



Distributed Systems (SE3020)

3rd Year, 1st Semester

Assignment 2

Fire Alarm System Report

Submitted By

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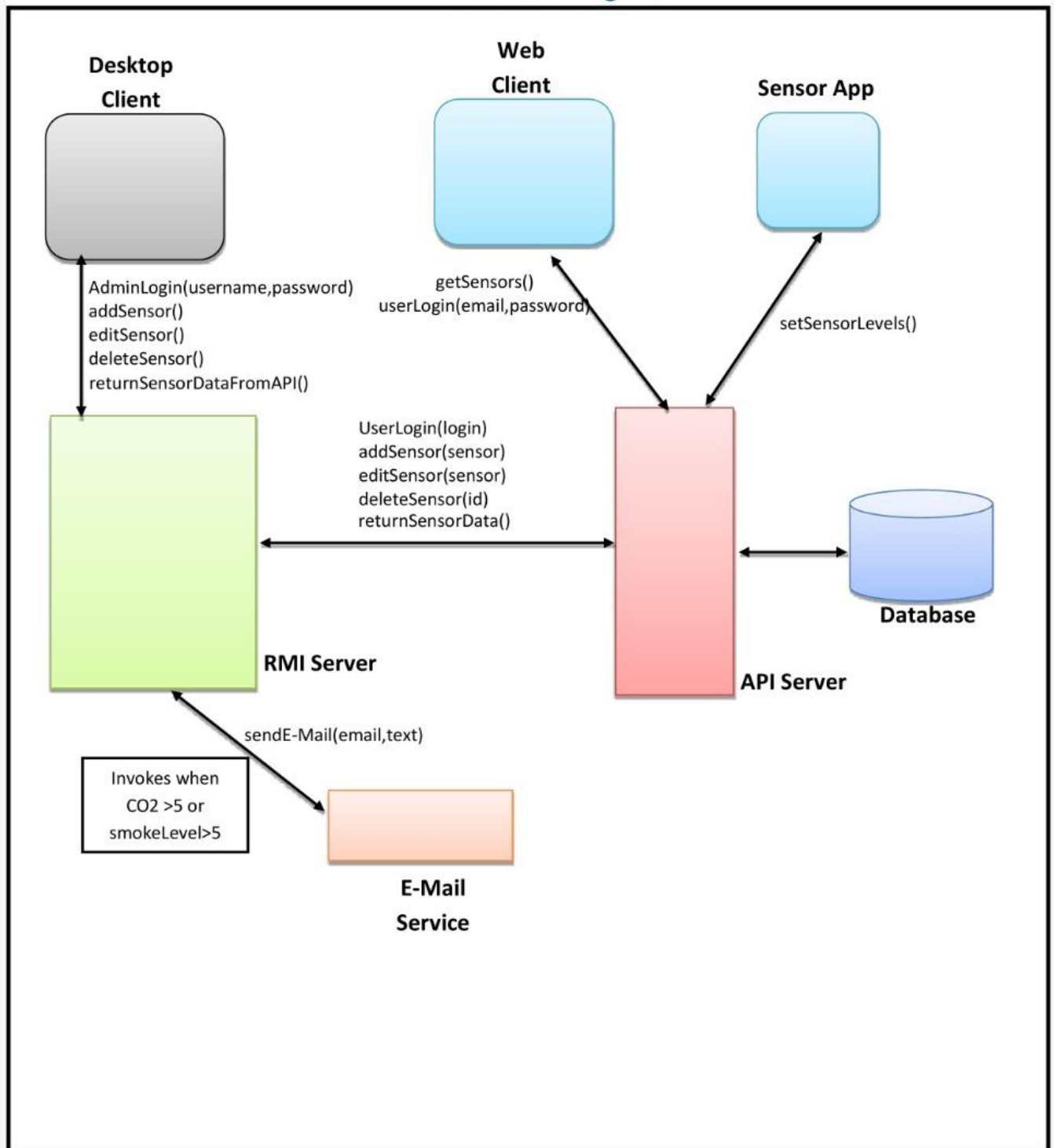
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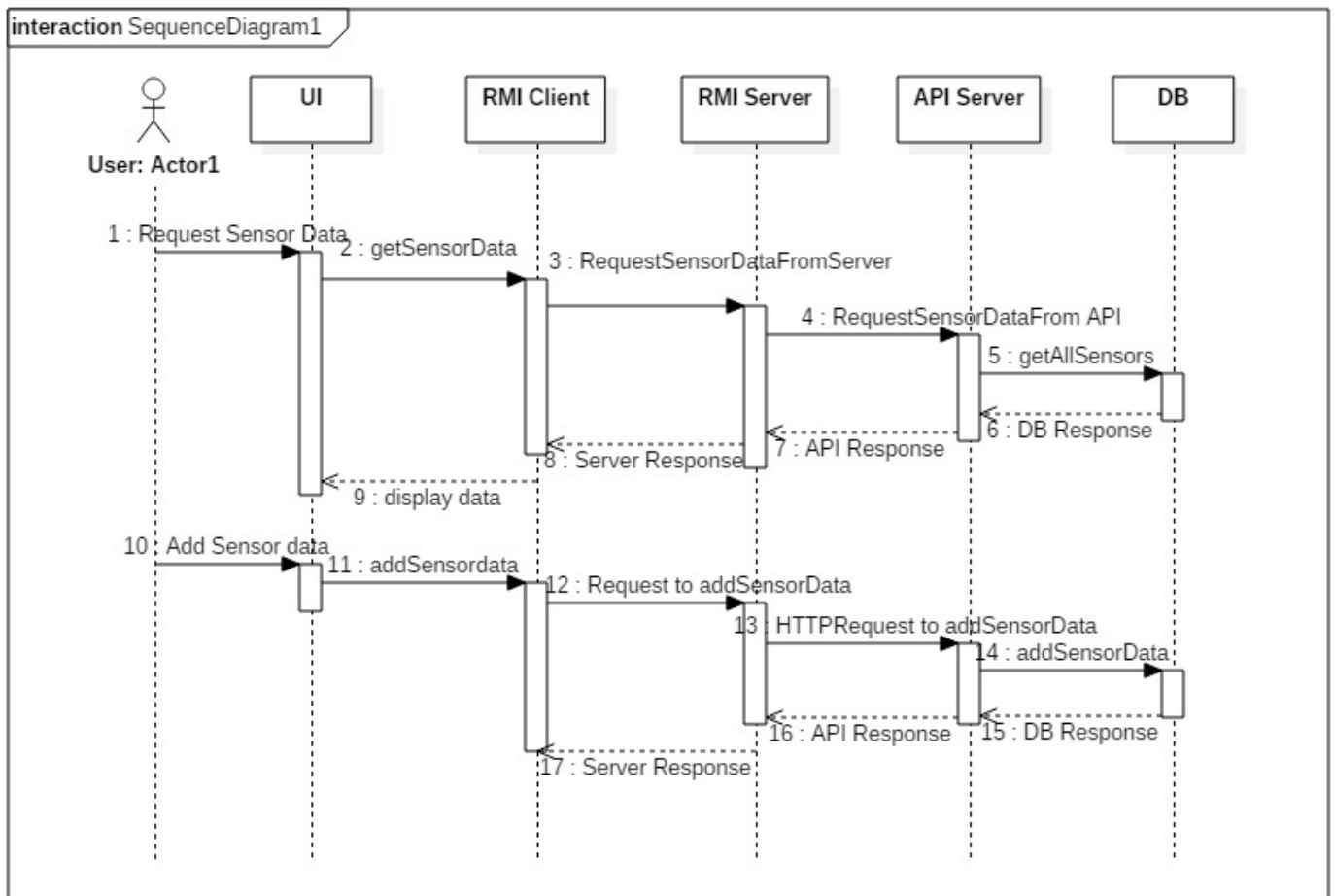
1. INTRODUCTION

