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Improvising micro transactions using IOTA tangle on smart refrigerator applications

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Abstract---The world moves towards the concept of automation. Day to Day more number of people uses the creation of new technology in effective manner. This paper helps to design a smart refrigerator using IOTA. The load sensor fixed under the tray of the refrigerator senses the load of the tray. If the load decreases the IP camera fixed to the refrigerator captures the image of the items in the tray and sends it to the user's registered email. The catalogue of products will be available via a mobile app, through which he/she will be able to purchase the items required by viewing the image of the refrigerator sent. The transactions will be performed through IOTA network. When micro transactions are performed in Block chain, it takes more time to approve the process. By using IOTA tangle, the transactions will be

carried out more fast and more secure. Thus, the payment process implemented using IOTA tangle is more secure and effective. Finally, the list of items ordered by the users will be sent to the nearby grocery store and will be delivered to the customer at their door step.

Keywords---IOTA, tangle, IOT, directed acyclic graph, mobile app, cloud.

Introduction

In the digital world, Internet Banking plays a vital role in banking sector. Most of the customers use net banking / wallets for their transactions. The internet banking facility makes the customer more convenient and does an easy transaction in his home/office through any devices such as lap, mobile or desktop. For instance: Paytm is one of the most popular E- Commerce websites. It offers many discounts and great deals for many products. But user reviews tell that it is well good in recharging mobile phones, but when it comes to online shopping it is not good. The gateway involved in Paytm is said to be less secure and due to middle Man intervention, the transaction is also slow. When the customer tries to perform minimum transactions, the amount cannot transfer to the merchants account but it is credited from the account holder. To avoid this kind of issues most of the firms move towards automation since it makes the machine- machine communication fast by reducing the human interaction.

Related Word

Zibin Zheng [2018]: This paper presents a detailed survey of blockchain. Initially, this paper details the technologies of blockchain which includes the key characteristics and blockchain architecture. It also explains the algorithms of consensus protocol used in blockchain. Typical applications of blockchain and comparison of the protocols used in blockchain technologies are investigated. This paper summarizes the cons of blockchain such as selfish mining, scalability, private leakage as well as the problems that delays the development of blockchain and the possible ways of solving this problem [5].

Bogdan [2018]: In this paper, the IOT applications used as data providers in blockchain technology is discussed. While doing the transactions it removes the validation of 3rd party and with the assistance of cryptographic proof, the trust of central authority for transaction is replaced. This paper discusses the creation of data network on Internet of Things and Automation tangle, sharing the data with the help of distributed ledger and to secure data with Masked Authenticated Messaging (MAM). The result of this work takes remote sensor of data and uses a storage system which is decentralized and eliminates the query models and the necessity for complex database. The constraints of this work is that the Proof of Work (PoW) algorithm cannot be done using the filed devices. Hence, running a system that need enormous data points may hinder the progress of the transaction when it is attached to the tangle [4].

Yeow [2018]: The shortage of reviews which are comprehensive on decentralized consensus systems of IOT is the motivation for this paper. An innumerable consensus dimensions like scalable consensus ledgers, transaction designs and data structure are explained in this paper. Blockchain or block chainless directed acyclic graph technologies serves as immutable public ledgers for transactions that are adopted by decentralized consensus. The advantages and disadvantages of state-of-the-art decentralizes consensus systems are analyzed and scrutinized in this paper. Thematic taxonomy is proposed with the help of extensive literature review and categorization according to decentralized consensus systems [3].

Serguei [2017]: The cryptocurrency for IOT industry (i.e.) IOTA and its mathematical foundations are analyzed in this paper. This analysis explains the cryptocurrency transactions stored in Directed Acyclic Graph which is known as Tangle. To establish machine - to - machine payment system, Tangle succeeds the blockchain and offers the features required [2].

System Overview

The IP camera is fixed to the refrigerator [1]. The weight sensor will help to observe the container weight. If the weight of the container is low, IP camera captures the items and the snapshot will be sent to the connected mobile. These pictures help to find the items which are present in the container. So that the particular person can able to know the items present in the storage area [7-11]. The item that are frequently purchased by the person will be displayed or they can able to choose new items from the list. The ordered details will send to the shop owners. The transactions can be made through tangle network. The shop owner will deliver goods to the corresponding address.



