TEST Engineering & Management

January - February 2020
ISSN: 0193 - 4120 Page No. 14343 - 14349

Secured Food Delivery and Monitoring using Blockchain Algorithm

Shivaanivarsha. N[1], Santhoshkumar. D.R[2]
[1] Associate Professor, Department of ECE, Sri Sairam Engineering College, Chennai, Tamilnadu, India .
[2]Student, B.E-Electronics And Communication, Sri Sairam Engineering College, Chennai, Tamilnadu, India

Article Info
Volume 82
Page Number: 14343 - 14349
Publication Issue:
January-February 2020

Article History
Article Received*: 18 May 2019*
Revised*: 14 July 2019*
Accepted*: 22 December 2019*
Publication*: 28 February 2020*

Abstract
The concept of guaranteeing the quality and secured food delivery to the customers for online booking by blockchain mechanism. It consists of temperature sensors and infrared sensors to track the pack placed inside the box. The values generated are sent to the server using Zigbee. A unique id is generated while placing the order and it is used as the genesis block of the blockchain and this id is based on the hash of the name, weight and other properties of the order. It clear that, this is originally packed at the right place and not been replaced by them. Next, when the pack is placed in the box the sensors are activated. Now every second the temperature of the pack and the location of the delivery guys are monitored and placed in the blocks of the blockchain. Thus, altering any values of the blockchain like changing the id or location breaks the whole chain.

Keywords:*Blockchain; Food delivery; Food monitoring; Security;*

I. INTRODUCTION

Foodstuff's journey from hotels, farms and various other manufacturing industries to table usually comprises many transactions between different organizations and people. The ability to track and trace foodstuffs' journey is necessary to ensure that the food consumed is not only safe and fresh but is also regulatory-compliant, and wastage are minimized.Today's conventional supply chain systems don't guarantee food safety, freshness and regulatory compliance. Fueled by inaccurate supply chain management and lack of a technological framework that can differentiate fakes from genuine foodstuffs, trade in counterfeit foods has become a flourishing venture. This paper discusses a secured based system that helps in effective food monitoring.

II.BACKGROUND

Now-a-days misuse of packed foods by online delivery boys happens at many sites and the trust of customers over that online company is greatly reduced due to such activities. They are also scared to order as the guys are altering the packs from cheap hotels. To avoid this, tracking of food at regular time and the information are stored in the unalterable blockchain. The sensors are positioned in such a place that these delivery packs can't be tampered without sending the data to the chain. Any changes to the information, breaks the chain. Thus, the trust of customers over the company is developed and made sure that the foods are delivered to the customers with prepared quality without any tamper.

III. MATERIAL & METHODOLOGY

The paper proposes a system that would constantly monitor food conditions in real time and send data to the applications and feed in a block of chain. Fig. 2 shows the functional block diagram of the system. The proposed system consists of a controller that acquires data from various sensors which are used to monitor various physical parameters of the food conditions in which the food is placed. These physical data acquired from the sensors are

Published by: The Mattingley Publishing Co., Inc.

January - February 2020
ISSN: 0193 - 4120 Page No. 14343 - 14349

processed by the controller and generated suitable signals that are given as control input, that is then feed to computer for further calculations.

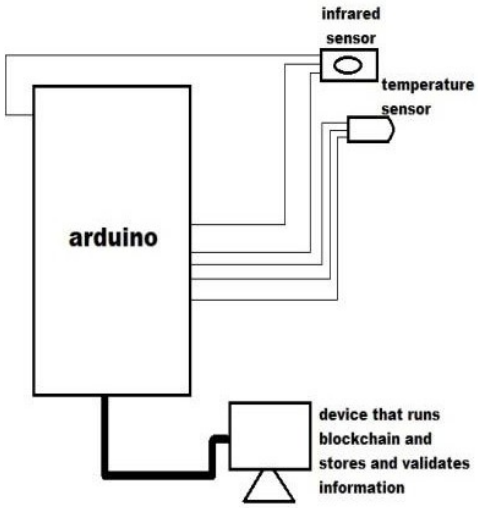

Fig. 1. Functional block diagram of the system

The system essentially consists of a microcontroller, zigbee transmitter and receiver, power supply unit, switches, electronic lock, gps module, number of sensors for monitoring various physical parameters.

