Whitepaper 1: ***SeeState Prototype / Project C***

The browser extension interface and blockchain protocol for unmoderated text transmission, communication and storage through smart contract transactions

Summary:

A prototype of the SeeState platform has been developed; composed of a browser extension interface and background blockchain-based functionality, an innovative approach to digital communication and data broadcasting has been established through textual information embedded into minimal cryptocurrency transactions sent to a smart contract address, utilising its decentralized design to achieve a transparent and tamper-proof interaction system. This founds a framework for permissionless commentary and data transmission overlaid onto conventional webpages, immune to intervention or censorship from any central authority, consequently creating a novel avenue for free public speech and press. Submitted content is assigned to string location, typically webpage address URLs, allowing users to associate textual information with webpages without requiring infrastructural cooperation from the websites themselves; furthermore, arbitrary character string locations may optionally be used to create obscured chat rooms or data repositories. In contrast to contemporary platforms, where communication is subject to legal and corporate oversight, SeeState operates outside the domain of centralized control associated with hosted services, ensuring data remains immutable and available free-of-charge through robust mechanisms of direct on-chain accessibility, a diverse network of nodes and off-chain subgraph indexing databases, balancing efficiency and security while being practically immune to interference or failure. The platform includes smart contracts deployed onto multiple EVM-compatible blockchain networks and users may select the desired channel depending on relevant parameters of price, speed and safety; advanced users may also manually deploy the contract onto a custom network, forming an exclusive and private communication medium.

An abundance of use cases may be discovered for the platform and its underlying protocol, such as public commentary, advertisement or product reviews, conveyed on any webpage address; moreover, a proposal of alternative and nuanced application scenarios is implied, such as a service for permanent archival of literature and textual data, or a communication system facilitating privacy and anonymity in virtual exchanges, concealing conversations and identity through integrated ciphers and sterile cryptocurrency wallet utilisation. In an intention to nurture an intuitive interaction ecosystem, users may internally reference and reply to other participant's comments or link external content, constructing a navigable network of interconnected data. Furthermore, encouraging productivity, a reward system is integrated in the smart contract's logic, permitting users to assign points to comments, referring the comment's author to a portion of transaction fees required for the interaction instance while reinforcing engagement and content curation through a model of financial incentive.

Freedom of speech and press, user autonomy and virtual anonymity are the dogmatic doctrine and the foundational promise of the project; this whitepaper clarifies conceptual details of the established system prototype, inspecting potential pragmatic, problematic, societal and ethical consequences of widespread platform adoption. The capacity for supplementary functionality and future updates is elaborated and examined in detail. At this stage, the extension prototype exclusively supports MetaMask transactions which, due to safety limitations, require script injections into relay webpages; however, alternative transaction models, utilising integrated wallet generation, burner wallets and fiat deposits, should be implemented eventually.

Contact:

Oliver Martin Meršinjak, project founder and developer
Zagreb, Croatia, 2024/2025

oliver.martin.mersinjak@proton.me
www.seestate.net

Acknowledgment:

The SeeState prototype has been developed by utilizing large language models and open-source software resources. All third-party contributions will be credited withing the project's documentation and code repositories.

Legal disclaimers:

- SeeState does not host absolutely any content, serving as a neutral conduit of information between users and the blockchain; all displayed data is decentralized, accessible through any blockchain interface
- Users assume full responsibility for compliance with local legislature regarding legality of content broadcast and blockchain usage
- SeeState explicitly disclaims liability for content distributed or accessed via its decentralized protocol and extension interface

Copyright and intellectual property:

Open to capital investment for supporting further development, necessary infrastructure and public adoption – for inquiries, contact me via the provided email address.

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Prologue

The digital age, associated with revolutionary technological breakthroughs such as the open internet, was once considered as the dawn of unprecedented freedoms and access to information; adversely, it became severely corrupt in centralization and the obsessive desire for control and surveillance, rotten through the global collaboration between governing authorities and corporations, which has limited speech to the triviality considered safe for the status quo, under the pretence of protecting public order, national security and individual safety. However, practical consequences of such arbitrary boundaries have been primarily protecting private corporate interests, galvanized by techno-feudalistic entities and profit driven news networks with unprecedented power in forming public opinion; operating under the disguise of neutrality while employing advanced algorithmically directed censorship and propaganda. In an effort to evade drastic regulatory policy, and likely due to unparalleled profits and proven electoral and political collaboration, these degenerate for-profit platforms have resorted to models of self-regulation by removing illicit content, relying on algorithms to preemptively remove illegal activity, and by systematically suppressing dissenting and disruptive opinion; individuals with incompatible stances are boycotted and ostracized, constraining unauthorized worldviews to alternative platforms where they are either radicalized or, effectively comparable, unreasonably equivalated with other radical and extremist opinion. The discourse, deported to secondary platforms, has been replaced by an artificial mainstream consensus on the modality of good and evil, of what is considered acceptable, desirable and correct, elevated by latest developments in artificial intelligence large language models, creating illusory traffic aimed to attract advertisement and please equity-holders. Another recent development in the virtual ecosystem, the commodification of attention produced by the imperative of maximising interaction time, has resulted in content curation algorithms which are parasitical by definition – exploiting the nature of human behaviour with sustained engagement circuits, manufactured ideological homogeneity and amplified sensationalist content, provoking well-known and widespread destructive psychological effects, considered endemic to social media consumption. Such predatory platforms, able to precisely identify vulnerable individuals and communities, have proven to be a crucial service for spreading consumeristic advertisement and targeted propaganda for private and political objectives. In a display of absolute disregard for user privacy, and to optimize such content curation algorithms, extensive quantities of sensitive personal and psychometric data has been aggregated, establishing an inescapable invasive supervision system which encompasses all spheres of behaviour and thought. A total freedom of speech is vital for combating and criticizing the development of novel dynamics in both virtual, societal, economical and political domains, a matter which goes beyond the base primacy such liberties – it is essential to meet the collusion of private and political entities with a strong and unmoderated response of public opinion. SeeState is the extreme response to extraordinary circumstances and a revolt against corporate control, with a grand promise of shattering artificial barriers imposed upon dialogue by centralized arbiters and empowering the sovereignty of public expression; a sanctuary for speech and a true technological manifestation of internet autonomy.

Concept

The platform's fundamental ambition is to provide the general public with a transparent, tamper-proof and permissionless system of online communication through the SeeState decentralized application (dApp), utilizing the permanence of information embedded in blockchain transaction records and their global accessibility, presented within a browser extension interface to create a layer of dialogue and data storage imposed upon webpages without requiring any infrastructural integration from underlying websites. The system allows users to transmit textual information (comments) associated with any webpage address URL or alternative arbitrary string (location) by executing minimal cryptocurrency transactions directed towards designated smart contract addresses, with the transaction payload containing the comment text and relevant metadata. By design, the mechanism is constrained within a framework where no central entity has any agency in dictating or governing the independent operation of platform functionality, since all blockchain interaction is managed by the self-executing smart contract logic, deployed on multiple blockchain networks (channels). The core platform architecture consists of two separate components:

1. *The smart contract*
    - Consistent of immutable interaction conditions and decentralized public functionality
    - Individually deployed blockchain networks, accessible through any valid nodes
2. *The browser extension*
    - Neutral interface for smart contract interaction assistance, transaction management and communication with alternative data structures

Furthermore, although not available in the platform prototype, another layer to platform functionality should be implemented in the final version, to aid in public adoption efforts, essential for participation without cryptocurrency prerequisites:

3. *Limbo comments*
    - Off-chain hosted alternative for broadcasting content within the extension interface, in a free-of-charge and non-permanent interaction model

The smart contract manages comment submission, either storing the comment structure in on-chain maps or saving gas costs by solely emitting the transaction event on node event libraries; regardless of the choice between *mapped* or *emit-only* comments, content is also aggregated by off-chain subgraph indexing protocols. All interaction data, publicly open and permanent, may be read directly from blockchain smart contract maps, from valid node event logs, from off-chain subgraph indexing providers or alternative off-chain databases. The hybrid data retrieval process, along with the possibility of preferential node selection, also enables optional content authenticity audits, for users or any third party, by cross-referencing low validity data with historical node information or raw smart contract variable states, while preserving an adaptable and adjustable approach to data retrieval for scenarios of off-chain database failures or loss of node credibility. Alternatively, any advanced user may interact with the smart contract directly through their desired blockchain interface, circumventing any requirements for extension integration. Supplemental functionality is achieved through assistant smart contract processes, such as comment ID maps, parent-child associations and point reward distributions. This system is engineered to function outside the jurisdiction of traditional online moderation, utilizing blockchain technology to the degree considered necessary to nurture a global conversation outside the conventional digital landscape, pioneering an entirely novel paradigm of virtual communication where participation is structured upon voluntary user action and consensus, rather than an enforced compliance.

Finally, an important disclaimer – SeeState is a neutral conduit of information between users and blockchain data, presenting smart contract data available through any other appropriate blockchain interface; the platform may be considered partially immune to compliance or takedown requests as, unlike traditional platforms, no content is being directly hosted, but merely organized for public convenience; transaction-based interaction is an unconventional prerequisite of this model.

