



# DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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## Experiment 4

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**Semester:** 6<sup>th</sup>

**Date of Performance:** 03/02/26

**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: After completing this experiment, the student will be able to:**

- 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:**

- src/App.jsx - Added React.lazy and Suspense for code splitting
- src/components/Header.jsx - Added React.memo, useCallback, and Material UI components
- src/pages/Logs.jsx - Added useMemo for filtering and Material UI components
- src/pages/dashboard.jsx - Added useMemo, useCallback, and Material UI components



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- src/pages/login.jsx - Added useCallback and Material UI components
- src/routes/ProtectedRoute.jsx - Added React.memo and cleaned up formatting

## App.jsx:

```
import { lazy, Suspense } from "react";
import { BrowserRouter, Routes, Route } from "react-router-dom";
import { CircularProgress, Box } from "@mui/material";

import Header from "./components/Header";
import ProtectedRoute from "./routes/ProtectedRoute";

// Lazy loading components - they load only when needed
const Logs = lazy(() => import("./pages/Logs"));
const Dashboard = lazy(() => import("./pages/dashboard"));
const Login = lazy(() => import("./pages/login"));
const DashboardLayout = lazy(() => import("./pages/dashboardlayout"));
const DashboardSummary = lazy(() => import("./pages/dashboardsummary"));
const DashboardAnalytics = lazy(() => import("./pages/dashboardanalytics"));

// Loading fallback component
const LoadingFallback = () => (
  <Box sx={{ display: 'flex', justifyContent: 'center', alignItems: 'center', height: '100vh' }}>
    <CircularProgress size={60} />
  </Box>
);

function App() {
  return (
    <BrowserRouter>
      <Suspense fallback={<LoadingFallback />}>
        <Routes>
          <Route path="/login" element={<Login />} />
          <Route
            path="/"
            element={
              <ProtectedRoute>

```



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```
<Header />
<DashboardLayout />
</ProtectedRoute>
}
>
<Route index element={<Dashboard />} />
<Route path="summary" element={<DashboardSummary />} />
<Route path="analytics" element={<DashboardAnalytics />} />
<Route path="logs" element={<Logs />} />
</Route>
</Routes>
</Suspense>
</BrowserRouter>
);
}
```

export default App;

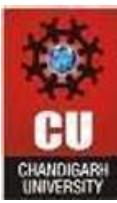
## dashboard.jsx:

```
import { useDispatch, useSelector } from 'react-redux';
import { useEffect, useMemo, useCallback } from 'react';
import { fetchLogs } from '../store/logSlice';
import { Box, Typography, List, ListItem, Button, CircularProgress, Paper } from
  '@mui/material';
import RefreshIcon from '@mui/icons-material/Refresh';

const Dashboard = () => {
  const dispatch = useDispatch();
  const { data: logs, status } = useSelector((state) => state.logs);

  useEffect(() => {
    if (status === 'idle') {
      dispatch(fetchLogs());
    }
  }, [status, dispatch]);

  // useCallback memoizes the function to prevent recreation on every render
  const handleRefresh = useCallback(() => {
    dispatch(fetchLogs());
  }, [dispatch]);
}
```



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}, [dispatch]);

```
if (status === 'loading') {
  return (
    <Box sx={{ display: 'flex', justifyContent: 'center', alignItems: 'center', height: '50vh' }}>
      <CircularProgress />
    </Box>
  );
}
```

// useMemo prevents recalculating totals on every render

```
const totalActivities = useMemo(() => {
  return logs.reduce((acc, log) => {
    acc[log.activity] = (acc[log.activity] || 0) + log.carbon;
    return acc;
  }, {});
}, [logs]);
```

// useMemo for filtering operations

```
const highCarbon = useMemo(() => logs.filter(log => log.carbon > 4), [logs]);
const lowCarbon = useMemo(() => logs.filter(log => log.carbon <= 4), [logs]);
```

return (

```
<Box sx={{ p: 3 }}>
  <Paper elevation={3} sx={{ p: 3, mb: 3 }}>
    <Typography variant="h4" gutterBottom>Total Activities</Typography>
    <List>
      {Object.entries(totalActivities).map(([activity, carbon]) => (
        <ListItem key={activity}>
          <Typography>{activity}: {carbon} Kg CO2</Typography>
        </ListItem>
      ))}
    </List>
  </Paper>
```

