

VI51 Project Subjects

Projet

- Project's groups must be composed by 3 or 4 students
- Evaluation criteria :
 - Final presentation of the project (10 minutes)
 - Analysis and Design Report (20 pages)
 - Project sources
- Documents to provide :
 - PDF report
 - Java or C++ sources
- You must select a subject only inside the given list. No other choice.
- Each subject contains mandatory elements and optional elements. To obtain a score of 10/20, you must tackle all the mandatory elements. The optional elements will be include in the score only if all the mandatory elements was developed.
- The responsables of the subjects are not here to provide source codes and algorithms. They provides helps and work directions. You must think yourself about the project.

Analysis and Design Report

The report must contains the following elements :

- First page
 - Requirement Analysis : (~ 2 pages)
 - Authors of the projet
 - Project's context
 - Goals of the project
 - Design Part (~ 10 pages)
 - Description of the software architecture
 - Design choice explanations
 - GUI choice explanations
 - Used techniques
 - Encountered problems
 - Benchmark
 - User Guide (~ 7 pages)
 - Explanations about how to install and use your project
 - GUI control documentation
 - Conclusion :
 - Tackled elements and performances of the software
 - Critical analysis of the results
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Deadline dates

The following dates must be respect or you will have several malus on your final score :

- 28th march at 18:00 : each group must have sent an email to Stéphane GALLAND containing the list of the project's members.
- 4th april at 18:00 : each group must have a contact with the subject responsible (email, meeting...).
- 18th april at 18:00 : each group must have sent its Requirement Analysis Document to the subject's responsible, for validation.
- 10th june at 18:00 : each group must have sent by email all its project sources and documents to Stéphane GALLAND.
- 13rd june and 19th june, during the PW time : Final presentation per each groupe. The planning will be given at the beginning of june.

Subject 1: Worlds' War

Contact : Stéphane GALLAND

The Earth counts a great number of terrestrial insects. Numbers of them are in competition concerning the food resources necessary to their survival. We will treat mainly in this project of the ants, the termites and the spiders (without closing the door with other insects or animals). The ants and the termites are companies centered around an individual dominating: the Queen. The Queen is localised in the center of a city where all the resources collected by the members of the company must converge called "workers". Certain members have specializations: the "soldiers" defend the other members of the colony, the "nurses" transport the born ones, the "cleaning ones" collect waste or the corpses within the colony. The spiders do not form colonies but are individual beings having for objective to only nourish itself. Several families of spiders exist: the "tisseuses ones" which builds a fabric to capture preys, and the "digger ones" which live a hole where they wait until a prey passes in the vicinity.

The ants nourish plants (mushrooms, sheets...), termites and spiders. The termites also nourish plants (bark and sheets of the trees). The spiders nourish ants and termites. The colonies between them (even if they are of the same species) are regarded as competitors. We will name civilization the whole of the colonies belonging to the same species.

The rules of the engagements between individuals are controls by the force of an individual on the one hand (possible chemical weapons), and by the chance on the other hand. The born ones are from the matrix of the Queen. They must be nourished by the nurses and to regularly transport point of the colony to another under penalty of dying. The born one is transformed by chance into nurses, workers and soldiers. The Queens die only of violent death (just like spiders). The other members of colonies must die at the end of a preset lapse of time.

The environment in which these alive beings move consists of open grounds (meadow, forests...) and of corridors in the colonies. Each type of individual has a particular swiftness (for example the soldiers will be slower than the workers, because heavier). You will choose the representation of the environment which will seem to you most judicious (grid, continuous space...).

This project aims to carry out a software of simulation of the populations implied in this search without end of food. You will have to propose a model and a software allowing to simulate the behaviors of the various insects. Simulation will stop when one of civilizations destroys all other civilizations.

Mandatory Elements :

1. environment model
2. movement behaviours
3. eating behaviours

Optional Elements :

1. Born/Evolution algorithms

2. Interactive addition of food
3. Graphical User Interface

Subject 2: Eurockéennes

Contact : Stéphane GALLAND

The « Eurockéennes » is a famous french rock festival that is located near Belfort. The site is composed of stages, entry and exit doors and obstacles (tree, stands...). During the festival, several rock groups play on a stage.

When arriving at the festival, people plan to heard several groups on already known stages. They try to move until the stage, listen and move to the next concert.

When something dangerous append during the festival, people must evacuate the place. They must go to the nearest exit door, if they perceive one and do not panic.

This project aims to carry out a software of simulation of the people. You will have to propose a model and a software allowing to simulate the behaviors of the various people. Simulation will stop when noone are on the « Eurockéenne » place.

Mandatory Elements :

4. environment model
5. movement behaviours
6. panic behaviours

Optional Elements :

1. Path Planning
2. People interaction (news exchanges about the good concerts...)
3. Graphical User Interface

Subject 3: Belfort City's Simulation

Contact : Stéphane GALLAND

Simulating a city could be a very complex task. Assuming that the road and the ways are already known and usable, several entities must be simulated: pedestrian, cars, bus... Each of them has a dedicated behaviour and day-to-day goals.

Each entity arrives inside the city by one of its entry points (near the bounds) and has several points to reach. An entity could leave inside the city forever or leave the simulation by one of the bounds of the city.

The entity could select their path with path planning algorithms or not, but they must not have an overall knowledge of the city roads.

This project aims to carry out a software of simulation of the city. You will have to propose a model and a software allowing to simulate the behaviors of the various entities. Simulation will never stop.

Mandatory Elements :

7. road and road-sign models
8. vehicle movement behaviours
9. bus movement behaviours

Optional Elements :

1. Path Planning
2. Pedestrian movement behaviours
3. Day-to-day planning
4. Graphical User Interface

Subject 4: Car Simulation and Platoon System

Contact : Franck GECHTER

Simulating precisely the dynamic of a car on a road is complex task. This must take into account car's parameters (weight, number of wheels, height,...) and the state of the road (iced, wet, dusted,...). Moreover, if we want to achieve hard autonomous tasks such as platoon system (cars in a row with only one, the head vehicle, driven by a human) , car simulation can be very usefull in order to avoid car crash.

The goal of this project is to build a dynamical car model (box with 4 springs and wheels) using PhysX library. Then, this model has to be used in order to simulate a platoon based on a regulation loop approach.

Mandatory Elements :

1. Simple Dynamical car model. (Box with spring dampers and 4 wheels)
2. Platoon with control of the distance between vehicles only (we can consider the vehicle being on a rail for the direction)

Optional Elements :

1. Advanced car model (with tyres model)
2. Full platoon with lateral control.
3. Weather changing with influence on tyre model.
4. Graphical user interface to change simulation parameters.

Subject 5: Human body model for medicine

Contact : Franck GECHTER

For a medical application, we want to model and simulate the behavior of a patient that suffer from breath disease. This model has to take into account all the pathological complication that can occur if the patient is not fast intubated. The model used can be based on probabilistic model such as Markov models. Inspiration can be taken from other medical applications.

Mandatory Elements :

1. Simple body functional model
2. Alert message when critical situation occurs

Optional Elements :

1. Advanced model with learning possibilities
2. Link with intubation application

Subject 6: Simulation for soccer robots

Contact : Franck GECHTER

Simulating small robots behaviors and perception can be usefull to avoid using real robots to make premilinary tests. However, this simulation has to be precise eanough to be able to predict real robots reaction. So, a physical model of the robots has to be determined precisely. To this way, we can use the PhysX library. Moreover, sensors models must also be precise (distorsion of the lens of a camera for instance). The goal of this project is to build a soccer robots simulator with a precise model of actuators (robots) and sensors (camera). We can start with simple models of each that can be extended during the project.

Mandatory Elements :

1. Simple robot soccer model.
2. Simple camera model.
3. Computation of simple behavior

Optional Elements :

1. Advanced model for robots and camera
2. Script language to quickly program behavior.

Subject 7: *Lemmings sapiens*

Contact : Fabrice LAURI

Lemmings are small creatures that **mindlessly** move **together** into danger without any fear.

Lemmings was also a popular puzzle video game developed by Psygnosis in 1991. The aim of this game was to help some lemmings to reach an exit, thus saving them for a certain death. One can say that the player was a benefactor of the lemmings-kind...

Your mission for this project, if you accept it, is to develop a simulation software of the environment and of lemmings of a second generation, that is lemmings that are more intelligent than the individuals of the current breed. Such advanced lemmings, or *lemmings sapiens* if you prefer, should **learn from their past experience** how to avoid dying. In any case, lemmings must move together, as fishes do when they move as a school.

Models of these social creatures, of the physical laws of the environment and possibly of the possible interactions from the user will have to be designed. For instance, a user interaction with the lemmings' environment would consist in either saving them by building a bridge between the edges of two mountains, or killing them by digging a hole into a mountain...

Mandatory Elements :

1. Environment model
2. Basic movement behaviors
3. Learning of movement behaviors

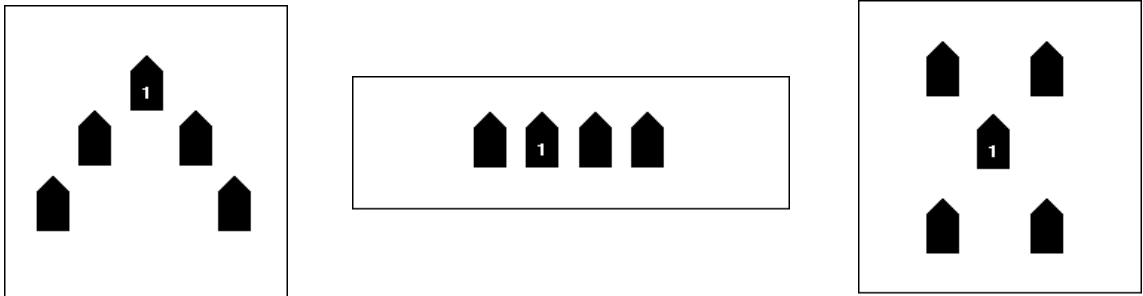
Optional Elements :

1. User Interactions
2. Graphical User Interface

Subject 8: Team of marines

Contact : Fabrice LAURI

A team of marines have to spread over an environment. They move in formation so that they can look at each other and thus are able to tackle lethal threats. Formation also allows them to move adaptively, according to the type of the local obstacles they encounter in the environment. For instance, the marines can move in delta formation, in line, or in diamond formation (see the figures below). A team is generally composed of a leader. He is the only one to know where and how to go to the destination, the other members follow him. Finally, if necessary, a team is able to divide itself into several groups, either on a user demand or autonomously.



The aim of this project is to develop a simulation software of the environment and of the team of marines. Models of the marines and of the possible interactions from the user will have to be designed. Marines should have their own goal. At any time, the user should be able to assign them another goal. Typically, a user interaction can consist in indicating to a group of marines where to go and with which formation.

Mandatory Elements :

1. Environment model
2. Movement behaviors of the marines
3. User interactions

Optional Elements :

1. Graphical User Interface