

WHITE PAPER

SMART CIRCLE

A Blockchain Powered Parking Solution

I. Summary

Smart Circle provides a state of the art sensory network to track and manage parking spots across a city and parking lots. It employs an IoT (Internet of Things) based sensory network to track and monitor the parking spots across parking locations to suggest or allow you to reserve parking spots closest to your destination in advance.

This revolutionary service saves countless time, hassle, traffic congestion, fuel and paper waste as transactions are made with the Smart Circle cryptocurrency and payments can be made by phone, online, auto payments, or monthly subscriptions. System also allows making payments by fiat currencies and credit cards if the user chose to do so over digital currencies.

The Smart Circle system is reinventing the parking industry as we know it today. On the Smart Circle platform users would be able to register or list their own free/open parking spaces, garages to rent out and make money from it. It would revolutionize the private parking rental industry, and provide users with means to capitalize on their empty and unused space.

Smart Circle is an easily adoptable Green, Clean and Smart Parking Reservation Platform that is accessible over a public API and freely available mobile applications. By utilizing the Tron Blockchain and SMC Utility Tokens, Smart Circle will offer a variety of solutions and smart contracts that will directly benefit a wide spectrum of stakeholders within urban metropolises and smaller cities.

Smart Circle is designed with an intention to continuously improve the flow of traffic and decrease carbon monoxide emissions and congestion. At the same time replace and renew outdated technology and invest in smart parking solutions through IoT (Internet of Things) devices, green field appliances, a real-time parking app and universal dashboards.

II. Legal disclaimer

1. Purpose

The purpose of this White Paper is to present Smart Circle and the SMC token to token holders . The information set forth below may not be exhaustive and does not imply any elements of a contractual relationship. Its sole purpose is to provide relevant and reasonable information to potential token holders in order for them to determine whether to undertake a thorough analysis of the company with the intent of acquiring SMC Tokens. Nothing in this White Paper shall be deemed to constitute a prospectus of any sort or a solicitation for investment, nor does it in any way pertain to an offering or a solicitation of an offer to buy any securities in any jurisdiction.

This document is not composed in accordance with and is not subject to laws or regulations of any jurisdiction, which are designed to protect investors. The product token is not a digital currency, security, commodity, or any other kind of financial instrument and has not been registered under the Securities Act, the securities laws of any state of the United States, Canada or the securities laws of any other country, including the securities laws of any jurisdiction in which a potential token holder is a resident.

This English language White Paper is the primary official source of information about Smart Circle and SMC Tokens. The information contained herein may from time to time be translated into other languages or used in the course of written or verbal communications with existing and prospective customers, partners etc. In the course of such translation or communication, some of the information contained herein may be lost, corrupted, or misrepresented. The accuracy of such communications cannot be guaranteed. In the event of any conflicts or inconsistencies between such translations and communications and this official English language White Paper, the provisions of this English language original document shall prevail.

Risks and uncertainties

The Smart Circle platform is not yet developed and is subject to further changes, updates, and adjustments prior to its launch. Such changes may result in unexpected and

unforeseen effects on its projected appeal to users, possibly due to the failure to meet users' preconceived expectations based on this White Paper, and hence, impact its success. For the foregoing or any other reason, the development of the Smart Circle platform and launch of Smart Circle future business lines may not be completed and there is no assurance that it will be launched at all.

Additionally, in a down-cycle economic environment, Smart Circle may experience the negative effects of a slowdown in trading and usage of the Smart Circle platform and may delay or cancel altogether the structuring and launch of the anticipated Smart Circle future business lines.

Further, should the costs, financial or otherwise, of complying with any newly implemented regulations exceed a certain threshold, bearing in mind the fact that it is difficult to predict how or whether governments or regulatory authorities may implement any changes to laws and regulations affecting future business lines, maintaining the Smart Circle platform and structuring and launching Smart Circle future business lines may no longer be commercially viable, and the Company may opt to discontinue the development and operation of Smart Circle platform.

We may not be able to pay any anticipated rewards in the future. There is no assurance that there will be sufficient engagement in the Smart Circle platform and that you will receive any rewards/discounts. The ability of the Company to pay any reward to you will depend on the future results of operations and the future business and financial condition of the Company.

In the case of unforeseen circumstances, the objectives stated in this document may be changed.

Despite the fact that we intend to reach all goals described in this document, all parties involved in the purchase of SMC tokens do so at their own risk. The Company will make every effort to ensure that the funds will be securely held in blockchain wallets. Notwithstanding such security measures, there is no assurance that there will be no theft of the cryptocurrencies as a result of hacks, sophisticated cyber-attacks,

distributed denials of service or errors, in the smart contract(s) on the Tronchain or any other blockchain, or otherwise. may not be able to use such funds for the development of the Smart Circle platform. In such a case, the launch of the Smart Circle platform might be temporarily or permanently curtailed.

No Cancellation and No Refund

All SMC token orders are deemed firm and final. The Client acknowledges that they are fully aware that they will not be entitled to claim any full or partial reimbursement under any circumstances whatsoever. As the sale of the proposed tokens is strictly reserved for experienced professional clientele, the Client may not claim any right of return against Smart Circle.

No guarantee on trading

The Company will use reasonable endeavors to seek approval for the availability of the SMC tokens for trading on a cryptocurrency exchange. Furthermore, even if such approval is granted by a cryptocurrency exchange, there is no assurance that an active or liquid trading market for the SMC tokens will develop, or if developed, will be sustained after the SMC Tokens have been made available for trading on such cryptocurrency exchange. The Company is not responsible for, nor does it pursue, the circulation and trading of SMC Tokens on the market. Trading of SMC tokens will merely depend on the consensus on its value between the relevant market participants.

Note on forward-looking statements

All claims and statements made in this Smart Circle white paper, Smart Circle website, press releases made by Smart Circle, and any oral statements made by Smart Circle team members or agents acting on behalf of Smart Circle that are not an accomplished fact may represent so-called forward-looking statements.

Some of these forward-looking statements may be considered such by containing the following terms: “will”, “anticipate”, “plan”, “aim”,

“target”, “expect”, “estimate”, “envision”, “intend”, “project”, “may”, “believe”, “if”, or any other such terms. Further, the terms listed above are not necessary to identify a forward-looking statement. All statements that include, but are not limited to any financial projections, estimates, plans or possible trends, risks, as well as future prospects of cryptocurrencies should be considered as forward-looking statements as well.