Smart contract

The recent addition of smart contracts in blockchain protocols revolutionized the technology by introducing decentralized self-executing commands which commit after objective predetermined conditions are met, with the terms of agreement and consequential function logic being permanently stored on-chain. For any such function which modifies the smart contract's state compensative gas fees are provided for required computational resources, contract logic is autonomously executed on blockchain nodes if the contract constraints are obeyed, reaching an outcome based on the consensus of the decentralized node network, without allowing for any intervention from central intermediaries. Presently, most smart contracts are restricted to rudimentary logic and most such dApp and DeFi projects are short-lived, with many impractical or fraudulent programs relying on publicity and marketing instead of sensible use-case scenarios. Arguably the biggest adoption barrier of such projects are inadequate user-friendly smart contract interaction interfaces and a perceived semantic complexity of cryptocurrency and underlying blockchain technology. Regardless, the SeeState smart contract functionality is based on elementary logic and common technological literacy is likely sufficient for comprehending the fundamental operational mechanisms.

The developed contract prototype has been deployed on multiple channels of varying parameters; subsequent deployment on such networks can easily be realised and integrated in the extension interface in a matter of minutes. The Ethereum Virtual Machine (EVM) cross-chain compatibility allows for deployment of a developed smart contract on any EVM-compatible blockchain networks, taking advantage of EVM standardisation to ensure identical cross-network execution; being the basal virtual environment for smart contract implementation, any contract compiled into understandable bytecode will be interpreted and executed in the same deterministic manner across such networks. The difference between EVM-compatible blockchains creates a diverse ecosystem of various parameters for deploying the compiled SeeState smart contract, authorising users with the flexibility of choosing an optimal communication channel depending on network transaction fees, finality speed, and decentralization degree. SeeState channels established through this dynamic are a central element of the project, not only solving temporary congestion related problems or delegating the prerogative of channel selection to participants, but also paving a way for a true decentralized future.

Once deployed, the smart contract gets assigned to an address on the native network, capable of receiving cryptocurrency transactions; if the transaction is embedded with an appropriately structured payload and, obeying the required fees, the contract logic gets executed autonomously. Regardless of the blockchain, any operation which modifies the contract state or the blockchain content incurs network fees (gas), through which users bid on node's computing power to get their transactions confirmed and finalized on the permanent ledger. Smart contract processes require significantly more computation than plain cryptocurrency transactions, so gas requirements for computationally heavy functionality have to be taken into account. Although such constructive actions, which add data to the blockchain, must be compensated through covering gas fees, reading the public-by-default blockchain data or the states of pure and view variables bear no expenses to users, as no modifications are made to the records.

The smart contract defines all functionality, constructs and terms of interaction, constituting all available logic which may trigger on appropriately structured transactions towards the contract address. Once deployed, no method of post-hoc modification to the smart contract logic can be done; no proxy upgradeability, modularisation capacity or killswitch has been employed, creating a truly immutable contract logic, immune to authoritarian intervention by design. The contract derives its core functionality from predefined structures, event-emitting functions and maps – the two fundamental structures, comment and point structures, along with associated metadata, are emitted and recorded in node event logs and stored within the contract's state in robust maps once the contract address receives a suitable transaction. The system prioritizes minimal mappings as a strategy for gas efficiency optimization, since every additional computation requires additional gas compensation, structure maps have been limited to those considered a practical necessity for proper operation. Although this whitepaper does not delve into redundant technical detail, a rudimentary overview of the contract functionality is presented:

- *Creating a new comment*
    - If required fees are covered, the contract commits to producing an outcome dependent on if mapped or emit-only comment transmission is requested
    - Regardless on comment type, the comment event and associated metadata is emitted on network node logs, enabling access from both nodes and subgraph protocols
    - If a mapped comment is requested, a comment structure containing a corresponding comment ID is mapped with relevant parameters for on-chain data retrieval purposes
- *Awarding points*
    - Again, the contract determines if action conditions are met
    - The event is publicly emitted, the point structure is assigned to a comment ID and a share of the required transaction fees is mapped to the original author's wallet address
- *On-chain data access functionality*
    - Mapped data may be retrieved free-of-charge through view functions, information is returned in chunks of adjustable quantity to make the operation scalable
    - Comments may be queried by their unique ID, location or parent comment ID; points may be queried by the comment ID they have been assigned to

Finally, some supplementary functionality has been implemented:

- *Helper and developer functions*
    - Point reward withdrawal functions which may only be triggered by a transaction from the corresponding wallet addresses
    - Reentrancy modifier functions, restricting malicious withdrawal requests
    - Adding and removing developer wallet addresses with administrative rights
    - Modification of minimal comment and point fees, restricted to administrator wallets, with a consequential impact of inherent centralisation concerns

Although the SeeState extension serves as a direct interface for interaction with the smart contract, a vital distinction has to be observed – the smart contract exists on the blockchain, independent from related dApp interfaces. The contract functionality is public and may be exploited through any alternative blockchain interface connected to a valid node provider; the developer team has no agency of subjecting the contract accessibility under control, as any user or third party may exploit or examine the smart contract through secondary interfaces, true to the intention of establishing a decentralized communication environment. Furthermore, the smart contract code is permanently public and may be observed through appropriate block explorer services, prompting alternative implementations and competitors to optimize the contract logic, achieving a plurality of similar platforms, additionally decentralizing the digital communicational landscape.

Channels

Channels are created through smart contract deployment on compatible blockchain networks, establishing a diverse environment of effectively distinct communication routes. The dynamics conditioned by the plurality of channel options emerge from varying core network parameters such as block size, transaction latencies, gas prices and node decentralization, creating communication channels of differing capacities. Channel selection is a critical factor in both content transmission and access, as users can choose the preferred channel depending on transaction prices, network throughput, traffic and reliability, tailoring their participation experience to suit their personal preferences. Channel selection is a crucial component of the interaction process – users decide on the appropriate network for immutable information transcription, as well as the channel, or aggregate of channels, from which data is being retrieved; the extension interface serves to remedy this process and provide users with an overview of available channels and relevant information. Furthermore, channels may rapidly be deployed based on userbase demands and market dynamics, especially important in the ever-evolving blockchain environment. Channels should be instituted on most convenient and popular networks, with the platform allowing for widespread deployment in a matter of minutes, and select testnets, which enable cryptocurrency acquisition through free open faucets, with pragmatics indistinguishable to live networks. To sustain the imperative of decentralization, and also facilitate user privacy and autonomy, custom channels, manually deployed by advanced participants or special software, may also be connected within the extension interface, rendering them inaccessible to those without specific knowledge of network ID, contract address or node endpoint information, cultivating an unprecedented and unique digital communicational ecosystem.

Transaction price will likely be the determinant and most decisive characteristic of channel choice for the majority of participants, dictated by variable gas fees and predetermined developer fees; traffic will definitely conglomerate around popular channels which offer maximal affordability, however, select users might tolerate paying premiums to transcribe information on monetarily exclusive or optimally decentralized channels. Although minimum fees will likely not be enforced on channels with prohibitively expensive gas costs, they are a necessary intervention on cheap channels, aimed to combat bot employment, discourage inauthentic behaviour and obstruct spam, simultaneously creating a sufficiently self-sustaining platform, evading requisition of potentially disruptive external financial investments. Such minimal fees must be low enough to not present an economic barrier for user participation, but adequately impactful to hinder en masse manipulation endeavours; although alternative channels with no employment of such interaction impediments must be enabled to stimulate a worldwide conversation, at the risk of spam and propaganda exposure. Transaction prices are also contingent on native network blockspace and blocktime parameters – the volume capacity of blocks and the frequency of their canonical publication. Slower

channels are generally associated with either low blockspace, blocktime or both; although communication may be conducted urgently through such channels by bidding substantial gas prices, faster channels are structurally more appropriate for a global userbase, lifting the restriction of financial constraints. Consequently, channels with consistently sparse interaction fees might congest the channel's network, experiencing increased gas price spikes at moments of intense platform operation, in turn temporarily restricting utilisation; to some degree, the heterogeneous channel solution combats this issue, inciting active participants to substitute channels when costs become unreasonable. Regardless of the aforementioned interaction prices, reluctant users may read the content of any channel free-of-charge, imperative to creating transparent dialogue and assist in public platform adoption.

Global network congestion refers to brief increases in a blockchain network's gas prices and associated confirmation latencies, caused by temporarily numerous queued transactions which overwhelm the network's throughput capacities, resulting in substantial changes in interaction prices or noticeable desynchronisation of the user experience consequent to delayed on-chain consolidation. Such occurrences are typically short-lived, caused in moments of unordinary market panic or minting events, regularly stabilizing with the cessation of the source congestion cause; users may wait the congestion out, endure the increased gas prices and engage in immediate interaction or swap channels if affordability is prioritised. Alternatively, the scenario of consistent long-term platform activity, especially on prominent string locations, leads to limited visibility and data inaccessibility due to large quantities of permanent comments and informational noise; such channels can be considered locally congested, with comments only being practically observable when sorted chronologically by recency. Circumstantial flexibility enabled by channel selection and advanced content curation algorithms mitigate the obstruction caused by this effect, although the permanent accumulation of information remains a persistent issue and distinction caused by the dynamic of underlying principles.