Our goal in this project report is to give a clear idea of how we have implemented the Fire Alarm System which have major 4 components consisting of RMI Server, Rest API, Desktop Client Application and Web Application to supervise the sensors of Fire Alarm System.

2. ARCHITECTURAL DIAGRAM



3. SEQUENCE DIAGRAM



4. COMPONENTS

4.1 Rest API

Rest API of the fire alarm system is developed using .NET framework and for database service SQL Server Management is used. Rest API connected to MYSQL has two entities

1. Entity UserModel for table dbo.Users
Attributes of the dbo.Users table are userId (Primary Key), userEmail, userName, userPassword, userRole
2. Entity SensorModel for table dbo.SensorDetails
Attributes of the dbo.SensorDetails table are sensorId (Primary Key), sensorName, floorNo, roomNo, smokeLevel, coLevel, sensorStatus

Two interfaces IUserPersistenceService and ISensorPersistenceService respectively extends in [UserPersistenceService](#) and [SensorPersistenceService](#) classes.

[UserPersistenceService](#) class contains `SignIn()` function implementation that's being used when a user sign in.

```
20
21 2 references
22 public async Task<UserModel> SignIn(UserModel user)
23 {
24     UserModel actualUser = await _context.Users.FirstOrDefaultAsync(
25         dbUserObj => dbUserObj.userEmail.Equals(user.userEmail) && dbUserObj.userPassword.Equals(user.userPassword)
26     );
27     if (actualUser == null)
28     {
29         return null;
30     }
31     else
32     {
33         //actualUser.userModel = await _context.Users.FirstOrDefaultAsync(userModel => userModel.userId == actualUser.userId);
34         return actualUser;
35     }
36 }
37
38
```

[SensorPersistenceService](#) class contains basic crud function implementations such as `AddSensor()`, `EditSensor()`, `DeleteSensor()`, `GetSensor()` and `GetSensors()`. Beside those `SetSensorLevel()` function is implemented in order to update only CO₂ and SmokeLevel values.

Methods implemented in [SensorPersistenceService](#):

```
12 3 references
13 public class SensorPersistenceService : ISensorPersistenceService
14 {
15     private readonly AppDbContext _context;
16
17     0 references
18     public SensorPersistenceService() { }
19
20     0 references
21     public SensorPersistenceService(AppDbContext context) {...}
22
23     2 references
24     public async Task<ApiResult> DeleteSensor(int id){...}
25
26     2 references
27     public async Task<ApiResult> EditSensor(SensorModel modelObj){...}
28
29     2 references
30     public async Task<ApiResult> GetSensors(){...}
31
32     2 references
33     public async Task<ApiResult> GetSensor(int id){...}
34
35     2 references
36     public async Task<ApiResult> AddSensor(SensorModel sensorDetObj){...}
37
38     2 references
39     public async Task<ApiResult> SetSensorLevel(SensorModel sensorState){...}
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257
```

Example method from `SensorController` class :

```
37
38 [HttpPost("AddSensor")]
   References
39 public async Task<ApiResult> AddSensor(SensorModel sensorDetObj)
40 {
41     return await _sensorPerService.AddSensor(sensorDetObj);
42 }
43
```

4.2 Desktop Client Application and RMI

`Service.java` class we have defined all the methods we are going to implement in `Server.java` class.

```
13 public interface Service extends Remote {
14
15     public String adminLogin(String userEmail, String userPassword) throws RemoteException;
16
17     public String[] addSensor(String jsonObj) throws RemoteException;
18
19     public String[] updateSensor(String jsonObj) throws RemoteException;
20
21     public String[] deleteSensor(String sensorId) throws RemoteException;
22
23     public void getSensorDetailsApi() throws RemoteException;
24
25     public StringBuffer returnSensorDetailsApi() throws RemoteException;
26 }
```

`Server.java` class contains the implementations we have defined in the `Service.java`. RMI Client and RMI Server has to update in every 15 seconds and in every 30 seconds respectively. RMI Client and Server updates are handled by the below code segment.

```
39 public Server() throws RemoteException {
40     super();
41     Timer timer = new Timer();
42     timer.schedule(new TimerTask() {
43         @Override
44         public void run() {
45             try {
46                 System.out.println("Hello from Server !");
47                 getSensorDetailsApi();
48             } catch (Exception ex) {
49                 ex.printStackTrace();
50             }
51         }
52     }, 0, 15000);
53 }
54
55
```

Initializing a new server object and binding the server object to RMI registry has been handled by the main method.

```
57 public static void main(String[] args) {
58
59     System.setProperty("java.security.policy", "file:allowall.policy");
60
61     try {
62
63         Server svr = new Server();
64         Registry registry = LocateRegistry.getRegistry();
65         registry.bind("SensorService", svr);
66         System.out.println("RMI initialized...");
67
68     } catch (RemoteException re) {
69         System.err.println(re.getMessage());
70     } catch (AlreadyBoundException abe) {
71         System.err.println(abe.getMessage());
72     }
73
74 }
```

Following code segment Initializes a new url object and receives an API Server's response that is relevant to the request made from RMI Server.

```
118     try {
119         URL obj = new URL(url);
120         HttpURLConnection con = (HttpURLConnection) obj.openConnection();
121
122         con.setRequestMethod("GET");
123         con.setRequestProperty("User-Agent", "Mozilla/5.0");
124
125         BufferedReader in = new BufferedReader(new InputStreamReader(con.getInputStream()));
126         String inputLine = in.readLine();
127     }
```

Register a new sensor

```
181     @Override
182     public String[] addSensor(String jsonObj) throws RemoteException {
183         String[] response = new String[1];
184         try {
185
186             Unirest.setTimeouts(0, 0);
187             HttpResponse<String> responseGet = Unirest.post("http://localhost:44381/api/sensor/addsensor")
188                 .header("Content-Type", "application/json").body(jsonObj).asString();
189
190             if (responseGet.getStatus() == 200) {
191                 response[0] = String.valueOf(responseGet.getStatus());
192                 getSensorDetailsApi();
193             } else {
194                 response[0] = String.valueOf(responseGet.getStatus());
195             }
196         } catch (Exception e) {
197             e.printStackTrace();
198         }
199
200         return response;
201     }
202
203 }
```

