

# MULTIAGENT SYSTEM WITH ARTIFICIAL NEURAL NETWORK ON FPGA DEVICES

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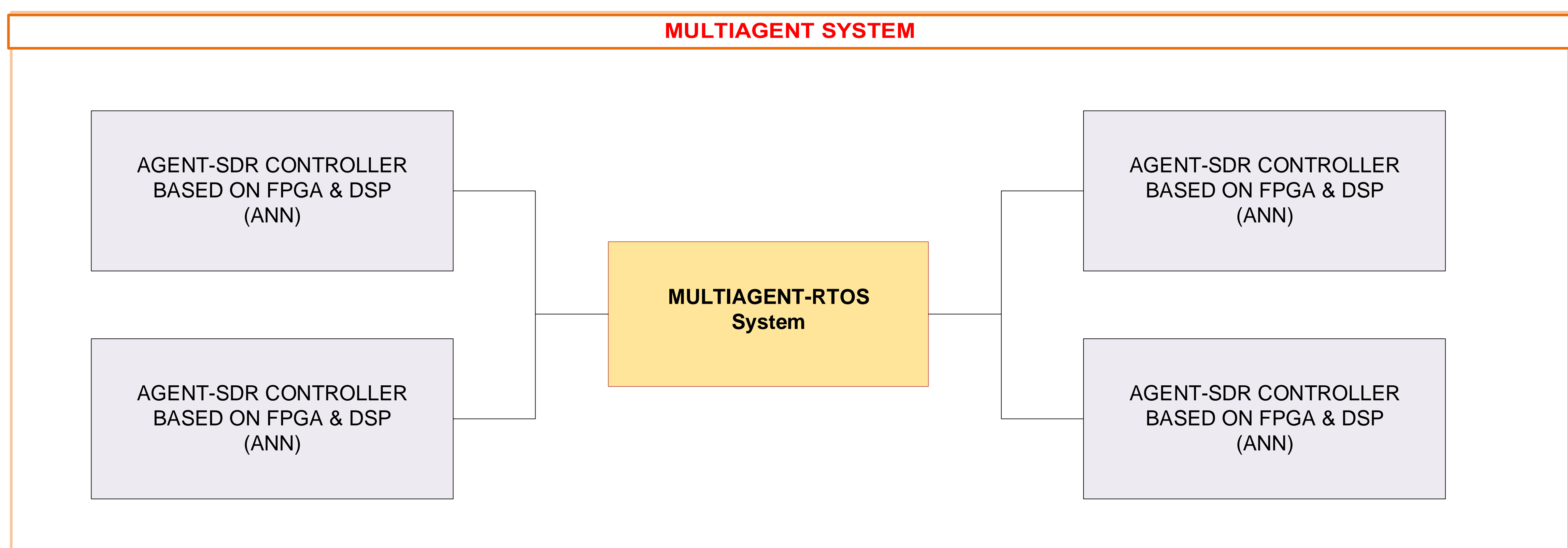
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## Multiagent System RTOS

A multiagent system (MAS) how Real-Time Operating System (RTOS) is formed by several agents based each one on Software-Define Radio (SDR) Controller based on FPGA and DSP digital circuits, which interact with each other, in order to solve complex systems in dynamic environments therefore it is required to design needs-oriented architecture specification agents can meet scheduling, communication through specific languages, code mobility or motivation of the system components (the agents) .

The main features that make it so complex multi-agent system are: interact with the environment, distribution of decision-making, emergent behavior, higher degree of user interaction and interaction with other agents.



## Motivation of the work

1. To apply VHDL programming language in FPGA circuits.
2. Deepen the studies about digital signal processing DSP and use in specific design with SDR based on FPGAs, observed how agent-controller.
3. To use the concept of to design artificial neural network (ANN) with the proposal of the design an agent-controller.
4. How work a multiagent system?. This is the question, obviously with a real-time operating system (RTOS) to design.
5. Which ANN it adapts to the target?. How and why?.

## THESIS OBJETIVES

- The objective of this work is to design a multiagent-RTOS system shaped by intelligent agents who select alternatives between several options, deducting different options subject to programming in VHDL also named Agent- Controller. For this subject it is necessary to develop an agent structure, which is organized in architecture Codesign Hardware and Software interactive, both are they need to be designed.

- Also, to organize a single model of agent-controller using software-define radio (SDR) concepts based on FPGA and DSP then design a multiagent-RTOS system; first we are to think about this agent that would have many specific utility functions for take rational decision with algorithms embedded on digital circuits so like take control signals from the multiagent-RTOS system integrated.

- Moreover, the architecture has a direct relation with the software system, also these will have levels and interfaces with handshaking control signals.

- The proposal of this theory it is to demonstrate that is possible implement a specific Hopfield Artificial Neural Network system based on FPGA and DSP digital circuits in a SDR, begin with individual cell next grouping another cells, under Agent concepts then multiagent-RTOS for deterministic signals between SDRs.

## RESEARCH PLAN

1. State of the Art on FPGA and DSP.
2. State of the Art about SDR.
3. Paper concerning on Cognitive Radio Wireless.
4. Theory Agent-SDR Controller.
5. Real-time Operating System RTOS design in function of Multiagent system.

## RESULTS & DISCUSSIONS.

During last years it was finished the following tasks:

- Task 1. Development the Chapter 1 and reported: Intelligent Agent.
- Task 2. Development the Chapter 2 and reported: Multiagent system.
- Task 3. Development the Chapter 3 and reported: Application of Artificial Neural Networks.
- Task 4. Development Chapter 4 and reported: Application of FPGAs Devices .

## NEXT YEAR PLANNING

- To research and analyze the State the Art.
- To study de VIVADO Suite platform.
- To study de FPGA – Zynq of Xilinx and DSP.
- To develop a model neuron cell on MATLAB and VHDL language. (Controller).
- To develop a Agent SDR-Controller on MATLAB and VHDL language based Hopfield neural network model using FPGA and DSP.

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