Another criteria users may take into account when deciding on the channel for broadcasting content is the perceived reliability and credibility of the host blockchain network, especially when inscribing data with the intention of immutable information storage. Networks with track records of stability and decentralization might be more attractive to users who demand a guarantee of content permanence. The users have autonomy to determine an adequate channel based on parameters they deem desirable for their particular demands; select channels and associated specifications emergent from network restrictions have been described in *Table 1*; a portion of applicable channels has been previewed, exhibiting the comparison of most relevant technical properties.

Table 1.

Select blockchain networks and associated transaction throughput, interaction price approximations and relevant parameters, prices figures are estimated and simplified for readability.

Network	***Blocktime***	***Transactions per second***	***Mapped comment***	***Emit-only comment***	***Point***	***Description***
Etherium ID: 1	*12 sec*	*15 tps*	*$1.00*	*$0.05*	*$0.15*	*Best node decentralization, impractical*
Polygon ID:137	*2 sec*	*65 000 tps*	*<$0.01*	*<$0.01*	*<$0.01*	*Scalable network solution, high throughput capacity*
Arbitrum ID: 42161	*1 sec*	*40 000 tps*	*<$0.01*	*<$0.01*	*<$0.01*	*Extremely suitable for utilisation, high capacity*
Eth. Sepolia ID: 11155111	*12 sec*	*15 tps*	*$0*	*$0*	*$0*	*Testnet currency free on open faucets, low capacity*
Arb. Sepoia ID: 421614	*1 sec*	*40 000 tps*	*$0*	*$0*	*$0*	*Testnet currency free on open faucets*

Interaction price dependant on gas price bid, price estimates calculated with recent average gas prices
Mapped comment gas approx. 450 000
Emit-only comment gas approx. 40 000
Point gas approx. 150 000

Comments and replies

The SeeState platform deliberately enforces a pragmatic restriction, permitting exclusively textual comments; this limit is set to mitigate both legal and technical risks associated with unregulated content submission – to obstruct permanent on-chain storage of critical illicit substance and because of the constraints of prohibitively expensive blockspace required for other types of data and media. Prohibiting the storage of other multimedia types ensures economic feasibility for participants and somewhat prevents malicious abuse of the platform's mechanisms, avoiding the obvious potential of publicly spreading explicit photographic and videographic material.

The extension formulates the transactional function call, consisting of the payload, containing comment text and associated metadata, and the approximated gas quantity necessary to cover node computation; alternatively, transaction price is finalized after communicating with external wallet providers which enable further control of gas limits and prices through their interfaces. Although metadata points are calculated autonomously by the smart contract logic, some metadata, such as the username or the comment location, may be assigned manually. Prior to comment confirmation, a preview of all associated metadata should be presented to the participant, since that data is permanent once committing to transaction execution; the node provider and smart contract logic manage any subsequent operations necessary to transcribe and organize the data accordingly. Gas required for successful broadcast scales with payload size, particularly concerning for comments with lengthy and elaborate bodies of text, notable especially in mapped comment scenarios, due to extensive blockspace prerequisites; users will naturally assess such financial constraints and personal preferences when submitting content to determine channel best suitable to their subjective demands.

If the transaction containing the comment payload is authorized by the smart contract, appropriately structured and sufficiently covering required fees, contract functionality commits the comment data into permanent records, ensuring public accessibility and cryptographic verifiability of all published content. Users may define the desired comment type in the transaction payload, balancing trade-offs in terms of price, auditability and data permanence – either mapped comments, immutably inscribed within the blockchain smart contract maps and complementary emitted in node event logs, or emit-only comments, which circumvent most gas requirements by evading computationally-heavy on-chain mapping operations, being registered only in node event log libraries, drastically reducing interaction prices. Information broadcast through both comment types can be considered safely stored in the underlying trustless logical protocol, however, mapped comment structures become embedded into the canonical blockchain structure, independently available directly from the smart contract's retrieval function through any connected blockchain interface or console. Testing revealed that, counting on identical data and metadata arrangement, emit-only comments are up to 50 times cheaper than their mapped counterparts, disregarding developer fees.

For all intents and purposes, the userbase will likely utilise emit-only comments beyond the measure of mapped structures, presumably because of the drastic difference between required computation compensations, the most significant barrier of user interaction. Although mapped comments, identical to the emit-only equivalent, exhibit accessibility from node event logs, enabling querying directly from nodes or simultaneously active subgraph indexing protocols; an added benefit users may occasionally demand are supplementary abilities originating from contract functionality. First and foremost, each mapped comment is assigned with an unique identifier, the comment ID, individually mapping incremental values with applicable comment structures. Furthermore, all complementary functionality, such as assigning points or replies to comments, logically demand valid on-chain identifiers for successful execution and association within relevant maps; to conduct such operations which modify the smart contract's state, taxing node computations has to be completed, resulting in the difference in required gas. Regardless, if reasonably low gas prices are supported by the channel network's parameters, the userbase might perceive both comment types financially indistinguishable, preferring the option with functional pragmatic advantages.

The extension interface's implemented functionality and front-end syntax create capacity for advanced actions, aiding in behaviour anticipated to develop organically. An additional functionality, pragmatically most significant, is the integration of encryption mechanism, which serve to counterbalance the permanent and public communication framework; before transmission, users may encrypt the comment text through symmetrical ciphers, such as the Advanced Encryption Standard (AES), using arbitrary keys necessary for appropriate

decryption; the communally accessible comment text appears completely unintelligible without knowledge of the cipher key, protecting sensitive information in the open and immutable conversational environment. Future updates should integrate further encryption methods, such as an asymmetrical option utilizing cryptocurrency wallet address public keys, decipherable through the complementary private wallet key alone, facilitating an obscured avenue for direct communication which does not require previous consensus on the cipher. Furthermore, comment text may also be formatted, enabling rudimentary style customization such bold or italic and, imperatively, allowing direct hyperlinks to any external webpage or internal content through unique comment identifiers or string location references. It is absolutely critical that any information presented or interacted with gets properly sanitized to prevent code injections, prioritising user safety in a digital landscape of unforeseen ungovernability.

The aforementioned metadata structure and interface capabilities create a innovative communicational dynamic – the extension automatically interprets the open webpage as a comment location, instantly querying the string for any available content on a selected channel or an aggregate of channels, displaying retrieved information in an objective and neutral hierarchy, dependant on the selected sorting algorithm. If a parent-child comment relationship can be identified through comment metadata, replies are organized in visually branching content structures; reply comments are otherwise structurally identical to any top-level comment. Considering data origin, comment authenticity may be inspected by audits through venues of higher validity; in case an off-chain database, such as a hosted indexing protocol, was selected in favour of efficiency, the comment data may be cross-validated with on-chain content records, ensuring that the written word remains unaltered through the guarantee enabled by the cryptocurrency transaction process. For transparency purposes, each comment structure metadata and associated block information may be directly accessed through the extension interface. Although the implementation of free-of-charge Limbo comments is paramount for assisting in the public adoption process, presenting an abbreviated and intuitive information interface, streamlining user interaction and content access, might remedy the inherent perplexities associated with the underlying technology; auxiliary functionality, potentially requisite only for advanced users or edge-case scenarios, must be appropriately concealed to avoid deterring authentic global participation.

The integration of a Limbo comment system must be executed in an alternative legal paradigm compared to regular platform processes as the result of hosted data requirements; restrictions have to be employed since such content does not reside under the protectorate of the primary blockchain information conduit service presented by the platform. Additional safety mechanisms have to be implemented to protect user interactions, such as a permanent encryption of all data related to depreciated Limbo comments. This model of data broadcasting has to be carefully developed, balancing legal restrictions with anticipated user behaviour and use case scenarios.

Points

The platform architecture allows for another layer of user interaction through the point system, an integral mechanism for content evaluation and engagement, conceptually similar to likes or upvotes and technically comparable to the structure of comments and associated on-chain maps. The purpose of this implementation is multifaceted – both supporting social dynamics of content curation through accustomed interaction habits, resulting in increased visibility for comments communally considered relevant, and providing a financial incentive for productive participation through a contractually defined procedure, splitting a portion of the developer fees of point transactions with the recipient comment author's wallet address, encouraging constructive behaviour in anticipation of rewards. Points are also embedded into minimal cryptocurrency transactions, in a process technically identical to comments, except consistent in gas requirements as a product of stable payload contents in different on-chain operations.

The point transmission process is fundamentally similar to the commenting procedure – the transaction sufficiently covering network gas fees and embedded with an appropriate function call in its payload is directed towards the smart contract address after a confirmation within the extension interface; the payload contains required information regarding the target comment, its author and the point awarder, along with associated metadata; immutable contract operations publicly emit the event on node logs, map the created point structure with associated comment ID and record the resulting funds retrievable by the comment author's wallet address.

Any user with a pending balance may request its complete amount by submitting a function call to the smart contract, compensating for any necessary gas fees due to modifying the blockchain canon. The utilisation of contract maps makes this process considerably more expensive than broadcasting emit-only comments, which involve scarce on-chain computation, but comparatively cheaper than transcribing mapped comments, considering the drastic differences in blockspace required. This system benefits from the same decentralization as other dApp function calls, independently interactable through any secondary blockchain interface, however its full functionality is achieved through content sorting algorithms in the extension front-end, weighing comment popularity by number of related points.

