PROJECT PAI

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EXECUTIVE SUMMARY

The cornerstone of artificial intelligence (AI) is the ability to make highly competent, humanistic decisions that successfully pass the Turing test [1]. In the last decade, we've seen rapid advancement of strong, sophisticated AI machines in a variety of industries; the autonomous vehicle industry is delivering a new transportation economy; Alphabet's AlphaGO has toppled the best Go board players in the world; neural networks like IBM Watson learn and process vast amounts of information at unimaginable paces. The peak of artificial intelligence is almost here, but

> **" THE PEAK OF ARTIFICIAL INTELLIGENCE IS ALREADY HERE. "**

with several limitations: current AI is only developed for a narrow, task-specific domains, is prohibitively resource-intensive, and thus is heavily influenced by and for the interests of a select number of industry leaders. For these reasons Project PAI is developing an open-source blockchain protocol to decentralize AI development for everyone. The foundation for an interoperable AI blockchain starts from the ground up firstly with creating AI for the individual.

This paper presents a utility network coin for using PAI, the world's first Personal AI (PAI), a 3D intelligent avatar designed to look like you, speak like you, and behave like you in the digital space. A person's PAI is directly owned and managed by the original user, who can be compensated for deploying their PAI online, creating a new AI economy. The unique, AI blockchain protocol enables the decentralization of PAI and contains many layers: authentication, network, storage, and AI. The PAI Network is a decentralized platform built from the protocol, and acts as an avatar repository and foundation for decentralized applications to use PAI in everyday life. As the AI economy grows, the blockchain protocol will be able to be used for purposes beyond PAI and other general broad-domain AI development.

A two-level currency structure maintains a user-friendly and consumer-facing use of PAI in mainstream culture. PAIcoins interact directly with the PAI Network, while credits are used within decentralized applications.

INTRODUCTION

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> **THE FOUNDATIONAL IDEA OF HUMANISTIC COMPUTING IS THAT PROVENANCE IS VALUABLE. INFORMATION IS PEOPLE IN DISGUISE, AND PEOPLE OUGHT TO BE PAID FOR VALUE THEY CONTRIBUTE THAT CAN BE SENT OR STORED ON A DIGITAL NETWORK.**
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> "
>
> **- JARON LANIER, WHO OWNS THE FUTURE?** [2]

Our entire lives exist in the digital world; our finances, social activity, and even behavioral traits. Wherever we go online, we leave behind a trail of data that corporations use to build our digital profiles and plug into AI algorithms that improve their services for us. The more we engage in their experiences, the better they can personalize our needs and retain us as loyal users.

Although this may seem advantageous, we need to realize that our digital profiles are now complex enough to build an accurate model of our real-world behavior — they are our real-world selves in disguise that are wholly owned by corporations. Currently our profiles exist in legacy data formats that have changed very little beyond traditional identities (e.g., passport IDs and bank account numbers). But enriched with AI through data such as our social interactions, we have the potential to introduce cognitive capability into our digital profiles.

Now imagine that our digital profiles are able to think and speak, born from the online personality patterns tied directly to ourselves. We add three-dimensionality to our intelligent profiles and turn them into 3D avatars; intelligent agents that have our personality and likeness that we command knowing that it is a trusted representative of our true identity. There are endless possibilities for us to use our intelligent agents anywhere in the digital space. But as it stands right now, companies build complex AI from our interactions on their platforms and monetize them through focused advertisements and search results; these corporations get all the associated benefits and revenue while we who provide the source for the profiles get limited access and no means to readily utilize them for our own needs and at our discretion.

We can build a new type of distribution platform to bring back value for the contributor and decentralize the way we use AI. It is a platform that inherits the best qualities of online experiences and efficient AI technologies, but begins with us, the individual contributor, as the center of the design. Each of us has an enormous volume of digital assets that can be refined with artificial intelligence to support a new type of digital economic system, an *Artificial Intelligence Economy*. In this humanistic platform, every person's AI asset is a node on a network, where these nodes cooperate with each other to build up value and are compensated for their actions. The higher the contribution to the network, the greater the compensation. It is an AI economy that is built by the people, for the people, with the people.

> "
> **A HUMANISTIC PLATFORM COULD ALLOW US TO CREATE OUR OWN COMPREHENSIVE DIGITAL PROFILES.**
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Right now the complexity of AI renders it inaccessible to a broader audience, and results in AI that is designed top-down to the benefit of the corporations who fund these initiatives. Project PAI is instead building the AI economy from the bottom up, starting with the everyday individual to empower them to be part of a collective AI community. From that seed, the platform can scale and help to solve the world's biggest problems.

And by tying artificial intelligence to our digital profiles, we breathe life into our personal information and turn them into our very own three-dimensional avatars; avatars that depict our likeness and voice, and can perform tasks as our representative in the AI economy. They are verified within a decentralized network as proof of acting upon our behalf and empower our online activity. Our intelligent digital assets can be collectively summed up as *Personal Artificial Intelligence (PAI)* — profiles that have the ability go out and tell the stories of our lives in our own words, in our own likeness and voice, and interact with the world on our behalf.

