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# LEARNING MANAGEMENT SYSTEM USING MULTI SMART CONTRACT

**M.J.U. Haris Bahrudin  R.R. Isnanto  R. Gernowo**

*Doctoral Information System Pascasarjana, Diponegoro University, Semarang, Indonesia*
*jokokumbaran@gmail.com, rizal_isnanto@yahoo.com, rahmatgernowo@lecturer.undip.ac.id*

**Abstract-** Education is an important component that determines the progress of the nation. National education functions to develop the ability and character and civilization of a dignified nation in the context of the intellectual life of the nation. In the development of technology in the Blockchain world, every year there are significant developments this is what drives developments in various world sectors, especially in the economic and education sectors. Learning management system based on blockchain is a new development in the world of education. The implementation uses multi smart contracts so that it can be connected with cryptocurrency under the blockchain network for its operation. This breakthrough is the background of this research for the development of technology on the blockchain side, apart from that the growing interest in learning for students who support using this system is also influenced by getting coins in every material that has been studied at LMS Abrar. Universities affiliated with LMS Abrar are also facilitated in attracting student interest in learning and also attracting interest to see in more detail the institutions affiliated with LMS Abrar. This interest can be proven by the results of respondents who have been analyzed using SPSS to conduct pilot tests, validity tests, and reliability tests.

**Keywords:** Learning Management System, Blockchain, Multi Smart Contract.

## 1. INTRODUCTION

Education is an important component that determines the progress of the nation. National education functions to develop the ability and character and civilization of a dignified nation in the context of the intellectual life of the nation. In the development of technology in the Blockchain world, every year there is significant development this is what drives developments in various world sectors, especially in the economic and education sectors.

The combination of the two sectors of the economy and education cannot be separated because the development of education in the digital era as it is today is very closely related to economic strata, therefore in this study we will combine two sectors that are closely related to the world of education and Blockchain technology with the Sub-studying. That way it will be able to attract interest in learning. In addition, the participating agencies will also sector of Economics using decentralized finance technology (DeFi) and Smart Contracts that will be integrated with the Learning Management System. LMS / Learning Management System is a software or software for administrative needs, documentation, reports of an activity, teaching and learning activities, online activities (connected to the internet), E-learning, training materials and all that is done online. In this study, from the university or educational institution side, a system will be facilitated to get students internationally with DeFi fundamentals and mining concepts on the LMS system which will be applied to attract many students by mining with learning concepts and completing the material available on the LMS.

The factor causing the low quality of learning is the low quality of educators and students. Study difficulties consist of two types of classifications, namely special and general study difficulties. In common difficulties, students experience learning difficulties in schools which are influenced by internal factors and external factors. "Internal factors are interest, attention, motivation and study habits. While external factors are the school environment, available facilities, learning methods, learning media and learning resources and socio-economic conditions.

Basically, Blockchain technology is very closely related to Cryptocurrency and in this research, the development of a place study system will be applied to every institution or agency that has an LMS and educational information system so that it can be integrated using Blockchain technology, both for promotion, educational collaboration, learning, and education. Standardization of education in it can be done on an international scale. This will facilitate the speed of data access and data security is more guaranteed because it uses Blockchain technology and is combined with Smart Contracts on the BSC network so that in its application it will solve several problems that often occur if implemented on a global scale.

The Blockchain running under the BSC network is the token used for transactions and the running system will be certified for security so that the Cryptocurrency token can be sold against the background of the white paper project study place. That it forms a business flow where students can get paid in the form of Cryptocurrency just by benefit from international relations, where every educational institution can join and establish cooperation.

Agencies that join can have students or students from every country who join the study place, with this concept it is hoped that it can provide new breakthroughs in the world of education globally.

Create a study place decentralized learning system Using Blockchain under the Binance Chain Network for smart contracts, with each educational institution able to promote its institution and provide prospectuses and materials according to the Learning Management System standard and purchase Cryptocurrency tokens (Abrar). Every community that checks with the concept of Decentralized Finance (DeFi) so every student who learns will get a Cryptocurrency token reward under the Binance Smart Chain network to attract interest in learning. So that everyone can learn for free and get paid.

The problem was then solved using Blockchain technology by researchers such as Bonomi, Lone, and Yunianto. Previous research has mostly used one smart contract to manage all digital evidence and can be used as a means for integration between LMS systems. However, the implementation of system integrity will be more specific in the Abrar LMS. From the results of the application, it can be concluded that the DeFi and Education business concepts can be used as an integrated system that can help students and universities in the teaching and learning process and business process implementation [2].

## 2. NONLINEAR MOTOR DYNAMICS

Testing on respondents using the Pilot test is a test of the reliability and validity of research equipment. Before the survey was distributed to actual respondents, the survey was first tested on students and heads of study programs. The pilot test is used to validate respondents who are testing the Blockchain-Based Learning Management System. The data features of the trial participants are in Table 1 as Characteristics of pilot test respondents.

