International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 04 | April - 2023 Impact Factor: 8.176 ISSN: 2582-3930

Deep Learning based Pothole Detection

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ABSTRACT

Generally, the Tenders or contracts are used by governments and companies to procure goods or services. Wrongful tender management leads to huge losses in case of faulty practices. This includes favoring of contractors, improper record maintenance, lack of transparency, hacking, data modification and other issues. To overcome this problem, we have used a simple and secure block chain technology and to secure by encryption coupled with indisputable block based architecture for transaction management. In this case we make use of block chain technology to secure transaction based documents along with transactions such as tender documents, applications, bid proposals, company profiles, past records, approving officer details, rejection details to ensure a completely transparent tendering process.The main objective of this project is "To ensure the complete tender management process is secure and efficient we make use of block chain technology to solve tender management issues."

INTRODUCTION

Current E-Tendering systems are not 'fair and open' meaning that the information is not shared with all stakeholders. The information is released on 'as they please' basis for example - when a company is selected as a winner of a contract, other companies that bid on the same tender are not notified of why their bid was rejected and why a particular company was selected as a winner. A company can request this information but it is a tedious process of getting this data. Even though auditing these documents is possible, evaluating the documents needs time. Apart from not being transparent, security is also a major issue for these portals leading to fraud and manipulation of data stored in a centralized database. If a hacker gets hold of this centralized database, bids can be leaked to competitors leading to major financial and strategic losses for a business.

Blockchain technology can be used to solve these security implications as it heavily focuses on the decentralization of information and is secured by encryption integrated with undeniable block-based architecture for transaction management. Hence, Blockchain and Smart Contract can be used as a transparent, decentralized and secured tendering framework that will facilitate bidders' oversight on portal functions and observe all the activities carried out by the tender portal.

Blockchain Explained Blockchain is based on the concept of decentralization. Hence, it can be viewed as a distributed database. In this case, the distributed database employs the concept of full replication i.e. each node has a full copy of a blockchain. Whenever the blockchain needs to be updated because of a transaction, a process called mining takes place . A block consists of many transactions. A consensus protocol is used and the mined block is broadcast to all other nodes. These blocks will have a cryptographic hash in the header that

relates to the previous block in the chain. If a block is manipulated the hash associated with this block changes and as a result, all the proceeding blocks should be re-mined which is not possible. In this manner, blockchain employs the property of immutability. How the blockchain is implemented and what consensus protocol is the core of blockchain.

The main objective of this project is "To ensure the complete tender management process is secure and efficient we make use of block chain technology to solve tender management issues."

Advantages over Existing System

- Simplifies stakeholder management
- Reduces the risk of duplicates
- Greater control over documents

LITERATURE STUDY

[1] Wang, Wenbo, et al. "A survey on consensus mechanisms and mining strategy management in blockchain networks." IEEE Access 7 (2019): 22328-22370.

The past decade has witnessed the rapid evolution in blockchain technologies, which has attracted tremendous interests from both the research communities and industries. The blockchain network originated from the Internet financial sector as a decentralized, immutable ledger system for transactional data ordering. Nowadays, it is envisioned asa powerful backbone/framework for decentralized data processing and data-driven self-organization in flat, open-access networks. In particular, the plausible characteristics of decentralization, immutability, and self-organization are primarily owing to the unique decentralized consensus mechanisms introduced by blockchain networks. This survey is motivated by the lack of a comprehensive literature review on the development of decentralized consensus mechanisms in blockchain networks. In this paper, we provide a systematic vision of the organization of blockchain networks. By emphasizing the unique characteristics of decentralized consensus in blockchain networks, our in-depth review of the state-of-the-art consensus protocols is focused on both the perspective of distributed consensus system design and the perspective of incentive mechanism design. From a game-theoretic point of view, we also provide a thorough review of the strategy adopted for self-organization by the individual nodes in the blockchain backbone networks. Consequently, we provide a comprehensive survey of the emerging applications of blockchain networks in a broad area of telecommunication. We highlight our special interest in how the consensus mechanisms impact these applications. Finally, we discuss several open issues in the protocol design for blockchain consensus and the related potential research directions.

Summary: Wang, Wenbo And team describes in this paper, we provide a systematic vision of the organization of blockchain networks

[2] Ambegaonker, Ajeenkya, Utkarsh Gautam, and Radha Krishna Rambola. "Efficient approach for Tendering by introducing Blockchain to maintain Security and Reliability." 2018 4th International Conference on Computing Communication and Automation (ICCCA). IEEE, 2018.

