Project Smart House

Problem:

Create a program to manage a smart house with the use of object oriented programming in c# language.

Main Functions

Classes:

Lamp:

Class that models a lamp, with the option of changing its brightness.

EcoLamp:

Class that models an eco friendly lamp,with the option of changing its brightness and its maximum brightness halved to save power. It also has a timer function to make sure the lamp automatically turns off after the selected timer comes to an end.

TwoLampDevice:

Class that combines two lamps, which can also be of different types, to turn them on or off or toggle it, increase the brightness or decrease it and change the brightness in a determined lamp of a determined brightness.

LampsRow:

Class that manages an arbitrary number of Lamps and EcoLamps from a single point. Allows to add new Lamp, new EcoLamp and a new AbstractLamp in a determined position and remove Lamp with name, with Guid and remove with name in a determined position. Allows to switch on and switch off with name and Guid and also switch all lamps on or off. Allows to change the brightness of a single lamp with the name or Guid and also change brightness of all lamps. Also allows to find the lamp with the highest or the lowest brightness, also can find all the lamps in a determined range or find all the lamps which are on or off, also can find a lamp with its Guid. Finally can sort lamps by intensity.

Thermostat:

Class which controls temperature with range 15°-30° (default 20°), always On. Verified IncreaseTemperature raises by 0.1° up to 30° (throws at max). Verified DecreaseTemperature lowers by 0.1° down to 15° (throws at min). Verified SetTemperature accepts any value in valid range, throws outside bounds.

Door:

Class which is a secure door controller with 4+ digit PIN, status Unknown. Verified OpenDoor works from Closed to Open, throws when Locked/Open. Verified CloseDoor works from Open to Closed, throws otherwise. Verified LockDoor works from Closed to Locked, throws when Open. Verified UnlockDoor works from Locked to Closed with correct PIN, throws with wrong PIN or when not Locked.

AirConditioner:

Class which is a fan speed controller (Low/Medium/High, default Medium). Verified TurnOn works when off, throws when on. Verified TurnOff works when on, throws when off. Verified SetFanSpeedLow/Medium/High work only when on, throw when off. Verified IncreaseFanSpeed cycles Low to Medium to High, throws at max or when off. Verified DecreaseFanSpeed cycles High to Medium to Low, throws at min or when off.

CCTV:

Class which have vision change methods set Night, Thermal, or Default vision but throw if already active. Zoom setters move to min, default, or max but throw if already at that level. IncreaseZoom and DecreaseZoom adjust zoom by 0.1 but throw if already at max or min.

Implementation Requirements

Lamp:

Metodo/Proprietà	Descrizione/Funzionalità
MinBrightness	Returns The minimum value of Brightness(0).
MaxBrightness	Returns The maximum value of Brightness(100).
DefaultBrightness	Returns The default value of Brightness(50).
Brightness	The current Brightness value.
SwitchOn()	Turns on the lamp and sets the brightness to its default value(50). Updates LastUpdatedAtUtc.
SwitchOff()	Turns off the lamp and sets the brightness to its minimum value(0). UpdatesLastUpdatedAtUtc.
SwitchOnOff()	Switches the lamp on if it's off or turns it off if it's on. Respectively sets the brightness to either its default or minimum value. Updates LastUpdatedAtUtc.
ChangeBrightness(int newbrightness)	When the lamp is on and newbrightness is in the range 0 to 100, sets brightness as newbrightness. Updates LastUpdatedAtUtc.

Dimmer()	When lamp is on, brightness decreases by 10. Updates LastUpdatedAtUtc.
Brighten()	When the lamp is on, brightness increases by 10. Updates LastUpdatedAtUtc.

EcoLamp:

Metodo/Proprietà	Descrizione/Funzionalità
MinBrightness	Returns The minimum value of Brightness(0).
MaxBrightness	Returns The maximum value of Brightness(70).
DefaultBrightness	Returns The default value of Brightness(30).
Brightness	The current Brightness value.
SwitchOn()	Turns on the lamp and sets the brightness to its default value(50). Updates LastUpdatedAtUtc.
SwitchOff()	Turns off the lamp and sets the brightness to its minimum value(0). UpdatesLastUpdatedAtUtc.
SwitchOnOff()	Switches the lamp on if it's off or turns it off if it's on. Respectively sets the brightness to either its default or minimum value. Updates LastUpdatedAtUtc.
ChangeBrightness(int newbrightness)	When the lamp is on and newbrightness is in the range 0 to 100, sets brightness as newbrightness. Updates LastUpdatedAtUtc.
Dimmer()	When lamp is on, brightness decreases by 10. Updates LastUpdatedAtUtc.
Brighten()	When the lamp is on, brightness increases by 10. Updates LastUpdatedAtUtc.

