MINI

Technical Whitepaper - Version 1.0 Draft

Made for beginners. Open to everyone. Built for low power.
Entry-level for newbs. Open for experts. Training for everyone.

Network path: Closed Testnet -> MINI LIVENET -> Alpha Block -> MINI Mainnet
Current MiniPOW: MiniPOW1 **Current protocol:** MINIMINERS/0.3

This draft distinguishes implemented technology, LIVENET specifications, Mainnet design targets, and decisions still to be finalized. MINI does not promise investment returns or exchange listing.

1. Why MINI Exists

MINI was created for people who have always wanted to mine cryptocurrency but did not know how, did not want to buy expensive mining equipment, or did not want to turn large amounts of electricity into heat just to participate.

> **Low-power mining is not a secondary feature of MINI. It is the reason MINI exists.**

MINI is designed from the beginning around inexpensive, low-power computers that ordinary people can own, understand, experiment with and leave running. An ESP32 is not a novelty miner attached to a network designed for giant computers. Low-power devices are part of the design center of the network itself.

A beginner should be able to start with a tiny miner, connect it to Wi-Fi, watch shares happen, earn MINI, use a wallet, learn addresses and seed phrases, understand pools and difficulty, and eventually understand and participate in the blockchain and node infrastructure behind the network.

MINI is also intended for tinkerers: battery mining, solar mining, custom displays, alternative ESP32 boards, Raspberry Pi nodes, homemade miners, efficiency experiments, custom software and community-built tools.

> **MINI's official miners are designed to run lightly in the background. MINI is a low-power mining network, not a competition to see who can turn the most electricity into heat.**

2. Permanent Design Principles

Low power by design. Mining and future network infrastructure should remain accessible to efficient, inexpensive computers.

Learn by participating. MINI teaches cryptocurrency through actual mining, wallets, transactions, pools, nodes and blockchain use.

Made for beginners, open to everyone. ESP32, CPU, GPU, Raspberry Pi and other supported hardware are welcome.

Free participation. Public mining software and firmware will be available without a required hardware purchase.

Optional convenience hardware. Official Mini Miners devices provide preconfiguration, testing, simple setup, automatic updates and support.

Frequent, visible mining. Shares are intentionally frequent so a beginner can see mining happen.

No electricity arms race as the design goal. Adaptive difficulty lets dramatically different hardware participate without raw throughput simply dominating per-miner rewards.

Low-power infrastructure. Raspberry Pi-class full-node operation is a Mainnet design target.

Education continues on Mainnet. The learning mission does not end when the blockchain launches.

Real economy. MINI is intended to develop utility, merchant use, trading and market value; it is not intended to remain an educational simulation.

3. Open Participation and Optional Hardware

MINI is not an ESP32-only network. Public implementations are intended for ESP32 devices, CPUs, GPUs, Raspberry Pis and additional platforms as support develops. Official CPU and GPU software will favor sensible, lower-power background participation rather than automatically consuming every available core or watt.

Anyone may use supported public software or build compatible hardware. Buying an official Mini Miner is not required to participate or receive normal mining treatment.

For beginners who want a plug-and-mine experience, Mini Miners plans to sell inexpensive preconfigured ESP32 devices for approximately **$20 cash**. A planned alternative is approximately **$10 cash plus MINI earned through network participation**. Exact commercial terms may change before sale.

The commercial product is the easy entrance. It is not the gate.

4. MiniPOW1 Technical Specification

Status: IMPLEMENTED / CLOSED TESTNET

MiniPOW1 is the currently implemented MINI proof-of-work algorithm. It combines SHA-256 with a per-attempt memory scratchpad and state-dependent memory access.

```
Challenge:       16 bytes / 128 bits
Nonce:           8 bytes / 64 bits, little-endian
Hash primitive:  SHA-256
Scratchpad:      65,536 bytes / 64 KiB
Block size:      32 bytes
Block count:     2,048
Mix rounds:      512
Result:          32 bytes / 256 bits
Target:          unsigned 256-bit integer, big-endian comparison
```

4.1 Seed generation

For each nonce attempt:

```
seed = SHA256(challenge || nonce_le64)
```

The 16-byte challenge is concatenated with the 64-bit nonce encoded little-endian. The resulting 32-byte digest seeds both scratchpad construction and later mixing.

4.2 Scratchpad construction

The 64 KiB scratchpad contains 2,048 sequential 32-byte blocks. Construction is dependent: each block depends on the previous block.

```
previous = seed
for i = 0..2047:
    block[i] = SHA256(previous || seed || LE32(i))
    previous = block[i]
```

This produces 65,536 bytes of per-attempt state.

