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**Topic: Blockchain**

**Article:** [**Blockchain Inspired RFID-Based Information Architecture for Food Supply Chain**](https://ieeexplore-ieee-org.proxy.seattleu.edu/document/8674550)

**Citation: S. Mondal, K. P. Wijewardena, S. Karuppuswami, N. Kriti, D. Kumar and P. Chahal, "Blockchain Inspired RFID-Based Information Architecture for Food Supply Chain," in IEEE Internet of Things Journal, vol. 6, no. 3, pp. 5803-5813, June 2019.**

**Summary of Article:**

A lot of people will buy a package product of food from the store without second thought, not realizing the food wasn’t fresh. Or the store has to throw away a lot of frozen chicken that arrived during a certain timeframe because it was recalled. The article introduced a way to prevent all that using IoT and blockchain in real time. The RFID (IoT based) would act as a sensor on each package and during it lifespan from production, transport, and received by the store; each transaction is scanned and put in a public ledger using blockchain for security. The authors introduced conventional blockchain, modified blockchain, address allocation, transaction information structure, transaction verification, and security. A single sensor integration was demonstrated in this paper to show how this technology can be adopted to food supply chain. More sensors for different measurements can be implemented for moisture, light, or specific volatiles can be integrated with the RFID.

**Article Purpose:**

The purpose of the article was to introduce the adaptation of blockchain with IoT tracking and tracing infrastructure to food supply chain. By doing so, the author mentioned that it could prevent the outbreak of food-borne illnesses, economically motivated adulteration, contamination, food wastage due to misconception, and losses due to spoilage. It was also mentioned that by using RFID to track quality of food and packaging, the potential recall can be narrowed down to the exact time, in turn saving cost. The proposed architecture have each packaged food product be embedded with sensorID, and through each stage (transportation, storage, consumer) of the product lifespan, the package is scan and the transaction validated. Once transaction is verified, the transaction of the sensorID is put into a block of information and appended to existing data blocks, this form a block chain. This will ensure that the public ledger is available for anyone to see while keeping the integrity of the manufacturer’s intact. Security was also covered to consider tampering and fake transactions. Since cyber address is publicly available, a malicious terminal can broadcast fake transactions. By securing the hardware and data storage should be encrypted to secure the process.

**Methodology**

The proposed plan is to have package information in a single RFID sensor on the package known as sensorID. The information on this package include RFID address, manufacturer, Timestamp, Sensor Type, and Sensor Data. The terminal is data collecting and processing node, that scans the sensorID. The terminals will all be on a shared network. Every scan of the sensorID by a terminal is known as a transaction. There’s also a manager node that is responsible for policy making and processing requests. The agent node is a third-party node that request information on the sensorID by providing a cyber address. The sensorID is about the size of a penny, the designed antenna resonates at 900 MHz. A local CPU is used to obtain the data which is further processed to create a transaction file to be added to the blockchain. The power consumption of the sensorID is determined to be 342 μA from a 1.8 V DC source, which can be found is a CR2032 Lithium ion battery. The sensorID can last for 230 hours with continuous use and this can be increase by setting the idle time to be longer. The authors then went into in-depth explanation about security and how having secure hardware and using encryption will keep the sensors safe.

**Conclusion**

The authors proposed an IoT based food supply chain monitoring architecture with this article. Each food package has a small sensor on it with public data about freshness, timestamp, and recall information on it. The data are updated as it moves through the food supply chain and added to a block to form a blockchain. By doing so, the information can help in updating the shelf life, identifying key bottlenecks in the FSC, implementing targeted recalls, and increase visibility. One sensor was created to calculate the power and battery life that the sensor would consume. Overall, using blockchain would security the public information about the package as it travels from plant to store.

**Article Strengths:**

The article provided mathematical proofs when it came to calculating computing time as well as how the transactions would be stored in each blockchain. The architecture diagrams was very clear and made sense as to how the parties involved would be affected. The article also provided a lot of backend information such as Proof-of-object vs brute force when it came to determine which technique was faster in scanning the cyber address. Their security analysis was very well researched and written. They covered fake terminal, fake transactions, probability of block validation of fake transaction in different scenarios and so on. So the technical research was there but it lacked the business or logical thinking that would require to make this idea happen.

**Article Weaknesses:**

The article lack a lot of cost analysis and an actual study about how much the whole process on using sensorID in food supply chain would cost. It might sound like an interesting idea to have but it just doesn’t seem plausible to me, especially with how many products are produced each day. There was a mentioned about a sensor lasting 230 hours, but not a lot about how much it will cost to create. Multiply this by the number of products being produce each day, the cost of the sensor and energy required to create the blockchain would create the cost of the product itself to rise. I don’t think consumers will want that to happen even if it means they have to rely on the expiration date of the packaging. Not to mentioned what will happen to the sensors after the consumer buy the product, it will probably end up in the landfill and that’s not good for the environment. Overall, there’s too much holes in the article to really back up the concept of using RFID to track packaging.

**Recommendation:**

There was not much recommendation that the article suggested. It mentioned that the RFID can be configured to sense other things in the package such as moisture, light, or specific volatiles. In addition to that, the security can be further improved by strengthening the hardware security of the sensorIDs and readers.

**Checklist:**

Number of Authors: 6

Number of Citations of Article: 33

Number of Citations to other articles: 1

Methodology Explained (Yes/No): Yes

Technology Explained (Yes/No): Yes

Experiments and Data Reviewed (Yes/No): Yes

Conclusion Exist (Yes/No): Yes

Recommendations Exist (Yes/No): No