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Modelling of Architecture with the Systems Multi-Agents for the Services M2M

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***Abstract*— There is an infinity of domains (Security and remote monitoring, management of the circulation) which use services of Machine to Machine - M2M - these services allow exchanges between equipments (servers, cameras…) and information systems automatically through networks.**

The general idea of we work is to conceive then to realize architecture with systems multi-agents which respects the criteria quoted for the services M2M. This architecture should be flexible and applicable over any existing structures M2M. The purpose will thus be to develop a solution with the systems multi-agents to include all M2M service by respecting three parts, the information system, the networks and then the distant equipments.

In this paper we are going to model a very precise study case to be able to generalize him later. The treated case is a miniature of big architecture with a system multi-agent for a service Machine to Machine.

***Keywords*—Architecture, Multi-agents systems, M2M, Modelling, Robitique, Real Time Systems.**

I. INTRODUCTION

We arrange, in our laboratory, some robots (KHEPERA III, NXT, HEMISSON). To begin this approach (the realization of the architecture), To begin this approach(initiative) we set as first objective the conception then the realization of architecture which will use robots NXT as distant equipments to apply him and adapt him, later, to the other possible equipments.

A system multi-agent allows the distribution of a problem on a number of entities volunteers. These entities, or agents, are autonomous and interact for the resolution of problem.

We took as study case, the case of a society of telecommunication which uses these robots to replace the technicians and especially for ease the access to the servers installed in inaccessible place.

We thus begin with the modelling of this architecture. This article presents the stages of the modelling of this architecture.

II. MULTI-AGENT APPROACH

A. *Agent*

An aent is an autonomous and intelligent, real or abstract entity, who is capable of acting on itself and on her environment in a multi-universe agent also, she can communicate with the other agents and whose behavior is the consequence of her observations, her knowledge and the interactions with the other agents [2].

B. *Multi-Agent System*

A multi-system agent is a compound distributed system of a set of agents, who feign to a certain extent the capacities of the human reasoning, the SMA is ideally conceived and implemented as a set of agents interacting between each other (Fig.1 [3]), mostly, according to modes of cooperation, competition or coexistence.

A system multi-agent can be:

- *Opened:* the agents enter it and go out of it freely. (An example of that is in e-commerce).
- *Closed:* group agents stay the same. (A football match is an example).
- *Homogeneous:* all the agents are built on the same model. (A working meeting, a colony of ants).
- *Heterogeneous:* agents of different models, granularities different. (An ecosystem).
- *Mixed (or not):* the agents "human beings" are integral part of the system. It is opened and heterogeneous. (A Medie workgroup by agents assistants) [4].

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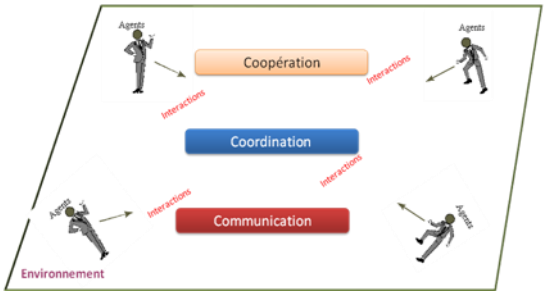

Fig. II-B.1: Principle of a Multi agents System [12]

III. Presentation Of The Case Study

For the realization of this solution, we began by working on a very precise case. Other persons of our laboratory had worked on robots dedicated to the research, specially, robots NXT. The idea and to conceive a solution which is going to combine several robots NXT (in the same application). The adaptation to other equipment will be very feasible then.

The expected features are:

- Communication machine to machine: both robots interact between them and make the tolerance of breakdown according to programs.
- The first robot visits the room server and consult the state of lamp and according to the color of the latter sending an order in the second robot.
- The second robot always stays in state of listening dice that it receives the message of the first robot, it makes the tolerance of breakdown.
- A mobile application which will be installed in a tool under the system Android.
- Connection and command of the robots by Bluetooth.
- A Web application for the control of person in charge and the writing of report of technicians.
- A database for the recording.