These forward-looking statements are not yet facts and Smart Circle does not take responsibility and cannot guarantee that the future results will correspond with above-mentioned forward-looking statements.

These forward-looking statements are also provided as-is and Smart Circle takes no

responsibility for updating these forward-looking statements, should any information relevant to the pertaining forward-looking statements become available in the future.

No information contained in this white paper should be considered as a promise, representation of commitment or undertaking as to the future performance of the Smart Circle platform, SMC token or any other component of the Smart Circle ecosystem.

III. Introduction

With the advances happening in the area of urbanization, with increased demand for dwellings and an increased number of vehicles on road, finding a parking spot has become one of the major pain points for the citizens. This is mainly due to the limited parking spaces available and difficulty in finding a vacant lot during busy hours. To overcome this limitation, one solution is to create smart parking spaces which are rather easier to find and use. In this work, we propose a Blockchain based solution where parking pools can be created by developing a transparent platform where individuals can rent out their unused land for a stipulated amount of time. A non-fungible token system representing unique parking lots will be created for transparency of the entire system. This also has the added advantage of generating revenue

from their otherwise unused property. Smart contracts over Blockchain enforce the contractual agreement between the participants, ensuring financial transparency in the proposed system.

With the ongoing urbanization process, parking has become one major pain for the citizens due to the limited parking spaces available in the cities . One solution is to build multi-level parking infrastructure so that more cars can be parked in a given land area. This is a better-voted solution but the major drawback is the huge infrastructural investment and the ongoing maintenance . Another option to reduce the parking crisis is to encourage people to use public conveyance such as buses, rail transport, metro, etc. However, in developing countries, public transportation may not be great and may not have deep penetration near the outskirts. Therefore, if we can create smart parking spaces with better usability, people can save their time and money by conserving gasoline wastage and time to find a parking lot along with reduced emissions. This would also reduce congestion on roads .

In general, there is the availability of privately owned unused land in every locality. If some of these lands can be utilized for creating smart parking pools, the intensity of vehicle congestion on roads searching for a vacant lot can be mitigated . Challenges in releasing these properties for leasing or rental are the legal complications owners will have to undergo, when they want the possession of their land back, before or after the expiry of the leasing contract. In this work, we propose a Blockchain powered smart contract based solution using IoT for leasing the property for creating parking pools . This smart platform could be extended to existing parking pools to provide smart service to the end users as well as to build a transparent revenue model for their rental business. Smart contracts ensure the enforcement of contractual conditions such that the participating agents are exempted from the legal complication involved in the process by building an immutable audit trail in Blockchain. An affordable parking ecosystem built up using this approach will be a win-win scenario for the public, government, landowner, and the contractor. The landowner will get returns from his land without any capital investment with the surety of his ownership over the property. This crowd-sourced parking solution approach will leverage governments to set up enough infrastructure with little

investment. The contracting agency managing the business will generate revenue from the vehicular parking and profit will be shared with the landowner and the government agency according to the contractual agreement. Operation cost and other recurring costs for managing the park chain will be met from incoming revenue. This solution could be extended to accommodate currently existing parking pools to migrate into the proposed Blockchain framework.

The proposed system is primarily a multi-agent system where the primary player is the governing body of the state. This governmental body will be responsible for linking the landowner and the sub-leasing agent and setting up the contractual conditions between the leasing party and the contracting parties. Multi-party consensus mechanism, say complete voting approach, is built on top of Blockchain powered smart contracts. Smart contracts ensure and enforce the terms and conditions along with the tenure of the leased property and the pricing options to be exercised during the lease period, revenue sharing contracts, etc. Terms and conditions including but not limited to the tenure of the lease period, the penalty for preterm withdrawal of the leased property, security deposit by the contracting agencies, agreement for preterm closure of the parking area by contacting party. The leased lands will be converted into digital assets using non-fungible tokens and can be traded over the public ledger mechanism of Blockchain.

Combined with Smart Circle is an ecosystem, which is designed with an idea to simplify our lives. With the advancement of technology, everything has become so easily accessible at the same time everything is so difficult to understand and sync in. A small thing such as parking, which was hardly an issue in the old days, now it is such a rare commodity to find. To find a parking spot is such a frustrating and time-consuming experience these days that people often have to leave the primary task and focus their time and effort on this unnecessarily important task. Smart Circle is just about to change that.

3.1. Motivation

Parking, especially in city areas is a continuous struggle due to the acute space constraints. People have to travel large distances in search of

parking spaces in a crowded locality. Also, an increasing number of residential apartments demands an increased parking requirement. Close-knit, thickly populated residential colonies or areas find guest parking nearly impossible or have to park along the roadsides, making roads congested. Parking demands will be high on weekends near shopping malls, beaches, and parks. On weekdays parking near official building premises by employees and their clients will be too huge. They end up losing unnecessary time and money for a journey in search of parking and due to congested roads. Huge traffic congestion in the cities can be mitigated by providing enough parking spaces. With a smart parking solution in place, the public will be pleased to park their vehicles within the vicinity securely and to meet their day to day needs. We propose a smart solution based on IoT and Blockchain smart contracts to create parking pools with a crowdsourcing concept, with private individuals having unused land willing to lease the land for a stipulated amount of time. Other participating parties include contracting agencies to run and manage the parking area, law enforcing governmental bodies, public people availing the parking facility, etc. The proposed solution offers the added benefit of making greener cities, with lesser emission, reduced traffic congestion, shorter travel time, generating revenue with little investment, improved and efficient city life and to build a transparent partnership between landowners, parking-enforcement agencies, citizens, local businesses, etc.

