JSP Servlet JDBC MySQL CRUD Example Tutorial

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jdbc tutorial jsp tutorial mysql servlet tutorial

In this tutorial, we are building a simple **User Management** web application that manages a collection of **users** with the basic feature: list, insert, update, delete (or CURD operations - Create, Update, Read and Delete).

You can download the source code of this tutorial from my GitHub repository and the link is given at the end of this tutorial.

Top JSP, Servlet and JDBC Tutorials:

> - **Servlet Tutorial**
> - **JSP Tutorial**
> - **JDBC 4.2 Tutorial**

> Check out **Build Todo App using JSP, Servlet, JDBC, and MySQL**.

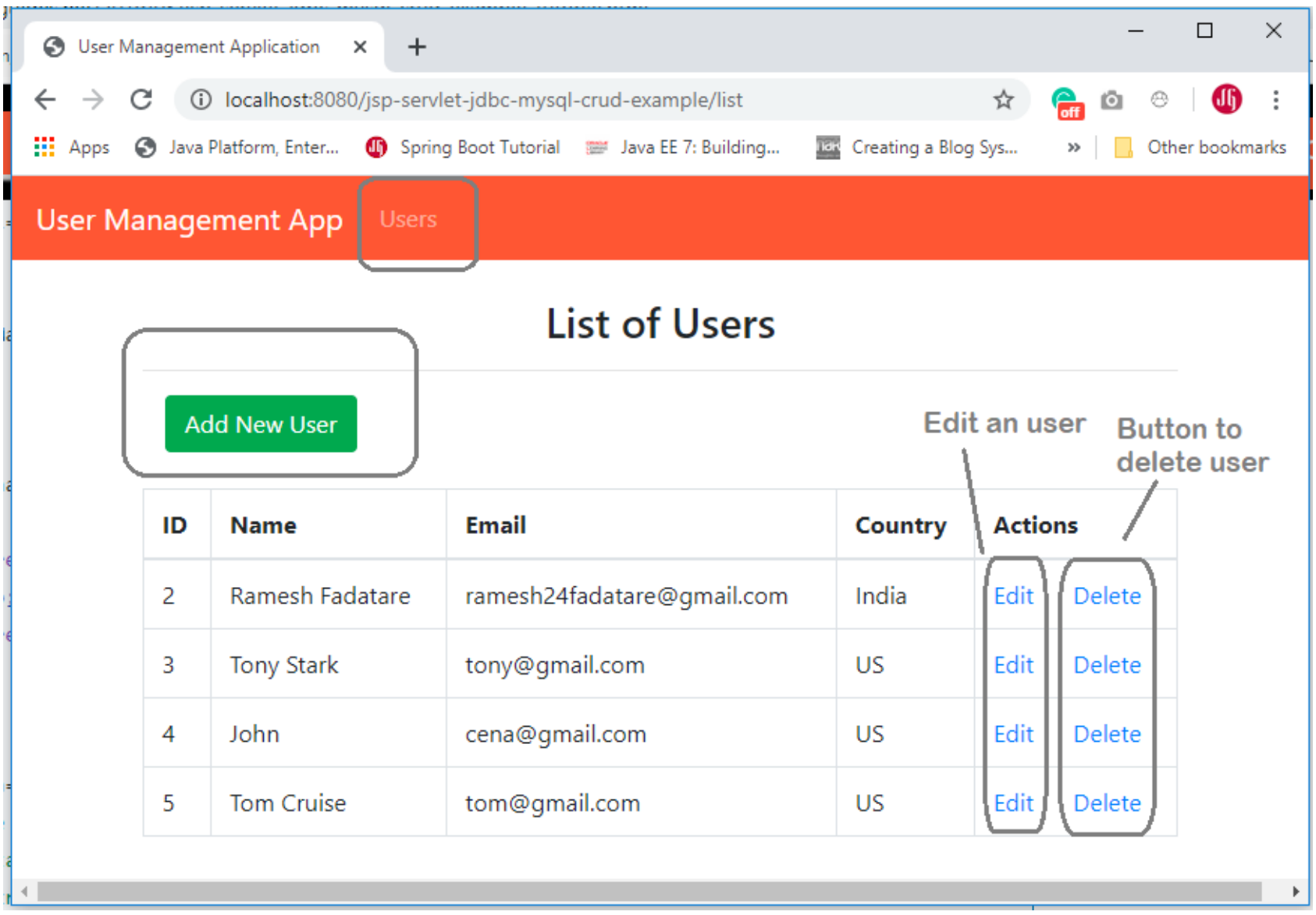
Video Tutorial

This tutorial explained very well in below youtube video. Subscribe to our youtube channel for more future video updates.

We will develop below simple basic features in our **User Management** web application:

1. Create a User
2. Update a User
3. Delete a User
4. Retrieve a User
5. List of all Users

The application looks something like this:



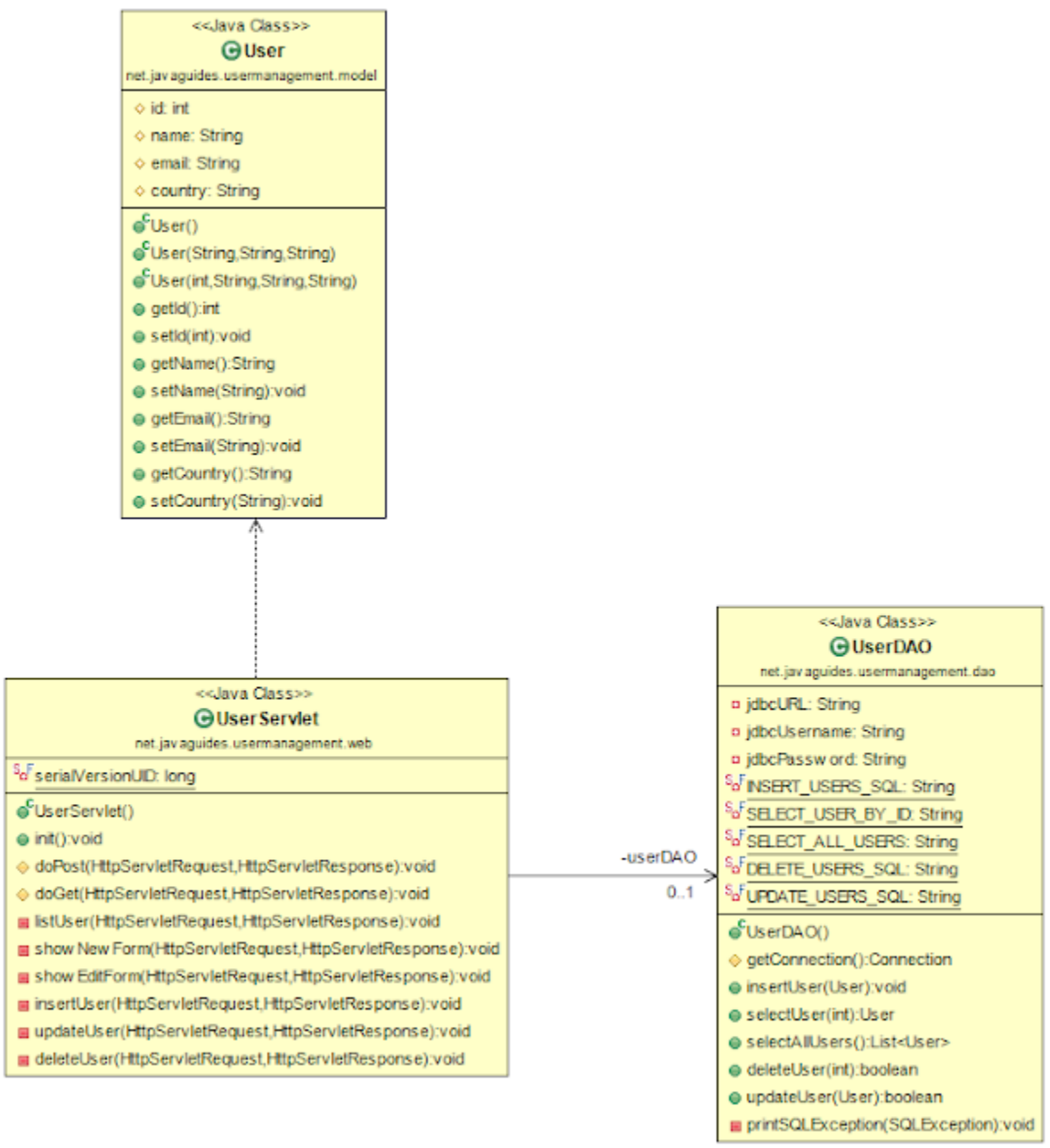
Tools and technologies used

- JSP - 2.2 +
- IDE - STS/Eclipse Neon.3
- JDK - 1.8 or later
- Apache Tomcat - 8.5
- JSTL - 1.2.1
- Servlet API - 2.5
- MySQL - mysql-connector-java-8.0.13.jar

1. Create an Eclipse Dynamic Web Project
2. Add Dependencies
3. Project Structure
4. MySQL Database Setup
5. Create a JavaBean - User.java
6. Create a UserDAO.java
7. Create a UserServlet.java
8. Creating User Listing JSP Page - user-list.jsp
9. Create a User Form JSP Page - user-form.jsp
10. Creating Error JSP page
11. Deploying and Testing the Application Demo

Class Diagram

Here is the class diagram of the **User Management** web application that we are going to develop in this tutorial:

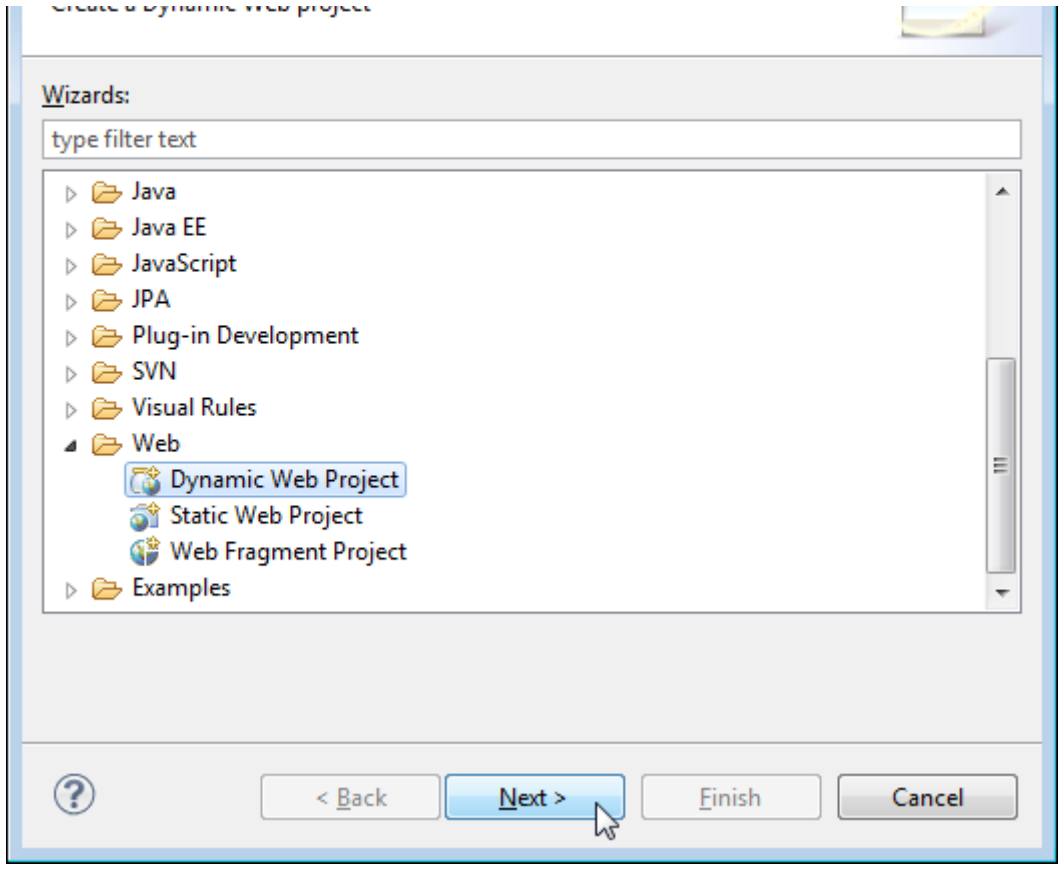


1. Create an Eclipse Dynamic Web Project

To create a new dynamic Web project in Eclipse:

1. On the main menu select **File > New > Project....**

2. In the upcoming wizard choose **Web > Dynamic Web Project.**



3. Click **Next**.

4. Enter project name as "jsp-servlet-jdbc-mysql-example";

5. Make sure that the target runtime is set to Apache Tomcat with the currently supported version.

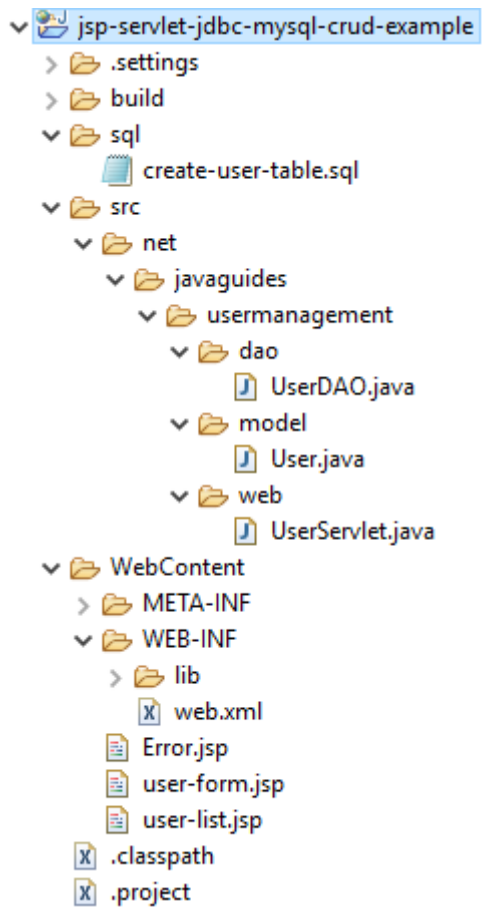
2. Add Dependencies

Add the latest release of below jar files to the `lib` folder.