We foresee the impact of integrated AI, and we will aim to harness the next great technological watershed moment in human history. Project PAI believes that the new age of the AI economy has arrived, and can be realized by first celebrating the individual.

PROJECT PAI TERMINOLOGY

Digital Profiles
Any form of personal identifier that can be contributed to the creation or improvement of a PAI. Some examples include: biometric, voice capture, facial recognition, semantics, social activity, and even personality.

PAI
The Personal Artificial Intelligence (PAI) is a 3D digital twin avatar that looks, talks, and behaves uniquely like the original human. The identity can be verified as true to the owner of the PAI, and be given duties to act on behalf of the owner as a delegated representative. The PAI is always improving through the accumulation of interactions and contributions from the owner and other users on the platform. (e.g. The owner may only speak English, but his or her PAI may speak Chinese, automatically learning from the collection of Chinese-speaking users.)

PAI Network
A decentralized platform upon which decentralized applications utilizing PAI can be built. A user's PAI can be created, stored, and deployed upon the platform onto any decentralized application, controlled discreetly at the owner's discretion.

AI Economy
An artificial intelligence-driven economy built upon the PAI Network, where PAI intelligently exchange goods and services for a new model of transaction reducing the reliance upon trusted entities.

Applications
Decentralized applications (PAI App) built upon the PAI Network. These applications span across the personal information economy i.e. social networking, healthcare, education, and other personalized products and services. Applications utilize PAI as the core functionality for the experience; this couples with consumer-facing currency generalized as Credits.

Authenticator
Anyone who offers human labor to verify and confirm changes that have taken place within the PAI Network. E.g. CAPTCHA uses tests only humans can grade and pass. Tasks able to be performed on mobile devices without requiring additional equipment investment.

Miner

Anyone who offers computing power to process changes to the blockchain and is compensated in PAIcoin as a reward. A Miner can also be considered a type of Authenticator.

PAIcoin

The native currency on the PAI blockchain with which applications and users transact to process changes.

Credits

Consumer-facing currency that exists on the application level. Users earn credits when contributing training data to the application or purchase them via PAIcoin. (e.g. recording audio from a script or facial data from a selfie.)

PAI Blockchain Protocol

A blockchain, a peer-to-peer network which stores identical and unalterable blocks of information across the network, will be utilized in the Project PAI technology. This blockchain exists from a combination of layers: *authentication, transaction, and data*. Any instance of PAI being active on an application, receiving credits for a transactional exchange of PAI information, checking for verification, storing for biometric data, or assisting in AI development, will be written to the blockchain protocol for immutability. Altogether, it enables the trustless uniquity in which PAI cannot be copied and deployed without a person's permission. Permission of PAI in most cases covers the *Right to Publicity* [3] or personality rights, where an individual controls the commercial usage of their image, likeness, or other facets of one's personal identity.

VISION OF PROJECT PAI

PURPOSE

A person's PAI is a *network-verified 3D AI avatar* that looks like the owner, speaks in the voice of the owner, and represents the owner when acting on his or her behalf [4]. Project PAI believes that every person in the world has the right to create, own, manage, and use their own PAI as per their Right to Publicity. To fulfill that mission, Project PAI proposes a blockchain protocol designed to give people trackable ownership and management rights (e.g., portability, limited sharing, and interoperability) to their intelligent personal data profiles, or their PAI. The protocol serves as the foundation of a new *AI economy*, where AI is decentralized, personal data is securely associated with a person's PAI, and people are fairly compensated for their contributions.

Current blockchain protocols are built upon a straightforward peer-to-peer network for transactions and management. The PAI Blockchain Protocol incorporates decentralized artificial intelligence development into the blockchain, in addition to typical transaction and management rights that cryptocurrencies such as Bitcoin and Ethereum contain. However layering artificial intelligence into the blockchain, and building around AI as a core component of the blockchain requires additional work and specialization to create an entirely independent protocol with functionalities custom-designed for AI usage. We believe that a wholly separate blockchain built independently for AI will encourage faster adoption by AI developers and maintain a focused domain around PAI-centric applications.

This unique blockchain protocol sets the stage for a *decentralized platform* (PAI Network) *supporting an AI Economy*. The act of decentralization ensures no one entity has ownership of personal data, and all processing of transactions are distributed among a vast network of computers. PAI can be stored, verified, and transacted, in addition to AI development to further improve PAI all on the PAI Network. PAI-centric applications can be built upon this decentralized platform; applications that can deploy and update PAI when user-interactions occur, and utilize the blockchain to verify and secure the movement of information.

> " **PROJECT PAI BELIEVES THAT EVERY PERSON IN THE WORLD HAS THE RIGHT TO CREATE, OWN, MANAGE, AND USE THEIR OWN PAI AND AS PER THEIR RIGHT TO PUBLICITY.** "

SMART CONTRACT IMPLEMENTATION

Permissions and Security
Users will have complete control over how their PAI is used on the network. They can enable their PAI to perform tasks on their behalf in different

applications on the PAI blockchain. PAI is secure as all PAI activities leave a footprint on the blockchain and are easily traceable in any case of malicious usage.

