White Paper: Bikera

Abstract

A blockchain application project for real world purpose. Hence everything will have a digital identity, including certain goods or real-world physical assets. Using this everyone will be able to participate in adding to a network of available physical assets with a digital key locked to this asset.

The project would only apply to two or more wheeled transportation, which uses an input of physical labor by the driver. Having incentives will promote the use of these transportations in cities, the combination of electric and muscle power has the advantage of not polluting the air and giving the users a healthy alternative transportation. An oracle feature will need to be implemented to link the real asset with its digital immutable identity. Being immutable on the blockchain does not mean immutable in the real world.

The network

Introduction

What is Bikera?

Bikera is a blockchain ecosystem that will function as a means to lend transportation and have it seamlessly maintained without having to worry about having a flat tire or any other mechanical difficulty that might cause inability to travel to your destination.

The Bikera network will always keep all the necessary parties informed on the latest and these will then swiftly present solutions.

The means of transportation isn't a solo challenge but a group effort. Depending on the class/group, roles will be assigned to accounts/persons. Acting on this role and delivering the requested solutions will result in a merit for these accounts/persons.

Accounts

users would be comprised of classes/groups, each having a purpose to adding value to the ecosystem. Anyone can be in any or all of these groups.

Consensus

The ecosystem safeguarding will be done by the numbers of the masses and the randomness of travel-trajectory of these individuals, this contributes to the Proof of Transit consensus protocol that will be used to mine the blocks.

A layer2 solution will be used to track the bikes in movement; using LoraWAn nodes to verify the movement is real, this will route information to our own side blockchain, which will be used to fulfill contracts and token releases

all our tokens will be created on this layer 2 or 1 blockchain for security reasons and immutability.

Physical Assets

Having real world assets used in a decentralized virtual system, needs a bridge between the virtual and the real world. This will be done by the development of a multi-functional lock.

This lock will be implemented with a long-distance radio for receiving and transmitting data. There will also need to be storage to securely store private and public keys or other data. A GPS-module

and/or Cellular network connectivity can be used to verify the location of the transportation, as feedback to the node network of gateway devices linking the lock to the blockchain.

Wireless Communication

A network of radio receiving nodes need to be used or placed to receive data of these locks. Multiple nodes throughout a “two” dimensional space can be used to triangulate these locks and verify its location. The use-case of legacy or centralized networks can be used in the beginning and as verification of the decentralized network.

Governance

DOA

All users/accounts will receive the right to vote on changes made to the blockchain infrastructure and the set of rules of conduct and standards. This applies to accounts that have a minimum of 100 reputation points. This reputation score will be a non-transferable token BikeraXP locked to the user’s account. The travel distance and duration will be used to increase BikeraXP. Certain multipliers or one-time bonus can be set in place for examples; the number of different bikes the biker has used since the creation of the account, upgrading to another class or group, winning bounty’s, … The amounts generated is further in detail described under Reputation score.

The implementation of BikeraXP will ensure users who use the service more frequently, to have more voting power, as well as the users who have invested time and material to add to the ecosystem. Their contribution will be rewarded in having more voting power. Bad actors will be discouraged by the physical movement or time invested by having to do real world actions to gain BikeraXP .

The ordinance of other groups will happen by the users who have enough reputation built up to question an account and flag these accounts and leave a bad review or slash reputation points. This could result in an account be downgraded from a certain group. In some case the foundation may step in to aid in solving unforeseen issues, these cases can then lead to improvements of the code and the blockchain.

If 70% of the network reputation score agrees with the changes to the core or other mechanisms of the blockchain, these changes will be implemented.

In start the foundation will be using improvements propositions MIP’s and voting power will be 100% done by the amount of MERA casting a vote. Gradually as Bikera grows this will switch to a different ratio together with BikeraXP, this to safekeep the interests of the actual users of the network.

The foundation

The founders will form a foundation to follow up on jurisdictions and law related topics. As the network grows, this foundation will be governed as a DAO. For assuring legality in the different cities and regions the service will be available and unlocking certain areas is a responsibility of the foundation.