Update a sensor.

```
208     public String[] updateSensor(String jsonObj) throws RemoteException {
209         String[] values = new String[2];
210         try {
211             Unirest.setTimeouts(0, 0);
212             HttpResponse<String> response = Unirest.put("http://localhost:44381/api/sensor/editsensor")
213                 .header("Content-Type", "application/json").body(jsonObj).asString();
214
215             if (response.getStatus() == 200) {
216                 values[0] = String.valueOf(response.getStatus());
217             } else {
218                 values[0] = String.valueOf(response.getStatus());
219             }
220         } catch (Exception ex) {
221             ex.printStackTrace();
222         }
223
224         return values;
225     }
226 }
```

Delete a sensor.

```

230  @Override
231  public String[] deleteSensor(String id) throws RemoteException {
232      String[] response = new String[1];
233      try {
234
235          Unirest.setTimeouts(0, 0);
236          HttpResponse<String> responseGet = Unirest.delete("http://localhost:44381/api/sensor/deletesensor" + id)
237              .header("Content-Type", "application/json").asString();
238
239          if (responseGet.getStatus() == 200) {
240
241              response[0] = String.valueOf(responseGet.getStatus());
242              getSensorDetailsApi();
243
244          } else {
245              response[0] = String.valueOf(responseGet.getStatus());
246          }
247
248      } catch (Exception e) {
249          e.printStackTrace();
250      }
251
252      return response;
253  }

```

Get sensor details into an ArrayList.

```

153  public ArrayList<Sensor> getSensors(String jsonRes) {
154
155      ArrayList<Sensor> arrayList = new ArrayList<>();
156      try {
157          JSONArray jArray = new JSONArray(jsonRes);
158          for (int count = 0; count < jArray.length(); count++) {
159              Sensor sensorObj = new Sensor();
160              JSONObject jsonObj = jArray.getJSONObject(count);
161              sensorObj.setSensorId(jsonObj.getInt("sensorId"));
162              sensorObj.setSensorName(jsonObj.getString("sensorName"));
163              sensorObj.setFloorNumber(jsonObj.getInt("floorNo"));
164              sensorObj.setRoomNumber(jsonObj.getInt("roomNo"));
165              sensorObj.setSmokeLevel(jsonObj.getInt("smokeLevel"));
166              sensorObj.setCo2Level(jsonObj.getInt("coLevel"));
167              sensorObj.setStatus(jsonObj.getString("sensorStatus"));
168
169              arrayList.add(sensorObj);
170          }
171      } catch (JSONException e) {
172          e.printStackTrace();
173      }
174      return arrayList;
175  }

```

Client.java – main method of the Client.java file is initially look up for server. Following code section handles that part of the system.

```

651  service = (Service) Naming.lookup("//localhost/SensorService");
652  service.returnSensorDetailsApi();

```

RMIClient call to RMIServer to get sensor details is below.

```

60
61  StringBuffer response = service.returnSensorDetailsApi();
62

```

Email Service

When the Server.java class is executing the following code invokes Email.java class

```

136  ArrayList<Sensor> emailArray = new ArrayList<>();
137  emailArray = getSensors(response.toString());
138
139  for (int i = 0; i < emailArray.size(); i++) {
140      if (emailArray.get(i).smokeLevel > 5 || emailArray.get(i).co2Level > 5) {
141          emailService.sendMail();
142      }
143  }
144
145

```

sendMail() function implemented in Email.java class:

```
23 public static void sendMail() {
24     Properties properties = System.getProperties();
25
26     properties.put("mail.smtp.host", host);
27     properties.put("mail.smtp.port", "465");
28     properties.put("mail.smtp.ssl.enable", "true");
29     properties.put("mail.smtp.auth", "true");
30
31     Session session = Session.getDefaultInstance(properties, new Authenticator() {
32         protected PasswordAuthentication getPasswordAuthentication() {
33             return new PasswordAuthentication("stdsender2020@gmail.com", "student321");
34         }
35     }); //session.setDebug(true);
36
37     try
38     {
39         MimeMessage message = new MimeMessage(session); // MimeMessage object.
40         message.setFrom(new InternetAddress(sender)); // Set From Field: adding senders email to from field.
41         message.addRecipient(Message.RecipientType.TO, new InternetAddress(recipient)); // Set To Field: adding recipient's email to fr
42         message.setSubject("Alert"); // Set Subject: subject of the email
43         message.setText("Fire Alarm Danger Alert !"); // set body of the email.
44
45         Transport.send(message); // Send email.
46         System.out.println("Mail successfully sent");
47     } catch (MessagingException mex) {
48         mex.printStackTrace();
49     }
50 }
```

4.3 Web Client Application

Web application is developed in order to monitor the sensors.

In the home page of the Web application your credentials will be checked.

```
getEmail = (e) => {
    e.preventDefault();
    this.setState({userEmail:e.target.value})
};

getPassword = (e) => {
    e.preventDefault();
    this.setState({userPassword:e.target.value})
};
```

```
submit = (e) =>{
    e.preventDefault();

    // Send a POST request
    axios
        .post("http://localhost:44381/api/user/signin", {
            userEmail: this.state.userEmail.toString(),
            userPassword: this.state.userPassword.toString()
        })
        .then(result => {
            this.setState({
                status: result.status,
                results:result,
                error: false,
            });
            if (this.state.results.statusText === "OK"){
                this.setState({
                    goToPage:true
                })
            }else{
                alert('Wrong Credentials !');
            }
        })
        .catch(err => console.error(err));
};
```


Then you will be directed to a page with sensor details. Code that allows web client to fetch sensor details is below:

```
fetchData = () =>{
  const req = new Request('http://localhost:44381/api/sensor/getsensors', {
    method: 'GET',
    cache: 'default'
  });
  fetch(req).then(response =>{
    return response.json();
  }).then(data =>{
    console.log(data);
    this.setState({content: data.msg});
  }).catch(err => {
    console.log("ERROR: " + err);
  })
};
```

Details such as floor number, room no, smoke level CO₂ level and status of the sensor will be displayed for every sensor that is in the system.

Sensors that are depicted in Red represents that the status of the relevant sensor is active which means either CO₂ level or smoke level or both the levels of the sensor are above 5.