3.2. Why Blockchain?

Blockchain is a distributed ledger technology that uses a consensus mechanism enabling trust, transparency, and immutability of data among the participants. It is a decentralized network of nodes working together to validate transactions by solving complex computationally intensive tasks. This technology eliminates the need for a trusted third party by allowing users to sign contracts electronically verifying them as valid and legal. It brings in the concept of decentralized consensus, thus eliminating the need for a central authority. The Blockchain is essentially a chain of blocks that contains the data of all transactions within a period of time, and a reference to the block before it. The cryptography that goes into creating a block differs depending on which Blockchain protocol is used, but typically one can traverse through the entire Blockchain and

every single transaction ever made, all the way back to the first one, called the genesis block. Hashing algorithms are used to make sure that all blocks are well formed and not tampered with, and thus the Blockchain keeps itself secure and virtually unchangeable. The decentralized nature of Blockchain along with the consensus mechanism can be used to enable a land leasing system for parking lots powered by smart contracts. This paper proposes a system to leverage unused land for parking and enforces leasing agreements through smart contracts.

This non-fungible token system avoids discrepancies or disputes in land usage patterns and ensures fair distribution of income to all the involved stakeholders. Eventually, this will promote small households to large corporations to build a new revenue model over their under-utilized resources.

There are several parking authorities and parking providers that exist today, each of them working on a different set of policies, standards and framework. This creates an unregulated, unchecked marketplace. If you notice, there are no rate regulations, controls or standards in place, when it comes to parking charges from place to place. Parking rates may vary anywhere between \$2 to \$10 per hour depending on various factors. This needs to be regulated and standardized, so consumers don't pay ridiculous amounts of money on parking.

Blockchain can easily solve the issue. Especially ethereum-based blockchain, which is capable of managing and executing smart contracts, has benefits over the others. Smart contracts can be set up between parking providers and different parking authorities in such a way so parking rates across a particular zone can be standardized and controlled. Since the rates and terms will be managed over blockchain and executed by smart contract, there is no possibility of tempering and manipulation of the policies, so no system can bypass it.

Consumers do not have to worry about parking payments when on domestic land or foreign. Since blockchain allows payment via digital currencies, so no currency conversion overhead costs or international credit card transaction charges for the customer. Parking experience for the consumers will become seamless.

Parking providers do not have to onboard and support different payment gateways like Visa, MasterCard, Moneris which charge anywhere between 3.9 to 10% on every transaction. Millions of dollars are paid to broker applications and payment gateways just to process transactions and on credit card transaction fees. Parking providers would be able to save all this revenue. This will boost the efficiency and productivity of their parking locations.

3.2.1. Why Smart Contracts?

Smart Contracts provide a decentralized, cheaper, secure and verifiable mechanism on the Blockchain to use the private land area for parking vehicles. Ethereum is a programmable public Blockchain technology developed on the basis of much-hyped crypto-currency termed bitcoin . Ethereum supports the conversion of physical or legal contracts into self-executing digitized formats called smart contracts, which are enforceable rules on Blockchain. Ethereum Virtual machine is a decentralized virtual machine that supports a Turing complete programming language.

The Ethereum Blockchain allows user-created digital smart contracts to be executed by implementing a generically programmable code . It is not solely a network for exchanging cryptocurrencies but a network where transactions can be used to execute an unlimited number of self-developed smart contracts. This Blockchain serves as the back-end of decentralized applications, which can be as different as voting systems, domain name registries, financial exchanges, confounding platforms, company governance, or intellectual property such as music songs. The Ethereum Blockchain solution allows everyone to write smart contracts resulting in decentralized applications where it is possible to build your own arbitrary rules for ownership, transaction formats, and state transition functions.

IV . Preliminaries

4.1. Challenges and Risks of Using Blockchain and Smart Contracts

For the time being, the transaction of cryptocurrency as a financial or monetary tool is illegal by law in a country like India. There is a lot of confusion revolving around whether cryptocurrencies can be treated as a non-monetary reflection for a smart contract, similar to Commodities Futures Trading Commission recognizing bitcoin or ethereum cryptocurrency as a commodity and taxing it accordingly. Another challenge is that the Blockchain and smart contracts are in their infancy stage and have to face both technical and legal challenges. Ethereum doesn't provide the privacy on the transaction records alone and it is buggy in nature. However, with the current momentum of research and developments happening in the Blockchain domain, would help the technology to mature with time and address these issues.

Park tokens created using ERC 721 non-fungible token standards will be made available to the stakeholders through mobile wallets. The token generation and issuance will be taken care of by the system and will be made available to the user through a simple mobile application integrated with the payment gateway. Users can make the payments through this application and transact for the park tokens to make use of the parking lots.

4.2. Blockchain Environment

Blockchains can be broadly classified as: Public, Private, and Consortium Blockchains.

4.2.1. Public Blockchains

Public Blockchains are accessible to anyone without restrictions and any node can take part in the consensus process. The consensus process determines which transactions get added to the Blockchain and maintains the current state of the system. Public Blockchain is decentralized, meaning no single entity has control over the network.

4.2.2. Private Blockchains

These are Blockchain systems that are maintained by an individual or organization and are not accessible to the general public. In the private

Blockchain, transaction validations are performed by a single centralized authority.

4.2.3. Consortium Blockchains

These Blockchains are controlled by a group of institutions who own a pre-selected number of nodes. These Blockchain can be considered partially decentralized .

In this proposed work, the responsibility of setting up the parking lot and meeting the expense toward it is not vested with the landowner but lies with the contractor. The objective of this work is not for commercializing tokens for crypto exchanges but for implementing a solution for the public good with proper government intervention. With the Blockchain backed infrastructure, the three parties build the ecosystem where any customer can loan the lot, and the generating revenue after meeting the maintenance costs and other recurring expenses, will be shared among the stakeholders.

4. Technology Integration

Any individual who possesses vacant land suitable for parking can register in the park-chain through a government-validated process and procedures. The system will evaluate the ownership and location of the property and generate approvals for parking lots to the landowner based on the inputs from the oracle through integrated external systems.

V. Why Smart Circle?

Some statistics are based on research conducted in the US, UK and Germany which makes it even more important to have a system such as Smart Circle to show some solution to these ever-growing problems.

Drivers spend an average of 17 hours a year searching for parking spots

Searching for parking is more painful than ever for U.S. drivers.

Motorists spend an average of 17 hours a year searching for spots on streets, in lots, or in garages, according to a report .

