Business Operation Using Identification of Product in Context of Developing Countries Emphasizing Nepal

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ABSTRACT

Purpose: *With the emergence of Online Purchasing, Product Identification is an essential model that allows the seller to add a product to a decentralized platform such as Blockchain and allows buyers to purchase the product from the decentralized platform. Fraud products, counterfeiting, and duplication are the current marketplace's major problems. This aims to develop a system for verifying product identification with their information, ownership, and validity detail.*

Design/Methodology/Approach: *The proposed system applies Extreme Programming (XP) to reduce the risk caused by the fixed-time project using new technology and thus the final project could be delivered in time. Solidity and metamask being new technologies were unstable and to adopt the changes, the agile development model was the best through ABI and the bytecode are deployed into the Ethereum Blockchain.*

Findings/Result: *This system maintains the buyers, sellers, and product details in a decentralized blockchain platform. This research details the entire product development process from planning, analysis, design, implementation, and testing for systematic online purchasing. Verifying the product ownership and its information to get the original product is the major difficulty in this space, but this research systematically solves some of those problems. This signifies an improvement in the current centralized way of purchasing goods online, where the information remains as it is entered by the seller while listing the product in Nepal and developing countries context.*

Originality/Value: *The study has produced a decentralized, reliable, secure, and third-party independent marketplace for buying and selling products for fraud free market.*

Paper Type: *Research paper*

Keywords: Decentralize platform, Security, Product uniqueness, Product valuation, validation, blockchain technology

1. INTRODUCTION :

Business is dynamic to cope with the environment [1] [2]. Production Identification is the platform through which people can incorporate in to a business strategy around the globe. Product Identification creates a marketplace for the people who want to sell and buy the product in a secured manner, as this system is based on blockchain technology such that it ensures the proper security of the data of the users who are using this system [3], [4]. Counterfeiting and duplication are always a problem when a product or technology is exported, as they can harm a company's brand, revenue, and customer health. Counterfeit or fraudulent items have become a significant cause of concern for producers, resulting in insignificant losses. This is where the Product Identification system comes into action as it is using blockchain technology, which can be used to verify the product's credibility [5], [6], [7].

A blockchain is a distributed network of personal computers that keeps track of duplicated transactions in a digital ledger. Every block contains many trades, and whenever a new transaction is conducted on the Blockchain, it is logged in all participants' records. Blockchain is a distributed ledger technology that records transactions using a hash, an unchangeable cryptographic signature.

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Counterfeiting is a problem that blockchain technology may be able to help with [8].

With this system, the Buyer will have assurance as the product purchased from a Customer or a Brand is genuine and its value to its age. Within this system, the seller will have the option to enter the detail about the product whether it's an old or new product. The basic information about the product such as name, and images will be stored in the normal database but the actual information such as manufacturing date, Batch No, and Barcode mapping is stored in Blockchain which is not editable as a chain of blocks. Also, no intruder can interfere with it as the smart contract will be deployed in a secure Ethereum platform. Now once sellers publish the ads for their product, buyers will search for it and make their choice. The buyer now will have the option to view the product detail if the seller allows anyone to view it, else the buyer will contact the seller and asks for the product detail. After the buyer will make the purchase, the seller will transfer the ownership to the buyer, and a new transaction log is saved in a blockchain [9].

2. RATIONAL OF THE RESEARCH :

Fake Product Identification is the major problem our system is focused on. Counterfeiting and duplication are always a possibility when a product or concept is sold globally. Fake documents could endanger the company's reputation as well as the security of its customers. Detecting a counterfeit item is currently the most difficult challenge. As a result, item creators will face significant challenges. In the countries like Nepal and India, fake and counterfeit products are an issue. Using Blockchain technology, the proposed method creates a unique transaction ID. Trade records are preserved in blocks in this method. It is difficult to change or obtain access to the information stored in these blocks since it is protected. Another problem identified is price value fluctuation. The more seller uses that product, the less its value will be going to be. But not in the scenario of Nepal, as we don't have any source to verify when this product was purchased first. And how many times the product is resold. These are the major problems identified for both the customers and the renters in the vehicle renting system in our country and the proposed system will set its objectives to alleviate both these problems [10], [11], [12].

3. OBJECTIVES :

The objective of the research is to track the transaction through Blockchain detailed information of the product before the buyer makes any transaction with the seller to value the product price based on its age during online purchase.

4. METHODOLOGY :

The agile software development methodology is a process for developing software. Agile means the ability to move quickly and easily and respond swiftly to change this is a key aspect of Agile software development as well [13]. Extreme Programming (XP) is an agile software development framework that aims to produce higher quality software, where software is developed in incremental cycles. It is used for time-critical applications, and for dynamically changing software requirements. It is suitable for a small co-located extended development team.

In the development of the project, blockchain technology was studied in detail. In the initial phase of the project, current blockchain technology, which is being used around different countries in the world, was studied. Considering the usefulness of those systems, the requirement of our system was defined. Our study on the current product identification process in Nepal showed that an online purchasing system through which people could buy or sell products without having to go to the marketplace is needed to increase security and fairness. A good buying and selling of products must have security, reliability, dynamic, and un-editable at the same time. To satisfy all these criteria, blockchain technology was chosen and different articles and papers were studied. After defining the requirements, a smart contract was written in Solidity. It was deployed and tested using Remix ide. It was checked if the smart contract could meet all the requirements. In this initially deployed smart contract, every address could buy and sell the products. This smart contract was again tested and was modified till it could meet all the functional and non-functional requirements. All the change in the smart contract was incorporated into the backend. To test Hardhat network was used [14].

The proposed system requires rapid change. For the dynamically changing software requirements, XP is appropriate and it was chosen for this project. This model also reduced the risk caused by the fixed-time project using new technology and thus the final project could be delivered on time. Solidity and

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metamask being new technologies were unstable and to adopt the changes, the agile development model was the best. It allowed to break lengthy processes, automated units, and functional testing and thus helped to deliver the project on time [14], [15], [16].

