



Experiment 4

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1. Aim: To optimize the performance of the EcoTrack React application using memoization techniques and code splitting, and to enhance the user interface using enterprise-grade Material UI components.

2. Objective:

- Understand the causes of unnecessary re-renders in React applications
- Optimize React components using React.memo to prevent avoidable re-renders
- Apply useMemo to efficiently compute derived data and avoid redundant calculations
- Use useCallback to memoize event handler functions and improve component performance
- Implement lazy loading of components and routes using React.lazy and Suspense
- Reduce initial bundle size and improve application load performance through code splitting
- Enhance the visual appearance and usability of the EcoTrack application using Material UI components
- Design a clean, consistent, and responsive user interface using Material UI layouts and typography

3. Implementation / Code:

Tools & Technologies Used:-

- React.js
- React Hooks (useMemo, useCallback)
- React Memo (React.memo)
- Material UI (MUI)
- JavaScript (ES6)
- VS Code
- Web Browser (Google Chrome / Firefox)

Implementation Description:-

- The EcoTrack application is optimized to improve **performance and user experience**.
- **Unnecessary component re-renders** are reduced using React.memo, which ensures components re-render only when their props change.

- The useMemo hook is used to memoize **expensive calculations**, preventing repeated execution on every render.
- The useCallback hook is applied to memoize **event handler functions**, ensuring stable function references across renders.
- Material UI components such as Container, Typography, Button, List, and Divider are used to create a **professional, responsive, and consistent UI**.
- The optimized structure improves application scalability, performance, and maintainability.

Sample Code Snippet:-

```
EcoItem.jsx U X
experiment-4-memoization > ecotrack > src > components > EcoItem.jsx > ...
1  import React from "react";
2  import { ListItem, ListItemText } from "@mui/material";
3
4  const EcoItem = React.memo(({ name }) => {
5    console.log("Item rendered:", name);
6    return (
7      <ListItem>
8        <ListItemText primary={name} />
9      </ListItem>
10    );
11  });
12
13  export default EcoItem;
14
```

```
EcoList.jsx U X
experiment-4-memoization > ecotrack > src > components > EcoList.
1  import { List } from "@mui/material";
2  import EcoItem from "../EcoItem";
3
4  function EcoList({ items }) {
5    return (
6      <List>
7        {items.map((item) => (
8          <EcoItem key={item} name={item} />
9        ))}
10      </List>
11    );
12  }
13
14  export default EcoList;
15
```

ImpactCalculator.jsx U X

experiment-4-memoization > ecotrack > src > components > ImpactCa

```
1  import { Typography } from "@mui/material";
2  import { useMemo } from "react";
3
4  function ImpactCalculator({ value }) {
5    const result = useMemo(() => {
6      console.log("Calculating impact...");
7      let total = 0;
8      for (let i = 0; i < 1000000; i++) {
9        total += value;
10     }
11     return total;
12   }, [value]);
13
14   return (
15     <Typography>
16       Environmental Impact: {result}
17     </Typography>
18   );
19 }
20
21 export default ImpactCalculator;
22
```

MemoButton.jsx U X

experiment-4-memoization > ecotrack > src > components > MemoButton.j

```
1  import React from "react";
2  import { Button } from "@mui/material";
3
4  const MemoButton = React.memo(({ text, onClick }) => {
5    console.log("Button rendered");
6    return (
7      <Button variant="contained" onClick={onClick}>
8        {text}
9      </Button>
10    );
11  });
12
13 export default MemoButton;
14
```

App.jsx U X

experiment-4-memoization > ecotrack > src > App.jsx > App

```
8  function App() {
10
11
12
13
14
15
16
17
18
19
20
21    return (
22      <Container sx={{ mt: 4 }}>
23        {/* App Title */}
24        <Typography variant="h4" gutterBottom>
25          EcoTrack App
26        </Typography>
27
28        {/* Counter Section */}
29        <Typography variant="h6">
30          Count: {count}
31        </Typography>
32
33        <MemoButton
34          text="Increase Count"
35          onClick={increaseCount}
36        />
37
38        <Divider sx={{ my: 3 }} />
39
40        {/* Impact Section */}
41        <Typography variant="h6">
42          Environmental Impact Value
43        </Typography>
44
45        <MemoButton
46          text="Increase Impact"
47          onClick={() => setImpact((prev) => prev + 1)}
48        />
49
50        <ImpactCalculator value={impact} />
51
52        <Divider sx={{ my: 3 }} />
53
54        {/* List Section */}
55        <Typography variant="h6">
56          Eco Items
57        </Typography>
58
59        <EcoList items={ecoItems} />
60      </Container>
61    );
62  }
```

4. Output:

- The EcoTrack application renders efficiently with reduced unnecessary re-renders



- Memoized components render only when required
- Expensive computations execute only when dependent values change
- Event handlers remain stable across renders
- Application UI is clean, responsive, and visually consistent
- Performance improvement is observed during state updates
- Material UI enhances professional appearance and usability

EcoTrack App

Count: 1

INCREASE COUNT

Environmental Impact Value

INCREASE IMPACT

Environmental Impact: 3000000

Eco Items

Tree

Water

Energy

5. Learning Outcomes (What I Have Learnt):

- Identify causes of performance issues in React applications
- Use React.memo to optimize component rendering
- Apply useMemo for expensive calculations
- Implement useCallback to optimize event handlers
- Improve application performance and scalability
- Use Material UI for enterprise-grade UI design
- Build efficient, optimized, and professional React applications