Factory of the futur

Context

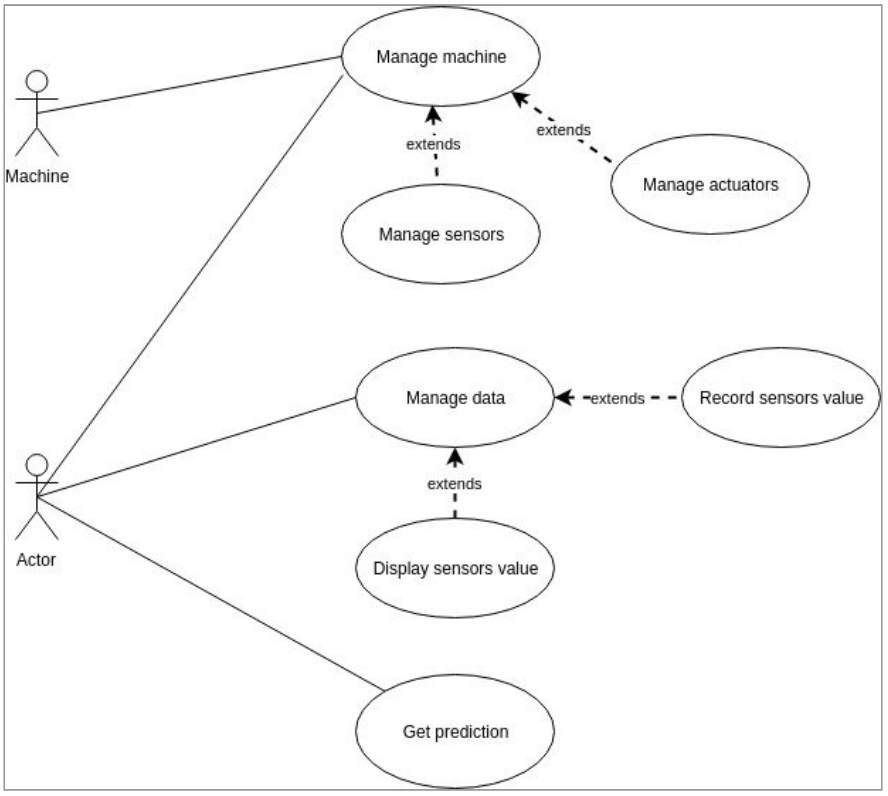
Factory of the future, Industry 4.0, cyber-factory or connected factory: Regardless of what it is called, this transformation of industry represents a revolution in manufacturing processes based on new technologies and innovative concepts. Why is it called Industry 4.0?

Because before arriving at this point, three successive industrial revolutions have already taken place:

- The first, in the 18th century, was characterised by mechanised production using coal and the development of the steam engine….
- The second, at the end of the 18th century, allowed for mass production after the arrival of electric power.
- The third, in the middle of the 20th century, allowed for automated production, using machine control and robots.

With Industry 4.0, the sector is entering its fourth revolution, characterised by a merging of the Internet and factories. At each link in the production and supply chains, tools and workstations communicate constantly via the Internet and virtual networks. Machines, systems, and products exchange information both among themselves and with the outside. By optimising production tools, manufacturers hope to speed up production at a lower cost, and in a more environmentally sound way.

Use Case

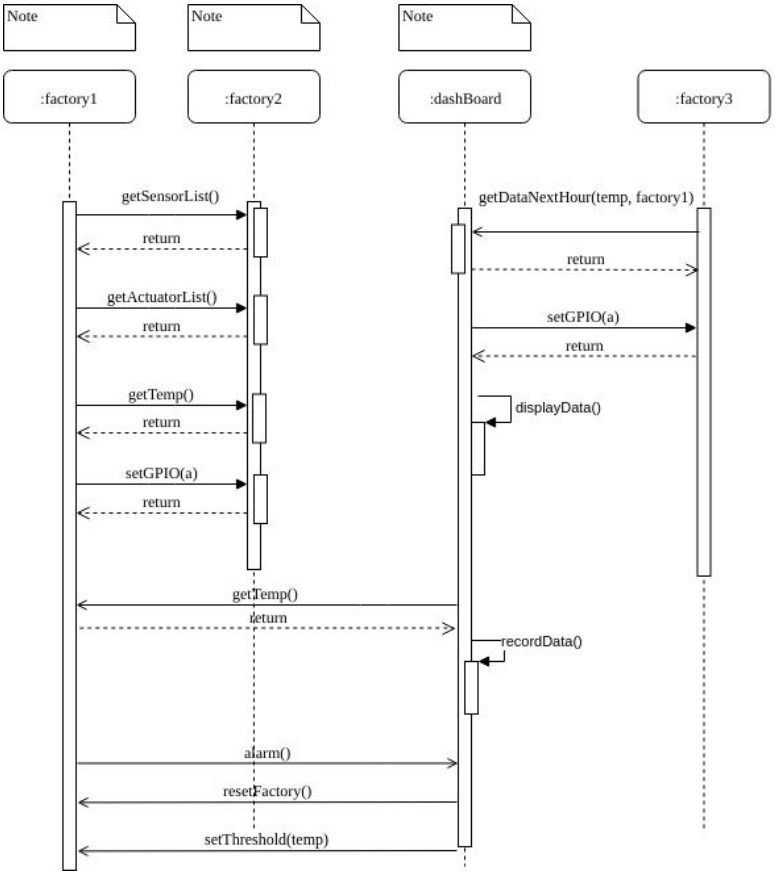


Manage machine:
This use case allows the management of sensors and actuators. The sensors are available remotely with a list that gives their characteristics, the actuators are managed in the same way. A service is used to obtain the value of a sensor as well as the last ten values recorded. The actuators can be remote controlled. Thresholds can be defined, in case of exceeding an alert must be transmitted to the dashboard. In case of an alarm, the factory warns all the other factories that stop all systems (gpio off). The alarm sounds for 60 units of time.

Manage data:
This use case allows remote data management. A registration service allows you to save the data in a precise format "date, sensor name, factory, value". This service also displays a real-time dashboard for all system data. The dashboard displays system alerts. The dashboard is able to poll the factories for information on sensors and actuators. It is possible to control the factories from the dashboard (GPIO ON/OFF, stop alarm).

Prediction / machine learning:
The prediction system makes it possible to define in advance the behavior of the system according to, for example, a linear regression on the evolution of a sensor. The service is able to give this information with as parameter the name of the sensor and the time.

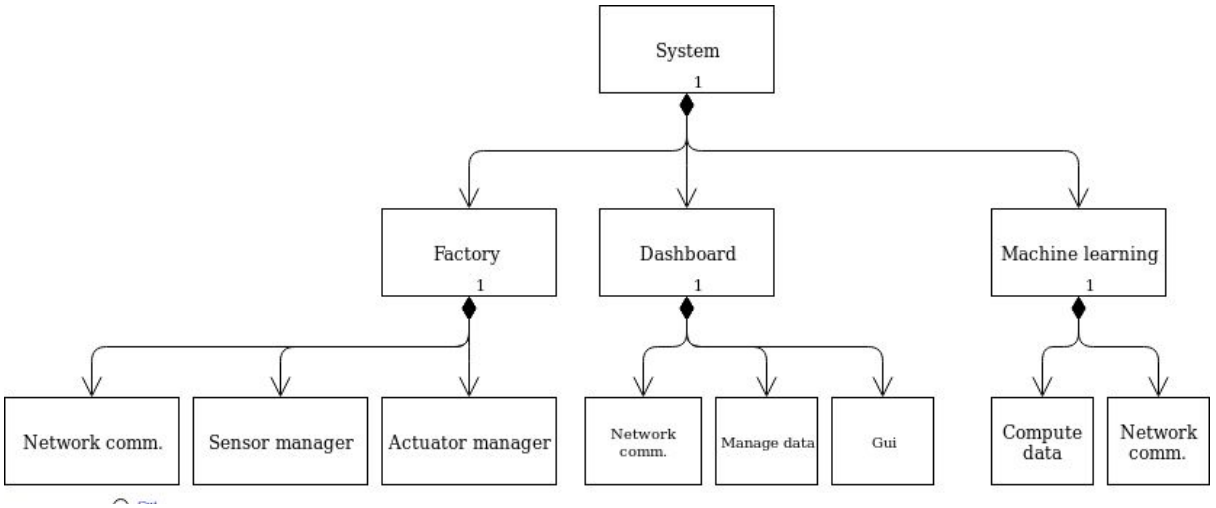
TODO:
- For each use case do a sequence diagram,
- Define the interfaces (service TCP),
- Define the M2M protocol.


Note
Note
Note
:factory1
:factory2
:dashBoard
:factory3
getSensorList()
return
getActuatorList()
return
getTemp()
return
setGPIO(a)
return
getDataNextHour(temp, factory1)
return
setGPIO(a)
return
displayData()
getTemp()
return
recordData()
alarm()
resetFactory()
setThreshold(temp)

Requirements:

Rq	Use Case	Grade
Manage machine		
1	It is possible to drive the GPIO remotely.	1
2	It is possible to control the actuators remotely.	1
3	It is possible to define thresholds for a sensor (also remove a threshold).	1
4	It is possible to trigger an alarm if the threshold is exceeded.	1
5	An alarm is sent to the system that makes the request to trigger the alarm.	1
6	Each factory has at least the following information: temperature, pressure, humidity.	1
7	Each factory has at least two actuators: led, relay.	1
8	The factories communicate with each other every 5 seconds: temperature, humidity, pressure.	1
9	The factories have a service that communicate the list of available sensors and actuators.	2
10	If an alarm is triggered then alarms from other factories must also be triggered for 60 units of time.	2
Manage data		
11	A dashboard allows to have all the information of factories: actuators, sensors, alarm state.	2
12	Factory data is sent every 5 seconds to the dashboard.	1
13	The dashboard display all the data.	1
14	The dashboard record all the data.	1
Machine learning		
15	A service makes it possible to give estimates on the different physical values of the factories. The estimators are computed with the GSL library: https://www.gnu.org/software/gsl/doc/html/lls.html#linear-regression https://www.gnu.org/software/gsl/doc/html/usage.html	3

Parts of the system: Block Diagram



The block diagram describes the different parts of the system. Each part has communication interfaces to interact between the different parts.

Internal Block Diagram

The internal block diagram describes the interconnections between parts of the system.