Footprint & Interoperability

On the PAI Network, users can use their PAIs simultaneously on multiple applications for dating, shopping, healthcare, and other services. Deployment on multiple fronts should be a seamless experience for users' respective PAIs. Owners can check their PAI's behavior on different applications and alter the PAI's decision making process through manual improvements and learned behaviors. The presence of PAI across applications on the platform leaves a digital footprint of the user's PAI on the blockchain.

Interoperability is also positively impacted as users do not need to rebuild a PAI profile or set new preferences for every application that is used; user profiles and learned behavior is automatically applied to the PAI on a new application.

Reputation

As PAI leaves a footprint on the network, it also builds a profile for the user. The digital footprint can be used to build a *personal score of trust* (similar to credit score) which will be useful for many decentralized applications on the PAI Network.

Proof of Identification

Proof of identification on the ecosystem is possible through implementation of the blockchain. Only one PAI is made per individual on the PAI Network, and all activities and interactions are subsequently timestamped and placed on the blockchain.

Fake profiles are not possible on the network through data verification performed by Authenticators. If the permissions are set by the user such that their PAI is usable by developers for external use, the user is still able to track the PAI activities to ensure their PAI is not misused for malicious behavior.

![PAI logo]

PAI PRINCIPLES

We propose developing and utilizing PAI from four key principles (see dia. 1):

(1)   Identical & Realistic Representation
(2)   Verification
(3)   Delegation
(4)   Collaboration
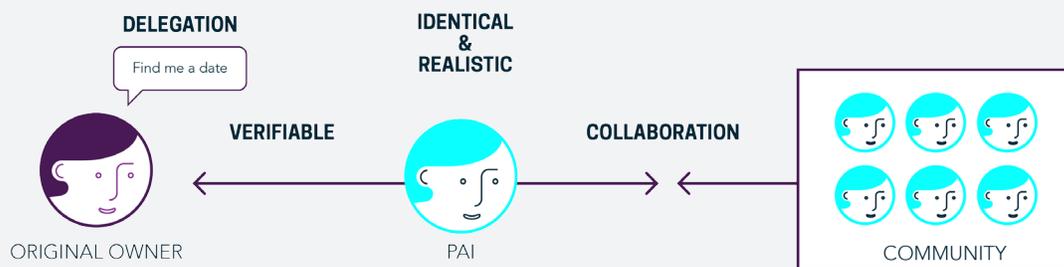
Dia. 1 Illustration of PAI development and utilization

PRINCIPLES

Identical & Realistic Representation

PAI will be a representation of the original owner - it will look like the owner, sound like the owner, and behave like the owner. The more data an individual contributes to their PAI, the higher the accuracy and reflection of likeness there will be for her and for the other community users. Identicality covers a broad spectrum of identifiers that include but are not limited to the user's voice color and intonations, facial capture, and their personality and behavioral traits. In this case Project PAI envisions the representation of PAI to best be exhibited in mobile devices and anticipates *mobile augmented reality (AR) functionality* as a naturally optimal, immersive environment for PAI to start.

Verification

The identity of the PAI can be verified for trust through the blockchain protocol. The data and experiences created, developed, and submitted by people or developers can also be verified for trust through the blockchain protocol. Anyone who helps verify through the blockchain is compensated with PAIcoins. Project PAI enables a self-serving network.

Delegation

These holistic PAI can operate on the owner's behalf and with permission, opening greater opportunities in the humanistic information economy. PAI will go out and create relationships with other parties, and will be able to perform duties that a user cannot, either from their lack of ability or from time constraints. E.g. PAI that can speak in other languages and perform time-saving conversations on their behalf.

Project PAI also provides a tool for its owners to exercise their *Right of Publicity*, where every person is an owner of their likeness and representation. As such, rights management and control of one's PAI belongs solely to the owner and not any other entity.

Collaboration

Any person will be able to simply create their PAI and instantly deploy it into any experience, joining a community of PAI users who are compensated for their work, and are contributing to the growth of the technology. People can train their PAIs by contributing personal data to a pool of information for deep learning that improves the quality of humanistic behaviors. The community thus collectively contributes to the evolution of the entire PAI ecosystem -- the more a person uses their PAI and contributes data to Project PAI, the faster, smarter and more useful everyone else's PAI will become.

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>
> **THE MORE DATA AN INDIVIDUAL CONTRIBUTES TO THEIR PAI THE HIGHER THE ACCURACY AND REFLECTION OF LIKENESS THERE WILL BE.**
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BLOCKCHAIN SUMMARY

THREE PILLARS OF THE BLOCKCHAIN

The PAI Blockchain Protocol is built with the intention to streamline AI technologies, machine learning, and deep-learning together in a user-friendly, individual-first approach. Three core components make up the landscape of the AI-enabled blockchain:

(1)   Authentication
(2)   Transaction
(3)   Data

Authentication
Strong encryption and hashing algorithms are used to ensure the security and veracity of network communication. Provenance, ownership, access, and chain-of-custody information is conveyed via strong asymmetric cryptography backed by a recommended multi-signature public key infrastructure (PKI) [5]. A PAIcoin wallet securely and anonymously ties together all of a user's AI data assets in an passwordless process. A PAI's ownership can be verified, through the use of asymmetric digital signing with the PAIcoin wallet, in every interaction — a public and private pairing.

