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.
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 et al
  - 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

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/
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/


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/affiliates/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/](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 nature preservation/protection/restoration milestones through smart contracts
- Two tokens:
  - Managing funds
  - Decentralized Governance

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/
Challenges and Open Directions for Future Work

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

- Sustainable Actions Registry
- Identity Management
- Rewarding Mechanism
- User Application
- Token Management
- Token Economy (Services that accept tokens)

Blockchain and Smart Contracts
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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