A certain number of tokens will be set for the build-up and to maintain the foundation. A piece of the fee system within the blockchain will be used to provide monetary funds to the foundation. The Blockchain is permissionless and open for anybody to use as a payment channel, the use and deployment of the hardware is bound to laws of a region and the use of radio frequencies. To protect users of the network and to support with legal claims by the ruling government or native individuals

Voting

The Bikera network will be a community effort. The reputation points given to the bikers and all other involved parties will address the voting weight of these parties. These votes will in turn be used to guide the network in the direction the users and involved parties want the network to go. For example: Number of points needed for a ban, a downgrade as validator, or supporter. will be reviewed by public votes by the biker's themselves, and only the ones that have proven to have ridden within the last 3 months will be liable for voting that week.

This will be able to be detected by the blockchain, hence only a certain amount will actually be added to the system of Proof of Transit. Having to use muscle power on these vehicles and having those who are actually using this muscle power to validate transactions means; that only the "real" bikers adding muscle power to this system, can vote so if any big company would want to maliciously try to win votes; they will need the bikers their support. 10% will be input by the foundation 30% by the stakers (this might involve governments or corporations).

The blockchain will imply a "by the people, for the people" ruleset.

Bikera's currency MERA

Depending on topology of underlaying networks fees will be done in the native network's fee. A smart contract can be added to lock native coins to omit so that the users can pay gas fees to the network in Bikera networks own token, MERA.

The MERA token will be used to pay the smart contracts for renting vehicles, vehicle maintenance, to receive as bounty for certain actions, as bikeblock-reward, ...

Classes on the Bikera Network

Within this ecosystem there are multiple classes of users, each contributing to the other classes and the ecosystem, respectively these are the bikers, the supporters, the validators, the producers, representatives of Bikera DAO.

In this section we go more into detail on what these Classes have as a function in the ecosystem. How they relate to on-another and how they work together, earn together, make the ecosystem and themselves thrive.

Bikers

The Bikers are the users of the transportation, they should be the biggest class/group. They lend the vehicles from the supporters or add their own vehicle to the network. Riding a vehicle with a verified lock adds BikeraXp to the biker's account. They will be able to create races or participate in games that or offered on the network. This can be some sort of capturing the flag or capture the geo location; these games will be organized by third parties or the bikers themselves.

Supporters

These are the backbone of the ecosystem; they will supply vehicles to the network. Anyone buying or creating a lock will be able to upgrade his account to Supporter. Having these vehicles noted on the network in the form of an address will create a vehicle log, this because the mileage on these vehicles will be logged by referring to the Bikers mileage done on the vehicle and logging all movement in the blockchain through the LoRa network and or GPS network. This gives an accurate detail on when the vehicle needs to be maintained, notices will be sent out to the biker if the vehicle is still in his possession, but to the supporter who owns it as well.

It’s the supporter’s task to maintain the vehicle-park he offers to the ecosystem. This does not necessarily apply to him as a person, he can also have this done at a shop or by the biker himself. Both supporter and bikers have to validate the maintenance, this is done by connecting to Bluetooth or any other near field technology white-listed by the foundation. Hereby connecting the lock’s account to the other parties.

The biker will be asked to fill in a checklist after maintenance. GPS and LoRa location services can verify the location of the different accounts are in the vicinity during this validation.

Validators

To prove the first admittance of a new vehicle to the ecosystem a validator needs to verify the state and the condition of the lock. This is the validator's main purpose. During certain time intervals the validators will need to revalidate this.

A validator is an account who has a high reputation or has a certain number of coins staked for a locked time to receive limited BikeraXP during a certain amount of time. A validator is possible to set-up a node to aid the LoRa network, this node can be a simple LoRa transceiver; that link the locks to the ecosystem these can be used to verify the existing main Lora-network. more on this in the lock section and the network section.

Validators are limited in number, there can only be a certain number of validators per 10km². preferably multiple will have different nodes, on different locations. Cross-referencing each-other on the truthfulness of their data logged on the blockchain. To prevent the network of being spammed; only verified locks will be used to mine a bike-block.