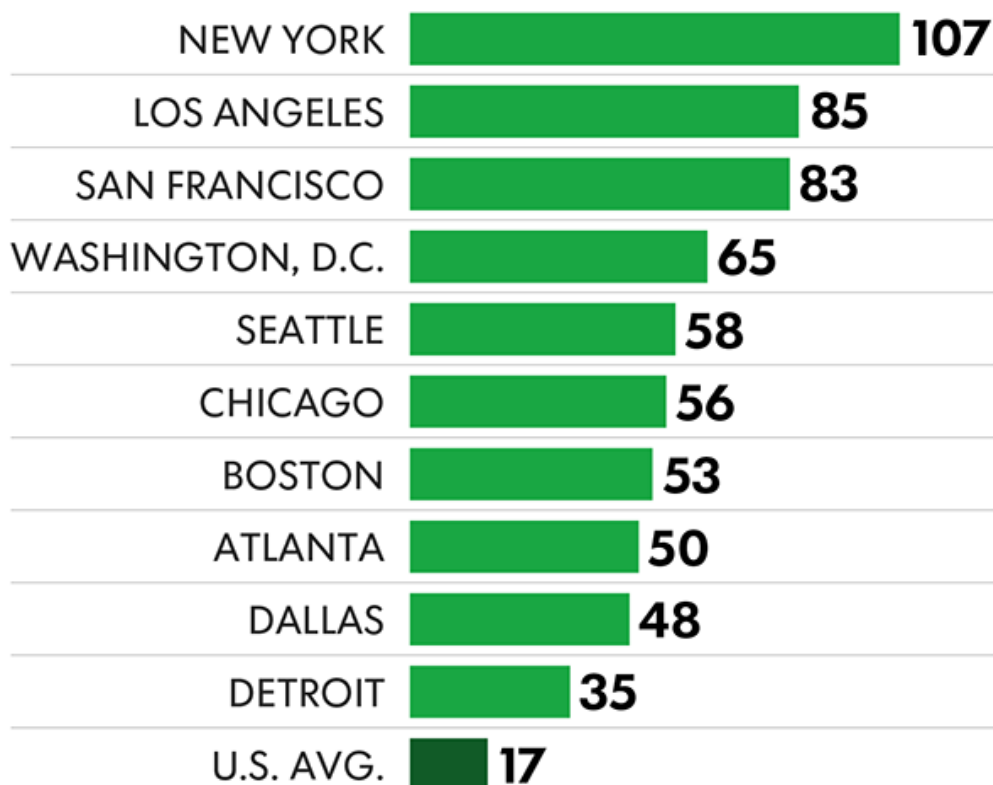
The hunt adds up to an estimated \$345 per driver in wasted time, fuel, and emissions, according to the analysis by INRIX, a leading specialist in connected car services and transportation analytics.

Overpaying — caused by drivers' inability to estimate how long they need to park or forking over extra at a garage to avoid the risk of getting a parking ticket — costs Americans more than \$20 billion a year or \$97 per driver, the report estimated.

Hunting for parking "imposes significant costs on our pocketbooks that we often don't think about," and also adds to (traffic) congestion," said Bob Pishue, an INRIX transportation analyst and co-author of the report. "This is a problem not only drivers face, but local shops and businesses, too."

Motorists in large cities endure the toughest challenges.

Top 10 cities and U.S. average for annual search time, hours per driver:



In New York City, the hardest-hit U.S. urban area, drivers on average spend 107 hours a year looking for parking spots, the report said. The searches add up to what the report estimates as \$2,243 in wasted time, fuel, and emissions per driver, plus \$4.3 billion in costs to the Big Apple.

Los Angeles, San Francisco, Washington and Seattle round out the top five cities with the toughest parking experiences, the report said.

The broader U.S. economy also feels the parking pain. In all, 63% of the nearly 6,000 U.S. drivers surveyed reported they avoided driving to shopping sites, airports, leisure or sports centers, and other destinations due to parking challenges.

The report acknowledged those drivers instead may have used other forms of transportation to reach their destinations or used e-commerce to make purchases after skipping stores.

While many Americans are all-too-familiar with parking problems, the first-of-its-kind report uses data from 100,000 locations across 8,700 U.S. and foreign cities and the interviews with drivers in and around 10 major U.S. urban areas in an effort to estimate the economic and non-economic impact of parking pain.

The at-times maddening searches may also lead to unforeseen personal and emotional problems. According to the report, nearly two-thirds of the U.S. drivers reported they felt stressed while trying to find a parking spot.

Additionally, nearly 42% of the U.S. respondents said they missed an appointment, 34% abandoned a trip because of parking issues and 23% experienced road rage, the report said.

Above number shows how big a problem parking really is, which we often ignore. This has caused huge problems in terms of money, environmental problems, health issues, traffic issues and so on.

According to INRIX 2017 survey, take a look at traffic situations in some of the top cities around the world. Almost every country developed or not is facing this issue today

In the USA Los Angeles tops the index with 102 hours spent on an average per driver in traffic congestion.

Londoners spend about 74 hours a year/driver in traffic.

5.1 . Challenges with Parking

In today's world where a car has become a necessity rather than a luxury, parking has become an equally important aspect of day-to-day life. Any place you travel, the first thing to consider is parking apart from a gas station. With the population explosion and more vehicles on the street than ever in the history of mankind, it is becoming more and more difficult to accommodate the traffic on the street. And so the parking places.

Many times people end up spending more time finding a parking spot than doing the actual work they are out for. Parking spots have become a rare commodity especially in the downtowns, city center, shopping complexes, marketplaces, theaters, stations, hospitals, and office spaces and sometimes even at the airports. Finding a parking spot at the desired location is a matter of luck and a rare occurrence.

The scarcity of parking spots also gives rise to some other environmental and economic disadvantages, which we seldom realize. People spend more and more fuel just to find a parking spot than in actual travel. Also, looking for a parking spot in a crowded place leads to accidents, which leads to frustrating traffic jams. People often have to drive on lower gears to search for parking spots causing more emission of harmful gases in the atmosphere, which leads to a rise in Co₂ contents adding to global warming. More driving, more the consumption of non-renewable resources like fuel, more the emission of gases.

Many times people end up parking in the no-parking zone in case of emergency hospital visits. The patient has to suffer even more. Eventually, it causes further parking issues and adds to the traffic woes

around the hospital for other patients and ambulances. It is a vicious circle.

