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Usable Embedded System Architectures For Autonomous Robotics

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Abstract :
This paper is a part of line of research that seeks to develop and systematize the body of knowledge of usable embedded system architectures for autonomous robotics, with a focus on its transfer to industry, particularly small and medium sized enterprises (SME) sector. Using research methodologies, documentary exploratory, evolutionary prototyping and case studies arises through targets, following development artifacts are conceptual: (1) characterize usable embedded system architectures for autonomous robotics, (2) characterize these architectures applications and their potential use in the region of municipalities and SMEs and (3) Identify free access or Usable inexpensive technologies to implement associated embedded systems used in autonomous robotics that an SME can implement in their production processes.

Key words: *Embedded systems, robots and autonomous intelligence systems*

1.Introduction

An embedded system is a computer system designed to perform a group of dedicated and specific functions, employing a combination of hardware and software resources. They have different characteristics (Include: concurrent, Parallel and distributed processing, robustness, reliability, low consumption and low cost) which makes them highly recommended in the management and control of mobile autonomous robots.

One of the points involved in the problem modeling of autonomous systems [Fritz, 1984, 1992, Fritz et al, 1989] is to axiomatic basis formally describing phenomena that occur in this type of systems. This formal description points to provide a tool for classify, measure and calculate in the field of intelligence. Formally, the classification is not relevant in natural or artificial. The purpose of the work is to abstract the common features of all intelligent processes. Then, classify intelligent systems as capable of giving in intelligent processes. A commonly associated characteristic with Intelligence is the ability to acquire new knowledge. This is manifested in the learning processes, who agree to be described in terms of assimilation and incorporating information from the context. One way to acquire new knowledge is the "trial and error method". This technique is to discover simple laws whose accuracy follows from the experience. In the theory presented by authors cited, this acquisition knowledge is centered on assimilation of experiences, with the laws of experimental experience units.

Intelligent Systems should have goals that are to access a situation. They are also trained to choose their actions according to these objectives and are able to learn what action is to be useful in relation there to every position. Situation is the set of the essential features of state of things, in relation to the objectives of the system. It is made on the basis of all sensory inputs and their time conceptualization. Based on this modeling, each action is chosen. To achieve its objectives and to choose appropriate actions, acting Intelligent Systems should have a memory in which they can file their experiences.

A unit consists experience of the situation experienced, action performed, the resulting situation and the fact that the consequences of the action have been beneficial or not to achieve the goal. East benefit or lack thereof, results in resulting utility. The decision on action you should take is done according to the accumulated experiences, if they are in relation to current circumstances (can be both the direct experiences of the system also known as experiences through that occurred in others). If the archiving experience such as a relationship exists and action chosen at that time was beneficial, will tend to choose again this same action or choose different alternatives if the action was detrimental. When it comes to a new situation, no previous experience of it is made used and action guided by the results obtained in previous performances is also not applicable.

Faced with familiar situations, Intelligent Systems tend to develop a performance that (from experience) considered as optimal (not necessarily the best). This trend is called habit. A bad habit is when the system action persists even when it is no longer corresponds to the situation.

In this paper we focuses on the study of architectures of embedded systems for autonomous robotics, looking for: [a] characterize usable embedded system architectures for autonomous robotics, [b] characterize these architectures applications and some potential uses in the region of Municipalities and small and medium sized enterprises (SMEs) and [c] identify free access or low cost associated technologies with embedded systems used in autonomous robotics that an SME can implement in their production processes, validating this via implantation cases accepted by the international community. This paper promotes validation of methods, techniques and tools, leading to an improvement in the field of embedded systems architecture used in autonomous robotics.

2.Progress In The Subject

The theories of autonomous intelligent system architecture with training based learning and weighting can be described as robot exploration that perceives the environment through the sensor system and the status registers and builds a local theory to the situation before the action taken [Garcia-Martinez and Borrajo; 1997, 2000]. If the local theory is equal to some recorded theory, it amplifies. If there is a plan in progress, that verifies the resulting position is the expected, if it does not, it aborts the plan and the control is returned to the planner. If a plan is implementing there, the planner generates one and sends it to the weighting by heuristic criteria to determine whether the plan is acceptable or not. If so, control is passed to the controller implementation plans, whose function is to determine the next action to be executed and whether the situations obtained are expected situations or not.