Producers

This is the group the consists of production facilities, tech individuals, companies, … they are providing the locks to the supporters, certain requirements of these locks will be set by the foundation. The foundation will provide Mechanical-designs, PCB-electrical-designs, software and programs, validated microcontrollers, …. This information will be publicly available on the website. This approach will be in the form of an “Open hardware” initiative.

The more producers the better; in a competitive free market, the quality and the price will be stabilized by the number of producers. The previous 3 groups will give these Producers a 0-10 rating on the lock, to safeguard the network from hostile producers; verified locks and bikers who rode the vehicle can give the producer a rating

Once an account is upgraded to producer other mechanics will apply to this account and the previous reputation will be converted into a rating. Producers will also have no vote, only a rating. The number of locks supplied will give producer’s a fair chance of gaining a good rating.

Elected officials by the DOA, Members of the foundation

These are a very select few accounts that during their election time or their time as an employee of the foundation, will be given in lease the total reputation score of all members who elect them or the foundation’s Base reputation score. They will govern the ecosystem, if the task of governing the ecosystem is not the concern of the persons using the system, or if they prefer to leave it to another person to make the decisions they can lease their reputation score to another account, with the exception of producers.

They will only intervene for matters that compromise the network, when abuse is reported and the local community cannot find agreements on matter's, … they will function as the peacekeepers and the guardians of the ecosystem. For example: If malicious hardware is found on any of the locks, they can downgrade a producer and therefore downgrade the created accounts for locks, to malicious lock. This will result in no more data log for the validators and these locks will not be able to mine a bike-block or attend to games and BikeraXP will be gained riding this lock, rendering the lock useless. How this will be arranged is still up for debate. The DAO is responsible for this matter. The locks still in warranty will be brought back to stores, giving the Supporters back their money. If eventually court-cases are to be fought against these intrusions; for locks that are out of warranty. The foundation and the elected officials within the DAO will be tasked to do this.

The reputation score/BikeraXP

The BikeraXP token

The reputation score will be measured through the amount owned of this separate token. Distributed equally and fair throughout the network, it results in the account having voting power or flagging power.

These tokens will not be transferable to another account, they a given as bonus to accounts that incentivize or use the network. An account will be able to lease their tokens, with immediate revoking capability of this lease every created block.

The economics on distribution of reputation points can be altered by votes within the network. These numbers are only a baseline of distribution in the beginning of the network. alteration will be limited in amount every voting period, to keep the ecosystem from suffering from major sudden changes in reputation score distribution. This is to keep a liquid state of harmony in the ecosystem. Reputation points given to group/class

Bikers

Every 10km a biker has ridden a vehicle he gains 1 reputation point, if this account uses different vehicles from different suppliers a multiplier will be in effect to the amassing of these points. the network can verify within its own blockchain database how many different bikes; this is done cross-referencing on the smart contracts made between biker, supporter and lock of the vehicle. having used a difference of these three will add 0.02 per vehicle and 0.2 per supporter of reputation points extra every 10km, if this is done within the last 3 months. depending on the blockchain block creation it will be a certain number of blocks that is approximately set to these 6 months = # blocks created.

These multipliers are given to these Bikers account because using multiple vehicles from multiple Supporters will result into having a more unbiased, more informed review on these other accounts, henceforth having a higher or faster growing reputation score.

Supporters

The reputation points are also logged every 10 km but a supporter will only gain 0.1 BikeraXP for the bikers riding their vehicles. BikeraXP gained as biker are still in effect and can also add to the total amount of BikeraXP of the account; this account can still receive reputation points as biker as well. An extra bonus of adding a vehicle to the network of 10 BikeraXP is given the first time a lock is initialized and verified new supporter account. This will be limited in time, every 3 months this bonus can be acquired, or a transition of a supporter's account can be implemented and be halved every time period passes.

This gives supporters also the ability to resell their locks, so secondhand use is possible for example when this person wants to stop being a supporter. Having the lock verified by a validator will also result in 50 additional BikeraXP. Maintaining a vehicle and updating the maintenance list of vehicles with scheduled curative actions will be given a 2-point bonus. An exception on this is If the biker chooses to maintain the vehicle themselves, these points will be on balance as unverified until either a biker or supporter validates the claims.

