

# Learning UML

O'Reilly

## Example System – Home Automation

This document describes the background to and requirements for a system that is used for practical examples throughout the *Learning UML* course.

Armadillo Secure Homes (ASH) is a company that installs intruder alarms primarily in the domestic market. The company's Chief Technology Officer (CTO) has recognised that there is an opportunity to develop the company's business into home automation systems using wireless communications. He has written the following requirements for a new software system to be developed by the company's software development team.

The purpose of the system is to be able to automatically control devices and equipment in the home. There are three kinds of device.

- On/off device: those that are either on or off. A light would be an on/off device.
- Open/closed device: those that are either open or closed. A garage door would be an open/closed device.
- Value in range device: those that can be set to some value in a range. A light with a dimmer, or a heater would be a value in range device.

The user of the system should be able to remotely control devices directly through the system, but the benefit comes from being able to automate the actions to take place without user intervention. There will be three kinds of trigger for actions.

- The first is time-based. The user should be able to set up a schedule of times and associate actions with those times, for example, to switch a coffee-maker on at 7.00 am.
- The second is based on measurements from passive sensors. The user should be able to set up a list of threshold values for sensors and associate actions with those measurements, for example, to turn on a light when a light sensor measures the light level has fallen below a threshold.
- The third is based on detecting an action in the real world. The user should be able to setup a list of triggers for actions based on active sensors that send some kind of signal to the system, for example, to turn on a light when someone steps on a pressure sensor.

So, the user might setup a schedule called Holiday Lights, which turns certain lights in the house on and off at specific times when the owner is away on holiday. The one schedule would have several events in it and would be associated with different devices, in this case lights. Or the user might have a greenhouse in their garden and set up sensors to measure temperature and soil humidity. When the temperature goes above a certain threshold, it would open the greenhouse skylights, when the soil humidity falls below a certain threshold, it would turn on a watering system, and turn it off again either after a set amount of time or when the soil humidity goes above a threshold.

To do this, the system needs to be as generic as possible with the ability to plug in new devices and sensors of different types, which may have their own software drivers, like plug and play devices on USB ports.

The user needs to be able to use the system in various ways through a web-based interface.

- To directly control a device (switch it on or off, open or close it, or set it to a value).
- To set up a schedule of events (specified times of day), with the ability to set a start date and end date for that schedule and to enable or disable it, and to associate a schedule to one or more devices.
- To set up a list of triggers that can happen at any time, either based on sensor measurements or on active sensors, with the ability to set a start date and end date for that list and to enable or disable it, and to associate a list of triggers with one or more devices.
- To query the status of all devices and sensors on the system, and to be able to filter the display in order to show only certain types of device or sensor.
- To add a new device to the system.
- To add a new sensor to the system.

The system should run on a small computer with a web server that allows the user to connect to it and administer and control the system. It should communicate with devices wirelessly, and this could be by a variety of methods, the simplest being over a domestic wi-fi network. It should be possible to set the control computer up so that the owner can access it securely via their router if they have a fixed IP address from their Internet Service Provider.

The system must provide a level of security that prevents unauthorised persons from accessing the control system and adding or swapping devices or sensors.

The initial implementation is planned to use wi-fi and should allow for more than one device or sensor sharing the same IP address, so each device or sensor needs its own unique id. However, the use of IP addresses and unique ids should be transparent to the user.

In the future it is planned to create an app to control the devices, but that is not a requirement of the first phase of implementation.