- jsp-api.2.3.1.jar
- servlet-api.2.3.jar
- mysql-connector-java-8.0.13.jar
- jstl-1.2.jar

3. Project Structure

Standard project structure for your reference -



4. MySQL Database Setup

```
CREATE DATABASE 'demo';
USE demo;

create table users (
 id  int(3) NOT NULL AUTO_INCREMENT,
 name varchar(120) NOT NULL,
 email varchar(220) NOT NULL,
 country varchar(120),
 PRIMARY KEY (id)
);
```

You can use either MySQL Command Line Client or MySQL Workbench tool to create the database. The above a **users** table looks like:

```
mysql> desc users;
+---------+--------------+------+-----+---------+----------------+
| Field   | Type         | Null | Key | Default | Extra          |
+---------+--------------+------+-----+---------+----------------+
| id      | int(3)       | NO   | PRI | NULL    | auto_increment |
| name    | varchar(120) | NO   |     | NULL    |                |
| email   | varchar(220) | NO   |     | NULL    |                |
| country | varchar(120) | YES  |     | NULL    |                |
+---------+--------------+------+-----+---------+----------------+
4 rows in set (0.00 sec)
```

5. Create a JavaBean - User.java

Let's create a `User` java class to model a **user** entity in the database with the following code:

```
package net.javaguides.usermanagement.model;

/**
 * User.java
 * This is a model class represents a User entity
 * @author Ramesh Fadatare
 *
 */
public class User {
    protected int id;
    protected String name;
    protected String email;
    protected String country;

    public User() {}

    public User(String name, String email, String country) {
        super();
        this.name = name;
        this.email = email;
        this.country = country;
    }

    public User(int id, String name, String email, String country) {
        super();
        this.id = id;
        this.name = name;
        this.email = email;
        this.country = country;
    }

    public int getId() {
        return id;
```

```
    }
    public String getName() {
        return name;
    }
    public void setName(String name) {
        this.name = name;
    }
    public String getEmail() {
        return email;
    }
    public void setEmail(String email) {
        this.email = email;
    }
    public String getCountry() {
        return country;
    }
    public void setCountry(String country) {
        this.country = country;
    }
}
```

6. Create a UserDAO.java

Let's create a `UserDAO` class which is a Data Access Layer (DAO) class that provides CRUD (Create, Read, Update, Delete) operations for the table **users** in a database. Here's the full source code of the `UserDAO`:

```
package net.javaguides.usermanagement.dao;

import java.sql.Connection;
import java.sql.DriverManager;
import java.sql.PreparedStatement;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.util.ArrayList;
import java.util.List;

import net.javaguides.usermanagement.model.User;

/**
 * AbstractDAO.java This DAO class provides CRUD database operations for the
 * table users in the database.
 *
 * @author Ramesh Fadatare
 *
 */
public class UserDAO {
    private String jdbcURL = "jdbc:mysql://localhost:3306/demo?useSSL=false";
    private String jdbcUsername = "root";
    private String jdbcPassword = "root";

    private static final String INSERT_USERS_SQL = "INSERT INTO users" + "  (name, email, country) VALUES " +
        " (?, ?, ?);";

    private static final String SELECT_USER_BY_ID = "select id,name,email,country from users where id =?";
    private static final String SELECT_ALL_USERS = "select * from users";
    private static final String DELETE_USERS_SQL = "delete from users where id = ?;";
    private static final String UPDATE_USERS_SQL = "update users set name = ?,email= ?, country =? where id = ?
```

```
        Connection connection = null;
        try {
            Class.forName("com.mysql.jdbc.Driver");
            connection = DriverManager.getConnection(jdbcURL, jdbcUsername, jdbcPassword);
        } catch (SQLException e) {
            // TODO Auto-generated catch block
            e.printStackTrace();
        } catch (ClassNotFoundException e) {
            // TODO Auto-generated catch block
            e.printStackTrace();
        }
        return connection;
    }

    public void insertUser(User user) throws SQLException {
        System.out.println(INSERT_USERS_SQL);
        // try-with-resource statement will auto close the connection.
        try (Connection connection = getConnection(); PreparedStatement preparedStatement = connection.prepareS
            preparedStatement.setString(1, user.getName());
            preparedStatement.setString(2, user.getEmail());
            preparedStatement.setString(3, user.getCountry());
            System.out.println(preparedStatement);
            preparedStatement.executeUpdate();
        } catch (SQLException e) {
            printSQLException(e);
        }
    }

    public User selectUser(int id) {
        User user = null;
        // Step 1: Establishing a Connection
        try (Connection connection = getConnection();
            // Step 2:Create a statement using connection object
            PreparedStatement preparedStatement = connection.prepareStatement(SELECT_USER_BY_ID);) {
            preparedStatement.setInt(1, id);
            System.out.println(preparedStatement);
            // Step 3: Execute the query or update query
            ResultSet rs = preparedStatement.executeQuery();

            // Step 4: Process the ResultSet object.
            while (rs.next()) {
                String name = rs.getString("name");
                String email = rs.getString("email");
                String country = rs.getString("country");
                user = new User(id, name, email, country);
            }
        } catch (SQLException e) {
            printSQLException(e);
        }
        return user;
    }

    public List < User > selectAllUsers() {

        // using try-with-resources to avoid closing resources (boiler plate code)
        List < User > users = new ArrayList < > ();
        // Step 1: Establishing a Connection
        try (Connection connection = getConnection();
```

```
            // Step 3: Execute the query or update query
            ResultSet rs = preparedStatement.executeQuery();

            // Step 4: Process the ResultSet object.
            while (rs.next()) {
                int id = rs.getInt("id");
                String name = rs.getString("name");
                String email = rs.getString("email");
                String country = rs.getString("country");
                users.add(new User(id, name, email, country));
            }
        } catch (SQLException e) {
            printSQLException(e);
        }
        return users;
    }

    public boolean deleteUser(int id) throws SQLException {
        boolean rowDeleted;
        try (Connection connection = getConnection(); PreparedStatement statement = connection.prepareStatement
            statement.setInt(1, id);
            rowDeleted = statement.executeUpdate() > 0;
        }
        return rowDeleted;
    }

    public boolean updateUser(User user) throws SQLException {
        boolean rowUpdated;
        try (Connection connection = getConnection(); PreparedStatement statement = connection.prepareStatement
            statement.setString(1, user.getName());
            statement.setString(2, user.getEmail());
            statement.setString(3, user.getCountry());
            statement.setInt(4, user.getId());

            rowUpdated = statement.executeUpdate() > 0;
        }
        return rowUpdated;
    }

    private void printSQLException(SQLException ex) {
        for (Throwable e: ex) {
            if (e instanceof SQLException) {
                e.printStackTrace(System.err);
                System.err.println("SQLState: " + ((SQLException) e).getSQLState());
                System.err.println("Error Code: " + ((SQLException) e).getErrorCode());
                System.err.println("Message: " + e.getMessage());
                Throwable t = ex.getCause();
                while (t != null) {
                    System.out.println("Cause: " + t);
                    t = t.getCause();
                }
            }
        }
    }
}
```