```
<Paper elevation={3} sx={{ p: 2, mb: 2, backgroundColor: '#ffeb3b' }}>
  <Typography variant="h5" sx={{ color: '#d32f2f', mb: 1 }}>High Carbon (&gt; 4 Kg)</Typography>
```



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```
<List>
  {highCarbon.map((log) => (
    <ListItem key={log.id}>
      <Typography>{log.activity}</Typography>
    </ListItem>
  )))
</List>
</Paper>

<Paper elevation={3} sx={{ p: 2, mb: 3, backgroundColor: '#e8f5e9' }}>
  <Typography variant="h5" sx={{ color: '#2e7d32', mb: 1 }}>Low Carbon ( $\leq$  4
Kg)</Typography>
  <List>
    {lowCarbon.map((log) => (
      <ListItem key={log.id}>
        <Typography>{log.activity}</Typography>
      </ListItem>
    )))
  </List>
</Paper>

<Button
  variant="contained"
  color="primary"
  startIcon={<RefreshIcon />}
  onClick={handleRefresh}
  disabled={status === 'loading'}
>
  {status === 'loading' ? 'Loading...' : 'Refresh Logs'}
</Button>
</Box>
);
};

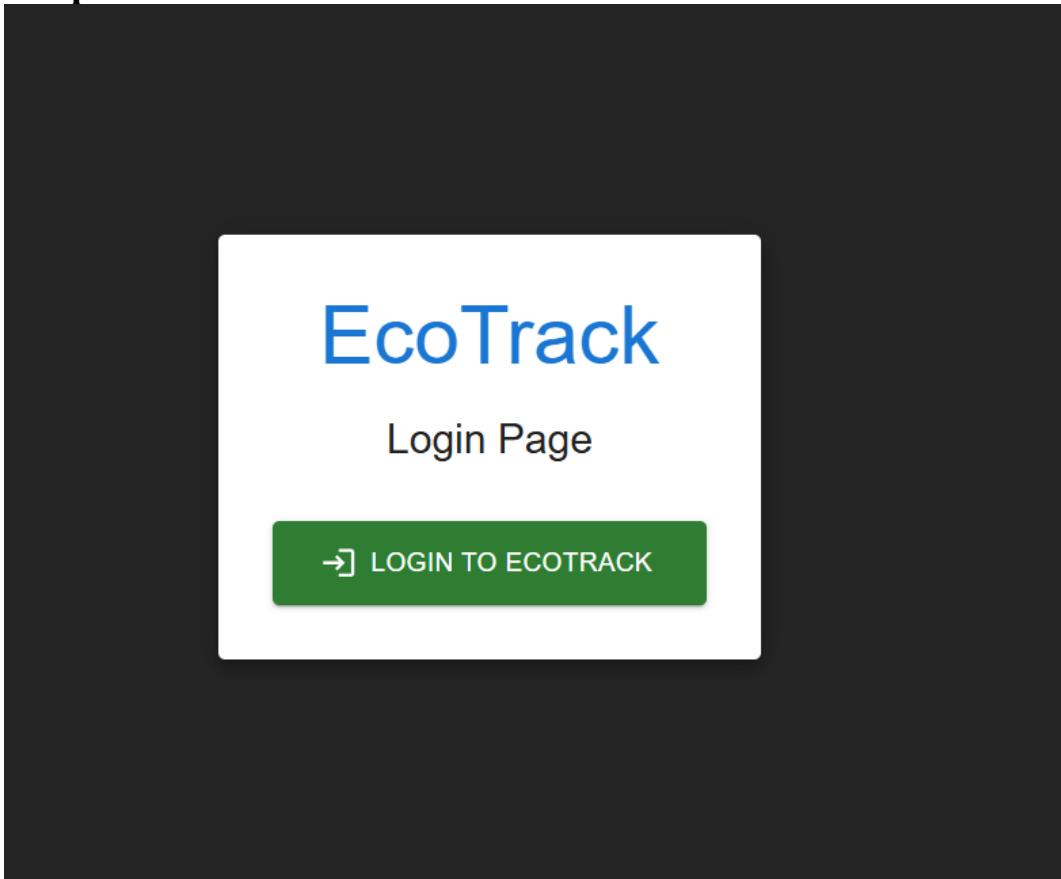
export default Dashboard;
```



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## 4. Output:



EcoTrack Dashboard [HOME](#) [SUMMARY](#) [ANALYTICS](#) [LOGS](#) [Logout](#)

**Dashboard**

[summary](#) | [analytics](#)

---

High Carbon Activities > 4

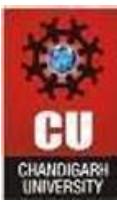
Electricity Usage = 6 kg CO<sub>2</sub>

Low Carbon Activities ≤ 4

Cycling = 1 kg CO<sub>2</sub>

Walking = 1 kg CO<sub>2</sub>

Public Transport = 2 kg CO<sub>2</sub>



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## 5. Learning Outcome:

- Identify and reduce unnecessary re-renders in React applications.
- Optimize React components using React.memo, useMemo, and useCallback.
- Implement lazy loading and code splitting to improve application performance.
- Enhance overall React app efficiency through performance optimization techniques.
- Design a clean, responsive user interface using Material UI components.