NFT MarketPlace Smart Contract Preliminary Audit Report

Project Synopsis

Project Name	**NFT Market Place**
Platform	Ethereum, Solidity
Github Repo	Not Provided
Deployed Contract	Not Deployed
Total Duration	6 Days
Timeline of Audit	**21st April 2021 to 26th April 2021**

Contract Details

Total Contract(s)	3
Name of Contract(s)	**Collections, NFTFactory**
Language	Solidity
Commit Hash	Null

Contract Vulnerabilities Synopsis

Issues	Open Issues	Closed Issues
Critical Severity	1	0
Medium Severity	7	0
Low Severity	5	0
Informational	2	0
Total Found	15	0

Detailed Results

The contract has gone through several stages of the audit procedure that includes structural analysis, automated testing, manual code review etc.

All the issues have been explained and discussed in detail below. Along with the explanation of the issue found during the audit, the recommended way to overcome the issue or improve the code quality has also been mentioned.

A. Contract Name: Collections

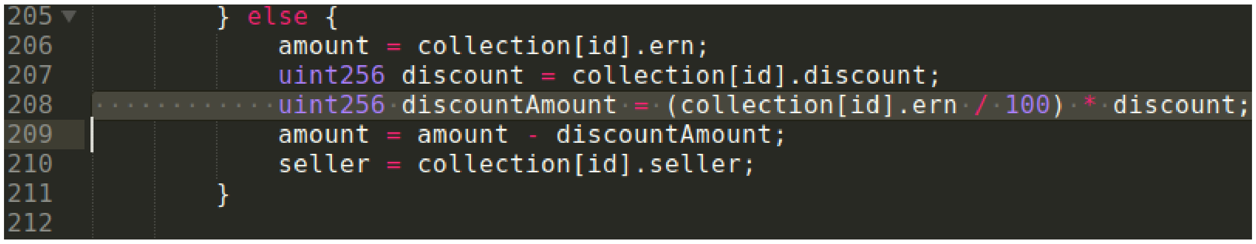
High Severity Issues

A.1 Multiplication is being performed on the result of Division

Line no - 208

***Explanation*:**

The ***buyByErn function*** in the Collections.sol contract performs multiplication on the result of a Division.



```
205          } else {
206              amount = collection[id].ern;
207              uint256 discount = collection[id].discount;
208              uint256 discountAmount = (collection[id].ern / 100) * discount;
209              amount = amount - discountAmount;
210              seller = collection[id].seller;
211          }
212
```

Integer Divisions in Solidity might truncate. Moreover, performing division before multiplication might lead to loss of precision.

The following functions involve division before multiplication in the mentioned lines:

- ***buyByErn** at 208*

Recommendation:

Solidity doesn't encourage arithmetic operations that involve division before multiplication. Therefore the above-mentioned function should be checked once and redesigned if they do not lead to expected results.

Medium Severity Issues

A.2 Contract State Variables are being updated after External Calls.

Line no - 213-218, 256-257

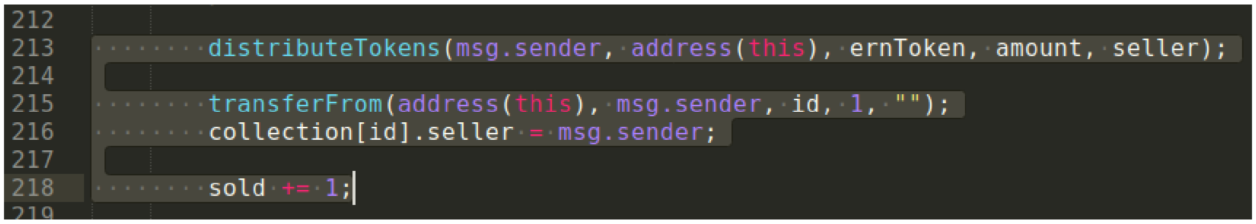
Explanation:

The Collections contract includes quite a few functions that update some of the very imperative state variables of the contract after the external calls are being made.

An external call within a function technically shifts the control flow of the contract to another contract for a particular period of time. Therefore, as per the Solidity Guidelines, any modification of the state variables in the base contract must be performed before executing the external call.
Updating state variables after an external call might lead to a potential re-entrancy scenario.