Fig.1: Overview of proposed System

Fig 1: The overview process of proposed System is shown for smart refrigerator using IOTA. The IP camera is connected to the refrigerator. It captures the products quantity which is stored in the fridge and sends the quantity to information to the owner's mobile. The particular person can purchase the items from the list [12,13,14]. The ordered details will send to the shop owners. The shop owner will deliver goods to the corresponding address.

Proposed System

This proposed method helps to implement the smart refrigerator with the help of Internet of things Application (IOTA). The IOTA is a protocol which helps to increase the micro transactions with cost effective [5]. By using this IOTA, the transactions can be faster compared to other technology. In an online transaction, Tangle uses the concept of directed acyclic graph (DAG) in data structures. The machine - to - machine communication takes place to authorize the transactions thereby reducing the manual interaction. The efficiency of the system will also be improved as there is no human intervention and accuracy of the system will be at higher rates due to machine validation. The Fig 2 clearly shows the benefits of IOTA over Block chain technology.

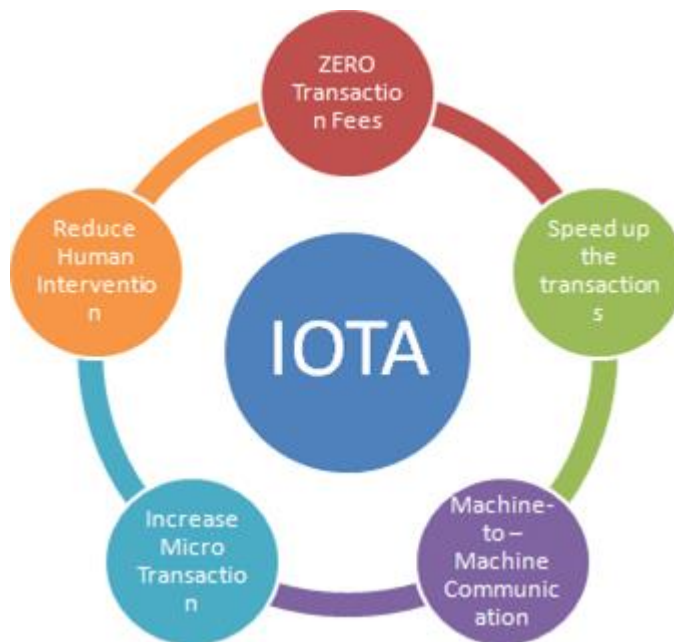


Fig. 2: Benefits of IOTA

Transactions through IOTA

Internet of Things and Automation (IOTA) protocol is a distributed ledger designed with a directed acyclic graph (DAG) system with an intend to record and implement a transaction between machines. Tangle is a type of directed graph that stores transactions. A vertex in the graph represents each transaction. When a new transaction is added to the tangle, it chooses two prior transactions to approve, giving the graph two new edges. Normally, in Blockchain technology, two

groups of people interact in the network: users and miners. In blockchain technology, users send and receive data and the miner secures the network. The miners have to approve minimum of six transactions which is chargeable. When the number of transactions increases, it takes long time to approve the transactions also leading to huge transactional charge. This is not feasible when the users do a small amount transaction. It stores all the transaction as blocks and keeps monitoring on everything and ensures that all the transactions obey the rules of the consensus network. The two groups are combined in IOTA tangle. Tangle network is attached to every transaction. The tangle validates the transactions using Proof of Work (PoW). PoW is a cryptographic hashing algorithm used for security purpose in a network. This algorithm validates the transaction by considering the number of users, current power and network load as the major parameters. [6-11] The PoW removes the necessity of miners thus adding security to the network. So, a better solution for the digitized environment can be provided using IOTA tangle technology which will make the user transaction fast, secure and reliable at free of cost without the human intervention. In Fig 3 shows how the tangle DAG has constructed in the system and processed in the network.

