

The background of the slide is a photograph of a city street scene. In the foreground, a white SUV is driving towards the viewer. The street is lined with tall, multi-story buildings. A sign for "PARK" is visible on one of the buildings. The sun is low in the sky, creating a bright glow and long shadows. A blue circular graphic is overlaid on the left side of the image, containing the text.

Blockchain proof-of-concept for car rentals in a Smart City

In an earlier article, we highlighted the remarkable transformation that the car rentals business is undergoing at the hands of technology. Leading rental services are using mobile apps for bookings and payments, facial recognition to improve speed and security around bookings, and data and analytics to improve customer service. However, the ecosystem in which car rental organizations operate is subject to a number of other inefficiencies that technology can address. One example is the time

and resources required to account for and settle speeding or parking violations when the car is in use by a customer. Resolution requires interaction between multiple agencies and can take weeks. **Blockchain** can be used to create a fast and effective intervention. The Blockchain solution is also a positive step in the direction of creating smart cities where connected systems are expected to improve efficiency and citizen experience.

Context of car rentals in a smart city

Dubai is one of the foremost smart cities in the world. In the context of car ownership, all cars are identified through unique government-issue RFID tags. Traffic sensors dot the entire

cityscape and these RFID tags can pick up the movement of individual cars on each road or street. Tollbooths and parking meters, likewise, recognize these RFID tags.



Figure 1: Tracking car movement using RFID tags

Blockchain + IoT = New ways of doing things

The data picked up by the sensors is relayed via an IoT gateway and processing system (see Figure 1) managed by a consortium of government and private agencies comprising road traffic authorities, toll road operators,

parking providers, insurers, etc., (see Figure 2). The car rental agency, which is a part of the consortium, can relay information related to fines and charges for its fleet of cars to a Blockchain network by filtering the data.