5.2 Current Parking Systems

There are different types of parking system installations at different places. Each has its own advantages and disadvantages. Majority of these parking systems are unmanaged. From figuring out an empty parking spot to reaching the spot on time before someone else takes it, it is a mad race. Most of these parking facilities are pay as you go setups, where you take a ticket from the kiosk while entering the parking area and pay when you leave depending upon the time you use the parking spot for.

The parking systems today only provide a smart payment solution but lacks a number management solution.

Three main parking systems in use today are TIBA, Kiosk, and Native. Kiosk is very common and everyone is aware of this system. This is a general system that you would find in any shopping complex, Airports, Train Stations etc. You take a ticket while going in and pay while going out by validating your ticket.

TIBA also works in a similar manner, but it provides some more options to validate the customer's ticket over online web console or mobile devices. Native parking systems are also very common in core downtown places, where a parking booth would be human controlled and you pay a flat parking price.

All the parking systems accept all popular payment methods like credit card, debit card or cash, but if Kiosk is unable to read the card then you are stuck at the hands of an agent resulting in long queues.

With cryptocurrencies and other blockchain-based products for payment solutions, the story is completely different. Critically important is the fact that there are usually no middlemen between the two parties making the transaction. This fact brings some major benefits:

- It takes seconds to perform the transactions.

- Transactions can be done over a mobile, no need to wait at the kiosk or booth for payment.
- No hassle of cash or change.
- No problem with currency exchanges while traveling to different countries or on a road trip.
- Transactions can be automated and there is no need to wait in a queue to make payments.

More points to consider and highlight the problem in details:

- Drivers in New York City spent an average of 107 hours (against a nationwide average of 17) per driver per year looking for parking, and this costs them \$2,243 per driver per year. Wasting time and fuel makes up the bigger part of the cost for searching parking spots
- Londoners end up driving around 67 hours (against the national average of 44) per driver per year, which costs them \$1,566 per driver per year.
- These are no small amounts of money to waste just on parking.
- Because of outdated technology and unreasonable rates, drivers also end up paying for hours of parking that they do not need
- Reasons for this include having to pay for a minimum of two hours while only needing 30 minutes
- Paying for extra hours out of fear for parking tickets.
- On average, drivers in the U.S. overpay for 13 hours per year while drivers in the U.K. do the same for 45 hours
- In the most extreme cases we're looking at 96 hours per year and \$896 per driver in New York, against 67 hours per year and \$539 per driver in London.
- Traffic Congestion and Delays due to parking hunters in the cities are causing pollution and carbon monoxide emission in the environment, which adds up to global warming.

Parking availability, wasted search time, cost of parking and stress related to parking make up for the most frustrating aspects of their endeavors.

VI. Smart Circle – Improved Parking Solution

Can traditional parking players provide fast, efficient, affordable parking services to businesses and individual's need? The answer is NO. They can simplify their front-end operations, but the machinery behind it still causes problems because of the way it is structured.

Smart Circle Solution Provides

- real-time parking availability,
- advanced parking reservation,
- advanced payment and navigation to parking.
- Notifications and updates about traffic congestion
- Alternate parking spot suggestions
- Parking airbnb system, to help reduce parking scarcity in the city

On an average only 8% of Americans use some sort of parking reservation application. Only 7% of Americans use some sort of real time parking update system. Which means we are targeting a very fertile and highly available market that could benefit from Smart Circle innovation and seek some immediate improvement in their lifestyle, environment around them and atmosphere they live in. Since Smart Circle will help reduce carbon monoxide and carbon dioxide footprint, it will also help reduce environmental dis-balance caused by traffic and present parking situations.

Smart Circle uses IoT sensory network over cloud based solutions, which can be easily adapted by cities, municipalities, institutions and individual customers. Smart Circle will run on Ethereum blockchain based platform, which could host smart contracts. These smart contracts make it possible to have an immutable agreement between companies, institutions, government authorities like (municipalities, parking governance systems) and consumers. The smart contract will make sure that drivers would pay only what they have used for, no more extra payments or parking ticket fear.

Smart Circle will also help reduce the traffic situation in the downtown area, which is caused due to the secondary traffic of parking spot hunters. People can avoid going to the areas where there is no parking spot available. Or can pre-book their spot before reaching the destination.

The Smart Circle system also has a smart notification service, which can provide real-time alerts to customers of all available parking spots and locations around them. It will also be able to provide a report of how many parking spots are available at what location with coordinates to the parking spot, so the customer doesn't have to circle around the parking facility to search for an empty spot. This will save a lot of fuel consumption and time. And will also save the environment from harmful gas by burning precious natural resources. This would also control the accidents to some extent caused due to over-parking or long parking queues, especially in the downtown and city center locations.

The Smart Circle system uses cryptocurrencies as a mode of payment and payments can be made by phone, online, auto payments, monthly subscriptions etc. This will save a lot of time, which is wasted on the payment kiosk. It will also save paper, which is wasted on printing parking tickets as Smart Circle system employs authentication token-based entry and exit validation. This will avoid the need for printing any parking tickets, hence saving tons of paper being wasted.

Smart Circle is designed with a view to target specific problems of society, the environment and the transportation industry. Smart Circle will provide a real-time, affordable, standardized, green, and clean parking solution on a global scale. It will help consumers to find and reserve a parking spot near their destination anytime anywhere, by significantly reducing time they spent in search of parking, fuel they lose, traffic issues and congestion and environment pollution they cause in the process.

In Addition to that Smart Circle will offer aT PALMS platform (Local Parking Location Monetization Platform), which will allow people to list their unused spaces, garages, parking alleys on Smart Circle platform,

which will be shown to consumers searching for parking spot in that area. This will help reduce the shortage of parking spaces in the cities, also people will be able to make money from their otherwise useless space. Imagine your parking spot making money for you while you are working in office, watching movie or enjoying vacation with your family.

Smart Circle will provide a universal and state of the art dashboard to all parties like Parking providers, Garage owners, Parking Authorities, Institutions (Airport, Hospitals etc), and Individual Customers which will show the real time availability and rates for any parking spot across the city/cities thereby cutting the middleman from the process, which drives the parking rates higher and higher.

