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ElGamal over the Permutations Group

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Abstract **The ElGamal encryption algorithm can be applied with good results in any group structure where the problem of the discrete logarithm is difficult to solve. In order to satisfy this requirement it is necessary that the order of the group to be high enough and to contain elements of high order. The permutations group of order n has the characteristics stated above. Another important aspect refers to the fact that it is necessary for a message to have associated in a biunivocal manner, an element from the group where the computations are realized. These two ideas are developed in the present paper. Also there are elaborated more versions of the ElGamal system over the perturbations group (symmetrical group). Finally, it is presented an example which illustrates the elaborated system.**

Key words: EGPGP-ElGamal over the permutations group, EGPGPn-ElGamal over the symmetrical group of order n, Pam-permutation associated to a message m.

I. INTRODUCTION

The encryption systems are conceived starting from the properties of some mathematical structures. The algorithms with public keys outline those properties which ensure the generation of sufficiently "secure" keys in a relatively simple way from computational point of view. Starting from the problem of the discrete logarithm over a group, the idea being presented in [1] [4] [5] , a structure can be chosen to ensure a high order of difficulty to determine the algorithm with regard to computations. Such a structure is the permutations group of order n.

The system suggested next is the ElGamal over the permutations group of order n. It is necessary to point out that this system is not a cipher of permutation or substitution, it is an asymmetrical cipher which is applied to group S_n.

II. PRELIMINARIES

In order to explain the terms, the necessary mathematical notations for the following construction are presented. The definitions and the theorems are selected from [3][9][10][11].

Definitions 1: Let A be a set of n elements. A bijective function $\sigma:\{1,..,n\}\to A$ is called a permutation of the elements of the set A.***

The set of the permutations of the set A is denoted S_A and the permutation can be represented as a table:

$$\sigma=\begin{pmatrix}1 & 2 & . & . & . & n\\ \sigma(1) & \sigma(2) & . & . & . & \sigma(n)\end{pmatrix}.$$

If $A=\{1,2,...,n\}$ then the set of the permutations is denoted S_n.

Theorem 1: S_n together with the operation of composition of permutations form a group structure. ***

There are different notations as shown below:

$$\sigma=\begin{pmatrix}1 & 2 & . & . & . & n\\ \sigma(1) & \sigma(2) & . & . & . & \sigma(n)\end{pmatrix}$$

$$\sigma=\begin{pmatrix}\sigma(1) & \sigma(2) & . & . & . & \sigma(n)\end{pmatrix}$$

This structure is called the symmetrical group of order n. In this case the operation of composition is called the product of permutations. The scheme of the product of permutations is the following:

$$\sigma\tau=\begin{pmatrix}1 & 2 & . & . & . & n\\ \sigma(1) & \sigma(2) & . & . & . & \sigma(n)\end{pmatrix}=$$

$$=\begin{pmatrix}1 & 2 & . & . & . & n\\ \tau(1) & \tau(2) & . & . & . & \tau(n)\end{pmatrix}=$$

$$=\begin{pmatrix}1 & 2 & . & . & . & n\\ \sigma(\tau(1)) & \sigma(\tau(2)) & . & . & . & \sigma(\tau(n))\end{pmatrix}$$

The symmetrical group of order n is not commutative, and its cardinal is n!.

The Stirling formula approximates n! very well (for great numbers). For n>100 the number of digits will be computed without error with this formula. The formula is:

$$n!\approx\left(\frac{n}{e}\right)^n\cdot\sqrt{2\pi n}$$

(In the formula appear two irrational numbers e≈2,71 and π≈3,14)

Definition 2: A permutation $\sigma\in S_n$ is called a cycle or a cyclic permutation of length l if there exist l different numbers $i_1,i_2,...,i_l$ in $\{1,2,...,n\}$ so that

$$\sigma(i_1)=i_2,\sigma(i_2)=i_3,...,\sigma(i_{l-1})=i_l,\sigma(i_l)=i_1$$

and $\sigma(i)=i$ for $\forall i\in\{1,2,...,n\}\setminus\{i_1,i_2,...,i_l\}$. In this case it is denoted $\sigma=(i_1,i_2,...,i_l)$. A cycle of length 2 is called a transposition.

From the notations point of view the cycle $\sigma=(i_1,i_2,...,i_l)$ means:

Monitoring system with intelligent agents

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***Abstract*—The paper presents a monitoring system that can be configured with intelligent agents. The paper contains 4 parts. The first part is a short introduction of multi-agent system, the second part describe the hardware and software architecture, the third part presents some experimental results and the last one presents the conclusions. The agents use Wi-Fi technology to communicate with each other and they are able to negotiate in order to allocate resources. This model implement the concept of virtual redundancy, meaning that if a part of a system fails, other parts will assume its tasks. Virtual redundancy provides a low cost reliable configuration.**

Keywords - multi-agent systems, sensors,access point,Wi-Fi communication.

