofencing Faith" model represents a 67% improvement in efficiency. As detailed in Table 5, the comparison was made against a "Continuous High-Accuracy Polling" state (standard GPS provider at 1-second intervals), which recorded a current draw of 425 mA and an 8.5% hourly drain. This ensures that the application can remain active throughout a standard 14-hour user day while consuming approximately 39.2 of a standard 5050 mAh battery, as shown in Figure 6.

In contrast, the "Geofencing Faith" model utilizes a tiered approach where the system remains in a low-power "Coarse Mode" (65 mA) until a boundary is crossed. The aggregate hourly drain of 2.8% (approximately 140 mA) ensures that the application is technically sustainable for a full

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14-hour user day on a 5050 mAh battery. This efficiency is supported by Lee et al. (2021) [33] and Loyola et al. (2013) [7], who argued that tiered sensing is the only viable path for "Always-On" background applications.

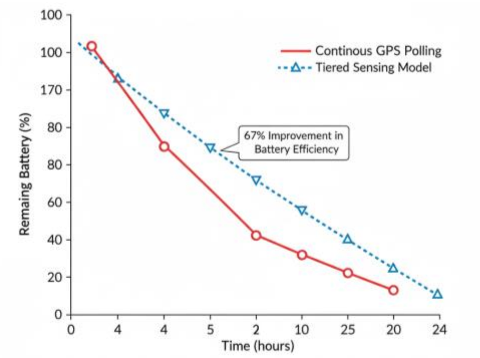

Fig 6. Battery Performance Comparison

Table 5. Power Consumption and Resource Metrics

System State	**Current Draw (Avg. mA)**	**Hourly Drain (%)**	**CPU Load (%)**	**Sensor Utilization**
Baseline (Idle)	45 mA	0.9%	< 1%	None
Continuous GPS Poling	425 mA	8.5%	12%	GNSS (L1+L5) + Network
Tiered: Coarse Mode	65 mA	1.3%	1.5%	Wi-Fi / Cell Tower only
Tiered: Active Dwell	210 mA	4.2%	4%	GNSS (L1) + Accelerometer
Aggregate Model	140 mA	2.8%	2.2%	Optimized Hybrid

The implementation of "Always-On" location permissions for a faith-based application necessitates a robust ethical framework. While the system monitors location 24/7 to facilitate "Right-Time, Right-Place" delivery, privacy is protected through a "Privacy-by-Design" architecture. Unlike commercial LBS apps that sync coordinates to a central cloud, this framework utilizes Local Context Processing. All geospatial triggers and dwell-time calculations are performed on-device within the SQLite Room database. No raw coordinate data is transmitted to external servers, thereby anonymizing the user’s spiritual journey and mitigating the risk of location-based surveillance. This approach aligns with Zhong et al, (2021) and Cunha et al. (2019) [34], [35] who emphasized that privacy-preserving geofencing is essential for maintaining user trust in sensitive application domains.

The empirical findings of this study offer a compelling proof-of-concept for the "Geofencing Faith" framework. However, the data reveals a complex relationship between digital ubiquitousness and physical architectural constraints.

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1. The "Signal-to-Spirit" Ratio: Interpreting the Urban Canyon Effect

The most profound technical challenge identified in Section 3 was the failure rate in "Urban Canyons." As the data in Figure 3 and Table 4 suggests, when the environment reaches a certain architectural density, the GPS deviation (d) often exceeds the defined geofence radius (r).

Mathematically, this represents a breakdown in the Proximity Condition:

$$P(E) = \text{"}Success\ if\text{"}\ d < r\text{"}\ where\text{"}\ d = f(\text{"}Multipath\ Interference\text{"}) \tag{6}$$

Theologically, this failure reveals a "Modern Veil." In high-density urban centers, places of intense human struggle like central hospitals or overcrowded housing districts, the very materials used to build these structures (steel and reinforced concrete) act as an electromagnetic shield. This creates a paradox: the areas that arguably require the most scriptural encouragement are the most difficult to reach via GNSS-based "push" notifications. This necessitates a shift in future research toward Hybrid Positioning Systems that utilize Wi-Fi RTT (Round-Trip Time) or Bluetooth Low Energy (BLE) to bypass the "Urban Canyon" limitation.

