

# **DISTRIBUTED LEDGER TECHNOLOGY FOR FREIGHT SYSTEM**

## **CROSS REFERENCE TO RELATED APPLICATIONS**

**[0001]** This application claims the benefit of U.S. Provisional Application No. 62/556,994 filed September 11, 2017, the entirety of which is hereby incorporated by reference.

## **TECHNICAL FIELD**

**[0002]** This disclosure relates to distributed information management and, in particular, to managing transportation and logistical information with distributed ledger technology.

## **BACKGROUND**

**[0003]** Transportation services rendered by truck, train, plane, ship, or other methods of transportation may involve agreements between parties for transporting freight. Traditional approaches to tracking the transportation of freight may involve inefficient processes, inaccurate data collection, and/or encumbered systems. In some Freight Bill Audit and Pay (FBAP) systems, transportation service providers may submit shipping information to satisfy the terms and conditions of a shipping agreement. Due to the deficiencies in current market solutions, the shipping information may be unverified and cumulative. Moreover, traditional approaches to FBAP processes may be prone to frequent errors, manually cumbersome, and/or unable to efficiently collect and process information in a timely manner.

## **SUMMARY**

**[0003a]** According to a first aspect of the present invention, there is provided a method, comprising: receiving, by a server node in communication with a blockchain database, a vehicle tracking update created by a vehicle tracking device, the vehicle tracking update comprising geographic location information indicative of a geographic location of the vehicle tracking device; identifying, in a blockchain stored in a database, a smart contract including a destination identifier and executable logic configured to determine a tracking metric; determining the tracking metric in response to receipt of the vehicle tracking update by calculating, using the

executable logic, the tracking metric based on a comparison of the geographic location information of the vehicle tracking update and previous geographic location information included in a previous datablock of the blockchain; appending a datablock to the blockchain, the datablock including the tracking metric and the geographic location information; determining a shipment associated with the vehicle tracking device has reached a destination corresponding to the destination identifier by detecting, using the executable logic and the vehicle tracking update, that at least one of the following conditions are satisfied: the vehicle tracking device has remained stationary for a predetermined amount of time included in the smart contract, or the vehicle tracking device is positioned in a geographic area, the geographic area identified by the smart contract; and synchronizing the blockchain with a plurality of blockchains stored in blockchain databases remote to the server node; wherein the blockchain comprises a first blockchain and the smart contract comprises a first smart contract; determining, based on the executable logic and the vehicle tracking update, that a shipment associated with the vehicle tracking device has been transferred from a first carrier associated with the first blockchain to a second carrier associated with a second blockchain, wherein the second blockchain comprises a second smart contract; reprogramming the tracking device with an identifier corresponding to the second smart contract; receiving a plurality of additional vehicle tracking updates from the vehicle tracking device after determination that the shipment has been transferred to the second carrier; and appending a plurality of datablocks to the second blockchain, the plurality of datablocks including tracking information corresponding to the additional vehicle tracking updates.

**[0003b]** According to a second aspect of the present invention, there is provided a system, comprising: a processor, the processor configured to: receive a tracking update created by a tracking device, the tracking update comprising geographic location information indicative of a geographic location of the tracking device; identify, in a blockchain, a smart contract including executable logic configured to determine a tracking metric; determine, using executable logic of a smart contract stored in a blockchain, the tracking metric in response to receipt of the tracking update, the tracking metric calculated based on a comparison of the

geographic location information of the tracking update and previous geographic location information included in a previous datablock of the blockchain; append a datablock to the blockchain, the datablock including the tracking metric; synchronize the blockchain with a plurality of blockchains stored in respective blockchain databases configured at respective server nodes, wherein the synchronization comprises communicating a blockchain synchronization message to the server nodes and wherein the blockchain synchronization message includes all or a portion of the blockchain; wherein the blockchain comprises a first blockchain and the smart contract comprises a first smart contract; determine, based on the executable logic and the tracking update, that a shipment associated with the tracking device has been transferred from a first carrier associated with the first blockchain to a second carrier associated with a second blockchain, wherein the second blockchain comprises a second smart contract; reprogram the tracking device with an identifier corresponding to the second smart contract; receive an additional tracking update from the tracking device, after determination that the shipment has been transferred to the second carrier; and append a datablock to the second blockchain, the datablock including tracking information corresponding to the additional tracking update.

