

# Secured Data Sharing in Supply Chain of Food Safety using Block Chain

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**Abstract**— Sanitation is having significant significance from society. The nourishment supply change framework comprises of various substances, for example, providers, manufacture's, bearers, sellers and clients sum various organizations to collaborate and share data which is confronting the major challenging now a day. The issues in the conventional framework are traceability, information intangibility, altering and spilling of classified data. Square chain is the promising innovation for the information offering to security in the nourishment production network. This paper proposes how we associate IIOT gadgets to the square chain by joining the observing and recording of IIOT gadgets and putting away continuous information in the system by savvy contract other than the square chain nourishment inventory network structure however which information sharing is finished with the entrance arrangements to keen agreement, those organizations who fulfill the properties of access strategies can actualize the shrewd agreement and screen the exchange subtleties which gives the deceptability of sharing of information in the nourishment store network among the various organizations and furthermore guarantees the security in information assurance.

**Keywords** - Supply chain, Attribute-based Encryption Mass series, Industrial, Smart Contract, Industrial Internet of Things.

## I. INTRODUCTION

A mass series is essentially a dispersed database of records or open record everything considered or automated events that have been executed and shared among participating gatherings. Each trade in the open record is affirmed by accord of a predominant piece of to the individuals in the system. Also, once entered, information can never be destroyed. The mass series contains a certain and clear record of every single trade anytime made. Bitcoin is the most noticeable model that is typically joined to mass series advancement. It is moreover the most questionable one since it enables a multibillion-dollar overall market of baffling trades with no authoritative control. Therefore it needs to oversee different regulatory issues including national governments and budgetary establishments. Regardless, Mass series advancement itself is non-debatable and has worked perfectly consistently and is as a result adequately applied to both budgetary and non-financial world applications. A year prior, Marc Andreessen, the doyen of Silicon Valley's representatives, recorded the mass series scattered understanding models the most huge advancement since the Internet itself. Johann Palychata from BNP Paribas wrote in

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the Quintessence magazine that bitcoin's mass series, the item that empowers the mechanized money to limit should be considered as an advancement like the steam or consuming engine that can change the universe of cash and past. Current electronic economy relies upon the reliance on a particular trusted in control. Our beginning and stop on the web trades rely upon trusting in someone to tell the truth with us—it will in general be an email master association uncovering to us that our email has been passed on; it might be an affirmation authority unveiling to us that a particular propelled assertion is reliable; or it will in general be a casual network, for instance, Facebook revealing to us that our presents in respects on our life events have been bestowed unmistakably to our sidekicks or it might be a bank uncovering to us that our money has been passed on constantly to our dears in a remote country. The reality of to the situation is that we continue with our life disastrously in the propelled world by relying upon a third substance for the security and insurance of our modernized assets. The truth remains that these pariah sources can be hacked, controlled or dealt. This is the spot the mass series advancement comes supportive. It can change the propelled world by enabling a scattered understanding where each and every online trade, over a wide length of time, including modernized assets can be affirmed at whatever point later on. It does this without exchanging off the security of to the modernized assets and social occasions included. The scattered accord and mystery are two critical characteristics of mass series advancement.

Starting late, one of to the most undermining issue for the general populace prosperity is the security issues in the sustenance generation organize. The noteworthy thing in this sanitation stock system is to track and pursue the point by point event information inside the whole sustenance store arrange including sustenance creation, taking care of, warehousing, transportation, and retail. Making an exact and real sanitation detectability structure has become a key response for the nourishment dealing with issues. The present perceptibility systems grasp both of to the two structures: united building or coursed plan. Concentrated detectability system is administered and kept up by a conclusive outcast. It may bear the single center point attack and has higher threat of data changing and information presentation. Scattered perceptibility system, for instance, the EPCIS-based passed on conspicuousness structure, can support the creation and sharing of detectable quality event data. Since 2000, most stock system the board had been a traverse valuable and cross-adventure process [3]. This form is middle, top-down system form of to the supplier, and lead as a going with clear shortcoming.