4.1 System Analysis:

Analysis of the system was carried out so that there is a strong guarantee of the system's utility and to facilitate the smooth completion of the project. The system analysis contains information about the requirements of the system as well as a feasibility study of the newly developed technology.

Requirement analysis is carried out so that the functional and non-functional requirements of the system can be figured out and implemented accordingly. There shall be an option for the seller to add numbers of the product (old + new) in the system. There is no barrier to limiting the product count. The buyer shall view the product without any authentication mechanism. The system shall store the user product detail in a decentralized ledger. The buyer shall view the purchased items. The seller shall view the list of products that are listed for sale. The UI should be clean and intuitive. A proper wallet connection should be established. The buyer shall view the product detail along with its previous owners and dates [16], [17], [18], [19].

4.2 Use Case Diagram:

The given diagram of figure 1 shows a generally high-level flowchart of the Product Identification System.
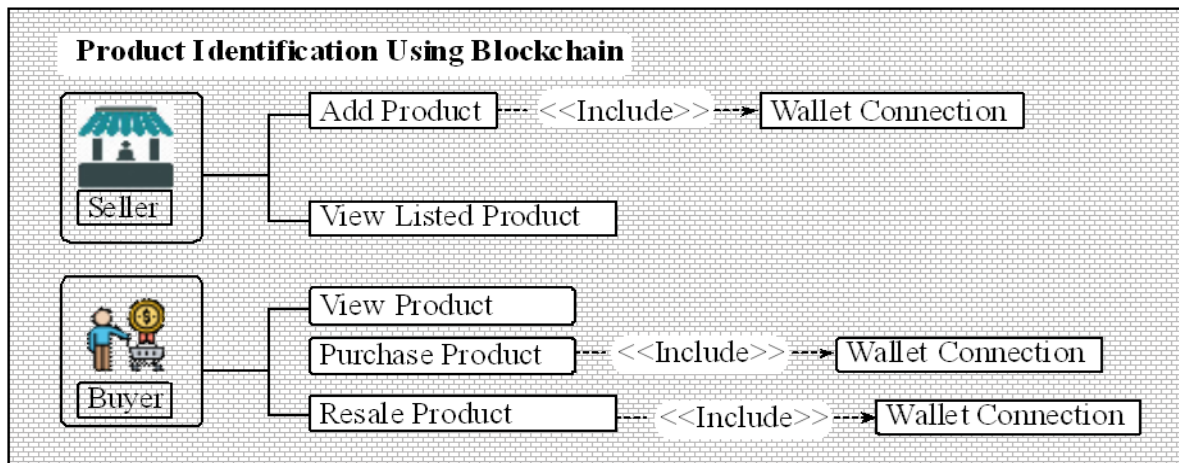

Fig. 1: Use Case Diagram [Authors]

The diagram can be used to understand the general working principle of the system. The process starts with a registered user logging into the system. The homepage will provide the user with options to either act as a buyer or a seller. If the user is a seller, s/he can post a product ad to the platform. The users who are registered as a seller can also be a buyer. Once the buyer is ready to purchase a product from the seller, the seller will have the option to transfer the ownership and a log is maintained in a Blockchain [20], [21], [22].

5. BUSINESS OPERABILITY :

Operational assurance is very important in helping business houses, and organizations to decide whether the system should be adopted or not which depends upon operational, economic, and technical suitability.

5.1 Operational Feasibility:

Operational feasibility measures the extent to which the system will solve the problem that is identified and fulfills the requirement of the potential users. In the current scenario, there is a lot of demand in Nepal regarding the product marketplace. The healthy boom in e- commerce and online product trade increases the need for a security marketplace. The points were taken for the operational feasibility of the proposed system. The proposed system will likely solve the secure marketplace problem for business operations by providing a secure platform that has been built using blockchain technology

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[15], [16]. The proposed system keeps track or records of any products maintaining the genuineness of the products and providing information about the products showing how many times they have been resale [17]. The proposed system also ensures the safety of the data of the users of this system [19]. The proposed system is using Metamask to connect user wallets and allows trading the products in the marketplace [23].

5.2 Economic Feasibility:

Efficiency determines if the project goal can be achieved within the resources limit allotted to it or not along with time considered. Since the proposed system has been built using blockchain technology such that there need to pay the gas fee to carry out every transaction and products price are also traded in crypto that the following considerations are taken for economic feasibility. The proposed system is using a smart contract for memory management such that it can minimize the economic burden to accomplish this project to some extent. Since this is a college project so, the proposed system is deployed locally using Hardhat (Local Ethereum Network) in a public network due to which there is no kind of deployment charge [23].

6. SYSTEM DESIGN :

After the requirement analysis, the system is designed and the process of system design is represented by a highly detailed activity diagram and a database schema that is used for making the application.