**[0003c]** According to a third aspect of the present invention, there is provided a non-transitory computer readable storage medium comprising computer executable instructions, the computer executable instructions executable by a processor, the computer executable instructions comprising: instructions executable to receive a tracking update created by a tracking device, the tracking update comprising geographic location information indicative of a geographic location of the tracking device; instructions executable to identify, in a blockchain, a smart contract including (a destination identifier and) executable logic configured to determine a tracking metric; instructions executable to determine, using a smart contract stored in a blockchain, the tracking metric in response to receipt of the tracking update, the tracking metric calculated based on a comparison of the geographic location information of the tracking update and previous geographic location information included in a previous datablock of the blockchain; instructions executable to append a datablock to the blockchain, the datablock including the tracking metric; instructions

executable to synchronize the blockchain with a plurality of blockchains stored in blockchain databases, wherein the synchronization comprises communicating a blockchain synchronization message to the server nodes and wherein the blockchain synchronization message includes all or a portion of the blockchain; wherein the blockchain comprises a first blockchain and the smart contract comprises a first smart contract; determining, based on the executable logic and the tracking update, that a shipment associated with the tracking device has been transferred from a first carrier associated with the first blockchain to a second carrier associated with a second blockchain, wherein the second blockchain comprises a second smart contract; reprogram the tracking device with an identifier corresponding to the second smart contract; receive an additional tracking update from the tracking device, after determination that the shipment has been transferred to the second carrier; and append a datablock to the second blockchain, the datablock including tracking information corresponding to the additional tracking update.

## CLAIMS

### What is claimed is:

1. A method, comprising:

receiving, by a server node in communication with a blockchain database, a vehicle tracking update created by a vehicle tracking device, the vehicle tracking update comprising geographic location information indicative of a geographic location of the vehicle tracking device;

identifying, in a blockchain stored in a database, a smart contract including a destination identifier and executable logic configured to determine a tracking metric;

determining the tracking metric in response to receipt of the vehicle tracking update by calculating, using the executable logic, the tracking metric based on a comparison of the geographic location information of the vehicle tracking update and previous geographic location information included in a previous datablock of the blockchain;

appending a datablock to the blockchain, the datablock including the tracking metric and the geographic location information;

determining a shipment associated with the vehicle tracking device has reached a destination corresponding to the destination identifier by detecting, using the executable logic and the vehicle tracking update, that at least one of the following conditions are satisfied:

the vehicle tracking device has remained stationary for a predetermined amount of time included in the smart contract, or

the vehicle tracking device is positioned in a geographic area, the geographic area identified by the smart contract; and

synchronizing the blockchain with a plurality of blockchains stored in blockchain databases remote to the server node;

wherein the blockchain comprises a first blockchain and the smart contract comprises a first smart contract;

determining, based on the executable logic and the vehicle tracking update, that a shipment associated with the vehicle tracking device has been transferred from a first carrier associated with the first blockchain to a second carrier associated with a second blockchain,

wherein the second blockchain comprises a second smart contract;  
reprogramming the tracking device with an identifier corresponding to the second smart contract;  
receiving a plurality of additional vehicle tracking updates from the vehicle tracking device after determination that the shipment has been transferred to the second carrier; and  
appending a plurality of datablocks to the second blockchain, the plurality of datablocks including tracking information corresponding to the additional vehicle tracking updates.

2. The method of claim 1, further comprising:  
generating, in response to determination that the shipment has reached the destination, a report comprising the tracking metric; and  
sending, to a terminal device, a link configured to cause the terminal device to display an interface including the tracking metric.

3. The method of claim 2, wherein the method comprises, responsive to the determined tracking metric, determining transportation costs associated with transportation of the shipment to the destination.
4. The method according to any previous claim, further comprising:
  - receiving freight contract parameters, the freight contract parameters comprising the executable logic;
  - generate the smart contract in response to receipt of the freight contract parameters; and
  - store, on the blockchain, a genesis datablock, the genesis datablock comprising the smart contract.
5. The method according to any previous claim, wherein appending a datablock further comprises:
  - identifying a tracking table in a previous datablock of the blockchain;
  - updating the tracking table with the tracking metric; and
  - including an updated tracking table in the datablock, the updated tracking table comprising the tracking metric.
6. The method according to any previous claim, wherein identifying the smart contract further comprises:
  - identifying, in the blockchain, a contract datablock comprising the smart contract; and
  - extracting, from the contract datablock, the executable logic.

