propvr

INDUSTRY WHITEPAPER

PROPVR SPATIAL OS

Spatial Cities

AI-Powered Digital Cities for Smart Planning

Dynamic, data-driven, life-like 3D city models built at scale through AI — for urban planning, real estate, infrastructure, tourism, and metaverse applications.

AI-POWERED GENERATION | REAL-WORLD GIS ACCURACY | MILLIONS OF POLYGONS | REAL-TIME EXPLORATION

srinath@propvr.ai

WWW.PROPVR.AI

01 INDUSTRY WHITEPAPER

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01 EXECUTIVE SUMMARY

AI-generated digital cities for smart planning

Cities are the most complex systems humanity has ever built. Planning them, managing them, and communicating their future to stakeholders has always been constrained by the limits of two-dimensional maps, static renderings, and fragmented data — tools that have never matched the complexity of the subject.

Spatial Cities is PROPVR's AI-powered digital city platform that creates dynamic, data-driven, life-like 3D models of entire cities — built at scale through artificial intelligence, GIS data, satellite imagery, and procedural generation. Every building is placed with real-world accuracy. Every road follows actual geography. The result is a photorealistic, explorable digital replica of the city, navigable on foot through MetaHuman avatars, from the air, or from any vantage point.

The platform serves urban planners simulating zoning changes, developers presenting projects in real urban context, infrastructure engineers modelling transit and utility corridors, governments engaging citizens in transparent planning, and tourism boards marketing destinations through immersive experiences. Currently live for Dubai, Abu Dhabi, and Riyadh — with PROPVR actively expanding and open to building a Spatial City for any city in the world.

> ***"The most realistic digital cities ever created — built by AI, driven by data, explored in real-time. Your city could be next."***
>
> THE SPATIAL CITIES THESIS

02 THE CHALLENGE

Why traditional tools fail at city scale

Urban planning and city-scale decision-making have historically relied on tools that cannot represent the three-dimensional, dynamic reality of a city. The decision-making picture is incomplete — and the consequences scale with the city.

THE LIMITATIONS OF TRADITIONAL TOOLS

Two-dimensional maps flatten spatial relationships. Physical scale models are expensive, static, and outdated the moment they are built. Architectural renderings show individual buildings in isolation — disconnected from the urban fabric they actually live in.

THE DATA GAP

Cities generate enormous data — GIS, cadastre, traffic sensors, environmental monitors — but it lives in silos. The transport authority has traffic data, the municipality has zoning, the utility has infrastructure. No single tool brings it together into one visual, interactive environment.

THE SCALE PROBLEM

Modelling a single building takes weeks. A neighbourhood takes months. An entire city — thousands of buildings, hundreds of kilometres of roads, parks, waterways, infrastructure — would take years with traditional methods. City-scale 3D has historically been prohibitively expensive or unacceptably low quality.

THE DECISION COST

The result: zoning changes approved without fully understanding transport implications. Transit corridors planned without seeing real-estate impact. Mega-projects shown to citizens in flat renderings that fail to communicate scale, context, or consequence.

THE STRUCTURAL GAP

Cities are the most complex systems we build, yet the tools used to plan and present them are the simplest in the digital toolkit. Decisions of generational consequence are made on the back of two-dimensional drawings and isolated renderings. The medium does not match the magnitude.

Spatial Cities solves the scale problem through AI-powered procedural generation, making it possible to create photorealistic city models in a fraction of the time and cost of manual approaches — with verified real-world accuracy from public datasets, satellite imagery, and street-level photography.

Modelling a city should not take years. With AI-powered generation, it takes weeks — and stays current as the city evolves.

THE SCALE SOLUTION

03 THE PLATFORM

Introducing Spatial Cities

PROPVR's AI-powered platform for creating dynamic, data-driven, life-like digital replicas of entire cities — combining AI, GIS, satellite imagery, street-level photography, and advanced real-time rendering.

AI GENERATION

What makes Spatial Cities different

Unlike traditional city models hand-built by artists, Spatial Cities uses AI-powered procedural generation. The AI ingests real-world data — building footprints, heights, road networks, terrain, land use, vegetation — and automatically generates bridges, parks, buildings, and infrastructure with real-world accuracy. Faster, more accurate, infinitely scalable.