The problem with present tendering is its reach which is limited to number of people, though the internet is expanding and tendering is also not far from this, we have some online system for tendering but it is not secure as it should be because tendering has confidential data which is not supposed to be leaked and Blockchain solves that problem efficiently. The motive of this research is to find better ways for tendering, as tendering is a very essential part of businesses and development, so improvement of this system leads to better development. Time efficiency, employment, and a fair system are some of the factors which can be improved by the proposed system of this research.

Summary: Ambegaonker, Ajeenkya team working on online system for tendering but it is not secure as it should be because tendering has confidential data which is not

supposed to be leaked and Blockchain solves that problem efficiently.

[3] Zheng, Zibin, et al. "An overview of blockchain technology: Architecture, consensus, and future trends." 2017 IEEE international congress on big data (BigData congress). IEEE, 2017.

Blockchain, the foundation of Bitcoin, has received extensive attention recently. Blockchain serves as an immutable ledger which allows transactions to take place in a decentralized manner. Blockchain-based applications are springing up, covering numerous fields including financial services, reputation systems and Internet of Things (IoT), and so on. However, there are still many challenges of blockchain technology such as scalability and security problems waiting to be overcome. This paper presents a comprehensive overview on blockchain technology. We provide an overview of blockchain architecture firstly and compare some typical consensus algorithms used in different blockchains. Furthermore, technical challenges and recent advances are briefly listed. We also lay out possible future trends for blockchain.

Summary:Zibin and team provides an overview of blockchain architecture firstly and compares some typical consensus algorithms used in different blockchains. platforms.**[4]Cachin, Christian, and Marko Vukolić. "Blockchain consensus protocols in the wild." arXiv preprint arXiv:1707.01873 (2017).**

A blockchain is a distributed ledger for recording transactions, maintained by many nodes without central authority through a distributed cryptographic protocol. All nodes validate the information to be appended to the blockchain, and a consensus protocol ensures that the nodes agree on a unique order in which entries are appended. Consensus protocols for tolerating Byzantine faults have received renewed attention because they also address blockchain systems. This work discusses the process of assessing and gaining confidence in the resilience of consensus protocols exposed to faults and adversarial nodes. We advocate to follow the established practice in cryptography and computer security, relying on public reviews, detailed models, and formal proofs; the designers of several practical systems appear to be unaware of this. Moreover, we review the consensus protocols in some prominent permissioned blockchain platforms with respect to their fault models and resilience against attacks.

Summary:Christian, and team discusses the process of assessing and gaining confidence in the resilience of consensus protocols exposed to faults and adversarial nodes.

[5] Pilkington, Marc. "Blockchain technology: principles and applications." Research handbook on digital transformations. Edward Elgar Publishing, 2016.

This paper expounds the main principles behind blockchain technology and some of its cutting-edge applications. Firstly, we present the core concepts at the heart of the blockchain, and we discuss the potential risks and drawbacks of public distributed ledgers, and the shift toward hybrid solutions. Secondly, we expose the main features of decentralized public ledger platforms. Thirdly, we show why the blockchain is a disruptive and foundational technology, and fourthly, we sketch out a list of important applications, bearing in mind the most recent evolutions.

Summary: Pilkington and team expose the main features of decentralized public ledge

[6] L. Luu, D.-H. Chu, H. Olickel, P. Saxena, and A. Hobor, "Making smart contracts smarter," in Proceedings of the 2016 ACM SIGSAC Conference on Computer and Communications Security. ACM, 2016, pp. 254–269.

Cryptocurrencies record transactions in a decentralized data structure called a blockchain. Two of the most popular cryptocurrencies, Bitcoin and Ethereum, support the feature to encode rules or scripts for processing transactions. This feature has evolved to give practical shape to the ideas of

smart contracts, or full-fledged programs that are run on blockchains. Recently, Ethereum's smart contract system has seen steady adoption, supporting tens of thousands of contracts, holding millions dollars worth of virtual coins. In this paper, we investigate the security of running smart contracts based on Ethereum in an open distributed network like those of cryptocurrencies. We introduce several new security problems in which an adversary can manipulatesmart contract execution to gain profit. These bugs suggest subtle gaps in the understanding of the distributed semanticsof the underlying platform. As a refinement, we propose ways to enhance the operational semantics of Ethereum to make contracts less vulnerable. For developers writing contracts for the existing Ethereum system, we build a symbolic execution tool called Oyente to find potential security bugs. Among 19, 366 existing Ethereum contracts, Oyente flags 8, 833 of them as vulnerable, including the TheDAO bug which led to a 60 million US dollar loss in June 2016. We also discuss the severity of other attacks for several case studies which have source code available and confirm the attacks (which target only our accounts) in the main Ethereum network.

