

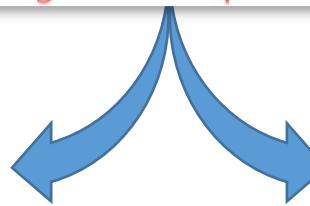


Smart Aquaponics



Vlaams Aquacultuur Symposium 2021:
blik op verduurzaming

Pannecouque Nick
Provinciaal Technisch Instituut



Campus Techniek & Design



Campus Wetenschap & Groen

Aquaponics: Project examples

Education:



PTI, 2010
Secondary school



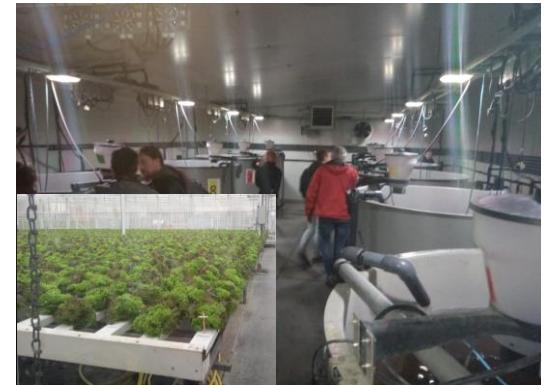
Aquaponiris, 2015
NGO

Uliège, 2012
University



Aquaponie BXL, 2016
NGO

PCG, 2015
Research center



Don Bosco, 2017
Secondary school

Aquaponics: Project examples

Small Professional:



Jardin de l'usine
Aquaponie BXL
2018



Atelier de Bossimé
2019



Ferme des 3 moutons
2021



Atelier de
Bossimé

Aquaponics: Project examples

Professional:



Aquaponics: Project examples

Professional:



Aquaponics emergence

Aquaponic systems are diverse

Aquaponics is a new technology

- >No advanced teaching programs
- >No specifics tools

How to foster aquaponics development?

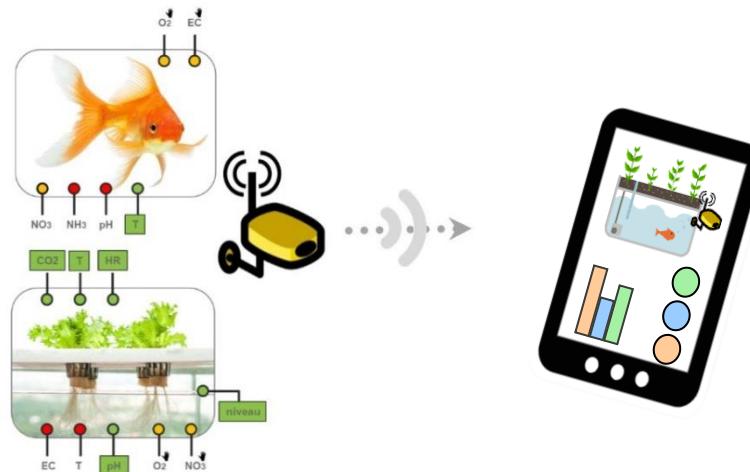
Smart Aquaponics, an application with:

- Monitoring tool
- Simulator
- Training program



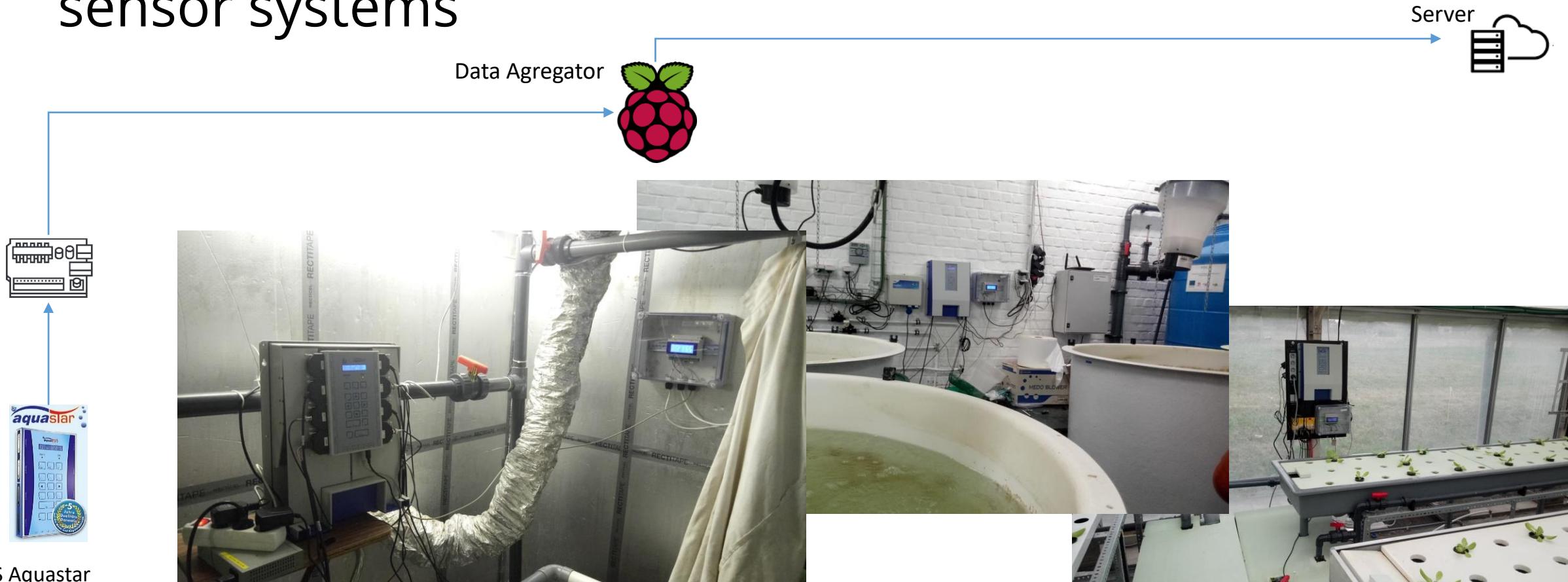
Monitoring tool

- Stay **connected** with your aquaponics system
- Fish & plant informations in one application
- **Anticipate** accidents



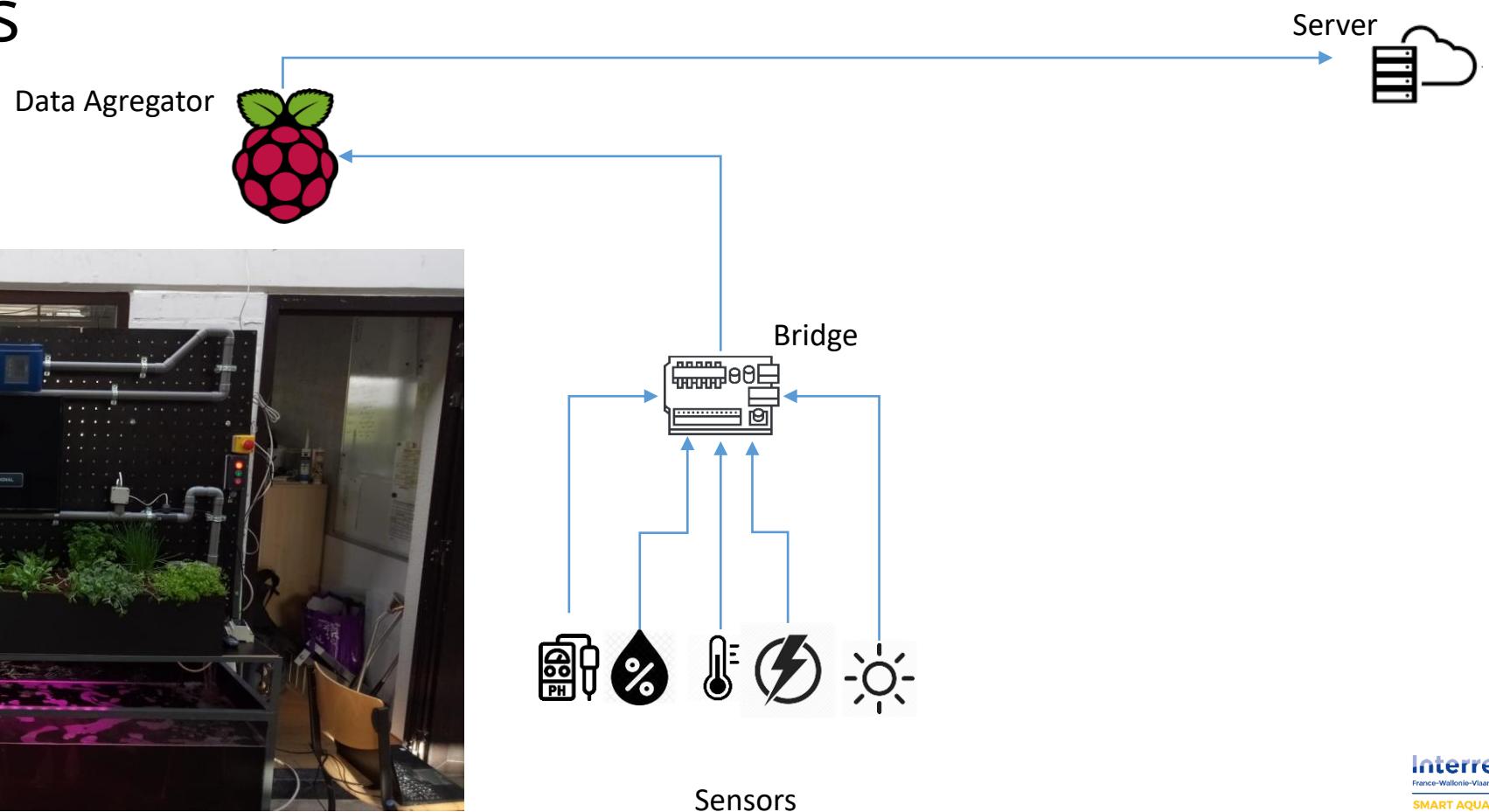
Smart Aquaponics: Sensing

The data acquisition chain collects data from different sensor systems



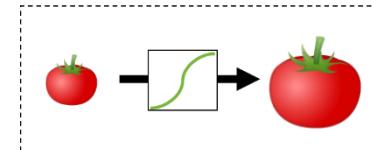
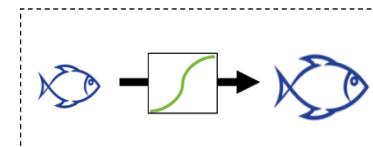
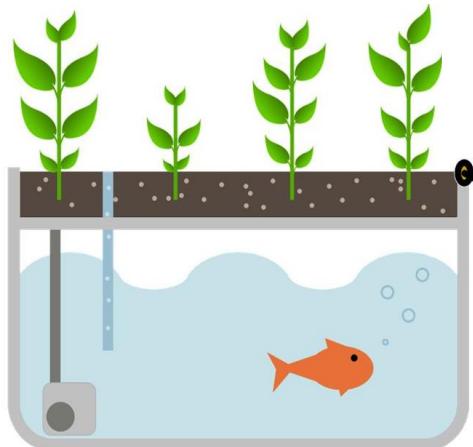
Smart Aquaponics: Sensing

The data acquisition chain collects data from different sensor systems



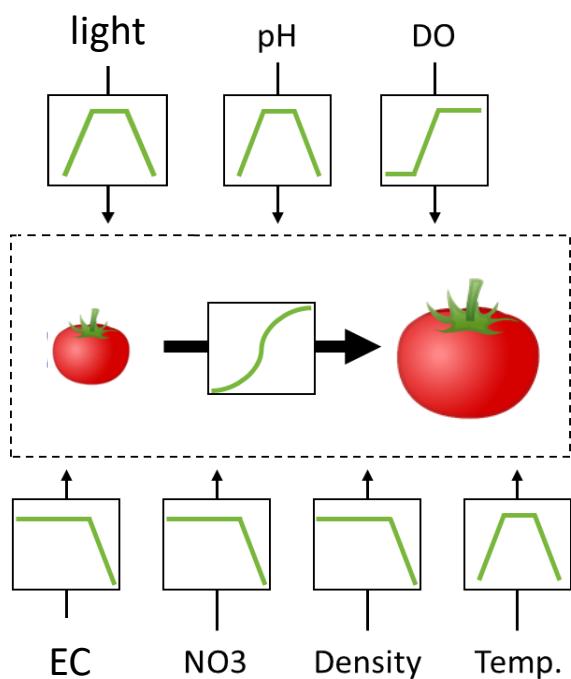
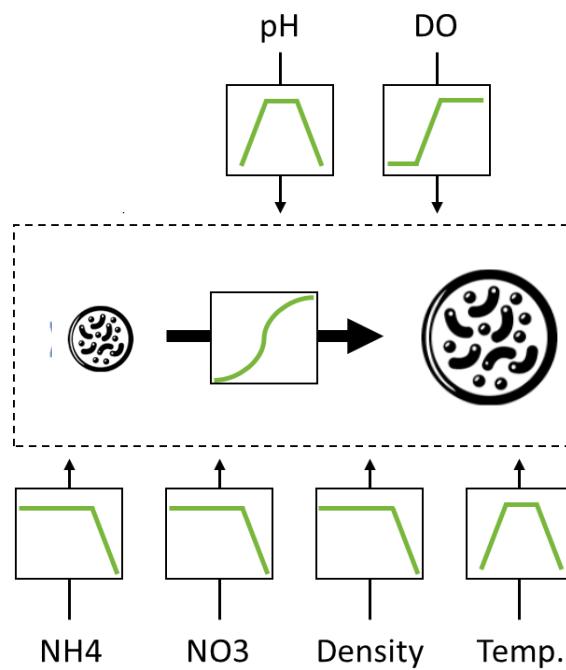
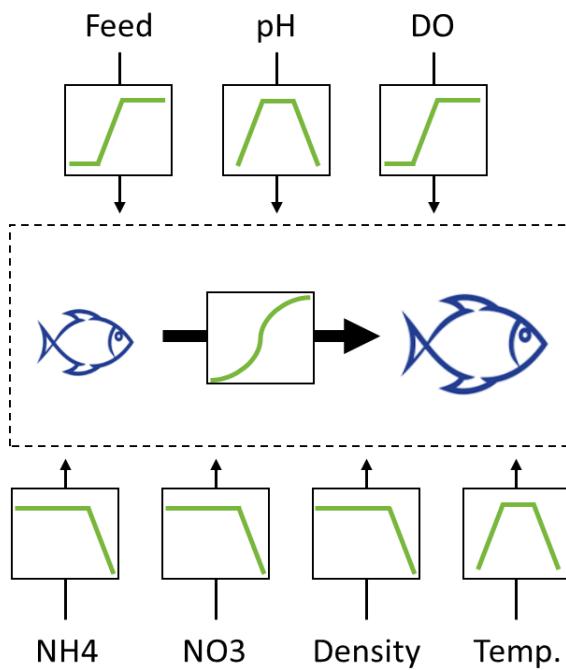
Simulator

- Design aquaponic system in the application
- Simulate different scenarios



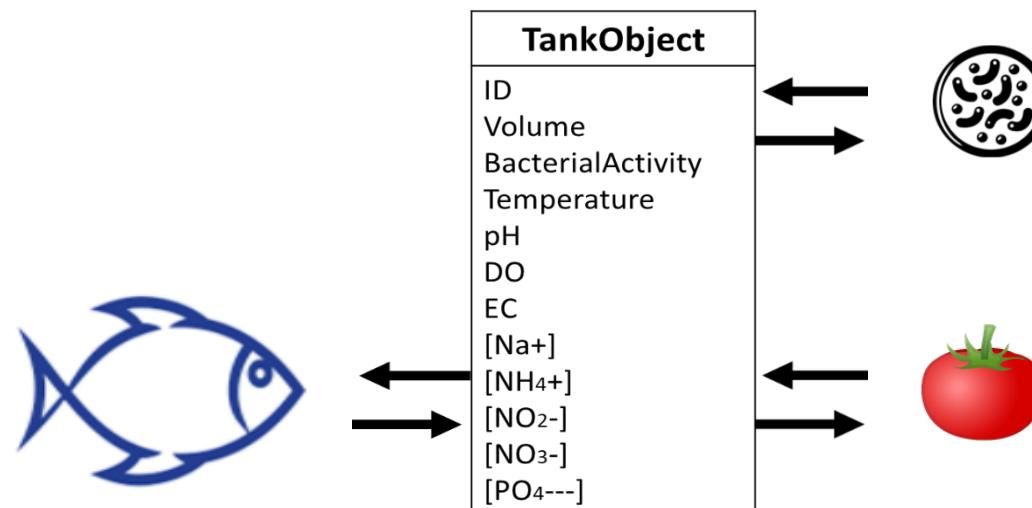
Smart Aquaponics Model

Our model simulates each objects of a system



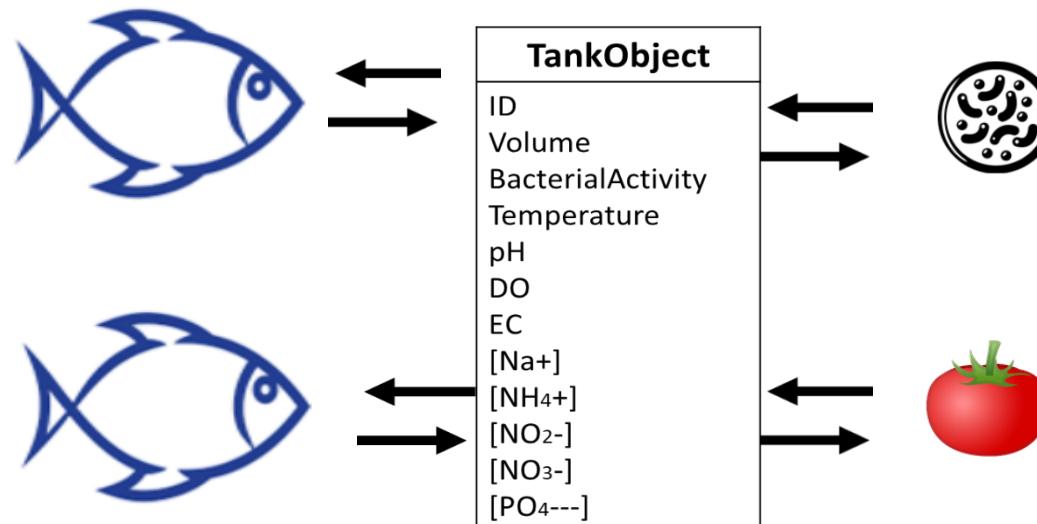
Smart Aquaponics Model

Interactions between objects enable simulation of **complex systems**



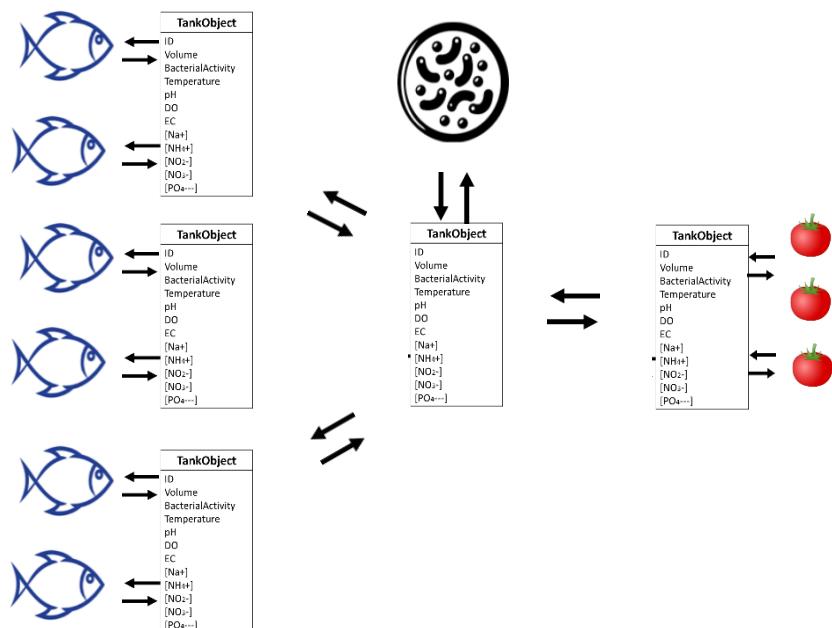
Smart Aquaponics Model

Interactions between objects enable simulation of **complex systems**



Smart Aquaponics Model

Interactions between objects enable simulation of **complex systems**



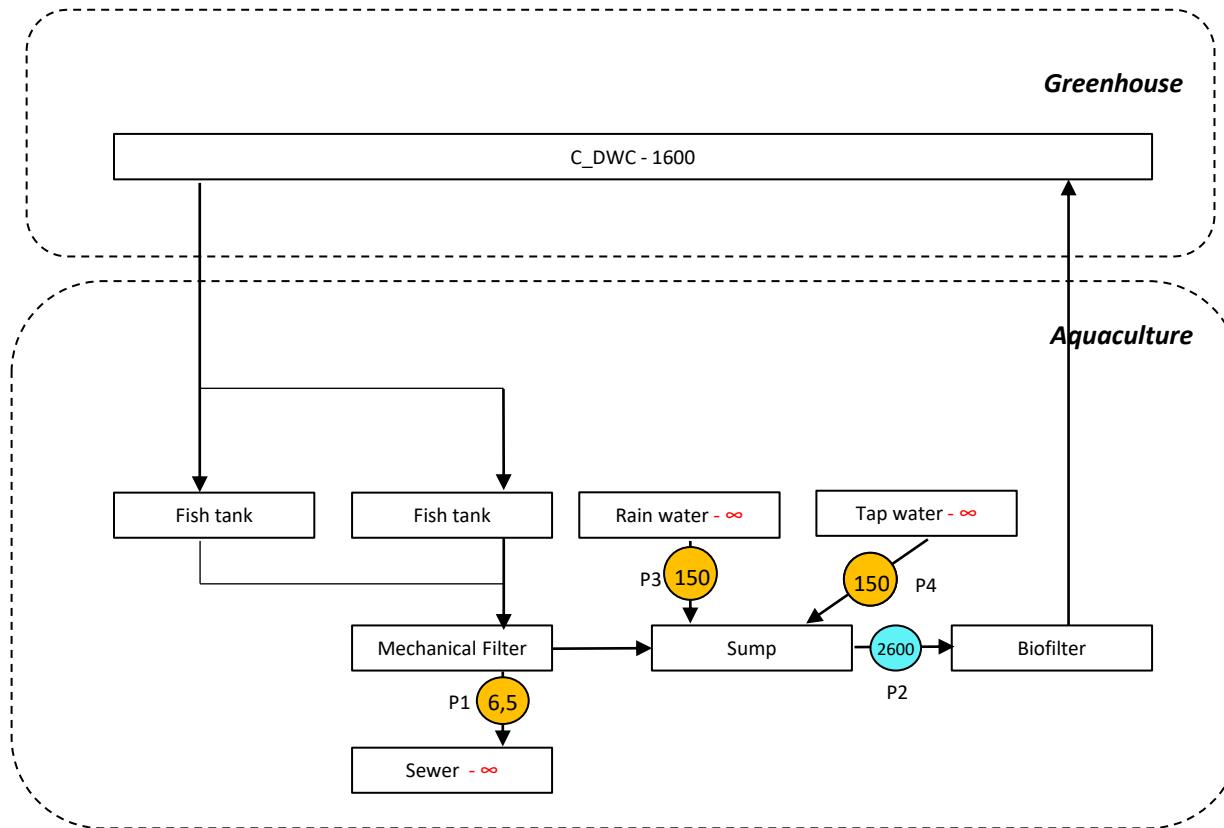
Smart Aquaponics Model

Practical example: Paff Boxx



Smart Aquaponics Model

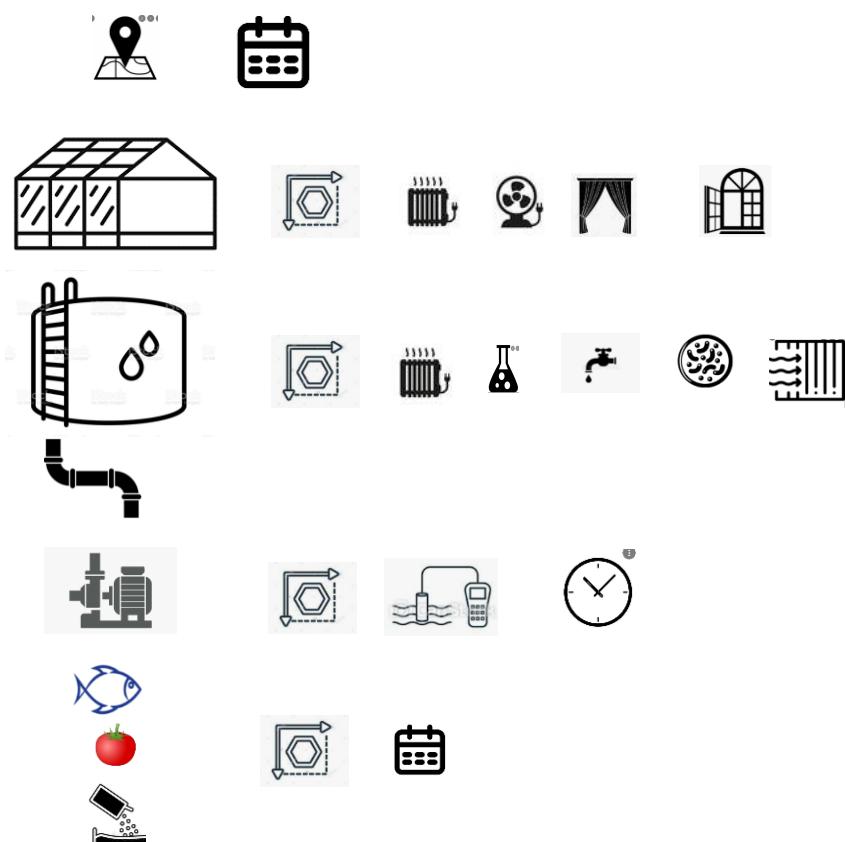
Practical example: Paff Box



Smart Aquaponics Model

Practical example: Paff Boxx

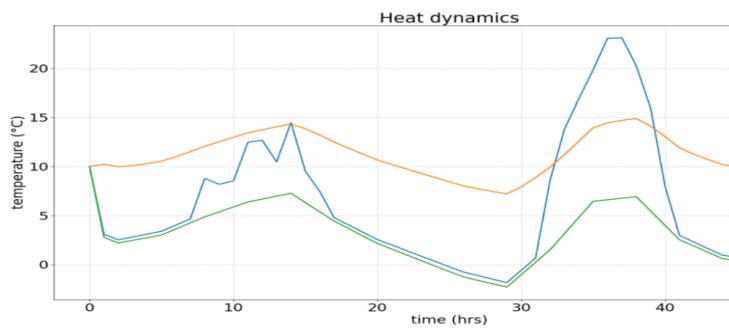
Fichier		Accueil	Insertion	Mise en page	Formules	Données	Révision	Affichage	Antidote	Dites-nous ce que vous voulez faire.	PaffBox_06.csv - Excel	Connexion	Partager																																														
Couper	Coller	Copier	Reproduire la mise en forme	Police	Alignement	Nombre	Style	Normal	Insatisfaisant	Neutre	Satisfaisant	Avertissement	Calcul	Somme automatique	Remplissage	Insérer	Supprimer	Format	Effacer	Trier et Rechercher	filtrer - sélectionner																																						
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A1																																																											
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	X	Y																																				
1	Information about the aquaponic system to be modelled - This file is the input for the aquaponics modeled developed for the Smart Aquaponics Proj																																																										
2	informations	system name	country	city	organisation	latitude	longitude	timezone	forecast																																																		
3	infos	PaffBox	Belgium	Brussels	Uige Univers	50.8503	4.3517	Ets/GMF=2	0																																																		
4	time parameter	step time [hr]	duration [hrs]	starting year	starting day	starting month	starting hour																																																				
5	time	1	100	2020	4	17	0																																																				
6	prices	object price	[euro/Wh]																																																								
7	electricity	0.00021																																																									
8	rooms	param id	number	name	unit price [eu/m]	width [m]	length [m]	average height	glazing	surface k value [W/m/light]	transmit	initial air tem	initial relativity	initial co2	cor day	temper day	temper night	temper night	tempers vents [1/0]	vents total su N fan	fan air flow r/fan consump	fan continuos shadings [1/0]	active shadings trans shadings	abs/N heaters	heater consu	heater effice	office N coolers	cool																															
9	10	room	1	Greenhouse	1000	2.5	5.8	2	55	1	0.91	10	80	450	7	22	22	25	16	18	1	2	0	0	0	0	0	0																															
10	11	room	2	Aquaculture	8000	2.5	5.8	2	50	0.3	0	10	80	450	7	22	22	30	10	20	0	0	1	4	15	1	0	0																															
11	12	room	3	Outdoor	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																																
12	13	lightings	parx id	number	name	unit price [eu on time [hrs]	off time [hrs]	ppfd [umol/m2/s]	par/w [W/m2]	consumption sensor	trigger low level	lim item [1/0]	room id																																														
13	14	tanks	param id	number	name	unit price [eu/m]	on time [hrs]	id	capacity [l]	volume [l]	cultivation	su	inside surface	free surface	irradiated	sur face	inter price [e]	TAN [mg/l]	Na [mg/l]	NO2 [mg/l]	NO3 [mg/l]	P [mg/l]	K [mg/l]	Mg [mg/l]	Ca [mg/l]	Fe [mg/l]	S [mg/l]	EC [mg/l]	DO [mg/l]	pH [-]	water temp	type	0 = hyd	cycling state	optimal back filtering tank	filtration mat	particles rem	partic																					
15	16	tank	1	FT1	0	2	400	400	380	0	2.6	1	1	0.001	0	9	0	0	20	20	20	20	1.5	10	50	0.000001	10	450	8	7.5	15	1	0.9	0	0	0	0																						
17	18	tank	2	FT2	0	2	400	380	380	0	2.6	1	1	0.001	0	9	0	0	20	20	20	20	1.5	10	50	0.000001	10	450	8	7.5	15	1	0.9	0	0	0	0																						
18	19	tank	3	Decanter	0	2	400	400	200	0	2.8	1	0.001	0	9	0	0	20	20	20	20	1.5	10	50	0.000001	10	450	8	7.5	15	1	0.9	0	0	0	0.6																							
19	20	tank	4	Sump	0	2	690	650	0	2.8	1	1	0.001	0	9	0	0	20	20	20	20	1.5	10	50	0.000001	10	450	8	7.5	15	1	0.9	0	0	0	0																							
20	21	tank	5	Biofil	0	2	115	45	0	4	0	0	0.001	0	9	0	0	20	20	20	20	1.5	10	50	0.000001	10	450	8	7.5	15	1	0.9	0	0	0	0																							
21	22	tank	6	DWC	0	1	1600	1600	8	10	0.5	0.5	0.001	0	9	0	0	20	20	1.5	10	50	0.000001	10	450	8	7.5	15	1	0.9	0	0	0	0																									
22	23	tank	7	Rain water	0	2	1000	1000	0	0	0	0	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																											
23	24	tank	8	Tap water	0	2	10000	10000	0	0	0	0	0.001	0	0	0	0	4.52	20	1.5	10	50	0.000001	10	450	8	7.5	15	1	0.9	0	0	0	0																									
24	25	tank	9	Sewer	0	2	10000	10000	0	0	0	0	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																											
25	26	pipes	param id	number	name	unit price [eu from tank id	to tank id																																																				
26	27	pipe	1	3	6	1																																																					
27	28	pipe	2	3	6	6																																																					
28	29	pipe	3	3	1	3																																																					
29	30	pipe	4	3	2	3																																																					
30	31	pipe	5	3	3	4																																																					
31	32	pipe	6	3	3	9																																																					
32	33	pipe	7	3	4	5																																																					
33	34	pipe	8	3	5	6																																																					
34	35	pipe	9	3	7	4																																																					
35	36	pipe	10	3	8	4																																																					
36	37	pumps	param id	number	name	unit price [eu/pipe id																																																					
37	38	pump	1	30	6	8.5																																																					
38	39	pump	2	450	7	2600																																																					
39	40	pump	3	20	9	150	1	1	level	downtank	550	720	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																							
40	41	pump	4	20	10	150	1	1	level	downtank	550	720	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																							
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100									
55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100														
59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																		
60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																			
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																								
69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																												
74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																	
78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																					
82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																									
86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																													
90	91	92	93	94	95	96	97	98	99	100																																																	
94	95	96	97	98	99	100																																																					
98	99	100																																																									



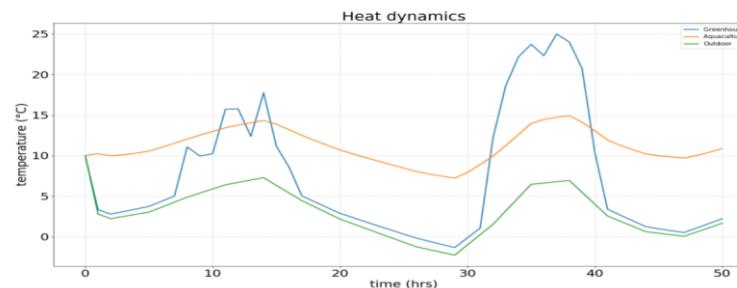
Smart Aquaponics Model

Practical example: Paff Box: T°

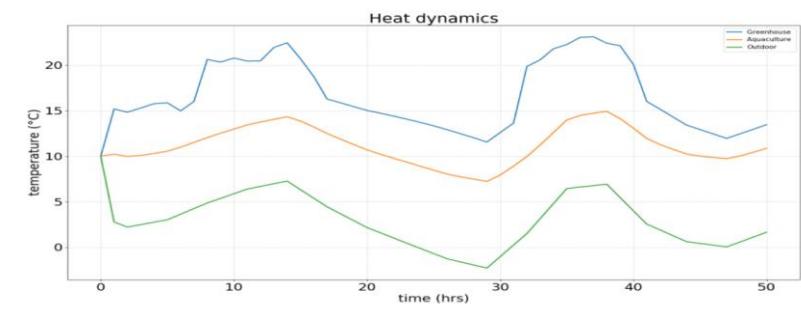
Greenhouse
Fish Room
Outside



Normal



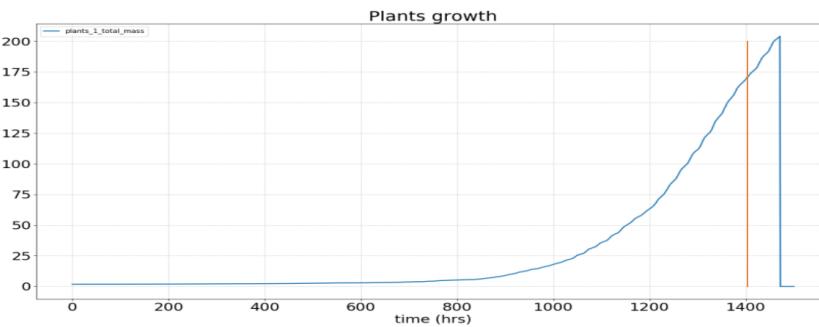
Insulation



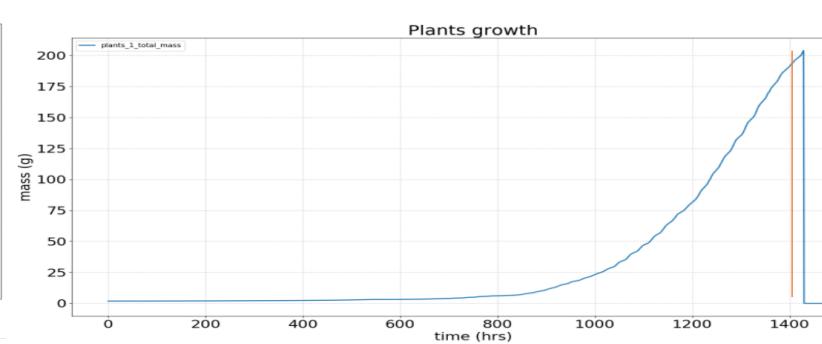
Heating system

Smart Aquaponics Model

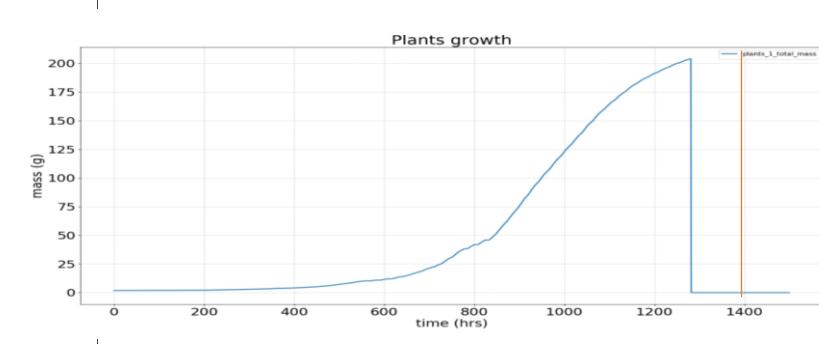
Practical example: Paff Box: Lettuce



Normal



Insulation



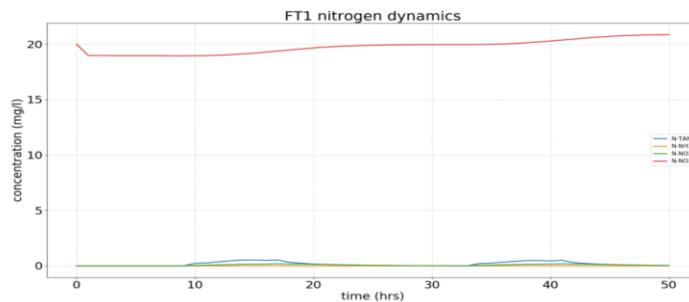
Heating system

Smart Aquaponics Model

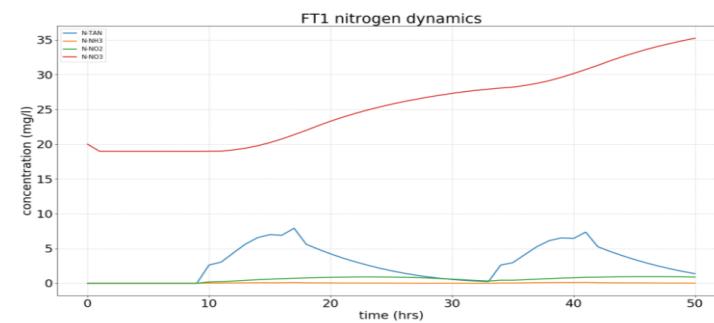
Practical example: Paff Box: N

Nitrate

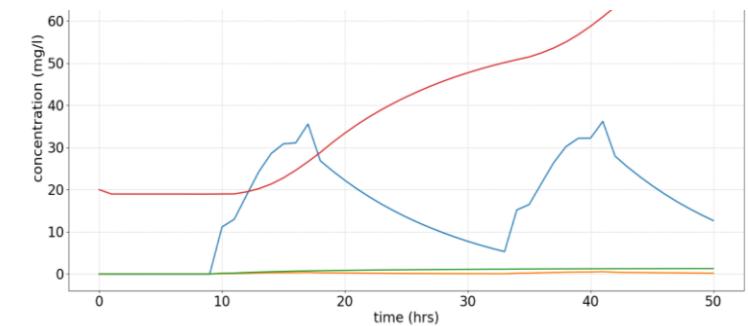
TAN (Amonia+Amonium)



20 fish/tank



200 fish/tank

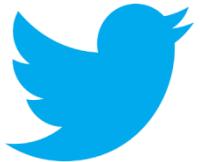


800 fish/tank

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