Table 1. Characteristics of pilot test respondents

| Jenis Masyarakat | Jumlah Respondent | Percentage |
|---|---|---|
| Kaprodi | 30 | 100% |
| Mahasiswa | 70 | 100% |
| Kuesioner | Jumlah Respondent | Percentage |
| Kuesioner Kembali | 40 | 100% |
| Jumlah | 40 | 100% |
| Usia | Jumlah Respondent | Percentage |
| 20-40 | 40 | 100% |

From the table above, it can be seen that there were 30 heads of study programs as respondents, 100 questionnaires were taken. The average respondent was 20-40 years old. After that the results of the pilot test were tested again with validity and reliability tests using SPSS version 23 for windows.

## 3. FEEDBACK LINEARIZATION CONTROL

Smart contract account with DApps available on the Abrar LMS. Figure 3 as Smart Contract Account Flow shows in detail the flow of how the Blockchain-based LMS process is carried out using smart contracts.

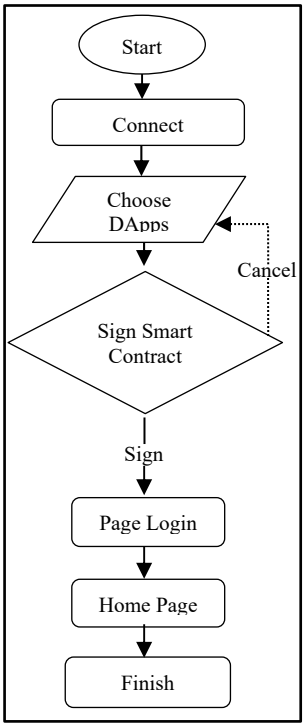


Figure 1. Account Flow Smart Contract

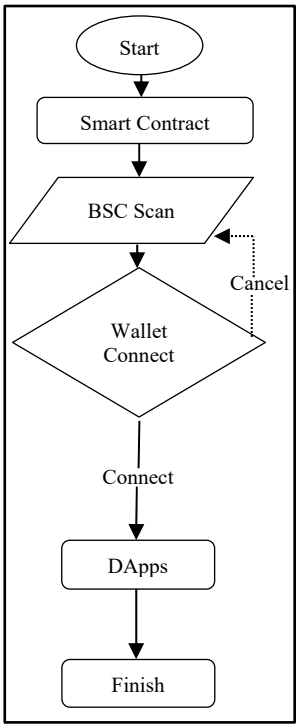


Figure 2. Basic Flow Token Contract

In Figure 1, the Smart Contract Account Flow to enter into the Abrar LMS, a smart contract account is needed by clicking the connect menu on the Abrar main page and selecting the available DApps, which will automatically be directed to the signing of the smart contract according to the regulations in the LMS. Login to enter the Abrar system after completion will be directed to the main page of the LMS Abrar.

1. Basic token contract, as a medium of exchange and used to record all transactions on the Abrar token into the Binance smart chain network. The flow of the implementation of the Basic token contract is shown in Figure 2 Flow of the Basic Token Contract.
2. In Figure 2 the Basic Token Contract Flow of the Abrar smart contract token can be checked via bscscan.com to check details regarding the Abrar token. If users want to make transactions and have Abrar tokens can connect to the wallet and make transactions in it the user can choose the DApps available on the Abrar LMS as an option to store Abrar tokens.

The Abrar token transaction process starts from having a smart contract account which is then connected to the BSC network to claim the Abrar token by triggering a claim click on the completed material on the profile page. The system will direct the smart contract call when approved by paying a transaction fee, the token will enter the wallet and will return to the user profile page and complete as shown in Figure 3 Terminable contract flow [3].

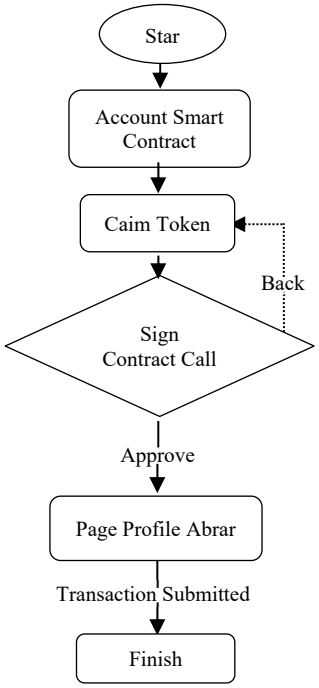


Figure 3. Terminable contract flow

## 4. THE LYAPUNOV-BASED APPROACH

The results of the pilot test based on several respondents who filled out the questionnaire can be explained as follows. Description of respondents in the study consisting of gender, age, and education, who participated in this study can be presented in Table 2 Results of Respondent Characteristics.