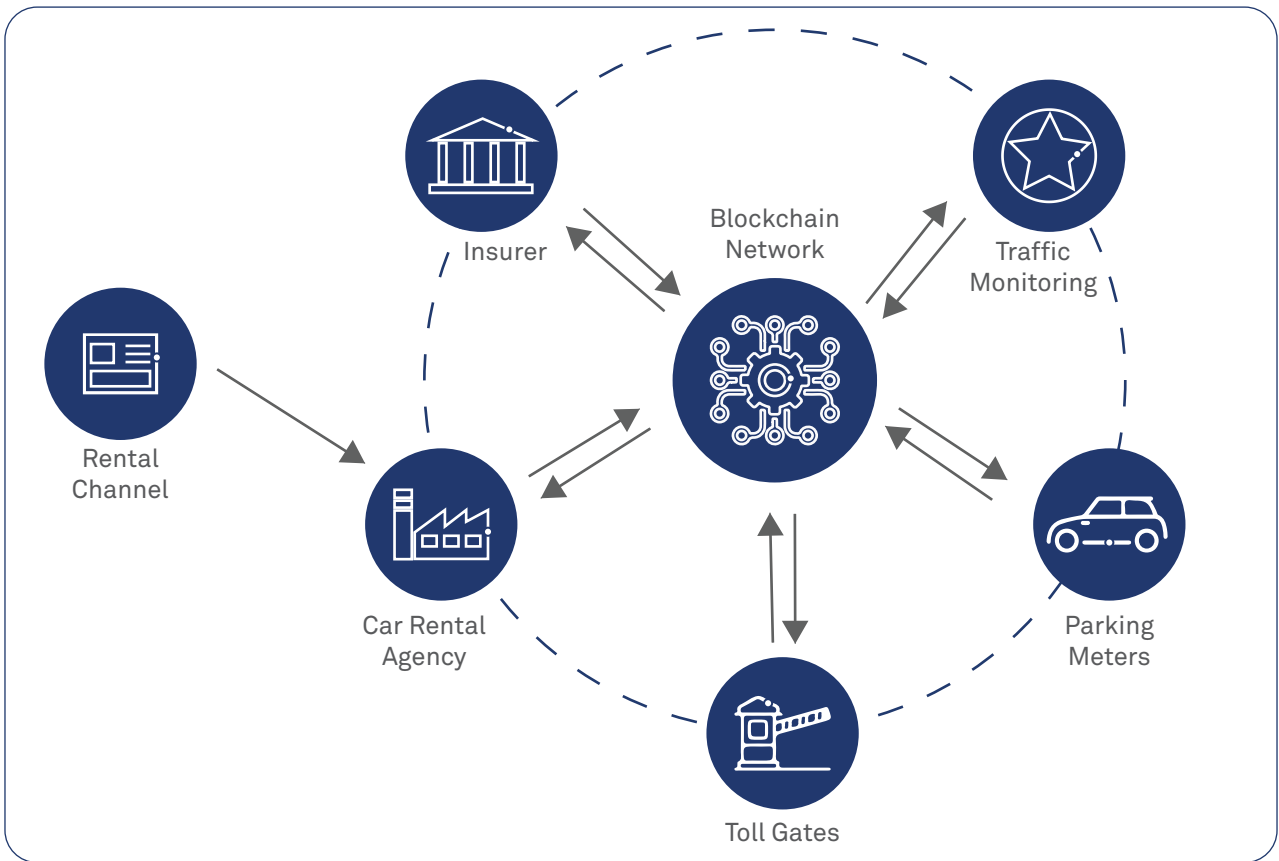


Figure 2: Blockchain consortium of government and private agencies

Solution Architecture

In the POC for the city of Dubai, a mobile app was created for initiating a car booking while Blockchain was used to simplify and link a variety of rental processes and the associated data. These included car booking, pickup, fines

and charges accrued during rental and car return (see Figure 3). **Hyperledger Fabric** was chosen as the Blockchain platform and **Oracle's Cloud-based "Blockchain as a Service"** was leveraged.