A. Diagram of case of use

The below described diagram the needs for our application:

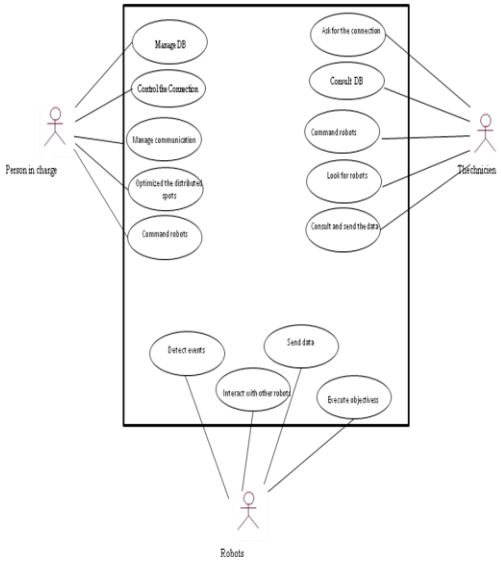

Fig. III-A.1: Diagram of case of use

B. The actors of the system

An actor represents the abstraction of a role played by external entities (user, material device or other system) which interact directly with the studied system.

An actor can consult and/or modify directly the state of the system, by emitting and/or by receiving messages possibly expanding of the data. [11]

The actors who use the system are the following ones:

Tab. III-B.1:
The different actors

Actor	Type	description of the role
Person in charge	human	Management of the data base Check connection. Management of newspaper
Technicians	human	Request of connection. Look for and command Robots. Recording of the report.
Robots	machine	Detection of the events Execution programs. Spend the order in the robot 2. Send information

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C. *Modelling of the context*

All the messages exchanged between the actors and the applications can be represented in a synthetic way on a diagram which we can qualify as diagram of dynamic context.

The diagram of dynamic context is used in the following way:

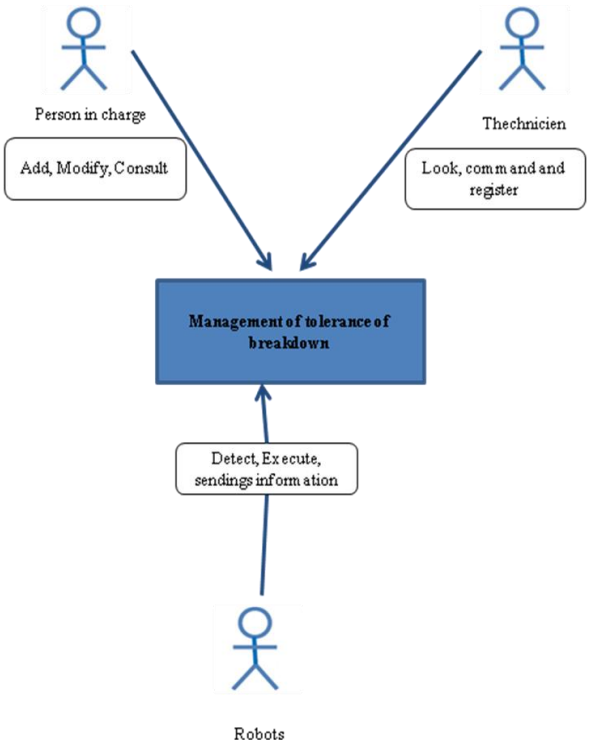

Fig. III-B.1: Diagram of dynamic context

IV. FUNCTIONAL NEEDS

A. *Case of use*

The cases of use are a technique of description of the studied system favoring the point of view of the user. They bound the system, its features and his relations with his environment. They allow to describe what the future system will have to make, without specifying how it will make it:

Table. IV-A.1:
The cases of use

use Case	main, secondary Actor	Message (s) emitted / received by the actors
Management database	Responsible engineer	to Add, to modify, to delete tables.
Control connection	Responsible engineer	to Add, to modify, to delete technicians
Management of Newspaper	Responsible engineer	Consult, delete Newspaper
Request of connection	technicians	Request of access for the given base
Look for and command robots	technicians	Look for by Bluetooth and connect in robots.
Recording of report	technicians	Connect and register his still owed account
Detection of the events	Robots	Detection of colors of server lamp
Execution of the programs	Robots	Execute the programs already prepared and registered in the memory of robots
Sending of information	Robots	Allows to send a message indicating the end of tolerance of breakdown

The division of a system packages it is made by:

· *Field of expertise job:* the most intuitive and often the most effective. He facilitates the specialization of the analysts and allows to organize the availability of the various experts;

· *Actor:* simple to implement only if every case of use is connected in one and a single actor, otherwise he is often similar to the previous criterion;

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· *The Lot of delivery:* within the framework of an iterative and incremental development, it is interesting to include in the same package the cases of use which will be together delivered to the customer. As a result, the structuring can be very different from that obtained by applying the first criterion. [2]

. The generic mechanism of grouping of elements in UML is called it packages. We are going to resort to this activity there, to structure our group cases of use. If we resume the preliminary board, by allocating every case of use to one package, We obtain what follows:

B. Package of case of use

Every package of case of use cause the creation of a diagram. Let us begin by analyzing the case of use of package " Management of the users ". Package " Management of the users "

Tab. IV-B.1:
Packages of cases of use

use Case	main, secondary Actor	Package
Management database	Responsible engineer	Management of administration
Control connection	Responsible engineer	
Management of Newspaper	Responsible engineer	
Request of connection	technicians	Management of Robots
Look for and command robots	technicians	
Recording of report	technicians	
Detection of the events	Robots	Management of the Tolerances of breakdowns
Execution of the programs	Robots	
Sending of information	Robots	

The diagram stemming from cases of use of it packages appears as follows:

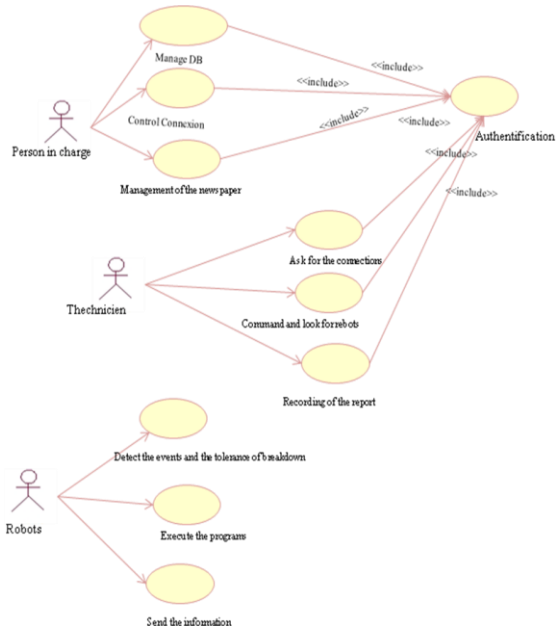

Fig. IV.B.1: Diagram of packages of cases of use

C. Description des cas d'utilisation

➢ *Control the connection*

Purpose : this case of use allows to add and to modify the technicians
Actor: person in charge.
Meadow condition:

1. Authenticate.

Nominal scenario: this case of use begins as Person in charge wishes to modify or to add a technician.

Operation: this stage allows to add a technician or to change access rights

Comment condition:

- Added Technician.
- Modified Technician.

➢ *Command and look for robots*

Purpose: this case of use allows to look for and to command at a distance robots.
Actor: technician.
Meadow condition:
1. Authenticate.
2. Verify the connection Bluetooth.