6.1 Activity Diagram:

The given diagram of figure 2 shows a generally high-level activity diagram of the Product Identification System. The diagram can be used to understand the general working principle of the system. The process starts with a wallet connection to the system. The homepage will provide the user with options to either act as a buyer or a seller. If the user is a seller, s/he can post a product ad to the platform. The users who are registered as a seller can also be a buyer. Once a buyer is ready to purchase a product from the seller, the seller will have the option to transfer the ownership and a log is maintained in a Blockchain [6], [7].
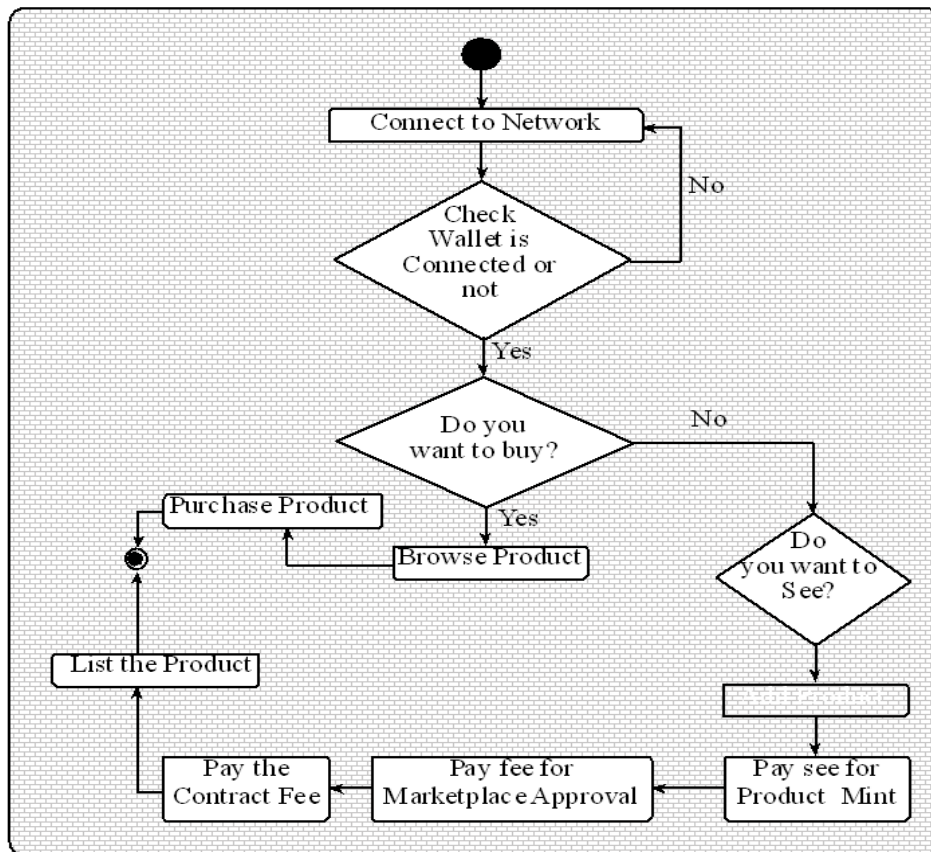
Fig. 2: Activity Diagram [Authors]

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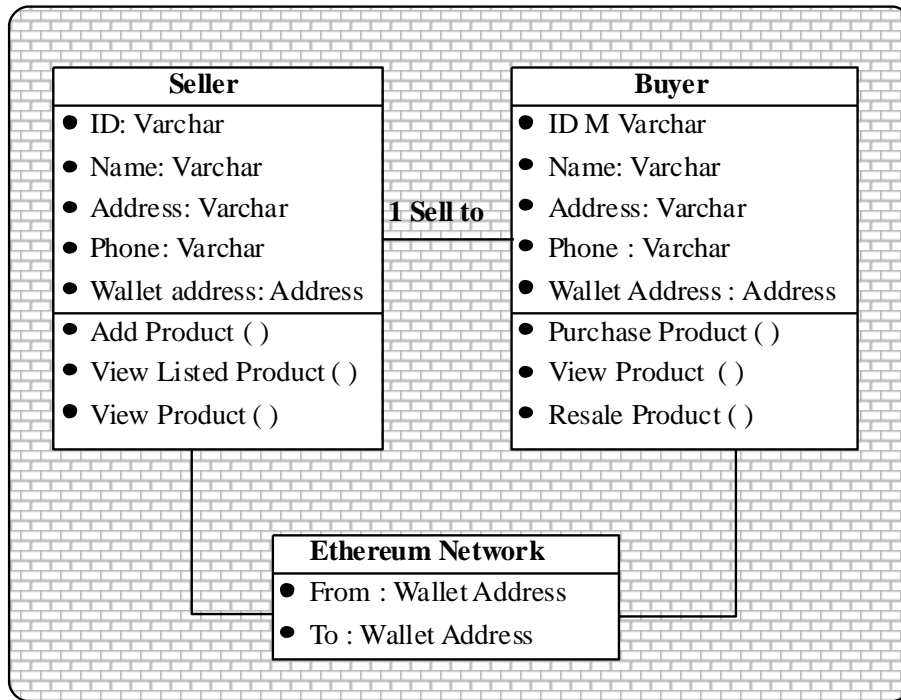
6.2 Class Diagram:

Fig. 3: Class Diagram [Authors]

The given class diagram of figure 3 shows the attributes and functions of the actors in the system. The relationship between seller and buyer is 1 too many meaning that one seller can have many buyers. Similarly, an admin can manage many systems and users [8].

6.3 Sequence Diagrams:
The sequence diagram is used primarily to show the interaction between objects in the sequential order that which that interaction occurs.

Fig. 4: Sequence Diagram [Authors]

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6. 4 Component Diagram:

The component diagram as shown in figure 5 this project depicts the association and dependencies between the various components and their interactivity.
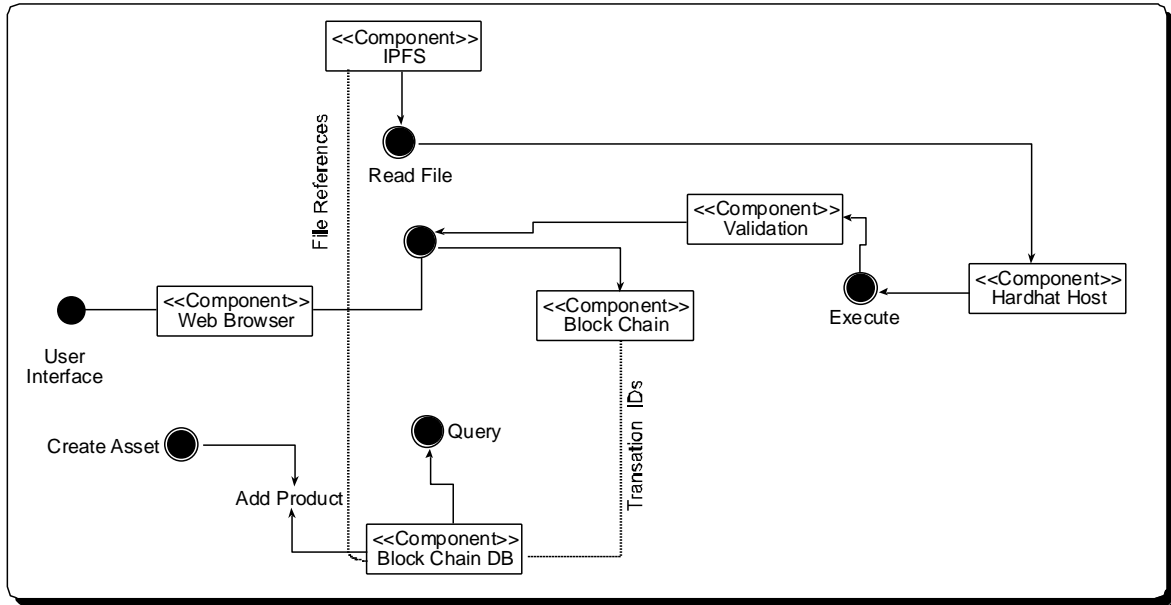
Fig. 5: Component Diagram [Authors]

6. 5 Deployment Diagram:
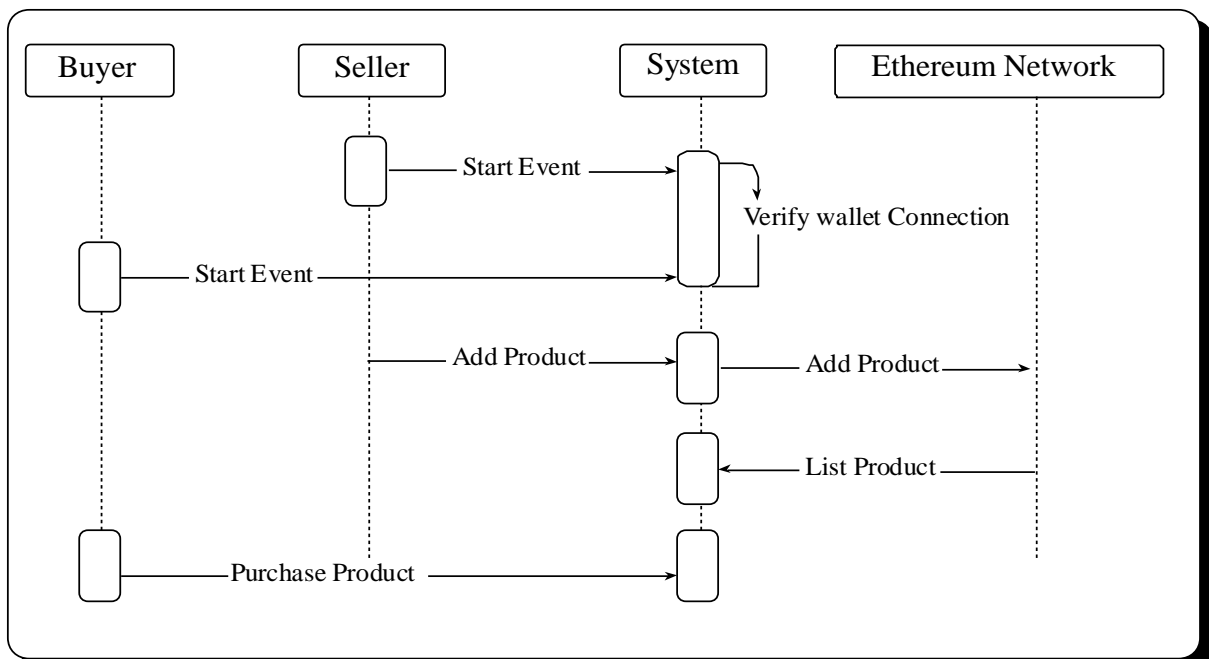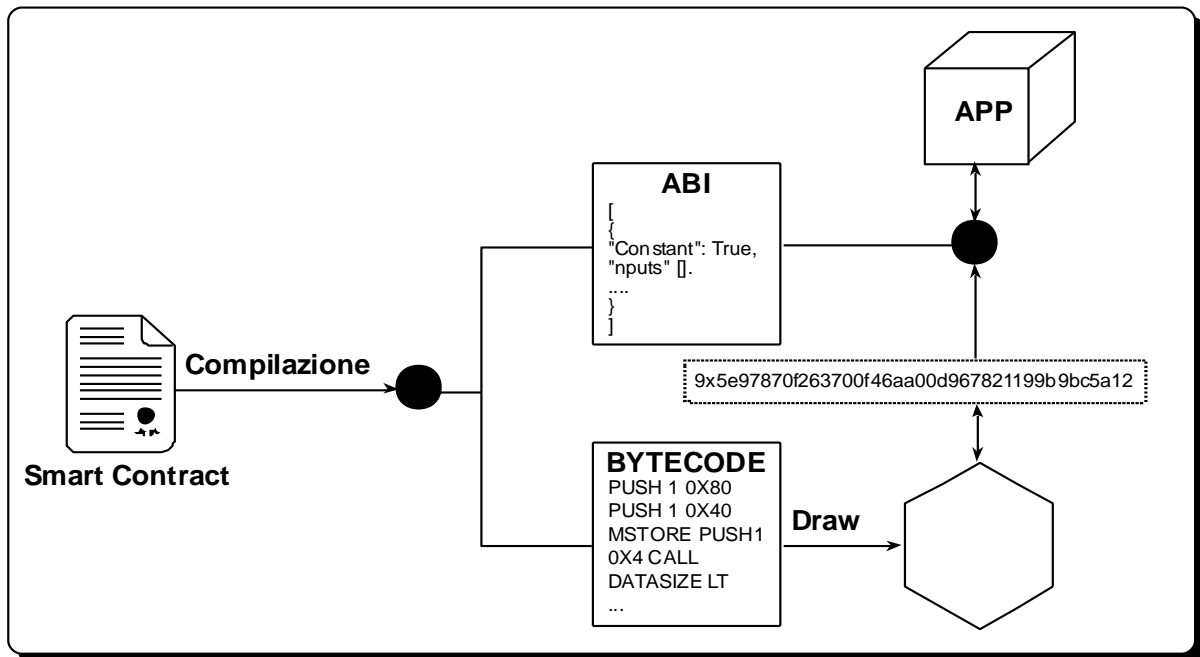