These dashboard systems will be connected to Smart Circle cloud, IoT networks and gateways. The traffic data feeds from different institutions including Google, parking authorities will help our system to provide consistent and real time notifications to consumers about any traffic congestion and suggest alternate parking spots. With more and more automobile companies heavily investing on IoT technologies and smart car initiatives, It's just a matter of time when almost every car company will be compatible to connect and integrate Smart Circle open Apis and smart parking solution into their consoles. We will be publishing open APIs to the community so they can use all the state of art services that Smart Circle is integrating into its smart solution.

The Smart Circle ecosystem runs exclusively on SMC utility tokens on the Ethereum blockchain. Smart Circle will also allow users to make parking reservations using other crypto

The components of the system such as Camera Surveillance, edge device, and a python library for image processing, are briefly explained below.

1. Camera Surveillance unit: This is installed at every parking pool and is connected to an IoT device. The camera surveillance unit captures and sends the images to the IoT device. This unit mainly focuses on obtaining images for monitoring the parking space.

2. IoT unit: This is a mini computer board which obtains images from the camera surveillance unit and gets inputs processed using the python library. The IoT unit analyses the images and obtains the list of empty and occupied parking spaces with respect to a timestamp.

3. Python Library: This is an image processing software used for analyzing the images obtained by the camera unit. This unit functions to enable image processing for the occupancy of the lots in a parking pool.

4. Database: This is a traditional MySQL database unit that stores the parking data obtained from the IoT device. The database schema consists of 1. Parking Id 2. Parking lot id 3. status (EMPTY, OCCUPIED, BOOKED, ILLEGAL) 4. Timestamp.

5. Mobile Application: This is the mobile application used by the customers who want to view and book available parking spots (Figures 9 and 10). Payment gateway integration is done with the fiat mode of payments for the bookings made.

6. Blockchain: Only the important details such as parking data are sent from the database through an Oracle to the Blockchain. Oracles connect the traditional database with the Blockchain system. Blockchain also manages the transactions of ERC -721 tokens between the owners, contractors, and customers.

The master data record of the parking lot will have details about the contractor name, landowner name, land location, bidding split, and initial investment. If a landowner is willing to run the parking lot then bidding will not be required and the landowner doesn't need to pay any caution deposit.

Better parking lot facilities will provide huge economic benefits to the society as it supports the growth and development of the surrounding neighborhood. This will also have a positive impact on the environmental condition, as less gasoline will be burnt by the vehicle owners while filling a vacant parking lot in the street. This also reduces traffic congestion as well.

6.1 Smart Circle System Architecture

Above figure shows the high-level enterprise architecture of the Smart Circle System. It is highly scalable and flexible and makes use of the latest technologies for its implementation.

The customer operations and front office operations will be made available on all popular devices like iPhone, Android, Windows and over the Web. Data will be served over a secured cloud network. The core component consists of IoT sensor modules, which relay events to the IoT gateway. IoT gateway aggregates the event and transforms the data into a machine-readable format. With the help of machine learning and data analytics, the system will be able to optimize the parking search over time and provide the most accurate locations in the least time on customer's devices. Back office operations will be available to support customers 24/7 with any issues or concerns they have regarding their bookings, use of the system, use of consoles, or any other technical difficulties.

6.2 Implementation Details

The Smart Circle system consists of hardware components like sensors, transponders, gateways, multiplexers, transmitters etc. and also many software modules and components. Below is the system interaction and component network diagram for the Smart Circle system.

Parking Cluster: It's a mesh of multiple parking facilities across a city. Each city is divided into a cluster. Similarly there will be multiple clusters for different cities. Each cluster will talk to a dedicated gateway and network server. These parking clusters will be equipped with IoT sensors and a transponder network, which communicates parking spot change events to the gateway.

Parking Console: It's an electronic device that would read the Universal Identification Number from the user's device. UIN will be in the form of a QR code. User's SMC wallet address will serve as their UIN on the

Smart Circle network. The Parking Console will scan the UIN and present a touch screen with available parking spots for selection and reservation. Once User selects a spot, a transaction will be triggered to contract on the blockchain.

IoT / Sensor Gateway: Gateway is a device which is capable of receiving all the IoT and Sensor communications. Sensor network from the parking facility will communicate the event data to the gateway. Gateway then feeds this to network servers in batches.

Adapter: Adapter is a software component, which provides capability of data transformation, orchestration, data enrichment, data translation, aggregation, routing and data massaging. Different devices on a network talking different technologies can communicate through an adapter.

Cloud: Data center will be hosted on cloud. It will store the metadata and transactional data received from different gateway modules and software components. Data is stored and read from the cloud via big data, a query plex framework. This will serve as a source for Business Analytics and Telemetry for business development and expansion.

Devices: Devices can be mobile devices like iPhone, Samsung etc. or Desktop, Laptop, Tablets, which will allow users to perform parking discovery, reservations and required transactions.

Smart Contract: SMC smart contracts, written in solidity, control the transactions performed during parking reservation. Smart contracts will hold the parking charges once the user scans UIN at the parking location or at the start of the reservation slot. When User leaves the parking spot, Sensors activates the network and triggers a confirmation to contract. The contract then transfers the amount equivalent to parking time used to the SMC wallet and reverses any access amount back to the user wallet.

Network Servers: Network Servers receive data and events from different systems in the network and store them over to cloud. They form the backbone of the ecosystem. Every data transaction directly or indirectly goes through Network Servers.

VII. How it Works?

7.1. Implementation

The step-by step implementation details of the parkchain is enumerated below.

- **Non-fungible parking token**

In the implementation of ParkChain, we create a non-fungible parking token for each parking lot in the given land. Non-fungible tokens represent uniquely verifiable parking lots that cannot be interchanged and eliminates any chance of fraud or duplication. ERC 721 standard is used for creating the non-fungible parking tokens in the Ethereum network. Based on the land provided, the system generates tokens for owner/contractor which could be rented to customers on an hourly/daily basis.