The observable pragmatics originating from this system result in minimal but significant changes in the user experience – a point counter present in the interface comment visualisation gets increased by the number of retrieved points, a credible testimonial reflective of genuine user sentiment because of the inherent transactionally recorded value, resistant to en masse artificial algorithmic promotion. The consequential sorting algorithm is completely objective and agnostic to the comment's contents, hierarchically ranking comments by the number of associated points. The economic incentive evident in the aggregation of rewarded funds might be invaluable for socially moderating the behaviour of pseudonymous actors in an environment where content is permanent and no proprietary regulatory intervention is possible, although the dynamic might give arise to superficial contributions aimed solely at earning rewards, even though the absence of similarly conceived interaction protocols precedents makes predictions about potential emergent behaviour futile.

Broadcasting data

Transaction signing

The reliance on blockchain transactions to authenticate and permanently record user interaction is both the critical advantage and detriment at the core of a decentralized interaction platform utilizing cryptocurrency transaction as a communicational medium, being the exclusive guarantee of immutability and public data availability. Every instance of user engagement, requiring state modifications within the smart contract and the blockchain records, necessitates a valid transaction that carries both the compensation for computational costs and interaction parameters which obey the contract's conditions; contrarily, observing the state of public blockchain and node event records bears no costs, ultimately facilitating a maximally transparent interaction framework, in which no data, unless directly encrypted, may be obscured. Gas represents the resource expenditure necessary for network nodes to successfully process transactions, fluctuating dynamically depending on the global network congestion, blockspace requirements and the computational intensity of invoked smart contract functions; the result is an effective bidding economy where higher price per unit of gas induce faster confirmation speeds, incentivising network participants to process the interaction, further reinforcing the economic dimension of blockchain. The payload, consisting of structured function calls, parameters, and embedded metadata, are interpreted by the smart contract's immutable logic, dictating the practical outcome or reversion depending on predetermined and public contractual constraints. Advanced cryptocurrency wallets streamline this process, suggesting gas price bids and approximating associated transaction latencies, signing transactions with user cryptographic keys, ensuring ownership before broadcasting and directing data.

Due to the decentralized and permissionless nature of cryptocurrency transactions, interacting with the SeeState smart contract requires no designated extension interface per se – any participant may directly engage in on-chain discourse via secondary dApp interfaces or blockchain consoles; however, the SeeState extension serves to streamline the experience, abstracting the complexities of transaction construction, gas estimations and contract function parameter compatibility, into an accessible and intuitive environment, shaped to accommodate a global userbase and not just avid cryptocurrency enthusiasts. Therefore, one of the biggest obstacles the project encounters is the challenge of creating an intuitive transmission process for the general public, unaccustomed to participation in the transaction-based pay-per-interaction models and lacking comprehension of underlying blockchain mechanisms. Although a critical interaction funnel may be created through free-of-charge ephemeral Limbo comments and the design facilitating open data access, an intelligent anticipation and assessment of

expected behaviour is paramount to accommodate an universal conversation in the environment unrestricted by technical impediments. Three distinct methods of signing and broadcasting transactions should be implemented in the final product platform version, allowing flexibility for both existent cryptocurrency users and inexperienced masses:

- *External wallets*
    - Users may connect existing self-custodied wallets and seamlessly exploit their assets for interaction purposes, at the potential cost of KYC association if identity-revealing behaviour had been conducted
    - Some wallet services mediate dApp transactions as node providers
- *Integrated wallets*
    - Mitigating reliance on external wallet transaction confirmations while retaining full ownership of private keys, generating new wallet addresses through the extension interface might be preferable for frequent interaction
    - Disposable burner wallets may be utilized if anonymity is prioritised
- *Fiat deposits*
    - Circumventing ownership of cryptocurrency assets, users may deposit fiat funds into a centralized account, which may manage background transaction executions on behalf of users, deducting costs from the user's balance
    - Although this model may sacrifice decentralisation, the enhanced usability might prove invaluable for mainstream adoption

The extension prototype supports MetaMask as the primary wallet provider, a non-custodial cryptocurrency wallet for managing digital assets and interacting with dApp protocols, because of its overwhelming public adoption exceeding tens of millions active monthly participants.

Extension-relay-blockchain interaction

The detriment of MetaMask's popularity are restrictive safety measures implemented to protect user assets, disabling communication between external extensions and the MetaMask wallet extension, effectively severing direct communication between the SeeState extension and its interface. Although this practical problem is present only in the current extension prototype, prioritising a showcase of platform capabilities and use case scenarios, this limitation imposes a critical bottleneck for platform functionality, requiring a temporary workaround through a relay webpage. Presently, any interaction utilizing MetaMask as either the transactional medium necessitates script injections into a relay webpage – the extension's background functionality injects code into designated relay website, exploiting MetaMask functionality indirectly; comparatively, accessed blockchain data is retrieved in a reverse process, first aggregated in the relay's structures and only then displayed within the extension interface. In other words, interaction is hindered by the obligation of an open relay website; disrupting frictionless communication, contradicting the expectation of direct transaction executions.

Any arbitrary webpage may be used for the information relay process, selected within the extension interface; preferably, an inactive tab may be delegated to remedy in relaying data between SeeState and MetaMask extensions. However, this ultimately presents a safety concern – website structures may track transactions and implemented functionality might modify data as a preemptive countermeasure to platform operation or for otherwise malicious purposes, either way an unacceptable implication for user sovereignty. As previously stated, a solution for this provisional interaction process must be constructed, integrating multiple alternative transaction pathways, facilitating flexible and reliable communication according to the project's fundamental aspirations of permissionless privacy, anonymity and autonomy. Relying exclusively on MetaMask, or any single wallet provider, introduces risks of alienating users uncomfortable or unaccustomed with contemporary blockchain interaction services; a diversified approach maximises both user security and platform accessibility, echoing the mantra of decentralization.

Minimum fees and flexible pricing

The deliberate imposition of demanded developer fees for every comment or point action is a design choice made to safeguard the platform against artificial and superficial behaviour, network congestion and external monetary influences. Unlike contemporary and traditional social media or communication platforms, where engagement may be conducted without financial restraints and the services are typically compensated by permissions to collect personal and behavioural user data, SeeState operates in a drastically different framework, where communication carries prerequisite economic weight mandatory to inscribe data into blockchain records. As previously established, requests for broadcasting comments and points require sufficient compensation of network computation through gas of variable quantity, depending on interactional function parameters, such as necessary blockspace or operational complexion, and situational parameters of network activity and average gas fees; any comment and point interaction is contractually obliged to also transfer cryptocurrency directly to the smart contract's address or get reverted if a minimum sum of developer fees is not sufficiently covered. The contract prescribes developer fees to be consistent for both mapped and emit-only comments, which differ in consequent network gas requirements; points should appropriately be priced cheaper, both to facilitate an environment of verifiable consensus and because of the narrower impact conducted through such interaction. The developer compensation is set to a symbolic nominal volume, invariant to the payload contents or text size, a marginal constant as the criteria for comment and point confirmation. The minimum developer fees, although different between channels to stimulate divergent behavioural dynamics, are of the magnitude comparable to cents, insignificantly increasing the total transaction price for ordinary participants, but collectively aggregating substantially to moderate protocol exploitation, cover operational costs and provide an incentive for developers. Developer prerogative of withdrawing accumulated funds allows for a self-sustainable revenue structure, avoiding subsidization of operation via advertisement, intrusive user data aggregation or external investment. This monetization model results in an apparent business-customer relationship between SeeState and its userbase; if utilisation gets unreasonably expensive or the platform is considered unreliable by technical or ethical standards, customers will organically migrate to alternative service providers, creating a direct avenue of accountability.

The smart contract's innate logic limits developer action to two activities – modifying the array of wallet addresses with administrative rights and adjusting minimum developer fees for both comment and point structures, with the only administrative privilege being the ability to interact with these specific functions. The flexibility of minimal developer fees depending on cryptocurrency market dynamics is paramount for maintaining a consistent equivalent of interaction value, especially critical due to the intrinsic volatility of price assessment in associated markets; unpredictable changes and spikes in exchange rates may effectively price users out of the conversation if developer compensation is not adapted accordingly or, in the opposite scenario, inflationary action may remove any economic barrier for undesired behaviour, invalidating the initial intention of such regulatory dynamics. However, this liberty introduces potential abuse and centralization concerns – excessive or even prohibitive pricing may be imposed through malicious exploitation of compensatory structures by compromised actors, making the platform invalid for its core use case. In mitigation of this issue, the contract defines a contingency mechanism which permanently disables any administrative access, rendering further fee modifications impossible; this irreversible final safeguard guarantees that, should the necessity arise, a complete transition into an immutable fee model may be enforced by disabling administrative rights to all wallets. In case inadequate integrity is displayed through administrative misconduct, it is recommended that users either connect to channels immune to such interventions or migrate platforms in collective protest.

Regardless, the fundamental reasoning and conceptual basis behind the architectural decision of developer fees is an intention to optimally deter widespread manipulational efforts, making such endeavours prohibitively expensive. The total transactional costs, accounting both gas and contractually defined developer fees, should be reasonably minimal, unnoticeable for any single genuine participant, even for users of impoverished economic backgrounds; contrarily, such expenses rapidly add up at scales of sustaining massive inauthentic interaction, discouraging botting, spam and propaganda. The increasing prevalence of automated artificial intelligence large language models presents an enormous risk to digital discourse, as entities exploit free engagement models to manipulate consensus through astroturfed discussion, conducting coordinated informational warfare aimed at influencing all domains of thought and behaviour; nominal interaction prices enact a measure of obstruction for such activity, as the associated financial barrier negates practical feasibility.