Validators

They will receive reputation points every 10km a biker rides a bike validated by the validator; this is 0.01 per vehicle / lock every 10km this vehicle is used. Validating a lock will result in 20 reputation points added to his account, revalidating will be also halved every 2 periods of time. Setting up a LoRa network gateway node will result in 200 reputation points. having an uptime of this Lora Gateway of 99.4% will result in an additional 5 reputation points every day or the number of blocks generated in a day. Resolving a conflict between Biker and Supporter will also result in an additional 50 reputation points.

Producers

As described above a producer's account will not get reputation points only a 0 out of 10 rating. the rating will be the original reputation points from upgrading the account given an unverified rating. The calculation is every reputation point equals a rating. if somebody gives a rating of 7/10 with 500 reputation points and the original account was 1000 reputation points with 10/10 then the rating is the multiplier (7*500 + 10*1000) / 1500 = 9 rating score; the formula is the average of all the rating weight of all reputation points given by the different accounts/adresses that have actually used the lock of the producer for a minimum of 20 km.

(nrating acount n * nRep account n) + (nrating acount n+1 * nRep account n+1) + .../ (nRep account n + nRep account n+1 + …) = Rating score for a Lock

The average of all ratings of locks produced by a certain producer will give an overall rating of this producer.

Members of the foundation

their accounts will receive an initial amount of reputation points surpassing the vast majority of the network, to govern the network into maturity.

The amount will remain as is from the genesis block, so eventually the complete amount of reputation points of the network will be able to surpass the initial amount of the foundation. This transition will be calculated so that the network will be self-sufficient and self-governed in time. An extra amount of reputation points can then be given to the foundation with an 70% vote of the network. There will be a limit on amount and a limit in times these reputation points can be generated for the foundation, eventually the foundation will exist out of elected representatives.

BikeraXP decreased on an account

There are actions that can be penalized with a diminishing amount of reputation points. Examples of these are not abiding the contract between supporter and biker, falsifying information about maintenance or not following up on the maintenance schedule. These decreasing reputation points will be discussed with the founders and eventually the whole network the same rules set in the blockchain for adding reputation points mechanism will apply to decreasing or slashing BikeraXP.

The amounts cannot be drastically changed only a certain percent every X number of blocks. This dynamic input will be depending on the course of the voters will take the ecosystem. A negative

Reputation will also affect the ability to use certain features of the network and fees will be risen for persons who have a negative reputation score.

Bikers

Supporters will also be able to block functionality to accounts, that have a negative reputation score. Bikers Not abiding the contract of returning a vehicle to a designated location; will result in an arbitrary amount of -5 reputation points. Using the vehicle outside the agreed lease time will be penalised with a -5 reputation points every 1km.

Supporters

Having not charged the bike or not available for the network when validated and not unvalidated by a request to withdraw the vehicle from the network, wil result in an decrease of -1 reputation point per day.

Not following up on maintenance will cost also -2 reputation point per day.

Validators

the nodes need to be up and running so a 99,99% of up time is required, unless scheduled maintenance is being applied. When a node doesn't reach 99.4% uptime every 0.2% during within the duration of a day unscheduled downtime, will result in a penalty of -5 reputation points per 0.2%

Blockchain and Bike-blocks

The blockchain is the beating heart of the ecosystem, it is used as a clock that registers every progress during a certain amount of time. The initial block time is still up for discussion or dependent on the native blockchain used where the tokens are minted. Eventually when the network grows the amount of data needing to be logged increases.

The blockchain will be used to log segregated data from seperate smaller side chains, through the use of trusted validators. This will be necessary to combat blockchain-bloat having these side chains register within the larger blockchain doesn't mean the initial blockchain blocks need to carry all the data logged. A snapshot of the network can be hashed into a transaction on a renowned blockchain. Komodo is one of the blockchains implementing this technique, the network can also be segregated side chains for certain areas and the main chain can then be Komodo for example. logging all of the data in the smaller side chains and just referencing data in the main chain, this referencing data will not be able to deliver the complete dataset of a sidechain, but it will be essential so anybody can verify the correctness of the side chain.

