DEPARTMENT OF
COMPUTER SCIENCE & ENGINEERING
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Experiment 4

Student Name: Madhav
UID: 23BAI70107
Branch: BE CSE AIML
Section/Group: 23AIT-KRG G1
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Subject Name: Full Stack
Subject Code: 23CSH-382

1. **Title:**
   Redux Toolkit & Asynchronous State Management in EcoTrack

2. **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.

3. **Objective:**
   After completing this experiment and its follow-up tasks, the student will be able to:

   1. Understand the causes of unnecessary re-renders in React applications
   2. Optimize React components using React.memo to prevent avoidable re-renders
   3. Apply useMemo to efficiently compute derived data and avoid redundant calculations
   4. Use useCallback to memoize event handler functions and improve component performance
   5. Implement lazy loading of components and routes using React.lazy and Suspense
   6. Reduce initial bundle size and improve application load performance through code splitting

7. Enhance the visual appearance and usability of the EcoTrack application using Material UI components

8. Design a clean, consistent, and responsive user interface using Material UI layouts and typography

4. Implementation/Code:

- logSlice.jsx:

```jsx
import { createSlice, createAsyncThunk} from "@reduxjs/toolkit";

export const fetchLogs = createAsyncThunk(
    "logs/fetchLogs",
    async() => {
        await new Promise((resolve) => setTimeout(resolve, 1000));

        return [
            { id: 1, activity: "Car Travel", carbon: 4 },
            { id: 2, activity: "Electricity Usage", carbon: 6 },
            { id: 3, activity: "Cycling", carbon: 0 },
        ]
    }
)

const logsSlice = createSlice({
    name : "logs",
    initialState : {
        data : [],
        status : "idle",
        error : null,
    },
    reducers : {},
    extraReducers : (builder) => {
        builder
        .addCase(fetchLogs.pending, (state, action) =>{
            state.status = "loading";
        })
        .addCase(fetchLogs.fulfilled, (state, action) =>{
            state.status = "success";
            state.data = action.payload;
        })
        .addCase(fetchLogs.rejected, (state, action) =>{
            state.status = "failed";
            state.error = action.error.message;
        })
    }
})

export default logsSlice.reducer;
```

- Logs.jsx:

```jsx
import { useEffect, useMemo, useCallback } from "react";
import { useDispatch, useSelector } from "react-redux";
import { fetchLogs } from "../store/logSlice";

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

  const handleRefresh = useCallback(() => {
    dispatch(fetchLogs());
  }, [dispatch]);

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

  const totalCarbon = useMemo(() => {
    return data.reduce((acc, log) => acc + log.carbon, 0);
  }, [data]);

  if(status === "loading"){
    return <p>Loading Logs...</p>;
  }
  if (status === "failed"){
    return <p>Error: {error}</p>;
  }
  return (
    <div>
      <h1>Logs</h1>
      <ol>
        {data.map((log) => (
          <li key={log.id}>
            {log.activity}: {log.carbon} kg CO2
          </li>
        ))}
      </ol>
      <h3>Total Carbon: {totalCarbon} kg CO2</h3>

      <button onClick={handleRefresh}>Refresh</button>
    </div>
  );
};

export default Logs;
```

- Store.jsx:

```jsx
import { configureStore } from "@reduxjs/toolkit";
import logsReducer from "./logSlice"

const store = configureStore({
    reducer : {
        logs : logsReducer,
    },
});

export default store;
```

- AuthContext.jsx:

```jsx
import { createContext, useContext, useState } from "react";

const AuthContext = createContext(null);

export const AuthProvider = ({children}) => {
    const [isAuthenticated, setIsAuthenticated] = useState(false);

    return (
        <AuthContext.Provider value = {{isAuthenticated, setIsAuthenticated}}>
            {children}
        </AuthContext.Provider>
    )
}

export const useAuth = () => useContext(AuthContext);
```

- ProtectedRoute.jsx:

```jsx
import { Navigate } from "react-router-dom";
import { useAuth } from "../context/AuthContext";
import { children } from "react";

const ProtectedRoute = ({children}) => {
    const {isAuthenticated} = useAuth();

    if(!isAuthenticated) {
        return <Navigate to = "/login" replace/>
    }
    return children;
}

export default ProtectedRoute;
```

