Experiment 4

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Branch: CSE **Section/Group: KRG 3-B**
Semester: 6th **Date of Performance:03/02/2026**
Subject Name: Full Stack Development – II **Subject Code: 23CSH-309**

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:-

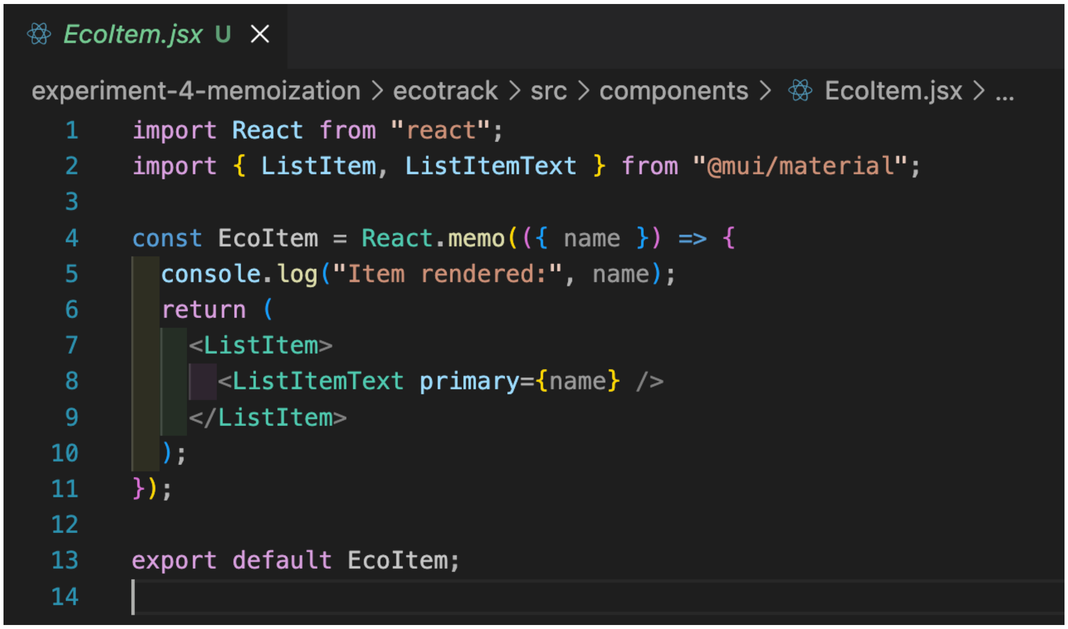
- React.js
- React Hooks (useMemo, useCallback)
- React Memo (React.memo)
- Material UI (MUI)
- JavaScript (ES6)
- VS Code
- Web Browser (Google Chrome / Firefox)

Implementation Description:-

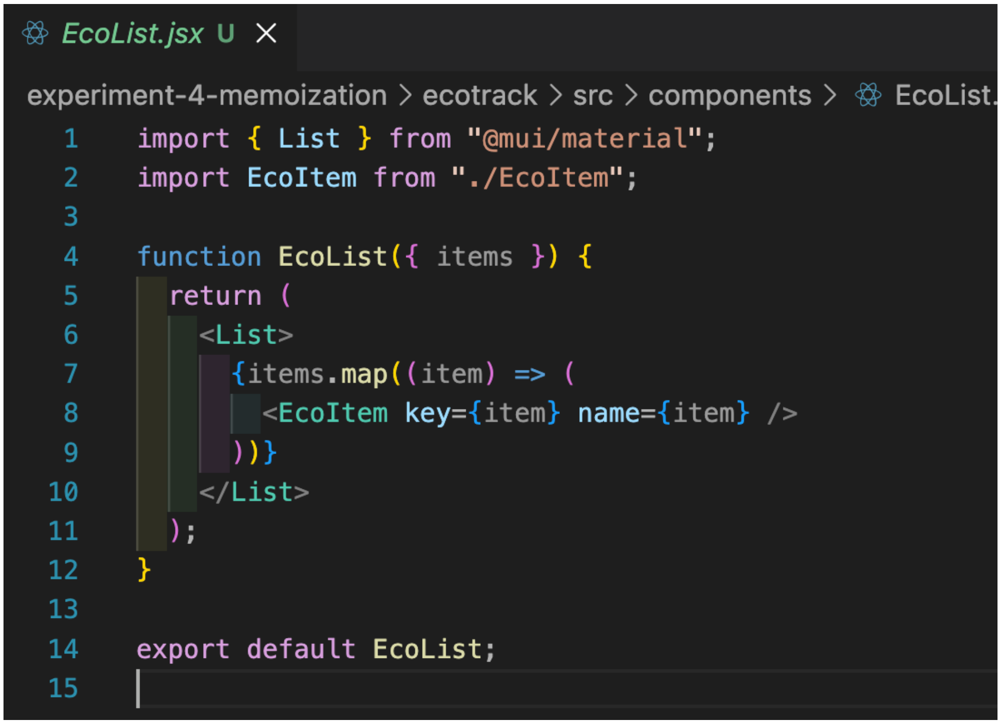
- The EcoTrack application is optimized to improve **performance and user experience**.
- **Unnecessary component re-renders** are reduced using React.memo, which ensures components re-render only when their props change.