4.3 Dependent mixing

After construction, the state begins as the seed. MiniPOW1 performs 512 rounds in which the current state selects a scratchpad block, hashes that block with the state and round number, then mutates the selected block.

```
state = seed
for r = 0..511:
    index = LE32(state[0:4]) mod 2048
    state = SHA256(state || scratchpad[index] || LE32(r))
    scratchpad[index] = scratchpad[index] XOR state
```

Later memory accesses therefore depend on previous hashing and memory operations, while selected scratchpad blocks change during execution.

4.4 Final digest and target

```
tail_index = LE32(state[4:8]) mod 2048
result = SHA256(state || scratchpad[tail_index] || seed)
```

The 32-byte result and the pool-provided target are interpreted as unsigned 256-bit big-endian integers. A share is valid when:

```
result <= target
```

The pool independently recomputes and validates submitted work. MINI does not claim MiniPOW1 is ASIC-proof, GPU-proof or CPU-proof. Its purpose is to provide a small-device-oriented workload with meaningful memory/state behavior rather than a trivial repeated SHA-256 loop.

5. Adaptive Difficulty and Frequent Shares

Status: IMPLEMENTED / CLOSED TESTNET

MINI miners can differ enormously in MiniPOW throughput. The pool therefore maintains difficulty per miner. Faster miners receive harder work; slower miners receive easier work.

The current user-experience target is approximately **one accepted share every three seconds** under calibrated operation. The initial calibration target is approximately **40 MiniPOW attempts per share**. Adaptive difficulty is already operating on ESP32 and PC-class test miners.

Adaptive difficulty is central to MINI's fairness model: raw computing power should not translate directly into proportionally larger per-identity rewards. The existing MiniPOW, adaptive-difficulty and reward behavior is considered a locked foundation for the current LIVENET design; anti-cheating controls operate separately on miner identity registration.

6. LIVENET Reward Direction

Status: LIVENET SPECIFICATION; emission policy still being finalized

The current LIVENET reward target is approximately **5 MINI per continuously participating approved miner per day**. Frequent shares divide that reward into many small accepted-share payments.

The network-wide maximum issuance model is being designed to flex with the number of legitimate miners so growth in miner population does not automatically create uncontrolled monetary expansion. Exact daily, monthly and annual network emission formulas will be published before LIVENET economic rules are finalized.

MINI does not promise a future fiat price, investment return or exchange listing. The project does intend to build utility, an active economy and sufficient infrastructure and adoption to pursue exchange listings in the future.

7. Preventing Parallel-Identity Cheating

Status: LIVENET SPECIFICATION

Adaptive difficulty solves differences in computing power, but a powerful computer could attempt to launch many parallel miner identities to multiply per-miner rewards. MINI therefore controls how quickly new accounts can create additional miner identities. This does not change MiniPOW, adaptive difficulty or the reward treatment of an approved miner.

A new verified account begins with **2 approved miners**. Account creation includes anti-bot controls and verified email.

After a seven-day qualification period with at least **85% sustained qualifying mining activity**, the account may register five additional miners. Each successful qualifying week adds five more:

```
Start:  2
Week 1: 7
Week 2: 12
Week 3: 17
Week 4: 22
```

Progress cannot go backward. If an account has 12 approved miners and records only 50% qualifying activity in the next period, it remains approved for 12. That week simply does not advance the account. A later qualifying period can resume progression.

Every approved miner receives the same MiniPOW, adaptive-difficulty and reward treatment from its first share. Probation limits registration velocity, not earnings.

After the initial proving period, legitimate accounts will be able to continue growing without a permanent lifetime miner ceiling. The exact post-probation registration velocity remains to be finalized. The principle is: **limit how quickly an operation can grow, not how far a legitimate operation can eventually grow.**

8. Portal, Identity and Separation of Responsibilities

Status: PARTLY IMPLEMENTED / LIVENET SPECIFICATION

The member portal manages human-facing account policy: registration, verified email, anti-bot controls, wallet access, miner-registration allowance and probation progression. The mining server remains the source of mining activity facts.

When a member requests additional miner registrations, the portal asks the mining infrastructure whether the account's approved miners met the required qualifying activity. The portal records the resulting allowance in its own database.

Current miner firmware uses persistent P-256 device identity. Identity is intended to survive firmware updates and normal configuration changes. Duplicate identity, one-active-session enforcement and contested-identity recovery are part of security hardening before public LIVENET.

9. MINI LIVENET

Status: NEXT PUBLIC NETWORK

MINI LIVENET is the public pre-blockchain MINI network. It is both a working cryptocurrency learning environment and a real-world proving ground for the project.

For participants, LIVENET provides hands-on experience with mining, shares, difficulty, pools, rewards, wallets, addresses, balances, transfers, security and eventually common cryptocurrency economic activity.