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Nominal scenario: this case of use begins at the time of the connection Bluetooth.

Operation: this stage allows to connect in robots and throw of the actions.

Comment condition:

- Connected Robot.
- Checked(controlled) Robot.

➢ Detect the events and the tolerance of the breakdowns.

Purpose: this case of use allows the first robot to detect an event and to spend a message in the second robot which is going to make the tolerance of breakdown. Actor: robots

Meadow condition:

2. Verify the connection Bluetooth.
3. Connect.

Nominal scenario: the robot n°1 detects an event and spends the order in the second robot so that it executes the tolerance of breakdown

Operation: this stage allows the detection of event and the analysis by the robot n°1 then spends the order in the robot n°2 according to the detected color which executes the program corresponds to it color.

Comment condition:

- Event detected by the robot 1.
- Robot 2 launches a sound message in the case of the end of the task.

V. Division In Categories

The division in categories constitutes the first activity of the stage of analysis (it becomes refined of course in a iterative way during the project). He succeeds the capture of the functional needs. This division is based on the diagrams of candidate classes deducted from the various cases of use.

This division has to base itself on the candidate identified classes hanging the capture of the functional needs but also on two principles: coherence and independence. It is thus a question here of grouping the classes semantically close.

Definition: a category consists of a logical grouping of classes with strong internal coherence and low external coupling.

The division in categories of our system gave the diagram of package of following analysis:

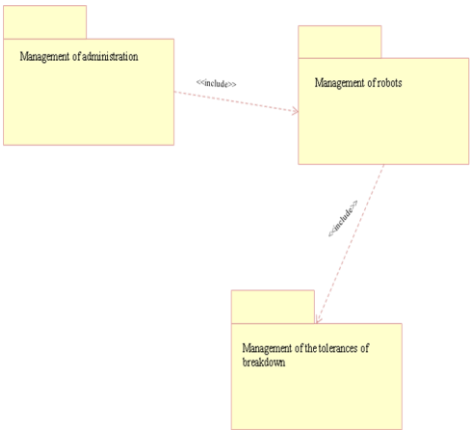

Fig. V-A.1: Diagram of categories

VI. Development Of The Static And Dynamic Models

A. *static Model*

The diagrams of classes established briefly in the diagrams of participating classes, then reorganized during the division in categories, are going to be, completed, and optimized. It is about an iterative activity, strongly coupled with the dynamic modelling.

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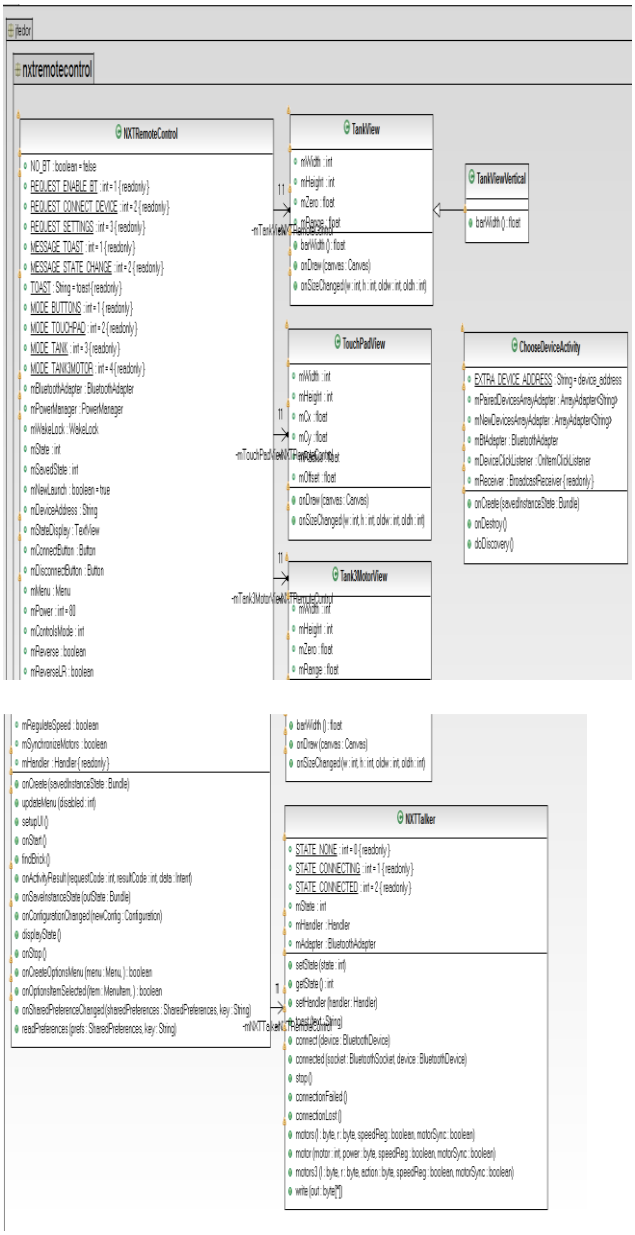