Mainchain

The Mainchain will be used to log the transactions of MERA over the network the accounts will be set as one in both sidechain and mainchain. But only the currency and relevant smart contracts between Supporters and Bikers on the lease of vehicles will be logged in this mainchain Sidechains will log the distance traveled and the Reputation points will daily be distributed on the mainchain from a one-way peg of all existing Bikera sidechains.

There is abundant trivial information logged on the sidechains and fee cost need to be accounted for; per city/country will be a sidechain with pegs in the mainchain. this to keep track of the reputation points given to the different classes. The sidechains will be divided over a certain area and a maximum number of accounts/users depending on amount the sidechain network can handle.

Bikera consensus

a hybrid proof of work and proof of stake will be used; the proof of work will rely on the transportation and its location. This will result in the Bike-block reward. This means that bikers help validate the network and create real random data, which will be used to select validators to mine blocks on the sidechain. In the form of an algorithm whereby the random factor is the biker's traveled distance and direction. The network will generate a random number of distance and direction; a true random function can be achieved by using real world randomness with original computational random functions. The biker who comes closest to this generated vector will co-sign the block mined by the closest node to that biker.

The proof of location and staking consensus will be set-up within a proof of location network. For example Helium Network, thingsIX, more information on the implementation of these networks visit https://www.helium.com , https://thingsix.com/

The staking amount will be necessary to trust the validators, because a minimum of reputation score is needed to participate in the block creation.

Proof of transit

The validating nodes are selected by the network to mine a block through a mechanism of random input of direction and distance traveled by the bikers. The vehicles are logging this data, separately by each lock sending out to the network's different nodes its coordinates every 10 minutes. The direction and the amount of km's traveled will increase the change of a certain node to mine the block.

The more bikers using the network the harder it will be to do a 51% attack. The price of the locks will discourage attackers. Aswell as the actual displacement of the locks attributing to node selection by the network.

This protocol will be used dynamically, depending on the number of bikers using the network and the vehicle for transportation, there will be a minimum of bikers needed to be traveling for the Bike-block to be mined. During a time where there is no displacement of enough bikes the sidechain will not be registering blocks. The nodes need to reach consensus on these amounts. With all this in place will make it practically impossible to coördinate a 51% attack.

Having different oracles and networks verifying these changes in distance and direction, will be used to verify if nodes are sending out false information or data, when trying to mine the next block. Eventually all nodes will keep all the reputation scores and transactions listed going into the next block, this will then also be cross-referenced with all other nodes, to reach consensus.

On exact amounts of tokens on accounts or transactions, there cannot be any deviation. This if implemented in the Sidechain as fee reductor, that instant payments of MERA are done of mainchain. Lightning network for example. If the node does not have the same Ledger as 51% of the rest of the network. It will be discarded as faulty input node and the block mining will follow up to the next in line winner of the proof of transit-protocol.

On reputation score, distance, direction travelled, there will be a larger fault tolerance applied. The accuracy of the network will result in a dynamic fault tolerance, depending on a list of variables that can affect radio waves or transmission of location. Examples: range of measuring distance, amount of nodes set-up, Oracles, weather, ...

Proof of stake

The Proof of stake part will be using a VRF 5 as many other POS-chains use. There will be a minimum amount needed to stake on 1 LoRa gateway Node, it will be possible to link nodes and multi-mine a block meaning that the different LoRa Nodes will be able to be linked to a certain validators adress. But every validator can only have a maximum of 3-5 nodes depending on the amounts of nodes on location. This will limit a validator in trying to spoof the network with false data or claiming all Bike-block rewards.

Tokenomics

Proof of Transit Dynamic Block Reward Inflation of the network will be set dynamically between 2% and 10%, of this is the total amount of (M)ERA tokens that will be generated during a year. The distribution of these tokens will happen through block rewards. the amount of tokens received as block reward will depend on the inflation rate set in that year; this will be adjusted every 52000 blocks to be divided over the next 52000 blocks. The validator earns for the proof of transit part; 35% of the block reward, 30% will go to the bikers having used a validated lock by this validator, 30% to the supporters and 5% to the producer of the lock. This means that the block reward will encourage validators to have multiple accounts but also multiple LoRa Gateway nodes. These dynamic block rewards per group/class can be adjusted in the rate of maximum +-2.5% difference in distribution, every 52000 blocks, through the voting mechanism.

