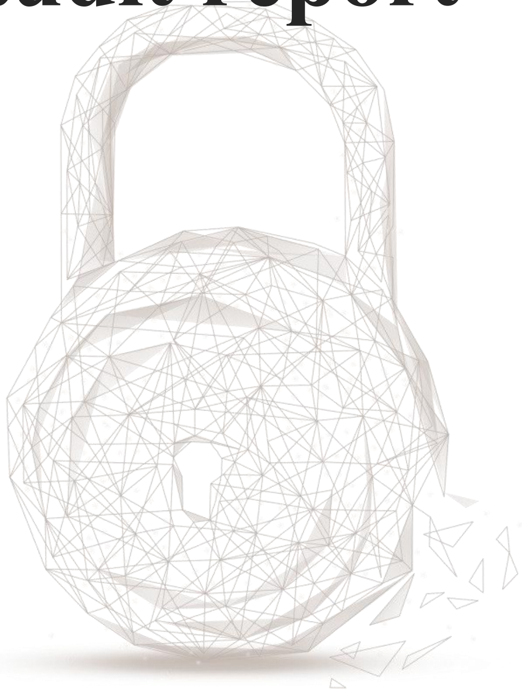
BEOSIN

Blockchain Security

Smart contract security audit report



Audit Number: 202107021148

Report Query Name: iLAVA&Airdrop

Smart Contract Name	**Smart Contract Address**	**Smart Contract Address Link**
iLAVAToken	0x924D79e9Ea369eb25491127daA9d42200f7c1aD0	https://bscscan.com/address/0x924D79e9Ea369eb25491127daA9d42200f7c1aD0#code
Airdrop	0xCAb6959eC8A55b57fD7D0671042364BEe1f7Ea6C	https://bscscan.com/address/0xCAb6959eC8A55b57fD7D0671042364BEe1f7Ea6C#code

Start Date: 2021.06.24

Completion Date: 2021.07.02

Overall Result: Pass

Audit Team: Beosin (Chengdu LianAn) Technology Co. Ltd.

Audit Categories and Results:

No.	Categories	Subitems	Results
1	Coding Conventions	Compiler Version Security	Pass
		Deprecated Items	Pass
		Redundant Code	Pass
		SafeMath Features	Pass
		require/assert Usage	Pass
		Gas Consumption	Pass
		Visibility Specifiers	Pass
		Fallback Usage	Pass
2	General Vulnerability	Integer Overflow/Underflow	Pass
		Reentrancy	Pass
		Pseudo-random Number Generator (PRNG)	Pass
		Transaction-Ordering Dependence	Pass
		DoS (Denial of Service)	Pass
		Access Control of Owner	Pass

		Low-level Function (call/delegatecall) Security	Pass
		Returned Value Security	Pass
		tx.origin Usage	Pass
		Replay Attack	Pass
		Overriding Variables	Pass
3	Business Security	Business Logics	Pass
		Business Implementations	Pass

Disclaimer: This report is made in response to the project code. No description, expression or wording in this report shall be construed as an endorsement, affirmation or confirmation of the project. This audit is only applied to the type of auditing specified in this report and the scope of given in the results table. Other unknown security vulnerabilities are beyond auditing responsibility. Beosin (Chengdu LianAn) Technology only issues this report based on the attacks or vulnerabilities that already existed or occurred before the issuance of this report. For the emergence of new attacks or vulnerabilities that exist or occur in the future, Beosin (Chengdu LianAn) Technology lacks the capability to judge its possible impact on the security status of smart contracts, thus taking no responsibility for them. The security audit analysis and other contents of this report are based solely on the documents and materials that the contract provider has provided to Beosin (Chengdu LianAn) Technology before the issuance of this report, and the contract provider warrants that there are no missing, tampered, deleted; if the documents and materials provided by the contract provider are missing, tampered, deleted, concealed or reflected in a situation that is inconsistent with the actual situation, or if the documents and materials provided are changed after the issuance of this report, Beosin (Chengdu LianAn) Technology assumes no responsibility for the resulting loss or adverse effects. The audit report issued by Beosin (Chengdu LianAn) Technology is based on the documents and materials provided by the contract provider, and relies on the technology currently possessed by Beosin (Chengdu LianAn). Due to the technical limitations of any organization, this report conducted by Beosin (Chengdu LianAn) still has the possibility that the entire risk cannot be completely detected. Beosin (Chengdu LianAn) disclaims any liability for the resulting losses.

The final interpretation of this statement belongs to Beosin (Chengdu LianAn).

Audit Results Explained:

Beosin (Chengdu LianAn) Technology has used several methods including Formal Verification, Static Analysis, Typical Case Testing and Manual Review to audit three major aspects of smart contracts project iLAVA&Airdrop, including Coding Standards, Security, and Business Logic. **The iLAVA&Airdrop project passed all audit items. The overall result is Pass. The smart contract is able to function properly.**

Audit Contents:

1. Coding Conventions

Check the code style that does not conform to Solidity code style.

1.1 Compiler Version Security

- Description: Check whether the code implementation of current contract contains the exposed solidity compiler bug.
- Result: Pass

1.2 Deprecated Items

- Description: Check whether the current contract has the deprecated items.
- Result: Pass

1.3 Redundant Code

- Description: Check whether the contract code has redundant codes.
- Result: Pass

1.4 SafeMath Features

- Description: Check whether the SafeMath has been used. Or prevents the integer overflow/underflow in mathematical operation.
- Result: Pass

1.5 require/assert Usage

- Description: Check the use reasonability of 'require' and 'assert' in the contract.
- Result: Pass

1.6 Gas Consumption

- Description: Check whether the gas consumption exceeds the block gas limitation.
- Result: Pass

1.7 Visibility Specifiers

- Description: Check whether the visibility conforms to design requirement.
- Result: Pass

1.8 Fallback Usage

- Description: Check whether the Fallback function has been used correctly in the current contract.
- Result: Pass

2. General Vulnerability

Check whether the general vulnerabilities exist in the contract.

2.1 Integer Overflow/Underflow

- Description: Check whether there is an integer overflow/underflow in the contract and the calculation result is abnormal.
- Result: Pass

2.2 Reentrancy

- Description: An issue when code can call back into your contract and change state, such as withdrawing BNB.
- Result: Pass

2.3 Pseudo-random Number Generator (PRNG)

- Description: Whether the results of random numbers can be predicted.
- Result: Pass

2.4 Transaction-Ordering Dependence

- Description: Whether the final state of the contract depends on the order of the transactions.
- Result: Pass

2.5 DoS (Denial of Service)

- Description: Whether exist DoS attack in the contract which is vulnerable because of unexpected reason.
- Result: Pass

2.6 Access Control of Owner

- Description: Whether the owner has excessive permissions, such as malicious issue, modifying the balance of others.
- Result: Pass

2.7 Low-level Function (call/delegatecall) Security

- Description: Check whether the usage of low-level functions like call/delegatecall have vulnerabilities.
- Result: Pass

2.8 Returned Value Security

- Description: Check whether the function checks the return value and responds to it accordingly.
- Result: Pass

2.9 tx.origin Usage

- Description: Check the use secure risk of 'tx.origin' in the contract.
- Result: Pass

2.10 Replay Attack

- Description: Check whether the implement possibility of Replay Attack exists in the contract.
- Result: Pass

2.11 Overriding Variables

- Description: Check whether the variables have been overridden and lead to wrong code execution.
- Result: Pass

3. Business Security

Check whether the business is secure.

3.1 Business analysis of Contract iLAVAToken

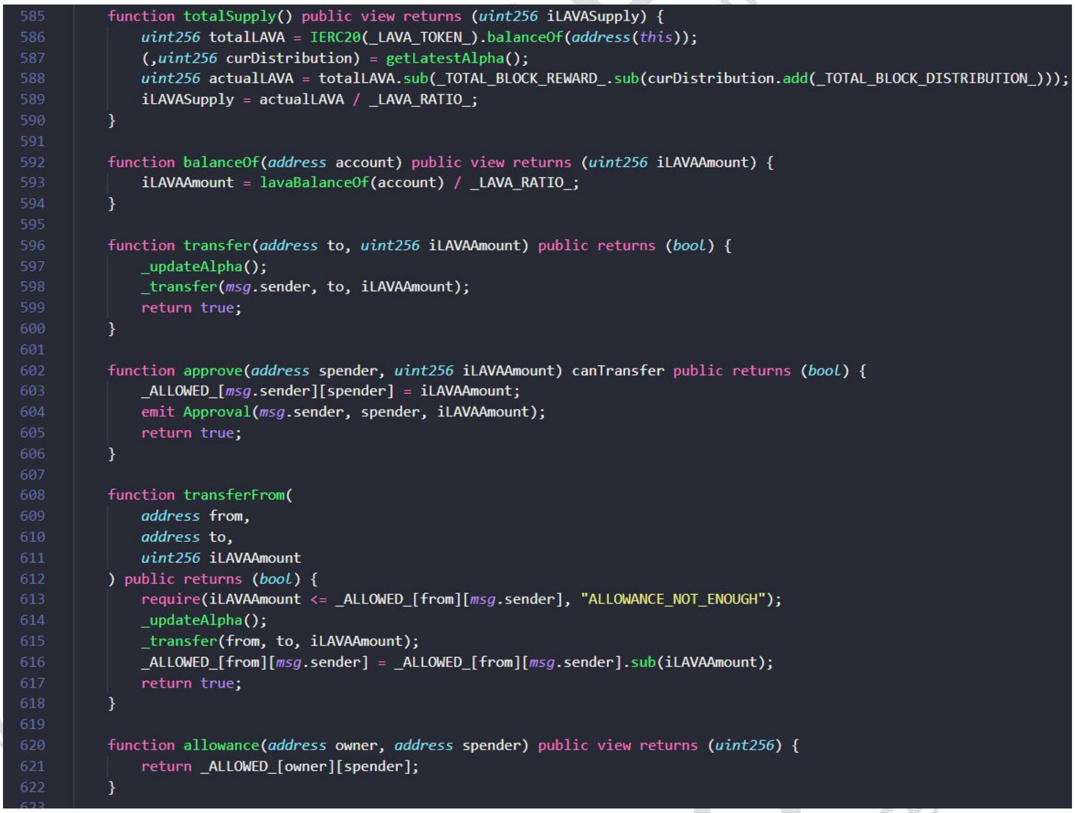
(1) Basic Token Information

Token name	iLAVA Membership Token
Token symbol	iLAVA
decimals	18
totalSupply	The initial supply is 0
Token type	BEP-20