7. A system, comprising:
- a processor, the processor configured to :
    - receive a tracking update created by a tracking device, the tracking update comprising geographic location information indicative of a geographic location of the tracking device;
    - identify, in a blockchain, a smart contract including executable logic configured to determine a tracking metric;
    - determine, using executable logic of a smart contract stored in a blockchain, the tracking metric in response to receipt of the tracking update, the tracking metric calculated based on a comparison of the geographic location information of the tracking update and previous geographic location information included in a previous datablock of the blockchain;
    - append a datablock to the blockchain, the datablock including the tracking metric;
    - synchronize the blockchain with a plurality of blockchains stored in respective blockchain databases configured at respective server nodes, wherein the synchronization comprises communicating a blockchain synchronization message to the server nodes and wherein the blockchain synchronization message includes all or a portion of the blockchain;
    - wherein the blockchain comprises a first blockchain and the smart contract comprises a first smart contract;
    - determine, based on the executable logic and the tracking update, that a shipment associated with the tracking device has been transferred from a first carrier associated with the first blockchain to a second carrier associated with a second blockchain,
    - wherein the second blockchain comprises a second smart contract;
    - reprogram the tracking device with an identifier corresponding to the second smart contract;
    - receive an additional tracking update from the tracking device, after determination that the shipment has been transferred to the second carrier; and
    - append a datablock to the second blockchain, the datablock including tracking information corresponding to the additional tracking update.
8. The system of claim 7, wherein the datablock is associated with a datablock type, wherein the processor is further configured to

communicate, to a terminal device, a first instruction to display a plurality of labels associated with respective data block types;

receive, from the terminal device, a selection input message, the selection input message indicative of a selection of the datablock type; and

communicate, to the terminal device in response to receipt of the selection input message, a second instruction to display information included in the datablock, the information including the tracking metric.

9. The system according to any of claims 7 to 8, wherein the processor is further configured to:

determine, based on the executable logic and the tracking update, that a shipment associated with the tracking device has reached a destination; and

cause the tracking device to stop sending tracking updates in response to determination that the shipment has reached the destination.

10. The system according to any of claims 7 to 9, wherein the smart contract includes a geographic area parameter corresponding to a geographical area, wherein the processor is further configured to:

determine, using the executable logic and the tracking update, that the tracking device is located within the geographic area; and

increase the tracking metric in response to determination that the tracking device is located within the geographic area, the tracking metric comprising a detention time metric.

11. A non-transitory computer readable storage medium comprising computer executable instructions, the computer executable instructions executable by a processor, the computer executable instructions comprising:

instructions executable to receive a tracking update created by a tracking device, the tracking update comprising geographic location information indicative of a geographic location of the tracking device;

instructions executable to identify, in a blockchain, a smart contract including (a destination identifier and) executable logic configured to determine a tracking metric;

instructions executable to determine, using a smart contract stored in a blockchain, the tracking metric in response to receipt of the tracking update, the tracking metric calculated based on a comparison of the geographic location information of the tracking update and previous geographic location information included in a previous datablock of the blockchain;

instructions executable to append a datablock to the blockchain, the datablock including the tracking metric;

instructions executable to synchronize the blockchain with a plurality of blockchains stored in blockchain databases, wherein the synchronization comprises communicating a blockchain synchronization message to the server nodes and wherein the blockchain synchronization message includes all or a portion of the blockchain;

wherein the blockchain comprises a first blockchain and the smart contract comprises a first smart contract;

determining, based on the executable logic and the tracking update, that a shipment associated with the tracking device has been transferred from a first carrier associated with the first blockchain to a second carrier associated with a second blockchain,

wherein the second blockchain comprises a second smart contract;

reprogram the tracking device with an identifier corresponding to the second smart contract;

receive an additional tracking update from the tracking device, after determination that the shipment has been transferred to the second carrier; and

append a datablock to the second blockchain, the datablock including tracking information corresponding to the additional tracking update.

12. The non-transitory computer readable storage medium of claim 11, wherein the computer executable instructions further comprise:

instructions executable by the processor to determine, based on the executable logic and tracking update, that a shipment has been transferred to a carrier; and

instructions executable by the processor to cause the tracking device to send tracking updates in response to determination that the shipment has been transferred to the carrier.

13. The non-transitory computer readable storage medium of claim 11 or claim 12, wherein the instructions executable by the processor to synchronize the blockchain further comprise:

instructions executable by the processor to communicate the datablock to a plurality of remote server nodes configured with a blockchain database, the blockchain database including a remote blockchain, the remote blockchain comprising the smart contract.