Strongly enforced security protocols are used to guarantee the safety of PAI ownership. It is paramount that a PAI knows its owner. That relationship cannot be counterfeit. It is equally important that an owner has total control of the permissions their PAI has to interact with the outside world [6].

Transaction
Users on the PAI Network transact with PAIcoins. The reward system for goods and services such as compensation for providing computational power or payment for using an application all operate with PAIcoins as the standard currency. The blockchain keeps record of those transactions for immutability.

Data
The data layer encrypts the data and secures the peer to peer interactions in the PAI Network.

GOVERNANCE RULES

The PAI blockchain protocol runs in the background whenever a user adds themselves to the system. This will facilitate user data learning and formal verification of the data by the miners who are compensated. Project PAI aims to decentralize the ownership of these user profiles and identities and return it back to the owners. The blockchain protocol provides the technical infrastructure to enable the following:

(1)   PAI developers deploy PAI in online applications and products.

(2)   Developers earn and transact PAI Coins by providing experiences and services.

(3)   Consumers from around the world are compensated for contributing data and training their PAI to collectively improve the neural network on the platform.

(4)   People own and control their PAI as per the US Right of Publicity.

(5)   PAIs are deployed within interactive and monetized experiences.

Building a PAI and developing PAI technology requires large amounts of data — not just from the person who wants to build their PAI, but also from the entire community. The more people contribute data to Project PAI, the better the quality of the PAIs will be for everyone else. For example, in the navigation application Waze, people contribute their driving data to the entire Waze network. Waze not only relies on the community of users to provide robust traffic information to quickly get users to their destination, but also learns preferred driving patterns of an individual and improves the overall quality of their navigation experience over time.

> " **PROJECT PAI AIMS TO DECENTRALIZE THE OWNERSHIP OF THESE USER PROFILES AND IDENTITIES BACK TO THE OWNERS.** "

DEVELOPMENT

The development of the PAI blockchain protocol is led by Alex Waters, who was previously part of the development team for the original Satoshi Bitcoin Client, now Bitcoin Core. He is the Cofounder and CEO of CoinApex which is a NYC-based software, technology, and cryptography incubator. Along with his collaborators, he has also founded Coin.co, a Bitcoin payment processing facilitator, and Coin Validation, a due diligence service for Bitcoin businesses. His experience in the development of early blockchain technology and expertise within the community provides a clear development path for the PAI blockchain protocol.

INNOVATION COLLABORATORS

The vision of Project PAI is made achievable through the support of collaborators and developers committed to bringing PAI to life. Project PAI is working alongside AI company ObEN to develop the PAI Network and blockchain protocol. As a leader in personal artificial intelligence technologies, ObEN is able to provide the necessary tools for harnessing personal data into intelligent avatars. Allied in values and ideals for the future of AI, ObEN is Project PAI's first contributing innovator.

OBEN

About ObEN

ObEN is an artificial intelligence company that creates Personal Artificial Intelligence (PAI) for consumers and celebrities, enabling never before possible social and virtual interactions.

ObEN builds a person's digital voice, image and personality to create a Personal AI that can be used across mobile, augmented reality, virtual reality, and IoT experiences. Founded in 2014, ObEN is a Tencent and Softbank Ventures Korea portfolio company and is located in Pasadena, California.

ObEN's mission is to develop artificial intelligence and design digital avatars that create human interactions that are as playful and unique as everyday life.

ObEN's Founders

Nikhil Jain is the cofounder and CEO of ObEN. Prior to ObEN, Nikhil worked at healthcare company, Kaiser Permanente, developing electronic medical record applications. He previously cofounded two start-ups, On Green, a B2B marketplace for cleantech and Up and Running Software, an open source software development company. Nikhil has an MBA from the University of Southern California, and a B.S in Electrical Engineering from Pondicherry University.

Dr. Adam Zheng is the cofounder and COO of ObEN. Prior to ObEN, Adam cofounded Baihe.com, the largest dating platform in China with over 200 million users. Baihe is the first dating company in China to implement ID-verification to ensure online profiles match in real life. Adam received his Ph.D. in Environmental Engineering from UC Davis and a Master of Financial Engineering from UC Berkeley.

Motivation

ObEN's personal artificial intelligence technologies are built on the principles of transfer learning, which means that a technology solution applied for one problem can also be applied towards other, similarly presented issues. In this case ObEN's neural networks learn from the experiences of an individual and applies its learning when engaging other users. When more individuals share their experiences with ObEN, the broader community benefits as well.

Unlike other AI technologies that rely on a finite number of users tied to a single platform, a decentralized platform offers AI technology many advantages when individuals are freely connected to a vast community of contributing users. Fully realizing these benefits, ObEN champions the ideas of open-accessibility and decentralization to advance and distribute its technologies around the world.

ObEN's technology not only meets the full spectrum of Personal AI (voice, behavior, and likeness), but also packages the technology in consumer-friendly products. The public can easily create their own personal AI through mobile devices without the requirement of expensive production tools. Whether ObEN's technology is deployed in service partnerships through APIs or SDKs or its own consumer products, the end user always experiences an easy, friendly way of creating and using their own PAI.