Summary:L. Luu, D.-H and team introduce several new security problems in which an adversary can manipulatesmart contract execution to gain profit.

Methodology

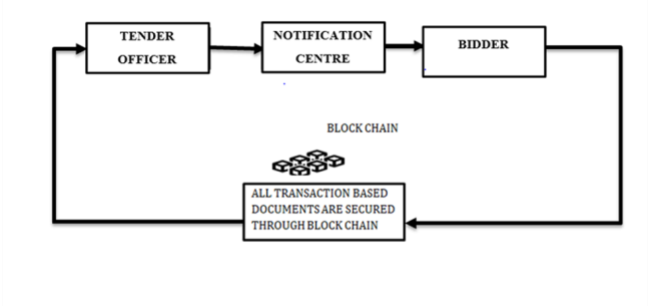


fig 1: System Block Diagram

fig 2: Flowchart Of The Model

YOLO AlGORITHM

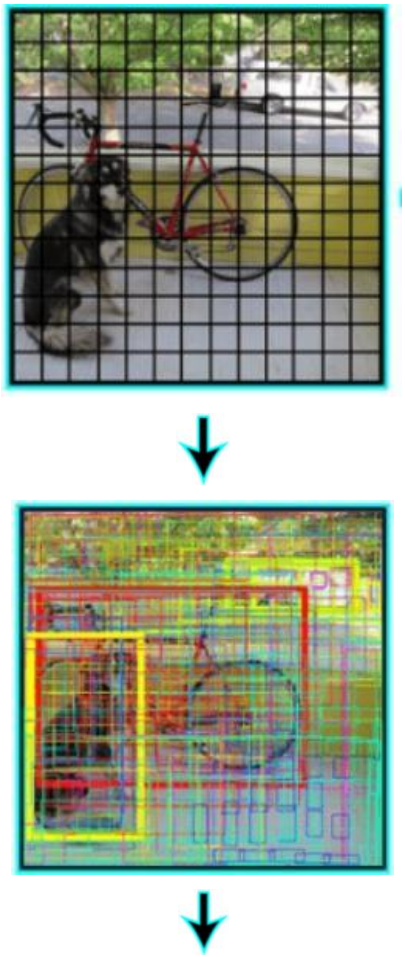
YOLOv4 is a SOTA (state-of-the-art) model for real-time object detection as shown in figure 3. It was published in April 2020 by Alexey Bochkovsky and it is the fourthversion of YOLO. It achieves SOTA performance on the COCO dataset consisting of 80 different object classes. YOLO is a single-stage detector.

- The one-step method is one of the two main modern methods used for object detection tasks where speed of completion is important.
- In the one-step detector model, the ROI (Region of Interest) is removed and classes and bounding boxes are predicted for the entire image.
- So this makes them faster than two-stage detectors.
- Another example is FCOS RetinaNet and SSD. The first version of YOLO was written in the Dark Net Framework (which is a high-performance open-source framework for implementing neural networks written in C and CUDA).
- DarkNet is usually the main network.
- It divides the object detection task into a regression task followed by a classification task.
- Regression predicts the class and bounding box for the entire image in one direction and helps identify the positions of objects.
- Classification defines the class of objects.

Algorithm Overview:

The architecture consists of different parts, in general,

- The input comes first basically the set of training images we have which is fed to the network
- It is processed in a parallel cluster of GPUs. Next comes the spine and neck where feature extraction and assembly takes place.
- Neck detection and head detection together can be called object detection and finally the detection/prediction is done by the head.
- Basically, the head is responsible for identification (localization and classification).