Sensors that are depicted in green are in normal condition

Sensors that are shown in white represents inactive sensors, therefore CO₂ level or the smoke level are not displayed.

```
render() {
  const { content } = this.state;

  return (
    <div id="Body">
      <div className="row m-5" id="Sensor">
        {content.map((item, sensor) => (
          <div className="col-md-3" key={sensor}>
            <div className="m-5">
              <div className=
                {(item.sensorStatus === "I") ? "card text-black
border-black mb-3" : (item.coLevel > 5 || item.smokeLevel > 5) ? "card text-white bg-
danger mb-3" : "card text-white bg-success mb-3"}>
                <div className={((item.coLevel > 5 || item.smokeLevel > 5)
?"card-header border-danger": "card-header border-success"} id="cardHeader"><h5
className="card-title">{item.sensorName}</h5></div>
                <div className="card-body " id="cardBody">
                  <p><span>Floor No : {item.floorNo}</span></p>
                  <p><span>Room No : {item.roomNo}</span></p>
                  <p><span>{(item.sensorStatus === "I") ? "Smoke Level :
N/A" : "Smoke Level : " + (item.smokeLevel)}</span></p>
                  <p><span>{(item.sensorStatus === "I") ? "CO2 Level :
N/A" : "CO2 Level : " + (item.coLevel)}</span></p>
                  <p><span>{(item.sensorStatus === "A") ? "Status :
Active" : "Status : Inactive"}</span></p>
                </div>
              </div>
            </div>
          </div>
        ))}
      </div>
    </div>
  );
}
```

Below code snippet is for updating the sensor details every 40 seconds:

```
componentWillMount() {  
  this.fetchData();  
  setInterval(this.fetchData, 40000);  
}
```

5. APPENDICES

Appendix A – Web Client Application

Appendix A.1

```
import React, {Component} from "react";  
  
export default class Login extends Component{  
  render() {  
    const {userEmail, userPassword, getEmail, getPassword, submit} = this.props;  
  
    return(  
      <div>  
        <br/>  
        <br/>  
        <div align="center">  
          <h1><font color="#006400"> Sign In </font></h1><br/><br/>  
        </div>  
        <div align="center">  
          <div className="col-md-4" >  
            <form className="px-4 py-3" style={{backgroundColor:  
"#F0FFF0"}}onSubmit={submit}>  
              <div className="form-group" align="left">  
  
                <label>Email Address: </label><br/>  
                <input name="userEmail"  
                  type="email"  
                  className="form-control"  
                  placeholder="Email"  
                  onChange={getEmail}  
                  value={userEmail}  
                  required={true}/>  
  
              </div>  
  
              <div className="form-group" align="left">  
                <label>Password: </label><br/>  
                <input name="userPassword"  
                  type="password"  
                  className="form-control"  
                  placeholder="Password"  
                  onChange={getPassword}  
                  value={userPassword}  
                  required={true}/><br/><br/>  
              </div>  
            </div>  
          </div>  
        </div>  
      </div>  
    );  
  }  
}
```

```

        <button type="submit" className="btn btn-success btn-lg btn-
block" >Sign In</button>

        </form>
      </div>
    </div>
  <br/>
  <br/>
  <br/>
  <br/>
  <br/>
  <br/>
</div>

  );
}
}

```

Appendix A.2

```

import React,{Component} from "react";
import Login from "../Login/Login";
import SensorPage from "../SensorPage/sensorPage";
const axios = require('axios').default;

export default class Main extends Component{

  state = {
    userEmail : '',
    userPassword: '',
    goToPage: false,
    error: '',
    status: null,
    results: [],
  };

  getEmail = (e) => {
    e.preventDefault();
    this.setState({
      userEmail:e.target.value
    })
  };

  getPassword = (e) => {
    e.preventDefault();
    this.setState({
      userPassword:e.target.value
    })
  };

  submit = (e) =>{
    e.preventDefault();

    // Send a POST request
    axios

```

```

        .post("http://localhost:44381/api/user/signin", {
            userEmail: this.state.userEmail.toString(),
            userPassword: this.state.userPassword.toString()
        })
        .then(result => {
            this.setState({
                status: result.status,
                results: result,
                error: false,
            });
            if (this.state.results.statusText === "OK"){
                this.setState({
                    goToPage: true
                })
            }
            else{
                alert('Wrong Credentials !');
            }
        })
        .catch(err => console.error(err));
    };

    render(){
        return (
            <div>
                {this.state.goToPage ?
                    <SensorPage/> : <Login
                        userEmail={this.state.email}
                        userPassword={this.state.password}
                        getEmail={this.getEmail}
                        getPassword={this.getPassword}
                        submit={this.submit}/>
                }
            </div>
        );
    }
}

```

Appendix A.3

```

import React, {Component} from "react";

export default class SensorPage extends Component{

    constructor(props) {
        super(props);
        this.state = {
            content: []
        };

        this.fetchData = this.fetchData.bind(this);
    }

    componentWillMount() {
        this.fetchData();
        setInterval(this.fetchData, 15000);
    }
}

```

```

fetchData = () =>{
    const req = new Request('http://localhost:44381/api/sensor/getsensors', {
        method: 'GET',
        cache: 'default'
    });

    fetch(req).then(response =>{
        return response.json();
    }).then(data =>{
        console.log(data);
        this.setState({
            content: data.msg
        });
    }).catch(err => {
        console.log("ERROR: " + err);
    })
};

render() {

    const { content } = this.state;

    return (
        <div id="Body">

            <div className="row m-5" id="Sensor">
                {content.map((item, sensor) => (
                    <div className="col-md-3" key={sensor}>
                        <div className="m-5" >
                            <div className=
border-black mb-3" : (item.coLevel > 5 || item.smokeLevel > 5) ? "card text-white bg-danger
mb-3" : "card text-white bg-success mb-3"> >
                                <div className={
?"card-header border-danger": "card-header border-success"} id="cardHeader"><h5
className="card-title">{item.sensorName}</h5></div>
                                    <div className="card-body " id="cardBody" >
                                        <p><span>Floor No : {item.floorNo}</span></p>
                                        <p><span>Room No : {item.roomNo}</span></p>
                                        <p><span>{(item.sensorStatus === "I") ? "Smoke Level
: N/A" : "Smoke Level : " + (item.smokeLevel)}</span></p>
                                        <p><span>{(item.sensorStatus === "I") ? "CO2 Level :
N/A" : "CO2 Level : " + (item.coLevel)}</span></p>
                                        <p><span>{(item.sensorStatus === "A") ? "Status :
Active" : "Status : Inactive"}</span></p>
                                    </div>
                                </div>
                            </div>
                        </div>
                    </div>
                ))}
            </div>

        </div>
    );
}

```

Appendix B – Sensor Application

Appendix B.1

```
import React from 'react';
//import logo from './logo.svg';
import './App.css';
import axios from 'axios';

class App extends React.Component {

  //This helps to call handleSensorUpdate() function in every 10 seconds
  componentWillMount () {
    this.handleSensorUpdate();
    setInterval(this.handleSensorUpdate, 10000);
  }

  //Main function to update smoke and co2 levels in all sensors
  handleSensorUpdate () {

    //Calling the api using GET method
    const req = new Request('http://localhost:44381/api/sensor/getsensors', {
      method: 'GET',
      cache: 'default'
    });

    //Taking the count of the sensors
    fetch(req).then(response =>{
      return response.json();
    }).then(data =>{
      console.log(data);

      //let count = data.msg.length;

      for(let i = 0; i < 100 ; i++){

        //Passing POST Json objects to each sensor to update levels
        const obj = {
          sensorId: i + 1,
          smokeLevel: Math.floor(Math.random() * 10) + 1,
          coLevel: Math.floor(Math.random() * 10) + 1
        };
        axios
          .post('http://localhost:44381/api/sensor/setsensorlevel', obj)
          .then((res) => console.log(res))
          .catch((err) => console.log(err));

      }
    })
  }
}
```

```

    }).catch(err => {
      console.log("ERROR: " + err);
    })
  };

  render() {
    return (
      <div>
        <h2 align="center">Sensor Updating App is running...</h2>
      </div>
    );
  }
}

export default App;