PHOTOREAL

Immersive game-like exploration

Inspired by AAA game environments and the Unreal Engine Matrix demo. Explore cities through lifelike MetaHuman avatars — walking streets at ground level, driving highways, or flying overhead with cinematic camera movement. Goes beyond visualization to genuine spatial understanding.

PERFORMANCE

High performance at scale

City-scale models contain millions of polygons — every building, road surface, tree, utility pole. NVIDIA DLSS 3 super-resolution and frame generation use AI to deliver smooth performance even on scenes with extraordinary geometric complexity.

ACCURACY

Real-world data accuracy

Every element is placed with real-world accuracy. Detailed maps, public datasets, and precise GIS ensure buildings sit in the right locations, roads follow correct alignments, and terrain matches actual elevation. Street-view imagery refines facades, signage, and urban furniture.

04 TECHNOLOGY

Core technology capabilities

AI PIPELINE

AI-powered procedural generation

Generates buildings from footprints & heights with procedural facades. Road networks with intersections, roundabouts, bridges, lane markings. Vegetation from satellite imagery. Bridges, tunnels, rail corridors. Terrain from elevation models. Streetlights, benches, bus stops from street-view analysis. Entire cities in days, not years.

NVIDIA

Advanced real-time rendering

Lumen global illumination for natural light bouncing across urban canyons. Nanite virtualized geometry streaming billions of triangles in real-time. DLSS 3 super-resolution + AI frame generation delivering smooth performance at high resolutions on complex scenes.

GIS DATA

GIS data integration

OpenStreetMap, municipal GIS, digital elevation models (SRTM, LiDAR), Maxar & Airbus & Planet Labs satellite imagery, street-view photography, cadastral data, transport networks, and environmental data — integrated for verified, multi-source accuracy.

METAHUMAN

MetaHuman integration

Unreal Engine MetaHuman avatars populate the city with photorealistic digital humans — realistic skin, hair, clothing, animation. Explore through their eyes at human scale, critical for decisions about pedestrian experience and public space quality.

PIPELINE

Game-ready asset pipeline

In addition to high-fidelity city models, Spatial Cities produces optimized low-poly 3D models — game-ready assets for scalable real-time gaming, metaverse platforms, and web-based applications. The same city data serves both ultra-high-quality visualization and lightweight deployment.

05 SOLUTIONS

Smart solutions across sectors

Each sector uses the same underlying city model in different ways to solve sector-specific challenges — one digital city, many strategic applications.

PLANNING

Urban planning & smart cities

Test zoning, model population growth, simulate development impact on traffic, evaluate green infrastructure, conduct shadow analysis, and engage citizens in transparent 3D planning consultations.

REAL ESTATE

Real estate & architecture

Contextual project visualization, floor-by-floor view analysis, investor presentations with neighbourhood context, design validation in urban context, and off-plan sales with location understanding.

INFRASTRUCTURE

Infrastructure development

Model metro lines, BRT corridors, cycling infrastructure. Visualize utility corridors in 3D. Simulate traffic impact of road changes. Plan smart grid & EV charging deployment. Monitor critical assets through IoT-connected digital twins.

TOURISM

Tourism & destination marketing

Virtual city tours of landmarks and cultural districts before booking. Hotel previews in city context. Heritage storytelling through interactive 3D. Event visualization showing how cities transform for festivals.

RETAIL

Retail & commercial planning

Foot-traffic simulation for mall layouts and store placements. Catchment analysis for demographic reach. Competitive mapping for commercial distribution. Site selection with neighbourhood visualization.

GAMING

Game-ready assets & metaverse

Optimized low-poly city models for gaming, metaverse platforms, simulation, and educational applications — maintaining architectural accuracy at interactive frame rates on consumer hardware.

ONE MODEL, MANY MISSIONS

Every sector benefits from the same underlying city model. Planning, real estate, infrastructure, tourism, retail, and gaming all draw from one source of spatial truth — aligned, current, and continuously enriched.