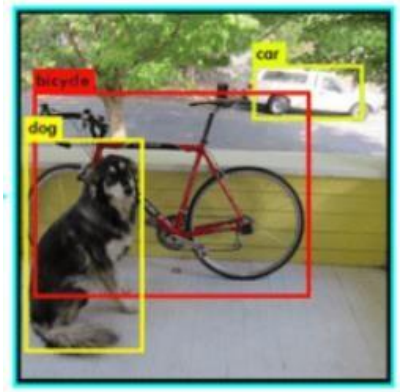


fig 3: YOLO Algorithm Overview using bounding boxes

Results And Discussion

After the execution of the entire program the following results are shown:

- Every pothole or road damage detected will be framed under a different coloured box with the accuracy of the detected damage as shown in figure 4, figure 5 and figure 6.

fig 4:Linear crack with accuracy

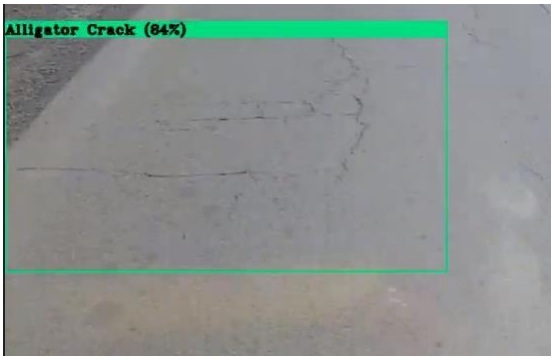


fig 5: Alligator crack with accuracy

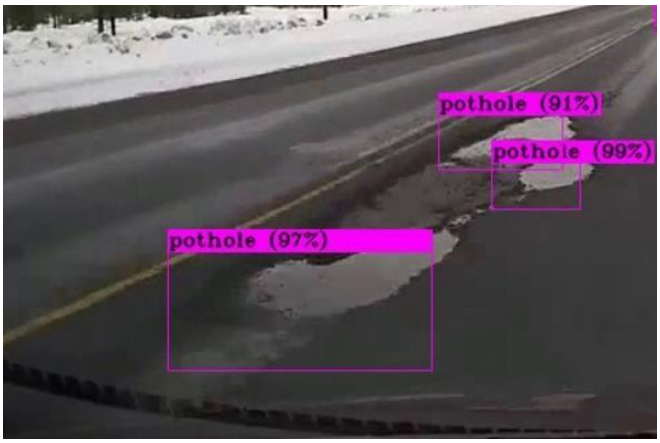


fig 6: Potholes with accuracy

- YOLO algorithm may not be the most accurate algorithm for pothole detection but it can certainly work at higher speeds when vehicles move faster
- When vehicles are at higher speeds YOLO Algorithm works best

fig 7: Algorithm comparison in terms of speed and accuracy

- YOLO Algorithm is the fastest algorithm when it comes to processing more frames per second in a given video.
- If an algorithm can process more FPS, then the time taken to get the result will be reduced drastically.

Figure 7 and Figure 8 show the comparative analysis of different algorithms implemented.

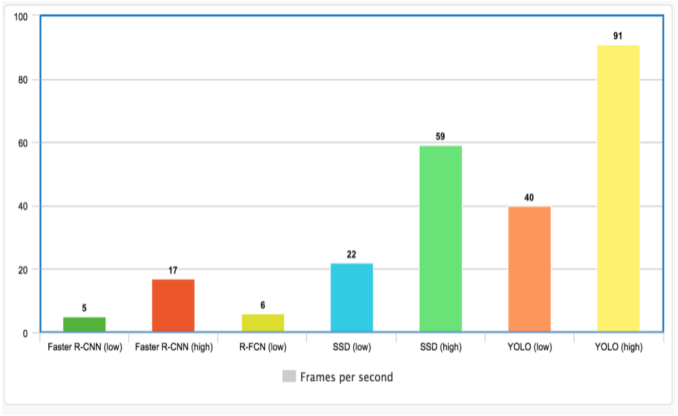


fig 8: Algorithm comparison in terms of FPS

Conclusion

When it comes to applications such as tender portals, where transparency and security are of foremost importance, traditional technologies and design patterns cannot be used as they pose a threat to these requirements. As discussed earlier, there are many security requirements for a tendering framework that cannot be solved just by using a centralized tender portal for creating and bidding on the contracts. The security requirements and openness required from this type of application can only be solved by using fair, open, decentralized technology such as Blockchain and Smart Contracts. In this paper, how such a system can be designed by mentioning various processes involved and their basic implementation.

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