Fig. VI-A.1: Diagram of classes

B. *dynamic Model*

It is about an iterative activity, strongly coupled with the activity of static modelling.

➢ *Identification of the actors*

A case of use describes a set of scenarios. A scenario describes a particular execution of a case of use from the beginning to the end.

He corresponds to a selection of chains of the case of use. We can distinguish several types of scenarios:

Nominal: they realize comment conditions of the case of use, in a natural and frequent way;

Alternate: they perform comment conditions of the case of use, but by borrowing diverted or rare ways. In the limits: they realize comment conditions of the case of use, but modify the system so that the next execution of the case of use will provoke an error. Of error: do not realize comment conditions of the case of use.

It is necessary to indicate that all the possible scenarios cannot be enumerated and described because they exist there a lot. This is why I am going to make a description of the most relevant scenarios.

➢ *Scenarios of the case of use " to look for and to command robots "*

The search and the management of robots by Bluetooth is made according to the following stages: The technician initiates the research by Bluetooth all at first on ring peripherals connected in a space Bluetooth and he puts the choice of the robot, a request will appear in the screen of the latter and after the validation of connection, the technician manages to command the robot:

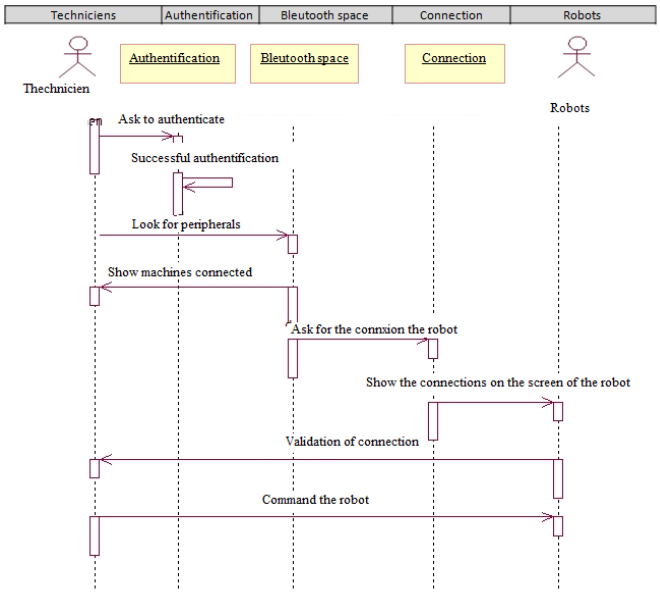

Fig. VI-B.1: Diagram of scenarios of case of use (1)

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➢ *Scenarios of the case of use " Control of connection "*

Control of connection is made according to the following stages:

The person in charge authenticates in the database and asks for the consultation of the technicians and later he makes the desired actions.