06 LIVE CITIES

Three cities live. Your city could be next.

Dubai, Abu Dhabi, and Riyadh — live today on Spatial Cities. PROPVR is expanding the portfolio and is open to building a Spatial City for any city in the world.

06.1 DUBAI

Spatial City — Dubai

A comprehensive digital replica spanning Downtown & Business Bay, Dubai Marina & JBR, Palm Jumeirah, DIFC, Deira & Bur Dubai, Dubai Creek Harbour, Jumeirah Village, Dubai Hills, Expo City, and surrounding infrastructure corridors — with building-level detail for thousands of structures.

PLANNING

Urban planning

Test zoning changes, model skyline impacts, analyse real-world effects instantly. Visualize setbacks, height limits, and FAR in 3D rather than interpreting them from 2D plans.

MOBILITY

Mobility & energy simulations

Model autonomous-vehicle deployment, smart-grid expansion, and rooftop solar across districts against Dubai's renewable-energy targets.

REAL ESTATE

Virtual real estate experiences

Buyers from 200+ nationalities evaluate towers in real urban context — Business Bay in relation to Downtown, Creek, and the highway network.

METAVERSE

Digital assets & metaverse

Aligned with Dubai's Metaverse Strategy — enabling Web3 ownership of virtual land and properties within the digital city.

SANDBOX

Smart infrastructure planning

Districts like Expo City modelled in detail to assess zoning, transit connectivity, and infrastructure capacity before physical development begins.

HERITAGE

Digital heritage mapping

Al Fahidi, Gold Souk, and Bastakiya digitally recreated — supporting both preservation planning and immersive cultural tourism alongside the modern skyline.

Where growth meets heritage — capturing both modern expansion and cultural identity.

SPATIAL CITY — DUBAI

06.2 **ABU DHABI**

Spatial City — Abu Dhabi

Abu Dhabi's distinctive geography — a central island connected by bridges to the mainland, with developments on Saadiyat, Yas, Reem, and Al Maryah — captured with full building-level detail, road networks, waterfront infrastructure, and bridge connections.

COASTAL

Island & coastal simulations

Model new island developments and their impact on marine ecosystems, coastal erosion, and tidal flows. Three-dimensional context for land reclamation, waterfront, and bridge proposals.

ASSET HEALTH

Asset monitoring

IoT-connected 3D models for bridges, tunnels, and highway interchanges — predictive maintenance and early fault detection with sensor data visualized on the Spatial City.

HOUSING

3D housing visuals

Affordable housing programmes showcased to public and stakeholders — explore density, green space, and amenity distribution in 3D.

CULTURAL

Cultural storytelling in 3D

Heritage districts — Grand Mosque, Corniche souks — preserved through virtual tours and spatial archives engaging residents and visitors alike.

VISION

Shape Abu Dhabi's future

Model real-world areas to test zoning, mobility, and infrastructure scenarios before build-out — new transit lines, major developments, and connectivity changes.

PROPERTY

3D property visualization

Properties presented in actual urban context — cultural attractions, waterfront access, transit connections, and neighbourhood character all visible.

TOURISM

Enhance guest experiences

Hotels and resorts offer virtual previews so guests can explore city context before arrival — beaches, cultural sites, entertainment.

SUSTAINABILITY

Smart resource management

Spatial context for energy consumption, water demand, and renewable installation impact — supporting Abu Dhabi's sustainability goals.

HERITAGE

Digital heritage mapping

High-fidelity recreation of key landmarks for access planning, asset preservation, and visitor engagement.

06.3 RIYADH

Spatial City — Riyadh

Riyadh is transforming from a sprawling, car-centric capital into a vibrant, mixed-use global city. KAFD, Diriyah Gate, Riyadh Front, New Murabba, King Salman Park, Sports Boulevard, and the Riyadh Metro are reshaping the urban landscape — Spatial City evolves alongside the physical city.

GROWTH

Smarter urban growth

Population projected to reach 15–20 million by 2030. Simulate density, transit-oriented patterns, and green-infrastructure strategies in the digital city before committing in the physical one.