Privacy and security run parallel to the development efforts of ObEN's technology. As AI continues to become more personalized and becomes a valuable container for sensitive personal data, the best solution points to decentralizing artificial intelligence and tying it securely to a blockchain protocol.

For these core reasons, ObEN is actively engaged with the mission of Project PAI and will participate in its development and adopt its protocol. ObEN's values align closely with the belief that a new personal information economy for PAI should be built by the people, for the people, with the people.

Technology

ObEN is the first AI company to combine speech, computer vision and natural language processing (NLP) technologies to construct a digital voice, 3D image, and personality; all the components required for a unified Personal AI. ObEN has over 15 patents pending and has produced a variety of technology APIs that can be easily integrated into the PAI.

SPEECH

Speech Synthesis
User records a small sample of their speech to create a personalized text-to-speech model that sounds like the user. Can then be used for a variety of voice applications.

Singing Synthesis
The capability to generate singing from a personalized text-to-speech. Enhances singing skills or map to any singing style.

VoiceID
ObEN technology can perform various degrees of identification based upon the user's data, such as speaker recognition and even identifying user's height from voice tonality.

COMPUTER VISION

Avatar Creation
Through a simple 2D photo, ObEN technology creates a 3D digital avatar that is a realistic, visual representation of the user.

Avatar System & API
A 3D avatar system which allows for changing body shape, clothes, hairs, animation, as well as virtual makeup. Cloud-based API for the system and avatar.

Avatar Animation
Full 3D body virtual animation, facial tracking and voice input for speech-driven animation. Facial tracking on mobile device allows for real-time animation as well.

FaceID
ObEN's technology can perform various degrees of identification based upon the user's data, such as facial recognition.

NATURAL LANGUAGE PROCESSING

Narrow Domain Chatbot
Users can chat with virtual avatars of celebrities or other real users, and perform Q&A around specific themes with the avatar.

Business Model
As the primary developer for Project PAI, ObEN's development efforts on PAI, the PAI Network, and the PAIchain, will be compensated through a portion of PAI Coins set aside during the Coin Generation Event.

ObEN will also be developing its own consumer applications for deployment on the PAI Network and will implement its own second-level, credits currency structure, called ObEN Credits. ObEN Credits can be earned or purchased using PAI Coins, and cannot be redeemed for fiat currency or other cryptocurrencies. Following Project PAI principles, ObEN Credits can be used across ObEN applications, and users who provide their personal information on these applications to improve the PAI technology will be compensated in ObEN Credits.

PARTNERS

AI STARS

AI Stars is an entertainment technology company that creates virtual celebrities, virtual versions of real celebrities that look, talk and behave like the celebrity and interact with their fans globally.

INVESTORS

To date, ObEN has raised venture funding from some of the most respected investors in the world. Major investors include:

- Tencent
- Softbank SB Next Media Innovation Fund (SB Media Fund)
- Ruigang Li: Founder of China Media Capital
- Soo-man Lee: Founder of S.M. Entertainment
- S.M. Entertainment Group (S.M.)
- DunAn Group
- Idealab
- HTC Vive X
- CrestValue Capital
- Cybernaut Westlake Partners
- Fengshion Capital
- Tsinghua Leaguer: Research Institute of Tsinghua University
- Inmaginator
- PreAngel
- The Third Wave Capital
- NewMargin Venture
- E3 Capital
- NewDo Venture
- Membrain Ventures

LEARN MORE

Please scan QR codes for a demo of ObEN's AI tech

YOUTUBE	YOUKU

PAICOIN AND CREDITS SYSTEM

Dia. 2 Illustration of the PAI ecosystem at consumer and platform levels.

A DUAL CURRENCY

The PAI platform accepts a two-level structure of cryptocurrencies to keep the blockchain ecosystem and end-user experiences separate (dia. 2):

