

Instructional Scenario

Smart Home Automation

Challenge



Course/Duty Area: Java Programming (Oracle)/ Learning the Fundamentals of Java as an Object-Oriented Programming Language

Scenario:

A company is developing a smart home system that automates home appliances based on user preferences. As a software developer for the company, you have been tasked with designing a Java-based prototype that models different smart home devices using object-oriented programming (OOP) principles.

Big Question:

How can object-oriented programming be used to develop scalable and efficient smart home systems?

Focused Questions:

- What are the benefits of using inheritance and polymorphism in software development?
- How can encapsulation and abstraction improve the security of smart devices?
- What real-world problems can be solved with smart home automation?

Student Project or Outcome:

Students will develop a Java application that

- defines a base class for smart devices
- implements subclasses for different appliances (e.g., SmartLight, SmartThermostat)
- demonstrates polymorphism by allowing devices to respond to different commands dynamically.

Project-Based Assessment:

- Well-structured Java code, implementing OOP principles
- A simulation of how devices interact with user commands
- A brief report explaining design choices and the benefits of OOP in smart home systems

Teacher Resources:

- Java OOP tutorials and documentation
- Sample code for device simulation (see below)
- Case studies on real-world smart home automation

Java Code: Smart Home System

// Parent class: SmartDevice

```
class SmartDevice {  
  
    protected String deviceName;  
  
    public SmartDevice(String deviceName) {  
  
        this.deviceName = deviceName;  
  
    }  
  
    public void turnOn() {  
  
        System.out.println(deviceName + " is now ON.");  
  
    }  
  
    public void turnOff() {  
  
        System.out.println(deviceName + " is now OFF.");  
  
    }  
  
}
```

// Subclass: SmartLight

```
class SmartLight extends SmartDevice {  
  
    private int brightness;  
  
    public SmartLight(String deviceName, int brightness) {
```

```
        super(deviceName);

        this.brightness = brightness;
    }

    public void adjustBrightness(int level) {

        this.brightness = level;

        System.out.println(deviceName + " brightness set to " + brightness + "%.");
    }
}

// Subclass: SmartThermostat

class SmartThermostat extends SmartDevice {

    private double temperature;

    public SmartThermostat(String deviceName, double temperature) {

        super(deviceName);

        this.temperature = temperature;
    }

    public void setTemperature(double newTemp) {

        this.temperature = newTemp;

        System.out.println(deviceName + " temperature set to " + temperature + "°C.");
    }
}
```

```
// Main class to simulate the system

public class SmarHome {

    public static void main(String[] args) {

        SmartLight livingRoomLight = new SmartLight("Living Room Light", 75);

        SmartThermostat homeThermostat = new SmartThermostat("Home Thermostat", 22.5);


        livingRoomLight.turnOn();

        livingRoomLight.adjustBrightness(50);


        homeThermostat.turnOn();

        homeThermostat.setTemperature(20.0);


        livingRoomLight.turnOff();

        homeThermostat.turnOff();

    }

}
```

Expected Output:

Living Room Light is now ON.

Living Room Light brightness set to 50%.

Home Thermostat is now ON.

Home Thermostat temperature set to 20.0°C.

Living Room Light is now OFF.

Home Thermostat is now OFF.

Scenario submitted by David Vogel, King George High School, King George County Public Schools