For the project, LIVENET exposes the system to real hardware, unstable connections, larger miner populations, attempted cheating, security attacks, unusual workloads and bugs that a small Closed Testnet cannot reproduce. Finding and correcting those problems before Mainnet is one of LIVENET's central purposes.

10. LIVENET Wallets and Economy

Status: LIVENET SPECIFICATION; features will roll out as ready

LIVENET is not intended to be mining-only. Common cryptocurrency operations will be introduced as they are ready: wallet addresses, balances, sending and receiving MINI, person-to-person transfers, transactions, buying and selling, and using MINI in exchange for goods and services.

LIVENET wallet infrastructure is intentionally more forgiving than Mainnet so beginners can learn wallet concepts, addresses, balances, seed-phrase concepts, private-key responsibility and transaction behavior before irreversible self-custody becomes mandatory.

Community members will be free to create tools, applications and merchant uses around MINI. A merchant may choose to accept MINI for merchandise or services. Mini Miners itself plans to accept earned MINI toward official low-power hardware. MINI does not need to operate every marketplace in its economy.

Buying, selling and merchant functionality may not all be available on LIVENET launch day. They will be introduced as the required systems are completed and tested.

11. MINI Is a Cryptocurrency, Not a Simulation

Education is a permanent MINI mission, but MINI is not intended to remain a classroom token. The long-term objective is a functioning cryptocurrency with its own economy, utility, community and independent blockchain.

MINI hopes to develop sufficient adoption, liquidity, infrastructure and community support to pursue listings on cryptocurrency exchanges. Listing and future market value cannot be guaranteed. Those outcomes depend on adoption, utility, market demand and the network that participants build.

Learning remains built into Mainnet. A new participant should still be able to start with an inexpensive miner or free software, learn mining and wallets, progress into transactions and self-custody, operate a MINI node, understand pools and blockchain infrastructure, and gain enough practical knowledge to also explore other cryptocurrencies and technologies.

12. Secure Miner Communication and DDoS Design

Status: LIVENET REQUIREMENT

Public LIVENET miners are intended to use encrypted hostname-based communication rather than exposing a permanent origin server IP and raw public mining port. HTTPS/WSS on standard secure web infrastructure is the current direction.

This allows encrypted miner-to-network communication, movable pool infrastructure, and use of appropriate edge/DDoS protection. Origin infrastructure should be protected against direct bypass where practical.

The MiniPOW job/share protocol remains conceptually separate from its transport. Secure transport should not require redesigning the already functioning proof-of-work or adaptive-difficulty system.

13. OTA and Beginner Reliability

Status: IMPLEMENTED DIRECTION / HARDENING BEFORE LIVENET

Official ESP32 devices use an OTA manifest containing version information, firmware location, SHA-256 integrity data and optional release controls. Firmware is downloaded, verified and installed to an inactive OTA partition.

Production OTA must preserve each customer's Wi-Fi configuration, miner identity, wallet/account association and other persistent settings. Public firmware must never contain the developer's personal credentials or private test configuration.

Before LIVENET, OTA will be aggressively tested for interrupted downloads, power/network failure, invalid images, integrity rejection, bad candidate behavior, health confirmation and rollback. A healthy installed miner should continue mining if the update service is unavailable.

14. Low-Power Network Infrastructure

Status: MAINNET DESIGN TARGET

MINI's low-power philosophy does not stop at the miner. The independent blockchain should be operable on inexpensive, energy-efficient computers. **Raspberry Pi-class full-node operation is an explicit design target.**

Future node specifications will include real CPU, RAM, storage, bandwidth and power budgets. The project will also investigate Pi-class pool infrastructure and, if the final consensus architecture includes staking or validator roles, whether those roles can remain accessible to low-power hardware.

Mainnet consensus, staking/masternode design, block timing, final supply schedule and validator rules are not yet finalized and will not be presented as completed technology until specified and tested.

15. Solar and Tinkerer Use

Solar power is a natural extension of MINI. Low-power ESP32 mining makes small battery and photovoltaic experiments practical, while the Mainnet goal of Pi-class infrastructure creates a path toward solar-powered nodes and small independent MINI stations.

Planned documentation will include measured power consumption, kWh/day and kWh/year, electricity-cost comparisons, battery runtime and practical solar sizing based on real hardware measurements. CPU, GPU, ESP32 and Raspberry Pi efficiency comparisons will be published as testing expands.

MINI is intended to be a playground for builders as well as an entry point for new cryptocurrency users.

16. From LIVENET to the Alpha Block

Status: MIGRATION PRINCIPLE LOCKED; implementation to be specified

MINI legitimately earned and held during LIVENET is intended to survive the transition to the independent blockchain.