Querying data

Data storage and origin points

The data dynamics which follow successful content submissions are a perfect fit for the platform's aspirations of decentralized and transparent communication; once transactions are finalized and confirmed on-chain, the transmitted data propagates through multiple independent structures, ensuring flexible accessibility and providing users with querying functionality which balances efficiency and trustlessness. The original content is permanently embedded in the smart contract's state on the blockchain and consequently dispersed on secondary mediums, transcribed in node event log libraries, automatically referenced within subgraph indexing protocols and, in certain cases, stored within external off-chain databases. This layered approach to data storage guarantees immutability and public accessibility for content broadcast, a service directly paid for by participants, establishing different data retrieval origin points of varying technical properties and advantages, appropriately scalable as to accommodate a global userbase, immune against centralized interference or obstruction:

1. *Smart contract's state on the blockchain*

   Data in the smart contract's state is part of the canonical blockchain record, immutable and unmodifiable by definition, it is the absolute ground truth regarding comment authenticity, requiring no trust assumptions to verify comment validity. Retrieving data through the contract's read-only function calls returns complete structure information contained on requested maps queries, which may be done free-of-charge regardless of blockchain interface used. However, although information stored on-chain is categorically authoritative, all other data access mechanisms operate solely because of the computational inefficiency caused by inherent limitation of smart contract execution within the EVM node environments, making this data origin point impractical for excessive utilisation. Furthermore, public blockchain nodes may restrict access to bulk queries, requiring establishment of dedicated node providers or self-hosted infrastructure to perform extensive data retrieval and ensure scalability.

2. *Node event log libraries*

   The smart contract emits structured transaction events following successful interaction instances, logged within historical logbook records of blockchain nodes, publicly accessible from any full node by querying all transactions associated with specific function call occurrences. Unlike smart contract storage, data is not inherently appropriately categorized in node memories, requiring external analyzation, organization and filtering according to desired parameters, since all relevant raw event data is retrieved. The client-side computational overhead required for processing and extracting relevant event entries presents a substantial challenge for front-end efficiency, a scalability problem for this data origin point. Accessed data is typically as genuine as data retrieved directly from the smart contract's state.

3. *Indexed event logs*

   Node back-end infrastructure may optimize the querying of raw events, preparing event data based on predefined indexed variables, such as comment ID or commenting location, significantly reducing front-end filtering complexity as node servers manage computationally intensive querying processes. This hybrid model combines the credibility of on-chain events and practicality of outsourced data extraction, presenting a scalable solution for data access, although subject to node reliability constraints due to the required trust in the integrity of indexing implementations, creating a balance between performance and decentralization, although compromisation remains unlikely due to reputational repercussions indexing providers may suffer if trust if breached.

4. *Subgraph indexing protocol*

   Further accelerating and streamlining the retrieval process, transactions addressed to the smart contract are automatically recorded utilizing The Graph Protocol or similar indexing services, constructing organized off-chain queryable databases of associated events, allowing for nearly instantaneous and highly efficient data access capabilities without direct node communication or blockchain interaction. Such subgraphs are continuously synchronized with on-chain contract information, ensuring low latency

availability of structured content records, with exceptional flexibility in selecting the filtering parameters. However, despite the superiority in technical performance, the reliance on third-party indexing structures necessitates trust assumptions, since the data integrity is contingent on indexing provider reliability and might be compromised in extreme cases.

5. *Alternative off-chain databases*

   Although not yet implemented, in addition to blockchain indexing mechanisms or subgraph services, alternative third-party or community-driven storage solutions may maintain the ethos of decentralization, despite sacrificing the assumptions of trustlessness associated with blockchain-based interaction, completely relying on the honesty of such database operators. Although independent data libraries may be constructed for intentions of content curation, moderation or archival purposes, potentially valuable for enhancing the user experience, data accessed through these structures should be cross-validated against on-chain sources to ensure authenticity in mitigation of potential manipulation risks.

Consequently, the choice of the data origin point and query mechanism is contingent on a fundamental trade-off between trustlessness and efficiency; the blockchain and associated processes are not optimized for SeeState's use case, ensuring cryptographically verified certainty and authenticity for successful transactions, at the cost of computational demands and increased latencies; specialized off-chain structures are technically sophisticated for the platform's requirements, although their centralized infrastructure introduces risks associated with manipulation and censorship. Integrating methodology for cross-validating content accessed through off-chain means with sources of verifiable validity is essential to creating a tamper-proof interaction platform which balances public accessibility and decentralization, catering to both casual users or passive observers and to advanced participants prioritizing explicit advantages of the unconventional communication paradigm.

Table 2.
Advantages and characteristics of data storage structures

Data structure	***Origin***	***Credibility***	***Performance***	***Restrictions***
Smart contract	*Blockchain transactions*	*Absolute, canonically accurate data*	*Slow, computationally intensive*	*Requires connected node RPC endpoint*
Node event logs	*Node event log libraries of past transactions*	*Usually great, data compromisation unlikely*	*Slow, requiring front-end filtration*	*Requires connected node RPC endpoint*
Indexed events	*Node back-end off-chain indexing infrastructure*	*Good, reputational risks limit provider misuse*	*Fast, depending on back-end optimization*	*Requires connected node RPC endpoint*
Subgraphs	*Automatic off-chain event indexing on dedicated structures*	*Good, functionality is typically autonomous*	*Fastest, specialized for flexible and fast queries*	*Possible rate limits*
Alternative databases	*Third-party off-chain infrastructure*	*Worst, no guarantee of credibility*	*Varying, depending on endpoint*	*Varying*

Auditing authenticity

Although subgraph and node indexing offer impressive efficiency, the potential for data manipulation or compromisation introduced by off-chain computation presents a threat to the project's core principles. The hierarchical model of data structure trustworthiness is mandated by the inherent inability of any external actor to modify content – the superlative quality being trustless, requiring no assumptions about trust as a premise, as no one has any ability of constructive or destructive intervention upon information by design. However, some data access mechanisms have to sacrifice the benefit of trustlessness in favour of pragmatical efficiency since the decentralized blockchain functionality is not developed for the scales necessary to sustain a global communication platform. The outcome, a hybrid solution, considers both credibility and efficiency as equal priorities.

The auditing process relies on cross-verifying data accessed from hierarchically low validity sources with data stored in trustless and tamper-proof structures. The smart contract's state can be considered the most authoritative version of canonical information, with all content being permanent and cryptographically signed; node event libraries may be regarded as of comparable credibility, consisting of information parallel with on-chain content. Any information retrieved from other data structures, along with associated metadata, may be cross-examined with on-chain records or node histories, balancing performance or latency, an interactional priority for any average user, with solid cryptographic proofs of authenticity. Considering the low likelihood of identical manipulation conducted upon data in more than a single structure, successful audits may be carried out even with separate independent unreliable databases, in case verification speed is imperative.

Node providers

Blockchain nodes act as distributed network participants, responsible for maintaining the decentralized integrity of on-chain data; they serve as communicational intermediaries between users and the blockchain, relaying transaction requests, retrieving data and processing smart contract interactions, compensated with gas for their computational efforts. Any blockchain network is only as resistant to centralized intervention as decentralized and diverse the underlying node network is; blockchain data is determined by a consensus process between connected nodes, meaning that no single node may individually alter the canonical credibility of stored information. User generally utilize commercial RPC node endpoints to access the blockchain, although the distinguishing feature and perceived advantage of blockchain networks is the inability of such popular node providers to monopolize interaction or impose censorship, as any single person may connect their own node to the blockchain and observe the unfiltered raw data, circumventing any possibility of manipulation by malicious actors or mediators. Although hardcoded to communicate with MetaMask's RPC endpoint in the prototype stage, SeeState embraces this step into complete decentralization and permissionless interaction by making unrestricted node customization an imperative future implementation, additionally developing dedicated software necessary to streamline independent node deployment.

The flexibility enabled by granting users with direct control over their preferred node configuration is an immense design advantage, invaluable for data integrity considerations and performance optimization. Public RPC nodes often implement request rate limits, detrimental to the ideal of global high-frequency interaction, making dedicated or self-hosted nodes mandatory for platform operation. Furthermore, dynamic alternation between nodes combats potential outage-related issues, bypassing a critical vulnerability traditional server-based communication services encounter regularly, guaranteeing continuous availability, even in case individual node providers experience downtime or geopolitical restriction. Different node providers may exhibit varying levels of efficiency based on hardware capabilities or network latencies; users may select and alternate between node endpoints depending on situational parameters and capacities. Alternatively, some providers may desert the ideal of neutrality, preemptively filtering out data and obstructing free access to transactional records, either due to personal motivation or legislative compliance; in any scenario, such situations present no threat to stable platform functionality if an appropriate network of safe nodes is presented to mediate network throughput.