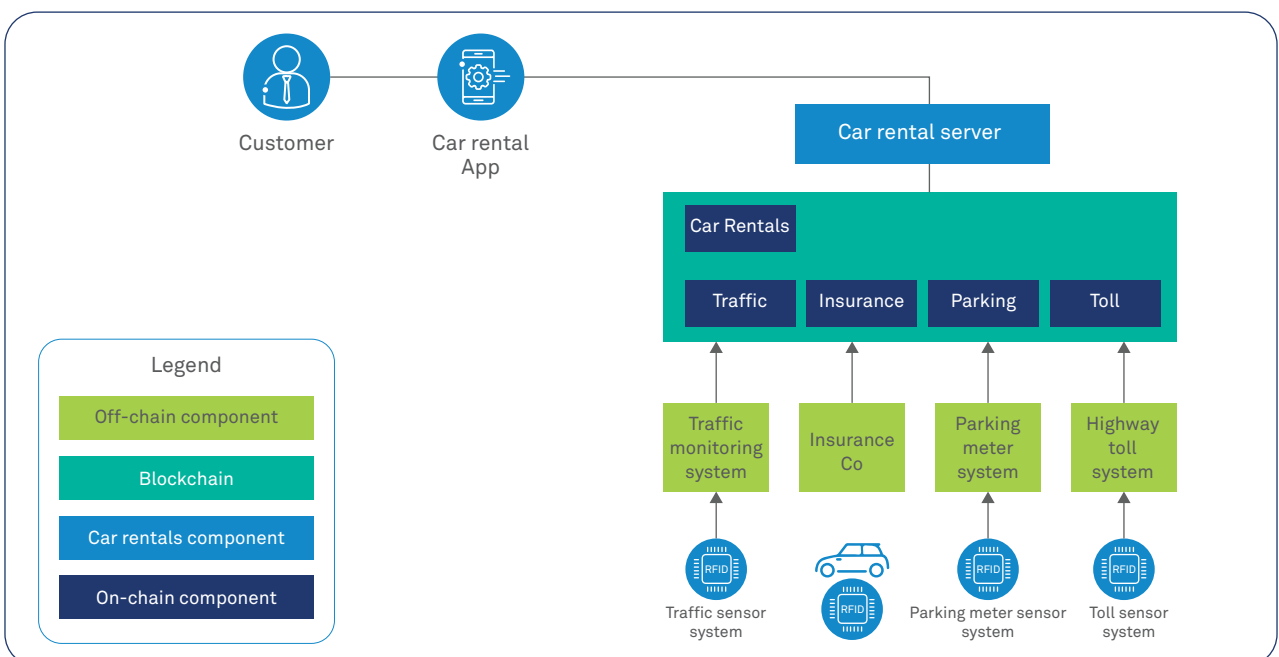
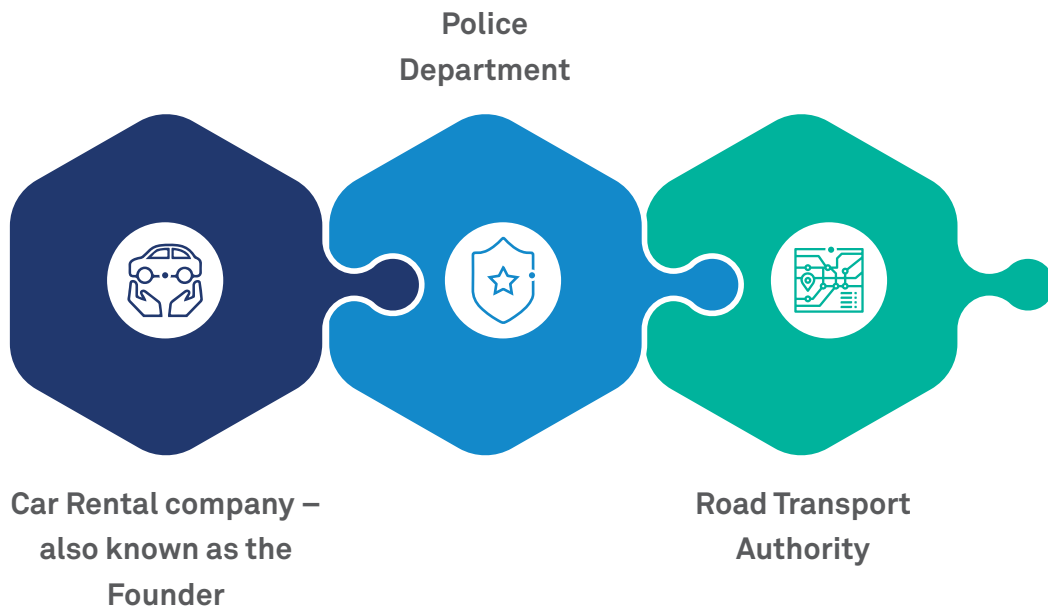


Figure 3: Blockchain-based system architecture

Blockchain Design

The Blockchain designed for the POC comprised three organizations that decided to collaborate in a business proposal, form a consortium and

share relevant data among themselves, adhering to a certain set of rules:



This translates to a Blockchain model comprising a 3-node network, each node representing an organization.

The Car Rental business works with a certain set of rules governing data sharing:

- Toll charges will be associated with the Car ID and exchanged between the Toll operator and Car Rental Agency

- Traffic fines will be associated with the Car ID and exchanged between the Police and Car Rental Agency
- Parking fees will be associated with the Car ID and exchanged between the Parking Service provider and Car Rental Agency

End-to-end process flow

Step 1: Booking a car

Using the rental channel, a customer makes a booking for a car, specifying the date, time, rental duration and the car pick-up / drop-off points.