GIGA

Giga-project visualization

KAFD, Diriyah Gate, New Murabba, Sports Boulevard, King Salman Park previewed in full 3D in city context — for investors, partners, and citizens.

DIGITAL TWIN

Infrastructure digital twin

Six-line metro system, BRT, road network expansion, utility modernization — real-time data linked to BIM models inside the Spatial City for construction, ops, and maintenance.

PARTICIPATION

Public participation

Aligned with Saudi Arabia's Quality of Life programme — immersive 3D consultations let citizens navigate proposed neighbourhood changes and give informed feedback.

MICROCLIMATE

Design Riyadh intelligently

Districts like KAFD modelled in detail to simulate wind patterns, shadow coverage, pedestrian comfort — critical in Riyadh's climate.

PROPERTY

Interactive 3D property display

Developments across Al Olaya, Diriyah, KAFD showcased in 3D — metro access, commercial centres, cultural landmarks, and green spaces all visible.

COMMERCIAL

Enhance commercial strategy

Foot-traffic modelling in commercial hubs like Riyadh Front to optimise layouts and boost retail performance.

HERITAGE

Digitise heritage experiences

Masmak Fort, Diriyah's At-Turaif (UNESCO), Souq Al Zal digitally recreated — supporting visitor planning and cultural-tourism growth.

RESOURCES

Optimise resource planning

Simulate grid usage, monitor performance, and support sustainable infrastructure growth across the expanding city.

Bringing Vision 2030 to life — visualizing large-scale growth with clarity.

SPATIAL CITY — RIYADH

07 STAKEHOLDERS

Government & institutional stakeholders

Spatial Cities serves the authorities responsible for planning, regulating, developing, and managing cities — at every level. One digital city, many missions.

DUBAI

Dubai Land Department

3D view of the real estate landscape: compliance verification, spatial market analysis, investor confidence, and dispute-resolution support through accurate property and view representations.

DUBAI

Dubai Municipality

Pre-approval visualization of permit applications, immersive presentation of Dubai 2040 Master Plan, public works planning in 3D, and environmental impact assessment for shadow, green space, and heat-island effects.

DUBAI

Roads & Transport Authority

Model new metro extensions, bus routes, and tram lines in actual city geography. Traffic simulation, autonomous-vehicle deployment scenarios, and pedestrian/cycling infrastructure planning.

DUBAI

DEWA & DTCM

DEWA: grid planning, rooftop-solar simulation, smart-meter consumption visualization. DTCM: virtual destination marketing, event visualization, hotel and attraction mapping.

ABU DHABI

Department of Municipalities & Transport

Unified 3D model for development proposals across islands and mainland. Transport network planning, municipal service optimization, and Estidama compliance assessment for sustainable development.

ABU DHABI

Culture & Tourism / Masdar

DCT: cultural asset preservation and immersive tourism experiences. Masdar: renewable-energy planning, Masdar City digital twin, and city-wide carbon-footprint modelling.

RIYADH

Royal Commission for Riyadh City

Vision 2030 visualization, giga-project integration (KAFD, Diriyah Gate, New Murabba, Sports Boulevard), and population growth planning for a city heading toward 15–20 million.

RIYADH

Riyadh Municipality & Green Riyadh

Municipality: development review, public-space planning, equitable service delivery. Green Riyadh: tree-canopy visualization, microclimate cooling simulation, progress tracking, and public engagement.

RIYADH

GEA, MoMRAH & PIF

GEA: venue planning, event simulation, destination marketing. MoMRAH: national benchmarking and housing programme visualization. PIF: portfolio visualization and investor presentations for mega-projects.

CROSS-GOVERNMENT VALUE

Inter-agency coordination from a shared digital city, smart-city command centres with real-time IoT overlays, international benchmarking for investment roadshows, and public transparency through interactive explorable models — one tool, many missions.

08 ECOSYSTEM

Integration with the Spatial OS ecosystem

Spatial Cities is a core product within the Spatial OS platform. Its city-scale digital models integrate with every other product in the ecosystem — creating powerful combinations across the entire customer journey.