Sorting comments

The platform serves as a neutral conduit of information and the resulting approach to displaying retrieved content must reflect that stance; preserving objectivity in content evaluation presents a challenge due to the inherent requirement of front-end algorithms for ranking comments by fair criteria. The comment sorting algorithms must ensure visibility, remain resistant to bias, while simultaneously adapting to user behaviour dynamics. SeeState takes the stance of providing entirely deterministic and mathematically verifiable sorting mechanisms, agnostic to content semantics, avoiding any subjective moderation criteria by definition, delegating advanced ranking functionality to third-party sorting algorithm integrations. Implemented sorting criteria are entirely transparent, utilising fundamental characteristics; comments may be objectively sorted by:

- *Recent, chronologically by their transaction timestamp*
    - The smart contract automatically assigns a timestamp to each comment structure as metadata, most recent submissions are displayed first
    - Preferable for participation on saturated locations or active discussions, providing visibility by prioritizing latest contributions, although vulnerable to spam and botting
- *Popular, number of associated points*
    - Ordering content through cumulative consensus by total points awarded
    - Effectively filtering out irrelevant contributions due to each point requiring a minor financial contribution, providing insight to real community sentiment
    - Impractical for cross-channel evaluation due to differing prices of point transactions
- *Value, financial equivalent required for transaction*
    - Organization of content by total monetary investment required for the original comment and all associated point transactions at their respective moments of interaction, presented in a fiat equivalent
    - Standardization of sorting criteria is invaluable for ranking comments retrieved from an aggregate of separate channels

Furthermore, alternative or advanced content curation and evaluation algorithms may be implemented by third-parties; although potentially necessitating back-end support from dedicated services, algorithms utilising identification of artificial interaction patterns, semantic analyses, content blacklists or external criteria ranking algorithms may be integral in public adoption. Although the open platform infrastructure should invite independent development and enhancement through supplementary features, the default paradigms for content organization should remain objective and robust by design, creating a bottom line of transparency in line with the project's ethos of trustless and permissionless communication.

Practical application

Commentary

The most apparent and primary application of the SeeState platform, and a direct demonstration of its ambition, is to provide users with agency of expressing and practicing unrestricted commentary on any webpage, rendering a universally accessible discussion superimposed upon the entire internet. Individuals may leave any impression, opinion, praise, criticism or other in an open forum that coexists alongside the internet, not requiring absolutely any infrastructural integration from the webpages themselves; on the contrary, thriving in the informational environment without boundaries imposed by central authorities, moderators or censorship. Although the transaction-based interaction premise comes at the cost of slower public adoption, it might serve as a practical deterrent to spam or mass produced and artificially generated content, nurturing unprecedented virtual human honesty and authenticity, with free-of-charge ephemeral Limbo comments remedying public adoption efforts. There is no precedent for such liberated discourse and it is not inconceivable that websites, particularly those seeking to curate a certain public image, might fiercely oppose such external commentary being displayed to visitors, yet they have minimal leverage to remove content that exists as a permanent record on the blockchain. Ultimately, the promise of this project lays on a philosophy which considers freedom of speech a fundamental primacy and a societal imperative, regardless of content or context.

Anonymous chat rooms

Secondary functionality emerges from the underlying logic which governs content assignment to string locations; users may specify custom string identifiers which serve as stand-alone locations, independent of any conventionally canonical web address. This capacity constructs persistent chat rooms, each anchored in arbitrary textual handles, creating spaces for either public or private exchange. In the case participants prefer confidentiality, any comment message may be encrypted through symmetrical keys prior to submission and any group may initiate in intimate and secret conversations by obscuring the message content in a collectively shared selected cipher key; alternatively, messages might be asymmetrically encrypted with the recipient's public wallet key, ensuring the holder of the corresponding private key with an exclusive right to decipher the content. This alternative platform use case creates an entirely novel dynamic for real-time unmoderated virtual communication in which users remain pseudonymous by definition, although true anonymity may be enabled through appropriately sterile cryptocurrency wallets with no identity-revealing history. The ramifications of such propositions are controversial, in character of any such service which guarantees privacy or confidentiality to customers; a moral high-ground may easily be established for both supporters of unrestricted speech, claiming that such communication conduits serve as a lifeline to victims of political and corporate tyranny, and those arguing that potential malicious action outweighs the personal right to absolute privacy, referencing criminal organisations or countless examples of nefarious behaviour; it is essential to accept the fact that society rests on individual accountability, and anonymity may stifle such responsibility, but it is comparably malicious to restrict the right to anonymous communication for the innocent majority in combating hypothetical examples of misuse. The platform creator's stance on the issue is clear; SeeState architecture defines a framework which can not interfere with user action, where moderation is conducted through organic user ethics or external legal structures in extreme cases.

Decentralized data storage

Embedding textual data in blockchain transactions creates a robust and permanent archive of submitted material that might otherwise face censorship or deletion. Users interested in preserving volumes of valuable information, literature, academic papers or public records may utilize integrated functionality as a direct tamper-proof medium for permanently broadcasting data immutably, impervious to political, corporate or infrastructural corruption. If appropriate optimisation is done to the smart contract to truly minimize required gas, large quantities of data may be stored on the decentralized ledger, creating a public library of knowledge and information, freely accessible through either the platform or any adequate node provider, agnostic to the observer's nature, location or alignment. Furthermore, leveraging custom location strings and sorting filters in a systematic manner may effectively enable hosting of entire journals, novel news outlets or blogs, structured through comment identifiers, location handles and logically organized indexing, transcending traditional hosting dependencies, takedown requests, server outages or domain seizures. Although this technical possibility remains encumbered by the complexity of the medium, the allure of underground self-publication and censorship immunity may raise an entire ecosystem of intertwined content or third-party aggregators remedying the discoverability gap, while preserving the ethos of authenticity and anonymity. Valid intellectual property concerns may be raised; however, SeeState merely serves to simplify a process presently existent and possible, as data may already be transmitted to the blockchain laissez-faire, although inconvenient for any practical retrieval or queries.

Advertisement and reviews

Although the unrestricted freedom of expression remains the project's philosophical cornerstone, the dynamics enabled through the platform's architecture create extensive commercial opportunities; the frictionless capacity to comment on any webpage invites individuals, entrepreneurs, businesses and even corporations to reimagine how they advertise their products or services. Instead of paying for conventional sponsored content, entities might broadcast promotional messages or announcements on relevant web pages or directly on competitor web stores, convincing customers through either competitive prices or product quality, circumventing regular marketing services and evading potential removal. Conversely, consumers gain the power to share product reviews or experiences beyond the scope of any conventional platform, holding corporations liable, regardless of official marketing narratives, in an unfiltered venue of free communication. As the perceived benefit of such guerilla

marketing channels grows, an equilibrium may be established between product advertisements and reviews; sustaining promotional en masse spam at such a scale, saturating prime web locations, gets as prohibitively expensive as genuine platform usage advances since consumers may directly criticize any dishonest promotional efforts. Although scenarios of corporate sabotage may be speculated, this system might revolutionize the digital marketing domain, encouraging genuinely useful and transparent product information instead of manipulative targeted advertisement, in the face of explicit public backlash and accountability.

Passive observation

Individuals may prefer to remain purely passive consumers of information through the SeeState platform, accessing an unmoderated global conversation, but never interacting, akin to a universal reading interface overlaid on internet webpages. Browsing the internet with the extension active provides users with real-time insight into present discussions or previous commentary, with potential visual cues notifying the user of available content, streamlining the process. Complete transparency is created by enabling flexibility in node selection or data retrieval methodology, establishing a robust and adaptable dynamic, further decentralizing the system in mitigation of database corruptions or failures. Readers are guaranteed access to any submitted data and may witness an authentic snapshot of collective sentiment and activity; facilitated through free-of-charge content audits which can be executed either directly through the extension, or through any third party blockchain interface connected to the channel's native protocol. Although the barrier of entry created by the payment model might give rise to an environment where many listen but few speak, an imperative of truly minimal fees and user-friendly transaction methods must be established to encourage heterogeneous discussion.

Humanitarian activity

The ultimate ideal of the SeeState platform is to liberate the oppressed and censored, in times of rising authoritarianism and techno-feudalistic centralization; as a culmination beyond the previous examples of practical application, the platform may serve as a safe haven where victims may broadcast information, seek relief efforts, coordinate or maintain testimonies in the irrefutable blockchain record, which may stand witness to resilience when other methods of resistance fail. For these reasons, it is crucial for the platform to provide absolute safety and unquestioned anonymity to users, even in the face of valid criticism. The embrace of decentralization also allows users to directly transfer cryptocurrency with each other, mutually identified through wallet addresses; future development should prioritize such solid use case scenarios presented to users in appropriately friendly and understandable interfaces, simplifying the innate perplexity of blockchain, instead of a paradigm focused on profit maximisation. Furthermore, due to relatively low costs required to sustain the platform, leveraging decentralization instead of pricey centralized server services, the profit surplus may also be used to aid in humanitarian and philanthropic activity. An adequate development and popularisation of the platform, although burdened with delicate moral complexity, may be a lifeline to the Assanges of the future, to those struggling under oppressive government regimes and to any who otherwise would not dare to speak publicly.