- User submits the car booking request
- The car rental server records this in its database

- The car rental server then invokes the car rental API through which booking metadata is passed on to the Blockchain

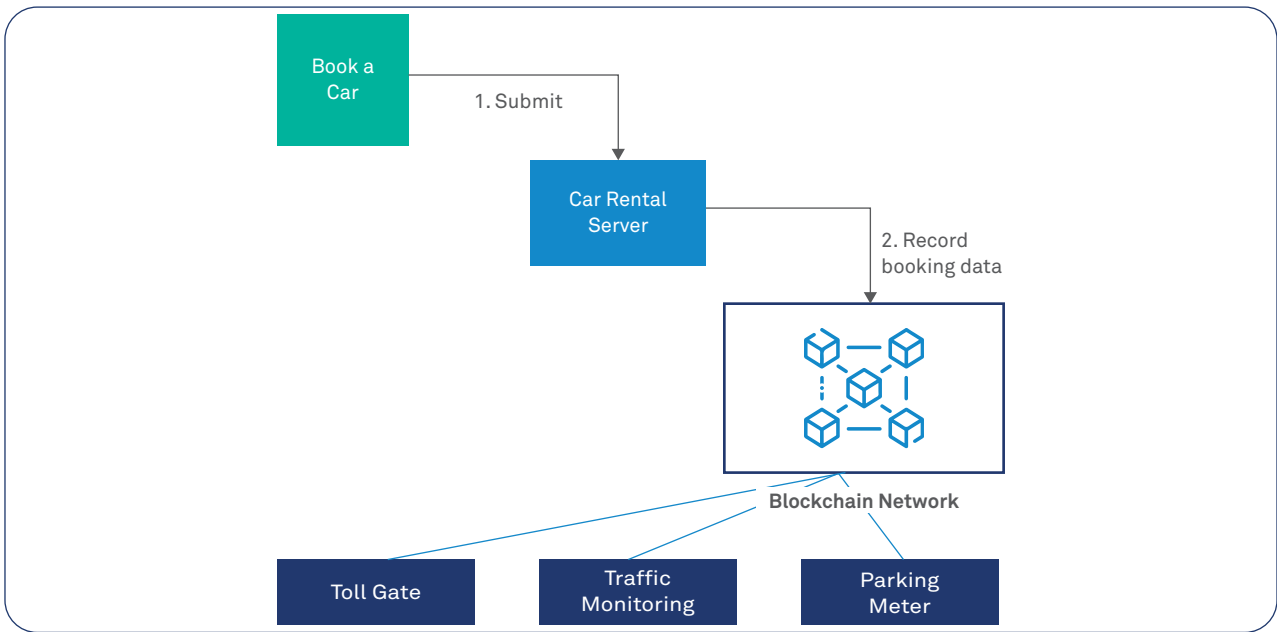


Figure 4: Architecture flow for booking a car

Step 2: Picking up the car

On the day and time of the booking, the customer reaches the pick-up spot, inspects the car, examines the insurance policy and commences their rental. The system is built such that these transactions are captured in real-time; the system associates the customer with the car in the back-end.

- The customer clicks “Submit” after inspecting the car and agreeing to the terms and conditions

- The car rental server records this in its database
- The car rental server then invokes the car rental API through which booking metadata is passed on to the Blockchain