Status	Status of the lamp: On/Off
Name	Name of the lamp
LastUpdateAtUtc	Date/Hour of the last update to the lamp's state

TwoLampDevice:

Metodo/Proprietà	Descrizione/Funzionalità
Lamp1	Returns an AbstractLamp
Lamp2	Returns an AbstractLamp
SwitchOn(int selectedLamp)	Turns on the selected Lamp
SwitchOff(int selectedLamp)	Turns off the selected Lamp
Dimmer(int selectedLamp)	Decreases the brightness of the selected Lamp
Brighten(int selectedLamp)	Increases the brightness of the selected Lamp
SwitchOnOff(int selectedLamp)	Turns on or off the selected Lamp
ChangeBrightness(int newBrightness, int selectedLamp)	Changes the brightness in a new brightness in a determined Lamp

LampsRow:

Metodo/Proprietà	Descrizione/Funzionalità
Lamps	Returns a list of AbstractLamp
AddLamp(string name)	Adds a Lamp with a determined Name

AddEcoLamp(string name)	Adds a EcoLamp with a determined Name
AddLampInPosition(AbstractLamp lamp, int position)	Adds an AbstractLamp in a determined position
RemoveLamp(string name)	Removes a Lamp with a determined Name
RemoveLamp(Guid id)	Removes a Lamp with a determined Id
RemoveLampInPosition(string name, int position)	Removes a Lamp with a specified name in a determined position
SwitchOff(Guid id)	Turns off a Lamp with its Id
SwitchOn(string name)	Turns on a Lamp with its name
SwitchOff(string name)	Turns off a Lamp with its name
AllSwitchOn()	Turns on all Lamps
AllSwitchOff()	Turns off all Lamps
SingleLampSwitchOnOff(string name)	Turns on or off a determined Lamp
SingleLampChangeBrightness(int newbrightness, string name)	Changes brightness in a new brightness in a determined Lamp with name
SingleLampChangeBrightness(int newbrightness, Guid id)	Changes brightness in a new brightness in a determined Lamp with Id
AllLampsSwitchOnOff()	Turn on or off all Lamps
AllLampsChangeBrightness(int newBrightness)	Changes brightness in a new brightness in all Lamps
FindLampWithMaxBrightness()	Finds the Lamp which has the max brightness
FindLampsByIntensityRange(int min, int max)	Finds The Lamps which are in a determined range of intensity

FindAllOn()	Finds all the Lamps which are on
FindAllOff()	Finds all the lamps which are off
FindLampById(Guid id)	Finds a Lamp with its Id
SortByIntensity(bool descending)	Sort all the Lamps by intensity and returns to you false if it order growing and returns to you true if it order decreasing

Door:

Metodo/Proprietà	Descrizione/Funzionalità
PIN	Returns a int
DoorStatus	Returns a state of DoorStatus
OpenDoor()	Opens the door when it's closed and throw an ArgumentException when it's locked
CloseDoor()	Close the door when it's open and throw an ArgumentException when is not open
LockDoor()	Locks the door when it's closed and throw an ArgumentException when is not closed
UnlockDoor()	Unlocks the door if it's locked and if the insert PIN is equal to the PIN and throw an ArgumentException when the PIN is not equal and when the door is not locked

AirConditioner:

Metodo/Proprietà	Descrizione/Funzionalità

FanSpeed	Returns the FanSpeed
TurnOn()	Turns the device on and throw an ArgumentException when is already on
TurnOff()	Turns the device off and throw an ArgumentException when is already off
SetFanSpeedLow()	Sets the FanSpeed of device to Low and throw an ArgumentException when is not on
SetFanSpeedMedium()	Sets the FanSpeed of device to Medium and throw an ArgumentException when is not on
SetFanSpeedHigh()	Sets the FanSpeed of device to High and throw an ArgumentException when is not on
IncreaseFanSpeed()	Increases the FanSpeed of device and throw an ArgumentException when is not on
DecreaseFanSpeed()	Decreases the FanSpeed of device and throw an ArgumentException when is not on

