pixels.earth

A Decentralized Earth-Scale Pixel Canvas

LITEPAPER v1.0

December 2025

"Own a piece of the Earth. One pixel at a time."

🔗 Built on Solana   ⚡ MagicBlock Ephemeral Rollups

Executive Summary

pixels.earth is a massively multiplayer collaborative canvas where users place colored pixels on a global Earth map. Built on Solana and accelerated by MagicBlock's Ephemeral Rollups, the platform enables real-time pixel placement with sub-second latency while preserving full on-chain security.

Users can claim *shards*—fixed-size pixel territories—earning passive income when others paint on their land. Through cooldowns, premium bypasses, and territory ownership, pixels.earth introduces sustainable economic incentives into collaborative digital art.

274B
Total Pixels

34M
Ownable Shards

<100
ms Latency

Contents

1 Introduction

Collaborative digital art experiments—from Reddit's r/place to early blockchain pixel games—have demonstrated humanity's deep desire for collective creative expression. Yet most implementations fall short in critical ways: centralized platforms can be shut down at will, blockchain versions suffer from prohibitive latency or cost, and few provide meaningful long-term incentives for participation.

pixels.earth addresses these fundamental challenges by unifying four essential properties:

🗄 Permanent State

Decentralized storage on Solana ensures artwork persists indefinitely, immune to corporate shutdowns.

⚡ Real-Time Speed

Ephemeral Rollups deliver sub-100ms interactions, matching Web2 responsiveness.

🪙 Sustainable Economics

Territory ownership creates ongoing revenue streams, aligning creator and collector incentives.

🌐 Planetary Scale

274 billion pixels mapped to Earth's surface enable truly global collaborative creation.

2 Technical Architecture

2.1 Canvas Specifications

The pixels.earth canvas maps directly onto Earth's surface using a Web Mercator projection, creating a familiar geographic context for collaborative art.

| Parameter	Value
Canvas Resolution	$2^{19} \times 2^{19}$ pixels
Total Pixels	**≈ 274 billion**
Shard Dimensions	**90 × 90** pixels
Total Shards	**≈ 34 million**
Color Depth	8-bit (255 colors + transparent)
Storage per Shard	~8 KB

2.2 Shard Architecture

Each shard is a Solana Program Derived Address (PDA) containing pixel data and ownership metadata. This structure ensures efficient on-chain storage while enabling granular ownership.

```
pub struct PixelShard {
    pub shard_x: u16,        // X coordinate on global grid
    pub shard_y: u16,        // Y coordinate on global grid
    pub pixels: Vec<u8>,     // 90 x 90 = 8,100 bytes
    pub creator: Pubkey,     // Original creator address
    pub bump: u8,            // PDA bump seed
}
```

Color Encoding: Pixel data uses direct 8-bit indices where 0 represents transparent/erased and 1–255 map to the color palette. This compact encoding minimizes on-chain storage costs.

2.3 Ephemeral Rollups

MagicBlock Ephemeral Rollups enable real-time interaction while preserving the security guarantees of Solana's base layer.
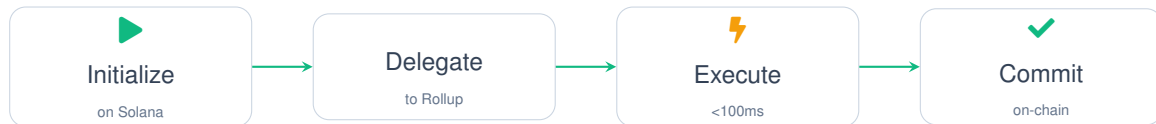
This architecture delivers a gasless-feeling user experience while maintaining the immutability and censorship resistance of base-layer settlement.

2.4 Session Keys

To eliminate repeated wallet approval popups, users generate deterministic session keys derived from a single wallet signature. These keys hold a limited SOL balance and are scoped exclusively to pixel interactions, minimizing security exposure while maximizing usability.

3 Game Mechanics

3.1 Territory Ownership

Users unlock shards by paying the rent-exempt minimum on Solana. Once unlocked, ownership confers permanent rights and ongoing benefits:

- **Permanent ownership** — Cannot be revoked or transferred without consent
- **Free painting** — Owners paint on their territory without cooldowns
- **Passive income** — Owners earn when others paint on their land

3.2 Cooldown System

Cooldowns balance accessibility with meaningful territory ownership. The system incentivizes land acquisition while keeping the canvas open to all participants.

Action	Cooldown
Painting own shard	**None**
Painting others' shards	50 pixels / 30 seconds
After premium payment	**None for 3 hours**

3.3 Premium Bypass

Premium payments flow directly to shard owners, creating a virtuous economic cycle. Artists gain unlimited creative freedom; landowners earn passive income. This alignment of incentives ensures the canvas remains both economically sustainable and creatively vibrant.

4 Economic Model

4.1 Revenue Streams

The platform generates sustainable revenue through three complementary mechanisms:

1. **Network rent** from shard initialization (one-time, covers Solana storage)
2. **Premium bypass payments** (ongoing, flows primarily to landowners)
3. **Platform fee** on premium transactions (small percentage for development)

4.2 Token Economics

Planned: A future governance token will enable community rewards, protocol governance, and staking mechanisms. Token design prioritizes long-term ecosystem health over short-term speculation.

5 Future Roadmap

Phase 1

Core Platform

- ✅ Real-time canvas
- ✅ Shard ownership
- ✅ Session keys
- ✅ Mobile support

Phase 2

Economics

- ● Premium system
- ● Owner dashboards
- ● Leaderboards
- ● Analytics

Phase 3

Social

- ● Faction system
- ● Territory wars
- ● User profiles
- ● Social feeds

Phase 4

Advanced

- ● Image uploads
- ● Trading cards
- ● Cross-chain
- ● AR integration

6 Conclusion

pixels.earth represents a new paradigm in collaborative digital art—one that merges the immediacy and accessibility of Web2 with the permanence and ownership guarantees of Web3.

By combining Solana's security with MagicBlock's Ephemeral Rollups, pixels.earth creates a living, economically sustainable canvas at planetary scale. Every pixel placed becomes part of a permanent, collectively-owned digital artifact mapped to the Earth itself.
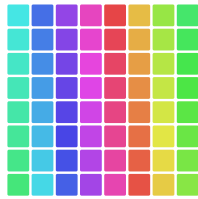
pixels.earth

https://pixels.earth

"Own a piece of the Earth. One pixel at a time."