Auto Gardening System Manual

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Usage

```
$ java -jar gardening.jar -h
usage: java -jar gardening.jar [-d=50] [-s=10]
 -d <arg>   [integer] Number of days to simulate, the days are in the
            gardening world. MINIMUM value:45, DEFAULT:60
 -h         Print help message
 -s <arg>   [float] Speed of simulation, the number of real world seconds
            is equal to one hour in the gardening world. For example s = 5
            means 5 second in real world == 1 hour in gardening world.
            DEFAULT: 1
```

Simulation model

Garden

A garden is make up of multiple **GreenHouseUnits**, each unit grows one kind of plant. Each unit has a set of **sensors** and **controllers**. Unit operate independently from other units. Unit also interacts with **outdoor environment**. All units share the same environment. Each plant has a **GrowingPlan** which can be adjusted by human.

GrowingPlan

Plan has the following dimensions:

Dimension	**Comments**
Temperature (unit: F)	
Humidity (unit: %)	
Light (unit: W/square foot)	
WaterContent (unit: ratio)	Represent level of water saturation in soil. https://en.wikipedia.org/wiki/Water_content

Nitrogen (unit: gram)	Nitrogen fertilizer requirement

These plans are specified as periods, for example for temperature:
`From day 0 to day 9: hour 0 to 7 value is 50, hour 8 to 17 value is 90, hour 18 to 23 value is 50`
`From day 10 to day 29: hour 0 to 7 value is 60, hour 8 to 17 value is 80, hour 18 to 23 value is 60`
`From day 30 to last day: hour 0 to 7 value is 55, hour 8 to 17 value is 75, hour 18 to 23 value is 55`

Sensors

Sensors read from indoor of a GreenHouseUnit.

TemperatureSensor	
HumiditySensor	
LightSensor	
PestLevelSensor	
WaterContentSensor	

Outdoor Environment

Metric	**Range**
Temperature (unit: F)	30-100
Humidity (unit: %)	0-1
Precipitation (unit: inch/hour)	0.1-0.5
Light (unit: W/square foot)	0-50
Pest (unit: level)	0-1

All environment metrics are randomly generated.

Controllers

A GreenHouseUnit has the following controller

Controller	Function
heater	increase temperature
ac	decrease temperature
humidifier	increase humidity
fan	decrease humidity
shades	decrease light from outside (window shades)
lightBlub	provide indoor light
sprinkler	provide water
roof	block rain fall (can open and close)
pesticide	kill pest
nitrogen	provide nitrogen

Outdoor Environment and GreenHouseUnit interaction

Environment and GreenHouse can exchange heat (influence temperature), water (through rainfall), humidity (through air flow), and light (through window/shades). All these are modeled in the system.