I. INTRODUCTION

Multi-agent systems (MAS) are a loosely coupled network of software agents that interact to solve problems that are beyond the individual capacities or knowledge of each problem solver [1]. A multi-agent system models complex systems and is composed of a large number of interacting agents, having common or conflicting goals. As shown in figure 1, these agents may interact with each other either indirectly (by acting on the environment), either directly (via communication and negotiation) and may decide to cooperate for a common goal, or compete in order to reach their own objectives [2]. Also, agents are sophisticated computer programs that act autonomously on behalf of their users, across open and distributed environments, to solve a growing number of complex problems. They are being used in an increasingly wide variety of applications, ranging from comparatively small systems for personal assistance to open, complex, mission critical systems for industrial applications [3]. One of the most important application fields of multi-agent systems is represented by information management [4].

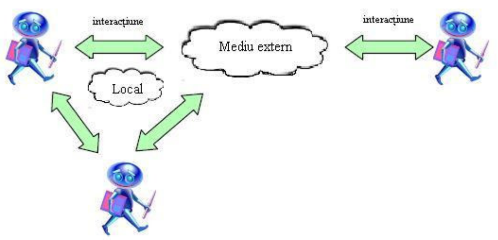

Figure 1: Multi-agent system

Industry is a very important field of application for multi-agent systems because they are where the first multi-agent system techniques were experimented with and demonstrated their initial potential. Examples of industrial domains where multi-agent systems have been fruitfully employed include process control, system diagnostics, manufacturing, testing, transportation logistics, and network management and distributed monitoring [2]. In particular, the Internet has been shown as an ideal domain for multi-agent systems due to its intrinsically distributed nature and the sheer volume of information available. Agents can be used, for example, for searching and filtering this mass of information [5]. The Internet has also pushed the use of agent technologies in the commerce and business process management fields. In fact, before the spread of Internet commerce, business process management was almost entirely driven by human interactions: humans deciding when to buy goods, how much they are willing to pay, and so on. Now electronic commerce and automated business processes are increasingly assuming a pivotal role in many organizations because they offer opportunities to significantly improve the way in which the different entities involved in the business process interact.

Interaction among agents in a multi-agent system is mainly realized by means of communication. Communication may vary from simple forms to sophisticated ones, as the one based on speech act theory. A simple form of communication is that restricted to simple signals, with fixed interpretations. Such an approach was used by Georgeff [6] in multi-agent planning to avoid conflicts when a plan was synthesized by several agents. A more elaborate form of communication is by means of a blackboard structure. A *blackboard* is a shared resource, usually divided into several areas, according to different types of knowledge or different levels of abstraction in problem solving, in which agents may read or write the corresponding relevant information for their actions. Another form of communication is by *message passing* between agents. In fact, agents need to be able to communicate with users, with system resources, and with each other if they need to cooperate, collaborate, and negotiate and so on. In particular, agents interact with each other by using some special communication languages, called agent communication languages, that rely on speech act theory [7] and that provide a separation between the communicative acts and the content language. The first agent communication language with a broad uptake was KQML [8]. It is a language and protocol for exchanging information and allows message content to be represented in a first-order logic-like language called KIF [9]. Currently the most used and studied agent communication language is the FIPA ACL, which incorporates many aspects of KQML [10]. The intention of FIPA ACL is to provide conversational logic to agents, thus raising the semantic level of agent communication to a higher level than existing technologies. An agent exists and performs its activity in a society in which other agents exit. Therefore, coordination is a process in which agents engage to help ensure that a community of individual agents acts in a coherent manner [11]. Coordination is also a means to achieve the coherent behavior of the entire system and may imply *cooperation* and *competition*. In first case the agent society works towards common goals to be achieved. In second case, coordination is important because the agent must take into account the actions of the

Generalized Predictive Control Algorithm Implementation and LabVIEW Real Time Benchmarks

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Abstract – **The purpose of this paper is to describe a set of experiments and real time benchmarks, designated to be implemented with industrial equipments, especially those produced by National Instruments. Three hardware and software configurations for process simulation and control will be used. The main aim is testing and evaluating the performance of Programmable Automation Controllers (PAC) when running Generalized Predictive Control (GPC) compared to PC based control system. Two embedded platforms developed by National Instruments (NI) are tested: NI CompactRIO Real-Time Controller and NI PXI Embedded Controller. A comparison between these platforms and PC, from the real time performances point of view, is made. A series of statistical parameters regarding real time performances of tested equipments (e.g.: standard deviation, maximum jitter and execution mean time) are emphasized. Because of the high portability of LabVIEW software, which with little modifications can be ran on completely different platforms, a benchmark was created.**

Keywords-component: embedded, real-time, control, benchmark, LabVIEW

I. Introduction

An embedded system is a special computer system designed to perform one or a few dedicated functions, often with real-time computing constraints. In contrast, a general computer, such as a PC, can do many different tasks depending on programming.

Tested platforms are Real Time Operating System (RTOS) and run applications written in LabVIEW Real Time (LabVIEW RT) under a Windows/Linux host, and can be transferred on an embedded target, one with no keyboard, mouse or display. VIs also runs on VxWorks or PharLap RTOS.

A real time system can be classified as hard real time and soft real time, partly depending on the consequences of a missing time deadline. A soft real-time system allows the absence of some deadlines with only a slight degradation in performance but without a complete failure. On the other hand, a hard-real time system will fail if some time deadlines are missing [2].