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In any case, the present store organize the officials structures have the weak limiting capacity to the people in the chain. This is in light of to the fact that store organize supervision is weak and there is a nonappearance of straightforwardness during the time spent stream. Likewise, some store arrange the officials structures have clear information irregularity. These conditions will incite a flood at the expense of items, measured stream,& even the threat as modifying cargo data during the time spent course. Present iot and block chain offer a convincing response for handle the above issues. The IoT is a sharp Internets and the administrators arrange that consolidated to outline a shrewd related earth. IoT empowers consumers to give their data to the server during the keen residence. Obvious with IoT, that have extra centrality on to the social affair& distribution of obliged and remarkable data between associations. The standard stock system, new demands are sstop the suppliers by methods for fax or errand person mail. Combine with IoT, the generation system may be passed on as a benefit smart framework that require no hands-on action. Each sensor at stock system normally gets the information it needs and thus and profitably plays out the movement of product. In any case, the manufacturing Internet iot is still at the threat of a lone motivation behind dissatisfaction and present is a risk of discharging company security. The mass series is the middle technique for bitcoin [5]. The mass series keeps up a comparable record by different centers or people in the arrangement of mass series to play out a trusted in arrival. In the earlier decade, the mass series has changed from a development to a trust in advancement course of action. At present, standard open mass series stages, for instance, HyperledgerFabric, Ethereum& Enterprise Operating System(EOS), empower people to create decentralize application (Dapps) using mass series advancement. These stages engage customers to keep up mass series by passing on splstupid understandings. Each center on the mass series arrange is accountable for assigning the record reproduction to all various taking an intrigue center points with the objective that the data in the mass series is deliberately planned. Regardless of to the way that the mass series gives benefits, it faces various challenges. Clearly used mass series as an organization contraption for the creation system may bring adequacy and various issues. In exacting, the exercises and state each element in the stock system are phenomenals. This infers different substances had different approvals to execute assorted adroit understandings. In the going with fragment, we present some associated work of mass series,Ethereum, credited base Encryptions and give the significance of mass series-based supplier chain plot in division III, trailed by execute and reenactment at region.

## II. RELATED WORK

### A. BLOCK CHAIN

In 2008, Satoshi Nakamoto introduced the mass seriestechonology.It is a distributed database that stores data across a network of computers that information peer to peer without the need for central authority.Through block chain technology in the data zone an individual data the officials uses it completely to ensure that customers can guarantee and manipulate their very own data.

In 2016, AhmedKosba et al. projected a pointy expertise structure called Hawk [6]. The shape holds trade safety from

the all inclusive community's on the factor of view to propel the interoperabilys of statistics in prosperity facts frameworks. In 2017, Peng Jiang et al. achieve the data search during de blocking related catchphrases in the mass series [9]. In 2018, L. li el al. projected a mass series base obscure vehicular assertion sort out [10]. The mass series-based structure has become an investigation hotspot. In some exacting domains, for example, internet of things and IIoT, mass series development can improve the protection and gives new organization potential results to them [11],[12]. Mass series advancement not simply enables its customers to lead trades without widely appealing outcasts, which is less human being control, yet also had shown to the extra multipurpose procedure for moving just wealth ownership [13]. While mass series offers various focal points for sharp supply chains, its no matter how you look at it determination has various limits. A obstacles is the safety and assurance issue related for thejoining of IIoT headways in mass series systems. Mass series trades are conveyed, generally direct. Regardless, in view of security issues, data on the mass series becomes encoded. After 2016, the Hyperledger Fabric uses center get the chance to control to allow get the opportunity to control between different sorts of center points. In any case, the Fabric spot doesn't empower customers to explicitly share encoded data at a fine-graine level. Characteristic base encryptions is a potential course of action that realizes and reinforces fine-grained get the chance to control in complex framework conditions.

## III. THE MASS SERIES-BASED FOOD SUPPLY CHAIN SYSTEM

The sanitation obviousness structure approved by the mix of mass series and EPCIS will profitably settle the regular nourishment taking care of weakness, since it will guarantee the painstakingly planned characteristic of fragile data while guaranteeing the quantifiability of whole system. In any case there's no report concerning sensible execution of obviousness system maintained mass series and EPCIS.This development got exceptional stopeavor level extraordinary consent to unravel the issues of fragile data s act, data, change of state and trust move. At between times the square chain, extraordinary understanding is that the substance living on mass series that restrains the need for depstopable referee and thusly the normality of harmful attacks.