Table 1 Basic Token Information

(2) BEP-20 Token Standard Functions

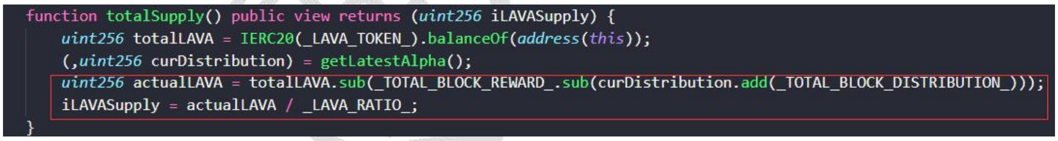
- Description: The token contract implements a token which conforms to the BEP-20 Standards. It should be noted that the user can directly call the *approve* function to set the approval value for the specified address, but in order to avoid multiple authorizations, it is recommended that the user resets the authorization value to 0 when calling this function to change the authorization value. Token transfer related functions are only available when the related status is true.



```
function totalSupply() public view returns (uint256 iLAVASupply) {
    uint256 totalLAVA = IERC20(_LAVA_TOKEN_).balanceOf(address(this));
    (,uint256 curDistribution) = getLatestAlpha();
    uint256 actualLAVA = totalLAVA.sub(_TOTAL_BLOCK_REWARD_.sub(curDistribution.add(_TOTAL_BLOCK_DISTRIBUTION_)));
    iLAVASupply = actualLAVA / _LAVA_RATIO_;
}

function balanceOf(address account) public view returns (uint256 iLAVAAmount) {
    iLAVAAmount = lavaBalanceOf(account) / _LAVA_RATIO_;
}

function transfer(address to, uint256 iLAVAAmount) public returns (bool) {
    _updateAlpha();
    _transfer(msg.sender, to, iLAVAAmount);
    return true;
}

function approve(address spender, uint256 iLAVAAmount) canTransfer public returns (bool) {
    _ALLOWED_[msg.sender][spender] = iLAVAAmount;
    emit Approval(msg.sender, spender, iLAVAAmount);
    return true;
}

function transferFrom(
    address from,
    address to,
    uint256 iLAVAAmount
) public returns (bool) {
    require(iLAVAAmount <= _ALLOWED_[from][msg.sender], "ALLOWANCE_NOT_ENOUGH");
    _updateAlpha();
    _transfer(from, to, iLAVAAmount);
    _ALLOWED_[from][msg.sender] = _ALLOWED_[from][msg.sender].sub(iLAVAAmount);
    return true;
}

function allowance(address owner, address spender) public view returns (uint256) {
    return _ALLOWED_[owner][spender];
}
```

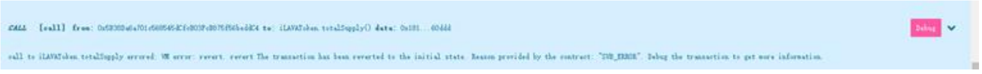
Figure 1 source code of BEP-20 functions

Note: The total supply of tokens is calculated by the formula, and the relevant parameters are modified and not checked before updating, which may result in a subtractive overflow in the calculation, e.g. _TOTAL_BLOCK_REWARD_ may be smaller than the curDistribution that increases over time(as figure 2, 3 below). and, the owner of the contract can set _LAVA_RATIO_ causing the user's balance display to change.



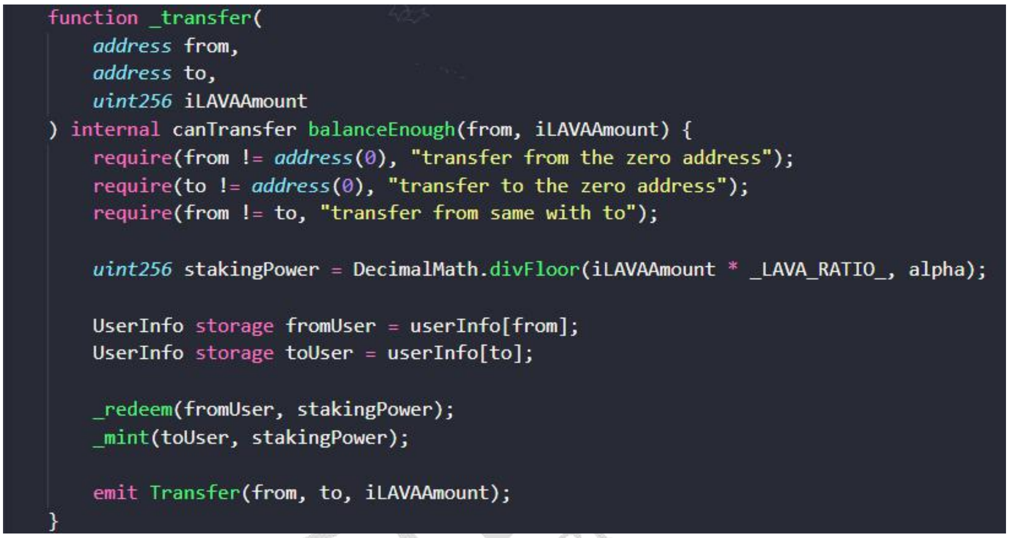
```
function totalSupply() public view returns (uint256 iLAVASupply) {
    uint256 totalLAVA = IERC20(_LAVA_TOKEN_).balanceOf(address(this));
    (,uint256 curDistribution) = getLatestAlpha();
    uint256 actualLAVA = totalLAVA.sub(_TOTAL_BLOCK_REWARD_.sub(curDistribution.add(_TOTAL_BLOCK_DISTRIBUTION_)));
    iLAVASupply = actualLAVA / _LAVA_RATIO_;
}
```

Figure 2 source code of *totalSupply*



```
CALL  [call] from: [illegible] to: iLAVAToken.totalSupply() data: 0x181...40ddd
call to iLAVAToken.totalSupply errored: VM error: revert. revert The transaction has been reverted to the initial state. Reason provided by the contract: "SUB_ERROR". Debug the transaction to get more information.
```

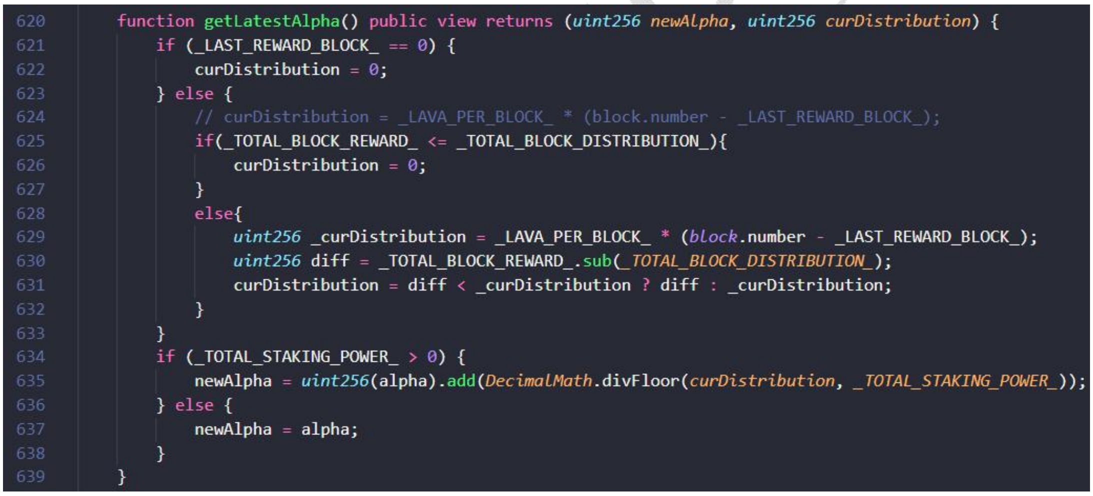
Figure 3 error about *totalSupply*



```
function _transfer(
    address from,
    address to,
    uint256 iLAVAAmount
) internal canTransfer balanceEnough(from, iLAVAAmount) {
    require(from != address(0), "transfer from the zero address");
    require(to != address(0), "transfer to the zero address");
    require(from != to, "transfer from same with to");

    uint256 stakingPower = DecimalMath.divFloor(iLAVAAmount * _LAVA_RATIO_, alpha);

    UserInfo storage fromUser = userInfo[from];
    UserInfo storage toUser = userInfo[to];

    _redeem(fromUser, stakingPower);
    _mint(toUser, stakingPower);

    emit Transfer(from, to, iLAVAAmount);
}
```

Figure 4 source code of *_transfer*

- Related functions: *name, symbol, decimals, totalSupply, balanceOf, allowance, transfer, transferFrom, approve*
- Safety recommendation: It is suggested to modify the calculation formula.
- Repair result: Fixed. The *getLatestAlpha* function has been modified so that when _TOTAL_BLOCK_REWARD is not greater than _TOTAL_BLOCK_DISTRIBUTION_, the value of alpha will no longer change and the total amount of tokens and the user's balance will not change and no error will occur.