- **Bidding for token lease**

Prospective contractors will submit their bids for the non-fungible park tokens and the best bid will be selected either online(through smart contracts) or offline. Criteria for selection would be assured profits, genuineness of owners, bidding history, etc. The bid which satisfies the above conditions will be selected. For example, if Contractor A submits a bid with a profit-sharing scheme of 20-20-60 for Legal agency—Land Owner—Contractor and Contractor B submit a bid with a profit-sharing scheme of 25-25-50, then Contractor B will be selected. The system will then prompt the winning Contractor to submit a security deposit which will be a function of the base value of the parking lot. The security deposit will be calculated based on:

1. Land area of the parking space
2. Capital the contractor has to invest for setting up the parking space and security measures if any

3. Accessibility and location of the parking space.

In short, the contractor should do the initial investment for setting up the parking lot. Operational as well as maintenance costs should be recovered from the revenue being generated. The profit, after deducting the recurring expenses and contingencies, will be shared across the stakeholders.

- Token leased to winning contractor

For every owner-contractor tuple, there will be one dummy customer wallet address. The customer wallet address is a dummy address, which is to build the traceability of the lending process by the contractor using blockchain, for every corresponding booking made by the customer. Each token can be made unique with the ERC 721 standards. These unique parking tokens avoid the double spending problem and ensure proper returns to landowners and tax collection for government. The Ethereum network forms the immutable public ledger listing transaction details of the non-fungible tokens which provide transparent data to all stakeholders to avoid disputes. This transparent ledger mechanism makes it possible to trace the demand for each parking lot and helps in the fair pricing of future bidding of parking lots.

- IoT setup for parking space monitoring

We used raspberry pi3 based IoT modules and cameras for continuous monitoring of the parking space (Ji et al., 2014). Python3 is used for the implementation. The OpenCV library is used for the identification of vacant slots and occupied ones from camera images. However, booked slot information along with time slots of booking would be available from the mobile app. This system also provides information regarding the duration of occupied lots, availability and location of vacant lots, etc. The derived data from the IoT modules and the mobile apps are persisted in a MySQL database.

If parking of a vehicle is violating the booking condition or not parked in the right slot or fraudulently parked, it will be marked as “Illegal Parking” in the database. The checkout of such vehicles will be handled

off-line based on the duration of parking and penalize the vehicle owner for the inconvenience.

- Mobile application for connecting the users

The mobile application provides the location and details of the available parking pools near the driver's current location or near the driver requested target destination. There are provisions for advance booking of the park token w.r.t time and location. The minimum pricing of the available park tokens will also be displayed across each identified park pool. The application also provides pricing information and details regarding other value-added services attached to each park token based on the time and day of availing service (e.g., busy or normal timings). Pricing of every booking is based on the add-on services provided in each parking lot, like a covered roof, cleaning facilities, charging point, security, normal/peak hour, etc., and payment is made in fiat currency through the payment gateway integrated into the mobile application. This application includes a payment wallet system to exchange park tokens and to release it afterward using the dummy wallet address internally. This wallet system is linked to the smart contract that ensures the real-time revenue distribution between the stakeholders by persisting the token transaction details in Blockchain. Smart contracts are used to trigger the computation of revenue share for each of the stakeholders.

- Ethereum based blockchain implementation of smart contracts

As already mentioned, smart contracts running on top of Ethereum Blockchain network make it viable for the proper revenue disbursement based on the utilization of Parking Tokens with agreed upon terms and conditions.

The bidding will be based on the profit allocation rules and is managed offline. After confirmation of the bidding, the Contractor will pay a security deposit.

The system can be further extended to include the credibility or reputation management system for accessing the genuineness of the

contractor and land-owners as an ongoing process by analyzing the activities of the participants and through gathering feedbacks from the peers. This includes accounting irresponsible actions from the contracting parties by penalizing them and incentivizing for actors successfully and ethically completing the tenure. This would help the system to eliminate or discourage fraudulent actors in the business network as the trustworthiness of every participant evolves along the line. However current system access the genuineness of the land-owner through input from the land-record registration department.

The Smart Circle App works on data collected and arranged by 3 different algorithms that works in symphony - Geo-Taging, Location Indexing and IoT event generator. Data will be collected real time and continuously over IoT networks and other sensory networks and hosted on a cloud. Where based on the principle of MDM probabilistic matching it will be collapsed and merged with metadata collected from Geo-Tagging and Location indexing during the installation and onboarding of a parking facility on the Smart Circle ecosystem. This data will be served to mobile applications and Dashboards across all consumers of the Smart Circle system. This will deliver a single source of truth and all the consumers and partners will have access to the same system, data and services. This will also cut off the middleman from the system thereby standardizing the parking rates across cities.

Users can then approach the booked parking location with the help of guided navigation provided by the Smart Circle app. At the parking facility users can either flash their UIN code to the Smart Circle console to gain access to the parking lot or use a touchless entry into the facility by installing RFID devices provided by Smart Circle. The UIN and RFID codes will be recognized by the system and grant users access to parking facility where they have pre- booked their spot. At this point system will trigger a timer on the user's account. When a user leaves the parking lot by flashing UIN or RFID a transaction will be triggered on Smart-Contract, which will deduct the tokens from users wallet for the time used by user on the parking facility. This way user will never have to worry about parking tickets, waiting in payment queues at the Kiosk - wasting his time, or even worry about parking payments. The Smart Circle wallet will be integrated within the Smart Circle app and

dashboard providing users with seamless payment, parking reservation, parking management experience. In case of any traffic issues, system will notify user of traffic congestion to his booking location and will also suggest an alternative spot closest to his destination. User would be able to change his reservation with a single click.

7.2 Online customer support

The Smart Circle online customer support team is ready to deal with any inquiries. Our team of dedicated professionals handles all issues and inconveniences. Support will be accessible online and via mobile, ensuring the necessary communication channels are on offer when required. We understand that continuous, high-quality support is the key to success, which is why we prioritize providing the very highest level of client support. Every user spreads the word about their product experience, and we want this word-of-mouth communication to be positive, encouraging more customers to join our community. We will dedicate all the necessary tools, resources and people to make this happen.

7.3 Knowing your customer and anti-money laundering

Anonymous and pseudonymous use of Smart Circle services will not be possible. All users will be requested to provide satisfactory identification, proof of residence and/or other documents necessary to meet all legal requirements.

AML modules will be integrated into the payment infrastructure offered by Smart Circle. That said, these measures are not intended to make users' lives difficult. The goal here is to systematically improve the credibility of cryptocurrencies as fair and legal means of payment.