Fig. 6: Deployment Diagram [Authors]

The deployment diagram is shown in figure 6 the execution architecture of the system. Here the proposed system execution starts when the Solidity compiler (solc) compiles the smart contract written in solidity. Once the Smart contract gets compiled by solc the Smart contract gets converted into Application Binary Interface (ABI) and bytecode as shown in the figure below. ABI is in the high-level form such that our system interacts with Smart contract using that ABI and the bytecode are deployed into the Ethereum Blockchain. Several small and medium businesses are working efficiently on it [24], [25], [26], [27].

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6. 6 Algorithm Details:

Here are the steps that are followed in order to deploy our smart contracts in the Ethereum Blockchain network and interact with it [28], [29], [30].

(a) Compile the Smart Contracts: Smart contract is written in Solidity programming language. So, smart contracts were compiled with solc compiler

(b) Setup the blockchain network or use the public blockchain network: Local blockchain networks can be set up with Ganache or Hardhat which provides the private key along with some ETH balance on it.

(c) Write the deployment script: Deployment script is the javascript function that actually connects to the blockchain network and sends transactions on it.

```
async function deploy(){
let r = await web3.eth.sendTransaction({ from: myAccount.address,
gas: 8000,
data: bytecode   })
}
```

(d) Store the Contract address: Once a smart contract is deployed, it returns the contract address along with the block number. This is how smart contracts are deployed in the Ethereum blockchain network.

7. IMPLEMENTATION :

Implementation of the system was carried out after the system was designed. The front-end and back-end logic of the application were both catered to provide maximum client satisfaction and fulfillment of the objectives that were initially defined in the project [31], [32], [33].

7.1 Tools and Technologies:

The implementation of modules can be differentiated into major categories that define the functionalities of the application and objectives defined for this project work. Some of those categories include Wallet connection, adding product to the blockchain network, purchasing the product, and resulting from the product. Currently, some of the modules have yet not been finished such as storing the buyer and seller's basic information in a relational database [34], [35], [36]. The front-end of the system was developed using React and Javascript. The reason to choose these frameworks is that it is easy to learn, flexible, and provide speed and performance. The backend of the project is supported by the development of smart contracts that are written using the Solidity programming language. And Hardhat framework is used to deploy the smart contract into the Ethereum network. The product is stored in a Decentralized network Blockchain. So Blockchain and Ethereum networks act as a decentralized database for us. Trello was used for project management. Github was used for version control and collaboration among the team members.

7.2 Wallet Connection with Metamask:

As users have to connect their wallet address using a browser extension such as Metamask.

Method for wallet connection with metamask

```
const web3Handler = async () => {
const accounts = await window.ethereum.request({ method: 'eth_requestAccounts'
})
setAccount(accounts[0])
const provider = new ethers. providers. Web3Provider(window.ethereum) const signer = provider.getSigner()
loadContracts(signer)
}
```

Add product for sale

This system allows the seller to add products for sale. Currently, the system supports a limited number of product categories. To add a product for sale, the seller has to complete three steps of verification along with a certain gas fee. The three steps are NFT mint, approval for the marketplace, and contract verification.

Method to add product

```
const createProduct = async () =>
{
```

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```
if (!image || !price || !name || !description) return; try {
const result = await client.add(JSON.stringify(
{image, price, name, description, productType, vehicleNo, lotNo, deviceIdentificationNumber,
propertyVerificationNumber, purchaseDate }
) );
mintThenList(result); } catch (error)
{console.log("ipfs uri upload error: ", error); } }
```

Purchase product

The system allows buyers to purchase the product from hosted Ethereum network. The buyer needs to pay the amount of the product along with the 1 percent market price.

Method to add product

```
const purchases = await Promise.all(results.map(async i =>
{
i = i.args
const uri = await product.tokenURI(i.tokenId) // use uri to fetch the product metadata stored on ipfs
const response = await fetch(uri)
const metadata = await response.json() // get total price of item (item price + fee) const totalPrice =
await marketplace.getTotalPrice(i.itemId) // define listed item object
let purchasedItem = { totalPrice, price: i.price,
itemId: i.itemId, name: metadata.name,
description: metadata.description, image: metadata.image }
return purchasedItem }))
```

Resale the product

The system allows buyers to re-sale the product they have purchased through the blockchain network. During reselling, they can edit the project name, description, and the price of the product.

Method to resale Product