When MINI is ready for Mainnet, LIVENET mining and transactions will be frozen. Every LIVENET wallet balance becomes final. The **Alpha Block** will initialize the MINI blockchain from those final balances on a **1:1 basis**.

If a participant holds 1,250 legitimate MINI at the LIVENET freeze, the corresponding opening Mainnet allocation is 1,250 MINI.

The frozen LIVENET will remain available in read-only form for a verification period. Users will be able to browse their final LIVENET wallets and compare those balances with their opening Mainnet balances.

```
Frozen LIVENET wallet -> final LIVENET balance -> opening Mainnet balance
```

A downloadable final LIVENET balance/ledger dataset and cryptographic hash are planned so technically inclined participants can independently verify the migration. Historical migration records should remain available even after legacy LIVENET infrastructure is retired.

17. Mainnet Self-Custody

Status: MAINNET REQUIREMENT

LIVENET's recoverable learning environment does not define Mainnet ownership. Mainnet will use actual cryptographic self-custody. Control of Mainnet MINI will depend on the required private keys or seed material.

MINI administrators will not be able to reset blockchain ownership or recover a lost Mainnet seed phrase. LIVENET exists partly so users can learn why those responsibilities matter before they become irreversible.

18. Pools, Nodes and Decentralization

Status: MAINNET DESIGN TARGET

The long-term network should not depend on one founder-controlled VPS, one pool or one physical location. Multiple independently operated full nodes should maintain and verify the blockchain. Multiple mining pools are intended.

Pools will distribute MiniPOW work and validate miner submissions. Mainnet nodes must ultimately be able to independently verify economically important claims rather than simply trusting a pool's assertion about its contribution.

The exact pool-to-chain accounting and consensus mechanism remain open engineering problems and will be specified before Mainnet.

19. Security Philosophy

MINI assumes a public cryptocurrency network will be attacked. Clients are not trusted merely because they claim to have done work. Pools validate shares. Account systems assume automation and abuse attempts. Public infrastructure should be designed for hostile traffic. Security controls should be transparent about what they do and do not prove.

MINI does not claim that verified email or probation proves one human equals one account. These systems are intended to make rapid large-scale parallel-identity abuse slower, more expensive and less attractive while keeping normal participation simple.

Confirmed legitimate MINI should not be casually clawed back because of later outages or unrelated identity problems. Security mechanisms should focus on current sessions, registration rights and pending issuance wherever possible.

20. Current Development Status

Closed Testnet - current. MiniPOW1, ESP32 mining, PC reference mining, adaptive difficulty, shares/rewards, persistent identity, setup/recovery work and OTA are operating or under active hardening.

MINI LIVENET - next. Public participation, free mining software/firmware, optional preconfigured hardware, secure transport, verified accounts, miner-registration probation, training wallets and expanding cryptocurrency functions.

Alpha Block. LIVENET freezes, balances become auditable final records, and legitimate balances initialize Mainnet 1:1.

MINI Mainnet. Independent blockchain, self-custody, distributed nodes, multiple pools and continued low-power education and experimentation.

21. What Is Still TBD

The following are intentionally not invented in this draft: final Mainnet total supply and emission schedule; block interval; final consensus mechanism; staking/masternode rules; exact post-probation registration velocity; final Mainnet anti-Sybil design; pool-to-blockchain accounting; and final node CPU/RAM/storage/bandwidth limits.

Those decisions will be documented when engineering and testing support them. MINI documentation should distinguish measured facts, implemented specifications, design targets and unresolved decisions.

22. The Educational Path

MINI is designed to teach cryptocurrency through real participation. A beginner can start with one inexpensive ESP32 or a computer they already own and learn mining, shares, difficulty, pools, rewards, wallets, transactions, seed phrases, self-custody, nodes and blockchain infrastructure by actually using them.

As their knowledge grows, so can their participation. A beginner can eventually operate multiple miners, experiment with hardware and solar power, use and secure wallets, buy and sell with MINI, understand blockchain transactions, operate a MINI node, participate in mining pools, build tools and understand how a cryptocurrency network functions from the miner to the blockchain.

That practical knowledge also gives participants the foundation to understand and explore other cryptocurrencies, mining systems, wallets, nodes and blockchain technologies.

> **MINI is designed so someone can begin by watching a tiny miner blink every time it finds a share and eventually understand - and participate in - the network behind that blinking light.**

23. Closing Statement

MINI was created for people who always wanted to mine cryptocurrency but did not know how.

It is designed from the ground up for low-power participation - from tiny ESP32 miners and solar experiments to Raspberry Pi-class network infrastructure. MINI teaches cryptocurrency by letting people actually mine it, earn it, use it, trade it, secure it and eventually participate in the blockchain that supports it.

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> **Entry-level for newbs. Open for experts. Training for everyone.**