```

Appendix C – Desktop Client Application

Appendix C.1

```

public class Sensor {
  int sensorId;
  String sensorName;
  int floorNumber;
  int roomNumber;
  int smokeLevel;
  int co2Level;
  String status;

  public int getSensorId() {
    return sensorId;
  }

  public void setSensorId(int sensorId) {
    this.sensorId = sensorId;
  }

  public String getSensorName() {
    return sensorName;
  }

  public void setSensorName(String sensorName) {
    this.sensorName = sensorName;
  }

  public int getFloorNumber() {
    return floorNumber;
  }

  public void setFloorNumber(int floorNumber) {
    this.floorNumber = floorNumber;
  }

  public int getRoomNumber() {
    return roomNumber;
  }
}

```

```

public void setRoomNumber(int roomNumber) {
    this.roomNumber = roomNumber;
}

public int getSmokeLevel() {
    return smokeLevel;
}

public void setSmokeLevel(int smokeLevel) {
    this.smokeLevel = smokeLevel;
}

public int getCo2Level() {
    return co2Level;
}

public void setCo2Level(int co2Level) {
    this.co2Level = co2Level;
}

public String getStatus() {
    return status;
}

public void setStatus(String status) {
    this.status = status;
}

}

```

Appendix C.2

```

public class Server extends UnicastRemoteObject implements Service {

    StringBuffer response = new StringBuffer();
    StringBuffer responseUsers = new StringBuffer();
    public static Email emailService = null;

    public Server() throws RemoteException {
        super();
        Timer timer = new Timer();
        timer.schedule(new TimerTask() {
            @Override
            public void run() {
                try {

                    System.out.println("Hello from Server !");
                    getSensorDetailsApi();

                } catch (Exception ex) {
                    ex.printStackTrace();
                }
            }
        }, 0, 15000);
    }
}

```



```

public static void main(String[] args) {

    System.setProperty("java.security.policy", "file:allowall.policy");

    try {

        Server svr = new Server();
        Registry registry = LocateRegistry.getRegistry();
        registry.bind("SensorService", svr);
        System.out.println("RMI initialized....");

    } catch (RemoteException re) {
        System.err.println(re.getMessage());
    } catch (AlreadyBoundException abe) {
        System.err.println(abe.getMessage());
    }

}

@Override
public String adminLogin(String userName, String password) throws RemoteException
{

    String jsonObj = "";
    try {
        jsonObj = new JSONObject().put("userEmail", userName).put("userPassword",
password).toString();
    } catch (JSONException e) {
        e.printStackTrace();
    }

    try {
        Unirest.setTimeouts(0, 0);
        HttpResponse<String> response =
Unirest.post("http://localhost:44381/api/user/signin")
            .header("Content-Type",
"application/json").body(jsonObj).asString();

        JSONObject myResponse = new JSONObject(response.getBody().toString());

        if (response.getStatus() == 200) {
            return String.valueOf(response.getStatus());
        } else {
            return "404";
        }

    } catch (UnirestException ex) {
        System.out.println("out : " + ex);
    } catch (JSONException ex) {
        System.out.println("JSONException : " + ex);
    } catch (Exception ex) {
        System.out.println("Exception : " + ex);
    }

    return null;

}

@Override
public void getSensorDetailsApi() {
    String url = "http://localhost:44381/api/sensor/getsensors";

    try {

```

```

        URL obj = new URL(url);
        HttpURLConnection con = (HttpURLConnection) obj.openConnection();

        con.setRequestMethod("GET");
        con.setRequestProperty("User-Agent", "Mozilla/5.0");

        BufferedReader in = new BufferedReader(new
InputStreamReader(con.getInputStream()));
        String inputLine = in.readLine();

        StringBuilder sb = new StringBuilder(inputLine);
        StringBuilder afterRemove = sb.delete(0, 21);

        String finJStr = afterRemove.substring(0, afterRemove.length() - 2) +
"];

        while ((finJStr) != null) {
            this.response = null;
            this.response = new StringBuffer();
            this.response.append(finJStr);
            finJStr = null;
        }

        ArrayList<Sensor> emailArray = new ArrayList<>();
        emailArray = getSensors(response.toString());

        for (int i = 0; i < emailArray.size(); i++) {
            if (emailArray.get(i).smokeLevel > 5 || emailArray.get(i).co2Level >
5) {
                emailService.sendMail();
            }
        }

        in.close();

    } catch (Exception e) {
        System.out.println("ERROR : " + e);
    }
}

public ArrayList<Sensor> getSensors(String jsonRes) {
    ArrayList<Sensor> arrayList = new ArrayList<>();
    try {
        JSONArray jArray = new JSONArray(jsonRes);
        for (int count = 0; count < jArray.length(); count++) {
            Sensor sensorObj = new Sensor();
            JSONObject jsonObj = jArray.getJSONObject(count);
            sensorObj.setSensorId(jsonObj.getInt("sensorId"));
            sensorObj.setSensorName(jsonObj.getString("sensorName"));
            sensorObj.setFloorNumber(jsonObj.getInt("floorNo"));
            sensorObj.setRoomNumber(jsonObj.getInt("roomNo"));
            sensorObj.setSmokeLevel(jsonObj.getInt("smokeLevel"));
            sensorObj.setCo2Level(jsonObj.getInt("coLevel"));
            sensorObj.setStatus(jsonObj.getString("sensorStatus"));

            arrayList.add(sensorObj);
        }
    } catch (JSONException e) {
        e.printStackTrace();
    }
    return arrayList;
}

```

```

@Override
public String[] addSensor(String jsonObj) throws RemoteException {
    String[] response = new String[1];
    try {

        Unirest.setTimeouts(0, 0);
        HttpResponse<String> responseGet =
Unirest.post("http://localhost:44381/api/sensor/addsensor")
            .header("Content-Type",
"application/json").body(jsonObj).asString();

        if (responseGet.getStatus() == 200) {
            response[0] = String.valueOf(responseGet.getStatus());
            getSensorDetailsApi();
        } else {
            response[0] = String.valueOf(responseGet.getStatus());
        }

    } catch (Exception e) {
        e.printStackTrace();
    }

    return response;
}

@Override
public String[] updateSensor(String jsonObj) throws RemoteException {

    String[] values = new String[2];
    try {
        Unirest.setTimeouts(0, 0);
        HttpResponse<String> response =
Unirest.put("http://localhost:44381/api/sensor/editsensor")
            .header("Content-Type",
"application/json").body(jsonObj).asString();

        if (response.getStatus() == 200) {
            values[0] = String.valueOf(response.getStatus());
        } else {
            values[0] = String.valueOf(response.getStatus());
        }

    } catch (Exception ex) {
        ex.printStackTrace();
    }

    return values;
}

@Override
public String[] deleteSensor(String id) throws RemoteException {
    String[] response = new String[1];
    try {

        Unirest.setTimeouts(0, 0);
        HttpResponse<String> responseGet =
Unirest.delete("http://localhost:44381/api/sensor/deletesensor/" + id)
            .header("Content-Type", "application/json").asString();

        if (responseGet.getStatus() == 200) {