```
const resaleProduct = async () => {const image = items[0].image; const price = items[0].price; const
lotNo = items[0].lotNo;
const vehicleNo = items[0].vehicleNo;
const propertyVerificationNumber = items[0].propertyVerificationNumber;
const deviceIdentificationNumber = items[0].deviceIdentificationNumber const productType =
items[0].productType;
const nft = items[0].nft; try {
const result = await client.add(JSON.stringify({ image,
price, name, description,
productType, vehicleNo, lotNo,
deviceIdentificationNumber, propertyVerificationNumber })
);
mintThenList(result, nft);
} catch (error) {
console.log("ipfs uri upload error: ", error);}}
```

7.3 Testing and Validating:

For 13 different unit test cases under four major functionalities, the application has to be tested and validated [37], [38], [39].

Table 1: Test Cases for Unit Testing and Result

S. No.	Test Case	Expected Outcome	Obtained Outcome	Result
Wallet Connection				
1.	User tries to connect their Wallet	The user wallet should get connected to the meta mask wallet when the user clicks on **Connect Wallet** button on the navbar of the system.	The user wallet is connected.	Pass

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Add Product for Sale			
2	The user clicks on the Dashboard	Once the user successfully connects to the wallet the user must be redirected to the dashboard.	The user is directed to the dashboard page.	Pass
3	In the dashboard, the user clicks sale the product	When the user clicks on the menu item **Sale Product** on the user dashboard page form page must need to get open.	The user is directed to the form, where they can add product	Pass
4	User select the product type and enter the detail based on the product type selected	Once the Form page is opened the user must be able to access the additional fields inside the form once the users fill-up the one field.	The user is prompt with additional fields	Pass
5	If the user did not fill all the Information	If the form did not get submitted then the system must throw an error displaying a warning message.	The user gets greeted with a warning message.	Pass
6	In the add product form, the user enters valid data and presses submit button.	If the user fill-up the form completely without any error the info on the form needs to get stored in the block chain network	Data is successfully stored in the block chain network.	Pass
Buyer Purchase Product			
7	User clicks on the Products Menu.	When a user clicks the menu item **Listed Products** in the user dashboard then the user must be redirected to the products listing page.	The user is directed to the products listing page.	Pass
8	The user clicks on the buy now Button	On clicking the buy now button on the product card the user must need to be prompted to the metalmark wallet to pay the amount of product.	The user is prompted with meta mask wallet.	Pass
9	The user clicks on the product Card	Whenever the user clicks on the anywhere in a product card the user must need to be redirected to the product detail page.	The user is directed to the product detail page	Pass
10	The user clicks the buy nowa button from the product detail page	Whenever the user clicks on the buy now button on the product detail page then the also the user must need to get prompted to the metamask wallet to pay the amount of product.	The user is prompted with a metamask wallet.	Pass
Resale the product			
11	The user clicks the dashboard Menu	After getting connected to the wallet whenever the user clicks the **Dashboard** on the top navigation bar then the user must need to be redirected to the particular user's dashboard.	The user is directed to the user dashboard.	Pass

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12	A user clicks on the purchased List	Whenever the user clicks on the **Purchases** menu item on the user dashboard the user must get redirected to the purchased products page.	The user is directed to the purchase product page.	Pass
13	A user clicks on a resale product	Whenever the user clicks on the resale button on the products listed on the purchased products page then they must need to get prompted to the metamask wallet and must complete the steps of NFT mint, approval for the market place and contract sign.	The user gets prompted to metamask wallet and all required operations are carried out.	Pass

7.4 **System Testing**:

Initially when the seller adds an item to the marketplace seller is the first owner of the product and when the buyer purchased the product, the ownership of the product is transferred to the immediate buyer and the buyer can also resale the product in the marketplace again. The system successfully forms the block and saves the transaction history and transaction detail in the blockchain and a new block is also formed in every transaction the buyer and seller made. For 13 different unit test cases under four major functionalities, the application so far has remained successful. This is a positive result as the success of these functions validates the successful design of the proposed system to make online marketing more compassionate [36], [37], [39], [40], [41].

Table 2: Test Cases for System Testing and Result

S. No.	Test Case	Expected Outcome	Obtained Outcome	Result
1.	Browser Compatibility	The system must not support all browsers.	The system is compatible with the only browser that supports web3.	Pass
2.	Responsiveness	The app must have to be responsive across all forms of devices.	The app is responsive on all devices.	Pass
3.	Navigation	The links, buttons, and menus should perform the desired task only.	The links, buttons, and menus perform the desired task.	Pass
4.	Wallet Connection	The wallet connection must work fine.	The wallet connection works fine.	Pass
5.	Data Validation	The form validation method must validate the data properly.	The form validation method works well.	Pass

The way Nepal is progressing on the track of rapid digitization from Agriculture to Education including administrative reforms assures that project product identification will be booming product very soon [42, 43, and 44]. Society is on the progression of society 5.0 for which we have to consider several factors and enhance smartness in every walk of life. Smartness in future academic operations to future business is a fundamental need for existence in the upcoming days [45, 46, and 47].