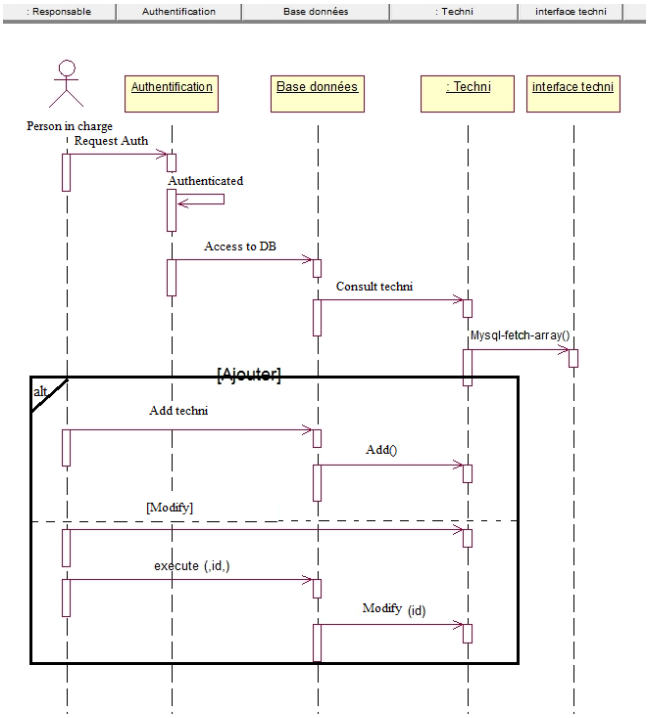

Fig. VI-B.2: Diagram of scenarios of case of use (2)

➢ *Scenarios of the case of use " to detect the events and the tolerance of the breakdowns "*

To detect the events and tolerance of the breakdowns is made according to the following stages:

In this scenario both robots reacted between them, the first robot detects the event (state of lamp of the server), if the lamp is green the robot announces a sound message " Nice Day" because the state is normal otherwise, it spends the order in the second robot which is always in listening by Bluetooth and it executes a program according to a condition (color of lamp), which are going to adjust the breakdown and make the lamp to the state normal and at the end he announces a sound message (Nice job).

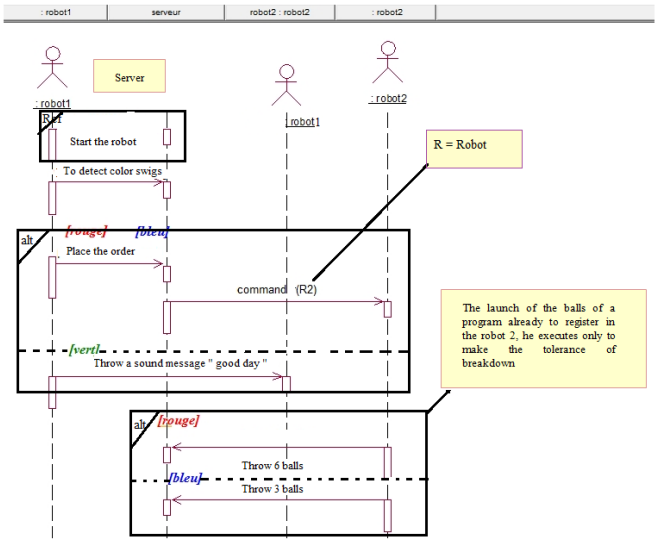

Fig. VI-B.3: Diagram of scenarios of case of use (3)

VII. CONCLUSION

In this article, we approached the description of the cases of use, the grouping of the cases of use package it, the elaboration of the diagrams of the candidate classes according to every package, the division in categories and the description of the diagrams of sequence of the most important scenarios, to be able to develop a solution which serves to adjust the problem defined at the beginning of this article. From this modelling, we are going to be able to define the technical needs to implement this architecture. We are also going to be able to develop the various software parts.

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