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Design and Development of Artificial Life with Dog for Virtual Reality

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Abstract:- It has recently been presented in the industry of computer games that motivate aspects relaxations violets. For this project developed pets can learn and interact with the user which is used for intelligent agents and reinforcement learning. Unlike the games that we see today; pet (a dog) can mimic many of the daily activities in artificial life, allowing it to evolve. There is an unreal world, if not a world very close to the existence of a pet. Shows several graphs where you can see the different emotional states of the pet, caused not only by user, also induced by other members of the same species, as well as adopting different behaviors depending on their temperament. Also shown are some of the different climates and environments where you can find the dogs. The pet goes through four stages: born, grow, reproduces and dies. As a result in the industry of computer games the project provides more realism and interaction, and finally to create liability on the owner of pet.

Keywords:- Affective state, pet behavior, graphics, artificial life, learning, chromosome, interaction.

I. INTRODUCTION

Years ago the Japanese market and the world were witnessed the success of the pet known as Tamagotchi virtual [1]. Toy portable, two-dimensional animations of an animal with a fundamental goal: the survival of the pet. His document is a template. An electronic copy can be downloaded from the conference website. Over time, Tamagotchi is success, but his name is still known by many people today. Several video game companies try to take up the idea, maintaining the fundamental concept of simplicity and entertainment [2] [3]. However, experience shows that its current success does not lie in its simplicity, but its realism [4]. Then there is the proposal to create a pet on life, rather than being characterized by its simplicity; it is recognized for its resemblance to a real pet. The software has an educational approach that involves a thorough study of artificial life [5]. The 3D graphics originates through a process of mathematical calculations on three-dimensional geometric entities produced on a computer, and whose purpose is to achieve a visual projection in two dimensions [6] [7].

II. METHOD

The system basically consists of five main modules and two auxiliary modules, from which fulfills its objectives and functions. The core modules are: selection of individual behavior (including generation of emotions), learning, recombination of chromosomes, and interaction between pets, running animations. The auxiliary modules are: Vector destination selection, selection of route. Each of them is realized by means of algorithms and models.

Selection of Individual Behaviour. To carry out the selection of behaviour the pet should be performed at each time step, we have implemented a prototype based on Cathexis, which is a distributed model to generate emotions and behaviours by autonomous agents [8]. This deployment model also handles the emotions of the pet plus your needs and the actions taken to meet them.

The model consists of a set of related systems via weights [9] so that the resulting behaviour is a linear mapping function of other variables.

Variables or systems are classified according to their function and purpose in the following groups: conditions, events, meters, timers, emotions, instincts, and emotions of love, objects and behaviours.

The algorithm consists of updating all the variables from the other. The update command is established according to the dependence of each system with respect to the other, so that the behaviours are updated at the end and having the largest value is selected as the current behaviour [8]. The current behaviour modifies some of the systems according to their intensity and their weights, causing the system feedback.

Each time the algorithm is executed, makes calls to the learning modules and interaction. The plug-ins is also used in this part to determine where they should move towards the pet and the path to follow to reach your goal.

A. Learning

This function is performed by a reinforcement-learning algorithm adapted to neural network that allows modifying the probability of an action being selected from a specific state [11] [12]. The input state is a vector formed by the values of instincts, emotions of love and closeness to the objects in the environment. The algorithm designed in the behavioural tendency in each weight update cycle, directing in the direction favourable to the maximization of the reinforcements. The network used is a neural network with competitive transfer function [13]. The update rule consists in modifying the weights of the row corresponding to the behaviour performed in proportion to their value, and the values at the time of releasing the selection behaviour. Taking into account more than one selection behaviour also performs the update rule, so that sequences of activities are considered together. The sense in which the weights are modified is established from the sum of the average reinforcements obtained in each state change, allowing learning to maximize the positive reinforcement by long time.

B. Chromosome Recombination

Whenever a virtual pet born object is assigned a chromosome; it determines their emotional characteristics, learning and behaviour. We have two methods to generate chromosomes: from random values and from parent chromosomes [14]. The first method is used when a pet has no parents, for example when the system is first opened. It is assigned to each variable a random value bounded by a maximum and a minimum. The second method is used when a child is born as a result of mating, and uses a genetic operator to determine the values of each variable in the new chromosome from the variables contained in the chromosomes of the parents [15]. For each variable, randomize the value contained in the chromosome of the father or the mother, taking into account a small probability of mutation to generate variability in the species [16].

C. Interaction between pets

Cellular automata allow to model social behaviour and gives a figure as effective as are the transition rules, applying this to the importance of emotions in social interactions can simulate the interactions when positioned over a dog system. They generate 83 rules of thumb about dog behaviour [17].