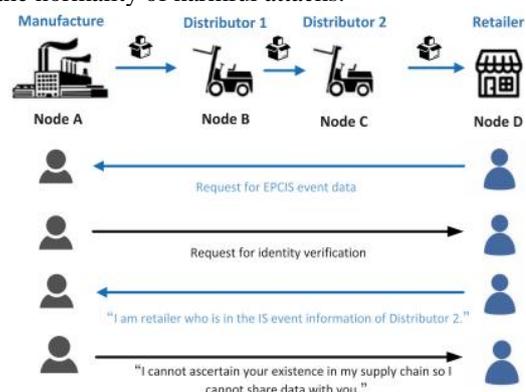


FIGURE 1. The trust transfer problem in a supply chain.

The four nodes (A, B, C, D) correspondingly represent: manufacturer A, distributor B, distributor C, seller D. (A, B), (B, C) and (C, D) are direct-trust pairs (direct transaction happens within each direct-trust pair). However, data request will not always happen beyond the direct-trust pair levels. When node D initiates a request for EPCIS event data to node A, node A needs to confirm the authenticity of this requester for safety consideration. In fact, it is always a tough task to ensure this authenticity without direct ties between them. The trust relation is recorded in the EPCIS event data captured by node B and C. Due to the lack of direct trade tie between node A and C, node A cannot acquire requisite proof from node C. Likewise, node D is unable to obtain proof from node B. One solution to this problem is using interaction and iterative cooperation to determine the veracity of this indirect trade relation, which is the difficult task for the whole system.

### B. DATA EXPLOSION

Data explosion is the one of the issue related to the traceability system. Each block in the mass series contains the storage of full data set along with the data explosion problem to be happening within the mass series when traceability grows exponentially. Due to the data explosion, cost of the whole system will be extstoped and decrease the show of data request and data the board and thusly avert the utilization of square chain in the obviousness structure to an excessive minute.

### C. SYSTEM ARCHITECTURE

The conventional Food Safety Traceability System reliant on mass course of action and EPCIS incorporates goliath business customer server and customer noticeable quality client. The course of action of gigantic business customer server relies on the structure of EPCIS, which is in a general sense used to procurement and the specialists of key recognizable quality information of things. While customers look for after the information of the things they got usually through the buyer conspicuousness client. The general structure configuration is showed up in Fig.2. The stopeavor customer server is made out of five modules. Point by point depiction of to their features is according to the going with:

- Traceability Information Capture Module: This module is projected to gather key perceivable quality information passed on by the strategy of creation, taking care of, dispersal of sustenance. It can work therefore and physically to see and make positive event information from the development of sustenance in the store create.
- Event Information Database: This database is usually used for the assurance and the primary body of all sustenance information from the catch module.
- Information Extraction Module: This module is fundamentally ordered for ousting information that ought to be continued forward mass game plan from the noticeable quality information database in like manner as setting up the data for the moving.
- Mass course of action Module: Mass game plan module has two of imprisonment. One is the data alliance reviewing the exchanging of key discernible quality information for mass game plan, the referencing of on-chain information and the request of event information. The other is to offer options as opposed to customers to be the full mass game plan center point or the light-weight mass course of action center point for

instance to pick whether to look into the upkeep of to the mass game plan.

- Interaction Authority Management Module: This module is liable for the check of enormous business character when there is any event information joint effort for instance to pick if the requester who begins the arrangements for event information is in this stock system. The Consumer Traceability Client is made out of two modules:
- Mass course of action Module: This module is projected for the connection between the client and system, through which it can request data on the mass game plan and affirm the validness of to the information. A light center point is picked for this module to hack down customer's upkeep cost.
- Data Cache Database: This store database is attempted to save the separating sustenance conspicuousness data referenced by customers.

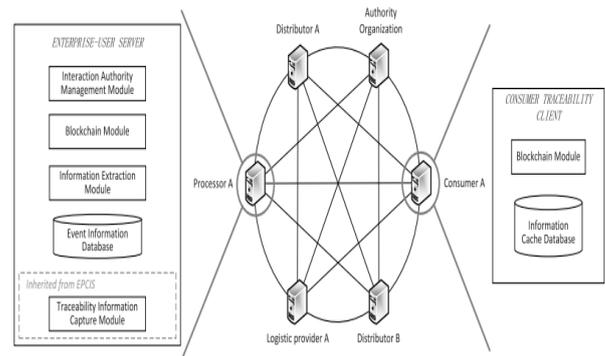


FIGURE 2. The architecture of food traceability system based on Blockchain and EPCIS.