Table 2. Results of the Characteristics of the Respondents

| Description | Frequency | Percentage |
|---|---|---|
| Gender | | |
| Man | 55 | 61% |
| Woman | 35 | 38% |
| Total | 90 | 100% |
| Age | | |
| 17-25 | 60 | 66% |
| 25-40 | 30 | 33% |
| Total | 90 | 100% |
| Education | | |
| S1 (Bachelor) | 56 | 62% |
| Masters (Postgraduate) | 34 | 37% |
| Total | 90 | 100% |
| Profession | | |
| Head of study program | 30 | 33% |
| Student | 60 | 66% |
| Total | 90 | 100% |

*Source of data processed by SPSS 23

Based on the Table 2, it can be seen that 38% of the respondents who filled out the questionnaire were female and 61% male. Respondents with an age level of 17-25 years, namely 60-66% and 25-40 years, namely 33%. Respondents with an education level of S2 were 62% and S3 were 37%. Respondents with occupational levels, namely heads of study programs as much as 33% and students as much as 66%.

Table 3. Descriptive analysis

| Variable | Min | Max | Mean | Standard deviation |
|---|---|---|---|---|
| $X_1$ | 8 | 21 | 15.54 | 2.524 |
| $X_2$ | 6 | 13 | 9.85 | 1.650 |
| $Y$ | 2 | 13 | 9.02 | 2.120 |

*Source of data processed by SPSS 23

Based on Table 3 Descriptive Analysis it can be seen that the variables $X_1$ and $X_2$ have a minimum value of 8, a maximum value of 21, while the mean value is 15.54 and the standard deviation value is 2.524. Thus, the mean value is greater than the standard deviation value. So, it can be concluded that $X_1$ has a good value and can be used to represent data as well as other variables.

## 5. SIMULATION RESULTS

### 5.1. Implementation of the Abrar Token Smart Contract on the BSC Network

Making smart contracts using Solidity which is the programming language used to write smart contracts. Details of making smart contract technology as follows:

1. Smart contract account, Integration on the website using a third-party API (moralis.io) with the following specifications:
a) Dapp:
https//:lylwom734pg0.usemoralis.com:2053/server
b) AppID:
NCIcYSKEfBKTpS2UxEgcNNAs3AuR1HrYvx2sJ
c) Mater Key:
RFvyi58Kab1gmlcOYB2Wh9lvoixi0cMK8dO1k7bs
d) Mongo DB IP: 188.166.220.55:56728

2. Basic token contract, create tokens using the BSC network with solidity programming language with the following details:
a) Programming Language: Solidity 0.5.16.
b) Network: BSC.
c) Compiler: 0.5.16+commit.9c3226ce.
d) Account: 0x5B38Da6a701c568545dCfcB03FcB875f56beddC
e) Gas Limit: 3000000
f) Decimals: 18
g) Total Supply:
100000000000000000000000000000000000
h) Symbol: ABR

3. Terminable contract, create a smart contract on token distribution and distribution with the following details:
a) Programming Language: Solidity 0.5.16.
b) Network: BSC.
c) Transaction Has:
0xdc85cb1b75fd09c2f6d001fea4aba83764193cbd7881a1fa8ccde350a5681109
d) Gas Limit: 3000000
e) Decimals: 18

### 5.2. Smart Contract Accounts

In making smart contract accounts in the LMS system using a third-party moralist, React programming language with integration on decentralized applications or DApps.

The steps for implementing a smart contract account that functions to connect the Blockchain network between smart contracts are as follows:

1. Calling authentication function: In LMS Abrar, the application of the account authentication function uses the BSC network, because it can perform block processing for 3 seconds using a method known as Proof of Staked Authority (PoSA), where the user uses BNB to become a validator. The algorithm used is that if the block is valid, the user will be charged a fee for using the BSC network and every transaction in it will be charged a network fee or better known as a gas fee. The use of the BSC network in making smart contract accounts uses a double chain architecture where users can make transactions between different networks.

```
import { useMoralis } from "react-moralis";

function App() {

    const { authenticate, isAuthenticated, user } = useMoralis();

    const login = async () => {
      if (!isAuthenticated) {

        await authenticate()
          .then(function (user) {
            console.log(user!.get("ethAddress"));
          })
          .catch(function (error) {
            console.log(error);
          });
      }
    }
}
```

Figure 4. Authentication account smart contract

2. Customizing Data on Chain: Synchronize data on the Blockchain network by identifying smart contracts that are connected to the learning management system database. In the LMS database to connect the Blockchain network with the LMS system, the data stored is the user ID, user name, email, smart contract and smart contract network. This data can be used to check transactions and history of each user.