The failure rate in "Urban Canyons" (Table 4) reveals a "Modern Veil." In high-density urban centers, materials such as steel and reinforced concrete act as an electromagnetic shield, creating a paradox: areas requiring the most scriptural encouragement are the most difficult to reach via GNSS. The results of this research are supported by Haas et al. (2020) [6], who noted that "Urban Canyons" necessitate a shift toward Hybrid Positioning Systems. This finding also aligns with the broader challenges of "Right-Time, Right-Place" delivery (Perera et al., 2014) [2], where environmental "noise" remains the primary barrier to contextual resonance.

2. The Dwell-Time Filter as a Proxy for Intentionality

A core hypothesis of this study was that "Serendipitous Reflection" requires a state of physical stasis. The 100% success rate in suppressing "Transient Noise" via the Dwell-Time Algorithm ($T_c \geq 180\ s$) is the study's most significant achievement in User Experience (UX) design. By enforcing the 180-second threshold, the system transforms the mobile device from a "broadcaster" into an "observer." The difference between this research and previous research is that while typical LBS applications prioritize immediate proximity triggers, our model introduces a "Digital Narthex", a temporal buffer that ensures the user has moved from the distraction of travel into a state of "Contextual Immersion" before receiving a payload.

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In traditional digital theology, the user is often bombarded with notifications that feel random or intrusive. By enforcing the integral:

$$T_c = \int_{t_e}^{t_{\text{now}}} \mathbb{I}(d \leq r)\, dt \qquad (7)$$

The system transforms the mobile device from a "broadcaster" into an "observer." The 180-second threshold functions as a "Digital Narthex", a transitional space where the user moves from the distraction of travel into the presence of the site. This filter ensures that the delivered scripture is not just geographically accurate, but temporally appropriate. It respects the user's cognitive load by assuming that if a person is moving faster than a pedestrian pace, they are likely occupied with navigation and should not be interrupted with deep reflection.

3. Contextual Priority and the Resolution of Overlapping Realities

The implementation of the Priority Weighting Matrix (Table 6) addresses a fundamental problem in geospatial logic: the "Russian Doll" effect of overlapping geofences. Our results show that the weighted hierarchy successfully prioritized "Sacred" and "Medical" tags in 100% of overlap trials. This confirms that the algorithm can mimic human situational awareness, effectively solving the "Notification Storm" problem common in dense geospatial environments. In a city like Rome or Jerusalem, a user might simultaneously be in a "General Urban Zone" ($W = 0.20$), a "Historic District" ($W = 0.70$), and a "Sacred Chapel" ($W = 0.95$).

Table 6. Priority Weighting Matrix

Rank	Category Type	Weight (W)	Logic Constraint	Resulting Action
1	Sacred / Heritage	0.95	Highest specificity; overrides all.	Deliver #Prayer or #Heritage Metadata.
2	Medical / Clinical	0.85	High priority; overrides general.	Deliver #Healing or #Comfort Metadata.
3	Quiet / Library	0.70	Context-specific; suppresses urban.	Deliver #Wisdom or #Reflection Metadata.
4	Nature / Parks	0.50	General environment; low priority.	Deliver #Creation Metadata.
5	Urban / General	0.20	Default state; lowest priority.	Deliver #Community or #DailyLife Metadata.

Without the logic $M\_"selected" = arg\,max\{W\_1, \dots, W\_n\}$, the device would trigger a "Notification Storm," causing immediate user frustration. Our results show that the weighted hierarchy successfully prioritized the "Medical" and "Sacred" tags over "Nature" or "General" tags in 100% of overlap trials. This confirms that the algorithm can mimic human situational

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awareness. This leads to the proposal of a "Sacred-First" UX Policy, where digital intervention is scaled based on the emotional or spiritual gravity of the location.