Anticipated user behaviour

Aside from the multitude of explicitly mentioned examples of practical use cases, the unconventional platform dynamics will establish a diverging pattern of human behaviour compared to contemporary social media or comment-thread platforms, influenced by the transaction-based interaction system, a universally available interface and the absence of top-down moderation capabilities. One predictable tendency is the emergence of interaction hotspots on home pages and popular webpage URL addresses, which regularly generate traffic and attract considerable attention; given the continual influx of visitors, a considerable portion can be expected to inspect or contribute to the overlaid conversation, aggregating volumes of relevant commentary and content. Parallelly, channel selection can be anticipated in consideration to associated parameters such as gas prices, transaction confirmation latencies and network throughput; users will naturally coalesce around channels promising cost-efficiency and rapid transaction settlement, although particular users may prioritize network decentralization, gravitating towards networks that displayed stability and longevity, regardless of potentially

increased fees. Over time, channels might organically acquire cultural identities and reputation, distinguished not only by technical traits, but also by the type of user groups attracted or the style of dialogue nurtured; in a manner reminiscent of the formative era of internet message boards, communities and subcultures might adopt specific channels as the principal avenue of communication.

Another phenomenon may arise as the consequence of content primarily being available overlaid onto conventional webpages, with content assigned to alternative strings being accessible only through the knowledge of esoteric custom string handlers; since users may internally link string locations or unique comment identifiers in the comment text, as well as external URL links, some comments may be used as de facto content directories, curating libraries of comments, illuminating obscured information and creating a true network of data. Furthermore, third-party aggregator applications or websites might serve similar purposes, streamlining content access for both the average user and the avid contributor.

Lastly, in an effort to facilitate truly unrestricted traffic and interaction, without any transactional requirements, the implementation of Limbo comments may be paramount – an ephemeral alternative for content which is temporarily hosted and separately displayed in the interface. Enabling such interaction removes any barrier of interaction to users, inviting a fundamentally different dynamic of user behaviour; participants who may merely seek the catharsis of expressing trivial commentary and outbursts of frustration or praise, may experience the satisfaction of expressional impulses psychologically relieved without immortalizing the content permanently on-chain, providing a seamless user experience while decongesting the network. Furthermore, such surrogates may enhance the civility and relevance of permanent threads, since an anonymous expression of immediate remarks is enabled, potentially significantly limiting the volume of immutable hateful or illicit content in immutable blockchain records. Although this substitution channel may require an alternative regulatory content-aware approach due to its hosted nature, it is a necessary intervention for nurturing a healthy informational ecosystem.

Practical problems

Extension removal or ban

Despite the project's emphasis on independence from centralized authorities, the most direct threat to public SeeState adoption is, ironically, potential removal of the program from mainstream browser extension repositories. If the platform gets interpreted as dangerous by corporate conglomerates and governing authorities or deemed undesired by the host of the extension package, modifications to the fundamentals of the platform might be requested, although straightforward delisting and deletion should be expected. It is extremely important to emphasize – SeeState does not host any content; it is exclusively an interface for broadcasting and accessing immutable blockchain data on the deployed smart contract protocol, information accessible through any node provider or third-party blockchain interface. Regardless, although not an immediate issue, project developers should not expect reason or technological literacy from neither users nor regulatory bodies and alternative methods of activating the extension interface should preemptively be developed. In case of such takedowns, adoption is slightly hindered, although interaction through secondary blockchain interfaces continues to be possible and previously submitted data remains safely stored on the blockchain, which underlines a vital distinction between the extension interface and the permanent smart contract logic. To counteract such obstruction, the extension must be downloadable through official web platforms or resilient mirror sites, independent peer-to-peer distribution must be enabled and package installers must seamlessly integrate the extension into browsers with minimal user intervention; coupled with the potential to alternate between node provides or self-host nodes, the user community would be equipped with the capacity to circumvent abrupt bans or censorship. Nonetheless, no matter how robust the fallback methods which are conceived, removal of the extension remains a hazard for essential visibility, convenience and credibility, ultimately, being a paradoxical testament to the project’s core idea.

User identification risks

The platform supports user pseudonymity by default – content is only truly linked to cryptocurrency wallet addresses; and although users may achieve partial anonymity through sterile wallets without any KYC associations, complete anonymity is hindered by a system of alternative metadata integral to the internet experience, exploitable for user identification. For example, users may enable invasive trackers in the same browser session, conventional ISP metadata could be used to correlate user IP addresses and transaction timestamps, previous cryptocurrency wallet activity may betray user identity, scarce platform usage may make identity reveal a probabilistic certainty and an array of similar scenarios can be conceptualized. The unsettling reality is that, regardless of the best efforts of the platform, other layers of virtual interaction may leak user identity and mitigating these vulnerabilities gets exponentially harder with popular platform adoption due to the attraction of technologically illiterate or privacy disinterested masses and ever-increasing edge cases; potentially deceiving users with the practically unattainable promise of anonymity. However, a dual paradigm to anonymity may be maladaptive – any anonymity is better than none and, after all, a rigorous approach to security and intelligent anticipation of user behaviour may equip the platform with an apparatus of anonymity-preserving operational mechanisms for those who demand such measures. For instance, users might be protected through internally generated burner wallets or non-custodial wallets, through transactions executed through secondary relay wallets or implementing specialized firewalls and utilising rotating VPN proxies, among others; depicting an arms race of privacy and anonymity, dynamically combating conventional metadata aggregation and surveillance methodology.

Illicit content

The imperative of anonymity and refusal to impose top-down moderation or censorship inevitably attract a spectre of sensitive or socially objectionable material, hateful rhetoric or commentary, illegally shared intellectually protected content and links to websites with prohibited explicit content or criminal essence. Consequently, a potential for social blacklisting is present, in case negatively perceived content rapidly migrates to the platform, media narratives may shape the reputation of SeeState as a communicational sanctuary of political extremist or criminals, conflicting with the right to be forgotten even in benign scenarios, discouraging legitimate usage. However, a valid argument can be made – such data may be immutably stored on the blockchain regardless of the SeeState smart contract and its browser interface; from the project's vantage point, the legal and moral burden of regulation is delegated to responsible legal authorities and the broader societal ecosystem; the platform serves as a neutral conduit of information and the base principle of the protocol logic makes policing submitted or accessed content practically impossible. Regardless, the platform may structurally deter such content as the permanent nature of blockchain records potentially exposes serious offenders to legal or reputational risks by broadcasting unlawful content on an immutable ledger, for example, publicly distributing domains containing explicit or illicit material exposes them to domain seizures and legal repercussions. Nonetheless, the platform, as an interface for a decentralized protocol, cannot interfere with content by definition, nor should it be required to do such action; however, although default platform mechanisms for content access and sorting remain exclusively neutral and content-agnostic, non-invasive third-party retrieval algorithms or specialized community-driven filters for content curation and blacklisting are invited and may be integrated as optional client-side measures, providing functional soft moderation processes which do not erase data from the blockchain, but reduce visibility within select user interfaces. Finally, although critics may consider it morally irresponsible, as with any discussion including free speech absolutism, SeeState limits its liability through a realistic, clear and unapologetic disclaimer – as a service which hosts no content and neutrally relays information between users and the blockchain, the platform is not accountable for any content broadcast and accessed or any consequential user behaviour; the burden of legal and moral responsibility for any misused liberty lays exclusively on the culprits.

The incomprehensible blockchain

The default SeeState architecture demands participants possess or acquire cryptocurrency to interact through a technology which remains cryptic to a significant portion of potential users. Although advanced participants may be comfortable with wallet address setup, gas prices and selecting suitable blockchain channels,

most contributors would presumably find the process overwhelmingly confusing, deterring a significant portion of the userbase, creating a limited demographic of select users. Mainstream adoption primarily depends on meticulously streamlining any intricacies related to the technology and removing the perceived barrier of entry related to the baffling complexities of transaction-based interaction; if the userbase population gets significantly selective, a risk of ideological echo chambers emerges and the sustainability and survival of the platform can rightfully be questioned. Although accessing previous content remains straightforward, addressing these concerns involves constructing a user-focused interface, primarily for a global audience and not just the blockchain enthusiast; alternative methods of submitting content, such as long-lasting minimal fiat deposits covering background microtransactions or even plain off-chain comments which other users may promote to a permanent on-chain status, such as Limbo comments, may be required to bridge the gap between user knowledge and the innate complexities of the blockchain technology, worsened by the price volatility and the stigmatizations brought upon cryptocurrencies through a history of speculative excess, fraudulent schemes, and dubious ventures that often overshadow the field's legitimate innovations. Creating a seamless user-friendly experience is imperative for the project, however, educational and promotional efforts will be necessary to broaden the platform's appeal beyond technologically advanced communities.

Unforeseen consequences

The behaviour emergent of novel and transformative technologies usually defies prior assumptions and postulating grand predictions about usage dynamics would be futile; any project with ambitions of such scales should be prepared for flexibility and perseverance in the face of unanticipated outcomes. Projects with such emancipatory potential should also acknowledge the definite unpredictability of collective human behaviour, paired with liberties beyond the platform's scope of control. It is perceivable that the project falls on deaf ears, with the transaction-based interaction being an insurmountable step for the average user of conventional contemporary communication media. However, a scenario can be conceived in which persistent adaptation and development of the platform, its transaction mechanisms and safety barriers, spearheads steady adoption for either niche communities or the global public, encouraged through novelty, curiosity or a legitimisation of its liberating use cases. In case a critical mass of users emerges, SeeState will likely find itself at the centre of ideological battles, with the outcome of tensions depending on variables which would be unreasonable to presume at this time. In the alternative scenario, a prototype of the platform might lay undisturbed and forgotten in mainstream browser extension repositories. In any case, the unpredictability of outcomes is underlined by the lack of existent precedents or previous platforms undertaking such endeavours, either proving a stronger potential for establishment in a market without competitors or implicating unsuccessful efforts for public adoption. Finally, it should be noted that a completely perverse result is possible and the platform provides a venue for massive propaganda and obstruction of truth, despite its architecture designed to cultivate a limitless global conversation through user autonomy, alienating authentic users and attracting engineers of exploitative social strategies, spreading political or corporate disinformation at unforeseen scales. In extreme cases, a vigilant developer and user community must maintain the willingness for forked or alternative implementations.