3. Creating a DApps Metamask Icon Display: Create a DApps drop-down menu so that users can select the Blockchain network to use to link user smart contracts to the LMS system. DApps icon is implemented in Abrar LMS, there are 2 choices of DApps, namely Metamask and wallet connect where DApps can create smart contract accounts for users and also function as digital wallets. This wallet selection will make it easier for users to determine the creation of a smart contract account and the selection of a Blockchain network.

### 5.3. Basic Token Contract

In making a basic token contract that is used for token generation and creating a smart contract network for transactions in the LMS. To make a smart contract using the solidity programming language using a remix platform. The steps for making smart contracts are divided into several stages, including:

#### 5.3.1. Create a Solidity Contract

Assign names, symbols, decimals, and total supply tokens used for transactions running on the Binance smart chain network

```
contract Abrar is Context, IBEP20, Ownable {
  using SafeMath for uint256;

  mapping (address => uint256) private _balances;

  mapping (address => mapping (address => uint256)) private _allowances;

  uint256 private _totalSupply;
  uint8 private _decimals;
  string private _symbol;
  string private _name;

  constructor() public {    infinite gas 1411600 gas
    _name = "Abrar";
    _symbol = "ABR";
    _decimals = 18;
    _totalSupply = 1000000000000000000000000000000000000000;
    _balances[msg.sender] = _totalSupply;

    emit Transfer(address(0), msg.sender, _totalSupply);
  }

  /**
   * @dev Returns the bep token owner.
   */
  function getOwner() external view returns (address) {    1141 gas
    return owner();
  }
```

Figure 5. Screenshot of token smart contract

In Figure 5 the Smart Contract Token Screenshot shows the token name (Abrar) and symbol (ABR). The token name and symbol display will appear on the BSC network which is used for transactions and token searches. Followed by the determination of decimals used to determine the total supply of tokens on the Blockchain network, the next step is to determine the total supply of tokens used to determine the printing of tokens that will be generated on the Blockchain network, the total supply can also affect the valuation of assets or value of Abrar token.

#### 5.3.2. Doing Compiler Smart Contract

After the creation of the smart contract is complete, the next process is to perform the compiler using a remix platform with series (0.5.16+commit.9c3226ce) which is used to set the series in the solidity programming language.

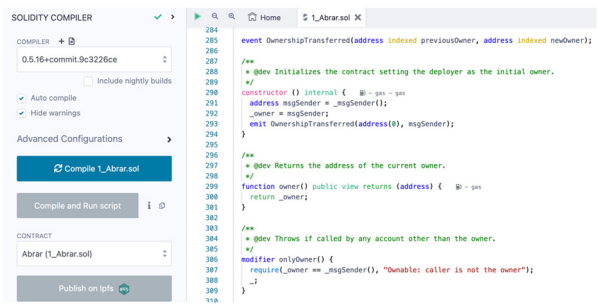


Figure 6. Compiler smart contracts

In Figure 6, the Smart Contract Compiler shows the ABI menu which is used to configure the smart contract network by selecting the BEP20 network or the Binance smart chain as the main network for connecting smart contracts to DApps.

The next stage after doing the compiler, it is necessary to configure Web3 on the network by linking the smart contract developer to the network and checking for confirmation as shown in Figure 7 Web3 Configuration. After configuring web3, the next process will be deploying a smart contract using Remix, the process of connecting the BSC network will be carried out at this stage and each connection requires a network fee or gas fee.

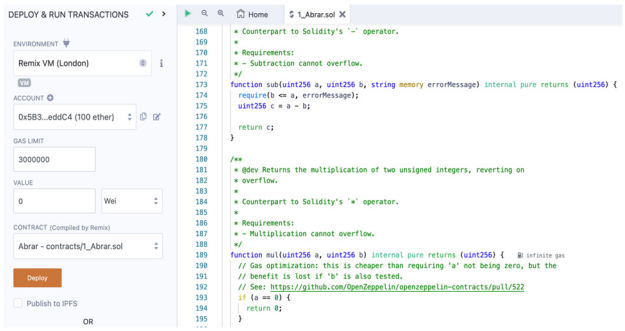


Figure 7. Deploy and executing transactions

In Figure 7, Deploy and Execute Transactions to run transactions on the network, it is necessary to perform several configurations, including:

1. Environment

Establish a smart contract network connection with the concept of using a Java Script VM where the old Blockchain network will be deleted and replaced with a new network and will delete the old Blockchain network to create a new Blockchain network. In making Abrar smart contracts using Environment Remix VM (London).

2. Account

This account is used to link smart contract developers into smart contract tokens which can later be used to change source code in the BCS network and develop smart contract networks. On will be connected to web3 which will reduce the developer balance on the network in the process of deploying smart contracts and for the creation of Abrar tokens using the BSC network with SC0x5B38Da6a701c568545dCfcB03FcB875f56beddC4

3. Gas Fee

Setting the maximum standard for network usage fees and transactions on the Abrar token using a maximum standard of 3000000 Abrar tokens

4. Value

The value menu will provide an initial value for the token by deducting the developer's balance and can be used for the valuation value of the Abrar token at the beginning of creation. The value (0) in Cryptocurrency denomination (gwei).