A. Ardiuno Uno

The Arduino is a microcontroller based on ATmega328. It has 14 digital I/O pins, 6 analog pins with a 16 MHz ceramic resonator, ICSP header, reset button.

Fig. 2. View of the Ardiuno microcontroller

B. Temperature Sensor

LM35 series of temperature sensors are used to provide fairly good accuracy for temperature of rooms between the region of -55 C to 150 C with an accuracy of 0.5 C which can be obtained in low cost. This sensor operates between 4 to 30 V power supply.

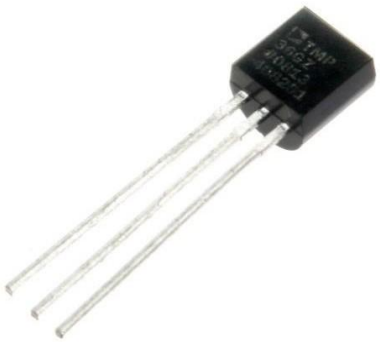

Fig.3. View of the Temperature sensor LM35

The output of this sensor in obtained in Voltage in mV range. This can be then calibrated to read in Celsius. With this LM35 the temperature can be obtained more accurately than with thermistor.

C. Infrared Sensor

Infrared Sensor is one of the most basic sensor used across various fields. It is an easy to operate sensor most commonly used in robotics. It comes with the form of diodes with 2 terminals, one transmitter and one receiver. It works with a simple principle of reception of signal transmitted from the same.

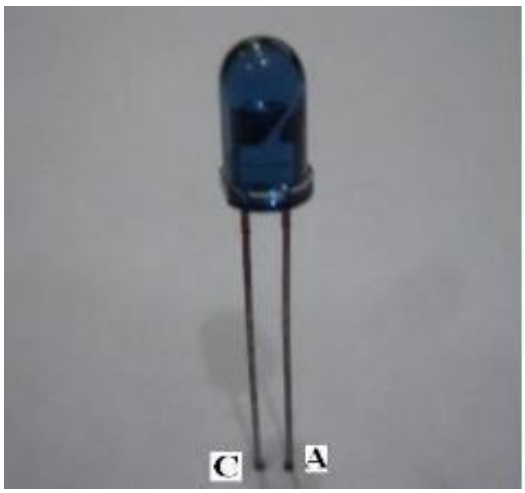

Fig.4. View Infrared sensor

D. GPS (Global Positioning System)

Published by: The Mattingley Publishing Co., Inc.

TEST Engineering & Management

January - February 2020
ISSN: 0193 - 4120 Page No. 14343 - 14349

GPS module is a small electronic circuit which when connected to main module will obtain the position coordinates. These modules will send and receive signals from the satellites whose position accuracy will be less than few meters.

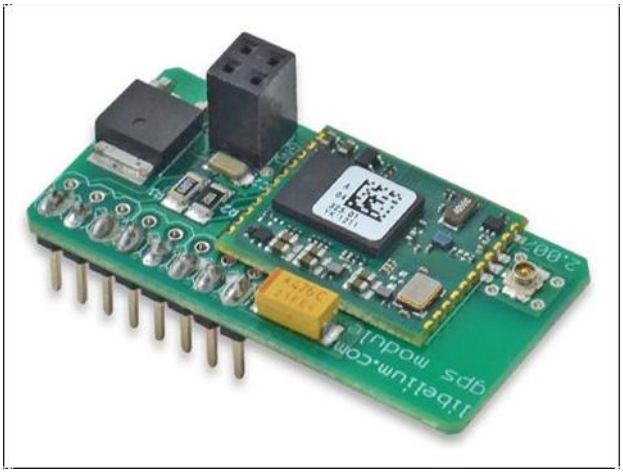

Fig.5. View of the GPS Module

E. Zigbee Module

Zigbee is a low power, low data rate which works on IEEE 802.15.4 suitable for high level communication protocols used to create personal area networks mainly for home automation system. Due to its low power consumption, the transmission of signal is limited to 10 – 100 meters depending of power output and environmental characteristics.