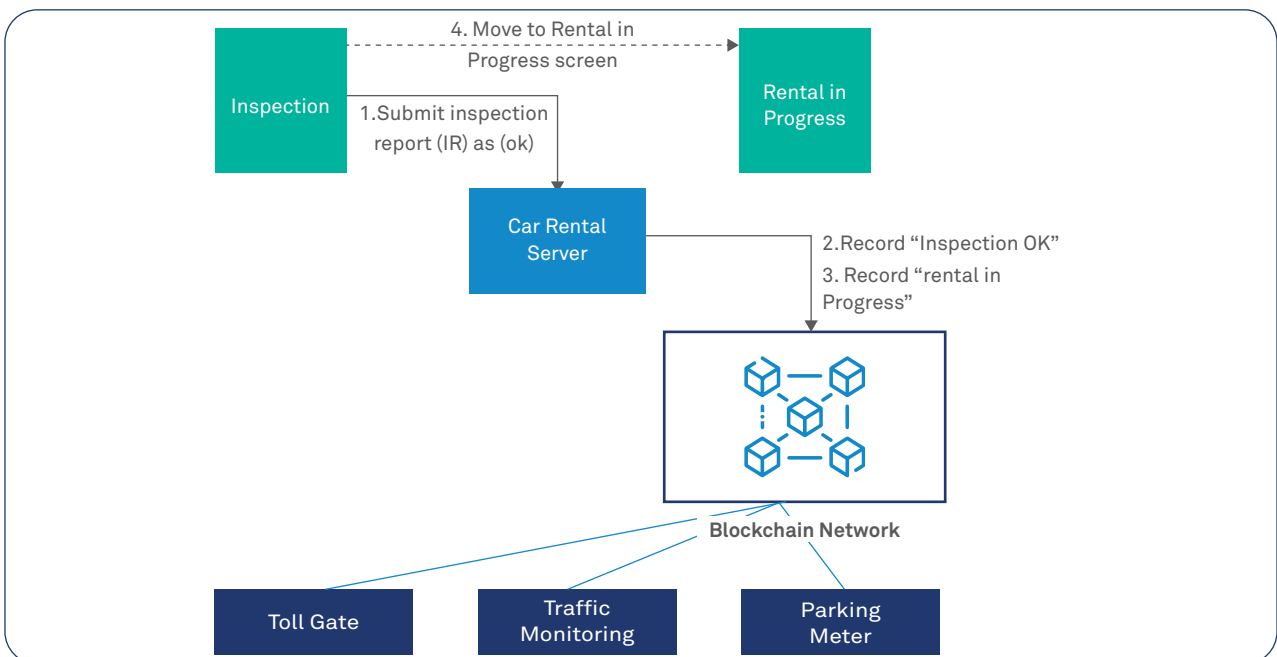


Figure 5: Architecture flow for picking up the car

Step 3: Rental in progress

While the rental is in progress, the RFID tag on the car enables the traffic monitoring system to detect over-speeding; parking meters to capture the duration for which the car was parked;

tollgates to record entry and exit points and compute applicable toll charges. This information is relayed to the Blockchain network in real-time.