5. Smart Contract Script

Define a smart contract program that has been created using solidity to be deployed on the remix platform. In Figure 4.29 Deploy and Execute Transactions the source code name of the Abrar token is (Abrar.sol).

6. Debugger

Perform testing on the smart contract network that has been created by connecting to the BSC network. After completing and successfully connecting to the BSC network, information will appear as shown in Figure 8.

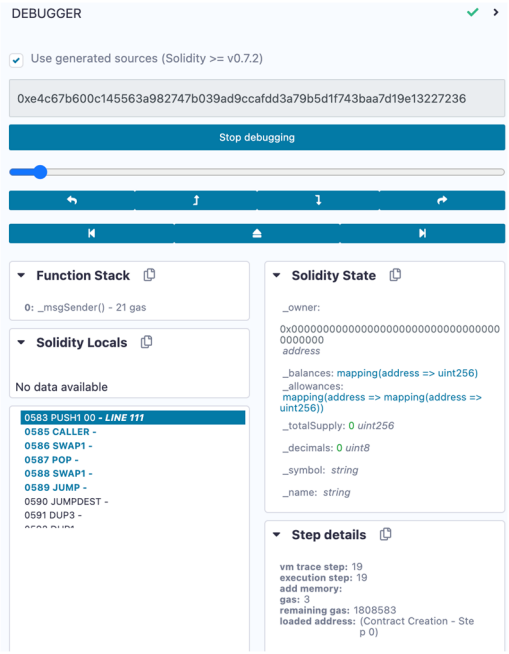


Figure 8. Debugger result

In the next stage, after deploying and testing on the remix platform for the basic token contract, then creating an Abrar token smart contract on the BSC network on the bscscan.com web here, smart contract developers can contribute to participate in developing the Abrar token smart contract that has been made with developer approval by link their smart contract accounts at the beginning of creation any changes will be recorded into the Blockchain network. Scan linking smart contract accounts using web3 trust wallet developers and smart contract users can contribute to the creation of Abrar token smart contracts. Abrar smart Contracts Token creation on BSC Scan. After making a smart contract on the bscscan.com web, the display of successful creation and accepted tokens on the BSC network. Results of the Abrar smart Contract Token on the BSC Scan.

The smart contract account linked to the browser will automatically be connected to the LMS system when linking to the Abrar LMS. As in Figure 9 Smart Contract Accounts on LMS Abrar.


Figure 9. Account smart contracts on LMS Abrar

### 5.4. Use of Basic Token Contract and Terminable Contract on LMS Abrar

Basic token contract, tokens using DeFi technology, with an exchange system using Terminable Contracts. Details of the division of roles divided into 2 in application of basic token contract on the Abrar system are as follows:

### 5.4.1. Student

Students can use Abrar tokens as a means to do mining by learning and getting tokens to be exchanged in DEX into USD or rupiah which can later be used to meet needs or continue formal education. The details of the learning process and the Abrar token exchange are as follows:

Connect to the Abrar system by clicking the connect menu on the Abrar LMS menu as shown in Figure 10 Connect LMS Abrar to connect student smart contract accounts into the Abrar LMS system.


Figure 10. Screenshot connect on LMS Abrar

If students already have a smart contract account on the Metamask DApps, they will be automatically connected and directly directed to the LMS Abrar registration page as shown in Figure 14 List of LMS Abrar. If a user with a smart contract account has previously registered, it will automatically go directly to the LMS Abrar main page.

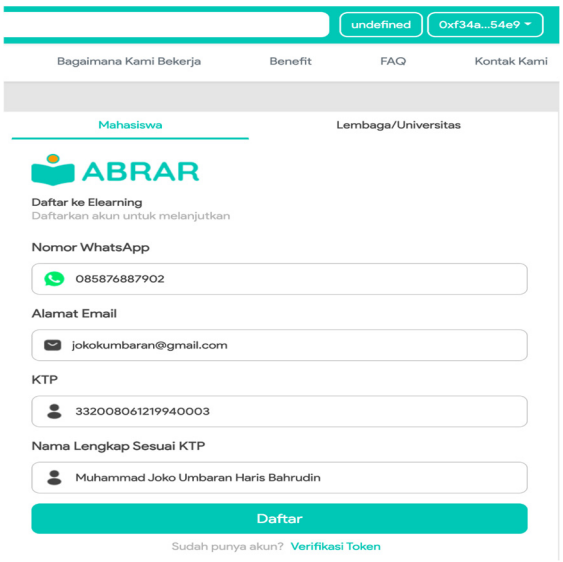


Figure 11. List of LMS Abrar

On the registration page, students must fill in the WhatsApp Number, Email Address, KTP, Full Name According to the KTP as shown in Figure 11. The LMS Abrar list after all the data is completed will be directed to the main page to select the university and major of interest as well as material according to specialization.