7. Create a UserServlet.java

```
package net.javaguides.usermanagement.web;

import java.io.IOException;
import java.sql.SQLException;
import java.util.List;

import javax.servlet.RequestDispatcher;
import javax.servlet.ServletException;
import javax.servlet.annotation.WebServlet;
import javax.servlet.http.HttpServlet;
import javax.servlet.http.HttpServletRequest;
import javax.servlet.http.HttpServletResponse;

import net.javaguides.usermanagement.dao.UserDAO;
import net.javaguides.usermanagement.model.User;

/**
 * ControllerServlet.java
 * This servlet acts as a page controller for the application, handling all
 * requests from the user.
 * @email Ramesh Fadatare
 */

@WebServlet("/")
public class UserServlet extends HttpServlet {
    private static final long serialVersionUID = 1 L;
    private UserDAO userDAO;

    public void init() {
        userDAO = new UserDAO();
    }

    protected void doPost(HttpServletRequest request, HttpServletResponse response)
    throws ServletException, IOException {
        doGet(request, response);
    }

    protected void doGet(HttpServletRequest request, HttpServletResponse response)
    throws ServletException, IOException {
        String action = request.getServletPath();

        try {
            switch (action) {
                case "/new":
                    showNewForm(request, response);
                    break;
                case "/insert":
                    insertUser(request, response);
                    break;
                case "/delete":
                    deleteUser(request, response);
                    break;
                case "/edit":
                    showEditForm(request, response);
                    break;
                case "/update":
                    updateUser(request, response);
                    break;
                default:
```

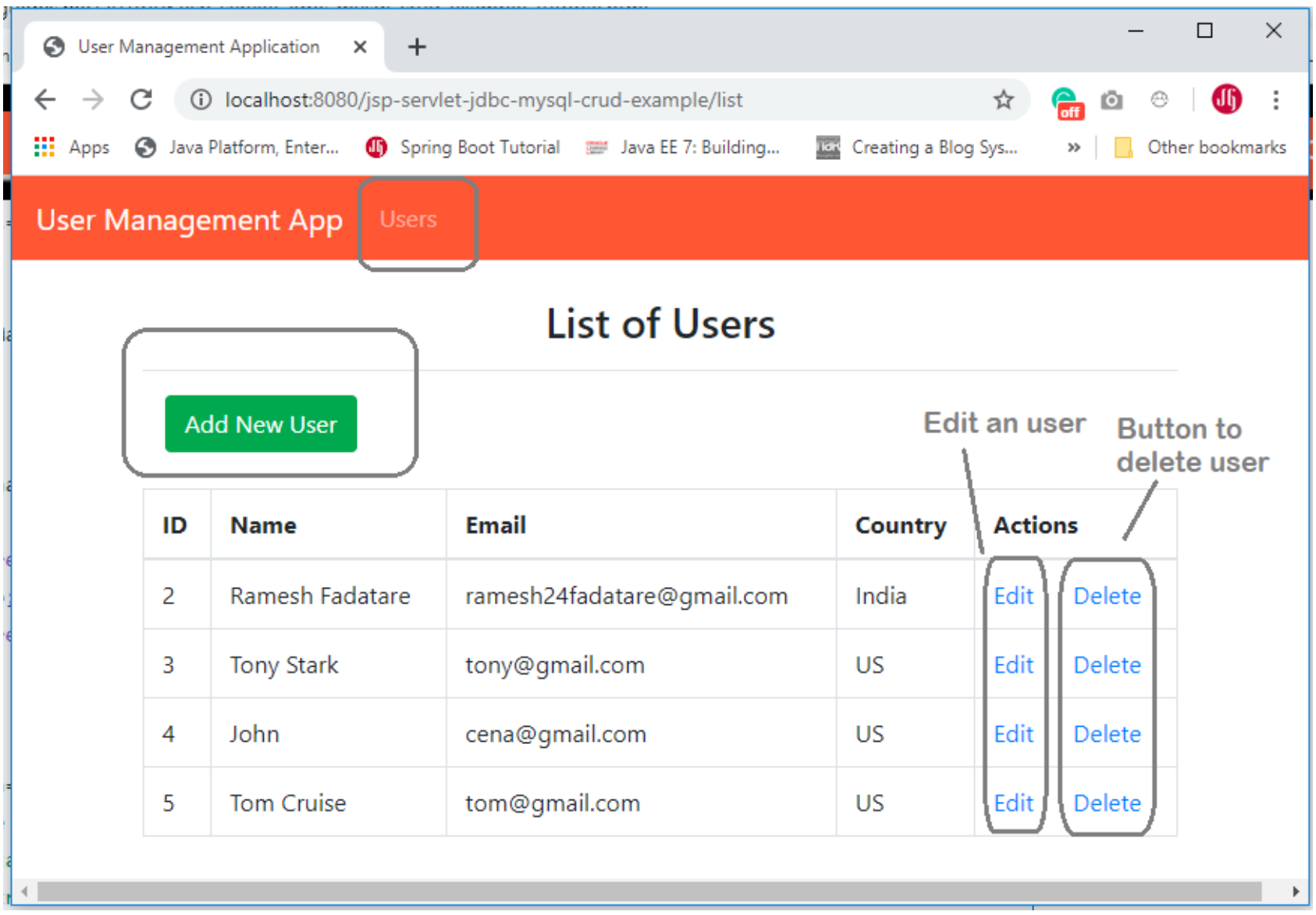
```
        } catch (SQLException ex) {
            throw new ServletException(ex);
        }
    }

    private void listUser(HttpServletRequest request, HttpServletResponse response)
    throws SQLException, IOException, ServletException {
        List < User > listUser = userDAO.selectAllUsers();
        request.setAttribute("listUser", listUser);
        RequestDispatcher dispatcher = request.getRequestDispatcher("user-list.jsp");
        dispatcher.forward(request, response);
    }

    private void showNewForm(HttpServletRequest request, HttpServletResponse response)
    throws ServletException, IOException {
        RequestDispatcher dispatcher = request.getRequestDispatcher("user-form.jsp");
        dispatcher.forward(request, response);
    }

    private void showEditForm(HttpServletRequest request, HttpServletResponse response)
    throws SQLException, ServletException, IOException {
        int id = Integer.parseInt(request.getParameter("id"));
        User existingUser = userDAO.selectUser(id);
        RequestDispatcher dispatcher = request.getRequestDispatcher("user-form.jsp");
        request.setAttribute("user", existingUser);
        dispatcher.forward(request, response);

    }

    private void insertUser(HttpServletRequest request, HttpServletResponse response)
    throws SQLException, IOException {
        String name = request.getParameter("name");
        String email = request.getParameter("email");
        String country = request.getParameter("country");
        User newUser = new User(name, email, country);
        userDAO.insertUser(newUser);
        response.sendRedirect("list");
    }

    private void updateUser(HttpServletRequest request, HttpServletResponse response)
    throws SQLException, IOException {
        int id = Integer.parseInt(request.getParameter("id"));
        String name = request.getParameter("name");
        String email = request.getParameter("email");
        String country = request.getParameter("country");

        User book = new User(id, name, email, country);
        userDAO.updateUser(book);
        response.sendRedirect("list");
    }

    private void deleteUser(HttpServletRequest request, HttpServletResponse response)
    throws SQLException, IOException {
        int id = Integer.parseInt(request.getParameter("id"));
        userDAO.deleteUser(id);
        response.sendRedirect("list");

    }
}
```