The Multifunctional Lock

Mechanical Design

The lock will be designed by our mechanical engineering and design department. The casing of the lock and the mechanical parts inside, will first be prototyped by the foundation. There will be extensive field-testing with different designs, to ensure quality standards can be set.

This will be a continuous effort by the mechanical engineering and design team of the foundation. Keeping the Bikera standards up to date with new innovations in production technology. The design itself will be available for download on the website.

Lean manufacturing

For the part of lean manufacturing, the design needs to be optimized for 3D printing the lock or a certain number of parts, at home or a distant location. The supply chain can be cut out because the model will be able to be printed directly from an advanced 3D printer which only uses crude rudimentary resources like powdered plastic and metal that can also be used for other projects producing a minimal amount of waste. The housing will need to be big enough to accommodate updates of PCB boards, if in the future an expansion, updated PCB or batteries are desired.

During the first stages of development a lot of time and resources will go into defining how to set quality standards. This process of trial and error will be posted on the website and a community sub thread so the community can follow up on the efforts of the team and they themselves can add to the research and development. Having multiple lock designs being tested by users who print mostly the mechanical parts themselves will give a lot of raw data to be used in the continuous improvement. This is according to the standards of OPEN hardware.

Standards

Certain standards and milestones will be logged in the Bikera chain. So that the standards and design specs on which the Bikera foundation/DOA expects to have a lock build, This a reference guide to the validators.

The design of the lock will be freely available to anyone using the network utilizing an internet connection. This to ensure transparency and open source of the project, immutable and always accessible everywhere in the world, as the network grows.

Electrical and PCB design

The wiring diagram will be maintained by the foundation members; later this task can be given to others according to the DAO's wishes. Official wiring diagrams of the PCB will have its own hash protected verification delivered as an on-chain notice and available for download from GitHub.

First iteration will be designed, and trial tested. This will take place during the test and prototyping phase as described in our roadmap. There can be multiple versions of PCB design, some having extra functions beyond the basic functionality the foundation describes on the website; bikera.org. Every version will need to be backwards compatible, with new versions of the Blockchain. After a certain amount of time some of the old locks will be phased out of the blockchain, when security isn't guaranteed. Using the app or the wallet bikers and supporters will be notified of the exclusion of a lock depending on the version of the lock or the outdated hardware that is installed on it. This will also be notified in our blog and on the website.

Low power MCU's will be used to reduce the power usage of the lock. Onboard a powerpack of 18650 batteries will be implemented, extension packs can be designed and by third parties.

Connection with the lock will be over BLE or NFC. During testing phase, the usage of either will be determined by longevity, battery consumption and user friendliness. A solenoid or a small motor will lock the lock mechanically.

Programming

The onboard MCU will be programmed with a program written in the language of that MCU. This might be a port from a language like python or C++. The ongoing development of the program is made public on the Bikera GitHub page. The development will be a community driven effort, and the foundation will set funds available for the bounties put out during hack-a-thons, or other incentives. Contributors to the code will be rewarded with MERA tokens.

The GitHub page will be the go-to for all the written code. This will be version based, adding over time to a functional product. Most of the testing will ocur before the official release of a working design. The Bikera foundation will maintain the programming of the locks as well as the GitHub page.

Lock quality verification and commissioning

The lock is real and verified if it has our project's own blockchain proven account/address linked to it. The addresses generated are given to certified production facilities.

The lock needs to be validated in the blockchain by a validator who will do a checkup of the lock by connecting with it and have a diagnostic scan run on the device, this to prove it meets the specifications and requirements and hasn't been tampered with or damaged during all transports in the supply chain. Installed according to guidelines of the foundation.

From the moment a validator links with the lock and the inspection leaves positive feedback, the lock gets a visible "Proof of Quality" emblem when looking it's address up in the blockchain.

There will need to be regular and surprise inspections of the locks to guarantee the lock is still untampered with and still meets the Bikera quality standards. These will be concluded by the validators.