- 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.

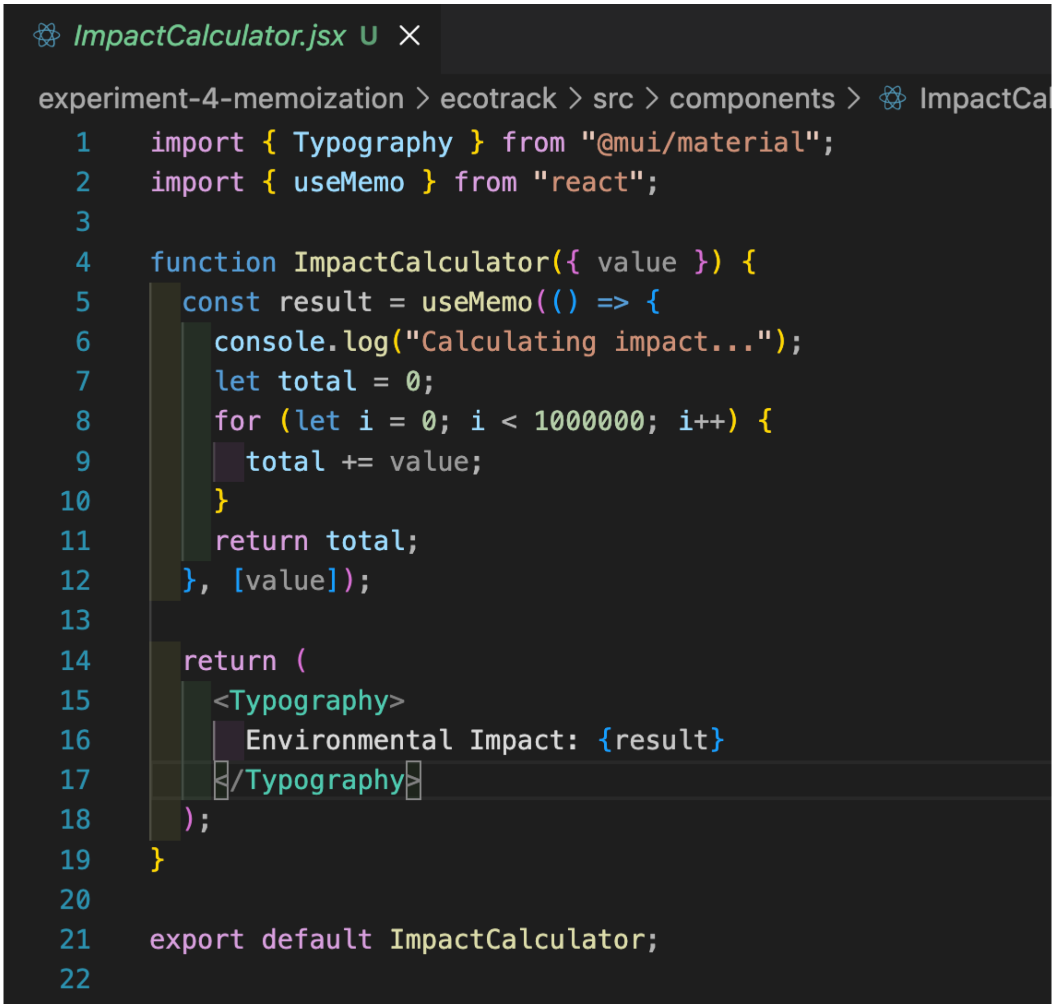
Sample Code Snippet:-


EcoItem.jsx U ×
experiment-4-memoization > ecotrack > src > components > EcoItem.jsx > ...