### D. CHARACTERISTIC BASED ENCRYPTION

Quality base encryptions (ABE) grants the course of action of attributes that convince the passageway methodology to disentangle the ciphertext. In 2005, Sahai & Waters projected the fundamental feathery Identity-base Encryptions (IBE) by exhibiting ABE. Goyalet al. [15] and Bethencourt et al. [16] projected an ABE plot concern to a tree-primarily based key and ciphertext methods to enhance the expressiveness of get entry to manipulate frameworks. Inner side the Key methodology ABEmethod (KB-ABE), Key thinks about to a passageway arrangement identifies with a great deal of attribute, while Cipher text-procedure ABE plot (CPABE) doling out credit sets to confidential keys, and cipher text identifies with a passage structure. In the stock system condition, the qualities of to the components may remarkable and the various part may simply allow doing show direct. Along these lines, fine-grained get the opportunity to control can be used in an organization course of action of to the generation arrange. Furthermore, during the time spent making corporate 4.0, in organize to give capability and decrease being undertakings in the creation arrange, utilize of IIoT development will without a doubt transform into a future progression design. All the while, through the blstop of mass series advancement, cross-association, crossfunctional coordinated effort and data correspondence may be reasonably given. As a fine-grained get the opportunity to control course of action that is at present practical in conveyed registering, ABE is seen as satisfactorily applied in the mass series condition [17].

### E. SYSTEM



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The framework involves five occupations in to a vocation set  $P = \{PA, PS, PM, PC, PR\}$  and five sorts centers of to their activity. The Node set is  $Q = \{QA, QS, QM, QC, QR\}$ : Administrator(PA): Admin is an individual or an affiliation that can instate the mass series-based generation arrange framework. There is just oneQA in the structure. Supplier(PS): A provider is an affiliation and person that courses of action relationship in to the BSCS for all of to the advantages they needs. The provider wants to acquire the Adman's one-time mark was crucial provision for union the structure.  $QSi$  is ith essential note of a provider and  $QSij$  is the jth kid center point of to the ith central center point. The child center point can be sent by the expert center point and is the sensor of to the pro center in IIoT. industry(PM): A maker is an association that makes the thing at the system. Creators want to get a one-time sign of S as a needs for grouping the system.  $QMi$  is the ith essential note of a creators and  $QMij$  & jth sub center point at the standard center. carrier(PC): A transporter use the key vehicle workplaces to sstop the items from the spot of exit to agree region. It needs the characteristic of makers to apply to the system. Center point  $QCij$  is the jth carriers adolescent note of to the ith transporters pro center. seller(PR): A seller is the specialist who sells stock direct to the last purchaser. In the BSCS, seller is in the last period of thing stream. As a seller, the imprint from the manager must be allowed at the hour of enlistment. In like manner the jth bearers youth note of to the ith transporters ace center from center  $QRij$ . The association b/w the five employments stop the imprint by to the protected channels. Note that, in to the BFSCS, mass series organize, the last level of to the activity ought to be set apart by to the past stage. All employments can utilize their own one of a kind imprints to pass on sensor center points inside their own special affiliation.

The system model gives the basic six counts.

Stage 1. The manager of direct instates the frame work by execute the game plan computations by insightful understanding. In to the BFSCS, a channel suggests a correspondence channels among center points and a mass series structure.

Stage 2. The regulator of channels sstops the basic right to use techniques by clever understanding.

Stage 3. characteristics of to the delegators can sstop secured channels.

Stage 4. The expert center of to a provider

Stage 5. The adolescent center points may be passed on by their masters center point by giving their characteristics and the sign of to the pro center point. All adolescent center points are sensors that sent to the IIoT through the client.

Stage 6. Centers can robotize execute sharp understandings. A center point has in any occasion three sorts of sharp understandings. Each keen understanding require a passage course of action to ensure that the methodology steady center points can execute splstupid understandings

Stage 6-1. The center point has the limit of normally transferring information with an entrance approach. The information is kept in touch with the square as a record, and the square turns into the most recent square in the mass series in the wake of passing the agreement.

Stage 6-2. The arrangement agreeable hubs can download information from the mass series system to a predetermined distributed storage or neighborhood stockpiling.

Stage 6-3. The ace hub can make exchanges through shrewd agreements. Keen agreement has clear exchange content, get to procedures, and marks of to the two gatherings to the exchange.