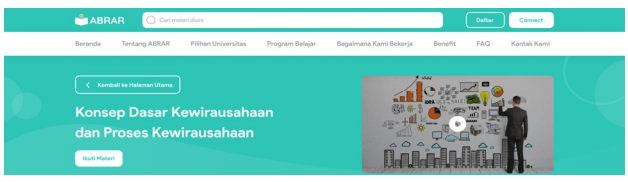


Figure 12. Dashboard Material Screenshot

Every material contained in the Abrar LMS follows the standards of each university that publishes material, so in one material it can contain a video, a pdf of the provisions on the system to complete the material, so students can claim Abrar tokens on the profile page. The coin claim process will charge transaction fees within the BSC network and each network used for transactions will be different in each nominal price. If the material is completed perfectly, the student can make a coin claim marked with a coin claim pop up. Every Abrar token claim transaction will be recorded on Blockchain technology in the BSC network. Students can check the tokens in DApps or DEX that are connected to the smart contract account used to claim Abrar tokens by checking the addition of tokens to the DApps or DEX used. If there is a pending transaction, you can also search the transaction hash on the network provider bscscan.com to view transaction details.

After successfully claiming the Abrar token, you can check on the student dashboard or by checking the DApps or DEX used. DApps Trust Wallet Token Abrar shows the addition of Abrar tokens of 200 ABR and the cumulative total of Abrar tokens owned is 1,000,000,200 ABR.

### 5.4.2. University

The university as a user has several features that can be used, including posting of material content, university profiles, and distribution of Abrar tokens. The advantage of universities can be promoted by putting a brief description of the university and sharing profiles of faculties and study programs within the university. Each material can be divided based on the related study program so that each study program can play an active role in distributing material and distributing Abrar tokens in every published material so that every student can do mining learning, namely students can learn and make money at the same time.

## 5.5. Implementation of Smart Contract Accounts in the Learning Management System

The Abrar login system requires users to have a smart contract account which will later be used as a liaison in Blockchain technology. The application in this study uses a Metamask wallet as a liaison as in the Figure 13.

### 5.5.1. Smart Contract on Metamask

The concept of smart contract integration begins by connecting smart contract networks to one network are connected using the BSC network and link accounts to the smart contract network contained on the website. On web3 Metamask will identify the network that is connected in the smart contract and adjust the network so that gas fees or transaction fees on the network are not too expensive. After the network is adjusted by the Metamask system, the user just needs to continue so that the smart contract system on the web and the smart contract on the Abrar LMS web is connected to each other. as shown in Figure 13 Select Smart Contract Account on Metamask. Furthermore, after the user's smart contract account and the smart contract on the LMS are connected, the Metamask will give the user to sign a digital contract as shown in Figure 20 Sign Connect Smart Contract on Metamask.

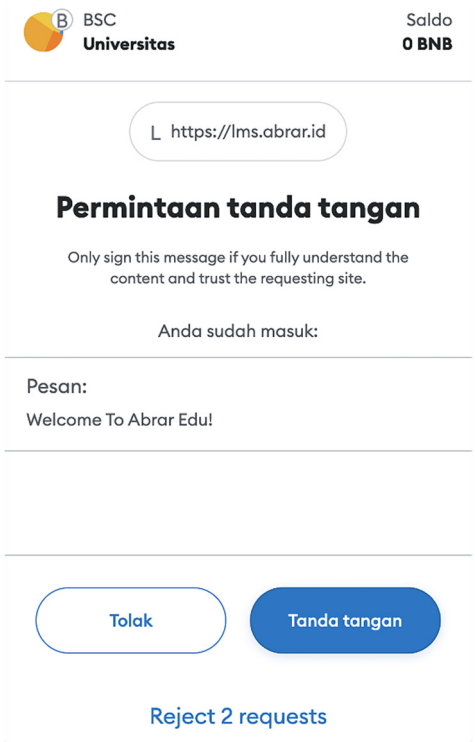


Figure 13. Sign smart contract on Metamask screenshot

The process of connecting the smart contract account and the Abrar smart contract is completed, a smart contract account will appear in the right corner of the LSM, to make it easier for LMS web users, every login will automatically recognize smart contracts that are connected to DApps by automatically logging in to the same device during a 24-hour grace period after 24 hours, users need to connect smart contract accounts using DApps installed on the device. Network The implementation on the Abrar LMS web using the BSC network with the network code (BEP-20) has a valuation value of 0.00 USD and the total supply of Abrar tokens is 1,000,000,000,000,000,000,000 ABR token holders with 3 smart contract addresses.