Fig.6. View of the Zibee Module

Zigbee network layer supports both star (Coordinator must me the central node) and tree network and generic mesh networking with one must coordinator device. This also supports secured connection with cryptographic keys, ciphering frames for communication.

F. Blockchain Algorithm

A blockchain is a decentralized, distributed and public digital ledger that is used to record transactions across many computers so that any involved record cannot be altered retroactively, without the alteration of all subsequent blocks. This allows the participants to verify and audit transactions independently and relatively inexpensively. A blockchain database is managed autonomously using a peer-to-peer network which is maintained under a separate time-stamping server. The use of a blockchain removes the characteristic of infinite reproducibility from a digital asset. It confirms that each unit of value was transferred only once, solving the long-standing problem of double spending. A blockchain has been described as a value-exchange protocol. A blockchain can maintain title rights because, when properly set up to detail the exchange agreement, it provides a record that compels offer and acceptance.

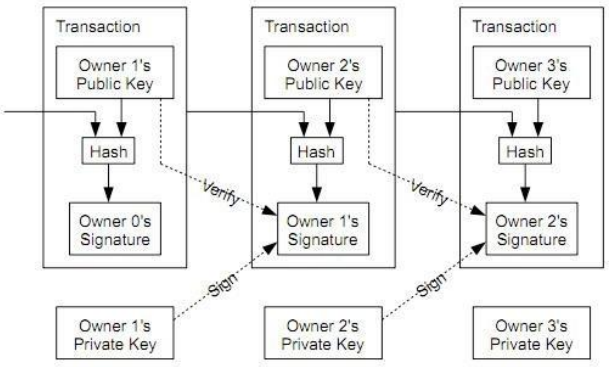

Fig.8. View of the Blockchain ledger Transactions

The blockchain works under the main concept of hashing of whole chunk of data obtained over a period of time. Since the whole chain crashes when the single unit is altered, Continuous hashing of random data is done at a very high rate with super computers to reverse the chain is the only way. This

Published by: The Mattingley Publishing Co., Inc.

January - February 2020
ISSN: 0193 - 4120 Page No. 14343 - 14349

comes under the concept of data mining on which the modern crypto currenciesworks.

IV. WORKING OF THE SYSTEM

The sensors described above are suitably positioned and food conditions are monitored and also the physical parameters like temperature, closing and opening of the box is determined where the food is positioned.

These parameters are sensed by the various sensors and the output of the sensors is given as input to the controller. The controller monitors and acquires data from the sensors in real time basis and process the information. It uses built-in ADC to process the analog inputs given to its pins to equivalent digital values.

A. Purpose of temperature sensor

Temperature sensor used here is to monitor the temperature conditions of the food and the food temperature conditions gets updated for a certain period of time according to the value set in microcontroller. In this food delivery box, 5 temperature sensors are place in order to obtain an average amount of temperature of the food. So any attempt to alter the food will be result in a vast change in the temperature and thus will alert the user and will lead to cancelation of the order.

B. Purpose of Infrared sensor

Infrared sensor is used for the counting of open/close of the delivery box lid. Every time the lid of the box is open and closed, the count is incremented and noted. When the count exceeds the fixed limit for each user (that is 3 or 4 count for each user) an alert is sent to the user, that the food is being is tampered. The delivery guy can adjust the food item when the food is mispositioned, so for that uncertain conditions, an extra count can be added. By monitoring the open/close of the food tampering is further prevented.