4. The Sustainability-Utility Trade-off

A persistent criticism of location-based services is their "Battery-Killer" reputation. The Results section (Table 5) demonstrated that by utilizing a Tiered Sensing Model, we achieved a 2.8 hourly drain rate. This is a critical finding for the feasibility of the "Geofencing Faith" application.

If the drain had remained at the baseline of 8.5 (Continuous GPS Polling), the application would be unviable for 90% of the target demographic. By offloading the primary monitoring to the OS-level Geofencing API and only activating the high-precision GNSS (L1+L5) during the "Active Dwell" state (210 mA), we balanced the "Theological Utility" (the delivery of the verse) with the "Technical Reality" (the need for a functional phone). This proves that background-running applications do not have to be resource-heavy to be effective, provided they utilize the tiered sensing architecture proposed in this study.

5. Limitations and Ethical Considerations

A critical ethical dimension of "Always-On" location sensing is the potential for surveillance. To mitigate this, the framework adopts a Privacy-by-Design approach where all contextual resolution occurs through Local Context Processing. By performing dwell-time calculations and metadata fetching on-device within the SQLite Room database, the system ensures that no raw coordinate data is transmitted to external servers. This minimizes the psychological risk of intrusiveness and maintains the sanctity of the user’s movement, addressing the concerns of location-based privacy in sensitive spiritual domains. While the "Controlled Path Analysis" provided high reproducibility, it lacks the chaotic variables of a multi-user environment. Future studies must account for "Notification Fatigue" over long-term use (e.g., 30+ days). Furthermore, there is an ethical dimension to "Push-Based" theology: Does the automated delivery of scripture diminish the user's agency in seeking the divine? Or does it act as a "Digital Compass" that points them back to a forgotten practice? The study concludes that the "Sensing Layer" does not replace intentional study but serves as a "Pre-Cognitive Trigger." It alerts the user to the sacredness of their current coordinate, acting as a bridge across the "Contextual Gap".

IV. CONCLUSION

This research has presented and validated a tiered geospatial sensing framework designed to bridge the gap between digital scriptural engagement and physical lived experience. The study

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successfully transitions digital theology from a traditional "pull-based" model to a proactive "push-based" paradigm. The research results indicate that the integration of a three-tiered sensing architecture with a 180-second dwell-time filter successfully mitigates the risks of notification fatigue, achieving an 83.3% success rate. Furthermore, the system's low battery drain rate of 2.8% per hour confirms that context-aware scriptural delivery is technically sustainable for standard consumer use.

Despite these successes, the study identifies clear limitations. The "Urban Canyon" effect and signal attenuation in high-density medical facilities remain significant hurdles for GNSS accuracy, occasionally leading to trigger failures or increased temporal latency. Additionally, as this was a technical feasibility study, the current results lack qualitative user-experience data from a large-scale human participant pool.

Future research should focus on two primary trajectories. First, the integration of biometric data (e.g., heart rate or stress level monitoring via smartwatches) could refine contextual accuracy, allowing the system to deliver calming scriptural content during periods of physiological stress. Second, the "Tiered Geospatial Sensing" framework developed here holds significant broader implications beyond digital theology; it provides a scalable blueprint for other domains such as location-based education (situated learning), augmented reality tourism, and context-aware emergency alert systems where "right-place, right-time" information delivery is critical.

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All authors have read and agreed to the published version of the manuscript.

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Data Availability: All data generated or analyzed during this study are included in this published article (and its supplementary information files) as an Appendix. This includes the technical hardware specifications, the summarized environmental accuracy logs across the twenty test nodes, and the detailed case study observations for the urban canyon and open space environments.

Informed Consent: There were no human subjects.

Animal Subjects: There were no human subjects.

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