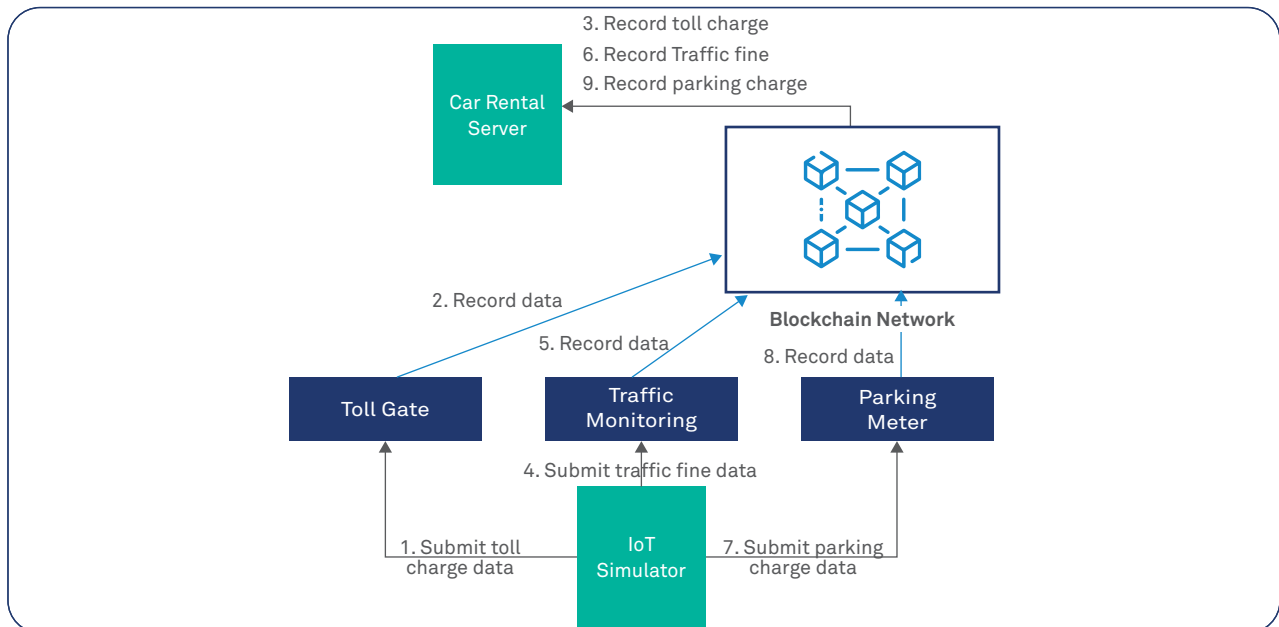


Figure 6: Architecture flow for receiving IoT data during the rental period

Step 4: Returning the car

Once the customer returns the car, the system calculates dues from information available in the Blockchain network and charges the customer accordingly.

- 'Return inspection report' metadata is passed on to the Blockchain network
 - Blockchain ledger is queried and related charges, fines, returns, etc. are fetched by the car rental API
 - Server applies this data to arrive at final payment to be made by the customer (or refunded to the customer)
- Customer then clicks on 'Pay', which passes the booking ID and payment metadata to the Blockchain