Thermostat:

Metodo/Proprietà	Descrizione/Funzionalità
Temperature	Returns temperature
MinTemperature	It’s a constant

DefaultTemperature	It’s a constant
MaxTemperature	It’s a constant
DefaultJump	It’s a constant
IncreaseTemperature()	Increases the temperature of the DefaultJump and when it’s at maximum throw an ArgumentException
DecreaseTemperature()	Decreases the temperature of the DefaultJump and when it’s at minimum throw an ArgumentException
SetTemperature(double newTemperature)	Sets a new temperature and throw an ArgumentException when the newTemperature is out of the range between MinTemperature and MaxTemperature

AbstractDevice:

Metodo/Proprietà	Descrizione/Funzionalità
Id	Returns a Guid
Name	Returns name
Status	Returns DeviceStatus
CreationTime	Returns DataTime
LastUpdateTime	Returns DataTime
SwitchOn()	Turns the device on if it’s off and update the LastUpdateTime to that moment

SwitchOff()	Turns the device off if it's on and update the LastUpdateTime to that time

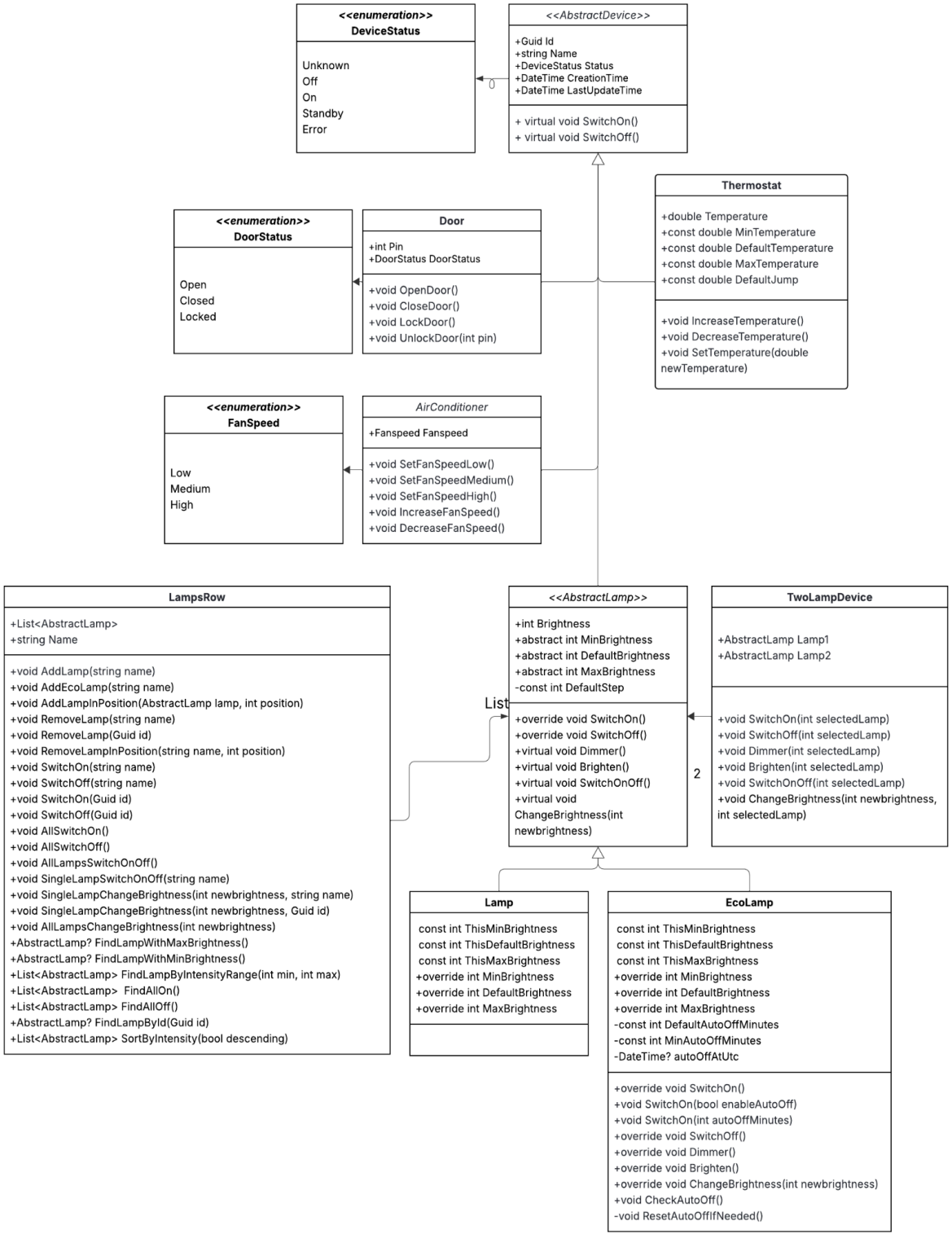
CCTV:

Metodo/Proprietà	Descrizione/Funzionalità
VisionType	Returns CCTVVisionType
MinZoom	It's a constant
DefaultZoom	It's a constant
MaxZoom	It's a constant
DefaultJump	It's a constant
SetDefaultVision	Sets VisionType to DefaultVision if VisionType is not already DefaultVision
SetNightVision	Sets VisionType to NightVision if VisionType is not already NightVision
SetThermalVision	Sets VisionType to ThermalVision if VisionType is not already ThermalVision
SetMinZoom	Sets zoom to MinZoom if zoom is not already MinZoom
SetDefaultZoom	Sets zoom to DefaultZoom if zoom is not already DefaultZoom
SetMaxZoom	Sets zoom to MaxZoom if zoom is not already MaxZoom
IncreaseZoom	Increases zoom until it's to the max

DecreaseZoom	Decreases zoom until it’s to the min

UML

Class Diagram


<<enumeration>>
DeviceStatus
Unknown
Off
On
Standby
Error
<<AbstractDevice>>
+Guid Id
+string Name
+DeviceStatus Status
+DateTime CreationTime
+DateTime LastUpdateTime
+ virtual void SwitchOn()
+ virtual void SwitchOff()
Thermostat
+double Temperature
+const double MinTemperature
+const double DefaultTemperature
+const double MaxTemperature
+const double DefaultJump
+void IncreaseTemperature()
+void DecreaseTemperature()
+void SetTemperature(double newTemperature)
<<enumeration>>
DoorStatus
Open
Closed
Locked
Door
+int Pin
+DoorStatus DoorStatus
+void OpenDoor()
+void CloseDoor()
+void LockDoor()
+void UnlockDoor(int pin)
<<enumeration>>
FanSpeed
Low
Medium
High
AirConditioner
+Fanspeed Fanspeed
+void SetFanSpeedLow()
+void SetFanSpeedMedium()
+void SetFanSpeedHigh()
+void IncreaseFanSpeed()
+void DecreaseFanSpeed()
LampsRow
+List<AbstractLamp>
+string Name
+void AddLamp(string name)
+void AddEcoLamp(string name)
+void AddLampInPosition(AbstractLamp lamp, int position)
+void RemoveLamp(string name)
+void RemoveLamp(Guid id)
+void RemoveLampInPosition(string name, int position)
+void SwitchOn(string name)
+void SwitchOff(string name)
+void SwitchOn(Guid id)
+void SwitchOff(Guid id)
+void AllSwitchOn()
+void AllSwitchOff()
+void AllLampsSwitchOnOff()
+void SingleLampSwitchOnOff(string name)
+void SingleLampChangeBrightness(int newbrightness, string name)
+void SingleLampChangeBrightness(int newbrightness, Guid id)
+void AllLampsChangeBrightness(int newbrightness)
+AbstractLamp? FindLampWithMaxBrightness()
+AbstractLamp? FindLampWithMinBrightness()
+List<AbstractLamp> FindLampByIntensityRange(int min, int max)
+List<AbstractLamp> FindAllOn()
+List<AbstractLamp> FindAllOff()
+AbstractLamp? FindLampById(Guid id)
+List<AbstractLamp> SortByIntensity(bool descending)
List
<<AbstractLamp>>
+int Brightness
+abstract int MinBrightness
+abstract int DefaultBrightness
+abstract int MaxBrightness
-const int DefaultStep
+override void SwitchOn()
+override void SwitchOff()
+virtual void Dimmer()
+virtual void Brighten()
+virtual void SwitchOnOff()
+virtual void ChangeBrightness(int newbrightness)
2
TwoLampDevice
+AbstractLamp Lamp1
+AbstractLamp Lamp2
+void SwitchOn(int selectedLamp)
+void SwitchOff(int selectedLamp)
+void Dimmer(int selectedLamp)
+void Brighten(int selectedLamp)
+void SwitchOnOff(int selectedLamp)
+void ChangeBrightness(int newbrightness, int selectedLamp)
Lamp
const int ThisMinBrightness
const int ThisDefaultBrightness
const int ThisMaxBrightness
+override int MinBrightness
+override int DefaultBrightness
+override int MaxBrightness
EcoLamp
const int ThisMinBrightness
const int ThisDefaultBrightness
const int ThisMaxBrightness
+override int MinBrightness
+override int DefaultBrightness
+override int MaxBrightness
-const int DefaultAutoOffMinutes
-const int MinAutoOffMinutes
-DateTime? autoOffAtUtc
+override void SwitchOn()
+void SwitchOn(bool enableAutoOff)
+void SwitchOn(int autoOffMinutes)
+override void SwitchOff()
+override void Dimmer()
+override void Brighten()
+override void ChangeBrightness(int newbrightness)
+void CheckAutoOff()
-void ResetAutoOffIfNeeded()

Testing

Lamp:

Performed 12 tests. Verified SwitchOn and SwitchOff which respectively turn on and off the lamp. Verified ChangeBrightness which cannot have negative value, the toggle which permits turning on and off and finally Dimmer and Brighten which increase or decrease the brightness.

EcoLamp:

Performed 12 tests. Verified SwitchOn and SwitchOff which respectively turn on and off the lamp. Verified ChangeBrightness which cannot have negative value, the toggle which permits turning on and off and finally Dimmer and Brighten which increase or decrease the brightness. Verified that the timer works.

TwoLampDevice:

Performed 39 tests.
Verified SwitchOn and SwitchOff which respectively turn on and off a determined lamp. Verified ChangeBrightness which cannot have negative value, the toggle which permits turning on and off and finally Dimmer and Brighten which increase or decrease the brightness.

LampsRow:

Performed 42 tests.
Verified SwitchOn and SwitchOff which respectively turn on and off a determined lamp with its name or Guid. Verified SingleChangeBrightness with name or Guid which cannot have negative value, the toggle which permits turning on and off and finally Dimmer and Brighten which increase or decrease the brightness of a determined lamp with name or Guid.
Verified AddLamp and AddEcoLamp, also tested RemoveLamp with name or Guid or simply with the position. Verified AllLampSwitchOn and Off. Verified finding a lamp by intensity, the status or the Guid.

Thermostat:

Performed 10 tests.

Verified constructor throws ArgumentException for null, empty string, or whitespace-only names. Verified SetTemperature throws ArgumentException when temperature exceeds max or below min, and correctly sets valid temperatures. Verified IncreaseTemperature throws ArgumentException when already at max, and correctly increases by 0.1° when valid. Verified DecreaseTemperature throws ArgumentException when already at min, and correctly decreases by 0.1° when valid.

Door:

Performed 12 tests.

Verified constructor throws ArgumentException for null, empty string, or whitespace-only names, and for PIN under 4 digits. Verified OpenDoor works when closed but throws when locked. Verified CloseDoor works when open. Verified LockDoor works when closed but throws when open. Verified UnlockDoor throws when open or with wrong PIN, but correctly unlocks when locked with correct PIN (1234).

AirConditioner:

Performed 17 tests.

Verified constructor throws ArgumentException for empty name. Verified TurnOn works when off but throws when already on. Verified TurnOff works when on but throws when off. Verified SetFanSpeedLow/Medium/High work only when on, throw when off. Verified IncreaseFanSpeed cycles Medium to High, throws at max or when off. Verified DecreaseFanSpeed cycles High to Medium to Low, throws at min or when off.

CCTV:

Performed 17 tests.
Verified constructor rejects empty name. Verified each vision mode switches correctly but throws if already active. Verified zoom modes update correctly, while re-setting or exceeding min/max zoom triggers exceptions.