```

```

        response[0] = String.valueOf(responseGet.getStatus());
        getSensorDetailsApi();

    } else {
        response[0] = String.valueOf(responseGet.getStatus());
    }

} catch (Exception e) {
    e.printStackTrace();
}

return response;
}

@Override
public StringBuffer returnSensorDetailsApi() throws RemoteException {

    return response;
}
}

```

Appendix C.3

```

import java.rmi.Remote;
import java.rmi.RemoteException;
import org.json.JSONObject;
import org.json.JSONArray;

public interface Service extends Remote {

    public String adminLogin(String userEmail, String userPassword) throws
RemoteException;

    public String[] addSensor(String jsonObj) throws RemoteException;

    public String[] updateSensor(String jsonObj) throws RemoteException;

    public String[] deleteSensor(String sensorId) throws RemoteException;

    public void getSensorDetailsApi() throws RemoteException;

    public StringBuffer returnSensorDetailsApi() throws RemoteException;
}

```

Appendix C.4

```
public class Login extends javax.swing.JFrame {

    Timer timer = new Timer();
    public static Service service = null;

    public Login() throws Exception {
        initComponents();
        this.setTitle("Admin Portal & Sensor Details");

        timer.schedule(new TimerTask() {
            @Override
            public void run() {
                try {
                    getSensorDetails();
                } catch (Exception ex) {
                    System.out.println("Exception : " + ex);
                }
            }
        }, 0, 30000);
    }

    public void getSensorDetails() throws Exception {

        StringBuffer response = service.returnSensorDetailsApi();

        ArrayList<Sensor> sensArr = new ArrayList<>();
        sensArr = getSensors(response.toString());

        DefaultTableModel model = (DefaultTableModel) jTableLogin.getModel();
        model.setRowCount(0);
        Object rowData[] = new Object[6];

        for (int i = 0; i < sensArr.size(); i++) {
            rowData[0] = sensArr.get(i).sensorId;
            rowData[1] = sensArr.get(i).floorNumber;
            rowData[2] = sensArr.get(i).roomNumber;

            if(sensArr.get(i).status.equals("A")){
                rowData[3] = sensArr.get(i).smokeLevel;
                rowData[4] = sensArr.get(i).co2Level;
                rowData[5] = "Active";
            }else{
                rowData[3] = "-";
                rowData[4] = "-";
                rowData[5] = "Inactive";
            }
            model.addRow(rowData);
        }
    }

    public ArrayList<Sensor> getSensors(String json) {

        ArrayList<Sensor> arrayList = new ArrayList<>();
        try {
            JSONArray jsonArray = new JSONArray(json);
            for (int count = 0; count < jsonArray.length(); count++) {
```

```

        Sensor sensorObj = new Sensor();
        JSONObject jsonObj = jsonArray.getJSONObject(count);
        sensorObj.setSensorId(jsonObj.getInt("sensorId"));
        sensorObj.setSensorName(jsonObj.getString("sensorName"));
        sensorObj.setFloorNumber(jsonObj.getInt("floorNo"));
        sensorObj.setRoomNumber(jsonObj.getInt("roomNo"));
        sensorObj.setSmokeLevel(jsonObj.getInt("smokeLevel"));
        sensorObj.setCo2Level(jsonObj.getInt("coLevel"));
        sensorObj.setStatus(jsonObj.getString("sensorStatus"));

        arrayList.add(sensorObj);
    }
} catch (JSONException e) {
    e.printStackTrace();
}
return arrayList;
}

```

Appendix C.5

```

public class Home extends javax.swing.JFrame {

    public static Service service = null;
    Timer timer = new Timer();

    public Home() {
        initComponents();
        this.setTitle("Admin Panel");
        try {
            getSensorDetails();
        } catch (Exception ex) {
            System.out.println("Exception : " + ex);
        }

        timer.schedule(new TimerTask() {
            @Override
            public void run() {
                try {
                    getSensorDetails();
                } catch (Exception ex) {
                    ex.printStackTrace();
                }
            }
        }, 0, 30000);
    }

    public void getSensorDetails() throws Exception {

        boolean booDanger = false;

        StringBuffer response = service.returnSensorDetailsApi();

        ArrayList<Sensor> sensArr = new ArrayList<>();
        sensArr = getSensors(response.toString());
    }
}

```

```

DefaultTableModel model = (DefaultTableModel) sensorDetailsTable.getModel();
model.setRowCount(0);
Object rowData[] = new Object[7];

ArrayList<String> dangerSensorArray = new ArrayList<String>();

for (int i = 0; i < sensArr.size(); i++) {
    rowData[0] = sensArr.get(i).sensorId;
    rowData[1] = sensArr.get(i).sensorName;
    rowData[2] = sensArr.get(i).floorNumber;
    rowData[3] = sensArr.get(i).roomNumber;

    if (sensArr.get(i).status.equals("A")) {
        rowData[4] = sensArr.get(i).smokeLevel;
        rowData[5] = sensArr.get(i).co2Level;
        rowData[6] = "Active";
    } else {
        rowData[4] = "-";
        rowData[5] = "-";
        rowData[6] = "Inactive";
    }

    if (sensArr.get(i).status.equals("A")) {
        if (sensArr.get(i).smokeLevel > 5 || sensArr.get(i).co2Level > 5) {
            dangerSensorArray.add(String.valueOf(sensArr.get(i).sensorId));
            booDanger = true;
        }
    }

    if (booDanger == true) {
        sensorStateNotify.setText("Danger zone sensor IDs : " +
dangerSensorArray);
    } else {
        sensorStateNotify.setText("");
    }

    model.addRow(rowData);
}

}

public ArrayList<Sensor> getSensors(String json) {
    ArrayList<Sensor> arrayList = new ArrayList<>();
    try {
        JSONArray jsonArray = new JSONArray(json);
        for (int count = 0; count < jsonArray.length(); count++) {
            Sensor sensorObj = new Sensor();
            JSONObject jsonObj = jsonArray.getJSONObject(count);
            sensorObj.setSensorId(jsonObj.getInt("sensorId"));
            sensorObj.setSensorName(jsonObj.getString("sensorName"));
            sensorObj.setFloorNumber(jsonObj.getInt("floorNo"));
            sensorObj.setRoomNumber(jsonObj.getInt("roomNo"));
            sensorObj.setSmokeLevel(jsonObj.getInt("smokeLevel"));
            sensorObj.setCo2Level(jsonObj.getInt("coLevel"));
            sensorObj.setStatus(jsonObj.getString("sensorStatus"));

            arrayList.add(sensorObj);
        }
    } catch (JSONException e) {
        e.printStackTrace();
    }
}