The autonomous intelligent system architecture with exchange-based learning theories perceives the environment through the sensor system. Before if any action is asks, it is necessary to exchange operators with another intelligent autonomous [Garcia-Martinez et al., 2006]. East process is performed by a module exchange operators. Then, the full perception of environmental situation is builds and a local theory with the previous situation and action will be executed. While, local theory is still not set the values for P, K and utility. If the local theory is equal to some recorded theory, it is reinforced and if there is no similar theory, they are weighted and the mutants generated theories weighted, which are recorded in the same form. Finally (after the process of generating theory, if there are mutants or similar theories) local theory incorporates and control is passed to the subsystem controller.

If a plan is in execution, it checks that the obtained situation is the expected situation or not, if not this plan is aborted and control is returned to planner. If there is no implementation plan, the planner generates one and sends it to weighting using a heuristic criterion to determine whether the plan is acceptable or not. In case so, the controller plans implementation determines the next action to be performed, that is passed to the platform to apply it in the environment.

Autonomous systems that operate under the life cycle model for learning based on shared knowledge [Ierache et al., 2008, 2009 and 2010], distinguished states of evolution and performance levels in the context of a life cycle for the Learning Autonomous Robots Systems (ARS). On this basis, it is a convenient learning mechanism that specify collaboration between ARSs, defining a learning life cycle consider architectures and models that characterize the ARS and its performance in the environment operation in particular ARSs more evolved collaborating with ARSs less evolved receptors. Centered learning mechanism is specified convenient to study experimentally collaboration between ARSs, validating the thesis that they have an improved performance using collaboration when not in use.

3.Objectives And Hypothesis Of Research

This paper is a part of line of research that seeks to develop and systematize the body of knowledge of usable embedded system architectures autonomous robotics with a focus on its transfer to industry, particularly the small and medium sized enterprises (SME) sector. Among the assumptions (or hypotheses) that guide the projects are:

3.1.Hypothesis I

There are computer systems architectures that standout in importance when used in autonomous robotics. Embedded system architectures have specific and differential characteristics (including concurrent, parallel and distributed processing, robust, reliability, low power consumption and low cost) to be used in the management and control of mobile autonomous robots.

3.2.Hypothesis II

There is availability in the market (Local and international) developments robotic hardware allows building prototypes of mobile autonomous robots. The possibility of having a wide range sensors, programmable processing units, versatile actuators and interfaces allowing user programming prototypes as well as access and management of its resources, paves aspects of integration of hardware and drivers in the mechanical construction of the robot and allows focusing the research project computer systems that will control.

3.3.Hypothesis III

One of the vectors modernizations of SMEs is through automation of their processes. Automation and robotics both the technologies are closely related. In a context, Industrial automation can be defined as a technology that is related to the use of mechanical-electrical systems for computer-based operation and production control. Consequently Robotics can be understood as a way of industrial automation. It can be said that there are three very broad classes in industrial automation as shown in figure 1: [a] fixed automation [b] programmable automation and [c] flexible automation. Fixed automation is used when the production volume is very high and therefore can be justified reasonably costly design specialized equipment to process the product, in high yield and high production rates. Besides the high cost of design, drawback of

fixed automation is its life cycle that goes according to the term the product in the market. Programmable Automation is used when the production volume is relatively low and there is a production diversity gain. In this, if the production equipment is designed to accommodate variations in product configuration, this adaptation is performed by of a computer program (software). The flexible automation is more suitable for a range of average production. These systems possess flexible characteristics of fixed automation and programmable automation. Usually Flexible systems are constituted by a series of stations interconnected by working systems storage and handling of materials,
controlled as whole by a computer. Among the three types of automation, robotics coincides more tightly with the programmable automation.