This model considers basic emotions as states discussed above, anger, joy, sadness, fear, except the surprise and aversion are hardly influenced, also has two states: dead newborn infant, with which infringe sadness or joy neighbours.

In this way we emotional interaction of individuals within the same space, giving a more dynamic environment for pets, that are affected emotionally by what then find out various behaviours of common classes of cellular automata [18], because due Cathexis, it is changed the emotions of the individual in relation to time homogeneous states are avoided, sometimes leading to chaotic states really varied by the interaction between two models. By increasing the emotional expressions, the system becomes more complicated but versatility. The prudent thing is to consider basic emotions.

To model the pet, the first was achieved actual image of a dog. This image was placed as a texture on a plane for guidance. Having done this, we used a spline (Slot) [19] to mark the outline of the pet. The only feature with which it must count the number of upper sides is equal to the number of lower sides. Once that we have the spline, we proceed to extrude (form profiles) to the width required for the pet. To manipulate the model is used a 3D engine jIrr [20] (a binding [21] Irrlicht Engine [22]), an API that allows you to import and manipulate animations, and provides tools for creating visual effects.

They use cameras, light [23], sky box (sky box) [22], collisions and particle systems. Managing collisions jIrr only provides information on intersections between lines and nets. If desired handling of collisions with higher level of realism is necessary to use physical libraries [24].

III. RESULTS

A set of graphs shows the behaviour of the variables involved in the selection of individual behaviour. It has selected a situation generated by the system, which has the following sequence of behaviours: the pet walking, urination, defecation, seeking water, drink, find food, eat, rest, walks, seeks an object and played with the object.

Meters involved in the situation are water, food and activity. In the graph of Figure 1 shows that water and food have initial values, but increase the needs to be met that generated. The activity increases with the movement of the pet and remains constant while meeting power needs evacuation and decreases with rest and increases drastically when playing or pursues an object.

In the graph in Figure 2 shows the emotional state of the pet for a while. Initially increase anger and sadness, as a result of the needs. Later, after the anger is prevalent, it is inhibited by the joy that provides an object thrown.

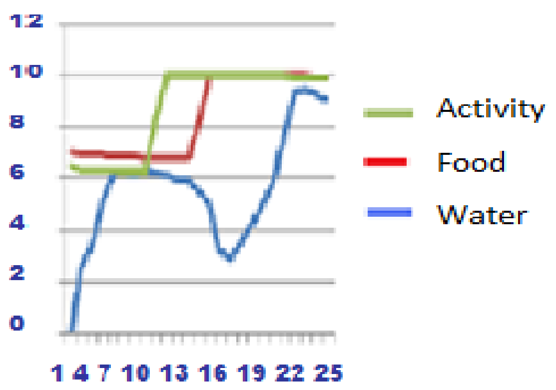

Fig. 1. Meters

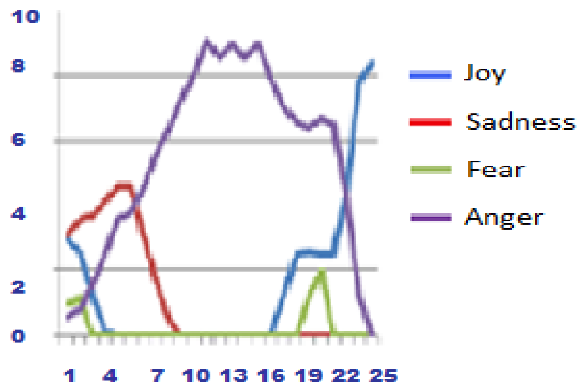

Fig. 2. Emotions

In the graph of Figure 3 can observe the behaviour of the pet in the situation analysed, for those whose value is maximum at each time step. It can be seen how, when a need is satisfied, its value decreases giving way to the realization of a different activity.