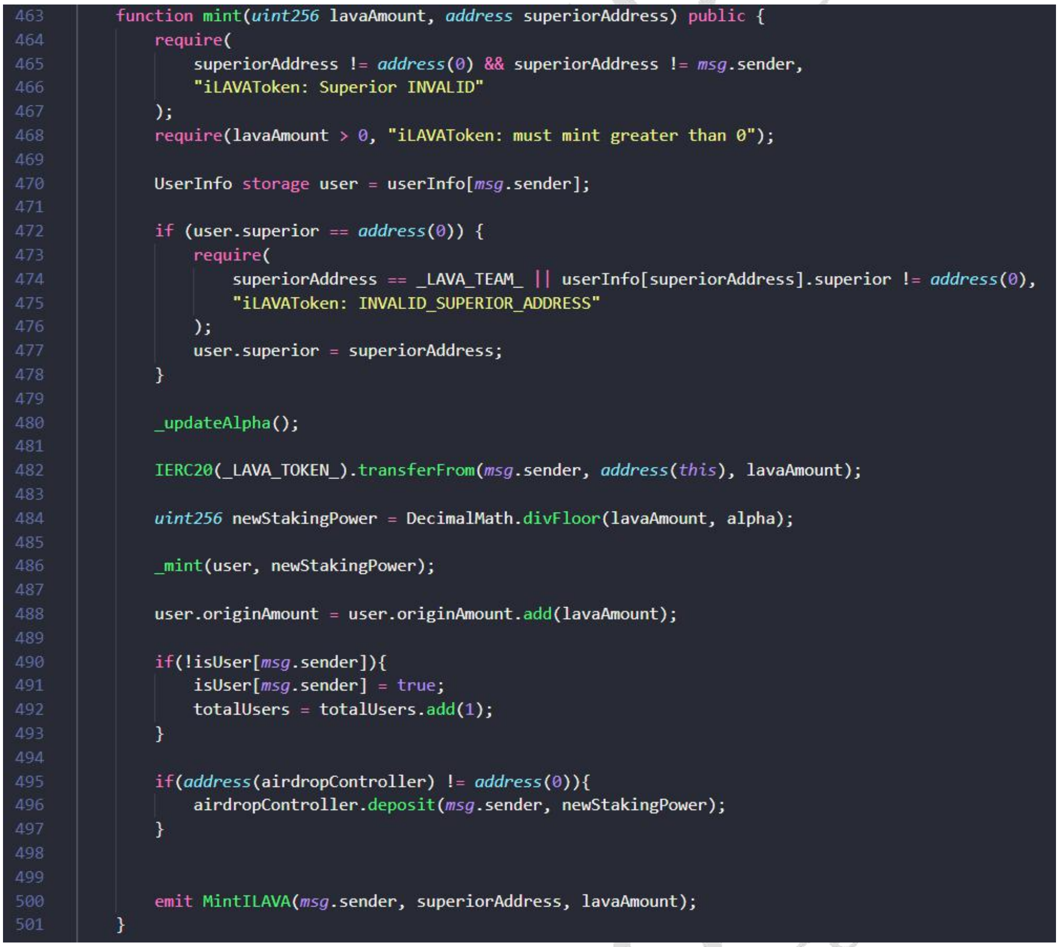
```
function getLatestAlpha() public view returns (uint256 newAlpha, uint256 curDistribution) {
    if (_LAST_REWARD_BLOCK_ == 0) {
        curDistribution = 0;
    } else {
        // curDistribution = _LAVA_PER_BLOCK_ * (block.number - _LAST_REWARD_BLOCK_);
        if(_TOTAL_BLOCK_REWARD_ <= _TOTAL_BLOCK_DISTRIBUTION_){
            curDistribution = 0;
        }
        else{
            uint256 _curDistribution = _LAVA_PER_BLOCK_ * (block.number - _LAST_REWARD_BLOCK_);
            uint256 diff = _TOTAL_BLOCK_REWARD_.sub(_TOTAL_BLOCK_DISTRIBUTION_);
            curDistribution = diff < _curDistribution ? diff : _curDistribution;
        }
    }
    if (_TOTAL_STAKING_POWER_ > 0) {
        newAlpha = uint256(alpha).add(DecimalMath.divFloor(curDistribution, _TOTAL_STAKING_POWER_));
    } else {
        newAlpha = alpha;
    }
}
```

Figure 5 source code of *getLatestAlpha* (new)

- Result: Pass

(3) mint function

- Description: The contract implements the *mint* function for user participation in staking mining (requires pre-authorization of this contract). The first call to this function will carry out the registration of the user address, the superior address cannot be 0 and the caller itself, and the staking amount needs to be greater than 0; the internal function *_updateAlpha* will be called before the collateral to update the relevant data, and *_mint* will be called after the collateral to update the relevant data of superior address. If the airdropController address is not 0, the *deposit* function in the airdrop contract will be executed to update the airdrop reward related parameters.



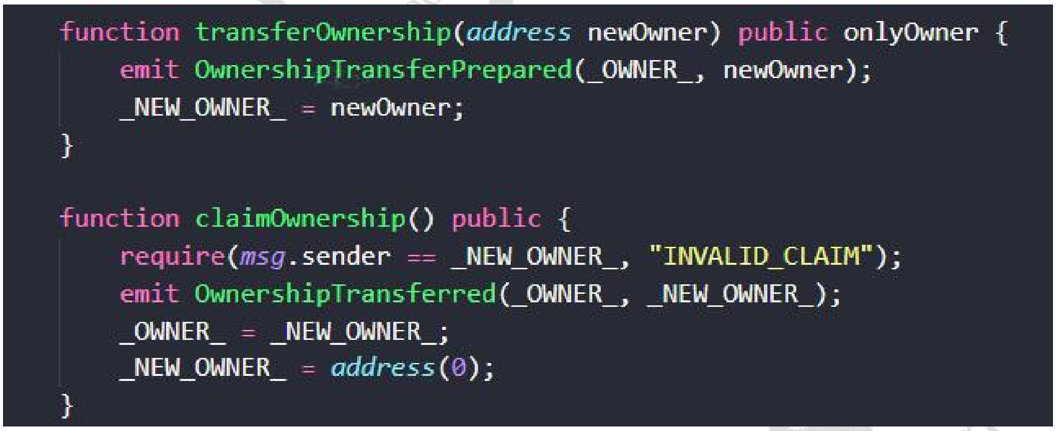
```
function mint(uint256 lavaAmount, address superiorAddress) public {
    require(
        superiorAddress != address(0) && superiorAddress != msg.sender,
        "iLAVAToken: Superior INVALID"
    );
    require(lavaAmount > 0, "iLAVAToken: must mint greater than 0");

    UserInfo storage user = userInfo[msg.sender];

    if (user.superior == address(0)) {
        require(
            superiorAddress == _LAVA_TEAM_ || userInfo[superiorAddress].superior != address(0),
            "iLAVAToken: INVALID_SUPERIOR_ADDRESS"
        );
        user.superior = superiorAddress;
    }

    _updateAlpha();

    IERC20(_LAVA_TOKEN_).transferFrom(msg.sender, address(this), lavaAmount);

    uint256 newStakingPower = DecimalMath.divFloor(lavaAmount, alpha);

    _mint(user, newStakingPower);

    user.originAmount = user.originAmount.add(lavaAmount);

    if(!isUser[msg.sender]){
        isUser[msg.sender] = true;
        totalUsers = totalUsers.add(1);
    }

    if(address(airdropController) != address(0)){
        airdropController.deposit(msg.sender, newStakingPower);
    }


    emit MintILAVA(msg.sender, superiorAddress, lavaAmount);
}
```

Figure 6 source code of *mint*

- Related functions: *mint, transferFrom, deposit*
- Result: Pass

(4) Ownership

- Description: The contract implements *transferOwnership* and *claimOwnership* functions to manage the contract's ownership. *transferOwnership* is used to set the newOwner address and can only be called by the current owner of the contract; The *claimOwnership* function can be called only by the current newOwner to receive the ownership and reset the newOwner address to 0.



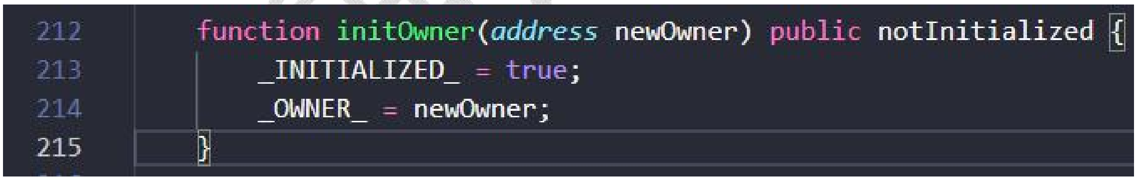
```
function transferOwnership(address newOwner) public onlyOwner {
    emit OwnershipTransferPrepared(_OWNER_, newOwner);
    _NEW_OWNER_ = newOwner;
}

function claimOwnership() public {
    require(msg.sender == _NEW_OWNER_, "INVALID_CLAIM");
    emit OwnershipTransferred(_OWNER_, _NEW_OWNER_);
    _OWNER_ = _NEW_OWNER_;
    _NEW_OWNER_ = address(0);
}
```

Figure 7 source code of *transferOwnership* and *claimOwnership*

- Related functions: *transferOwnership, claimOwnership*
- Result: Pass

(5) Initialize owner

- Description: The contract implements the *initOwner* function to initialize the owner after the contract is deployed and can only be called once. It is recommended to call the contract immediately after it is deployed.



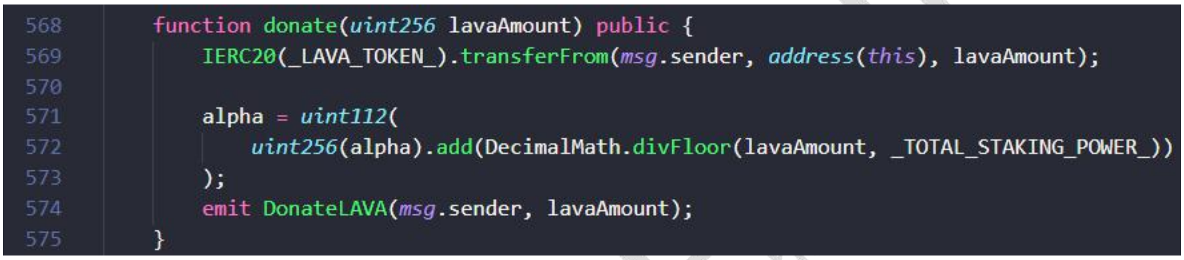
```
    function initOwner(address newOwner) public notInitialized {
        _INITIALIZED_ = true;
        _OWNER_ = newOwner;
    }
```

Figure 8 source code of *initOwner*

- Related functions: *initOwner*
- Result: Pass

(6) Donate

- Description: The contract implements the *donate* function for users to donate tokens to the contract, which will update the value of alpha.



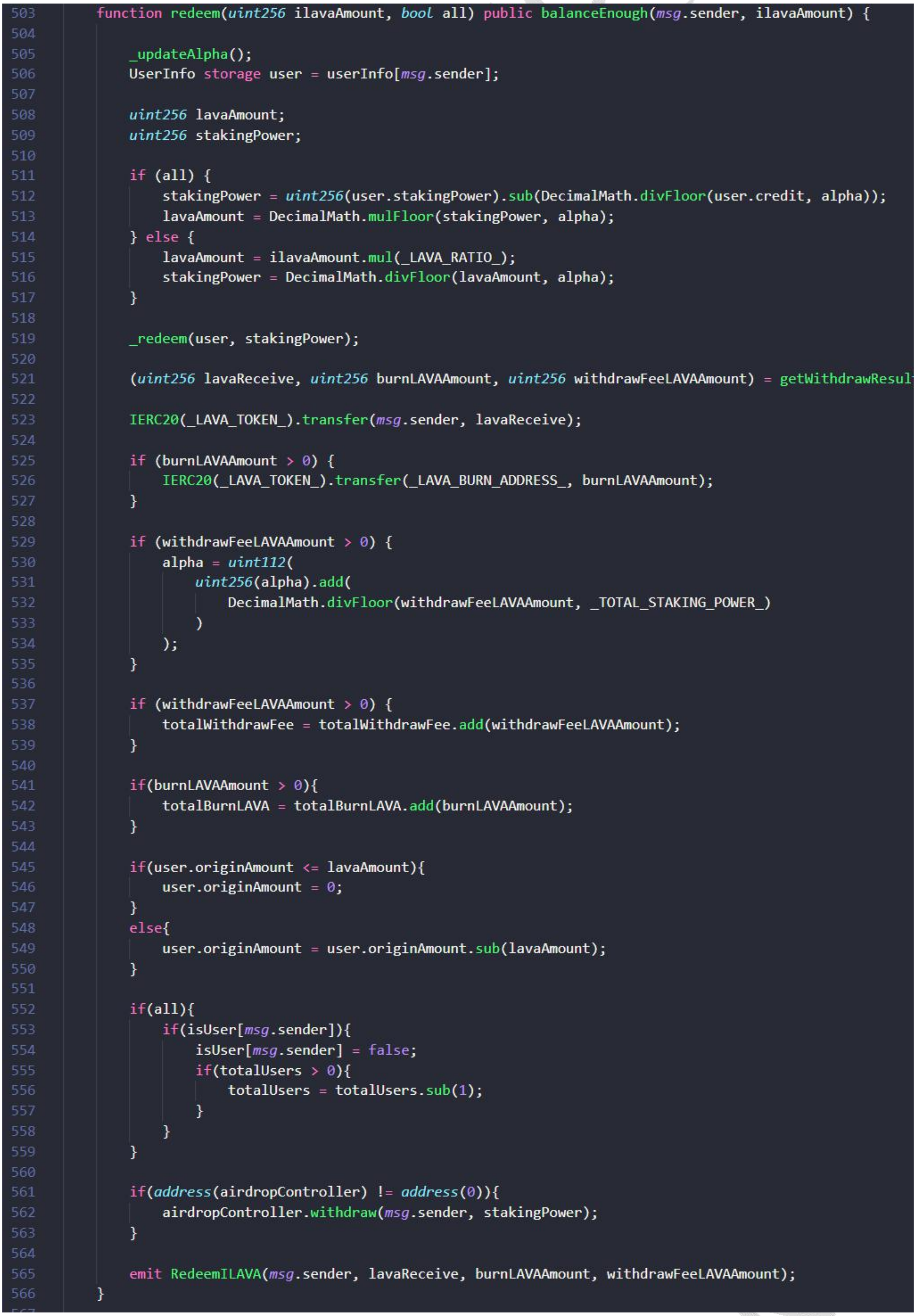
```
    function donate(uint256 lavaAmount) public {
        IERC20(_LAVA_TOKEN_).transferFrom(msg.sender, address(this), lavaAmount);

        alpha = uint112(
            uint256(alpha).add(DecimalMath.divFloor(lavaAmount, _TOTAL_STAKING_POWER_))
        );
        emit DonateLAVA(msg.sender, lavaAmount);
    }
```

Figure 9 source code of *donate*

- Related functions: *donate*
- Result: Pass

(7) Redeem

- Description: The contract implements the *redeem* function for the user to withdraw the pledged Lava tokens. Before the withdrawal, the internal function *_updateAlpha* is called to update the relevant data, determine whether the user is withdrawing all, call the internal function *_redeem* to update the information about the superior address. Then calculate the actual withdrawal amount, whether destruction and transaction fees are incurred, and make the relevant transfer. If the user withdraws all, the user's identity will be cancelled. If the airdropController address is not 0, the *withdraw* function in the airdrop contract will be executed to update the airdrop reward related parameters.



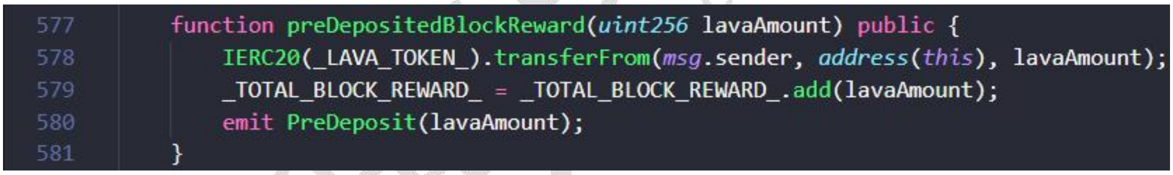
```
    function redeem(uint256 ilavaAmount, bool all) public balanceEnough(msg.sender, ilavaAmount) {

        _updateAlpha();
        UserInfo storage user = userInfo[msg.sender];

        uint256 lavaAmount;
        uint256 stakingPower;

        if (all) {
            stakingPower = uint256(user.stakingPower).sub(DecimalMath.divFloor(user.credit, alpha));
            lavaAmount = DecimalMath.mulFloor(stakingPower, alpha);
        } else {
            lavaAmount = ilavaAmount.mul(_LAVA_RATIO_);
            stakingPower = DecimalMath.divFloor(lavaAmount, alpha);
        }

        _redeem(user, stakingPower);

        (uint256 lavaReceive, uint256 burnLAVAAmount, uint256 withdrawFeeLAVAAmount) = getWithdrawResul

        IERC20(_LAVA_TOKEN_).transfer(msg.sender, lavaReceive);

        if (burnLAVAAmount > 0) {
            IERC20(_LAVA_TOKEN_).transfer(_LAVA_BURN_ADDRESS_, burnLAVAAmount);
        }

        if (withdrawFeeLAVAAmount > 0) {
            alpha = uint112(
                uint256(alpha).add(
                    DecimalMath.divFloor(withdrawFeeLAVAAmount, _TOTAL_STAKING_POWER_)
                )
            );
        }

        if (withdrawFeeLAVAAmount > 0) {
            totalWithdrawFee = totalWithdrawFee.add(withdrawFeeLAVAAmount);
        }

        if(burnLAVAAmount > 0){
            totalBurnLAVA = totalBurnLAVA.add(burnLAVAAmount);
        }

        if(user.originAmount <= lavaAmount){
            user.originAmount = 0;
        }
        else{
            user.originAmount = user.originAmount.sub(lavaAmount);
        }

        if(all){
            if(isUser[msg.sender]){
                isUser[msg.sender] = false;
                if(totalUsers > 0){
                    totalUsers = totalUsers.sub(1);
                }
            }
        }

        if(address(airdropController) != address(0)){
            airdropController.withdraw(msg.sender, stakingPower);
        }

        emit RedeemILAVA(msg.sender, lavaReceive, burnLAVAAmount, withdrawFeeLAVAAmount);
    }
```

Figure 10 source code of *redeem*

- Related functions: *redeem, withdraw*
- Result: Pass

(8) Pre-deposit

- Description: The contract implements a *preDepositedBlockReward* for users to send Lava tokens as reward, this part of Lava tokens will not enter into iLAVA related calculations and cannot be withdrawn.



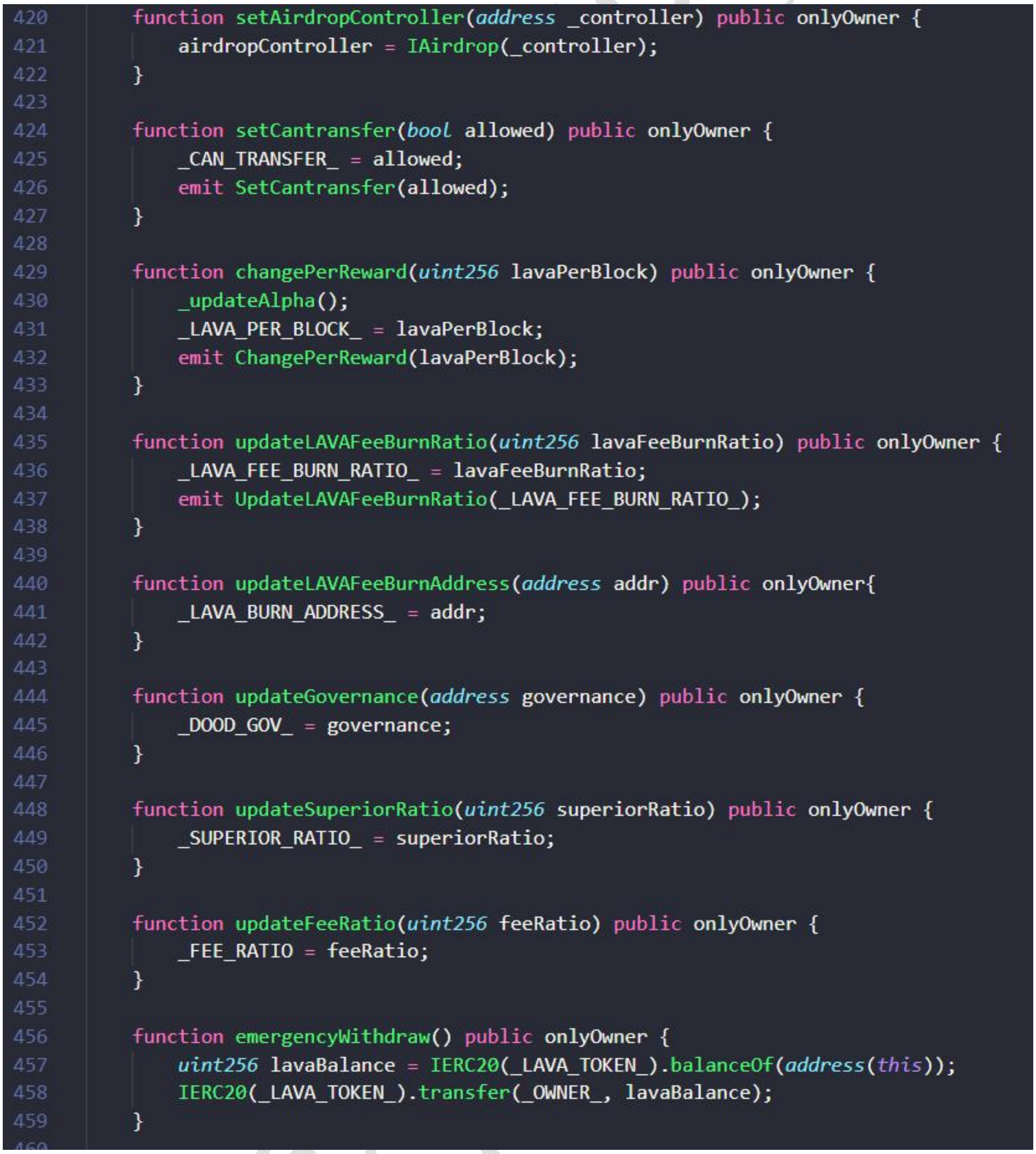
```
    function preDepositedBlockReward(uint256 lavaAmount) public {
        IERC20(_LAVA_TOKEN_).transferFrom(msg.sender, address(this), lavaAmount);
        _TOTAL_BLOCK_REWARD_ = _TOTAL_BLOCK_REWARD_.add(lavaAmount);
        emit PreDeposit(lavaAmount);
    }
```

Figure 11 source code of *preDepositedBlockReward*

- Related functions: *preDepositedBlockReward*
- Result: Pass

(9) Contract parameter setting functions

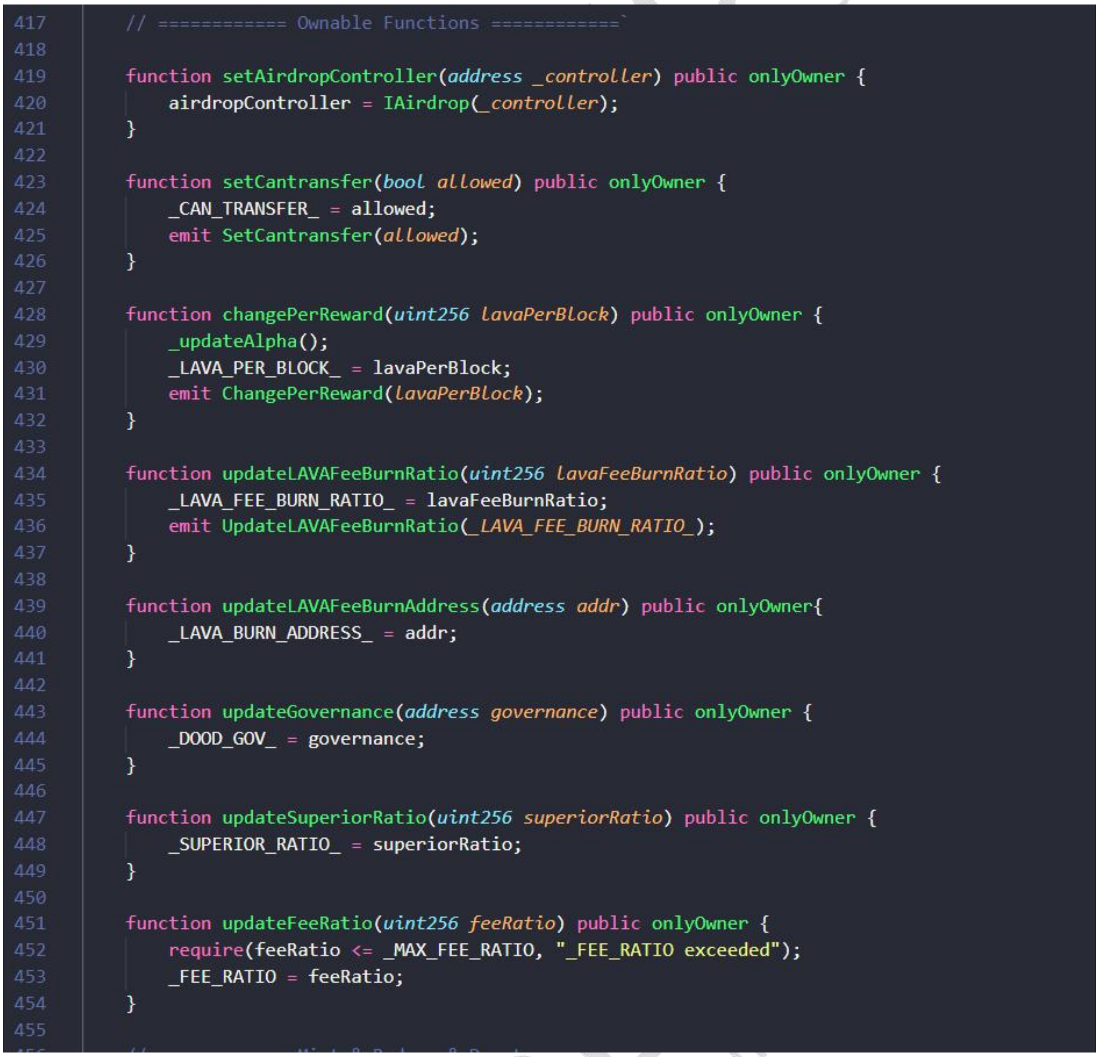
- Description: The contract implements the following functions that only the contract owner can call: The *setAirdropController* function is used to set the address of the airdropController contract; *setCantransfer* to set whether iLAVA transfers are allowed; *changePerReward* to change _LAVA_PER_BLOCK_; *updateLAVAFeeBurnRatio* to change the rate of the destruction fee. *updateLAVAFeeBurnAddress* for setting the address to receive tokens when they are destroyed; *updateGovernance* for setting _DOOD_GOV_; *updateSuperiorRatio* for setting the rate of reward for superior addresses; *updateFeeRatio* for setting the rate of transaction fees; *emergencyWithdraw* is used to withdraw all Lava tokens from the contract to the owner's address. Note: The owner can extract all the Lava tokens in the contract by calling the *emergencyWithdraw* function, which may affect subsequent users calling redeem to redeem their Lava tokens. And when modifying the relevant parameters without judging whether the parameters are appropriate, the modification may lead to errors in the relevant calculation.



```
    function setAirdropController(address _controller) public onlyOwner {
        airdropController = IAirdrop(_controller);
    }

    function setCantransfer(bool allowed) public onlyOwner {
        _CAN_TRANSFER_ = allowed;
        emit SetCantransfer(allowed);
    }

    function changePerReward(uint256 lavaPerBlock) public onlyOwner {
        _updateAlpha();
        _LAVA_PER_BLOCK_ = lavaPerBlock;
        emit ChangePerReward(lavaPerBlock);
    }

    function updateLAVAFeeBurnRatio(uint256 lavaFeeBurnRatio) public onlyOwner {
        _LAVA_FEE_BURN_RATIO_ = lavaFeeBurnRatio;
        emit UpdateLAVAFeeBurnRatio(_LAVA_FEE_BURN_RATIO_);
    }

    function updateLAVAFeeBurnAddress(address addr) public onlyOwner{
        _LAVA_BURN_ADDRESS_ = addr;
    }

    function updateGovernance(address governance) public onlyOwner {
        _DOOD_GOV_ = governance;
    }

    function updateSuperiorRatio(uint256 superiorRatio) public onlyOwner {
        _SUPERIOR_RATIO_ = superiorRatio;
    }

    function updateFeeRatio(uint256 feeRatio) public onlyOwner {
        _FEE_RATIO = feeRatio;
    }

    function emergencyWithdraw() public onlyOwner {
        uint256 lavaBalance = IERC20(_LAVA_TOKEN_).balanceOf(address(this));
        IERC20(_LAVA_TOKEN_).transfer(_OWNER_, lavaBalance);
    }
```

Figure 12 source code of Ownable functions

- Related functions: *setAirdropController, setCantransfer, changePerReward, updateLAVAFeeBurnRatio, updateLAVAFeeBurnAddress, updateGovernance, updateSuperiorRatio, updateFeeRatio, emergencyWithdraw*
- Safety recommendation: The *emergencyWithdraw* function has excessive owner privileges and can extract Lava tokens pledged by the user, so it is recommended to remove it. The *updateFeeRatio* has excessive owner privileges and can set the fee rate arbitrarily and the fee receiving address can be set freely by the owner. It is recommended to add a limit to the fee rate to prevent malicious tokens from being sent to a specific address after the private key is lost.
- Repair result: Deleted and increased maximum transaction fee rate (20%).



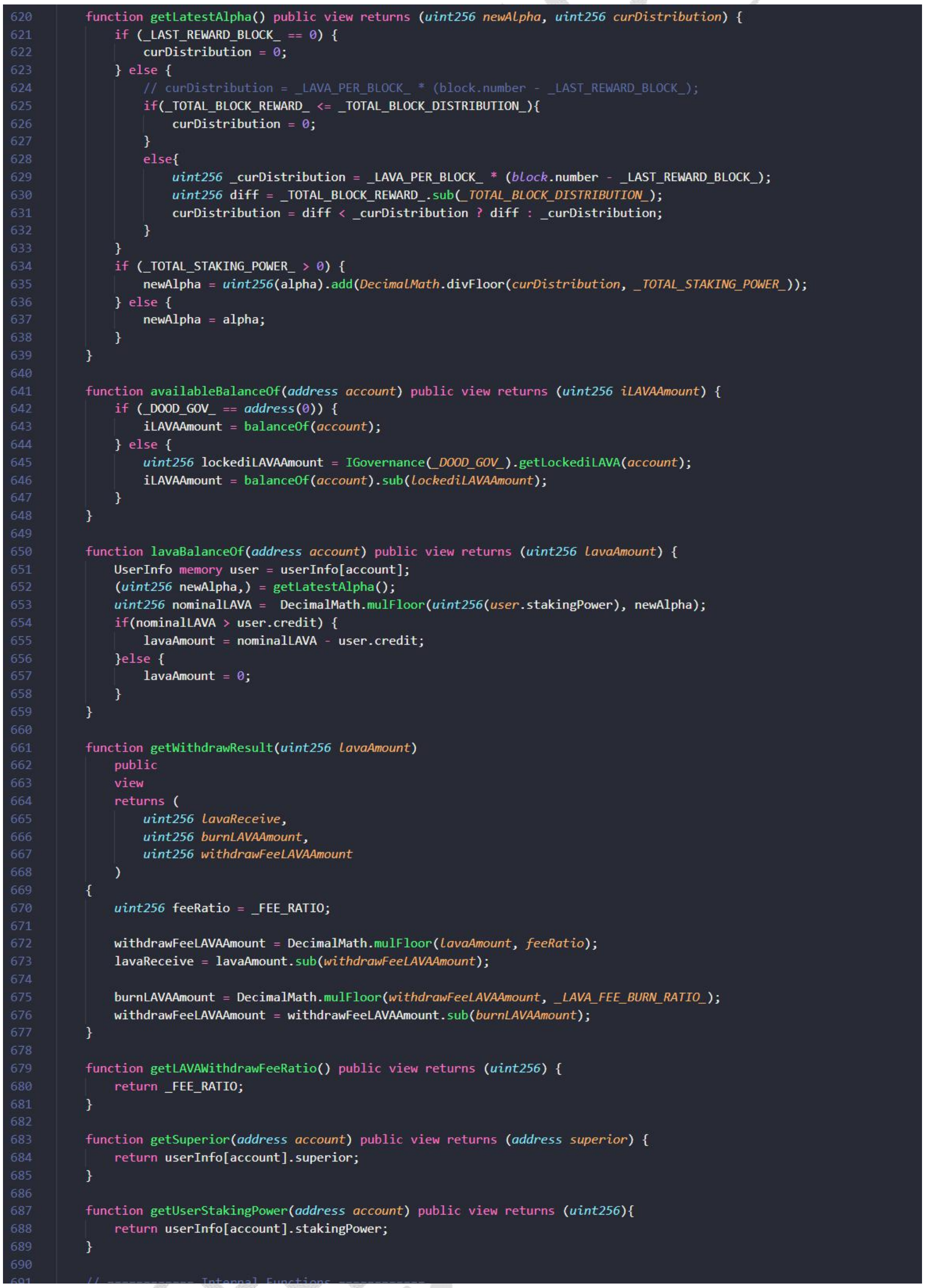
```
    // ============ Ownable Functions ============`

    function setAirdropController(address _controller) public onlyOwner {
        airdropController = IAirdrop(_controller);
    }

    function setCantransfer(bool allowed) public onlyOwner {
        _CAN_TRANSFER_ = allowed;
        emit SetCantransfer(allowed);
    }

    function changePerReward(uint256 lavaPerBlock) public onlyOwner {
        _updateAlpha();
        _LAVA_PER_BLOCK_ = lavaPerBlock;
        emit ChangePerReward(lavaPerBlock);
    }

    function updateLAVAFeeBurnRatio(uint256 lavaFeeBurnRatio) public onlyOwner {
        _LAVA_FEE_BURN_RATIO_ = lavaFeeBurnRatio;
        emit UpdateLAVAFeeBurnRatio(_LAVA_FEE_BURN_RATIO_);
    }

    function updateLAVAFeeBurnAddress(address addr) public onlyOwner{
        _LAVA_BURN_ADDRESS_ = addr;
    }

    function updateGovernance(address governance) public onlyOwner {
        _DOOD_GOV_ = governance;
    }

    function updateSuperiorRatio(uint256 superiorRatio) public onlyOwner {
        _SUPERIOR_RATIO_ = superiorRatio;
    }

    function updateFeeRatio(uint256 feeRatio) public onlyOwner {
        require(feeRatio <= _MAX_FEE_RATIO, "_FEE_RATIO exceeded");
        _FEE_RATIO = feeRatio;
    }

```

Figure 13 source code of owner functions(new)

- Result: Pass

(10) Related parameter query function

- Description: The contract implements *getLatestAlpha* function to query the latest alpha value; *availableBalanceOf* function to query the available balance of the specified address; *lavaBalanceOf* function to calculate the number of Lava tokens pledged to the contract from the specified address; *getWithdrawResult* function to calculate the actual withdrawal amount based on the input amount; *getLAVAWithdrawFeeRatio* function to query the fee ratio of the Lava tokens withdrawn from the specified address; *getSuperior* function to query the superior address; *getWithdrawResult* function is used to calculate the actual number of tokens withdrawn based on the amount entered; *getLAVAWithdrawFeeRatio* function is used to query the fee rate for withdrawing Lava tokens; *getSuperior* function is used to query the superior address of the specified address; The *getUserStakingPower* function is used to query the collateral power of the specified address.



```solidity
    function getLatestAlpha() public view returns (uint256 newAlpha, uint256 curDistribution) {
        if (_LAST_REWARD_BLOCK_ == 0) {
            curDistribution = 0;
        } else {
            // curDistribution = _LAVA_PER_BLOCK_ * (block.number - _LAST_REWARD_BLOCK_);
            if(_TOTAL_BLOCK_REWARD_ <= _TOTAL_BLOCK_DISTRIBUTION_){
                curDistribution = 0;
            }
            else{
                uint256 _curDistribution = _LAVA_PER_BLOCK_ * (block.number - _LAST_REWARD_BLOCK_);
                uint256 diff = _TOTAL_BLOCK_REWARD_.sub(_TOTAL_BLOCK_DISTRIBUTION_);
                curDistribution = diff < _curDistribution ? diff : _curDistribution;
            }
        }
        if (_TOTAL_STAKING_POWER_ > 0) {
            newAlpha = uint256(alpha).add(DecimalMath.divFloor(curDistribution, _TOTAL_STAKING_POWER_));
        } else {
            newAlpha = alpha;
        }
    }

    function availableBalanceOf(address account) public view returns (uint256 iLAVAAmount) {
        if (_DOOD_GOV_ == address(0)) {
            iLAVAAmount = balanceOf(account);
        } else {
            uint256 lockediLAVAAmount = IGovernance(_DOOD_GOV_).getLockediLAVA(account);
            iLAVAAmount = balanceOf(account).sub(lockediLAVAAmount);
        }
    }

    function lavaBalanceOf(address account) public view returns (uint256 lavaAmount) {
        UserInfo memory user = userInfo[account];
        (uint256 newAlpha,) = getLatestAlpha();
        uint256 nominalLAVA =  DecimalMath.mulFloor(uint256(user.stakingPower), newAlpha);
        if(nominalLAVA > user.credit) {
            lavaAmount = nominalLAVA - user.credit;
        }else {
            lavaAmount = 0;
        }
    }

    function getWithdrawResult(uint256 lavaAmount)
        public
        view
        returns (
            uint256 lavaReceive,
            uint256 burnLAVAAmount,
            uint256 withdrawFeeLAVAAmount
        )
    {
        uint256 feeRatio = _FEE_RATIO;

        withdrawFeeLAVAAmount = DecimalMath.mulFloor(lavaAmount, feeRatio);
        lavaReceive = lavaAmount.sub(withdrawFeeLAVAAmount);

        burnLAVAAmount = DecimalMath.mulFloor(withdrawFeeLAVAAmount, _LAVA_FEE_BURN_RATIO_);
        withdrawFeeLAVAAmount = withdrawFeeLAVAAmount.sub(burnLAVAAmount);
    }

    function getLAVAWithdrawFeeRatio() public view returns (uint256) {
        return _FEE_RATIO;
    }

    function getSuperior(address account) public view returns (address superior) {
        return userInfo[account].superior;
    }

    function getUserStakingPower(address account) public view returns (uint256){
        return userInfo[account].stakingPower;
    }

    // ------------ Internal Functions ------------
```

Figure 14 source code of query functions

- Related functions: *getLatestAlpha, availableBalanceOf, lavaBalanceOf, getWithdrawResult, getLAVAWithdrawFeeRatio, getSuperior, getUserStakingPower*
- Result: Pass

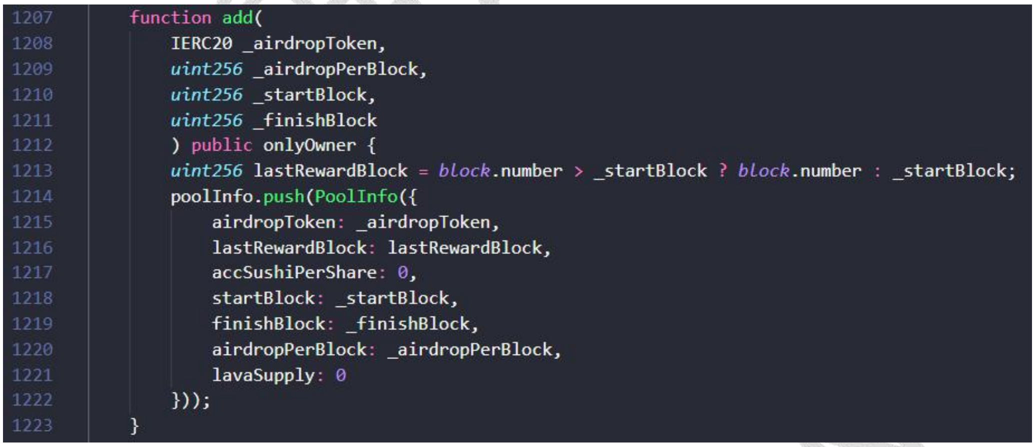
3.2 Business analysis of Contract Token Airdrop

iLAVA's collateral arithmetic varies according to its holdings. iLAVA token species only *mint* and *redeem* functions update the user airdrop reward calculations in the Airdrop contract. If the iLAVA token is opened for transfer, the receiving address can update the data related to the airdrop reward through functions such as *syncIlava* to get the airdrop reward; however, the data related to the airdrop reward in Airdrop for the transferring address will not be updated and can continue to maintain the same yield as before the transfer.

(i.e. the iLAVA token holdings decrease while the reward remains unchanged) The project owner declares that iLAVA transfers will not be activated and that if they are, the relevant airdrop contract will be voided.

(1) add function

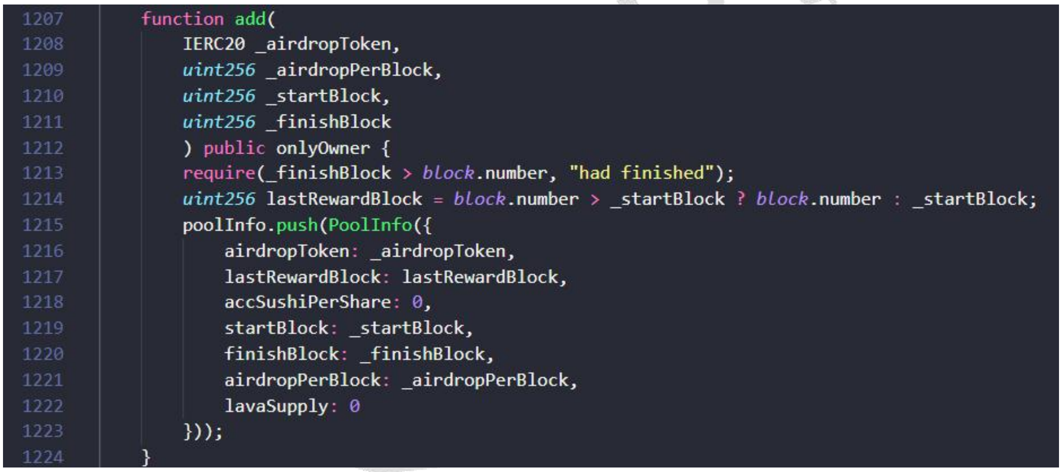
- Description: The contract implements the *add* function for the contract's owner to add new airdrop tokens and set airdrop reward related parameters. Note: Adding duplicate airdrop tokens will cause the reward to be calculated incorrectly, so administrators should be careful to prevent duplicate additions.



```
function add(
    IERC20 _airdropToken,
    uint256 _airdropPerBlock,
    uint256 _startBlock,
    uint256 _finishBlock
    ) public onlyOwner {
    uint256 lastRewardBlock = block.number > _startBlock ? block.number : _startBlock;
    poolInfo.push(PoolInfo({
        airdropToken: _airdropToken,
        lastRewardBlock: lastRewardBlock,
        accSushiPerShare: 0,
        startBlock: _startBlock,
        finishBlock: _finishBlock,
        airdropPerBlock: _airdropPerBlock,
        lavaSupply: 0
    }));
}
```

Figure 15 source code of *add* function

- Safety recommendation: It is recommended to add a finishBlock greater than the current time to prevent the reward from being calculated incorrectly.
- Repair result: Fixed



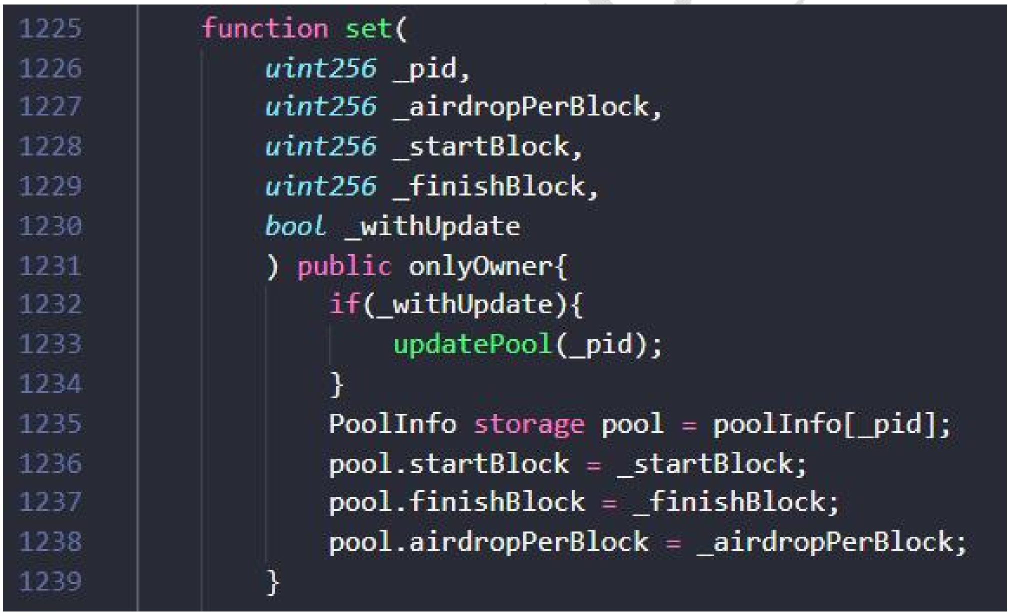
```
function add(
    IERC20 _airdropToken,
    uint256 _airdropPerBlock,
    uint256 _startBlock,
    uint256 _finishBlock
    ) public onlyOwner {
    require(_finishBlock > block.number, "had finished");
    uint256 lastRewardBlock = block.number > _startBlock ? block.number : _startBlock;
    poolInfo.push(PoolInfo({
        airdropToken: _airdropToken,
        lastRewardBlock: lastRewardBlock,
        accSushiPerShare: 0,
        startBlock: _startBlock,
        finishBlock: _finishBlock,
        airdropPerBlock: _airdropPerBlock,
        lavaSupply: 0
    }));
}
```

Figure 16 source code of *add* function(new)

- Related functions: *add*
- Result: Pass

(2) set function

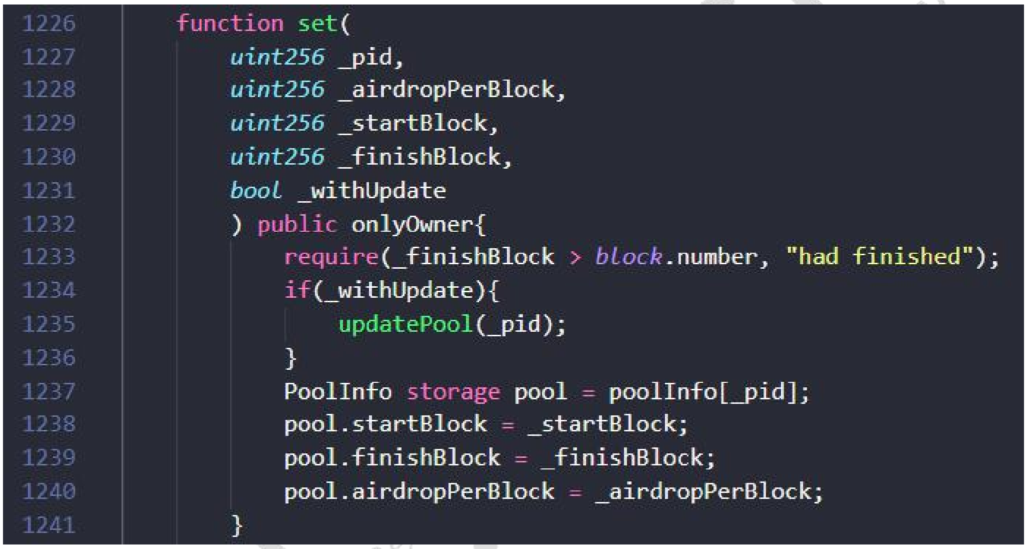
- Description: The contract implements the *set* function for the owner of the contract to modify the parameters related to the airdrop token rewards for the specified id, optionally executing the *updatePool* function to update the rewards related data before the modification.



```
    function set(
        uint256 _pid,
        uint256 _airdropPerBlock,
        uint256 _startBlock,
        uint256 _finishBlock,
        bool _withUpdate
        ) public onlyOwner{
            if(_withUpdate){
                updatePool(_pid);
            }
            PoolInfo storage pool = poolInfo[_pid];
            pool.startBlock = _startBlock;
            pool.finishBlock = _finishBlock;
            pool.airdropPerBlock = _airdropPerBlock;
        }
```

Figure 17 source code of *set* function

- Safety recommendation: It is recommended to add a finishBlock greater than the current time to prevent the reward from being calculated incorrectly.
- Repair result: Fixed



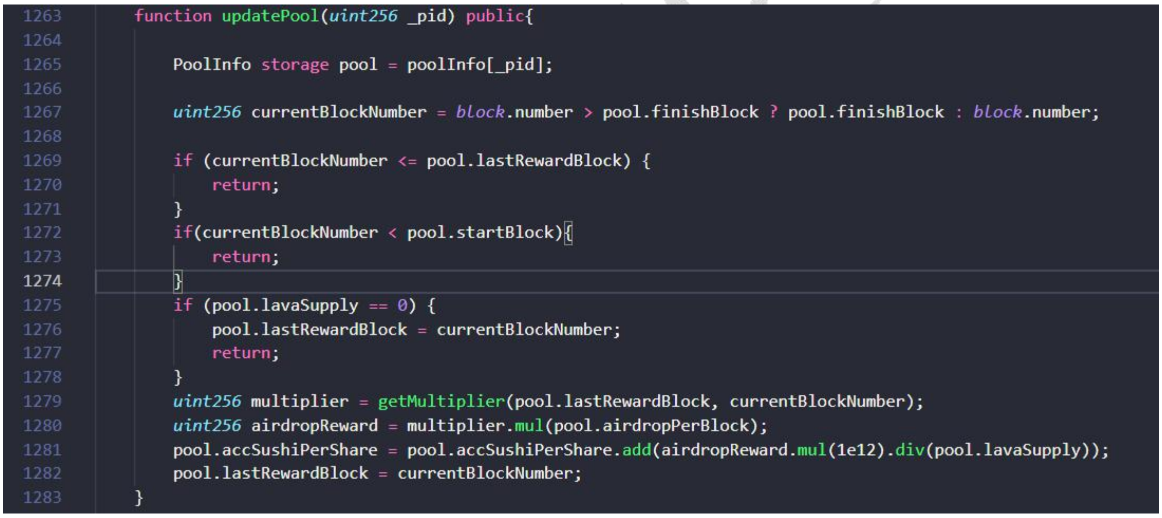
```
    function set(
        uint256 _pid,
        uint256 _airdropPerBlock,
        uint256 _startBlock,
        uint256 _finishBlock,
        bool _withUpdate
        ) public onlyOwner{
            require(_finishBlock > block.number, "had finished");
            if(_withUpdate){
                updatePool(_pid);
            }
            PoolInfo storage pool = poolInfo[_pid];
            pool.startBlock = _startBlock;
            pool.finishBlock = _finishBlock;
            pool.airdropPerBlock = _airdropPerBlock;
        }
```

Figure 18 source code of *set* function(new)

- Related functions: *set, updatePool*
- Result: Pass

(3) updatePool function

- Description: The contract implements *updatePool* function to update the data related to the airdrop token rewards for the specified id.



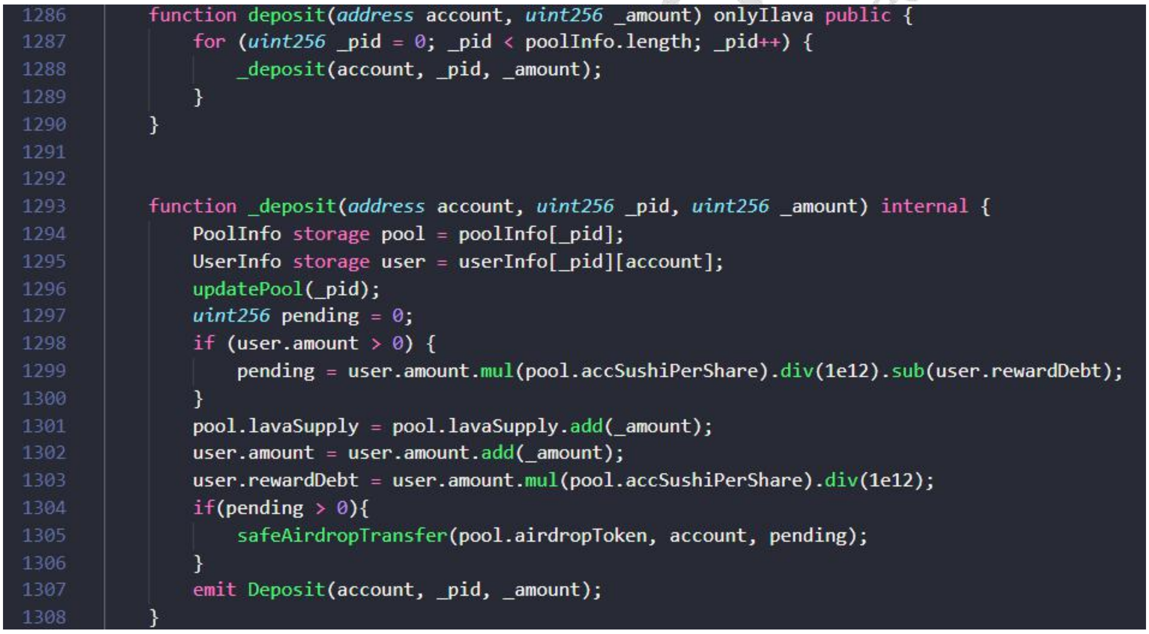
```
    function updatePool(uint256 _pid) public{

        PoolInfo storage pool = poolInfo[_pid];

        uint256 currentBlockNumber = block.number > pool.finishBlock ? pool.finishBlock : block.number;

        if (currentBlockNumber <= pool.lastRewardBlock) {
            return;
        }
        if(currentBlockNumber < pool.startBlock){
            return;
        }
        if (pool.lavaSupply == 0) {
            pool.lastRewardBlock = currentBlockNumber;
            return;
        }
        uint256 multiplier = getMultiplier(pool.lastRewardBlock, currentBlockNumber);
        uint256 airdropReward = multiplier.mul(pool.airdropPerBlock);
        pool.accSushiPerShare = pool.accSushiPerShare.add(airdropReward.mul(1e12).div(pool.lavaSupply));
        pool.lastRewardBlock = currentBlockNumber;
    }
```

Figure 19 source code of *updatePool* function

- Related functions: *updatePool, getMultiplier*
- Result: Pass

(4) deposit function

- Description: The contract implements the *deposit* function to update all the user's drop reward related data (increasing the user's calculation), by calling the internal function *_deposit,* and the updatePool is executed to update the airdrop token data before increasing. If the user's calculated amount is not 0, the previous airdrop rewards are calculated and sent. Only iLAVA token contract addresses can be called.



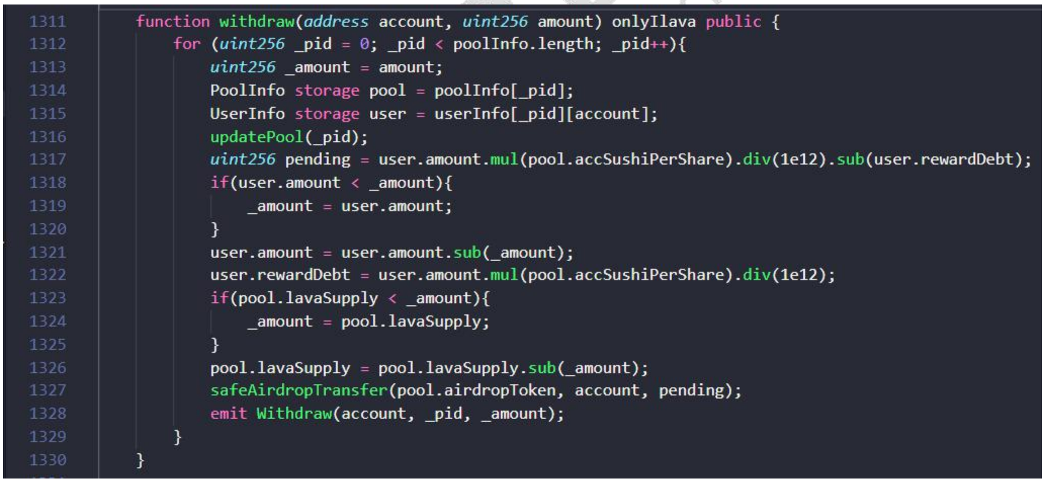
```
    function deposit(address account, uint256 _amount) onlyIlava public {
        for (uint256 _pid = 0; _pid < poolInfo.length; _pid++) {
            _deposit(account, _pid, _amount);
        }
    }


    function _deposit(address account, uint256 _pid, uint256 _amount) internal {
        PoolInfo storage pool = poolInfo[_pid];
        UserInfo storage user = userInfo[_pid][account];
        updatePool(_pid);
        uint256 pending = 0;
        if (user.amount > 0) {
            pending = user.amount.mul(pool.accSushiPerShare).div(1e12).sub(user.rewardDebt);
        }
        pool.lavaSupply = pool.lavaSupply.add(_amount);
        user.amount = user.amount.add(_amount);
        user.rewardDebt = user.amount.mul(pool.accSushiPerShare).div(1e12);
        if(pending > 0){
            safeAirdropTransfer(pool.airdropToken, account, pending);
        }
        emit Deposit(account, _pid, _amount);
    }
```

Figure 20 source code of *deposit* function

- Related functions: *deposit, updatePool, safeAirdropTransfer*
- Result: Pass

(5) withdraw function

- Description: The contract implements the *withdraw* function to update all the user's airdrop reward data (reducing the amount of calculations for the user), before reducing the *updatePool* to update the airdrop token data. If the user's calculated amount is not 0, the previous airdrop rewards are calculated and sent. Only iLAVA token contract addresses can be called.



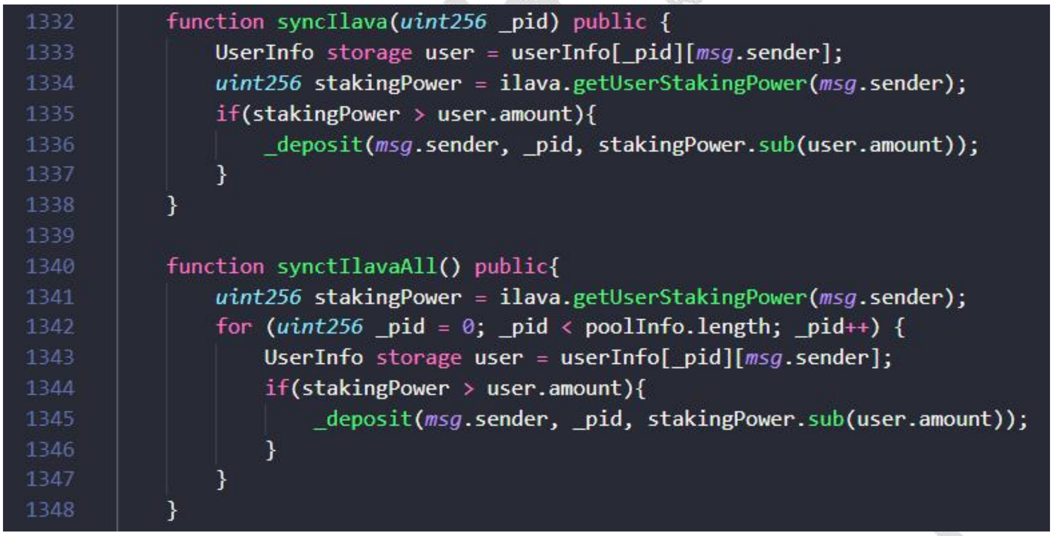
```
function withdraw(address account, uint256 amount) onlyIlava public {
    for (uint256 _pid = 0; _pid < poolInfo.length; _pid++){
        uint256 _amount = amount;
        PoolInfo storage pool = poolInfo[_pid];
        UserInfo storage user = userInfo[_pid][account];
        updatePool(_pid);
        uint256 pending = user.amount.mul(pool.accSushiPerShare).div(1e12).sub(user.rewardDebt);
        if(user.amount < _amount){
            _amount = user.amount;
        }
        user.amount = user.amount.sub(_amount);
        user.rewardDebt = user.amount.mul(pool.accSushiPerShare).div(1e12);
        if(pool.lavaSupply < _amount){
            _amount = pool.lavaSupply;
        }
        pool.lavaSupply = pool.lavaSupply.sub(_amount);
        safeAirdropTransfer(pool.airdropToken, account, pending);
        emit Withdraw(account, _pid, _amount);
    }
}
```

Figure 21 source code of *withdraw* function

- Related functions: *withdraw, updatePool, safeAirdropTransfer*
- Result: Pass

(6) sync functions

- Description: The contract implements the *syncIlava* function for the user to update the reward-related data for their specified airdrop tokens, calling the internal function *_deposit* to update when the user's iLAVA collateral arithmetic exceeds the amount of calculations for the specified airdrop tokens. *synctIlavaAll* function for the user to update the reward-related data for all their airdrop tokens, traversing all airdrop tokens and updating only iLAVA collateral arithmetic exceeds the computed amount of the corresponding airdrop token.



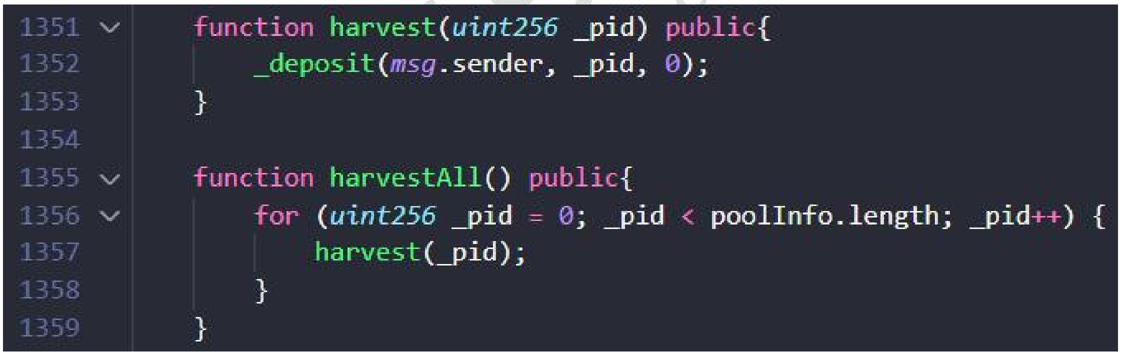
```
function syncIlava(uint256 _pid) public {
    UserInfo storage user = userInfo[_pid][msg.sender];
    uint256 stakingPower = ilava.getUserStakingPower(msg.sender);
    if(stakingPower > user.amount){
        _deposit(msg.sender, _pid, stakingPower.sub(user.amount));
    }
}

function synctIlavaAll() public{
    uint256 stakingPower = ilava.getUserStakingPower(msg.sender);
    for (uint256 _pid = 0; _pid < poolInfo.length; _pid++) {
        UserInfo storage user = userInfo[_pid][msg.sender];
        if(stakingPower > user.amount){
            _deposit(msg.sender, _pid, stakingPower.sub(user.amount));
        }
    }
}
```

Figure 22 source code of sync functions

- Related functions: *syncIlava, synctIlavaAll, getUserStakingPower*
- Result: Pass

(7) harvest functions

- Description: The contract implements the *harvest* function for the user to receive the airdrop reward for the specified airdrop token, implemented by calling the internal function *_deposit*. The *harvestAll* function is used for the user to receive the airdrop reward for all airdrop tokens.



```
    function harvest(uint256 _pid) public{
        _deposit(msg.sender, _pid, 0);
    }

    function harvestAll() public{
        for (uint256 _pid = 0; _pid < poolInfo.length; _pid++) {
            harvest(_pid);
        }
    }
```

Figure 23 source code of harvest functions

- Related functions: *harvest, harvestAll*
- Result: Pass

4. Conclusion

Beosin(ChengduLianAn) conducted a detailed audit on the design and code implementation of the smart contracts project iLAVA&Airdrop. The problems found by the audit team during the audit process have been notified to the project party and reached an agreement on the repair results, the overall audit result of the iLAVA&Airdrop project's smart contract is **Pass**.

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