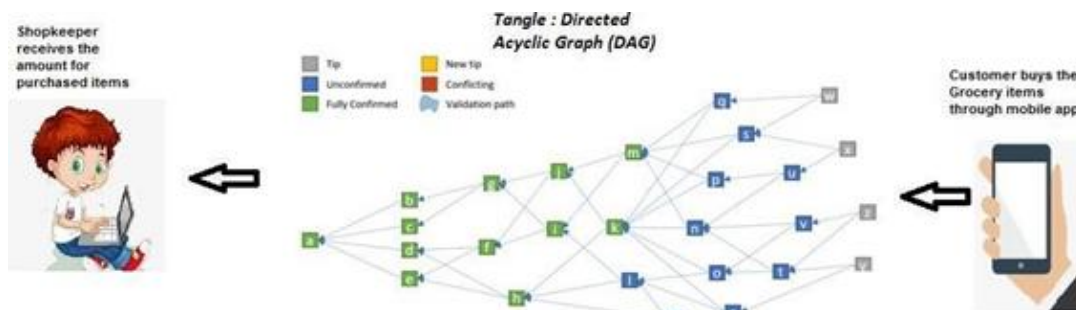


Fig 3: Transaction done through IOTA

A multitude of applications is permitted by Internet of Things and Automation to work on the message tangle. This application can be designed by anyone and the application to be run on their nodes can be determined by the user. Storing the data and the layer of communication to broadcast can be used by all these applications. Nevertheless, the applications that are needed to operate the protocol may require every node that could operate certain core applications. Message payloads that are stored on the layer of communication can be read and created by the applications. Object is the basic unit of data in Internet of Things and Automation Protocol. A size and its type have been defined for every object. Precisely defined in this schema are the specification of the object present in this field and their arrangement. The way the node inspects the object is also determined by this type. A message is nothing but a type of object. The generic data is another example of such type. The recognition and inspection of a list of such types of objects is maintained by each node. It is meant that the transactions between the devices that are connected will be enabled by IOTA and it can be accessed by the users. The main motive to introduce IOTA is to achieve transactions on devices in standard mode. IOTA is tagged as "public permission - less backbone for Internet of Things that enables interoperability between multiple devices" by its founders. [16] In Internet Of Things And Automation, the combination of these groups are tangled.

Hardware Design

Load Sensor

The device weight is determined by using a load sensor [15,17]. At the bottom of the veggie tray, a load sensor is connected. It is possible to set a threshold weight. The low signal is sent to the phone when the veggie tray falls below the threshold value.

IP Camera

This camera is linked to the refrigerator in three separate locations. The first camera is mounted on the veggie tray, while the second is mounted on the door and is used to detect goods placed on the door. The third camera will be used to display the things / vessels that have been placed on the tray [16]. The IP camera catches the vegetables and sends the pictures to the owner's phone whenever the veggie tray load sensor generates a low signal. The owner of the mobile phone will be able to see what vegetables/items are in the tray / veggie tray.

Mobile Application

The low signal is sent by the pressure sensor to the owners. The Grocery app on Android allows the user to see what's on the fridge and purchase new things. The mobile identifies the purchasing pattern in the Grocery app. On the top, the most popular / often purchased thing might be shown. He/she can either select the same items/vegetables from the shop or purchase different items from the shop. The owner can make an online payment and have the purchased items can be delivered to the corresponding address. The transactions can be done via IOTA tangle.

Result & Discussion

Thus, the implementation of sensing the weight of the items in the fridge using pressure sensor and mobile application for ordering necessary groceries are done successfully.

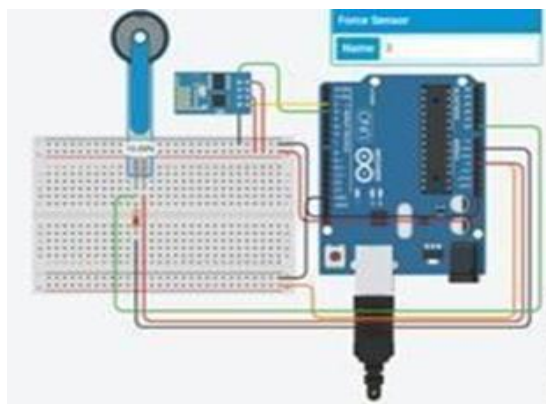


Fig 4: Minimum amount of pressure

If light touch is given in the pressure sensor it will show the minimum amount of pressure.

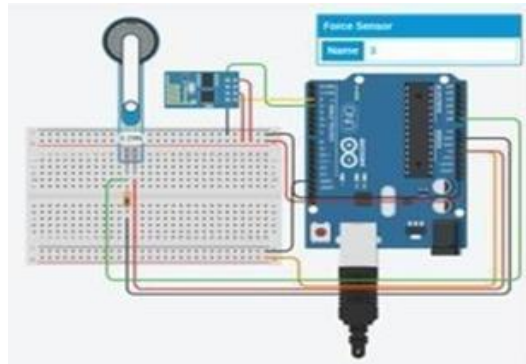


Fig 5: Maximum amount of pressure

If harder touch is given in the pressure sensor it will show the maximum amount of pressure.