8. CONCLUSION :

After the completion of the project, a decentralized, reliable, secure, and third-party independent

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marketplace for buying and selling products was developed. With the creation of Smart Contract, deployed successfully in the Ropsten test network, a full functioning DApp using Truffle was made. The system is compatible with the only browser that supports web3.

The app is responsive on all devices. The links, buttons, and menus perform the desired task. The wallet connection works fine. The form validation method works well. This system is only applicable to larger organizations. Since the system is running in Ethereum, a private blockchain should be set up to use for in the marketplace. Less knowledge of people about blockchain technology. Future enhancements are needed to make revolutionary changes at the national level and create a digital identity using Uport. Mandala the best blockchain which needs to be studied.

9. ACKNOWLEDGEMENT :

REFERENCES :

[1] Krishnakumar, S., Prasanna Devi, S. and Surya Prakasa Rao, K. (2013). A business dynamics model in entrepreneurial orientation for employees. *Industrial and Commercial Training*, *45*(1), 36-50. https://doi.org/10.1108/00197851311296692.

[2] Grünig, R., Kühn, R., Morschett, D. (2022). Formulating the Business Strategy. In: The Strategy Planning Process. Springer, Cham. https://doi.org/10.1007/978-3-030-93918-2_24.

[3] Wang Jian (2015). Product Marking Failure Prediction and Remediation Method Based on Manufacturing History Data. *Computer Integrated Manufacturing System*, http://www.cims-journal.cn/CN/10.13196/j.cims.2015.09.026.

[4] Buvaneswari, B. et al, (2021). Fake Product Identification using Blockchain. *International Journal for Research in Applied Science & Engineering Technology (IJRASET), 9*(3), 877-880. https://www.ijraset.com/fileserve.php?FID=33370.

[5] Bastos, W. (2012). A history of the concept of branding: practice and theory. *Journal of Historical Research in Marketing, 4*(3), 347-368. Google Scholar↗

[6] Batey, M. (2015). Brand Meaning: Meaning, Myth and Mystique in Today's Brands (1st ed.). USA: Routledge, 2015.

[7] Biraghi, S. (2015). Corporate branding: Where are we? A systematic communication-based inquiry. *Journal of Marketing Communications, 21*(4), 260-283. Google Scholar↗

[8] Fayez, A., et al. (2022). Design and Implementation of New Collision Resistant Fast Hash Function Family for IoT Healthcare Blockchain Ledger. *International Conference on Innovation and Intelligence for Informatics, Computing, and Technologies (3ICT),* 609-615. Google Scholar↗

[9] Ma, J. et al. (2020). Blockchain-Based Application System for Product Anti-Counterfeiting https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8985337.

[10] Leng, J., Jiang, P., Xu, K., Q. Liu, J. L. Zhao, Y. Bian, and R. Shi, (2019). Makerchain: A blockchain with a chemical signature for self-organizing process in social manufacturing. *J. Cleaner Prod., 234*(1), 767–778. Google Scholar↗

[11] Alzahrani, N. and Bulusu, N. (2018). Block-supply chain: A new anticounterfeiting supply chain using NFC and blockchain,'' in Proc. 1st Workshop Cryptocurrencies Blockchains Distrib. Syst. (CryBlock), pp. 30–35. Google Scholar↗

[12] Rosenfeld, M. (2012). [Online]. Available: https://bitcoil.co.il/BitcoinX.pdf.

[13] Samli, Monisha Gupta, Abhishek Sharma, Susheela Hooda, Jaswinder Singh Bhatia (2023). Distributed Agile Software Development (DASD) Process Book Editor(s): Susheela Hooda, Vandana Mohindru Sood, Yashwant Singh, Sandeep Dalal, Manu Sood https://doi.org/10.1002/9781119896838.ch9.

A. K. Mishra, et al. (2023); www.srinivaspublication.com

PAGE 123

International Journal of Applied Engineering and Management Letters (IJAEML), ISSN: 2581-7000, Vol. 7, No. 1, March 2023

SRINIVAS PUBLICATION

[14] Cheng, H. et. al, (2022). Declarative Smart Contracts https://doi.org/10.48550/arXiv.2207.13827.

[15] S.-T. Li, T.-T. Pham, and H.-C. Chuang, (2019). Do reviewers' words affect predicting their helpfulness ratings? Locating helpful reviewers by linguistics styles. *Inf. Manage., 56*(1), 28-38. Google Scholar↗

[16] Srivastava, V. and Kalro, A. D. (2019). Enhancing the helpfulness of online consumer reviews: The role of latent (content) factors. *J. Interact. Marketing, 48*(1), 33-50. Google Scholar↗

[17] Wood, G. (2014). Ethereum: A secure decentralised generalised transaction ledger. *Ethereum Project Yellow Paper, 151*(1), 1–32. Google Scholar↗

[18] Panikkar, S., Nair, S., Brody, P. and Pureswaran, V. (2015). ADEPT: An IoT practitioner perspective. *IBM Inst. Bus. Value, New York, NY, USA, White Paper*, pp. 1–18. Google Scholar↗

[19] Matthew English, S. and Nezhadian, E. (2017). Application of bitcoin data structures & design principles to supply chain management. arXiv:1703.04206. [Online]. Available: http://arxiv.org/abs/1703. 04206.

[20] Tian, F. (2016). An agri-food supply chain traceability system for China based on RFID & blockchain technology. Proc. 13th Int. Conf. Service Syst. Service Manage. (ICSSSM), Jun. 2016, pp. 1–6. Google Scholar↗

[21] Shepard, S. (2005). RFID: Radio Frequency Identification. New York, NY, USA: McGraw-Hill, 2005.

[22] Lu, Q. and X. Xu, (2017). Adaptable blockchain-based systems: A case study for product traceability. *IEEE Softw., 34*(6), 21–27. Google Scholar↗

[23] OTS (2022). Modern information technologies and services: Proceedings of the twenty-fifth conference, Maribor, September 7 and 8, 2022. https://doi.org/10.18690/um.feri.10.2022.

[24] Kwofie, B., & Tetteh, E. D. (2020). Emerging Opportunities for Blockchain Use by Small and Medium Enterprises (SMEs) in Developing Economies. In Cross-Industry Use of Blockchain Technology and Opportunities for the Future (pp. 166-175). IGI Global. Google Scholar↗

[25] Meher, B. K., Hawaldar, I. T., Mohapatra, L., Spulbar, C. M., Birau, F. R., & Rebegea, C. (2020). The impact of digital banking on the growth of Micro, Small and Medium Enterprises (MSMEs) in India: a case study. *Business: Theory and Practice, 22*(1), 18-28. Google Scholar↗

