

```

1 // SPDX-License-Identifier: MIT
2 // OpenZeppelin Contracts (last updated v4.5.0) (access/AccessControlEnumerable.sol)
3
4 pragma solidity ^0.8.0;
5
6 import "./IAccessControlEnumerable.sol";
7 import "./AccessControl.sol";
8 import "../utils/structs/EnumerableSet.sol";
9
10 /**
11  * @dev Extension of {AccessControl} that allows enumerating the members of each role.
12  */
13 abstract contract AccessControlEnumerable is IAccessControlEnumerable, AccessControl {
14     using EnumerableSet for EnumerableSet.AddressSet;
15
16     mapping(bytes32 => EnumerableSet.AddressSet) private _roleMembers;
17
18     /**
19      * @dev See {IERC165-supportsInterface}.
20      */
21     function supportsInterface(bytes4 interfaceId) public view virtual override
22     returns (bool) {
23         return interfaceId == type(IAccessControlEnumerable).interfaceId || super.
24             supportsInterface(interfaceId);
25     }
26
27     /**
28      * @dev Returns one of the accounts that have `role`. `index` must be a
29      * value between 0 and {getRoleMemberCount}, non-inclusive.
30      *
31      * Role bearers are not sorted in any particular way, and their ordering may
32      * change at any point.
33      *
34      * WARNING: When using {getRoleMember} and {getRoleMemberCount}, make sure
35      * you perform all queries on the same block. See the following
36      * https://forum.openzeppelin.com/t/iterating-over-elements-on-enumerableset-in-open-zeppelin-contracts/2296 [forum post]
37      * for more information.
38      */
39     function getRoleMember(bytes32 role, uint256 index) public view virtual override
40     returns (address) {
41         return _roleMembers[role].at(index);
42     }
43
44     /**
45      * @dev Returns the number of accounts that have `role`. Can be used
46      * together with {getRoleMember} to enumerate all bearers of a role.
47      */
48     function getRoleMemberCount(bytes32 role) public view virtual override returns (
49     uint256) {
50         return _roleMembers[role].length();
51     }
52
53     /**
54      * @dev Overload {_grantRole} to track enumerable memberships
55      */
56     function _grantRole(bytes32 role, address account) internal virtual override {
57         super._grantRole(role, account);
58         _roleMembers[role].add(account);
59     }
60
61     /**
62      * @dev Overload {_revokeRole} to track enumerable memberships
63      */
64     function _revokeRole(bytes32 role, address account) internal virtual override {
65         super._revokeRole(role, account);
66         _roleMembers[role].remove(account);
67     }
68 }

```