The following function in the contract update the state variables after making an external call:

- ***buyByErn*** *at Line 216 and 218.*
- ***buyByStones*** *at Line 257*



```
212
213         distributeTokens(msg.sender, address(this), ernToken, amount, seller);
214
215         transferFrom(address(this), msg.sender, id, 1, "");
216         collection[id].seller = msg.sender;
217
218         sold += 1;
219
```

Recommendation:

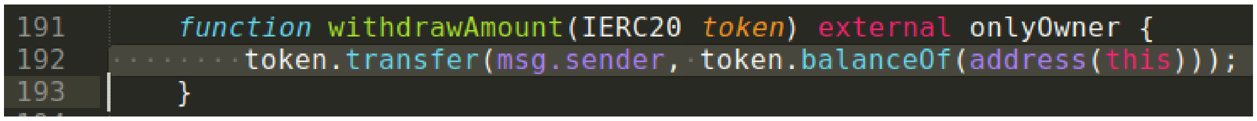
Modification of any State Variables must be performed before making an external call.

A.3 Return Value of an External Call is Not used Effectively

Line no - 192,256, 289-315,

Explanation:

The external calls made in the above-mentioned lines do return a boolean value that indicates whether or not the external call made was successful.
These boolean return values can be used in the function as a check to ensure that the further execution of the function is only allowed if the external is successfully made.



```
    function withdrawAmount(IERC20 token) external onlyOwner {
        token.transfer(msg.sender, token.balanceOf(address(this)));
    }
```

However, the Collections contract never uses these return values throughout the contract.

Recommendation:
Effective use of all the return values from external calls must be ensured within the contract.

A.4 Violation of Check_Effects_Interaction Pattern

Line no - 167, 220, 259, 152, 122

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

However, the following functions in the Collections contract emit events after the external call has been made at the line number mentioned above:

- ***addCard***
- ***buyByErn***
- ***buyByStones***
- ***cancelSale***
- ***cardTransfer***

Recommendation:
[Check Effects Interaction Pattern](#) must be followed while implementing external calls in a function

A.5 Loops are extremely costly

Line no: 136, 182

Description:
The ***for loops,*** at the above-mentioned lines, in the contract includes state variables like ***.length*** of a non-memory array, in the condition of the for loops.
As a result, these state variables consume a lot more extra gas for every iteration of the for loop.
The following functions include such loops at the above-mentioned lines:

- ***cardTransferBatch function***
- ***addCardBatch***

Recommendation:
Its quite effective to use a local variable instead of a state variable like **.length** in a loop.
For instance,
uint256 local_variable = ids.length;
for (uint24 i = 0; i <local_variable; i++) {
        addCard(sellers[i], ids[i], erns[i], stones[i], discounts[i]);
    }

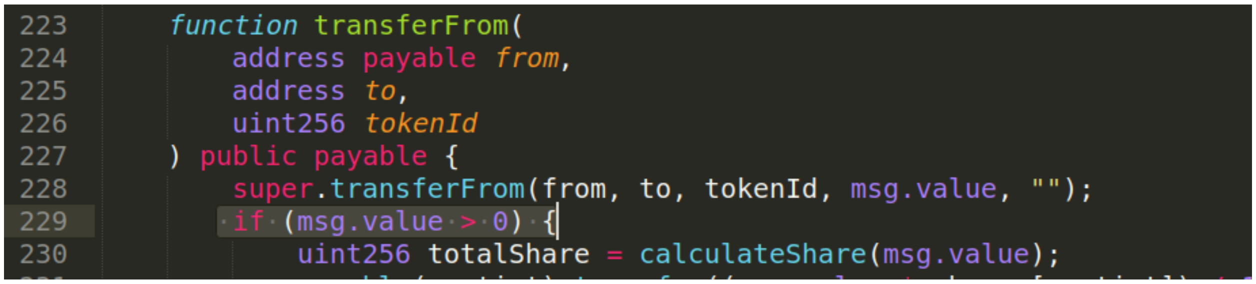
A.6 transferFrom function should include "*require*" statement instead of IF-Else Statement

Line no: 320-322

Explanation

The ***transferFrom*** function includes an **if statement** at the very beginning of the function to check whether or not the **msg.value** sent while calling this function, is greater than **ZERO**.
Most importantly, the function body is only executed if this **IF statement** holds true.