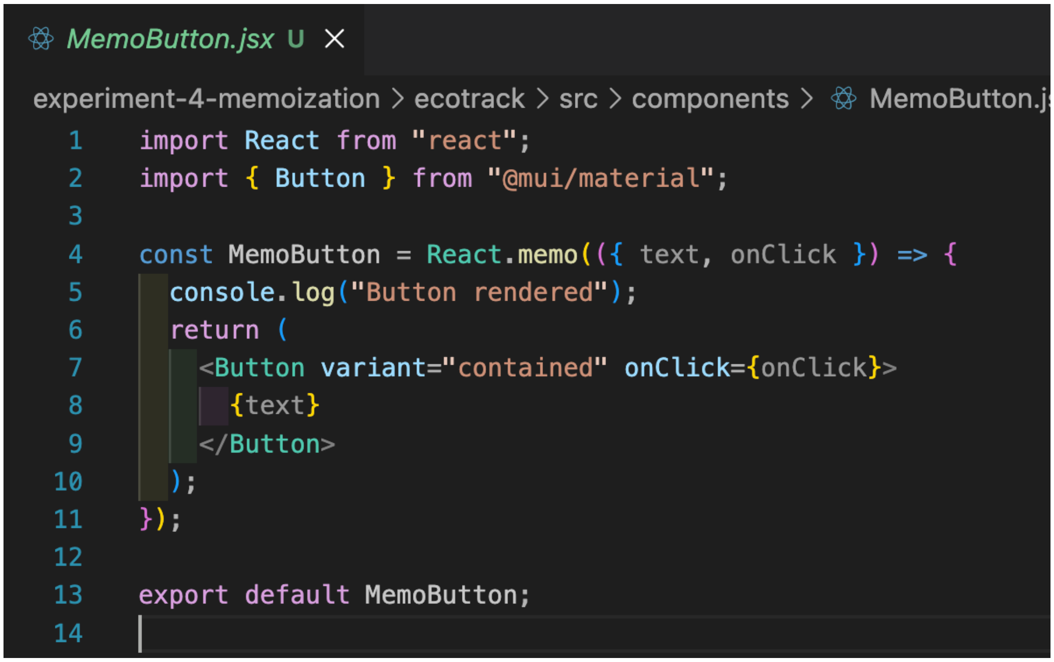
```jsx
import React from "react";
import { ListItem, ListItemText } from "@mui/material";

const EcoItem = React.memo(({ name }) => {
  console.log("Item rendered:", name);
  return (
    <ListItem>
      <ListItemText primary={name} />
    </ListItem>
  );
});

export default EcoItem;

```


EcoList.jsx U ×
experiment-4-memoization > ecotrack > src > components > EcoList.