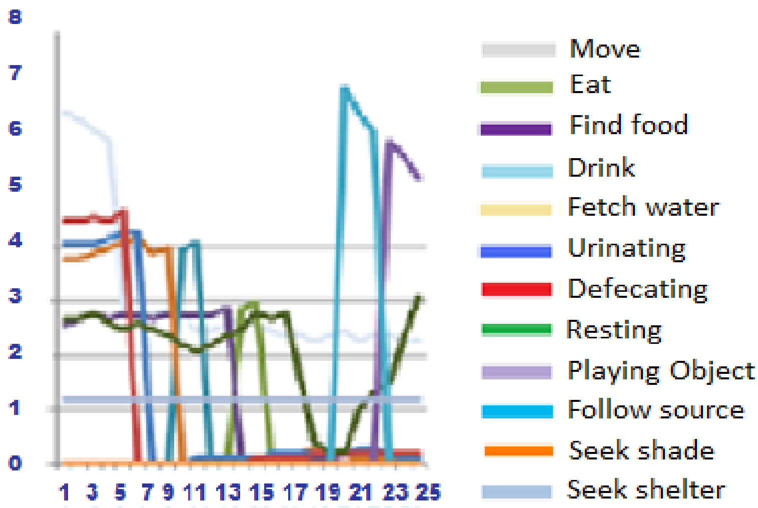

Fig (3) Behaviours

A. Humour and temperament

The graph in Figure 4 shows the behaviour of the emotions of the pet to be attacked by another. It can be seen as fear increases dramatically. However, in the graph of Figure 5 shows that a different pet, located in the same position and with the same initial state behaves differently.

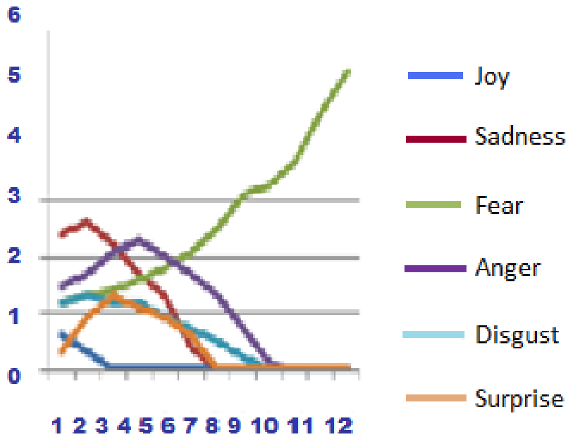

Fig. 4. Humour and temperament of a pet when is attacked for other

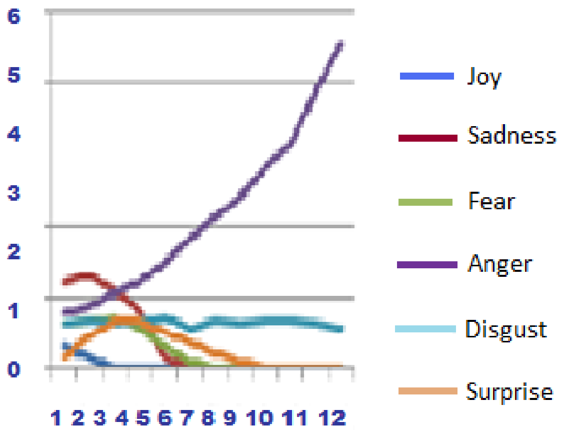

Fig. 5. Behaviour of pet 2 when is attacked

The difference in behaviour is that pets temperaments are different, and do not react the same way to similar situations. If the same pet twice facing the same situation, but with a different initial condition, behaviour is not the same. The graph in Figure 6 shows the value of the defecation behaviour with respect to instinct that generates it. It can be seen that as a result of learning, the value of behaviour "Clarify" instinct is not for the "evacuation" while the proximity to a specific object is high, but when it lowers the behaviour increases its value, and consequently the probability of be released.

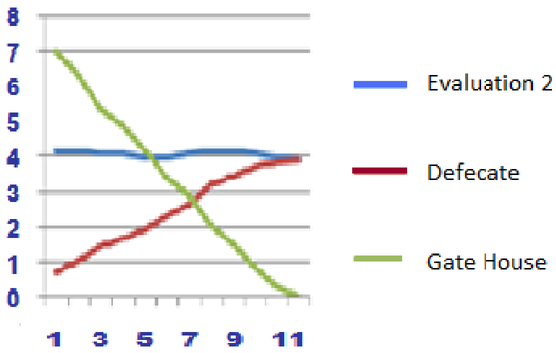

Fig 6. Learning Process

B. Interaction between pets

In the graph of Figure 7 the predominant emotion to start the period of analysis is anger, but gradually decreases because the other pet is happy. The graph in Figure 8 pet B shows that although initially the joy is the emotion with greater value, it gives way to the fear that causes another pet. Later, when the anger of the pet A decreases does the same fear resulting joy.