In order to check for such **strict validations** in a function, **require statements** are more preferable and effective solidity. While it helps in gas optimizations it also enhances the readability of the code.



```
    function transferFrom(
        address payable from,
        address to,
        uint256 tokenId
    ) public payable {
        super.transferFrom(from, to, tokenId, msg.value, "");
        if (msg.value > 0) {
            uint256 totalShare = calculateShare(msg.value);
```

Recommendation

Use **require statement** instead of **IF statement** in the above-mentioned function line.
For instance,
require(msg.value > 0, "Error MSG: msg.value should be more than ZERO");

A.7 addShares function does not include Zero Address Validation

Line no: 60

Explanation:

The **addShares** function initializes some of the most imperative state variables in the Collections.sol contract and assigns their respective share amount.

However, during the automated testing of the contract, it was found that the function doesn't implement any Zero Address Validation Check to ensure that no zero address is passed while calling this function.

Recommendation:
Since the **addFunction** initializes imperative addresses and assigns share amount to those addresses, it is quite crucial to implement zero address checks and ensure that only valid addresses are updated while calling this function.

Low Severity Issues

A.8 External Visibility should be preferred

Explanation:

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:

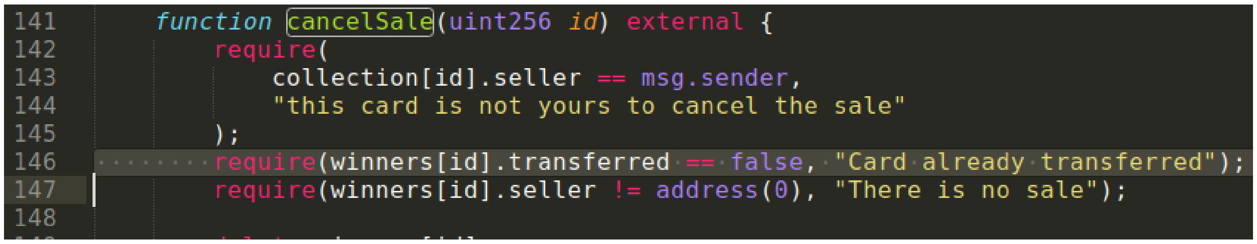
- ***addShares***
- ***addCardBatch***
- ***transferFrom***

Recommendation:
External Visibility should be preferred for the above-mentioned functions.

A.9 Comparison to boolean Constant

Line no: 146

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.



```
141     function cancelSale(uint256 id) external {
142         require(
143             collection[id].seller == msg.sender,
144             "this card is not yours to cancel the sale"
145         );
146         require(winners[id].transferred == false, "Card already transferred");
147         require(winners[id].seller != address(0), "There is no sale");
148
```

Recommendation:

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

A.10 Functions with similar names should be avoided

Line no - 223
Description:
The Collections.sol contract includes two with exactly similar names.

Since every function has different behavior, it is considered a better practice to avoid similar names for 2 different functions to eliminate any dilemma and enhance the readability of the code.

Mentioned below are the function(s) with similar names but different behavior and arguments:

- ***transferFrom - Collections.sol contract #Line223***
- ***transferFrom - ERC1155.sol contract #Line148***

Recommended:
It is recommended to avoid using a similar name for different functions.

A.11 Order of layout

Description:
As per the Solidity Style Guide, the order of elements and statements should be according to the following layout:

a. Pragma statements

b. Import statements

c. Interfaces

d. Libraries

e. Contracts

Inside each contract, library or interface, use the following order:

a. Type declarations

b. State variables

c. Events

d. Functions

The following documentation links can be used as a reference to understand the correct order: -
https://solidity.readthedocs.io/en/v0.8.0/style-guide.html#order-of-layout