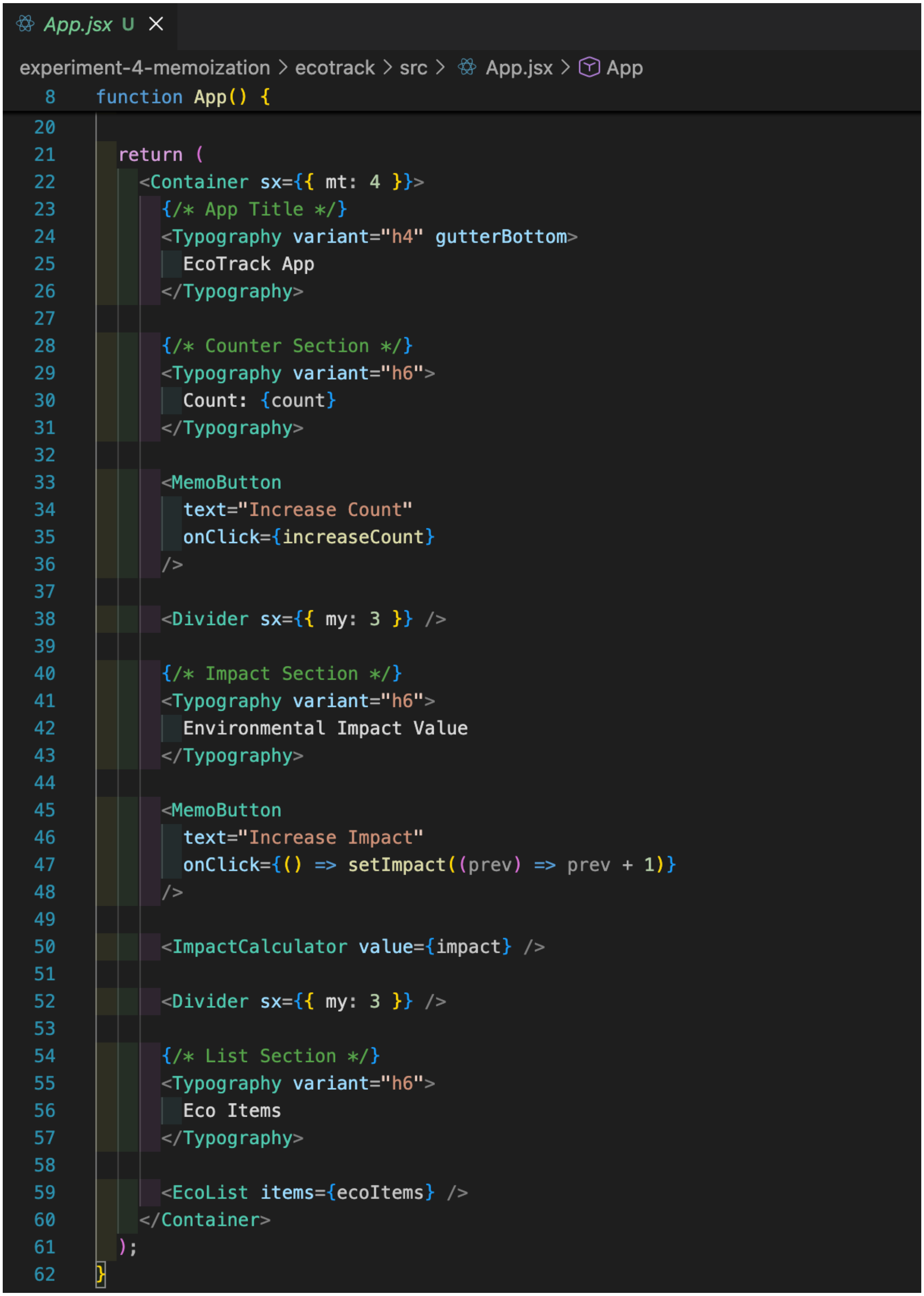
```jsx
import { List } from "@mui/material";
import EcoItem from "./EcoItem";

function EcoList({ items }) {
  return (
    <List>
      {items.map((item) => (
        <EcoItem key={item} name={item} />
      ))}
    </List>
  );
}

export default EcoList;

```


ImpactCalculator.jsx U
experiment-4-memoization > ecotrack > src > components > ImpactCal

```jsx
import { Typography } from "@mui/material";
import { useMemo } from "react";

function ImpactCalculator({ value }) {
  const result = useMemo(() => {
    console.log("Calculating impact...");
    let total = 0;
    for (let i = 0; i < 1000000; i++) {
      total += value;
    }
    return total;
  }, [value]);

  return (
    <Typography>
      Environmental Impact: {result}
    </Typography>
  );
}

export default ImpactCalculator;

```


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

```jsx
import React from "react";
import { Button } from "@mui/material";

const MemoButton = React.memo(({ text, onClick }) => {
  console.log("Button rendered");
  return (
    <Button variant="contained" onClick={onClick}>
      {text}
    </Button>
  );
});

export default MemoButton;