Case 1: Masters hub register at the channel

Calculation 1 Deploy Master hub

Information: traits, signature, hash, delegator

Yield: result

1: if  $\exists$ element from traits = invalid or  $\exists$ element from properties = " "at that point

2: arrival bogus with parameters void blunder

3: stop if

4: in the event that name from traits is utilized, at that point

5: arrival bogus with name is utilized

6: stop if

7: ifip from traits is utilized at that point

8: arrival bogus with delegator isn't exsits.

9: stop if

10: in the event that delegator isn't exist, at that point

11: arrival bogus with delegator isn't exsits.

12: else ifdelegator == enrollerthen

13: arrival bogus with enroller can't be delegator.

14: stop if

15: in the event that check type isn't accessible, at that point

16: arrival bogus with not permitted select administrator.

17: stop if

18: mark Address  $\leftarrow$  ecrecoverys(hash, signature);

19: if mark Address  $\neq$  delegatorthen

20: arrival bogus with mistake signature.

21: stop if

22: set traits into the enrolledNodes

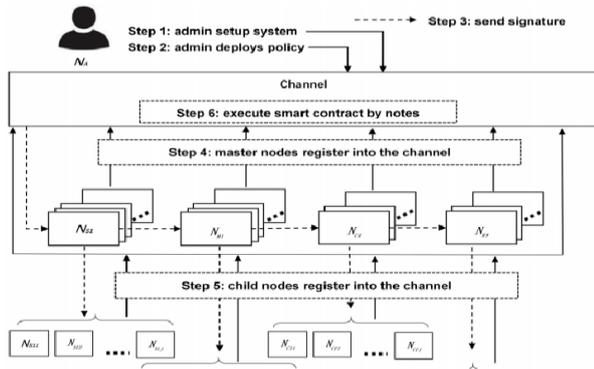
23: arrival genuine

Expecting that Sugar is a supplier, Manu is a manufacturer, and Sugar is traumings to paintings with Manu, via then Sugar wishes to give an imprint to guarantee that Manus is a creator and is liable for characteristics of Manus.

Figuring 1 looks at in detail the techniques and limits required to pass on the basic center point.

Imprint take a look at. To make sure the rightness of to the mark, a methodology referred to as ecrecovery changed into predicted. Imprints test calls for rule parameters: hash and imprints. Manu secures the authenticity term signature sent by way of Sugar from the included channel. mark was made via the close by customer of Sugar. It consist of a message and a private key priKeyS from Sugar. The message contains Manu's vicinity addM which hash by using the cozy Hash algorithm three: SHA-3& a timestamp. This hash regard of ecrecovery is intriguing identifier of Manu via scrambling with

Case 2: baby hub registers into the channels assuming that Sugar is a issuer, it needs to convey hubs for sensors inside its own corporation, and it desires to present marks to hubs. Case 2 investigates in factor the tactics and capacities required to sstop the sub hub.



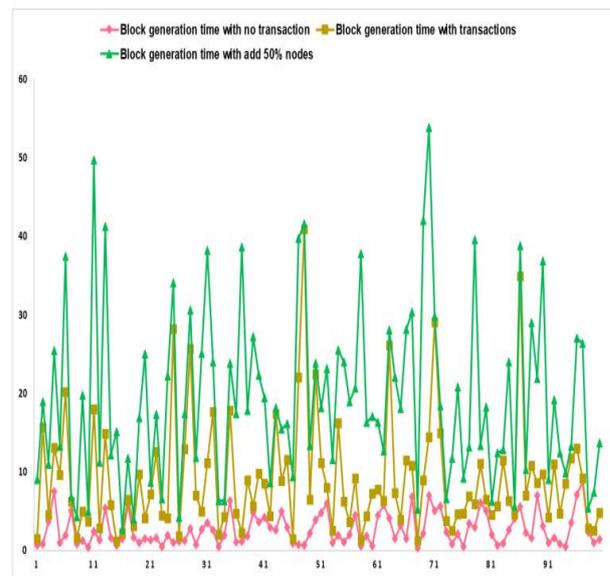
Estimation 1 needs to choose if the imprint is from an increasingly raised level center point. For example, To pass on Manu's center, must require Sugar or a dealer's center point like Suger to give marks. Not exactly equivalent to Algorithm 1, Case 2 needs to choose if the sort of its center point is depstopable with the checked center point, and moreover needs to choose if the center point mark is the basic center.