https://solidity.readthedocs.io/en/v0.8.0/style-guide.html#order-of-functions

B. Contract Name: NFT Factory

Medium Severity Issues

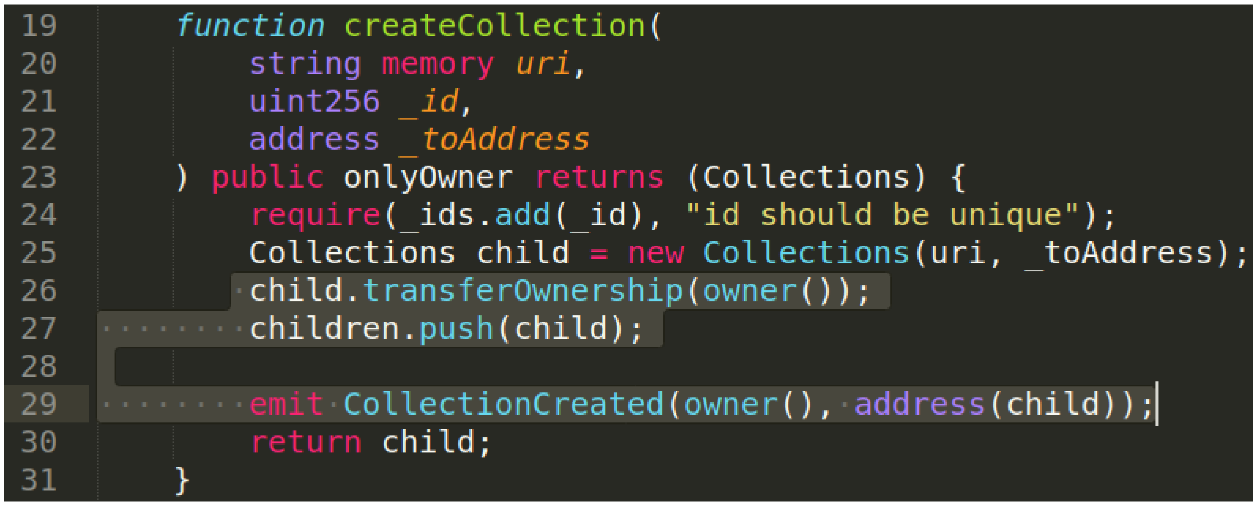
B.1 State Variables are being updated after External Calls. Violation of Check-Effects-Interaction Pattern

Line no - 26-29

Explanation:

The NFTFactory contract includes a function that updates a state variable after making an external call.
Moreover, as per the Check_Effects_Interaction Pattern in Solidity, external calls should be made at the very end of the function and event emission, as well as any state variable modification or event emission, must be done before the external call is made.
However, the following function in the Collections contract updates a state variable and emits events after the external call has been made at the line number mentioned above:

- ***createCollection function*** *at Line 27-29*



```
    function createCollection(
        string memory uri,
        uint256 _id,
        address _toAddress
    ) public onlyOwner returns (Collections) {
        require(_ids.add(_id), "id should be unique");
        Collections child = new Collections(uri, _toAddress);
        child.transferOwnership(owner());
        children.push(child);

        emit CollectionCreated(owner(), address(child));
        return child;
    }
```

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

Low Severity Issues

B.2 External Visibility should be preferred

Explanation:

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:

- ***createCollection***

Recommendation:
External Visibility should be preferred for the above-mentioned functions.

Informational

1. **Coding Style Issues**
   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.
   Therefore, it is highly recommended to fix the issues like naming convention, indentation, and code layout issues in a smart contract.

2. NatSpec Annotations must be included

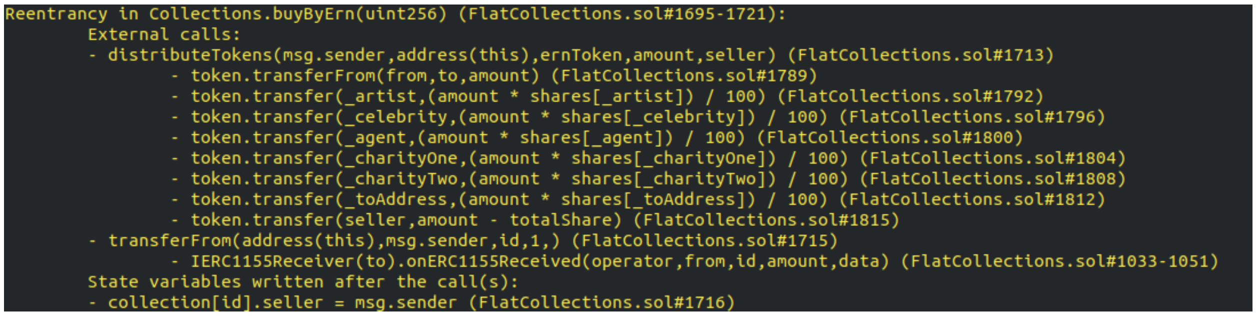
Description:

The smart contracts do not include the NatSpec annotations adequately.

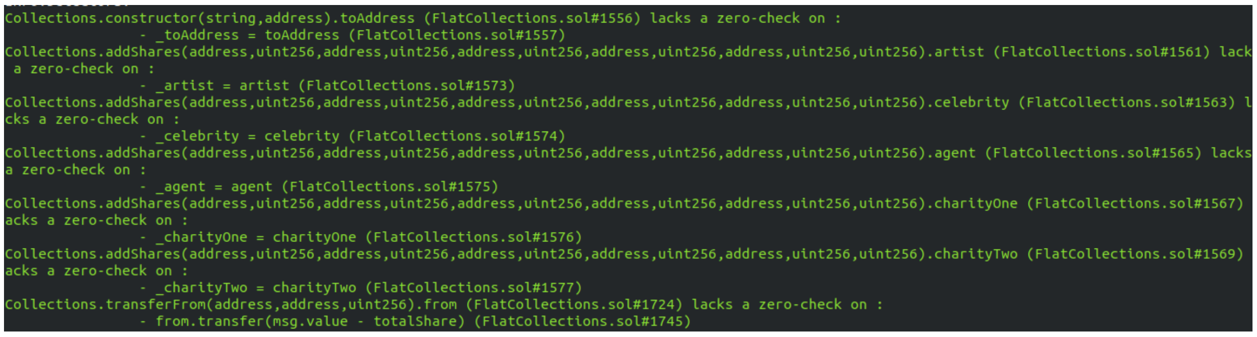
Recommendation:

Cover by NatSpec all Contract methods.