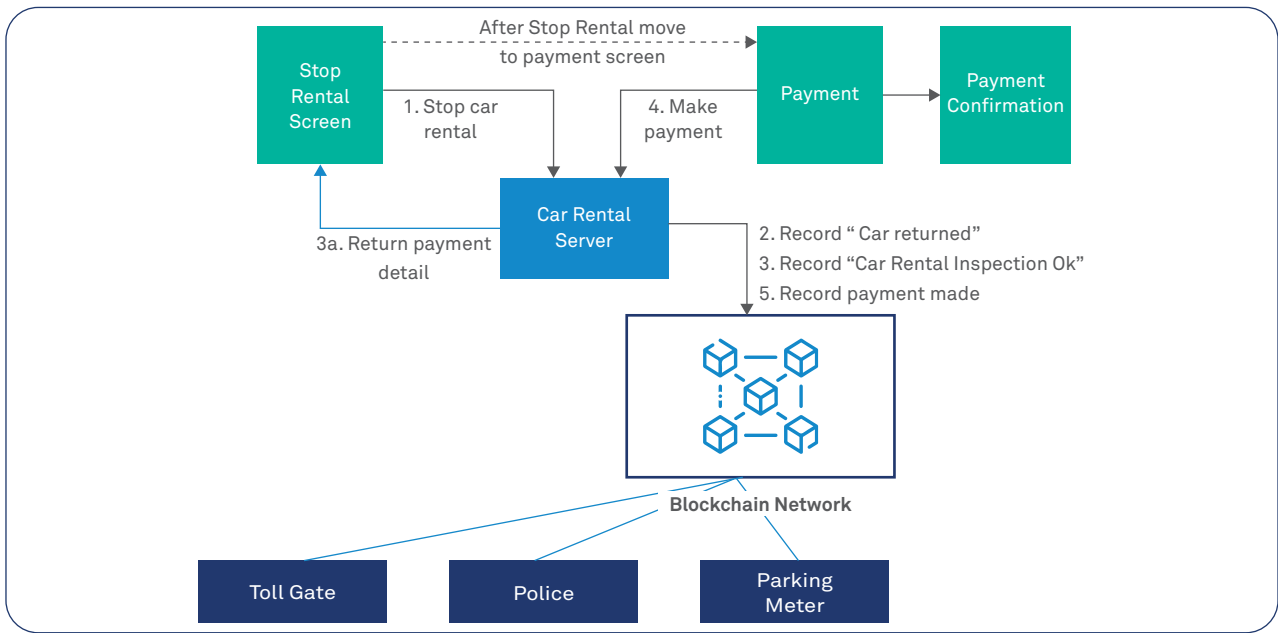
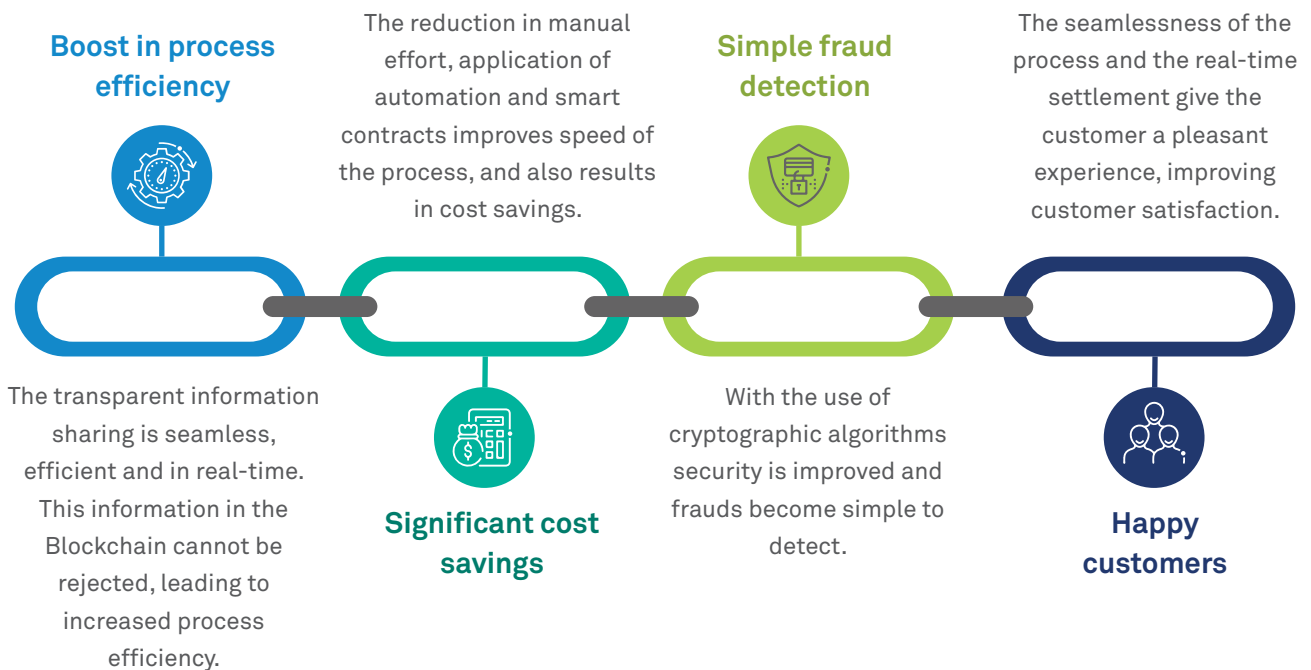


Figure 7: Architecture flow for returning the car

The benefits of Blockchain



This solution is especially applicable for Smart Cities that are rapidly building connectivity and integrating a variety of systems to create citizen conveniences. But car rental businesses need to improve their services and bring it on par with customer expectations being set by other

industries such as retail, CPG and banking. Implementation of Blockchain also results in lowering operational costs and eliminating fraud. Organizations that implement advanced technologies like Blockchain will, naturally, drive disruption in their industry.

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