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Blockchain-enabled Personalized Incentives for Sustainable Behavior in Smart Cities

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Outline

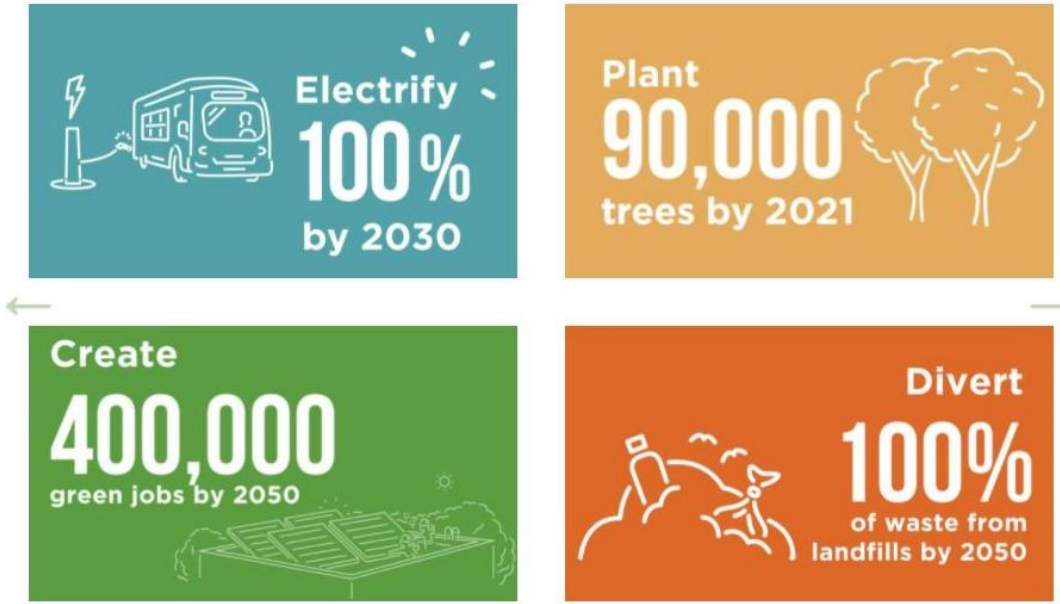
Overview of existing research and projects applying Blockchain and other technologies to incentivize individuals and organizations to engage in more sustainable behaviors, with a focus on:

- Transportation
- Energy Efficiency
- Waste Diversion

We also discuss suitable architecture and future directions.


GREEN NEW DEAL
PLAN
HOME
L.A.'S GREEN NEW DEAL
GET INVOLVED
GND NC TOOLKIT
Descarga el Nuevo Acuerdo Verde en español

Targets


Electrify
100%
by 2030
Plant
90,000
trees by 2021
Create
400,000
green jobs by 2050
Divert
100%
of waste from
landfills by 2050

Examples

- Transport
  - Drife, Commuterz, Fair Ride 21, 22, 23 ride hailing
  - Decentralized Ride Sharing
  - Baza etal
  - Paper 28 and 29 Cycling
- Energy Efficiency
  - Sun Exchange
  - Universal Carbon
  - Vechain
- Waste Recycling
  - Plastic Bank
  - Eco COIN
  - Gain Forest


Transportation

Financial Incentives for Cyclists

- Allow cyclists to receive financial compensation from city and local business sponsors
- Bicycle-powered sensors allow cyclists to collect activity data and redeem them through Ethereum smart contracts
- Envision expanding to include other sensors allowing cyclists to monetize data

Jaffe, Caroline, Cristina Mata, and Sepandar Kamvar. "Motivating urban cycling through a blockchain-based financial incentives system." *Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2017 ACM International Symposium on Wearable Computers*. 2017.

Ride-Hailing

- Integrated and personalized scheme to incentivize energy efficient travel and mobility decisions
- Active traffic management on a decentralized platform
- Using IoT technologies to connect transport systems and local business sectors to redistribute traffic demands and customer flows in time and space based on contextual preferences and requirements
- Going beyond congestion pricing and carbon credits while enabling trust and reducing prices(Removing the middleman(Uber) by using a decentralized platform)

https://www.drife.io/

B. Wang, S. Li, Q. Wang, and Z. Lin, “Understanding travelers’ mobility decisions in response to customer incentives,” Transport Policy, vol. 97, pp. 113–120, Oct. 2020

Rewarding Ride Sharing on the Blockchain

- Reduce congestion and ecological footprint by incentivizing carpooling
- Decentralizing Ride Hailing and peer-to-peer rides to tokenize ride-sharing economy
- Mobility as a service token
- P2P Mobility service enabling trustless collaboration
- FairRide: another incentivized blockchain-based transportation platform

https://www.commuterz.io/

M. Li, L. Zhu, and X. Lin, “Efficient and Privacy-Preserving Carpooling Using Blockchain-Assisted Vehicular Fog Computing,” IEEE Internet of Things Journal, vol. 6, no. 3, pp. 4573–4584, Jun. 2019

M. Baza, N. Lasla, M. Mahmoud, G. Srivastava, and M. Abdallah, “BRide: Ride Sharing with Privacy-preservation, Trust and Fair Payment atop Public Blockchain,” arXiv 1906.09968, Jun. 2019


Energy

Tokenized Carbon Credits

- World’s first tradeable carbon token on a public blockchain
- Backed by UN REDD+ projects UN(Reduction of Emissions from Deforestation and Forest Degradation Plus)
- Reducing emissions from deforestation and forest degradation in developing countries
- UPCO2 is an ERC20 token on the Ethereum Network that companies or individuals can trade to offset carbon footprint

https://universalcarbon.com/

Incentivizing Renewable Energy

- SolarCoin: Rewards solar power producers who register their panels with a SolarCoin affiliate
- Blockchain-based incentive mechanism for a solar-powered planet
- One Solarcoin(SLR) per megawatt of energy produced
- Operating on Energy Web Chain, Ethereum based blockchain, 73 countries

https://solarcoin.org/

Reducing Carbon Footprint

- VeChain is a blockchain and IoT based digital carbon ecosystem on VeChainThor blockchain
- Verification by third party DNV for awarding carbon credits
- Unique two-token system to separate cost of using blockchain from market speculation
- BYD, largest manufacturer of electric vehicles is participating in the ecosystem
    - Carbon credit tokens can be traded for products and services by ecosystem enterprises/affiates/vendors.

https://www.vechain.org/


Waste Diversion

Recycling Plastic

Founded in 2013 and operates in Haiti, Brazil, Indonesia, Philippines, Egypt.