PSEUDO CODE: To find the weight of the Tray

```

if (fsrReading < 10) { Serial.println(" - No pressure");
} else if (fsrReading < 200) { Serial.println(" - Light touch");
} else if (fsrReading < 500) { Serial.println(" - Light squeeze");
} else if (fsrReading < 800) { Serial.println(" - Medium squeeze");
} else {
  Serial.println(" - Big squeeze");
}

```



Fig.6. List of groceries available is shown. Buyers can add necessary items to the cart.

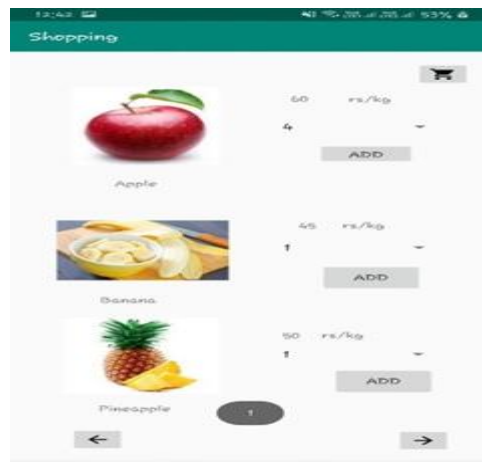


Fig.7: Adding the required items from the list. Buyers can customize the required amount



Fig.8: Total amount will be added and displayed and will redirect to payment page once confirmed

Comparison Between Blockchain, Byteball And IOTA

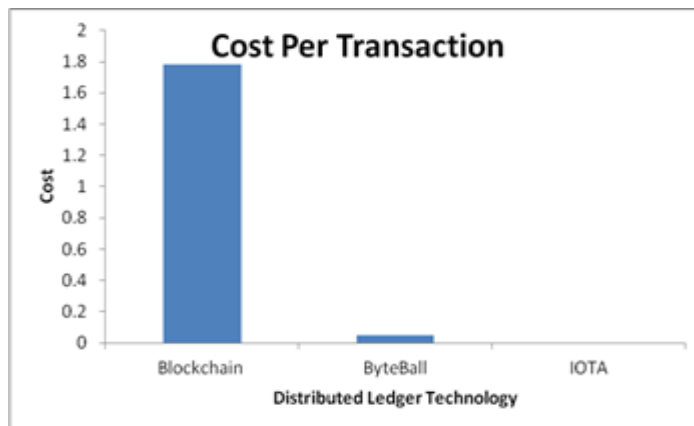


Fig.9: Comparison between IOTA and other Distributed Technology

Blockchain, IOTA, Byte ball are all distributed ledgers. In Blockchain technology and Byte ball, user has to pay a lot of amounts for each transaction. Blockchain miner's charges \$1.78 per transaction for validating the block and in Byte ball \$0.05 for each transaction. In IOTA, there are no miners' charges. Comparatively, Blockchain blocks can be validated by at least 6 miners, where as in IOTA, it is enough that two miners accept our transaction and the users need not pay any amount for transaction. Thus, IOTA is the best choice compared to Blockchain and Byte ball. It makes transaction easy with less cost and in more secure way.

Conclusion

Smart refrigerators are already available on the market. That type of smart refrigerator helps in sensing the kinds of products that are stored in the storage area and it shows the lifetime of that product. But in this paper, the smart refrigerator's IP camera captures the products which are stored in the storage area and if the products are in minimum quantity, it sends the information to the owner's mobile. The person can order the same product or he may order some other products through mobile application. The list of products will be available in mobile app from which he/she can purchase the products. List of purchased items will be send to the merchant. The merchant will deliver the products to the buyers. The old age people cannot able to go and purchase their daily needs day-by-day. This smart refrigerator helps the old age people to buy the product from their home itself. Not only helpful for old age peoples it also helpful for working people.

This project helps to implement the smart refrigerator with the help of Internet of things Application (IOTA), where IOTA is a protocol which helps to increase the transactions process in a cost-effective way. By using this IOTA, the transactions can be faster compared to other technology. While doing transaction, Tangle uses the concept of directed acyclic graph (DAG) in data structures. The machine - to - machine communication takes place to authorize the transactions thereby reducing the manual interaction. The efficiency of the system also willbe improved as there is no human intervention and accuracy of the system will be at higher rates due to machine validation.

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