[26] Omar, A., Ramayah, T., Lin, L. B., Mohamad, O., & Marimuthu, M. (2011). Determining factors for the usage of web-based marketing applications by small and medium enterprises (SMEs) in Malaysia. *Journal of Marketing Development and Competitiveness, 5*(2), 70-86. Google Scholar↗

[27] Kamble, S. S., Gunasekaran, A., & Sharma, R. (2020). Modeling the blockchain-enabled traceability in agriculture supply chain. *International Journal of Information Management, 52*(1), 01-09. Google Scholar↗

[28] Konstan, J. A. and J. Riedl, (2012). Recommender systems: From algorithms to user experience User Model. *User-Adapted Interact., 22*(1-2). 101-123, DOI: https://doi.org/10.1007/s11257-011-9112-x.

[29] Cruz-Hinojosa, N. J., & Gutiérrez-de-Mesa, J. A. (2016). Literature review of the situation research faces in the application of ITIL in Small and Medium Enterprises. *Computer Standards & Interfaces, 48*(1), 124-138. Google Scholar↗

[30] Dang, B. T., & Trung, N. X. (2019). Research on the Application of E-commerce to Small and Medium Enterprises (SMEs): the Case of India. *International Journal of Economics and Management, 1*(4), 16-24. Google Scholar↗

[31] Duan, Y., Edwards, J. S. and Dwivedi, Y. K., (2019). Artificial intelligence for decision making in the era of Big Data–evolution, challenges and research agenda. *International Journal of Information Management, 48*(1), 63-71. Google Scholar↗

A. K. Mishra, et al. (2023); www.srinivaspublication.com

PAGE 124

International Journal of Applied Engineering and Management Letters (IJAEML), ISSN: 2581-7000, Vol. 7, No. 1, March 2023

SRINIVAS PUBLICATION

[32] Ghezzi, A., & Cavallo, A. (2020). Agile business model innovation in digital entrepreneurship: Lean startup approaches. *Journal of Business Research, 110*(1) 519-537. Google Scholar↗

[33] Jahanshahi, A. A., Khaksar, S. M. S., & Pitamber, B. K. (2011). Electronic commerce applications among Indian small and medium enterprises. *Information Management and Business Review, 2*(6), 276-286. Google Scholar↗

[34] Karimi, S., & Naghibi, H. S. (2015). Social media marketing (SMM) strategies for small to medium enterprises (SMEs). *International Journal of Information, Business and Management, 7*(4), 86-95. Google Scholar↗

[35] Potluri, R. M., & Vajjhala, N. R. (2018). A study on the application of web 3.0 technologies in small and medium enterprises of India. *The Journal of Asian Finance, Economics, and Business, 5*(2), 73-79. Google Scholar↗

[36] Rosu, S. M., Dragoi, G., & Guran, M. (2009). A knowledge management scenario to support knowledge applications development in small and medium enterprises. *Advances in Electrical and Computer Engineering, 9*(1), 8-15. Google Scholar↗

[37] Liu, Y., Soroka, A., Han, L., Jian, J., & Tang, M. (2020). Cloud-based big data analytics for customer insight-driven design innovation in SMEs. *International Journal of Information Management, 51*, 102034, 01 – 35. Google Scholar↗

[38] Quinton, S., Canhoto, A., Molinillo, S., Pera, R., & Budhathoki, T. (2018). Conceptualising a digital orientation: antecedents of supporting SME performance in the digital economy. *Journal of Strategic Marketing, 26*(5), 427-439. Google Scholar↗

[39] Shrimali, A. K., & Soni, V. K. (2017). A review of issues of lean manufacturing implementation by small and medium enterprises. *International Journal of Mechanical and Production Engineering Research and Development (IJMPERD), 7*(3), 283-300. Google Scholar↗

[40] Sun, W., Zhao, Y., & Sun, L. (2020). Big data analytics for venture capital application: Towards innovation performance improvement. *International Journal of Information Management, 50*(1), 557-565. Google Scholar↗

[41] Yeng, S. K., Osman, A., Haji-Othman, Y., & Safizal, M. (2015). E-commerce adoption among small and medium enterprises (SMEs) in Northern State of Malaysia. *Mediterranean Journal of Social Sciences, 6*(5), 37-37. Google Scholar↗

[42] Mishra, A. K. Nepal Ananda, Aithal, P. S. (August 2022). Industry 4.0 Concept for Nepal - Operating Virtual Farming Industry. PP- 31-35, Proceedings on Future Trends in ICCT and its Applications in IT, Management and Education, Editors: Dr. Krishna Prasad, K., Dr. P. S. Aithal, & Dr. A. Jayanthiladevi, ISBN: 978-81-949961-8-7, DOI: https://doi.org/10.5281/zenodo.7215189.

[43] Bhagat, C., Mishra, A. K., & Aithal, P. S., (2022). Model for Implementation of e-Government Services in Developing Countries like Nepal. *International Journal of Case Studies in Business, IT, and Education (IJCSBE), 6*(2), 320-333. DOI: https://doi.org/10.5281/zenodo.7139657.

[44] Bhagat, C., Sharma, B. and Mishra, A. K., (2021). Assessment of E Governance for National Development – A Case Study of Province 1 Nepal. *East African Scholars J Eng Comput Sci, 4*(4), 46-52. DOI: https://doi.org/10.36349/easjecs.2021.v04i04.003.

[45] Bhagat, C., Sharma, B. & Mishra, A. K., (2021). Critical Success Factors for the Implementation of E-Governance - A Case Study of Province 1 Nepal. *International Journal of Interdisciplinary Research in Arts and Humanities, 6*(1), 22-26. https://doi.org/10.5281/zenodo.4771690.

[46] Rajat Pokharel, Mishra, A. K., & Aithal, P. S., (2021). Practicability Assessment of Smart Village Project: A Case of Sandakpur Rural Municipality, Ilam Nepal. *International Journal of Management, Technology, and Social Sciences (IJMTS), 6*(2), 265-281. DOI: https://doi.org/10.5281/zenodo.5799392.

A. K. Mishra, et al. (2023); www.srinivaspublication.com

PAGE 125

International Journal of Applied Engineering and Management Letters (IJAEML), ISSN: 2581-7000, Vol. 7, No. 1, March 2023

SRINIVAS PUBLICATION

[47] Mishra, A. K. & Nepal Ananda, (2022). Be Prepared for Futuristic Sustainable Academic Operation. 9th International Conference on Modern Education and New Learning Technologies, ISBN Number: 978-920-5-20233-4, 63-67, https://doi.org/10.5281/zenodo.7748843.

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A. K. Mishra, et al. (2023); www.srinivaspublication.com

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