SPATIAL PRODUCT	INTEGRATION WITH SPATIAL CITIES
Spatial Twin	Project-level digital twins placed inside the accurate city context. Zoom from city to neighbourhood to building to apartment in one continuous experience.
Spatial Lite & Spatial World	Web-based showcases and portfolio views reference the Spatial City for contextual information — location, transit, amenities, and urban fabric in every presentation.
Spatial Guide	Sales agents begin at city scale during remote tours — showing buyers location, neighbourhood character, and connectivity before zooming into specific projects.
Spatial Map	GIS and location-intelligence layers complement the Spatial City's 3D visualization with demographics, transport analytics, catchment analysis, and environmental data.
Spatial Stream & Spatial Touch	Streamed via Spatial Stream to any browser globally, or deployed on Spatial Touch devices in sales galleries, government offices, and consultation venues.
Spatial Cave & Spatial Table	Presented in a Spatial Cave immersive room or on a Spatial Table interactive surface — master plans displayed at room scale with the full city context visible around them.

One content investment, every channel

The same city data powers ultra-high-quality planning presentations, immersive cave installations, browser-based public consultations, and game-ready metaverse assets — from one source of spatial truth.

09 IMPLEMENTATION

Implementation & deployment

Creating a new Spatial City follows a structured six-phase process. Cloud-streamed via browser, hardware-deployed in offices and galleries, or immersive in Spatial Cave environments — deployment matches the use case.

01 WEEKS 1 – 4
Data Collection
Gather GIS data, satellite imagery, street-view photography, building databases, and infrastructure maps for the target city.

02 WEEKS 4 – 8
AI Generation
The procedural-generation engine processes the data, creating the base 3D city with buildings, roads, terrain, vegetation, and infrastructure.

03 WEEKS 8 – 12
Refinement
Manual refinement of landmarks, hero buildings, and prominent urban features that benefit from higher fidelity than procedural generation alone.

04 WEEKS 12 – 14
Validation
Cross-reference the digital model against ground truth, correct inaccuracies, and verify the model meets quality standards.

05 WEEKS 14 – 16
Integration
Connect the Spatial City to the Spatial OS platform, enabling access through Spatial Stream, Spatial Touch, and other products.

06 ONGOING
Updates
Periodic regeneration of areas where new construction, demolition, or infrastructure changes have occurred — keeping the digital city current.

DEPLOYMENT OPTIONS

Cloud-streamed via Spatial Stream · Hardware-deployed on Spatial Touch · Immersive via Spatial Cave · Interactive on Spatial Table · Web-embedded via Spatial Lite.

10 ROI

Return on investment

Spatial Cities delivers measurable value across three primary stakeholder groups — government authorities, real estate developers, and infrastructure operators — each unlocking efficiency, transparency, and reach from the same digital-city investment.

GOVERNMENT

For government authorities

Faster planning approvals through 3D contextual review. Reduced planning errors as spatial visualization reveals conflicts that 2D analysis misses. Higher citizen engagement — less opposition to development proposals. Inter-agency efficiency from a shared model. Greater international competitiveness for investment and talent.

DEVELOPERS

For real estate developers

Contextual sales — properties shown in real urban context sell faster than isolated renderings. International reach: digital tours for remote buyers. Earlier design validation reduces costly revisions. Faster regulatory approvals when authorities see projects in city context.

INFRASTRUCTURE

For infrastructure operators

Predictive maintenance from IoT-connected digital cities. Better capacity planning through spatial visualization of demand. Coordination of utility corridors, road works, and construction to minimize conflicts and disruption.

The same digital city accelerates planning approvals, drives real-estate conversion, and powers infrastructure operations — one investment, three returns.

ROI ACROSS STAKEHOLDERS

propvr

CONTACT US

Your city could be next.

Three cities live today — Dubai, Abu Dhabi, Riyadh — and the portfolio is growing. PROPVR is open to building a Spatial City for any city in the world. To discuss your city, request a feasibility assessment, or see a working deployment, reach out.

EMAIL
info@propvr.ai

WEBSITE
www.propvr.ai

PRESENCE
India · UAE · Saudi Arabia