

System Scenarios

for

Machine Learning Smart Home

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1. Introduction

In order to better understand the motivations for using the learning home automation system, we have created a number of scenarios where we expect the behaviour of homeowners to follow patterns that a machine learning algorithm could pick up on. These particular scenarios were chosen because they involve relationships between multiple devices which may not be obvious. The scenarios also include a list of smart devices involved. Using the devices identified in these scenarios, the team can compile a list of devices which will showcase the machine learning capabilities of the system for testing and demos.

2. Music Automation

2.1 Background

Smart home automation should make your life easy and fun. Imagine a group of people arrive at your house for a party. Your home automation system has learned how to set up your environment to give you the best experience possible. The lights dim, the temperature goes down, and the music goes up. Your home is now ready for your guests!

2.2 System Interaction

The home automation system will be able to interact with a music system. The remote interface will allow the user to turn on and off music and control the system volume. The system may also be able to control the specific speakers that are active and playing music.

The user may choose to schedule the operation of music within the home to start at a certain date or time. Alternatively, the user may train the system that when many people enter the home then music should start playing at a certain volume. This could be accomplished by entering training mode, having a large number of people enter the room and then turning on music. Motion sensors would be required to measure the occupancy of the home to enable this learning.

Using a similar method to the music training, the user could train the system to tune the temperature, lights, and any other devices they wish. This could indicate to the system that when there are many people in the home, all of the trained systems should be activated.

2.3 System Requirements

To be able to monitor the home, the following sensors may be of interest. These sensors will be use to monitor the occupancy of the home as well as determine the noise level of the home to appropriately adjust the music.

Sensor	Usage
Beam Motion Sensor	2 Beam sensors series can be used detect occupancy
Audio Sensor	Audio sensor for tuning music volume the atmosphere

The system will require some devices to be able to produce the desired outputs. The following table lists example devices to allow this system to perform the tasks outlined in this scenario.

Device	Usage
Speakers	Controllable speakers for home configuration
Controllable Lights	Lights that can be controlled by the central system
Thermostat	Controllable thermostat for changing temperature

3. Efficient Lights and Temperature

3.1 Background

A smart home should reduce your energy bills and keep you comfy. During your work week, your home is left to cool during the day when no one is home. In the evening, before you arrive, the system heats the house to a comfortable temperature. As you arrive home, the lights automatically turn on in the rooms that you will enter. Later in the evening, the system cools the house to a comfortable sleeping temperature and dims the lights.

On the weekend, the house remains warm during the day while you are home. If you leave then to go to a store, the system turns off all the lights and lowers the temperature. When your arrive home again the system turns the lights back on and raises the temperature.

In the summer months, when it is more light outside, the system does not turn the home's lights on until later. In the winter months, the home turns the lights on earlier.

3.2 System Interaction

The system will need to interact with multiple sensors as well as light and temperature controllers. The remote interface will need to be able to display the state of all the sensors in the system. The remote will also need to offer control of the other devices in the system.

The system will also be able to be trained to obtain the desired output. To be able to have the lights turn off when the user leaves the room, the user could enter training mode with the lights on, leave the room and then turn off the lights. If this interaction was repeated then the system might learn this behaviour.

For the system to learn the desired temperature that the user desired, the learning process may be much longer. At different times of day the user will change the temperature. As environmental factors changes, the system will make these observations and use them to decide what the should be set to.

3.3 System Requirements

To enable light and temperature control, sensors will be needed to observe the system. The sensors will be needed to observe the ambient light and temperature of the home. There will also need to be sensors to determine the occupancy of the home. The following is a list of sensors that will be needed for this scenario.

Sensor	Usage
Light Sensor	Used to determine the amount of light in the home
Temperature Sensor	Need to observe the temperature of the home
Motion Sensor	Will provide information about the occupancy of the home

To enable this scenario, the system will need to be able to control a number of devices. The system will need to have control of the home's lights and thermostat. In addition to having the devices in the system, the system's user interface will need to provide control mechanisms for the device. The following is a list of the devices that will be needed and how they will be used in the system.

Device	Usage
Smart Lights	Lights can be controlled through the API
Thermostat Controller	A controller that can control the temperature through the API

4. TV Automation

4.1 Background

Automation of a smart home should go beyond simple tasks and make it easy to stay on top of a busy schedule. Your favourite TV show is on every week at the same time but your schedule changes from week to week. The smart home system should recognize that this channel is on at the same time each week and that it is a show of interest. If one week you cannot make it to watch the show, you should not be bothered to have to set up the personal recording device, the smart home system should record the show for you.

4.2 System Interaction

The automation system will have to interact with a smart TV in order to communicate the channel information of the TV. The system will also need to have access to a personal video recording device.

To train the system to record a show, the user could watch a show one week and then record it the next week. The user could teach the system that recoding should happen when they are not present by setting the system to record when they are not in the room. If there are motion sensors then the system could detect the user's presence.

4.3 System Requirements

To be able to determine if the user is present in the home, the system will need various sensors for light and motion. The following is a list of sensors that will be needed for this scenario.

Sensor	Usage
Motion Sensor	Will provide information about home occupancy

The system will also need to be able to communicate to a smart TV and digital video recording device for recording TV shows. The following smart devices will be needed to control TV channels and record TV shows.

Device	Usage
Smart TV	TV the commu channel informat and c: controll remotely
Video Recorder	Record capturin user's T

5. Coffee Automation

5.1 Background

Routine tasks done on a periodic schedule and can be automated by a smart process. Every morning you wake up and make a pot of coffee before you go about your day. Making a pot of coffee is a task that can be handled automatically by the smart home system. The system should learn when you wake up and make your coffee for you.

Let's imagine that on the weekend you don't make any morning coffee, the system should learn this behaviour and adapt during the days of the week. On a day that you are not at home, the system should not make any coffee either.

5.2 System Interaction

The system will need to be able to interact with a number of sensors to detect the user's presence. The system will also need to be able to communicate to a smart coffee maker so that it can observe when it is running as well as turn it off and on. The system will also need to be able to differentiate between the different days of the week and the time of day.

In order to train the system, the user could put the system into training mode and then get into bed. The user could then get out of bed and go directly to the kitchen and make a pot of coffee. The system could observe the user's leaving the bed with motion sensors and track that they are making coffee in a smart coffee maker.

5.3 System Requirements

To track the user's motion in the home, the system will need motion sensors. To be able to differentiate between the days of the week and time, the system will also need access to a clock and a calendar. The following is a list of sensors that will be required for this interaction.

Sensor	Usage
Motion Sensors	Used to track user movement throughout the home
Clock	Used to determine the time of day that the user makes coffee
Calendar	Used to determine what day of the week the user makes coffee

To be able to actually make the coffee, a smart coffee maker will be needed. This is the only smart device that will be required to automate this scenario.