- Login.jsx:

```jsx
import { useAuth } from "../context/AuthContext";
import { useNavigate } from "react-router-dom";

const Login = () => {
    const {setIsAuthenticated} = useAuth();
    const navigate = useNavigate();

    const handleLogin = () => {
        setIsAuthenticated(true);
        navigate("/");
    }
    return (
        <>
        <h3>Login</h3>
        <button onClick={handleLogin}>Login</button>
        </>
    )
}
export default Login;
```

- Logout.jsx:

```jsx
import { useEffect } from "react";
import { useNavigate } from "react-router-dom";
import { useAuth } from "../context/AuthContext";

const Logout = () => {
  const { setIsAuthenticated } = useAuth();
  const navigate = useNavigate();

  useEffect(() => {
    setIsAuthenticated(false);
    navigate("/login");
  }, [setIsAuthenticated, navigate]);

  return <p>Logging you out...</p>;
}

export default Logout;
```

- DashboardSettings, DashboardSummary, DashboardAnalytics:

```jsx
const DashboardSettings = () => {
    return (
        <h3>These are the settings</h3>
    )
}

export default DashboardSettings;
```

```jsx
const DashboardSummary = () => {
    return (
        <h3>This is a Summary</h3>
    )
}

export default DashboardSummary;
```

```jsx
const DashboardAnalytics = () => {
    return (
        <h3>This is a Analysis</h3>
    )
}

export default DashboardAnalytics;
```

- DashboardLayout.jsx:

```jsx
import { Link, Outlet } from "react-router-dom";
import { Container, Button, Stack, Typography } from "@mui/material";

const DashboardLayout = () => {
  return (
    <Container>
      <Typography variant="h4" gutterBottom>
        Dashboard
      </Typography>

      <Stack direction="row" spacing={2} marginBottom={2}>
        <Button variant="contained" component={Link} to="settings">
          Settings
        </Button>

        <Button variant="contained" component={Link} to="summary">
          Summary
        </Button>

        <Button variant="contained" component={Link} to="analytics">
          Analytics
        </Button>
      </Stack>

      <Outlet />
    </Container>
  );
};

export default DashboardLayout;
```

- Header.jsx:

```jsx
import React from "react";
import { AppBar, Toolbar, Typography, Button } from "@mui/material";
import { Link } from "react-router-dom";
import { useAuth } from "../context/AuthContext";

const Header = () => {
  const { isAuthenticated } = useAuth();

  return (
    <AppBar position="static">
      <Toolbar>
        <Typography variant="h6" sx={{ flexGrow: 1 }}>
          EcoTrack
        </Typography>

        <Button color="inherit" component={Link} to="/">
          Dashboard
        </Button>

        <Button color="inherit" component={Link} to="/logs">
          Logs
        </Button>

        {isAuthenticated ? (
          <Button color="inherit" component={Link} to="/logout">
            Logout
          </Button>
        ) : (
          <Button color="inherit" component={Link} to="/login">
            Login
          </Button>
        )}
      </Toolbar>
    </AppBar>
  );
};

export default React.memo(Header);
```

- App.jsx:

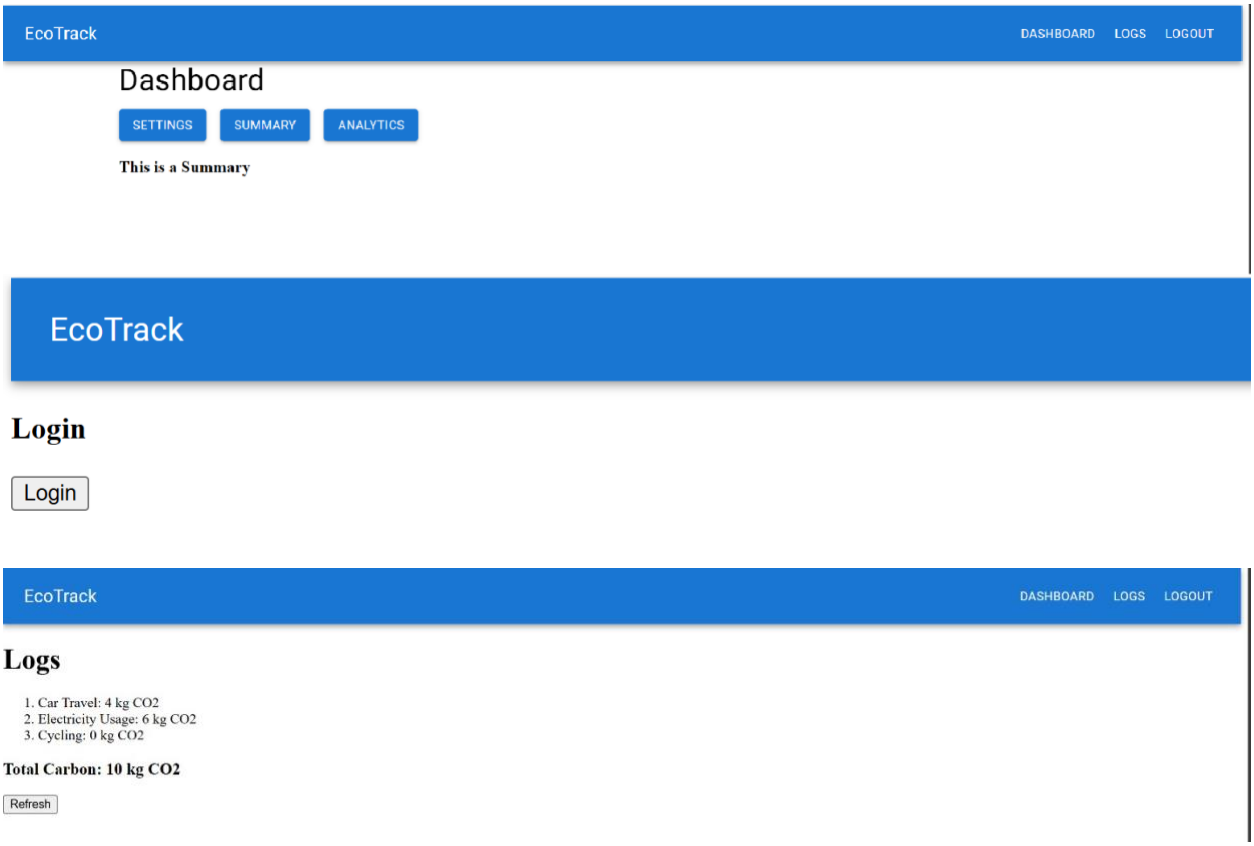
```jsx
import { Route, Routes } from "react-router-dom";
import { Suspense, lazy } from "react";
import ProtectedRoute from "./routes/ProtectedRoute";
import Header from "./components/Header";

const Login = lazy(() => import("./pages/Login"));
const Logout = lazy(() => import("./pages/Logout"));
const DashboardLayout = lazy(() => import("./pages/DashboardLayout"));
const DashboardSummary = lazy(() => import("./pages/DashboardSummary"));
const DashboardSettings = lazy(() => import("./pages/DashboardSettings"));
const DashboardAnalytics = lazy(() => import("./pages/DashboardAnalytics"));
const Logs = lazy(() => import("./pages/Logs"));

function App() {
  return (
    <>
      <Header />
      <Suspense fallback={<h2>Loading...</h2>}>
        <Routes>
          <Route path="/login" element={<Login />} />
          <Route path="/logout" element={<Logout />} />
          <Route
            path="/"
            element={
              <ProtectedRoute>
                <DashboardLayout />
              </ProtectedRoute>
            }
          >
            <Route index element={<DashboardSummary />} />
            <Route path="settings" element={<DashboardSettings />} />
            <Route path="summary" element={<DashboardSummary />} />
            <Route path="analytics" element={<DashboardAnalytics />} />
          </Route>
          <Route
            path="/logs"
            element={
              <ProtectedRoute>
                <Logs />
              </ProtectedRoute>
            }
          />
        </Routes>
      </Suspense>
    </>
  );
}

export default App;
```

5. Output



6. Learning Outcome

- We learnt about React Apps and how to create them.
- We learnt about redux and it's components.
- We learnt about the use of thunks and Slices.
- We learnt about Authentication and index pages
- We learnt the use of MaterialUI and useSelector.
- We learnt about the flow of a React project.