```

```

        return arrayList;
    }

    private void submitBtnActionPerformed(java.awt.event.ActionEvent evt) { //GEN-FIRST:event_submitBtnActionPerformed
        if (validateInsertInputs()) {

            String sensorName = sensorNameAdd.getText();
            String roomNumber = roomNoAdd.getText();
            String floorNumber = floorNoAdd.getText();
            int status = cmbInsertStatus.getSelectedIndex();

            String finStatus = "";

            if (status == 1) {
                finStatus = "A";
            } else {
                finStatus = "I";
            }

            String jsonObj = "";
            try {
                jsonObj = new JSONObject()
                    .put("sensorName", sensorName)
                    .put("floorNo", floorNumber)
                    .put("roomNo", roomNumber)
                    .put("sensorStatus", finStatus).toString();
            } catch (JSONException e) {
                e.printStackTrace();
            }
            String[] response = new String[3];

            try {
                response = service.addSensor(jsonObj);
            } catch (RemoteException ex) {
                System.out.println("RemoteException : " + ex);
            }

            if (response[0].equals("200")) {
                try {
                    service.getSensorDetailsApi();
                    getSensorDetails();
                } catch (RemoteException ex) {
                    System.out.println("RemoteException : " + ex);
                } catch (Exception ex) {
                    System.out.println("Exception : " + ex);
                }
                JOptionPane.showMessageDialog(jPanell1, "Successfully saved the
sensor.", "SUCCESS!", JOptionPane.PLAIN_MESSAGE);
                roomNoAdd.setText("");
                floorNoAdd.setText("");
                cmbInsertStatus.setSelectedIndex(1);

                try {
                    this.getSensorDetails();
                } catch (Exception ex) {
                    System.out.println("Exception : " + ex);
                }
            }
        }
    }
}

```



```

        }

        } else if (!response[0].equals("200")) {
            JOptionPane.showMessageDialog(jPanel1, "Failed to save the sensor!",
"ERROR!", JOptionPane.ERROR_MESSAGE);
        }
    } else {
        JOptionPane.showMessageDialog(jPanel1, "Validation error!", "WARNING!",
JOptionPane.WARNING_MESSAGE);
    }
}

} //GEN-LAST:event_submitBtnActionPerformed

//This method is to perform the Sensor update task.
private void updateBtnActionPerformed(java.awt.event.ActionEvent evt) { //GEN-
FIRST:event_updateBtnActionPerformed
    if (validateUpdateInputs()) {

        String id = idUpdate.getText().trim();
        int finId = Integer.parseInt(id);
        String sensorName = sensorNameUpdate.getText().trim();
        String roomNumber = roomNoUpdate.getText().trim();
        String floorNumber = floorNoUpdate.getText().trim();
        int status = cmbUpdateStatus.getSelectedIndex();
        String finStatus = "";
        if (status == 1) {
            finStatus = "A";
        } else {
            finStatus = "I";
        }

        String jsonObj = "";
        try {
            jsonObj = new JSONObject()
                .put("sensorStatus", finStatus)
                .put("roomNo", roomNumber)
                .put("floorNo", floorNumber)
                .put("sensorName", sensorName)
                .put("sensorId", finId).toString();
        } catch (JSONException e) {
            e.printStackTrace();
        }

        String[] response = new String[3];

        try {
            response = service.updateSensor(jsonObj);
        } catch (RemoteException ex) {
            System.out.println("RemoteException : " + ex);
        }

        if (response[0].equals("200")) {
            JOptionPane.showMessageDialog(jPanel1, "Successfully updated. (sensor
id : " + id + ")", "SUCCESS!", JOptionPane.PLAIN_MESSAGE);
            idUpdate.setText("");
            sensorNameUpdate.setText("");
            roomNoUpdate.setText("");
            floorNoUpdate.setText("");
            cmbUpdateStatus.setSelectedIndex(1);

            try {
                service.getSensorDetailsApi();
                getSensorDetails();
            } catch (Exception ex) {

```

```

        System.out.println("Exception : " + ex);
    }

    } else if (!response[0].equals("200")) {
        JOptionPane.showMessageDialog(jPanell1, "Failed to update! (sensor id
: " + id + ")", "ERROR!", JOptionPane.ERROR_MESSAGE);
    }
    } else {
        JOptionPane.showMessageDialog(jPanell1, "Validation error!", "WARNING!",
JOptionPane.WARNING_MESSAGE);
    }

}

public boolean validateUpdateInputs() {

    int count = 0;

    if (idUpdate.getText().toString().isEmpty()) {
        count++;
    }
    if ((roomNoUpdate.getText().toString().isEmpty()) ||
(!roomNoUpdate.getText().matches("[0-9]+"))) {
        count++;
    }
    if ((floorNoUpdate.getText().toString().isEmpty()) ||
(!floorNoUpdate.getText().matches("[0-9]+"))) {
        count++;
    }

    if (count > 0) {
        return false;
    } else {
        return true;
    }
}

public boolean validateInsertInputs() {

    int count = 0;

    if (sensorNameAdd.getText().toString().isEmpty()) {
        count++;
    }
    if ((floorNoAdd.getText().toString().isEmpty()) ||
(!floorNoAdd.getText().matches("[0-9]+"))) {
        count++;
    }
    if ((roomNoAdd.getText().toString().isEmpty()) ||
(!roomNoAdd.getText().matches("[0-9]+"))) {
        count++;
    }

    if (count > 0) {
        return false;
    } else {
        return true;
    }
}

private void btnDeleteActionPerformed(java.awt.event.ActionEvent evt)
    String id = idUpdate.getText().toString();

```

```

if (!id.isEmpty()) {
    String[] response = new String[3];

    try {
        response = service.deleteSensor(id);
    } catch (RemoteException ex) {
        System.out.println("RemoteException : " + ex);
    }

    if (response[0].equals("200")) {
        try {
            service.getSensorDetailsApi();
            getSensorDetails();
        } catch (RemoteException ex) {
            System.out.println("RemoteException : " + ex);
        } catch (Exception ex) {
            System.out.println("Exception : " + ex);
        }
        JOptionPane.showMessageDialog(jPanell1, "Successfully deleted the
sensor. (sensor id : " + id + ")", "SUCCESS!", JOptionPane.PLAIN_MESSAGE);
        idUpdate.setText("");
        sensorNameUpdate.setText("");
        roomNoUpdate.setText("");
        floorNoUpdate.setText("");
        cmbUpdateStatus.setSelectedIndex(1);

        try {
            this.getSensorDetails();
        } catch (Exception ex) {
            System.out.println("Exception : " + ex);
        }

        } else if (!response[0].equals("200")) {
            JOptionPane.showMessageDialog(jPanell1, "Failed to delete the sensor!
(sensor id : " + id + ")", "ERROR!", JOptionPane.ERROR_MESSAGE);
        }
        } else {
            JOptionPane.showMessageDialog(jPanell1, "Select a sensor to delete !",
"WARNING!", JOptionPane.WARNING_MESSAGE);
        }
    }

private void sensorDetailsTableMouseClicked(java.awt.event.MouseEvent evt) {

    DefaultTableModel model = (DefaultTableModel) sensorDetailsTable.getModel();

    int rowIndex = sensorDetailsTable.getSelectedRow();

    idUpdate.setText(model.getValueAt(rowIndex, 0).toString());
    if (model.getValueAt(rowIndex, 6).toString() == "Active") {
        cmbUpdateStatus.setSelectedIndex(1);
    } else {
        cmbUpdateStatus.setSelectedIndex(0);
    }
    sensorNameUpdate.setText(model.getValueAt(rowIndex, 1).toString());
    floorNoUpdate.setText(model.getValueAt(rowIndex, 2).toString());
    roomNoUpdate.setText(model.getValueAt(rowIndex, 3).toString());

}

public static void main(String args[]) {