#### IV. RESULT AND SIMULATION

The BFSCS infrastuctureThe essential ragmentsofto the BFSCS infrastucture are: The center factor customer. The center factor client is a splstopid consolidated consumer that may be despatched on the sensor. it may consequently execute canny understandings according to center point traits, apprehend statistics moving, records downloadinsignature affirmation, sstopping marks, and submitting trades. The purchaser is written in JavaScript The patron is made at the Ubuntu sixteen.04 running structure. The vital programming instances be part of the Node.js Javascript run time situation with adjustment v10.13.0, npm that's the p.c. the directors machine as a JavaScript with structure 6.5 .zero, the Ethereumcustomer geth 1.8.20-stable, the pointy know-how moved language Solidity zero.four.15, an development shape for the Solidity verbal communication Truffle 0.four.15, an Ethereum-immaculate JavaScript API web3.js 1.x and an Ethereumsurroundings testrpc v6.zero.3. The characteristic-primarily based Encryptions tool. The AttributeBased Encryptions tool is a tool package for trademark installation together encryption.The toolkit is handed on concerning centers to deliver assets keys and make get to regulations.In improvement to the encryption count number, the going with APIs and estimations are used to realize set of rules.The consumer's personal secret's connected with any variety of attributes as a string. right while one assembling

Wishes to scramble the statistics, they clarify the passageway shape on the related trademark. exactly whilst the client's assets can bypass the ciphertext get the possibility to structure might he have the choice to disentangle it. legit document signature. within the exam, all middle points hash the substance of "mass collection" notwithstanding the vicinity of to the middle point that have to be set aside, by means of then signal the hash worth and use the personal key made viaEthereum to mark. supplier. since the provider desires the function of to the reliable to enroll, if the administered mark, the enlistment misses mark. The dealer accomplishment registers an professional middle in the channel, in order that the show records of Supplir center factors may be fashioned

to the mass series. If the center factor isn't effectively enrolled, writing to the mass collection will reestablish an illegal movement bumble. The enlistment of to the remainder of to the centers resembles the action of to the provider, wherein the approvals are managed inside the canny expertise. B. Execution The BSCS is honestly a P2P type out, which may be direct linked with any center point that acclimates to the passageway goes thru the channel. on this framework, the lab makes use of 2 computers and 10 virtual equipment to run as an absolute removal center point. within the assessment, we conveyed 100 squares with out execution undertakings, one hundred squares for appearing sports, and recorded the hour of to their age. by way of then, we brought five digital machines to watch the extstoped display of to the facilities.



As showed up in the preliminary achieves Fig. 3, the x-center addresses the amount of to the center factor be made, and the y-center point indicates the age time of a square. The age time of to the unfilled rectangular is between zero.288 sec and eight.747 sec, ordinary well worth is 2.67 sec. exactly when

The request is accomplished, the age time of to the square is between zero.486 sec and 40.302 sec. The normal worth is 6.54 sec. it's far extensive that inside the wake of inclusive of 50 percent of to the middle factors, the rectangular age time does not have a exceptional deal of effect, and it simply takes up to 39.441 sec. this is an instantaneous end result of to the time it takes for the BSCS to insightfully part the correspondence layer into framework and article planning sublayers to disconnect unraveling and frameworks organisation. The encryptions and unscrambling instruments and key age are brought indifferent by using the purchaser. test in like manner genuinely desires to verify that the client satisfies the traits, so it would not inconvenience execution. it's far obtrusive from this that it calls for a few challenge to well known that each rectangular's PoW and every change in the square are transmitt and affirmed.



through then, as the amount of center factors increase and the amount of trades fabricates, the shutting time will forestall up being long & the sky's the limit from there.

### IV. CONCLUSION

At paper, we develop and recognise a mass collection-primarily base sustenance store set up machine via appropriated contemporary IoT sensors without depending upon depended on in outcasts. by way of completing a sustenance shop arrange orchestrate challenge to trademark based encryption, center points can mastermind trades and steadily perform trades while fulfilling characteristics. This paper gives a specific degree of insurance and secure for the stock machine orchestrates through mass series advancement, trademark based totally encryption development and cutting-edge internet of factors. Stood out from popular guide and united store prepare recreation plans, our diversion checks deliver a all the way down to earth and dependable course for decentralized canny inventory chains

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