1. The native and decentralized PAIcoin by Project PAI
2. Dedicated application-level credits, which can be designed by people and organizations for their own applications.
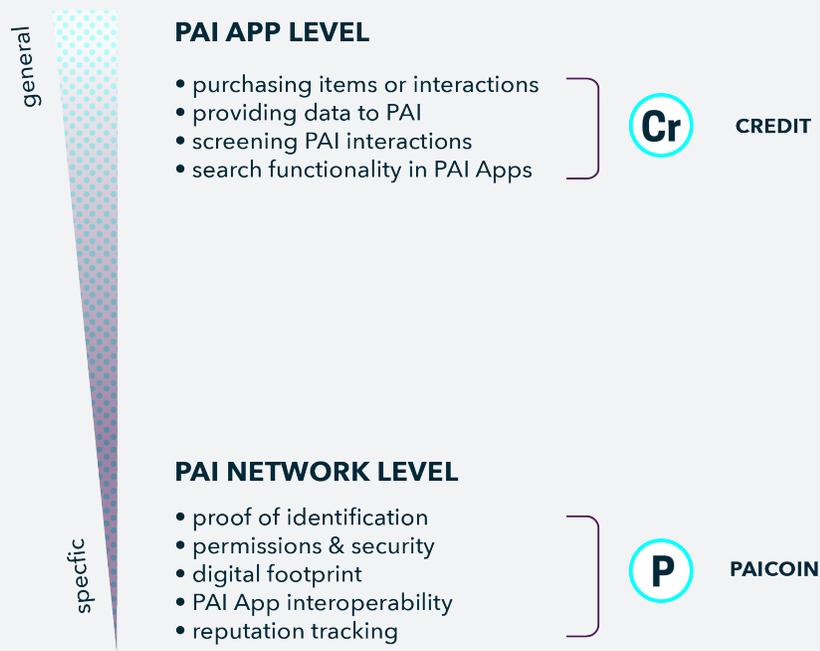
Currently, many resources estimate there are 10 million active Bitcoin users in the world [7]. Compared to Facebook, WeChat, or Snapchat, the numbers for cryptocurrency adoption are not in the same order of magnitude. Project PAI's structure is designed to lower the bar for everyday consumers to engage with blockchain-built applications and the PAI platform without needing to own Bitcoin or Ethereum or understand blockchain; hence creating a low barrier to entry for a consumer [8].

Any person who engages with the platform on the ecosystem level can be compensated for their participation with PAI Coins. Every person that operates on the PAI blockchain directly can be a Miner. Any person who engages with the platform on the application level can be compensated for their participation with credits. Any decentralized application will have their own credits with currency nomenclature unique to the application itself (e.g. Application A has Z gems, application B has Y cash).

Developers can construct smart contracts for transactions on both native PAI Coins and application-level credits. These smart contracts, written to the blockchain, are designed to screen PAIs, enforce transaction, verify and enforce the additions and changes to the PAI platform (see dia. 3).

> "
> **PROJECT PAI'S STRUCTURE IS DESIGNED TO LOWER THE BAR FOR EVERYDAY CONSUMERS**
> "

PAI APP LEVEL

- purchasing items or interactions
- providing data to PAI
- screening PAI interactions
- search functionality in PAI Apps

Cr CREDIT

PAI NETWORK LEVEL

- proof of identification
- permissions & security
- digital footprint
- PAI App interoperability
- reputation tracking

P PAICOIN

general

specfic

Dia. 3 Difference of smart contracts between credits and PAI Coins

PAI USE CASES

Project PAI will work with developers and organizations around the world to create PAI-based experiences that encourage consumers to leverage the PAI platform. Below are several diverse industry use cases that demonstrate how applications can be built utilizing PAI as its core functionality while remaining integral to a vast range of everyday activities.

PERSONAL ASSISTANT

Personal assistants offer numerous time-savings, from scheduling meetings to preference-based searching. Current assistants only exist within platform-centric entities such as an email client, and are unique in their identity. A PAI can perform tasks while still acting as yourself, so you are free to do other activities.

> PAI Utility
>
> • Facilitator in decision-making and reducing the number of choices a user must decide from.
>
> • Gatekeeper that screens undesirable experiences in front of the user.
>
> • Navigator that walks people through experiences and enhances their online journey.

Shopping

Ellie is a teenager from Los Angeles who loves shopping but rarely has the opportunity to visit top stores given her busy school schedule. Ellie's PAI learns her dressing style, tracks the latest designs and tries on digital outfits. Ellie pulls up her PAI on her mobile device and watches it wearing different outfits using AR. She selects her favorite ones and purchases the real outfits for herself.

Flight Deals

Lily is an avid traveler who looks forward to her next trip abroad. She uses AR on her mobile device to pull up PAI travel agents and have them help her find interesting destinations at a great price. She notices one agent is wearing a Roman tunic and finds out there is a great promotional package to historic sites around Greece and Italy. Lily

loves the package and sends her PAI to ask her favorite travel buddies if they might be interested in joining.

Restaurant Takeout

Richard's family has difficulty finding takeout restaurants that meets everyone's food preferences; it takes time to search, call, inquire about food restrictions, and take every family member's order. Richard's PAI can search for restaurants that cater to his family's dietary needs, create a selection of order combinations, and check with each family member to approve the selections.

SHARING ECONOMY

Every individual has a variety of idle assets from empty bedrooms to parked cars. Companies like Uber and Airbnb have built up their platforms by partitioning markets of the sharing economy. All these sharing economy platforms are based upon the tenets of trust and communication, where PAI can easily manage the exchanges between individual parties. The PAI Network also has the ability to link all these disparate sharing markets so that sharing any asset becomes seamless.

> PAI Utility
>
> • An arbitrator to share the owner's idle assets and services with other parties, and mediate transactions.

Car Sharing

Diane has an idle autonomous car parked at her company's site. While she is at work, Diane's PAI announces to other users that her autonomous car is available for use during the day. A user who is interested sends their PAI to Diane's PAI and negotiates pickup times, location, and pricing. All the parties involved, from the autonomous driving car company, to Diane, to the user, and even the insurance agency engage with the PAI Network for a direct pay and seamless transaction process.