### 5.6. Implementation of Basic Token Contract in Learning Management System

At the implementation stage, the previously designed smart contract, Smart Contract Flow will be implemented on the BSC network.

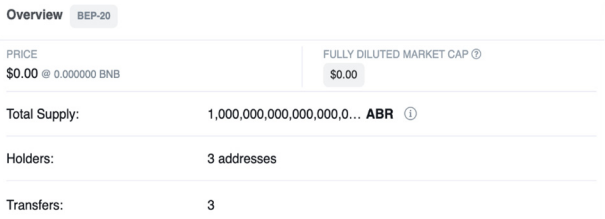


Figure 14. Token Abrar on BSC Network

The implementation on the Abrar LSM web uses the BSC network with the network code (bep-20) having a valuation value of 0.00 USD and total supply of Abrar tokens totaling 1,000,000,000,000,000,000,000 ABR with token holders of 3 smart contract addresses.

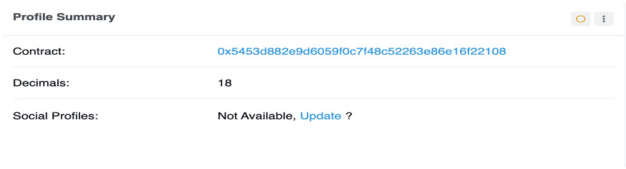


Figure 15. Profile Token Abrar on BSC Network

Network Abrar token transaction in the BSC network shown in Figure 23 the Abrar Token Transaction List on the BSC Network provides details of Abrar token transfer as follows:

1. Txn Hash : (0x4d838b8a9801d51b3c32ecf2308ac104807ca8982accd8dd41e7d6e798e60030)
2. Method : 0x60806040
3. Age : 8 days 6 hr. ago
4. From : Null Address: 0x000...000
5. To : 0xf34a62aec2b5f7917d43e45076e57c16a48054e9
6. Quantity : 1,000,000,000,000,000,000,000

Abrar Token User List on the BSC Network, token holders will be recorded using Blockchain technology. The list of Abrar token transactions will rank from the largest holder to the smallest by showing the smart contract account for each Abrar token user and showing the percentage of each Abrar token holder. Graph of Abrar Token Users on the BSC Network, each Abrar token user will be explained in detail about the use of the token by looking at the detailed graph of each user by identifying the smart contract account. The graph of Abrar Token Users on the BSC Network shows the smart contract user accounts of the accounts that transacted using the following smart contract (0xf34a62aec2b5f7917d43e45076e57c16a48054e9) with the purchase of 1,000,000,000 Abrar tokens using a DEX trust wallet. Development of the Abrar Smart Contract Token on the BSC Network, each user can contribute to developing the Abrar smart contract by asking permission from the main Abrar developer using the solidity language.

Each Abrar token transfer will be recorded in the Blockchain system by providing details of the amount of Abrar token transfer each month, providing information on calculating transfers between smart contract accounts per month, providing recipient information, providing sender information and the total delivery and receipt of Abrar tokens each month which is used as a graph Abrar token analysis every month.

The Abrar token on the Pancaceswap Application Exchange shows transactions using DApps Wallet Connect with Pancaceswap DEX media as a transaction intermediary.

1. The first thing that must be done to exchange the Abrar token and enter it into the Abrar LMS system is to have the Abrar token by exchanging it in the DEX Pancaceswap, there are several stages, Go to https://pancakeswap.finance
2. Enter the trade menu and select the swap menu
3. Select the network to make the exchange (BNB)
4. Enter the address of the smart contract token Abrar Smart contract 0x5453D882e9D6059F0c7F48C52263e86e16F22108

5. Enter the amount you want to exchange
6. Click Confirm Swap and the token will automatically be entered into the smart contract account.
7. After approving and making payment for the exchange transaction fee, transaction submitted information will appear.
8. Transaction checking can be done by clicking View on BscScan and transaction details

Next, use a smart contract account that already has the Abrar token available to connect to the LMS system, it can automatically be used to fill out materials on the LMS system.

## 6. CONCLUSIONS

The result of this research is the creation of a new system based on the Learning Management System Blockchain, it is hoped that this information system will provide free learning for students and get tokens that can be exchanged in the form of money. This Learning Management System is a marketing tool for universities to find new students for universities by distributing materials other than indexing and also increasing university rankings.

Some suggestions or input for this E-Learning Management System for the future. Conducting training for universities, namely students and lecturers to be able to operate this Learning Management System and it is hoped that users will understand how to operate it. Perform periodic maintenance by the school to prevent system errors.

## APPENDICES

### Appendix 1. Reliability Test

The reliability test is a test tool used to measure the independent variables and the dependent variable whether they are normally distributed or not. The questionnaire is declared reliable if (*r*) count > (*r*) table can be seen from the Cronbach Alpha value > 0.60.