A RTOS is an Operating System (OS) that has been designed to run code in a predictable manner with minimal latency. This means it fulfils the requirements for hard real time. The CPU allocates a period of time for each application or process, regardless of priority. On a desktop computer, LabVIEW is subjected to timing uncertainties caused by the desktop OS since we cannot be sure that the OS will not suspend the execution during critical-time VI while it goes out to perform some routine maintenance. This type of real time soft cannot be used to generate or respond to critical-time tasks where the latency needs to be higher than a few milliseconds [2].

For Generalized Predictive Control (GPC) implementation to wastewater treatment plants process control a real-time platform is required.

The purpose of this paper is testing and evaluating the performance of Programmable Automation Controllers (PACs) compared to that of PC based control systems (e.g. PID contollers). The two embedded platforms tested here are developed by National Instruments (NI): NI CompactRIO Real-Time Controller (NI cRIO) and NI PXI Embedded Controller (NI PXI).

II. Controller Design

There were suggested various approaches of predictive control. One possibility is to minimize the following cost function:

$$J(N_1, N_2, N_u) = E\left\{ \sum_{j=N_1}^{N_2} [y(t+j) - y_r(t+j)]^2 + \right.$$
$$\left. + \sum_{j=1}^{N_u} [\rho(j)[\Delta u(t+j-1)]^2 \right\} \quad (1)$$

where:

- Δ - the differencing operator 1-q -1;
- N 1 - the minimum costing horizon;
- N 2 - the maximum costing horizon;
- N u - the control horizon;
- ρ(j) - a control-weighting sequence;
- y r - the future reference sequence.

The choice of design parameters N 1, N 2, N u and ρ (j) leads to different approaches of the adaptive generalized predictive control algorithm described in the literature.

The use of the CARIMA plant model:

$$A(q^{-1}) \cdot y(t) = B(q^{-1}) \cdot u(t-k) + C(q^{-1}) \cdot \frac{e(t)}{\Delta} \quad (2)$$

introduces in the controller an integrator as a natural consequence. For simplicity in this development C(q -1) is chosen to be 1.

To derive a j step ahead predictor of the process output y(t+j) on considers the polynomial identity:

$$1 = E_j(q^{-1}) \cdot A(q^{-1}) \cdot \Delta + q^{-j} \cdot F_j(q^{-1}) \quad (3)$$

where E j(q -1) and F j(q -1) are polynomials uniquely defined, given A(q -1) and the prediction interval j, of degree j-1 and respectively n (n - the process order).

Based on this identity we have:

$$y(t+j) = E_j(q^{-1}) \cdot B(q^{-1}) \cdot \Delta u(t+j-k) +$$
$$+ F_j(q^{-1}) \cdot y(t) + E_j(q^{-1}) \cdot e(t+j) \quad (4)$$

The optimal predictor, given measured data up to time t (including t) is written as:

Finite element modeling of the prosthetic glenohumeral joint

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***Abstract*—A finite element modeling was performed in order to study the glenohumeral joint. A comparison study was made between the healthy humerus and the prosthetic humerus using an uncemented prosthesis. There were simulated three types of movement in order to compare the load, strain and stress appeared in the prosthetic humerus with the healthy one. The results show that for three types of movement the results are similar for both cases. This study will be used to test different types of prosthesis cements.**

Keywords-biomechanics, finite element, glenohumeral joint, prosthesis

I. INTRODUCTION

Orthopedic implants are intended to support forces and must thereby be firmly attached to the rest of the skeleton [[1]]. The implant is placed in the body either with an acrylic cement that gradually fails as regeneration of connecting bone tissue is proceeding, or without cement using an implant with an interface designed to provide the necessary attachment. Because of the difficulty of performing implant tests in vivo, mathematical models have been developed to carry out the structural analysis of implants before application on a patient. Accordingly bone-implant scapulohumeral prosthesis could be designed and studied with computer simulations.

Finite element analysis is becoming an increasingly important part of biomechanics and orthopedic research, as computational resources become more powerful, and data handling algorithms become more sophisticated [[2]]. It is used as a tool for the design and analysis of total joint replacement and other orthopedic devices. To design highly durable prostheses one has to take into account the natural processes occurring in the bone. In most cases this models consider that the bone is an isotropic even though the reality shows otherwise. This approximation is imposed due to the fact that there isn't a database that contains the mechanical properties of the bone according to the model topography. [[9]]

Many physical or computer models of the scapulohumeral joint have been developed to improve understanding of its function. Some were developed to understand and analyze muscle action developed during certain movements of the upper limb .Others, based on the concept of deformable bodies, were proposed and used to calculate the distribution of bone stresses [[3]].

There were made many studies in order to model the prosthesis integration into the bone. Bone implants are affected by some mechanical, chemical and thermal factors. The problem in bone implants is to find a material that is biocompatible and to assure the best possible bio integration. There were made studies of the mechanical stresses that induce implant loosening or failure in the humerus using the finite element technique. Goel et al [[4]] made a study using a specially developed casting and sectioning technique, the three-dimensional finite element meshes of an intact humerus and a humerus fitted with Coonrad prosthesis were obtained from a human cadaver elbow. In [[5]] was studied the design of a new innovative glenohumeral test rig which will be used to develop and test the prosthesis devices of the future. There were made tests in order to improve the prosthesis design, in [[6]] a finite element model was used to compare a reversed prosthesis with an anatomical implant. Another finite element stress analyses were performed on the proximal humerus before and after the simulated implantation of stemmed, metallic prosthetic components with porous sintered surfaces for direct bony attachment [[7]]. There were also studied some aspects with respect to bone in growth, fracture healing and intra-osseous wound healing for a model of bone in growth into a prosthesis [[8]]

The objectives of this study were to quantify some physical properties of the shoulder joint. There were made tests on healthy shoulder and prosthetic glenohumeral joint. Using finite element modeling there was developed a 3D model of the shoulder and humerus-prosthesis assembly. There were simulated some movements of the shoulder that can give information about the prosthesis behavior. The motivations were to assist in prosthesis development.

II. FINITE ELEMENT MODEL

There were made experiments concerning the forces effect on the normal glenohumeral joint, and the case when there is prosthesis.

It is well known that the bone is not an isotropic material, considering this the development of a model is not an easy task. We can obtain a handy model of the humerus by 3D scan and digital reconstruction. By using the finite element modeling approach one can analyze the load, strain and stress appeared into the bone when external forces are applied. In Fig. 1, one can see the steps in achieving the finite element model of the humerus.

Fig. 1 a) Humerus b) Resulting mesh c) 3D reconstructed model

Considering that the role of this study is to analyze the mechanical behavior of the glenohumeral-prosthesis assembly, there was used o prosthesis developed by Solar [[10]]. The development of humerus prosthesis implies some constrains for its shape and the composing material. In Fig. 2, is the finite element model of the prosthesis.

Monitoring and Control System of General Services in a Hydroelectric Power Plant Using The GSM Network

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***Abstract*- "Clean" energy production is a field of great interest and is a modern and necessary topic of research. Scientists are developing hardware and software components to maximize the control and supervision rate of their systems placed in remote locations. Water dams are complicated structures and special surveillance equipments are needed to monitor them. Inside the hydroelectric plant there are several services that come in help of energy production. Most hydroelectric plants are multipurpose facilities since it is necessary to meet certain obligations other than power generation(maximum elevation, danger of flooding, minimum plant discharge, irrigation and navigational commitments)[1]. This paper presents an application developed for the monitoring and control of and automated system. For example I will use the residual water system and the infiltration water system in a hydroelectric power plant. There are references to the hardware, software, parameters and communications used in the development of this supervisory system. The system developed in this application collects data from transducers and analyzes them; also it takes action depending on the situation described in the software specifications. The transfer of the data from the process to the supervisory computer or device is done using the GSM network available in the area. For a better analysis of the system, the data is being kept in databases from where reports can be generated. The advantages of the presented application is that it focuses only on these services, the windows are very easy to learn and use, and the surveillance of the installation is increased due to the characteristics of the application windows, and the communication used for long distance data transfer.**

I. Introduction

Nowadays electricity is a resource used in all existing activities in the world. Today a large amount of electricity is produced using water. Having the system permanent under observation and control is very important. A small but important part of a power plant is the cooling and waste water system. The cooling water system provides water for cooling the aggregates and keeping the system at a safe working temperature. The waste water system evacuates the water from infiltrations, residual water, and prevents the system from flooding. If there is a failure in the plant due to the general services, the system presented in the following paper must take action and analyze the event and further take decision to repair the damage or/and solve the failure. GSM (Global System for Mobile communications) is the most popular standard for mobile phones in the world. GSM is used by over 3 billion people across more than 212 countries and territories. Computers can connect to the GSM network via a special modem that has integrated a GSM card. Ensuring the correct operation and taking the most appropriate corrective actions to preserve the functionality of these structures is essential for: (1) avoiding the flood of the plant, (2) keeping the generators at a normal functioning temperature and avoiding the temperature increase that could cause to major damage in the system [2]. The advantages of using the GSM-SMS solution are: (1) simple power solutions; (2) GSM system covers a wide range of areas; (3) Using GSM–SMS service, if the host server is out of service, the user data can be kept in the GSM service center for 24 h (ETSI, 1996) and the data can be received once the server is repaired. (4) Group broadcast functions can be enabled easily to send real-time alerts to workers for immediate attention when any monitoring device is not functioning properly.[3]

II. Description of General Services in a Hydroelectric Plant

A. Waste Watter Evacuation System

Waste water evacuation sistem has the role to evacuate the waste water collected in the waste water tank and prevent the plant from flooding. Waste water installation in composed from:

- Waste water tank situated in the plant at 511,00 maS (meters above sea)
- Underwater level transducer, range 0–10m
- Pumps foe evacuating the water from the plant

The system should provide automatic start / stop signals to the pumps at preset levels and indicate the continuous state of the installation and in case of failure to provide the safe shut down of the installation.

Preset levels for waste water are:

- 560.40 maS*– max. level – crash, overload tank, plant shut down
- 513.00 maS*– pumps stop signal
- 514.00 maS*– working pump start level
- 514.20 maS*– back-up pump starting level
- 514.40 maS* – alarm pump starting level
- 514.90 maS*– crash pump starting level total shut down of the plant
- 511.30 maS* – reference level– transducer placement *maS=meters above sea level

B. Cooling Water System

Cooling water system provides cooling for the central aggregates by providing cooling water to the hydro-aggregates. Water cooling equipment consists of:

- Water tank situated in the plant at 556 maS (meters above sea), volume 900m^3
- Level transducer, range 0 – 10 m
- Pumps for lifting water in the tank

Water in the tank must be maintained between certain limits; this is achieved by starting / stopping the pumps by the system automatically. Measuring level in tank is made continuously through the level transducer witch sends 4 – 20 mA signal to the comand sistem. The system should provide automatic start / stop signals to the pumps at preset levels and indicate the continuous state of the installation

Genetic Distributed Fuzzy Logic for Urban Vehicle Traffic Control

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***Abstract*—The urban vehicle traffic is one of the most hazardous systems. A solution to the vehicle traffic control problem using coordinated fuzzy logic controllers is presented. Genetic algorithms are used to tune the main parameters of the distributed fuzzy logic controllers such that the congestions are avoided. The temporal differences between intersection cycles lead to variable and different times of data used to take the decisions. The controllers have to take into account the temporal differences of the information provided by neighbors, those collected from detectors and the operator's priorities assigned to the lanes, to optimize global system behavior. A new hierarchical structure of the fuzzy logic rule set is used to implement the path global priorities on the local controllers and to diminish the rule set dimension. The controllers transform the global priorities into local priorities that are implemented through structuring according to the local fuzzy rule sets.**

Urban vehicle traffic control; distributed control; genetic algorithms; fuzzy logic control

I. INTRODUCTION

Street and road networks have to solve many of the current (people or freight) transportation problems raised by modern society. Traffic system improvements involve higher route flexibility, higher speeds and densities of traffic participants. The UVT system contains advance scheduled buses or trams (with fixed routes and timetables) and independent vehicles (trucks, cars etc.) that have to be dynamically accepted without losing the safety and disturbing the other traffic participants' schedules. To avoid the buses delays, their rates are low and their speeds were much under their capacities so that the timetable could be fulfilled. Such systems are inflexible and the road network resources are underused. Sometimes the bus delays are removed by creating special lanes used only by buses. These lanes are underused too. UVT control systems are implemented through networked embedded real-time applications with long and short reaction time magnitudes. Many people expect or desire that buses and even the individual cars fulfill timing requirements to arrive at destinations.

In many towns, the increase in the lane numbers and the construction of crossings at different levels is not feasible, so the control system has to solve the critical section utilizations. It is economically unfeasible to build and expand the roads to accommodate the increase of traffic rates without traffic management improvement.

The traffic control system must fulfill some real-time constraints. The traffic participants can move from one place to another under time constraints only if the traffic systems do not exceed some worst case loading constraints. The Urban Vehicle Traffic (UVT) control system has the task to maintain at least specified transfer rates for all input lanes of intersections. This goal can be achieved by correct design of the maximum vehicle traffic flows and right control decisions.

The UVT is one of the most hazardous systems, but everyone expects it to behave in a deterministic manner. A solution to the problem is based on the increase the traffic volume using more lanes. The design of the real-time traffic flows has to guarantee some specified rates. The flow splits at each intersection are considered specified as well as the minimum accepted input demanded flows. If the drivers try to exceed the maximum acceptable input rates, the control system must be able to delay their entrance. But inside the traffic network the drivers can choose different routes than those that have been predicted and so unbalance the traffic system. Furthermore, some vehicles can enter the traffic network from parking places or can leave earlier the traffic network and disturb the expected flows. If some flows need to exceed the current capacities, the lower priorities phases are those that are not able to fulfill the demands.

The current paper describes a solution to the vehicle traffic control problems using Fuzzy Logic Controllers (FLCs) assigned to each intersection and Genetic Algorithms (GAs) to tune the main parameters. The FLCs have to cooperate to improve the control system performances. They coordinate each other using messages. The temporal differences between intersections lead to variable and different times of data used to make the decisions. The controllers have to take into account the temporal differences of the information provided by neighbors, those estimated using data from detectors and operator's priorities assigned to the lanes, to optimize global system behavior. The parameters of the FLCs have to be calculated such that to avoid the appearance of traffic congestions and taking into account the paths global priorities.

II. STATE OF THE ART

The main problems of UVT systems are:

- Design a traffic network that fulfills some specified requirements concerning system or path throughput.
- Find a route in a given traffic net (from starting point to destination) that fulfills some requirements such as the best route that minimizes a given evaluation function or a route that avoids some specified areas (such as vehicle high density areas) and includes given points.
- Control a traffic system using the current, previous or predicted values and concerning the system throughput (including congestion avoidance), the path throughputs, the waiting times or the avoidance of faults or diminishing the congestions.
- Guide a traffic participant from a starting point to reach a destination such that some specified requirements are met and reach the destination before a specified moment in time, avoid congestion areas or diminish the traffic system fault effects.

The problems involved by UVT can be divided into structure problems and control problems. Some of the

Digital Systems with Self-Healing by Hardware Reconfiguration

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***Abstract*-This paper proposes a new approach for distributed system testing and repairing using reconfigurable systems. Our goal is the design of a networked reconfigurable environment which does not need human intervention for maintenance and testing. The discussed architecture presents a high level of flexibility.**

I. Introduction

In a society where the speed of information affects not only financial status but lives, the increasing interest in the scientific field toward reusable software and hardware seems logical. Capabilities such as mobility, self-organizing, self-healing, self-learning are used for a large number of solutions, in networking, license protection, testing, speech-recognition.

Self-healing refers to the possibility of the hardware or software solutions to be able to assure the system's correct functioning over failures by solving error issues. Regarding FPGAs, one aspect of such capability is the change in hardware implementation. This modification is a must when one dispensable part of the system is reused to further assure the critic functionalities when a component breaks. In industry, distributed controlled processes are implemented in order to obtained automation, reduced maintenance periods, real-time and independent parameter monitoring. In a failure situation, established alarms improve the reaction time during emergency situations. An improvement could be the system's ability to indentify reusable hardware and to move the tasks completion from the error point to a disposable one.

II. Reconfigurable System

This article focuses on the use of reconfigurable systems and tries to find a viable and cost efficient solution for the implementation of such systems. Hardware self-maintenance is a relatively new method and implies that the defective device or the device that is about to be out of order "takes notice" and recovers from this state. Usually, this can be realized through a surplus or a duplication of the present functions, in hardware, and through the use of local software or the use of decision electronics for testing and/or deactivating the defective part and reallocating the tasks to the spare part of the device.

Over the past years, several approaches and techniques for increasing systems' reliability were used. One of the most commonly used techniques is the use of triple-modular redundancy, this being a scheme that brings many advantages [1]. It permits the system's functioning while a faulty module is replaced and detects an error in every single one of the three modules. The disadvantages are that the system fails if more than one module is faulty, the increased hardware overhead and the high importance of the voter reliability. The triple-modular redundancy is a particular case of N-modular redundancy.

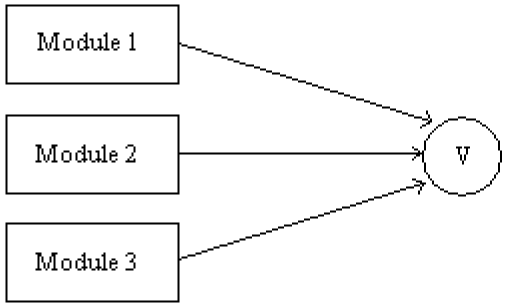

Figure 1. Triple-Modular Redundancy

The use of a concurrent error detecting system is also a viable solution, this scheme being used in the architecture of fault-tolerant ALUs of computers [2]. The concurrent error detection module signals if an error is detected, so that the unit in charge of correcting the faults can take the requested action. In the majority of the systems where intermittent failures take place, a retry action is the sufficient correcting action for system recovery [3]. Also, built-in self-test schemes for diagnosis in multiple or single FPGA systems was proposed [4].

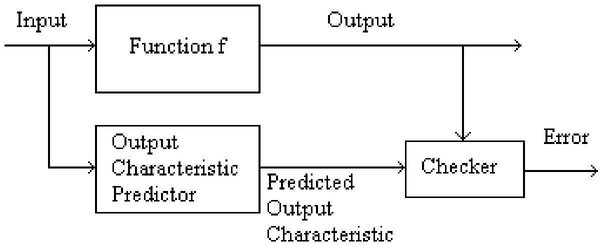

Figure 2. General Architecture of a Concurrent Error Detection Scheme

There are many solutions for the decision logic and the replacement of the tasks. For example, if the functionality is implemented in an FPGA, in case of a fault, an unused part of the matrix can be reconfigured, taking over the functionality of the defective part [5,6]. For better results, one can use a method for detecting the faulty parts which is similar to the human immune system: the cells found to be defective are replaced with spare ones that take over their functions. Another possibility is the application of predefined entrances, to which the outputs are known, to the circuit that has to be checked. If an input sequence generates another output than the one expected, this means that the circuit under test is faulty and corrective action needs to take place [7].

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Electronic Health Records in Romania Based on OpenEHR and GCOF

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"Abstract- **This paper addresses the problem of saving medical data in electronic format securely and efficiently. It discusses the case of the General Clinical Observation File (GCOF), which is used to record a hospitalization episode in the Romanian medical units. The complex clinical concepts that it includes are modeled with the means of openEHR archetypes and templates. The paper describes the features of archetypes, the steps to create templates with their help and it presents the advantages of using them in medical information systems.***"*

I. INTRODUCTION

Medical services from Romania are in a continuous development process to increase their quality. This process cannot occur without high attention on computerizing medical records. Nowadays, medical data of patients are collected and reported with a specific format of system DRG(Diagnosis Related Group) which is a unit of classifying patients by diagnosis, average length of hospital stay, and therapy received; the result is used to determine how much money health care providers will be given to cover future procedures and services. An important problem of DRG system format is that medical data stored cannot be reused properly by medical units or medical data collected are insufficient.

EHR(Electronic Health Record) structure is not completed but there are some open source specifications and references of future EHR systems. In Romania a project based on OpenEHR and EN13606 is being developed at the Technical University Of Cluj-Napoca, Romania. The project wants to create a simple functional prototype capable of storing medical data, from GCOF(General Clinical Observation File), using archetypes and templates.

General Clinical Observation File (GCOF) is the medical file created for each patient in continuous hospitalization in the Romanian healthcare. A GCOF is created for each continuous hospitalization episode. The episode is defined as the duration of a patient's hospitalization without interruption, from admission until discharge. The file contains two types of information regarding the patient: demographic and medical. The demographic information refers to patient identification and medical data includes all the clinical information regarding the patient's health during the hospitalization.

The OpenEHR Foundation is an independent, nonprofit community, founded by University College London,UK, and Ocean Informatics Pty Ltd, Australia. It is dedicated to development of an open interoperable electronic healthcare records.It does this by searching clinical requirements, creating specifications and implementations. One main activity of the OpenEHR Foundations is the development of evidence-based clinical information, known as archetypes.

The EN 13606 aims to define a rigorous and stable information architecture for communicating part or all of the Electronic Health Record (EHR) of a single subject of care (patient).

Base on OpenEHR and EN 13606 this paper describes the steps how the GCOF, can be stored in an electronic format EHR. It describes how archetypes are built, combined to create the final result which is an electronic data of GCOF, that can be easy readable, re-used, or transferred to other hospitals.

III. WHAT ARE ARCHETYPES?

In OpenEHR, an archetype is the model (or pattern) for the capture of clinical information – a machine readable specification of how to store patient data using the openEHR Reference Model.

Archetypes are a keystone in OpenEHR architecture. Each archetype describes a complete clinical knowledge concept as 'diagnosis' or 'test result'. By design, they provide structure and specify content which means that archetype can be both clinically meaningful and interpretable by EHR systems. Archetype data will have the same meaning no matter what context it is used within the EHR and, similarly, no matter which EHR system it is used or what language is used.

Archetypes are formal content specifications, expressed in terms of constraints on a reference model [5]. Any reference model can be used. In health, concepts that can be modeled using archetypes include things like: blood pressure, microbiology results, diagnosis. Archetypes are combined together by templates, and used at runtime to create data, enable smart querying and to support legacy data transformation.

Archetypes are standalone entities and can be:

- Created – build a new archetype to meet clinical needs.
- Shared- existing archetypes are stored in a web-based archetype repository, currently located on the Ocean Information web site.
- Reused – clinicians or software developers are able to re-use existing archetypes from the archetype repository in various EHR systems.
- Specialized – an existing archetype can be refined in order to meet special or specific clinical requirement. e.g the "weight" arc-

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Power Quality Measurements with a Real-Time System

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***Abstract*-The paper present the new technology for measuring and monitoring the power quality using Programmable Automation Controllers (PACs) with real-time performance. A test platform was implemented using an industrial embedded system developed by National Instruments (NI CompactRIO Real-Time Controller) and a board with two specials hall sensors. A set of experiments can be designated to be implemented by students during their laboratories of Embedded Systems using this platform. After attending this application the students will gain skills in equipment connection and knowledge in implementing LabVIEW programs which respect real time constrains and measure power parameters. The main advantage of this implementation is the possibility to modify and changed all computing parameters in short time, which is important for a didactical stand.**

Keywords-Power Quality, CompactRIO, Real Time System, Virtual Instrumentation, Hall Sensors.

I. Introduction

Power quality has become an important issue and is receiving increasing attention by utility, facility, and consulting engineers. Present equipment and devices used in commercial and industrial facilities, such as digital computers, power electronic devices, and automated equipment, are sensitive to many types of power disturbances. Power disturbances arising within customer facilities have increased significantly due to the increasing use of energy efficient equipment such as switch-mode power supplies, inverters for variable speed drives, and more. The monitoring and data collection of power disturbances for power quality study has to be conducted at the users' premises [1].

Action should be taken as soon as the first signs of poor quality appear such as overheated transformers and cables, excessive current in neutral conductors without any explicable cause, tripped protective devices, flickering lights, computer failures and data network problems, interference in telephone lines or inexplicably increased energy costs. Causes can be pinpointed and the elimination of faults can be implemented through the use of suitable measuring equipment [2].

The complete industrial solutions named ENA400, 450 or 571 are implemented by ELCOM, using Compact RIO, LabVIEW and custom modules for measurement. The power quality analyzer implemented by ELCOM includes a set of instruments, capable of performing all necessary electric power measurements and is able to run in parallel on a small size hardware system with a real-time operating system. They also had to take in consideration the expandability of the system to encompass the latest IEC and EN standards when design measurement and data processing algorithms are considered [3].

Other producer like ABB or Gossen Metrawatt offer devices for monitoring and analysis system of power rails.

An embedded system is a special computer system designed to perform one or a few dedicated functions, often with real-time computing constraints. In contrast, a general computer, such as a PC, can do many different tasks depending on programming.

Applications in LabVIEW Real Time (LabVIEW RT) are developed under a Windows host, and can be transferred on an embedded target, one with no keyboard, mouse or display and runs on a Real Time Operating System (RTOS) such as VxWorks or PharLap.

A real time system can be classified as hard real time and soft real time, partly depending on the consequences of a missing time deadline. A soft real-time system allows the absence of some deadlines with only a slight degradation in performance but without a complete failure. On the other hand, a hard-real time system will fail if some time deadlines are missing [4].

A RTOS is an Operating System (OS) that has been designed to run code in a predictable manner with minimal latency. This means it fulfills the requirements for hard real time. The CPU allocates a period of time for each application or process, regardless its priority. LabVIEW on a desktop computer is subject to the timing uncertainties caused by the desktop OS since we cannot be sure that the OS will not suspend the execution time-critical VI while it goes out to perform some routine maintenance. This kind of soft real time cannot be used to generate or respond to time-critical tasks where the latency needs to be higher than a few milliseconds [4].

The purpose of this paper is to describe a setup for experiments designated to be used by students during their laboratories of Embedded Systems. They will test and evaluate the performance of Programmable Automation Controllers (PACs) to acquire the signals to measure the voltage, current and calculate few parameters to evaluate the power quality, include FFT analyzer.

In this moment not all measurement functions necessary for power quality equipment like: vector analyzer, power flow monitor, flickermeter, RMS monitor and alarms are implemented, but are possible in future development applications [5].

II. Voltage and Current Measurement

All needed measurements are taken in real time, on line using Compact RIO and LabVIEW technology.

The general schematic with connections, implemented to measure the voltage and current consumption is shown in Figure 1. Both voltage and current transducers have 0…20 mA output signals. To interface with the NI cRIO 9215 the conversion from current to voltage was necessary using 200 ohms load resistors. The board includes a ±15 V power supply. All design rules were respected to have a better measurement circuit.

The setup implemented for voltage and current measurement contains an electronically board with two hall sensors developed in laboratory.

Monitoring Resources for RO-14-ITIM Grid site

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The idea of monitoring is well known as an important domain in networking and Grid computing. The document presents the monitoring, software and hardware solution, at RO-14-ITIM Grid site locate at the National Institute for Research and Development of Isotopic and Molecular Technologies (INCDTIM) in Cluj-Napoca, a key data center in the Nord-West part of Romania The development of the Grid site was made for offering facilities to the ATLAS Grid project and other inland and world wide research, reason of which a good monitoring is essential in his functionality.

Grid Computing, monitoring, solution, (key words)

I. INTRODUCTION

The GRID Infrastructure considered as a new IT technology arose from the acute necessity of the scientific domain to process and store a growing number of data resulted from performed experiments and researches. There are well known activities in the field of physics and chemistry on study of elementary particles, finding or creating new materials, the study of the universe formation, Earth physics, astronomy, medicine, biology aso., in fact we may say there are areas of high professional activities that could not work without Grid. In solving of these problems are involved international projects like ALICE[1], ATLAS[2], LCG[3], CMS[4] or virtual organizations like Enabling Grids for E-science (EGEE) [5] which are using Grid network formed over 20000 processing units and a lot of petabytes storage capacity.

The existence of a processing power and of an ample data storage space represents a current and also future necessity for any research-development entity. Every institute, research facility, university, developing center uses processing power and storage capacity for their developments. The natural consequence is that all this equipment has to be put into "one place". This so called "place" is a data center. For an easy understanding the data centers are divided with the help of the TIA 942 [6] standard in 4 types, Tier 1, 2, 3 and 4. Each of them has some key elements including telecom, architecture, electric, monitoring, and operations [7]. These key elements are the most important path for building one of them. Once such a facility is online the most important think is providing a good feedback of what happens inside. Easy to say but hard to manage. Even if data centers regularly reap respect from technical employees, people see them as sounding boards for all their computer problems. Asking the staff member of a data center, you'll discover this distinct lack of respect is frightfully common. [8] What researchers real do in a data center could be compacted into many domains: High computing performance (HPC) [9], Grid Computing [10], Cloud Computing [11], networking, Clustering and parallel processing etc. All this work, as said before, has to be monitored. Monitoring a data center has two directions - software and hardware. Software monitoring is used in determining the stability of a cluster, a Cloud or Grid Computing site, a network instrument or anything else that has something to do with processing or storing data. Hardware monitoring is used in determining the environmental condition of a data center. In each case you have to monitor some or all sensors that are part of the subject to be monitored.

The outcome of monitoring is an easy life for network administrator and a full functional facility for research activity in any filed. So being on holiday, no one will walk into the data center and notice the console screen that indicates an imminent failure [12]. That's why monitoring solution have to be full functional and backup solutions for them have to be able to stand on guard 24/7/365 days.

If any problems occur there would be wise to have a system that could report all of them in one place through, e-mail, Short Message Service, audio or visual alarm. [13]

II. MONITORING IN GRID COMPUTING

Monitoring in distributed environment establishes status of the monitoring environment, show the problems and disclose information about Components and Grid Services. The broadest distributed environment is the Grid computing network.

Monitoring Grid site, used for monitoring closely the processes in progress, means determining the current status of Grid components, the location of any problems arising and publication information. Monitoring is most effective if applied to all components like applications, software, hardware or network itself.

With the help of monitoring we are able to verify the status of components at a time - whether its the services, applications, middleware, operating systems, processors, hard-ROMs, memory, network interfaces, Routers, switches, etc. - to solve problems, to optimizes task execution and done troubleshooting. [14]

A. *Architecture*

A complete end-to-end monitoring system has several components, as shown in Figure 1. It consists of three layers each with its own monitoring duties.

The first level is the Instrumentation level, which is responsible for gathering information about a Grid site. Data gathered at this level are number of processing cores, storage capacity, status of Grid services, middleware, operating system, nodes, routers, switches or end-to-end paths. Another important monitoring duty is the synchronization of nodes in Grid computing environment and the overhead determination of Grid site.