Future improvements

Limbo comments

A forthcoming feature among the prospective updates not yet implemented in the prototype, and arguably the most transformative, Limbo comments stand out as a critical innovation for expanding SeeState's accessibility, allowing users to publish content without any attached fees, which expire and disappear after a predetermined interval. In essence, a hybrid dynamic is created between ephemeral commentary and permanent data as any sponsor may promote a Limbo comment to a permanent on-chain status through covering the required transaction fees, enabling a truly unlimited global conversation and immutable records of content considered valuable by the community. This function serves not only as an onboarding funnel for new users and sceptics, acknowledging the

barrier introduced by a transaction-based interaction model and circumventing any friction for initial engagement, but also as a solution for multiple overarching practical problems. Anyone may use the development as they please, as a channel for communicating casual observation, endorsements or transmitting data; however, participants seeking a relieve of encapsulated frustration through public expression, either containing hateful remarks or regarding controversial topics, may use this mechanism as a venue for impulsive commentary, containing such content to a temporary context without excessively crowding the blockchain or congesting the network, effectively moderating which content gets permanently recorded on the ledger. As previously stated, in the case a submission is considered sufficiently valuable it may be effectively crowd-funded and stored on-chain; alternatively, the comment permanently disappears after the universal time period presumed reasonable and fair. The self-cleansing function introduces an invaluable process for an environment which defies standard moderation techniques, although subjecting the platform to a different regulatory paradigm or legal hurdles, especially if such content is server-hosted during its lifecycle. Furthermore, such interaction is at increased risk of persistent unauthentic content due to not incurring any immediate transaction fees; in combating such behaviour implementing minimal captchas or rate limits may be required. Overall, the integration of Limbo comments will enable the accommodation of an inclusive conversation and establish an universally accessible platform, implementing a self-regulatory mechanism while achieving a convenient user experience; and although malicious actors may thrive in the newfound freedom, the actions of agitators attracted to the technological novelty are likely to diminish as the imposing impression of the technology settles and as the appropriate use case is discovered through public adoption.

Alternative transaction methods

Despite the, arguably, trivial transaction requirements in which minimal fees regulate unmoderatable communication, the payment process for every single interaction instance might be psychologically discouraging to a mainstream userbase accustomed to an instant and supposably chargeless communication dynamic, in which case compensation occurs through providing platforms with arrays of psychometric and behavioural data resold to data brokers of suspicious intentions. In recognition of this logistical barrier, multiple alternative financial transaction methods merit consideration, namely, direct fiat deposits and cryptocurrency deposits into integrated non-custodial wallets. In case the fiat deposit approach is preferred, users may bring a fiat balance into association with their account, transferring a minimal sum of traditional currencies through conventional transaction methods; unfortunately, reintroducing a partial reliance on traditional banking systems, potentially subjecting the platform to further regulatory or compliance obligations. Such fiat deposits would sufficiently cover background microtransactions necessary for this communication model, potentially inciting contract interaction from a designated centralized SeeState wallet address or another method of embedding content permanently into the blockchain. Alternatively, a direct integration of non-custodial wallets may be favoured, enabling users to bypass any external complexities, signing the smart contract transaction containing the payload directly from the extension interface; moreover, such development may also enable the creation of temporary burner wallets, as well as facilitate immediate user-to-user fund exchanges; although, merging wallet functionalities intensifies security requirements as any vulnerabilities in the system threaten the participating userbase. These scenarios, combined with the option of aforementioned free-of-charge Limbo comments, reasonably bridge the logistic and semantic gap between the platform's model and unaccustomed users or sceptics, presumably alleviating the innate friction introduced through mandatory cryptocurrency transactions. Overall, these additions aim to reconcile the tension between a technically-demanding decentralized process and conventional expectations, not negating the transaction-based model entirely, but presenting it in forms intuitive to a broad audience, without fatally compromising the trustless promise of the project.

Dynamic channel deployment

Advanced users already have the agency of changing the node provider or modifying the RPC endpoint used to access on-chain data; however, as the culmination of decentralization, the potential of autonomous channel deployment emerges. The coverage provided through developer-deployed channels, although extensive and diverse enough for any average user, may not be sufficient for all communication cases; enabling independent

channel deployment, either on existent networks or locally hosted blockchain networks, establishes an ideal of user sovereignty – any avid participant should be able to adjust the relevant parameters to the extent of connecting with private EVM compatible blockchain networks, with the deployment process being abstracted to the simplest necessary processes. The possibility of temporary, completely private communication channels is established, obscured to anyone without the knowledge of specific parameters which enable connection and undesired intrusion.

An alternative deployment dynamic originates from the developer's prerogative – the active smart contract logic may prove unsustainable, logically vulnerable or otherwise unpractical, in which case the deployment of advanced channels may be vital. If such adaptation is requisite, currently deployed channels will remain accessible in the form of legacy channels, with channels containing advanced logic being parallelly accessible and selection dependent on user preference. This approach eliminates developer monopoly on the officiality of channels, shifting the imperative to a collective consensus based on public endorsement of stability, sustainability or novel features.

Third-party development

As an ecosystem, by definition, denotes competition and adaptation; the platform should also nurture a healthy ecosystem by enabling external development of functionalities, which may be selected as optional client-side measures for content access or sorting; there is no guarantee that a central developer team may truly understand the demands of a global userbase, and to expand on the integral idea of decentralization, alternative third-party functionality should be implementable in user interfaces. A marketplace of content-curative algorithms and heuristics might ensue, ranging from semantic or sentiment analyses, alternative off-chain voting mechanisms or community-driven content blacklists, adjusting the user experience according to specific requirements. Furthermore, entirely new use cases might be created by allowing residence to relevant third-party applications in the extension interface, which may either harness a part of the SeeState on-chain or off-chain processes or may otherwise be relevant to the fundamental ambition of the platform; for example, visualising branching transaction trees directly in the extension interface, aiding in identification of unauthentic wallets through their transaction history or association with other wallet addresses. An open-source paradigm should be evaluated as to attract the germination of external ideas and development, although prospective improvement may both broaden the platform's appeal and create regulatory constraints; naming the ongoing tension between liberty and the human desire for control as the central narrative of the project's developmental process.

Disclaimers and conclusion

An author's note of complete honesty and transparency, hopefully paving the way for an equally virtuous development – my educational background is in general psychology and I have no formal or professional experience in software engineering; however, my passion for this project guided by my belief in personal privacy and autonomy has inspired me to establish the functioning prototype version by myself, greatly aided by, ironically, the assistance of the same large language models the platform aim to combat. Although the SeeState prototype is rudimentary in design, it serves as a conceptual demonstration of the platform's communicational capacities, displaying most aforementioned functionality; however, public adoption prerequisites drastic refinement of the user interface, streamlining any relevant processes and decisions, and optimisation to the smart contract's logic by committed and passionate contributors.

Developmental efforts must be focused to, first and foremost, relieving the innate complexities associated with cryptocurrency transaction, the one main hindrance to any dApp project, especially one with ambitions to change global digital discourse. Although unrestricted available content and the implementation of temporarily hosted Limbo comments may create a participation funnel for reluctant users, the intended use case demands an adequate understanding of the underlying technology, at least regarding acquiring and spending cryptocurrency, even though such restrictions may be circumvented through alternative transaction mechanisms such as fiat deposits. Appropriate anticipation of user behaviour and simplification of the interaction experience is imperative to project success, minimizing alienation of the unaccustomed public through an intuitive interface and potential

sacrifices to the dogma of decentralization, while providing flexibility in supplementary functionality to advanced users. The scarcity of projects which exploit the advantages of blockchain are a result of an inherent association of cryptocurrencies with financial investments, although it also indicates the infancy of the ecosystem; solid practical use cases, such as those established by this platform, may excel the public enthusiasm for adoption. Alternatively, in the case SeeState completely precedes relevant blockchain systems, a substantial advantage is shaped by establishing a structure conceptually and technically equipped to embrace novel blockchain development.

In conclusion, this platform offers unprecedented liberty to online commentary, utilizing the permanence and public accessibility of blockchain records to create an innovative domain of permissionless and trustless communication, with an obvious practical obstruction of innate cryptocurrency transactions requirements. The platform acts as a neutral conduit of information between users and blockchain data, indifferent to content or intentions, in a paradigm of decentralization which prioritizes authenticity and obstructs artificial behaviour and propaganda, galvanized by recent technological developments in artificial intelligence. The conversation which may be overlaid on all webpages might alter the conventional digital landscape through its multitude of use cases, ranging from plain public commentary, advertisement and reviews, immutable data storage, to advanced scenarios, such as deploying entirely private communication channels; although extensive in potential to completely modify internet interaction dynamics, the scale of impact cannot be assessed accurately due to the absence of any comparable precedent.