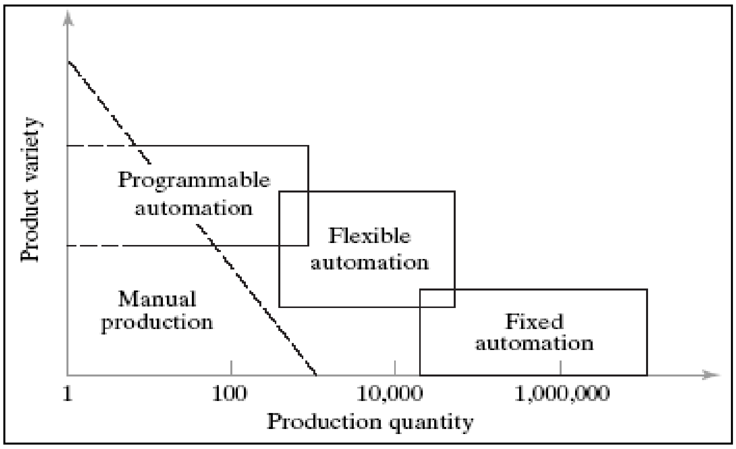

Figure 1: Production Quantity And Product Variety Related To Different Types Of Automation

3.4.Hypothesis IV

The emerging educational robotics as a promising branch in which the student can experience concretely as executing a software program developed by him that translates into actions to transform robotic mechanisms certain reality. In this way achieves a new dimension appropriate software as a component of the new paradigms of transformation of matter. The overall objective of this project is to study of embedded system architectures for autonomous robotics, looking for: [a] characterize usable embedded system architectures in autonomous robotics, [b] characterize these applications architectures and their potential use in the region of Municipalities and SMEs and [C] identify free access technologies or Usable inexpensive to implement associated embedded systems used in autonomous robotics that an SME can implement in their production processes, validating this implementation through accepted case by the international community.

3.5.Specific Objectives Related To Hypothesis I

- Relieve different computer system architectures used in autonomous robotics, focusing the study on embedded systems architectures by identifying specific and differential characteristics and determining the applicability of the same in the management and control of robots mobile autonomous.
- Select embedded system architectures and implement these management and control algorithms for autonomous robots.

3.6.Specific Objectives Related To Hypothesis II

- Relieve the various robotics hardware developments to build prototype autonomous mobile robots in the market.
- Develop prototypes for the autonomous robots phones to be managed and controlled architectures of selected embedded systems, and thus test thereof.

3.7.Specific Objectives Related To Hypothesis III

- Develop a model application and use potential embedded system architectures and autonomous robotics in the region of Municipalities and SMEs.

3.8.Specific Objectives Related To Hypothesis IV

- Develop a methodology for students in the Bachelor Systems, so that they can experience and develop the skills in the areas of computer architecture, embedded systems, robotics automation, distributed communications systems, concurrent programming and in real time processing.

4.Working Methodology

Specific Objectives 1 and 3 is proposed a literature exploratory linked to the concepts of interest, analyzing also alternatives available in the industry.

Specific Objectives 2 and 4 is proposed field of testing architectures and selected prototypes.

Specific Objective 5 proposes methodology developed by prototyping model of evolutionary application and potential use in the region of Municipalities and SMEs.

The process is carried out in an evolutionary way and requires: [a] Identification of potential case studies in the area of Municipalities and SMEs, [b] Initial prototype development model application. Identification information test for model validation, [c] validation of the model developed; based on assessments applied to cases of study identified prototyping evolutionary. The software development process be conducted under the guidelines of the standard IEEE 1074-1989.

5.Conclusion

The need for advances in the development of methodological field is evidenced by the effected, which identifies deficiency models and associated systematic techniques. In this context, the project promotes validation of methods, techniques and tools, leading to an improvement in the field of embedded systems architecture used in autonomous robotics. Methods to equip the engineering approach development process: objectivity, systematic, rational, generality and reliability, contribute to the advancement of scientific knowledge using consistent techniques. The expected bias for the project sector enables SMEs that, results can be transferred to industry with filing in the area of Municipalities and SMEs as it looks to identify free access technologies or low cost embedded associated autonomous robotics used in a SME can implement in their production processes.

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