We will use a leading KYC service provider to deliver our users a fast and effective onboarding process. Smart Circle is entitled to bring top-level Know Your Customer standards to its business operations. What's also important to note is that the authentication process we have designed is intended to avoid the shortcomings of similar processes used.

This authentication service will offer maximum convenience, and the verification of user information should take no longer than 24 hours.

7.4 Security and audit

To ensure Smart Circle's ability to comply with security requirements, we aim to conduct external security audit no less than once per year. The scope of such audit encompasses the entire Smart Circle platform.

First such audit scheduled to be held in the second quarter of 2019.

We will also use independent security audits of a narrower scope throughout our product development lifecycle. Our security philosophy is based on two main principles:

- Creating a reliable technology platform that has sufficient protection from external threats by design.
- Protection from the human factor through adherence to widely accepted best practice

7.5 Conclusion

With the upcoming smart cities and the ever increasing number of vehicles on road, effective traffic management systems will be in demand. Searching for the parking spaces in cities will aggravate the mobility issues. In this work we propose a Blockchain based IoT powered transparent framework for creating more parking spaces. The public ledger mechanism of Blockchain acts as the backbone of the system for managing the leasing of the un-utilized property. This Blockchain ecosystem also supports a transparent payment mechanism over a decentralized platform. Smart contracts manage the entire process of revenue income as well as revenue sharing and improve the ease of doing business with minimal discrepancies. IoT powered sensors connected to the ecosystem manages and monitors the parking process and the mobile application proves to be the handlers to the customers and end users aiding in terms of navigation, payment, reservation, etc.

Parkchain is revolutionary parking and land utilization solution for ongoing smart city projects across the globe. This can be further extended to other business models including land leasing, mortgage, etc

where anonymous parties can build a trusted network with smart contract enabled Blockchain.

Smart Circle is a project that aims to bring revolution in parking system and introduce cryptocurrencies into your everyday life. At present, the growing numbers of people who wish to integrate cryptocurrencies into their daily transactions still face too many obstacles.

We believe that currently the parking industry is still operating on the generations-old model and it needs a major change. This industry has remained aloof from technological advancement for a long time.

We believe the step forward needed is to bridge the gap and remove the inefficiencies in the system. Simultaneously help save the environment of its non-renewable resources, papers wastage, traffic issues, accidents etc. and help people spend more time with family and less time on finding a parking spot.

VIII. Smart Circle Tokens

SMC is the official token for the Smart Circle ecosystem. Tokens can be used in 2 ways:

- as Utility Tokens and
- as Value tokens.

Utility tokens provide discounted parking rates to the token holders, when they use these token. These tokens will be used to make the payment against parking and reservations. To use Smart Circle APIs SMC tokens will be needed. SMC tokens are utility tokens as it is needed to use the Smart Circle ecosystem and integration framework.

User can chose to stake SMC tokens as value tokens in this case they would work like bonus accumulating tokens or loyalty tokens. To use SMC as Value Tokens the token holder should hold the tokens in their SMC wallets, in other words, stake the tokens for a fixed amount of period, once they do so, these staked tokens will gain loyalty bonus, which will be released by the company from time to time. Bonus

allocation would start once the Smart Circle platform is successfully installed and operational for the public use.

8.1 Token Allocations

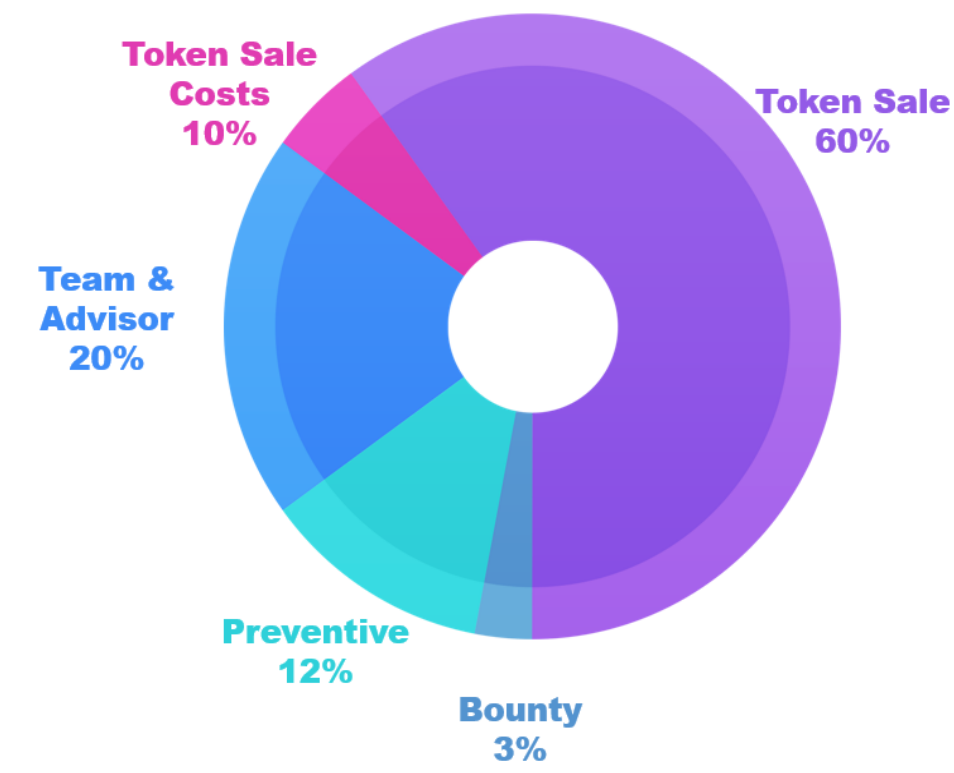
Smart Circle Token Symbol SMC

Token Standard TRC 20

Tokens Issued 200 000 000 SMC

All funds received from the will be used for the development, maintenance and deployment of the Smart Circle ecosystem. Specifically:

Token Allocation:



8.2 Token Sale Proceedings

Proceeds from the Smart Circle Token Sale will be allocated in what we deem the best way to achieve our primary vision: providing a parking reservation system. We believe the appropriate mix to make this happen

is devoting our resources (which includes our funds, as well as the Smart Circle ecosystem's focus) on the following areas:

