Bitlectro Labs

DreamLoops

Smart Contract Audit Report

May 03, 2021

Introduction

1. About Bitlectro Labs

Bitlectro Labs Dreamloops are a programmatically generated series of audio-visual non-fungible tokens (NFTs). Minted on the Ethereum blockchain, and hosted via IPFS (Interplanetary File System), the first line of Dreamloops NFTs will feature 16-bit retro style musical loops. Each NFT has a one of a kind album art. 1 in 5 Dreamloops (20%) will be redeemable for physical media. 10,000 Dreamloops will be minted in the first release. As the first release from Bitlectro Labs, Dreamloops will be a set of chiptune style musical loops with unique melodies, drum beats, and basslines. Each tune will have a corresponding cover or album art, designed in a retro 16-bit fashion but with unique visual elements - think retro-futurism. The elements and features of both the music and cover art will have a fixed scarcity. Some covers will be fully animated and have features unique to only a few (or in some instances one) Dreamloops in the edition, whereas others will be common and easier to obtain. Musical compositions will be shared across the collection, with some only appearing with “rare” or “uncommon” NFTs and others being more obtainable with “common” releases.

Visit http://bitlectrolabs.com/ to know more about.

2. About ImmuneBytes

ImmuneBytes is a security start-up to provide professional services in the blockchain space. The team has hands-on experience in conducting smart contract audits, penetration testing, and security consulting. ImmuneBytes’s security auditors have worked on various A-league projects and have a great understanding of DeFi projects like AAVE, Compound, 0x Protocol, Uniswap, dydx.
The team has been able to secure 15+ blockchain projects by providing security services on different frameworks. ImmuneBytes team helps start-up with a detailed analysis of the system ensuring security and managing the overall project.
Visit http://immunebytes.com/ to know more about the services.

Documentation Details

The Bitlectro Labs team has provided documentation for the purpose of conducting the audit. The documents are:

1. https://docs.google.com/document/d/12TkzNNCo_yLhTZc3KMRF33qWg3mQq5dMXu7Xz-vPJn4/edit

Audit Process & Methodology

ImmuneBytes team has performed thorough testing of the project starting with analyzing the code design patterns in which we reviewed the smart contract architecture to ensure it is structured and safe use of third-party smart contracts and libraries.

Our team then performed a formal line-by-line inspection of the Smart Contract in order to find any potential issues like Signature Replay Attacks, Unchecked External Calls, External Contract Referencing, Variable Shadowing, Race conditions, Transaction-ordering dependence, timestamp dependence, DoS attacks, and others.

In the Unit testing phase, we run unit tests written by the developer in order to verify the functions work as intended. In Automated Testing, we tested the Smart Contract with our in-house developed tools to identify vulnerabilities and security flaws.

The code was audited by a team of independent auditors which includes -

1. Testing the functionality of the Smart Contract to determine proper logic has been followed throughout.
2. Analyzing the complexity of the code by thorough, manual review of the code, line-by-line.
3. Deploying the code on testnet using multiple clients to run live tests.
4. Analyzing failure preparations to check how the Smart Contract performs in case of bugs and vulnerabilities.
5. Checking whether all the libraries used in the code are on the latest version.
6. Analyzing the security of the on-chain data.

Audit Details

- Project Name: Bitlectro Labs
- Contract Name: Dreamloops.sol
- Languages: Solidity(Smart contract)
- Github commit hash for audit: a58898c71e868d32138b715fc02dd40ab7251459
- GitHub link: https://github.com/tigerthelion/bitlectro_contract_v1
- Platforms and Tools: Remix IDE, Truffle, Truffle Team, Ganache, Solhint, VScode, Contract Library, Slither, SmartCheck

Audit Goals

The focus of the audit was to verify that the smart contract system is secure, resilient, and working according to its specifications. The audit activities can be grouped into the following three categories:

1. Security: Identifying security-related issues within each contract and within the system of contracts.
2. Sound Architecture: Evaluation of the architecture of this system through the lens of established smart contract best practices and general software best practices.
3. Code Correctness and Quality: A full review of the contract source code. The primary areas of focus include:
    a. Correctness
    b. Readability
    c. Sections of code with high complexity
    d. Quantity and quality of test coverage

Security Level References

Every issue in this report was assigned a severity level from the following:

High severity issues will bring problems and should be fixed.

Medium severity issues could potentially bring problems and should eventually be fixed.

Low severity issues are minor details and warnings that can remain unfixed but would be better fixed at some point in the future.

Issues	High	Medium	Low
Open	-	3	4
Closed	-	-	-

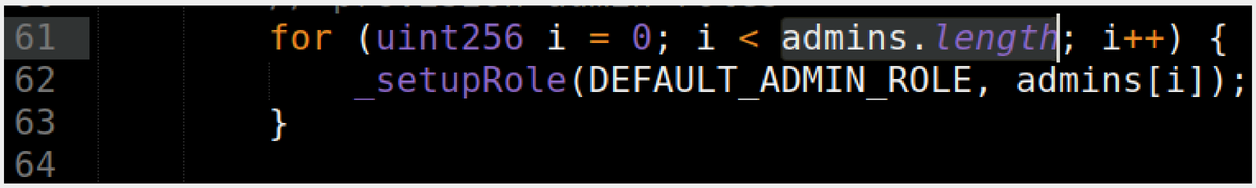
High severity issues

No issues found.

Medium severity issues

1. **Loops are extremely costly**
   Line no - 61, 66

   Description:
   The **DreamLoops** contract has some **for loops** in the contract that include state variables like .length of a non-memory array, in the condition of the for loops.



```
61          for (uint256 i = 0; i < admins.length; i++) {
62              _setupRole(DEFAULT_ADMIN_ROLE, admins[i]);
63          }
64
```

   As a result, these state variables consumes a lot more extra gas for every iteration of the for loop.
   The following function includes such loops at the mentioned lines:
   - **constructor at Line 61,66**

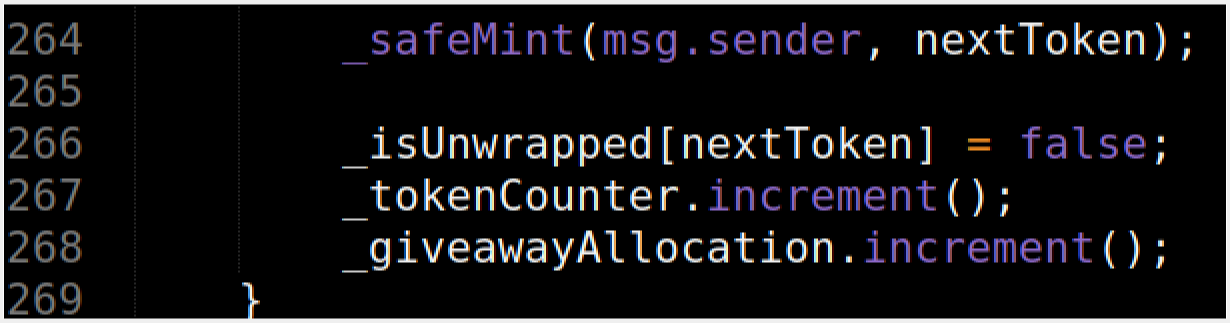
   Recommendation:
   It's quite effective to use a local variable instead of a state variable like .length in a loop. This will be a significant step in optimizing gas usage.
   For instance,

```
local_variable = admins.length
for (uint256 i = 0; i < local_variable; i++) {
        _setupRole(DEFAULT_ADMIN_ROLE, admins[i]);
    }
```

2. **State Variables Updated After External Call. Violation of Check_Effects_Interaction Pattern**
   Line - 264-269, 308-311, 322-325

   Description:
   As per the Check_Effects_Interaction Pattern in Solidity, external calls should be made at the very end of the function. Event emission as well as any state variable modification must be done before the external call is made.

However, during the manual review of the DreamLoops.sol contract, it was found that some of the functions in the contract violate this **Check-Effects-Interaction** pattern at the above-mentioned lines.



```
264             _safeMint(msg.sender, nextToken);
265
266             _isUnwrapped[nextToken] = false;
267             _tokenCounter.increment();
268             _giveawayAllocation.increment();
269         }
```

These functions update state variables in the contract after making an external call. Although the external call is made to the token contract itself, the secure development practices must not be avoided. The following are the functions that implement such function design:

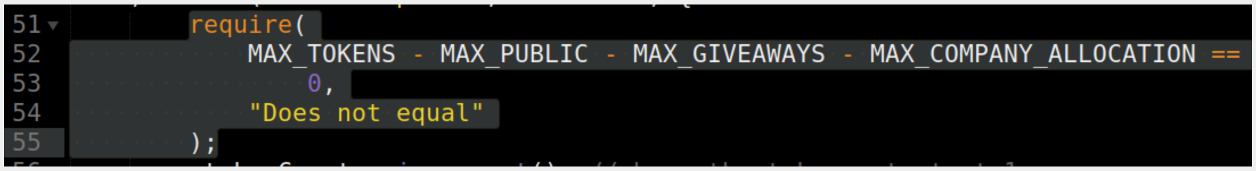
- **redeemGiveaway**
- **mint**
- **companyMint**

Recommendation:
Modification of any State Variables must be performed before making an external call. Check Effects Interaction Pattern must be followed while implementing external calls in a function.

3. **Redundant Require Statements in Constructor of the Contract**
   Line no : 51-55

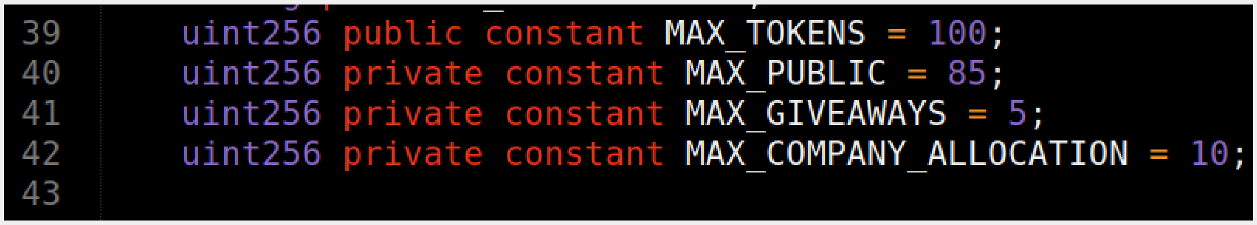
Description:

a. **Constructor**: The constructor of the DreamLoops contract includes a require statement at the very top to ensure that the allocations are done as expected.



```
51         require(
52             MAX_TOKENS - MAX_PUBLIC - MAX_GIVEAWAYS - MAX_COMPANY_ALLOCATION ==
53                 0,
54             "Does not equal"
55         );
```

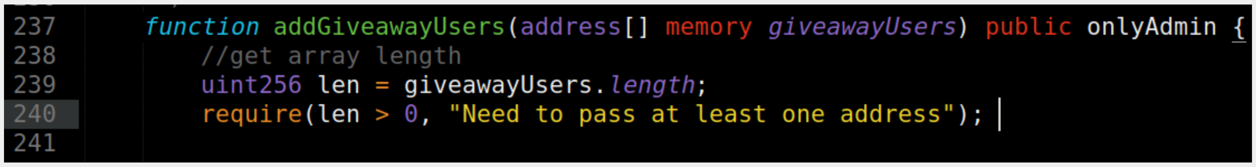
However, since the allocations for Public, Giveaways etc are being hardcoded in the contract state variable itself(from Line 39-42), this **require statement** is not really significant.



```
    uint256 public constant MAX_TOKENS = 100;
    uint256 private constant MAX_PUBLIC = 85;
    uint256 private constant MAX_GIVEAWAYS = 5;
    uint256 private constant MAX_COMPANY_ALLOCATION = 10;
```

Such **require** statements checks are effective and necessary when allocation amounts are passed as argument to the constructor.

b. **addGiveawayUsers**: The **addGiveawayUsers** function also includes a requirements to ensures that empty arrays are not being passed in the function.



```
    function addGiveawayUsers(address[] memory giveawayUsers) public onlyAdmin {
        //get array length
        uint256 len = giveawayUsers.length;
        require(len > 0, "Need to pass at least one address");
```

However, since the **onlyAdmin** modifier has already been attached to the   function making it only accessible to the admins instead of all users, this require statement is not imperative as the admins of the contract should never pass empty arrays.

It must be noted that adding such unnecessary **require statements** will increase the gas consumption during contract deployment which is not very adequate.

Recommendation:
Redundant **require statements** should be removed from the smart contract.

Low severity issues

1. **External Visibility should be preferred**

Description:
Those functions that are never called throughout the contract should be marked as **external** visibility instead of **public** visibility.
This will effectively result in Gas Optimization as well.

Therefore, the following function must be marked as **external** within the contract:

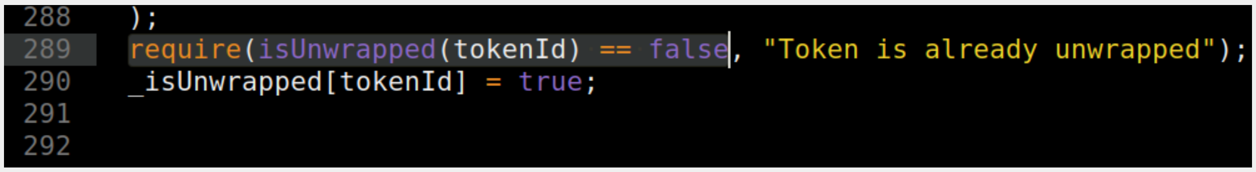
- **grantRoleOwner**
- **setBaseURI**
- **setSale**
- **isSaleStarted**
- **calculatePriceForToken**
- **addGiveawayUsers**

- **redeemGiveaway**
- **mint**
- **companyMint**
- **withdrawAll**

Recommendation:
If the **PUBLIC** visibility of the above-mentioned functions is not intended, then the **EXTERNAL** Visibility keyword should be preferred.

2. **Comparison to boolean Constant**
Line no: 289, 298

Description:
Boolean constants can directly be used in conditional statements or require statements. Therefore, it's not considered a better practice to explicitly use **TRUE or FALSE** in the **require** statements.

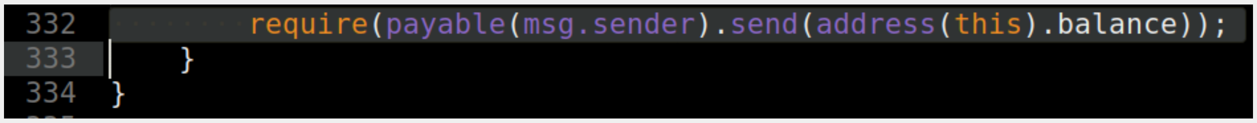


```
288    );
289    require(isUnwrapped(tokenId) == false, "Token is already unwrapped");
290    _isUnwrapped[tokenId] = true;
291
292
```

Recommendation:
The equality to boolean constants must be removed from the above-mentioned line.

3. **Absence of Error messages in Require Statements**
Line no - 77, 332

Description:
The **DreamLoops** contract includes a few functions(at the above-mentioned lines) that doesn't contain any error message in the **require** statement.



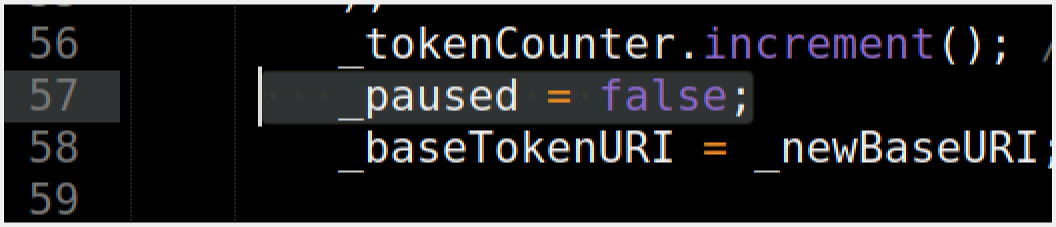
```
332             require(payable(msg.sender).send(address(this).balance));
333         }
334 }
```

While this makes it troublesome to detect the reason behind a particular function revert, it also reduces the readability of the code.

Recommendation:
Error Messages must be included in every require statement in the contract

4. **Redundant Initialization of State Variable**
   Line no - 57

   Description:
   The State Variable **_paused** is being initialized to **FALSE** in the constructor.



```
56          _tokenCounter.increment();
57          _paused = false;
58          _baseTokenURI = _newBaseURI
59
```

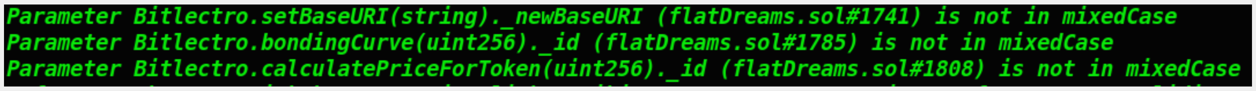
   However, boolean state variables are FALSE by default and does not require explicit initialization to false.

   Recommendation:
   Unnecessary Initialization of State variables should be avoided in the contract.

Recommendations

1. **Coding Style Issues in the Contract**

   Description:
   Code readability of a Smart Contract is largely influenced by the Coding Style issues and in some specific scenarios may lead to bugs in the future.

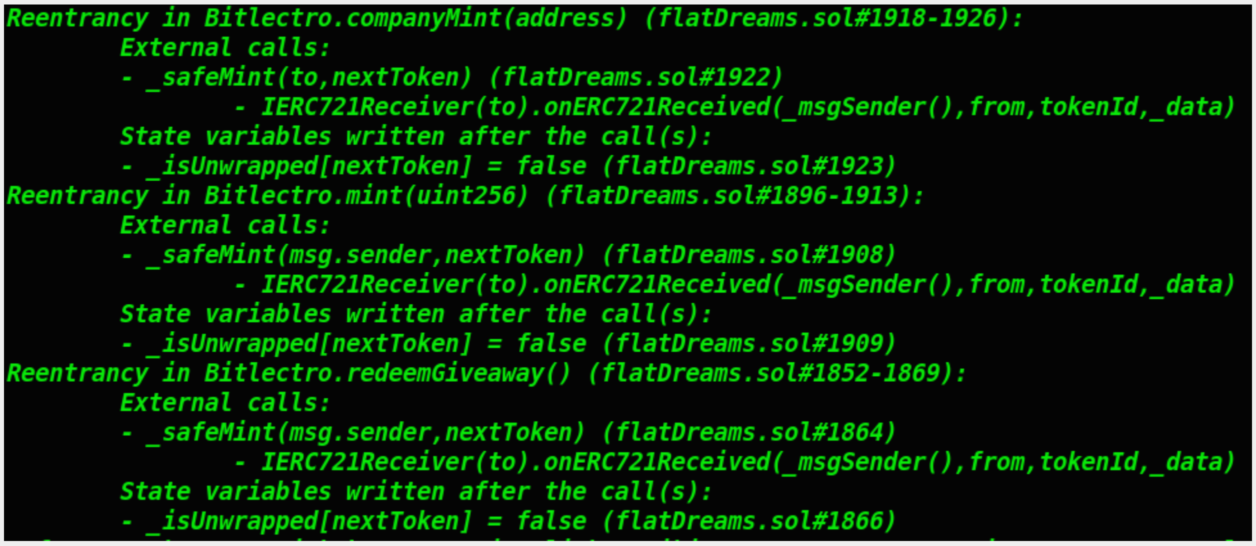


```
Parameter Bitlectro.setBaseURI(string)._newBaseURI (flatDreams.sol#1741) is not in mixedCase
Parameter Bitlectro.bondingCurve(uint256)._id (flatDreams.sol#1785) is not in mixedCase
Parameter Bitlectro.calculatePriceForToken(uint256)._id (flatDreams.sol#1808) is not in mixedCase
```

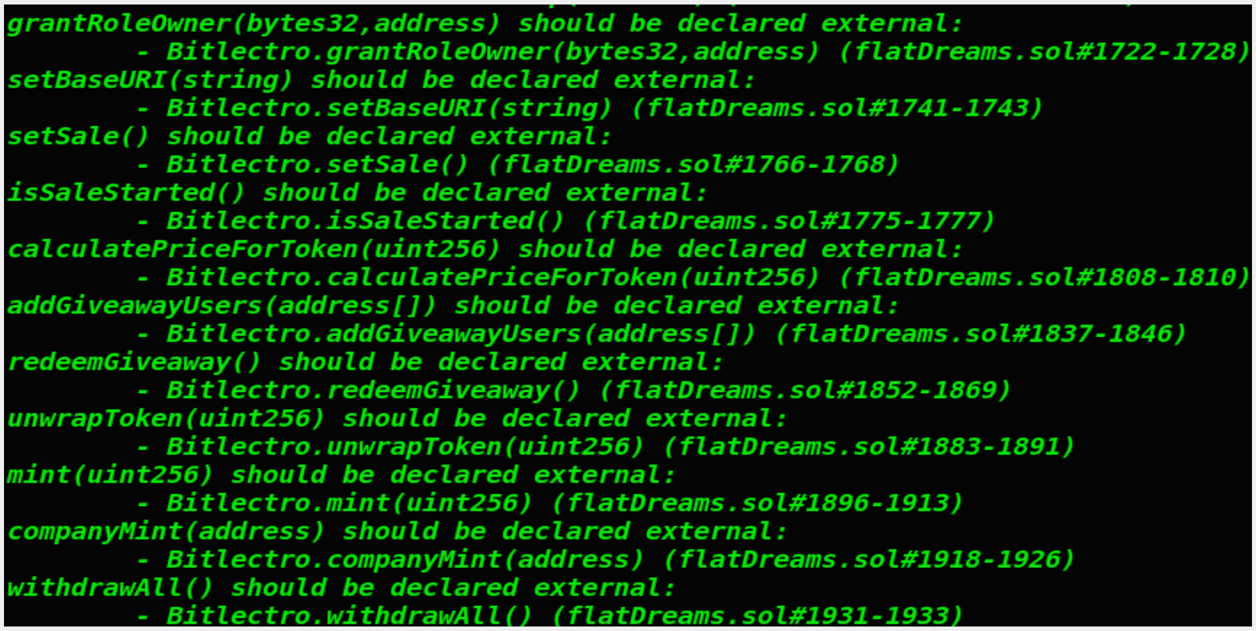
   During the automated testing, it was found that the DreamLoops contract had a few code style issues.

   Recommendation:
   Therefore, it is highly recommended to fix the issues like naming convention, indentation, and code layout issues in a smart contract.

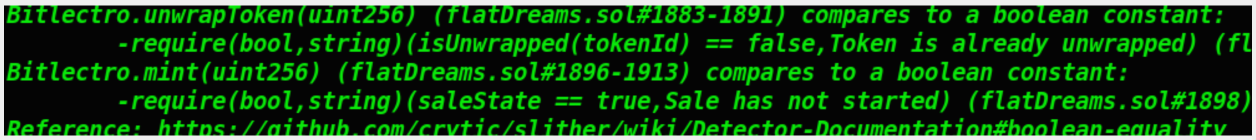
Automated Test Result



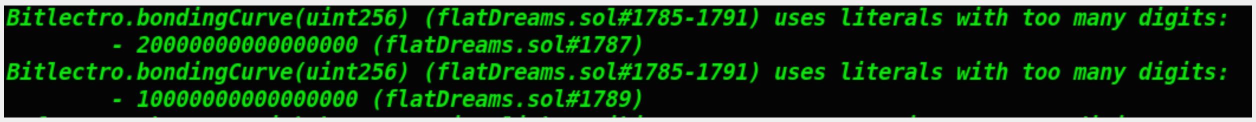
```
Reentrancy in Bitlectro.companyMint(address) (flatDreams.sol#1918-1926):
        External calls:
        - _safeMint(to,nextToken) (flatDreams.sol#1922)
                - IERC721Receiver(to).onERC721Received(_msgSender(),from,tokenId,_data)
        State variables written after the call(s):
        - _isUnwrapped[nextToken] = false (flatDreams.sol#1923)
Reentrancy in Bitlectro.mint(uint256) (flatDreams.sol#1896-1913):
        External calls:
        - _safeMint(msg.sender,nextToken) (flatDreams.sol#1908)
                - IERC721Receiver(to).onERC721Received(_msgSender(),from,tokenId,_data)
        State variables written after the call(s):
        - _isUnwrapped[nextToken] = false (flatDreams.sol#1909)
Reentrancy in Bitlectro.redeemGiveaway() (flatDreams.sol#1852-1869):
        External calls:
        - _safeMint(msg.sender,nextToken) (flatDreams.sol#1864)
                - IERC721Receiver(to).onERC721Received(_msgSender(),from,tokenId,_data)
        State variables written after the call(s):
        - _isUnwrapped[nextToken] = false (flatDreams.sol#1866)
```



```
grantRoleOwner(bytes32,address) should be declared external:
        - Bitlectro.grantRoleOwner(bytes32,address) (flatDreams.sol#1722-1728)
setBaseURI(string) should be declared external:
        - Bitlectro.setBaseURI(string) (flatDreams.sol#1741-1743)
setSale() should be declared external:
        - Bitlectro.setSale() (flatDreams.sol#1766-1768)
isSaleStarted() should be declared external:
        - Bitlectro.isSaleStarted() (flatDreams.sol#1775-1777)
calculatePriceForToken(uint256) should be declared external:
        - Bitlectro.calculatePriceForToken(uint256) (flatDreams.sol#1808-1810)
addGiveawayUsers(address[]) should be declared external:
        - Bitlectro.addGiveawayUsers(address[]) (flatDreams.sol#1837-1846)
redeemGiveaway() should be declared external:
        - Bitlectro.redeemGiveaway() (flatDreams.sol#1852-1869)
unwrapToken(uint256) should be declared external:
        - Bitlectro.unwrapToken(uint256) (flatDreams.sol#1883-1891)
mint(uint256) should be declared external:
        - Bitlectro.mint(uint256) (flatDreams.sol#1896-1913)
companyMint(address) should be declared external:
        - Bitlectro.companyMint(address) (flatDreams.sol#1918-1926)
withdrawAll() should be declared external:
        - Bitlectro.withdrawAll() (flatDreams.sol#1931-1933)
```



```
Bitlectro.unwrapToken(uint256) (flatDreams.sol#1883-1891) compares to a boolean constant:
        -require(bool,string)(isUnwrapped(tokenId) == false,Token is already unwrapped) (fl
Bitlectro.mint(uint256) (flatDreams.sol#1896-1913) compares to a boolean constant:
        -require(bool,string)(saleState == true,Sale has not started) (flatDreams.sol#1898)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#boolean-equality
```



```
Bitlectro.bondingCurve(uint256) (flatDreams.sol#1785-1791) uses literals with too many digits:
        - 20000000000000000 (flatDreams.sol#1787)
Bitlectro.bondingCurve(uint256) (flatDreams.sol#1785-1791) uses literals with too many digits:
        - 10000000000000000 (flatDreams.sol#1789)
```

Concluding Remarks

While conducting the audits of Bitlectro Labs smart contract - DreamLoops.sol, it was observed that the contracts contain Medium and Low severity issues, along with a few areas of recommendations.

Our auditors suggest that Medium and Low severity issues should be resolved by the Bitlectro Labs developers. Resolving the areas of recommendations are up to the team's discretion. The recommendations given will improve the operations of the smart contract.

Disclaimer

ImmuneBytes's audit does not provide a security or correctness guarantee of the audited smart contract. Securing smart contracts is a multistep process, therefore running a bug bounty program as a complement to this audit is strongly recommended.

Our team does not endorse the Bitlectro Labs platform or its product neither this audit is investment advice.
Notes:

- Please make sure contracts deployed on the mainnet are the ones audited.
- Check for the code refactor by the team on critical issues.

ImmuneBytes Pvt Ltd.