Next, create a JSP page for displaying all **users** from the database. Let's create a `list-user.jsp` page under the **WebContent** directory in the project with the following code:

```
<%@ page language="java" contentType="text/html; charset=UTF-8"
 pageEncoding="UTF-8"%>
    <%@ taglib uri="http://java.sun.com/jsp/jstl/core" prefix="c"%>
        <html>

        <head>
            <title>User Management Application</title>
            <link rel="stylesheet" href="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/css/bootstrap.min.c
        </head>

        <body>

            <header>
                <nav class="navbar navbar-expand-md navbar-dark" style="background-color: tomato">
                    <div>
                        <a href="https://www.javaguides.net" class="navbar-brand"> User
    Management App </a>
                    </div>

                    <ul class="navbar-nav">
                        <li><a href="<%=request.getContextPath()%>/list" class="nav-link">Users</a></li>
                    </ul>
                </nav>
            </header>
            <br>

            <div class="row">
                <!-- <div class="alert alert-success" *ngIf='message'>{{message}}</div> -->

                <div class="container">
                    <h3 class="text-center">List of Users</h3>
                    <hr>
                    <div class="container text-left">

                        <a href="<%=request.getContextPath()%>/new" class="btn btn-success">Add
    New User</a>
                    </div>
                    <br>
                    <table class="table table-bordered">
                        <thead>
                            <tr>
                                <th>ID</th>
                                <th>Name</th>
                                <th>Email</th>
                                <th>Country</th>
                                <th>Actions</th>
                            </tr>
                        </thead>
                        <tbody>
                            <!--   for (Todo todo: todos) {  -->
                            <c:forEach var="user" items="${listUser}">

                                <tr>
                                    <td>
                                        <c:out value="${user.id}" />
                                    </td>
                                    <td>
```

```
                                    <c:out value="${user.email}" />
                                </td>
                                <td>
                                    <c:out value="${user.country}" />
                                </td>
                                <td><a href="edit?id=<c:out value='${user.id}' />">Edit</a>   &nb
                            </tr>
                        </c:forEach>
                        <!-- } -->
                    </tbody>

                </table>
            </div>
        </div>
    </body>

    </html>
```

Once you will deploy above JSP page in tomcat and open in the browser looks something like this:



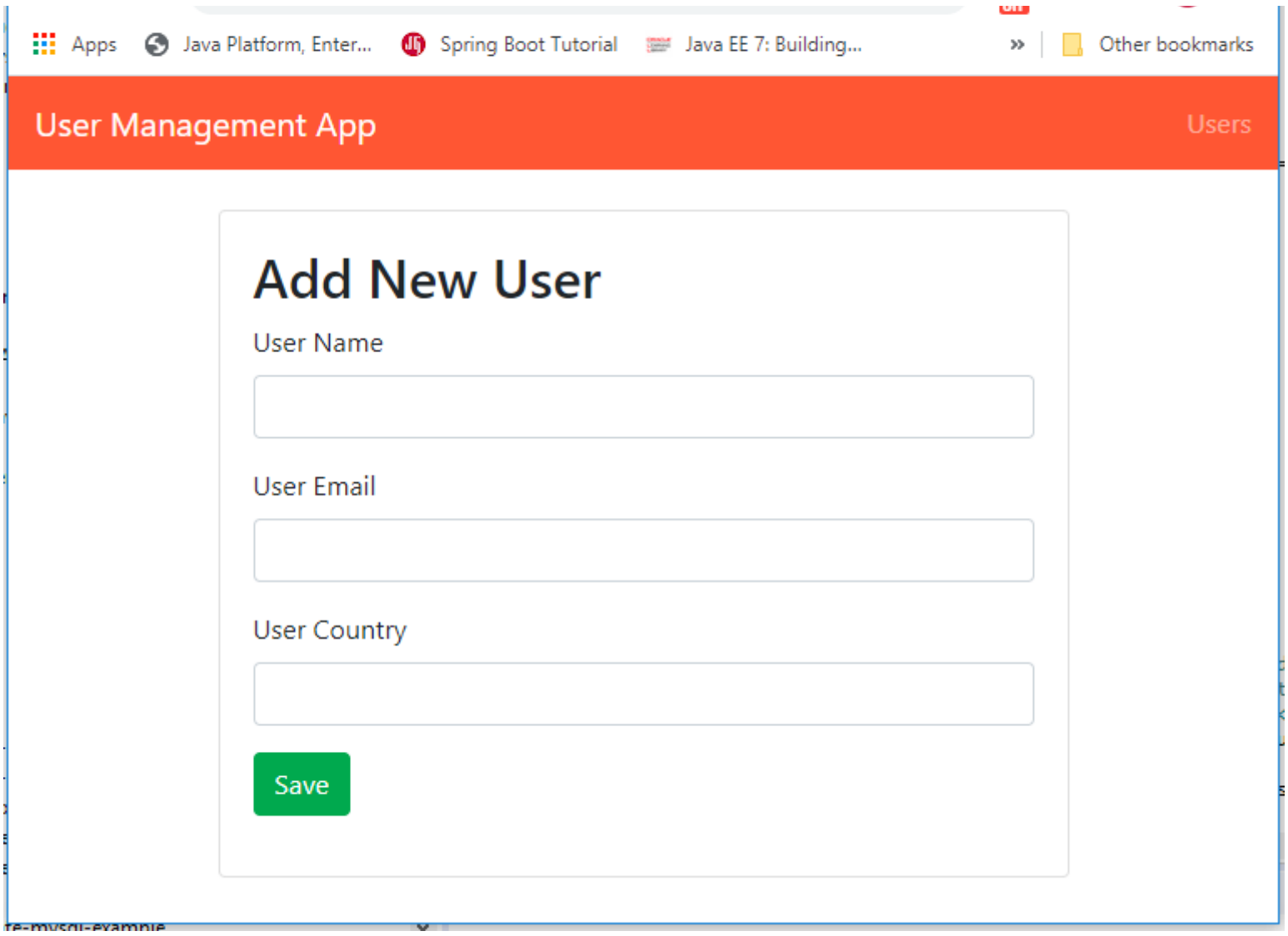
9. Create a User Form JSP Page - user-form.jsp