```

```

System.setProperty("java.security.policy", "file:allowall.policy");
try {
    service = (Service) Naming.lookup("//localhost/SensorService");
    service.returnSensorDetailsApi();

} catch (NotBoundException ex) {
    System.err.println(ex.getMessage());
} catch (MalformedURLException ex) {
    System.err.println(ex.getMessage());
} catch (RemoteException ex) {
    System.err.println(ex.getMessage());
}

java.awt.EventQueue.invokeLater(new Runnable() {
    public void run() {
        new Home().setVisible(true);
    }
});
}

```

Appendix C.6

```

public class Email {

    public static final String recipient = "stdrecipient2020@gmail.com";
    public static final String sender = "stdsender2020@gmail.com";
    public static final String host = "smtp.gmail.com";

    public static void sendMail() {
        Properties properties = System.getProperties();

        properties.put("mail.smtp.host", host);
        properties.put("mail.smtp.port", "465");
        properties.put("mail.smtp.ssl.enable", "true");
        properties.put("mail.smtp.auth", "true");

        Session session = Session.getDefaultInstance(properties, new
Authenticator() {
            protected PasswordAuthentication getPasswordAuthentication() {
                return new PasswordAuthentication("stdsender2020@gmail.com",
"student321");
            }
        });

        try
        {

            MimeMessage message = new MimeMessage(session);

            message.setFrom(new InternetAddress(sender));

            message.addRecipient(Message.RecipientType.TO, new
InternetAddress(recipient));

```

```

        message.setSubject("Alert");

        message.setText("Fire Alarm Danger Alert !");

        Transport.send(message);
        System.out.println("Mail successfully sent");
    }
    catch (MessagingException mex)
    {
        mex.printStackTrace();
    }
}
}

```

Appendix D – Fire Alarm Monitoring System API

Appendix D.1

```

namespace FireAlarmMonitoringSystem.Web.API.Controllers
{
    [Route("api/[controller]")]
    [ApiController]
    public class SensorController : ControllerBase
    {
        private readonly AppDbContext _context;
        private readonly ISensorPersistenceService _sensorPerService;

        public SensorController(AppDbContext context, ISensorPersistenceService
sensorPerService)
        {
            _context = context;
            _sensorPerService = sensorPerService;
        }

        [HttpGet("GetSensors")]
        public async Task<ApiResult> GetSensors()
        {
            return await _sensorPerService.GetSensors();
        }

        [HttpGet("GetSensor/{id}")]
        public async Task<ApiResult> GetSensor(int id)
        {
            return await _sensorPerService.GetSensor(id);
        }

        [HttpPost("AddSensor")]
        public async Task<ApiResult> AddSensor(SensorModel sensorDetObj)
        {
            return await _sensorPerService.AddSensor(sensorDetObj);
        }

        [HttpPut("EditSensor")]

```

```

    public async Task<ApiResult> EditSensor(SensorModel sensorDetObj)
    {
        return await _sensorPerService.EditSensor(sensorDetObj);
    }

    [HttpDelete("DeleteSensor/{id}")]
    public async Task<ApiResult> DeleteSensor(int id)
    {
        return await _sensorPerService.DeleteSensor(id);
    }

    [HttpPost("SetSensorLevel")]
    public async Task<ApiResult> SetSensorLevel(SensorModel sensorDetObj)
    {
        return await _sensorPerService.SetSensorLevel(sensorDetObj);
    }
}
}

```

Appendix D.2

```

namespace FireAlarmMonitoringSystem.Web.API.Controllers
{
    [Route("api/[controller]")]
    [ApiController]
    public class UserController : ControllerBase
    {
        private readonly AppDbContext _context;
        private readonly IUserPersistenceService _userPerService;

        public UserController(AppDbContext context, IUserPersistenceService
userPerService)
        {
            _context = context;
            _userPerService = userPerService;
        }

        [HttpPost("SignIn")]
        public async Task<UserModel> SignIn(UserModel curUser)
        {
            UserModel dbUser = await _userPerService.SignIn(curUser);
            return dbUser;
            //Authentication authentication = new
Authentication(_configuration);
            //return authentication.GetToken(loginUser);
        }

        [HttpPost("AddUser")]
        public async Task<ApiResult> AddUser(UserModel user)
        {
            return await _userPerService.AddUser(user);
        }
    }
}

```

Appendix D.3

```

namespace FireAlarmMonitoringSystem.Web.Data.Entities

```

```

{
    public class ApiResult
    {
        [JsonProperty("BOOVAL")]
        public bool BOOVAL { get; set; }

        [JsonProperty("MSG")]
        public object MSG { get; set; }
    }
}

```

Appendix D.4

```

namespace FireAlarmMonitoringSystem.Web.Data.Entities
{
    public class AppDbContext : DbContext
    {
        public AppDbContext(DbContextOptions<AppDbContext> options) :
base(options)
        {
        }

        public DbSet<UserModel> Users { get; set; }
        public DbSet<SensorModel> SensorDetails { get; set; }
    }
}

```

Appendix D.5

```

namespace FireAlarmMonitoringSystem.Web.Data.Entities
{
    public class SensorModel
    {
        [Key]
        [JsonProperty("sensorId")]
        public int sensorId { get; set; }

        [JsonProperty("sensorName")]
        public string sensorName { get; set; }

        [JsonProperty("floorNo")]
        public string floorNo { get; set; }

        [JsonProperty("roomNo")]
        public string roomNo { get; set; }

        [JsonProperty("smokeLevel")]
        public int smokeLevel { get; set; }

        [JsonProperty("coLevel")]
        public int coLevel { get; set; }

        [JsonProperty("sensorStatus")]
        public string sensorStatus { get; set; }
    }
}

```

Appendix D.6

```
namespace FireAlarmMonitoringSystem.Web.Data.Entities
{
    public class UserModel
    {
        [Key]
        [JsonProperty("userId")]
        public int userId { get; set; }

        [JsonProperty("userEmail")]
        public string userEmail { get; set; }

        [JsonProperty("userName")]
        public string userName { get; set; }

        [JsonProperty("userPassword")]
        public string userPassword { get; set; }

        [JsonProperty("userRole")]
        public string userRole { get; set; }
    }
}
```