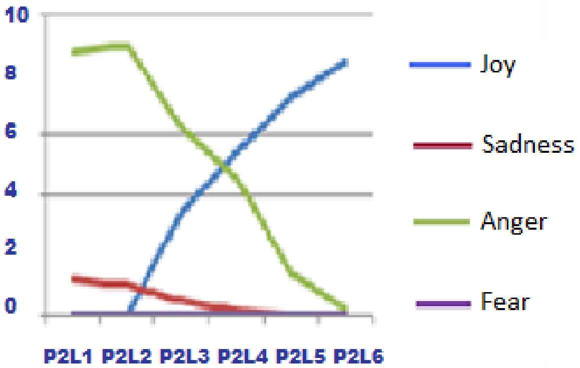

Fig. 7. Pet A

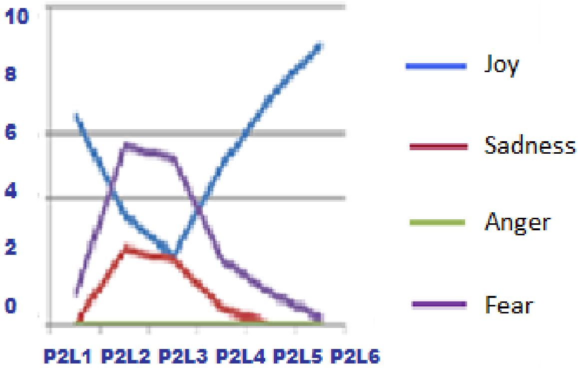

Fig.8. Pet B. Interaction between pet.

Figures 9 and 10 samples of food and water available

Fig. 9. Virtual pet food available

Fig. 10. Water Available for Virtual pet.

Mating is an essential part of the system, to generate new pets apply genetic algorithms to the inheritance of certain traits and emotions. See Figure 11. Mating is the beginning of the cycle of life, the death is the end, and that this fact influenced emotionally in other team members. See Figure 11.

Fig. 11. Virtual pet breeding.

Fig. 12. When a virtual pet dies.

In addition to the default setting (the yard of a house), it has a large green area and a park, which can be walking the dog, as shown in Figure 13, there is also a shop where you buy food and toys.

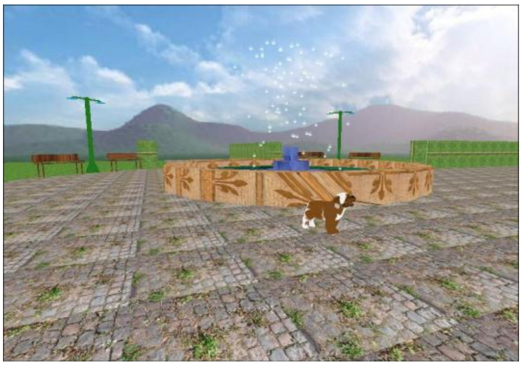

Fig. 13. Source Simulation

Figures 14, 15 and 16 show some weather generating their onset and duration probabilistically using particle systems own 3D engine to simulate rain, snow and fog.

Fig. 14. Snow Climate Simulation **Fig. 15.** Simulation of a cloudy day. **Fig. 16.** Simulation of Rain

You may experience cold and heat by implementing own weather sounds like the song of birds or the wind blow respectively. In the system implemented the transition from day to night and vice versa. See Figure 17.

Fig. 17. Sunset Simulation

IV. CONCLUSIONS

This paper presents the design and implementation of a virtual pet that can simulate affection, interact with other pets, learn and play and interact with the user. One of the most important modules of the system is responsible for modeling emotions and select the pet's behavior, for which we used a model based on Cathexis. The selection of the base model mentioned was successful mainly because of its flexibility to be modified and its ease of adaptation to other algorithms such as cellular automata and learning, as well as his proposal to model mood and temperament. The learning mode is best suited for reinforcement. The only reinforcement learning algorithms are based on tables, and limit the number of states that can take as input the system. Because of this, so that the learning of the pet is compatible with the network of the system variables of behavior, has developed a learning algorithm based on those applied to tables, and modifying them to adapt to neural networks. The designed algorithm provides compatibility with realism and instinctive behaviors and allows sequential learning activities. The interaction between pets, it is another objective of the system, and it is performed by adding a cellular automaton individual behavior; it has been performed successfully due to the feasibility of modeling virtual worlds from this model. However, the number of rules used for its implementation, as well as the space dimension and the number of neighbors that each cell are factors that increase the complexity of the algorithm, both for implementation and in terms of computational cost. Therefore, these factors need to be selected carefully so that system performance is not impaired. Regarding the graphical modeling of the pet, it is important to carefully select the number of vertices of the models, to get the right balance between quality and performance. The limitations imposed by exporting the models are compensated by graphic engine used, so that visual effects can be used without problems, although the platform is partially lost characteristic by using another language native methods. Regarding the graphical modeling of the pet, it is important to carefully select the number of vertices of the models, to get the right balance between quality and performance. The limitations imposed by exporting the models are compensated by graphic engine used, so that visual effects can be used without problems, although the platform is partially lost characteristic by using another language native methods. Finally, it is important to mention that the design of the system is dynamic, so that both the algorithms and animations can be changed without serious problems.

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