Next, we create a JSP page for creating a new User called `user-form.jsp`. Here's its full source code:

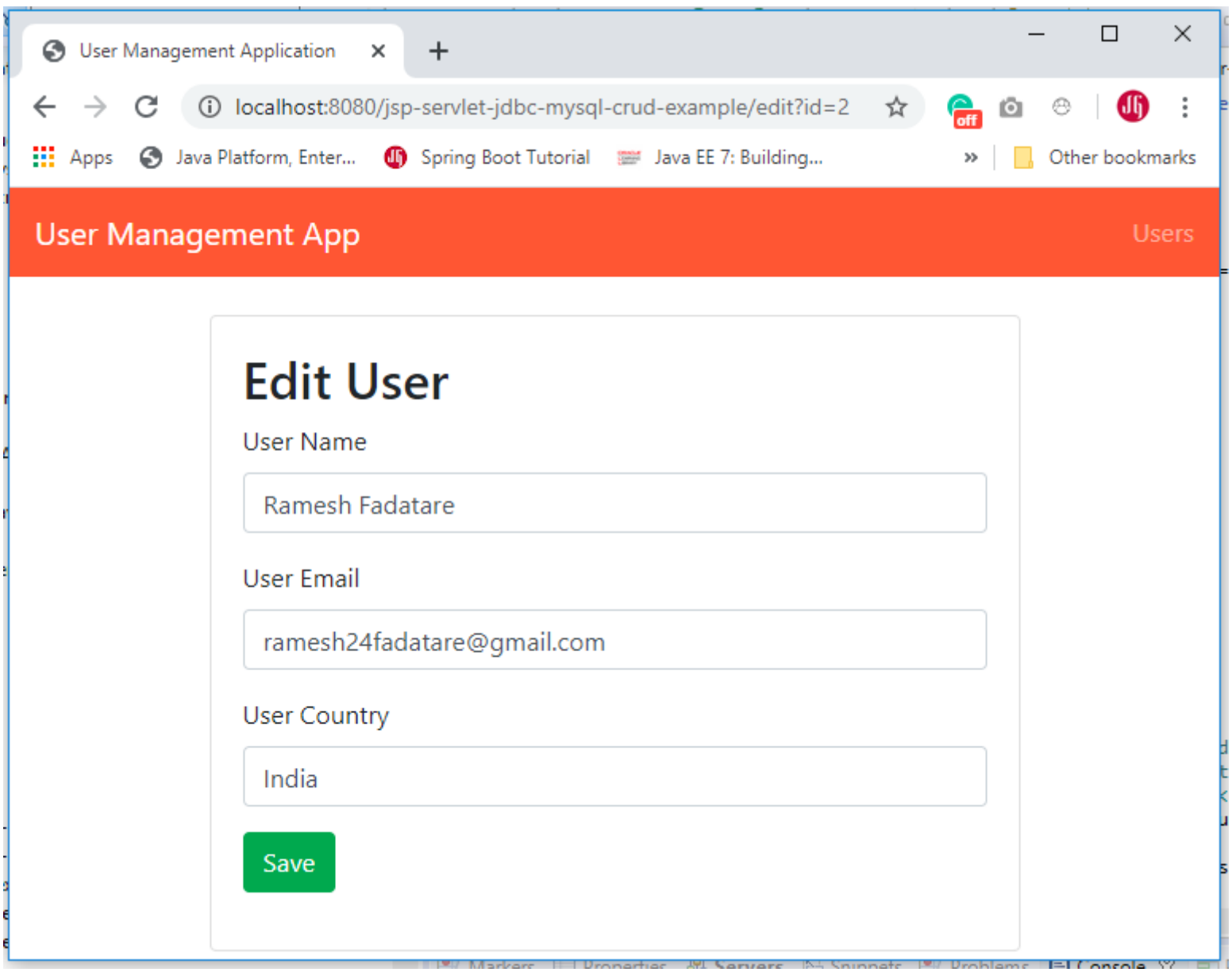
```
<%@ page language="java" contentType="text/html; charset=UTF-8"
 pageEncoding="UTF-8"%>
    <%@ taglib uri="http://java.sun.com/jsp/jstl/core" prefix="c"%>
        <html>


        <head>
            <title>User Management Application</title>
            <link rel="stylesheet" href="https://stackpath.bootstrapcdn.com/bootstrap/4.3.1/css/bootstrap.min.c
        </head>
```

```
            <nav class="navbar navbar-expand-md navbar-dark" style="background-color: tomato">
                <div>
                    <a href="https://www.javaguides.net" class="navbar-brand"> User Management App </a>
                </div>

                <ul class="navbar-nav">
                    <li><a href="<%=request.getContextPath()%>/list" class="nav-link">Users</a></li>
                </ul>
            </nav>
        </header>
        <br>
        <div class="container col-md-5">
            <div class="card">
                <div class="card-body">
                    <c:if test="${user != null}">
                        <form action="update" method="post">
                    </c:if>
                    <c:if test="${user == null}">
                        <form action="insert" method="post">
                    </c:if>

                    <caption>
                        <h2>
                            <c:if test="${user != null}">
                                Edit User
                            </c:if>
                            <c:if test="${user == null}">
                                Add New User
                            </c:if>
                        </h2>
                    </caption>

                    <c:if test="${user != null}">
                        <input type="hidden" name="id" value="<c:out value='${user.id}' />" />
                    </c:if>

                    <fieldset class="form-group">
                        <label>User Name</label> <input type="text" value="<c:out value='${user.name}' />"
                    </fieldset>

                    <fieldset class="form-group">
                        <label>User Email</label> <input type="text" value="<c:out value='${user.email}' />
                    </fieldset>

                    <fieldset class="form-group">
                        <label>User Country</label> <input type="text" value="<c:out value='${user.country}
                    </fieldset>

                    <button type="submit" class="btn btn-success">Save</button>
                    </form>
                </div>
            </div>
        </div>
    </body>

    </html>
```