House Sharing

Tanya is a homeowner in Berlin, and occasionally rents out her additional rooms when

she's away. Answering everyone's questions and coordinating the experience can be very time intensive. Tanya's PAI coordinates arrival dates with her guest and answers commonly asked questions about the home. When they arrive, Tanya's guests use AR on their mobile device to get a tour of the rooms from her PAI.

HEALTHCARE

Healthcare systems have often stretched their staffing resources thin. Patients have more questions than doctors have time to answer and hospitals are seeking out innovative means to maintain patient satisfaction and increase efficiencies. PAI comes as a medium to bridge better patient-doctor relationships and as a proxy to represent owners that are absent from conversation.

> PAI Utility
>
> • A representative of electronic medical records for healthcare stakeholders to interact
>
> • Preparatory guide that coaches patients through recovery and the healthcare system
>
> • A monitor to remind and advise patients on maintaining health

Pre-operative Preparation
Eileen is preparing to have knee replacement surgery at her local hospital. In the coming weeks before the operation she has to be prepared. Her surgeon's PAI can introduce himself and offer scripted instructions on how to get ready. On the day of the surgery, Eileen is cleared by the hospital for operation thanks to the instructions and feels comfortable knowing she's already met her surgeon beforehand.

Medication Reminders
Yuchen is in elementary school and needs to take regular medication for his condition. He often forgets to take the prescriptions which also carry complex instructions. Yuchen's doctor uses his PAI to send Yuchen daily reminders to take his prescriptions. In AR Yuchen can watch his doctor's PAI act out the instructions for taking the medication which serves as a visual reminder. Yuchen's trust of his doctor encourages him to follow the instructions as given.

Patient Monitoring

Liam lives alone in his living community and his age and health have started to catch up with him. Dr. Abbas has so many other patients with conditions that he can't visit Liam every day. Instead he sends his PAI to do a daily check-in with Liam to ensure that Liam is taking his medication and to monitor his health. Dr. Abbas's PAI will alert him if anything is wrong.

Physical Therapy

Jess goes to her physical therapist to rehabilitate a recent rugby injury. All the physical therapy exercises are complex to perform and remember on her own, so her physical therapist sends her animations of her PAI performing the exercises. When Jess is at home, she can watch her avatar go through the motions and copy the exercises exactly as she sees it on her own body.

SOCIAL NETWORKING

The core of social networking experiences are built around effectively communicating context, intent, and finding creative means to express emotion and personality. PAI offers more ways to express oneself online and be present in conversations even when the owner is not physically present.

PAI Utility

- A favorable representation of the user in the virtual world

Dating

Amy's busy work schedule prevents her from spending time to find the perfect match. Instead she allows her PAI to do the searching for her — it will search according to her preferences and find profiles it knows align with Amy's personality. It will even talk to other PAI and answer questions during the search process. It then presents Amy with a matching PAI profile. Because the PAI is verified and identical to the owner, she knows that the profile exists in the real world and looks exactly like his PAI so there are no surprises on the first date [9].

Job Search

Mindy is a recent college graduate looking for a job and sends her PAI to a virtual career fair. She notes the most interesting companies, and sends her PAI to hand out her resume and tell recruiters the highlights of her background. Using AR on her mobile device, she pulls up the PAI of company recruiters and watches them pitch their company vision.

Group Chat

Amie likes to chat with her friends in group conversations, but doesn't like doing video conferencing since there's pressure to put on makeup and look presentable. Instead she talks through her PAI that she has beautified through makeup filters. Her friends also decide to talk through their PAI and feel like they are all together when projected in AR on their mobile devices. They create animations of their PAI interacting with each other and have them do tricks that are entertaining for the entire group.

Voicemail

Ira flies on planes quite often and is worried about missing important phone calls. Ira's PAI is deployed while he is up in the air to screen messages and track who has called. When Ira lands from his flight, he gets a summary update from his PAI who lets him know who called, if it's important to give them a call back, and screens out telemarketing calls so he knows he doesn't have to listen to those missed messages.

Emoji Stickers

Timur likes to send his friends silly memes, gifs, and emojis into their group messages. Using his PAI he can have himself dance, say silly things, and act out emotions to make his friends laugh in the group without having to do it himself.

ENTERTAINMENT & MEDIA

Star power and strong brands have untapped potential to influence even larger audiences, and further strengthen relationships with loyal consumers. Celebrities have a limited amount of time they can spend with their fans. They seek ways to further their brand and diversify monetization channels. PAI can empower celebrities and branded experiences to exist where they previously could not, and diversify into more channels of interaction that will add value to users.

PAI Utility

- Entertainment provider and social interaction medium

Coffee with Celebrity

Jun is a big fan of Elon Musk, and closely follows all of his projects and companies. Jun wishes that he could sit down with Elon to ask the biggest questions on his mind. For a small fee, Jun reserves an AR coffee meeting with Elon's PAI and his three closest friends. Jun and his friends sit at a virtual table and ask Elon's PAI questions about raising funds, his childhood, and advice for starting companies.