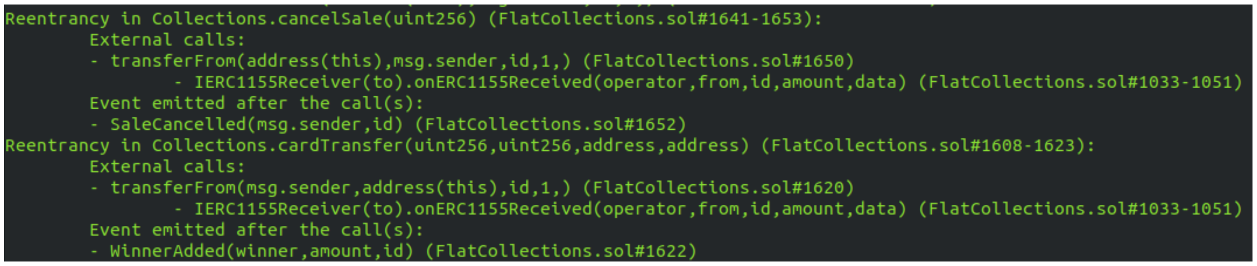
Automated Test Results



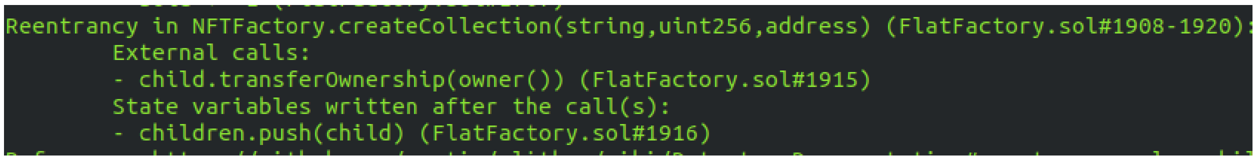
```
Reentrancy in Collections.buyByErn(uint256) (FlatCollections.sol#1695-1721):
        External calls:
        - distributeTokens(msg.sender,address(this),ernToken,amount,seller) (FlatCollections.sol#1713)
                - token.transferFrom(from,to,amount) (FlatCollections.sol#1789)
                - token.transfer(_artist,(amount * shares[_artist]) / 100) (FlatCollections.sol#1792)
                - token.transfer(_celebrity,(amount * shares[_celebrity]) / 100) (FlatCollections.sol#1796)
                - token.transfer(_agent,(amount * shares[_agent]) / 100) (FlatCollections.sol#1800)
                - token.transfer(_charityOne,(amount * shares[_charityOne]) / 100) (FlatCollections.sol#1804)
                - token.transfer(_charityTwo,(amount * shares[_charityTwo]) / 100) (FlatCollections.sol#1808)
                - token.transfer(_toAddress,(amount * shares[_toAddress]) / 100) (FlatCollections.sol#1812)
                - token.transfer(seller,amount - totalShare) (FlatCollections.sol#1815)
        - transferFrom(address(this),msg.sender,id,1,) (FlatCollections.sol#1715)
                - IERC1155Receiver(to).onERC1155Received(operator,from,id,amount,data) (FlatCollections.sol#1033-1051)
        State variables written after the call(s):
        - collection[id].seller = msg.sender (FlatCollections.sol#1716)
```



```
Collections.constructor(string,address).toAddress (FlatCollections.sol#1556) lacks a zero-check on :
                - _toAddress = toAddress (FlatCollections.sol#1557)
Collections.addShares(address,uint256,address,uint256,address,uint256,address,uint256,address,uint256,uint256).artist (FlatCollections.sol#1561) lack
 a zero-check on :
                - _artist = artist (FlatCollections.sol#1573)
Collections.addShares(address,uint256,address,uint256,address,uint256,address,uint256,address,uint256,uint256).celebrity (FlatCollections.sol#1563) l
cks a zero-check on :
                - _celebrity = celebrity (FlatCollections.sol#1574)
Collections.addShares(address,uint256,address,uint256,address,uint256,address,uint256,address,uint256,uint256).agent (FlatCollections.sol#1565) lacks
a zero-check on :
                - _agent = agent (FlatCollections.sol#1575)
Collections.addShares(address,uint256,address,uint256,address,uint256,address,uint256,address,uint256,uint256).charityOne (FlatCollections.sol#1567)
acks a zero-check on :
                - _charityOne = charityOne (FlatCollections.sol#1576)
Collections.addShares(address,uint256,address,uint256,address,uint256,address,uint256,address,uint256,uint256).charityTwo (FlatCollections.sol#1569)
acks a zero-check on :
                - _charityTwo = charityTwo (FlatCollections.sol#1577)
Collections.transferFrom(address,address,uint256).from (FlatCollections.sol#1724) lacks a zero-check on :
                - from.transfer(msg.value - totalShare) (FlatCollections.sol#1745)
```



```
Reentrancy in Collections.cancelSale(uint256) (FlatCollections.sol#1641-1653):
        External calls:
        - transferFrom(address(this),msg.sender,id,1,) (FlatCollections.sol#1650)
                - IERC1155Receiver(to).onERC1155Received(operator,from,id,amount,data) (FlatCollections.sol#1033-1051)
        Event emitted after the call(s):
        - SaleCancelled(msg.sender,id) (FlatCollections.sol#1652)
Reentrancy in Collections.cardTransfer(uint256,uint256,address,address) (FlatCollections.sol#1608-1623):
        External calls:
        - transferFrom(msg.sender,address(this),id,1,) (FlatCollections.sol#1620)
                - IERC1155Receiver(to).onERC1155Received(operator,from,id,amount,data) (FlatCollections.sol#1033-1051)
        Event emitted after the call(s):
        - WinnerAdded(winner,amount,id) (FlatCollections.sol#1622)
```



```
Reentrancy in NFTFactory.createCollection(string,uint256,address) (FlatFactory.sol#1908-1920):
        External calls:
        - child.transferOwnership(owner()) (FlatFactory.sol#1915)
        State variables written after the call(s):
        - children.push(child) (FlatFactory.sol#1916)
```