

Improving transparency and security of supply chain using Blockchain and Knowledge Graphs

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Problem Statement

The current supply chain system is riddled with disruptions and inefficiencies. The Covid-19 outbreak demonstrated to us how simple it is to completely disrupt the supply chain, leading to the downfall of entire economies. A shipping company transporting goods across multiple transit points would require active tracking, review and approval causing lots of paperworks in the process. This creates opportunity for fraud at multiple points. By executing smart contracts at each stage to automate the management of products and freight, we hope to reduce this process through blockchain and the ledger.

Objectives

- Increase traceability of goods in supply chain to ensure corporate standards are met
- Lower losses from counterfeit/gray market trading
- Improve visibility and compliance over outsourced contract manufacturing
- Reduce paperwork and administrative hurdles
- Availability of this data within blockchain can improve visibility and compliance over outsourced contract manufacturing, increase traceability of the material supply chain

Literature Survey

- When Blockchain Meets Supply Chain: A Systematic Literature Review on Current Development and Potential Applications [doi: 10.1109/ACCESS.2020.2983601.]
- Digital Supply Chain Transformation toward Blockchain Integration [doi: 10.24251/HICSS.2017.506]
- Blockchain technology: implications for operations and supply chain management [doi: 10.1108/SCM-09-2018-0309]

Proposed Solution

- Creating a Supply Chain using knowledge graphs and Neo4j, where every node is a port/sub center and every connecting link is a path that the goods can take to reach from one port to another
- Finding the best path from one port to another using Graph Algorithms on multiple criteria (eg. distance, ease of transport etc).
- A blockchain is setup, which is configured to execute smart contracts of a few different types according to the requirement.
- Package on reaching every node, would execute a smart contract, causing the status information being stored on the blockchain distributed ledger.

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Months

+



Jan

November

Jan

Data Collection and Pre-Processing ● Oct 6 - 31 ● 26 days

Data Collection

Data Cleaning and Augmentation

Data Pre Processing for Graph Ingestion

Graph Ingestion in Neo4j

Neo4j Path Analysis ● Nov 1 - 24 ● 24 days

Path Analysis

Embedding

Blockchain ● Nov 24 - Dec 13 ● 20 days

Setting up the Blockchain (Ropsten)

Smart Contract Creation

Execution of contract on each hub

Finalizing ● Dec 13 - 16 ● 4 days

Data Combining and Display

Documentation

Research Article ● Dec 16 - 31 ● 16 days

Research Article

Research Article Dec 16 - 31

- Data Collection and Pre-...

● Neo4j Path Analysis

Research Article

Current Status

- Data Collection
- Knowledge Gathering
- Literature Review

Summary

- Solving Supply Chain problems using knowledge graphs
- Embedding graphs using Neo4j and other tools
- Solving missing link prediction problems and graph classification
- Predicting general trends in the supply networks

Thankyou

References

- S. E. Chang and Y. Chen, "When Blockchain Meets Supply Chain: A Systematic Literature Review on Current Development and Potential Applications," in IEEE Access, vol. 8, pp. 62478-62494, 2020, doi: 10.1109/ACCESS.2020.2983601.
- Korpela, Kari, Hallikas, Jukka and Dahlberg, Tomi, "Digital Supply Chain Transformation toward Blockchain Integration", in Proceedings of the 50th Hawaii International Conference on System Sciences, doi: 10.24251/HICSS.2017.506
- Cole, R., Stevenson, M. and Aitken, J. (2019), "Blockchain technology: implications for operations and supply chain management", Supply Chain Management, Vol. 24 No. 4, pp. 469-483. doi: 10.1108/SCM-09-2018-0309