Table 4. Reliability test results

| Variable | Cronbach's Alpha | Keterangan |
|---|---|---|
| Mahasiswa | 0.798 | Reliable |
| Kaprodi | 0.846 | Reliable |
| LMS | 0.845 | Reliable |

Based on the Table 4 it is known that the reliability test results for each variable have a Cronbach's Alpha value > 0.60. So, it can be concluded that the research questionnaire questions were considered reliable.

## NOMENCLATURES

Recording on blockchain technology using the BSC network connected to the Abrar system will be made in the following details;

### 1. Acronyms

Transaction Hash Used to provide security for every transaction that occurs on the blockchain network
Status Provides information about transactions that have occurred and there are 3 categories of failed, pending and successful
Block Recorded on the BSC network block
Time Stamp Provides detailed information about the time of recording block transactions on the BSC network
Form Providing detailed information about the sender by attaching the sender's smart contract account.
To Provide detailed information about the recipient by attaching the recipient's smart contract account
Transaction Action Provides detailed information about activities that occur in the BSC network.
Value Provides the value of transactions that occur in comparison to dollars or currencies in the BSC network
Transaction Fee Provides information on the number of transactions that occur in nominal dollars
Gas Limit Limit for setting transaction fees on the BSC network
Gas Used by Transaction Percentage of determining the cost of using the BSC network per transaction.
Gas Price Information on costing per transaction with standard currency in the BSC network
Nonce Index of block position determination on the BSC network
Input Data Transactions that occur in smart contracts will be encrypted and translated in binary language on the BSC network.
Private Note Provide a note to the recipient when the transaction occurs

### 2. Symbols / Parameters

$Y$: LMS Abrar
$X1$: Student
$X2$: Head of Study Program
$\alpha$: Constant
$e$: error
$\beta$: Slop or Coefficient estimate

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## BIOGRAPHIES

Name: **Muhammad Joko Umbaran**
Surname: **Haris Bahrudin**
Birthday: 06.12.1994
Birth Place: Demak, Indonesia
Bachelor: S.Kom, Department of Information System, Faculty of Computer Science, Dian Nuswantoro University, Semarang, Indonesia, 2016
Master: M.Kom, Department of Information System, Faculty of Information System, Diponegoro University, Semarang, Indonesia, 2018
Doctorate: Student, Department of Information System, Faculty of Information System, Diponegoro University, Semarang, Indonesia, Since 2020
Research Interests: Blockchain, Big Data, GIS
Scientific Publications: 5 Papers, 3 Patents, 2 Theses, 1 Book
Scientific Memberships: Association for Information Systems of Indonesia

Name: **R. Rizal**
Surname: **Isnanto**
Birthday: 27.07.1970
Birth Place: Wonosobo, Indonesia
Bachelor: S.T, Department of Electrical Engineering, Faculty of Electrical Engineering, Gadjah Mada University, Yogyakarta, Indonesia, 1998
Master: M.M./Ir, Department of Electrical Engineering, Faculty of Electrical Engineering, Gadjah Mada University, Yogyakarta, Indonesia, 2002
Doctorate: Department of Electrical Engineering and Information Technology, Faculty of Electrical Engineering and Information Technology, Gadjah Mada University, Yogyakarta, Indonesia, 2013
The Last Scientific Position: Prof., Department of Computer Engineering, Faculty of Information Systems, Diponegoro University, Semarang, Indonesia, Since 2022 - Head of Computer Engineering Department, Diponegoro University, Semarang, Indonesia, Since 2016
Research Interests: Information Systems, Biomedical and Biometric Image Processing, Pattern Recognition
Scientific Publications: 25 Papers, 7 Theses

Name: **Rahmat**
Surname: **Gernowo**
Birthday: 23.11.1965
Birth Place: Purworejo, Indonesia
Bachelor: S.Si, Department of Physics, Faculty of Mathematics and Natural Science, Gadjah Mada University, Yogyakarta, Indonesia, 1995
Master: M.Si, Department of Physics, Faculty of Mathematics and Natural Science, Gadjah Mada University, Yogyakarta, Indonesia, 1999
Doctorate: Department of Physics, Faculty of Earth Sciences and Technology, Bandung Institute of Technology, Bandung, Indonesia, 2009
The Last Scientific Position: Prof., Department of Physics, Faculty of Information Systems Diponegoro University, Semarang, Indonesia, Since 2022 - Head Information Systems for Doctoral Study Program, Diponegoro University, Semarang, Indonesia, Since 2022
Research Interests: AI for Information Systems, Digital Implications, Computational Physics, Simulation and Modeling, System Signals, Pattern Recognition, Evolutionary Algorithms, Climate Modeling
Scientific Publications: 21 Papers, 7 Theses