- Recovering more than 21,224,000 kg of ocean bound plastic with more than 25700 collectors
- Reward users for recycling plastic with blockchain based tokens that are convertible for local fiat currency or for water, food, tuition
- Inclusive ecosystem enabled on a permissioned blockchain , Hyperledger Fabric

https://plasticbank.com/

Sustainable Smart Contract for Natural World

- Decentralized Green Fund using blockchain and other digital technologies to protect natural ecosystems
- Natural preservation platform to reward communities that protect natural ecosystems
- Autonomous linking of funds from donors to local communities which have achieved verifiable natur preservation/protection/restoration milestones through smart contracts
- Two tokens:
  - Managing funds
  - Decentralized Governance

GainForest

https://www.gainforest.app/

Digital Currency for sustainable actions

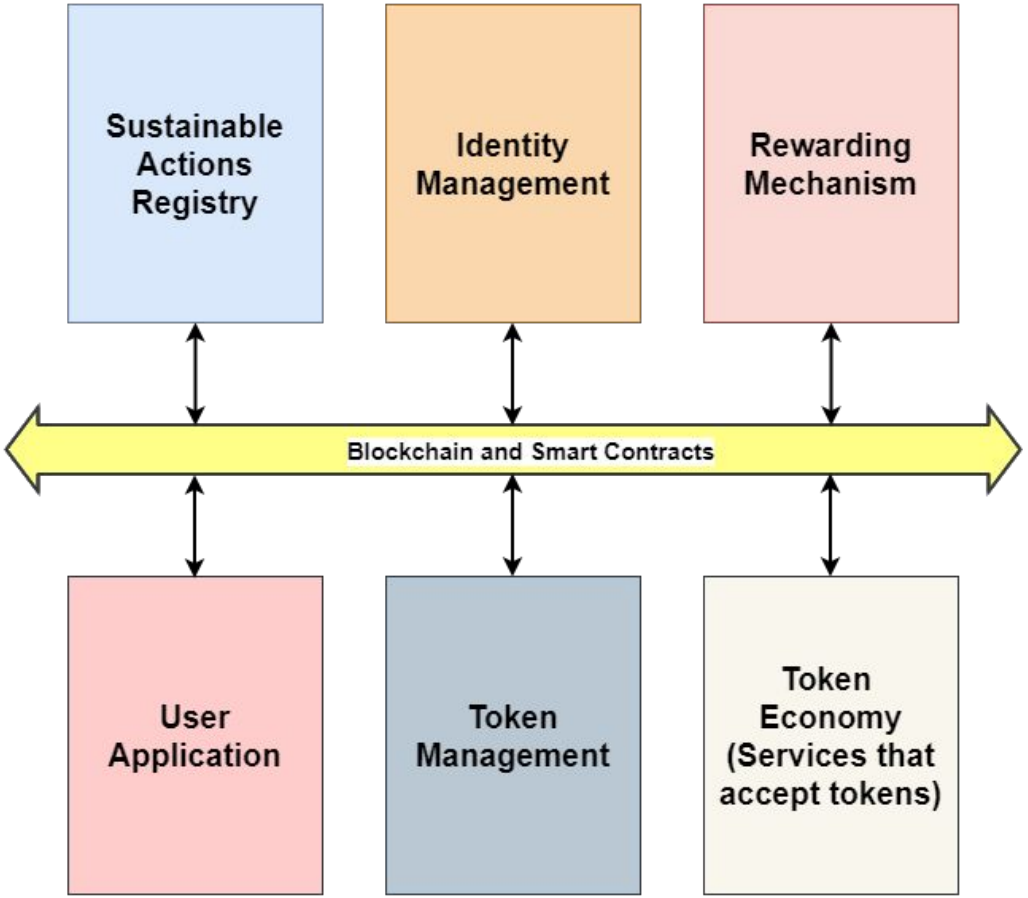
- Ecological token backed by natural currency, trees
- Introduced in 2017 based on circular economy concept
- Earn coins for individual or organization level actions like opting for green energy providers or biking to work
- Verification through smart IoT integration, inspections and vendors
- Value of token determined through relative carbon offsets

https://www.ecocoin.com/

Verification of Sustainable Behavior

- Need to verify sustainable actions to ensure correctness
- The complexity and the data requirements for the verification process depend on the sustainable behavior
- May require mechanisms to ensure correctness without violating the privacy of the user
- Note that the user may try to cheat to earn rewards if the verification process is weak.

Architecture for Incentivization Platform



Challenges and Open Directions for Future Work

- **Transparent Reward Management Engine**

Transparency vs Privacy

How to build a reward engine on blockchain that balances the need for transparency and privacy?

How to weigh the pros and cons of public vs private blockchains for incentive architectures and decentralized platforms?

- Scalability
- Transaction fees
- Security

Challenges and Open Directions for Future Work

- Mechanism Design and Token Economy
- Verification of action
- Implementation details

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Thanks

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