Once you will deploy above JSP page in tomcat and open in the browser looks something like this:



The above page acts for both functionalities to create a new User and Edit the same user. The edit page looks like:



10. Creating Error JSP page

Here's the code of the `Error.jsp` page which simply shows the exception message:

```
<%@ page language="java" contentType="text/html; charset=UTF-8"
    pageEncoding="UTF-8" isErrorPage="true" %>
<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
 "http://www.w3.org/TR/html4/loose.dtd">
<html>
<head>
```

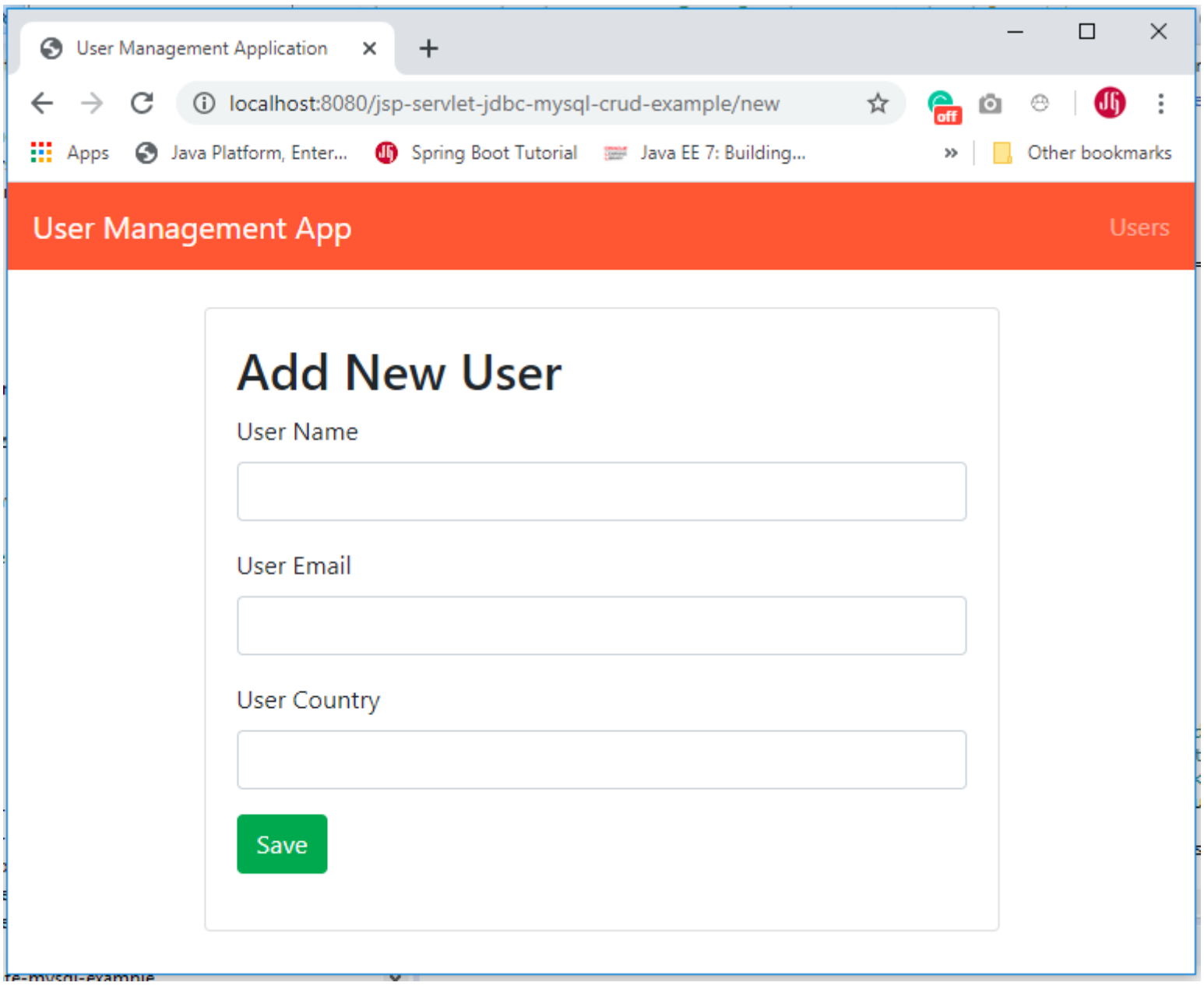
```
 <center>
  <h1>Error</h1>
  <h2><%=exception.getMessage() %><br/> </h2>
 </center>
</body>
</html>
```