Internet of Things (IoT)

Katie loves having connected devices in her home, because they improve all aspects of her lifestyle. She uses her smart devices to order groceries, dim the lights, and play her favorite movies starring Morgan Freeman. Katie likes Morgan Freeman so much that she purchases his PAI and integrates it into all of her IoT devices. Now she can hear his booming voice on all her smart products and carry Morgan's PAI as a companion on her mobile device.

eBook

Seven-year old Molly loves to listen to her father read her favorite Harry Potter book at bedtime. Whenever her father is out of town, Molly is able to load up his avatar and listen to her favorite stories in his voice again. She uses augmented reality to project her father's PAI on top of the bed covers, so she can see his expressions as he reads new stories. Molly can hear the stories in his voice and have his PAI say good night to her.

Celebrity

Rising K-pop star Hoon does his best to engage with his fans, but there is a demand for intimacy that can't be met given his busy schedule. With his PAI, Hoon creates personalized one-on-one experiences; fans have music duets with Hoon's PAI and share the videos with their friends. Hoon's PAI is also a personal companion on fans' mobile phones and can show up in AR to tell jokes, stories, and engage in conversation when fans are feeling lonely. Fans can also receive the latest updates and gossip about Hoon when they engage in conversation with his PAI.

Karaoke

A local arcade has just installed a virtual reality (VR) karaoke game. Summer is both an avid gamer and an aspiring young singer, and is excited to challenge herself at the karaoke arcade. She adds stylish outfits to her PAI which loads it into the game where she can sing and watch her PAI dance on the VR stage. In the bonus round of the game, her PAI switches to AI mode where she watches it sing perfectly on its own and it dances like a celebrity. She downloads the video of her PAI and uses it to practice her own

singing and dance moves at home.

Tastemaker

Lucia is a popular video blogger who talks about fashion, lifestyle, and design. She is supported by a variety of brands. Her fans always ask for advice on clothing and design decisions. Lucia uses her PAI to directly engage with her fans when she is not there and recommends her favorite brands based on the type of clothing they ask her about. Her PAI is a cultural tastemaker; every morning it greets her fans with a selection of news articles and daily updates on her life that fans can browse.

DISTRIBUTED ARTIFICIAL INTELLIGENCE

A core layer of the PAI Blockchain Protocol is built around supporting the development of AI. This enables not just PAI but also other AI applications and algorithms that can share common structures such as distributed computing on the blockchain, all aimed toward empowering the individual.

> AI Utility
>
> • Distributed computing and reward system framework for AI development

Genomic Sequencing

Fernando is interested in learning about the genetic mutations in his family's heredity patterns to identify if his children are at risk for a particular disease. Using the PAI Blockchain Protocol, he uses his PAI and open-source algorithms to process the computing power needed to pinpoint the mutations at a low cost and without handing over his medical data to any outsider.

Independent Game Design

Dolly is the sole designer working on an interactive VR game that allows users to choose their own adventure that are unique every time the game is played. She runs her VR game through the blockchain protocol to run thousands of simulations to autonomously create new adventures for her users.

Amateur Astronomy

In her free time, Samra enjoys tracking planetary orbits and looking for new, undiscovered

objects in the sky. She has hundreds of night images taken over the years that she runs through the blockchain protocol using an algorithm looking for hidden objects and mapping out orbital paths. She shares her results with other amaetur astronomers around the world and together on the blockchain they create an evolving network of quality information that rivals government-funded programs.

NGO Hospital

A volunteer doctor, Seyed, is administering a healthcare operation overseas in a region lacking a healthcare system. Because of a shortage of trained staff, Seyed relies on a PAI to help answer patient questions. He uses the blockchain to run deep learning computations on the datasets of conversations to improve patient health outcomes. His PAI learns to personalize responses and educates Seyed about cultural sensitivity towards his patients. Seyed and the other nearby NGOs share their data to collaborate and build better AI models to improve the affected region.

CONCLUSION

The future of our digital identities will be decentralized, and there are multiple organizations pushing to retrieve privacy and ownership in the hands of the true identity holder. The ability for our digital identity to be comprehensive, identical to ourselves, and intelligent enough to perform tasks on our behalf exists only in the form of Personal Artificial Intelligence (PAI). Imagine owning a digital avatar that is certifiably you, that looks and speaks like you, and that freely interacts in the digital world on your behalf without requiring constant oversight. It opens numerous new possibilities for online experiences to occur and allows you to have more time to do things that matter.

Certainly there are challenges with developing AI that limit the range of PAI functionality. But as Project PAI grows and develops a pool of users to provide data, the pace of innovation within PAI will rapidly accelerate. As seen with other technological advances that rely on the growth of user populations and data, improvements of PAI will scale rapidly as users increase their frequency of engagement [10].

To the average consumer, PAI may seem like a magical phenomenon. Yet the foundation of PAI and its success relies on the support of a community that actively contributes to the improvement and training of PAI. Contributions stem from simply maintaining a lifestyle of everyday activities such as online messaging or gaming.

Project PAI will launch a new blockchain protocol that will create this reality and will be the catalyst for delivering personal avatars to the world. We believe that every person in the world will have their own PAI and be able to create and manage it in any way they so choose. The next AI economy will be powered by PAI for everyday interactions, and Project PAI will be the spark that helps this future community thrive.

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