```

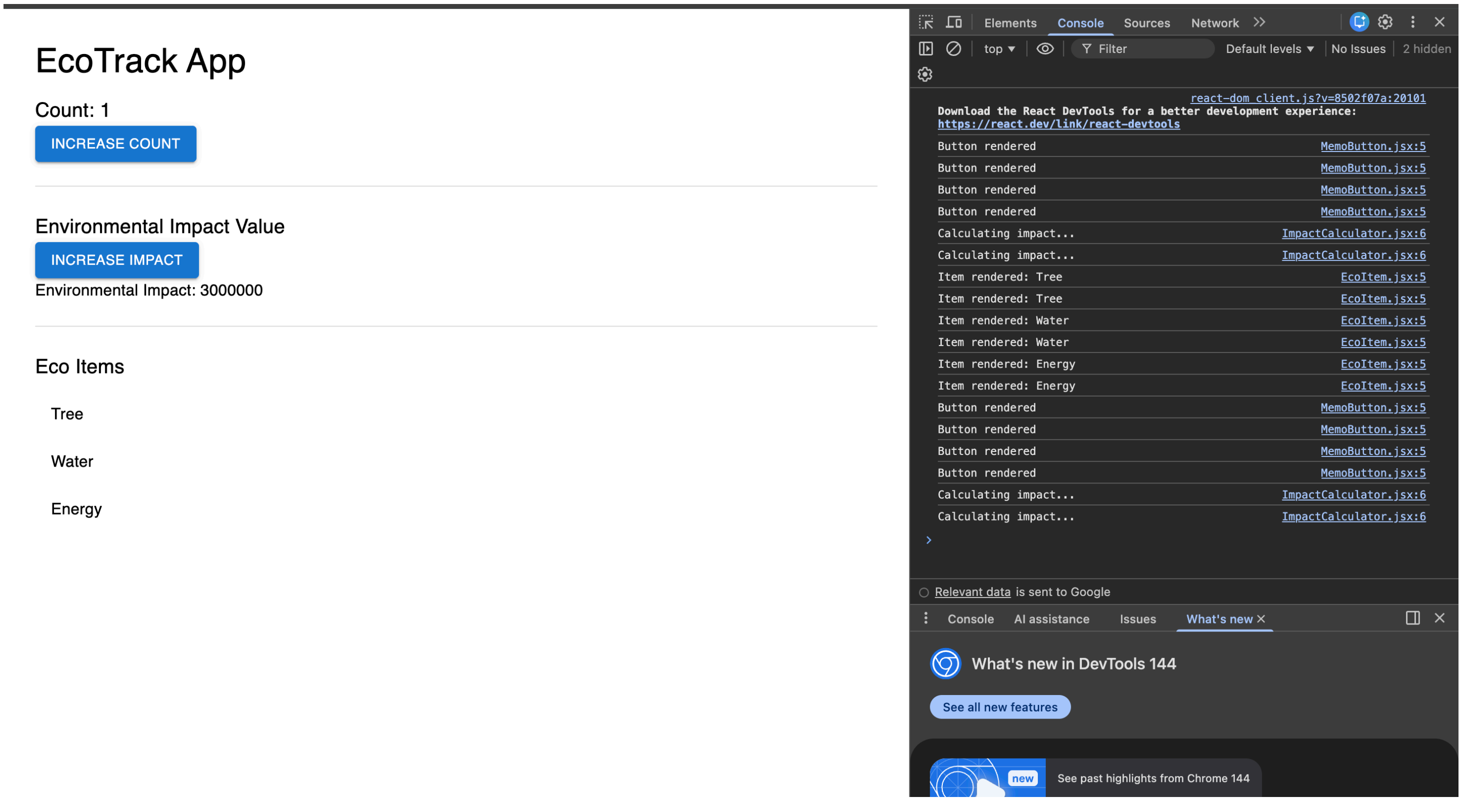


```jsx
function App() {

  return (
    <Container sx={{ mt: 4 }}>
      {/* App Title */}
      <Typography variant="h4" gutterBottom>
        EcoTrack App
      </Typography>

      {/* Counter Section */}
      <Typography variant="h6">
        Count: {count}
      </Typography>

      <MemoButton
        text="Increase Count"
        onClick={increaseCount}
      />

      <Divider sx={{ my: 3 }} />

      {/* Impact Section */}
      <Typography variant="h6">
        Environmental Impact Value
      </Typography>

      <MemoButton
        text="Increase Impact"
        onClick={() => setImpact((prev) => prev + 1)}
      />

      <ImpactCalculator value={impact} />

      <Divider sx={{ my: 3 }} />

      {/* List Section */}
      <Typography variant="h6">
        Eco Items
      </Typography>

      <EcoList items={ecoItems} />
    </Container>
  );
}
```

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

```
                                    react-dom_client.js?v=8502f07a:20101
Download the React DevTools for a better development experience:
https://react.dev/link/react-devtools
Button rendered                                      MemoButton.jsx:5
Button rendered                                      MemoButton.jsx:5
Button rendered                                      MemoButton.jsx:5
Button rendered                                      MemoButton.jsx:5
Calculating impact...                          ImpactCalculator.jsx:6
Calculating impact...                          ImpactCalculator.jsx:6
Item rendered: Tree                                     EcoItem.jsx:5
Item rendered: Tree                                     EcoItem.jsx:5
Item rendered: Water                                    EcoItem.jsx:5
Item rendered: Water                                    EcoItem.jsx:5
Item rendered: Energy                                   EcoItem.jsx:5
Item rendered: Energy                                   EcoItem.jsx:5
Button rendered                                      MemoButton.jsx:5
Button rendered                                      MemoButton.jsx:5
Button rendered                                      MemoButton.jsx:5
Button rendered                                      MemoButton.jsx:5
Calculating impact...                          ImpactCalculator.jsx:6
Calculating impact...                          ImpactCalculator.jsx:6
>
```

Relevant data is sent to Google
Console
AI assistance
Issues
What's new
What's new in DevTools 144
See all new features
new
See past highlights from Chrome 144

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