C. Purpose of Switches

Switches are used for the loading the input and output data for the box. The delivery guy can add how many users and food items is loaded, for that purpose Load, Unload and Clear buttons are placed. So every time when user is loading the food, the load button is pressed for 1 time ,this load button is placed according to the number of users, and unloaded when the user delivers the food.

D. Purpose of Zigbee Controller

The main purpose of the Zigbee controller is to collect the data from temperature and infrared sensor and also location from gps module and also various other parameters and thereby feeding the data by means of wireless communication to the server. This data is further feed to the blockchain for security monitoring of the food, so preventing hackers form tampering the information.

E. Purpose of Blockchain

With the use of blockchain algorithm, one can achieve the following benefits:

1) Food safety is guaranteed: Securely traces foodstuffs in seconds—not days or weeks—to mitigate cross- contamination, the spread of food-related illness, and unnecessary wastages.

2) Food freshness is guaranteed: Stakeholders gain unparalleled transparency into supply chain data to

Published by: The Mattingley Publishing Co., Inc.

January - February 2020
ISSN: 0193 - 4120 Page No. 14343 - 14349

enhance food freshness, increase its shelf life and minimize losses.

3) Food wastages are minimized: Maximizes food shelf life by optimizing the supply chain and providing quick responses about food recalls.

The information must be stored in a trustful way that increases the customer trust. Blockchain is the most trustful record management algorithm in which the inserted data is unalterable. The id represents the genesis block and temperature, location and other properties of the pack gets hashed which fills the fore coming blocks of the blockchain. Any latter change of data cuts the entire chain making the tamper visible.

Here is the sample data that is being feed to the blockchain before tampering of the food data:

Fig.10. View of the Original data of the block.

The mining process is done to maintain a relationship between the block of the chain. If one block of the blockchain is disturbed or tampered, the entire block gets affected. Here the block 1 is having a nonce value, which is used for security purpose, one can increase the security by increasing the nonce value and while mining the block, a hash with 4 or more zeros are embedded at the beginning of the hash, according to nonce value. So now the block is mined and hash is generated. Now the second data is feed to the block and mined, before mining it adds the previous hash, along with the new hash and gets mined and so the mining of many blocks continue.

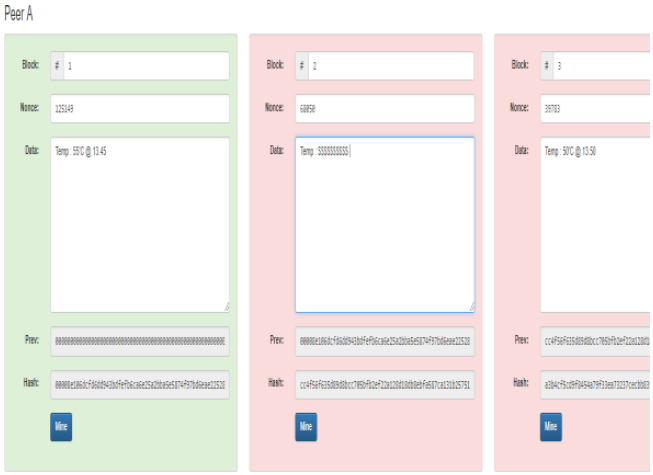

Fig.11. View of the Altered data of the block.

Here in this above fig,11, we have tampered the data of the second block by adding "$$$$$$$". By tampering only the second block the entire block after the second block gets affected. So in-order to change the block to its normal state, again mining of the block is required. But the concept is that, one cannot mine the block unless the nonce and previous hash values are known. So it prevents tampering of data effectively and used for secure transactions of data.

V. FUTURE SCOPE

The real purpose of this project is to implement the blockchain in all industry for security transactions of data. The above discussed Food delivery monitoring is just a prototype for a large-scale industry purpose food monitoring. Such as meat, fruits and vegetables and also agricultural products can be also monitored with the help of necessary sensors like temperature, humidity sensor and various other sensor that will be helpful in monitoring the external parameter of the food conditions.