11. Deploying and Testing the Application

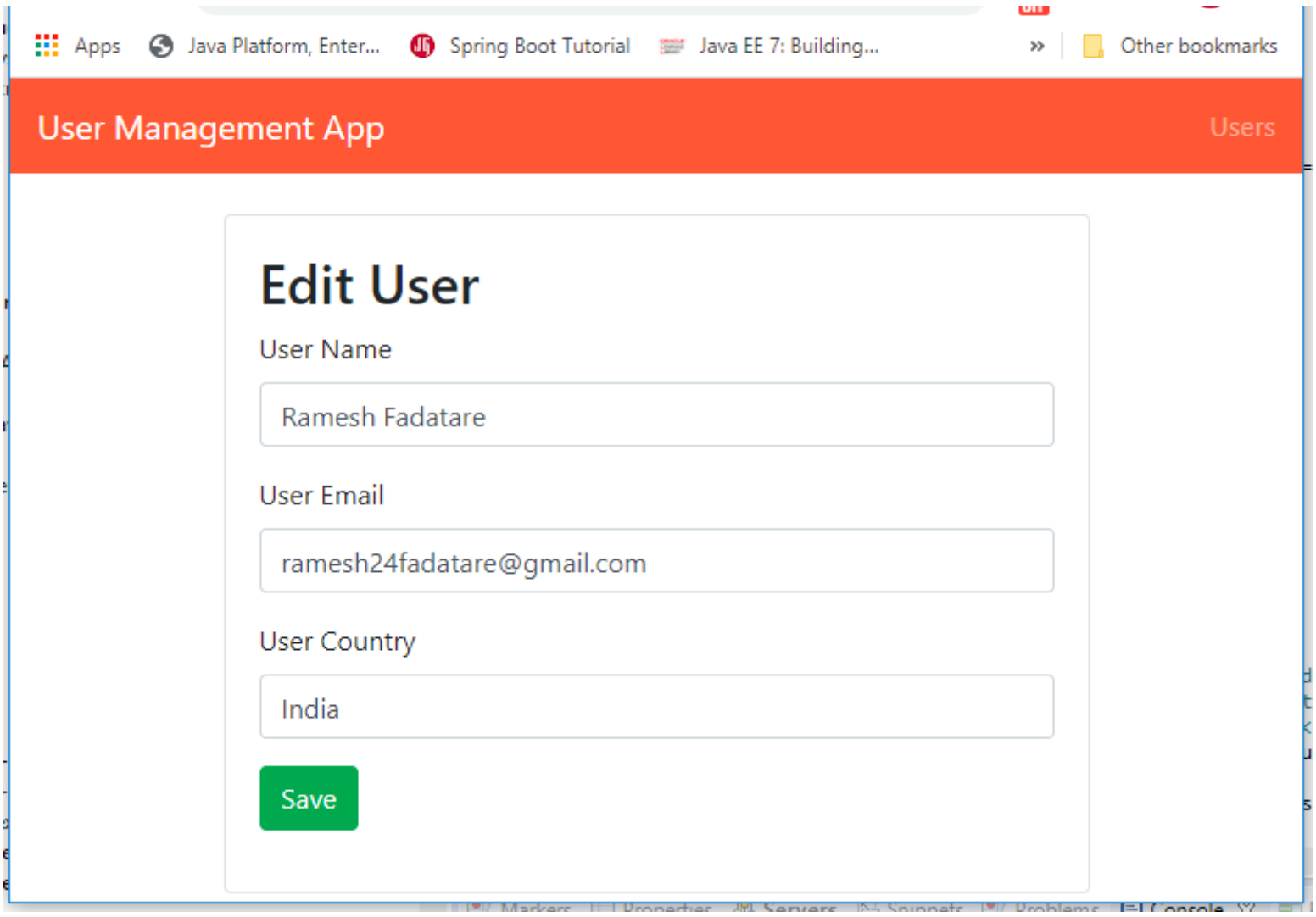
It's time to see a demo of the above **User Management** web application. Deploy this web application in tomcat server.

Type the following URL in your web browser to access the **User Management** application: **http://localhost:8080/jsp-servlet-jdbc-mysql-crud-example/**

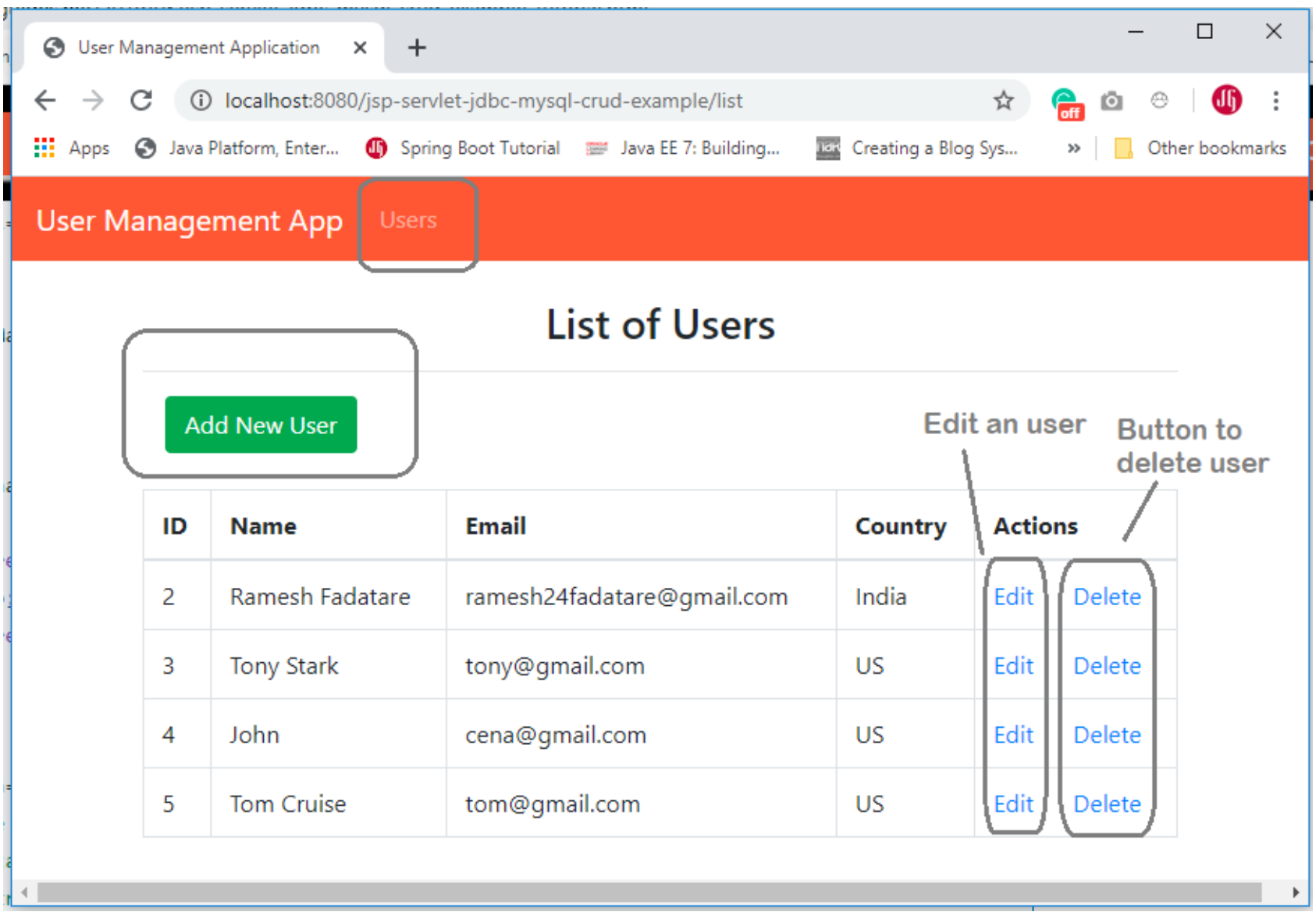
Create a new User



Edit a User



List of all Users



GitHub Repository

The source code this tutorial (User Management) is available on my GitHub repository at **https://github.com/RameshMF/jsp-servlet-jdbc-mysql-crud-tutorial**.

> Check out **Build Todo App using JSP, Servlet, JDBC, and MySQL**.

Servlet + JSP + JDBC + MySQL Examples