For example, local farms can use an IoT system in their business using the NEM blockchain and Arduino. In this example, the temperature of a shipment of beef is tracked from when it leaves the

Published by: The Mattingley Publishing Co., Inc.

January - February 2020
ISSN: 0193 - 4120 Page No. 14343 - 14349

farm until it reaches the local supermarket. Data such as which animal it was from, the farm, the farmer, and more can also be logged.

To make sure the meat has been at a consistent and safe temperature throughout shipment. This way can be used to avoid consuming anything that may harm them before anyone could even buy the item. Bacteria can start growing on meat once it reaches higher temperatures, which can generate toxic proteins.This also allows farms and supermarkets to isolate incidents of food poisoning, as they can track the shipment to a certain animal or plot of land.

Fig.12. View of Approval Chart

Recently in Chennai, there was an adulteration of food stuffs like replacing cow's meat instead of dog's meat, which lead to many serious court issues and health issues. With a method(monitoring food using blockchain with necessary hardware) such as this, they could've tracked down a bad batch down thus isolating the incident.

In NEM, a transaction can contain a 1024 character message. This transaction that we send contains a message, which would look something like this:

beef-crate#149&temperature@40F&time@12:49:34PM

This message means the crate of beef with ID 149 (same as the bull the meat was from) has an average temperature reading of 40 degrees Fahrenheit at 12:49 PM. This process happens every 10 minutes and is sent to the farm's beef NEM address.There could be an address representing shipments for lamb, duck, or fish. Each address corresponds to a type of meat. Finally, when the crate reaches the supermarket, our device is returned back to the farm and the meat is stocked. When a customer walks in, they can view the journey of the shipment along with which animal the meat is from. The customer app indexes the beef shipment from the company's NEM account and displays if the temperature threshold has been crossed (if the meat is safe for consumption). In other words, it either gives a SAFE or NOT SAFE reading for that specific package of meat.

VI. CONCLUSION

Blockchain is a great use case for this type of application. It provides transparency and trust, and in this case, assurance for the customer. It also allows industries and corporations to isolate incidents. Thus by dumping the data to the blockchain it remains unaltered and the trust of the customer can be gained. We can make sure that the foods are prepared and packed at the right hotel, that they are not replaced at cheap stores. We can also guarantee that those foods are not misused by the delivery guys. Thus the food is delivered to the customer at the prepared quality without any known tampering of the food.

REFERENCES

[1] "Blockchains: The great chain of being sure about things". The Economist. 31 October 2015. Archived from the original on 3 July 2016.Retrieved 18 June 2016. The technology behind bitcoin lets people who do not know or trust each other build a dependable ledger. This has implications far beyond the crypto currency.

[2] Morris, David Z. (15 May 2016). "Leaderless, Blockchain-Based Venture Capital Fund Raises $100 Million, And Counting". Fortune.Archived from the original on 21 May 2016.Retrieved 23 May 2016.

[3] Popper, Nathan (21 May 2016). "A Venture Fund With Plenty of Virtual Capital, but No Capitalist". The New York Times.Archived from

Published by: The Mattingley Publishing Co., Inc.

January - February 2020
ISSN: 0193 - 4120 Page No. 14343 - 14349

the original on 22 May 2016.Retrieved 23 May 2016.

[4] Iansiti, Marco; Lakhani, Karim R. (January 2017). "The Truth AboutBlockchain". Harvard Business Review. Harvard University.Archived from the original on 18 January 2017.Retrieved 17 January 2017. The technology at the heart of bitcoin and other virtual currencies, blockchain is an open, distributed ledger that can record transactions between two parties efficiently and in a verifiable and permanent way.

[5] Crosby, Michael; Nachiappan; Pattanayak, Pradhan; Verma, Sanjeev;Kalyanaraman, Vignesh (16 October 2015). BlockChain Technology: Beyond Bitcoin (Report). SutardjaCenter for Entrepreneurship & Technology Technical Report.University of California, Berkeley.Retrieved 2017-03-19.

Published by: The Mattingley Publishing Co., Inc.