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Table of Content

Automatic Character Recognition in Porcelain Ware

David Álvarez[1)], Santiago Garrido[1)], Luis Moreno[1)], Adriana Birlutiu[2)], and Manuella Kadar[2)]
[1)] Department of Systems and Engineering, University Carlos III of Madrid, Leganés, Spain
{dasanche,sgarrido,moreno}@ing.uc3m.es
[2)] Department of Computer Science, University 1 of December 1918, Alba Julia, Romania
adriana.birlutiu@gmail.com, manuellakadar@yahoo.com

Summary: This paper presents an automatic serial number recognition based on computed vision techniques. The approach uses standard algoritmhs for digit segmentation and a deep learning approach for the recognition. The system is developed within a project in collaboration with one of the biggest porcelain ware producer in Europe.

Keywords: Deep Learning, Computer Vision, Digit Recognition.

Motivation

While manufacturing any type of porcelain ware, in the case of a detection of a defect, the error is usually propagated to all the series in a production. The root of the problem can be found in many different parts of the process: the raw materials [1] (clay, feldspar, or silica) might be contaminated or any of the processing steps [2] (crushing, mixing, forming the shape, glazing, firing, painting) might contain a malfunctioning machine which provokes the defect. In order to identify the parts of the process, characters (numbers and letters) are engraved in the porcelain ware. This work attemps to detect and recognise these symbols in order to help in the quality control process, aiming to facilitate defect measurements and rectifications in the porcelain ware manufature.

As far as the authors know, there is not bibliographic research literature available of computer vision solutions for plate inspection, other than extracting texture features for detecting defects on ceramics [3], [4]. However, it is an emerging technology in the global ceramic industry [6], and a standardization on the determination of ceramics quality has been established by the International Standard Organization (ISO) in the SNI ISO 10545-2:2010 document.

The work presented in this paper is tested using round plates in which the symbols are engraved in the backside. The images of the plates are taken in a real manufacturing line, without controlling light conditions. An example of an original image can be seen in the left side of Fig. 1. The engraved symbols are organized in 3 groups of letters which have 4, 3, and 1 symbols each. In order to segment the individual symbols, the geometrical properties of the plates are searched in the image in a sequential manner. First, 8-connected components of contiguous regions of a binarized version of the image are studied, measuring their area and perimeter. This allows us to select the largest area (corresponding to the plate) and find the inner circle using Equation 1. In the central image of Figure 1, the inner circle is drawn in red.

$$circularity = perimeter / 4 * \pi * area \quad (1)$$

The inner circle area is again binarized, the resulting edges are enlarged and, again, 8-connected components of contiguous regions are studied to detect the 3 groups of letters, as shown in upper part of the right side of Figure 1. Then, in each group, the projection of the letters into the X-axis is studied to separate the individual letters, as shown in lower part of the right side of Figure 1.

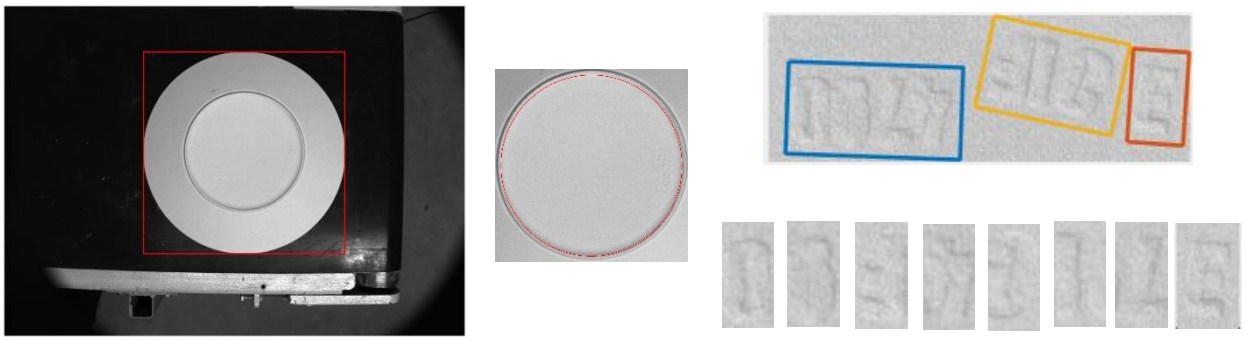
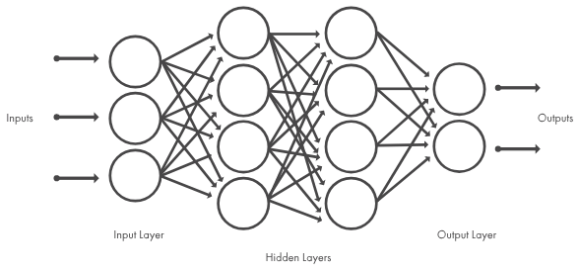


Figure 1: Segmentation process of round plates.

Results

All the individual collected characters are manually sorted and labeled into their respective category, resulting in 18 different characters. With the resulting database, a Convolultional Neural Network (its characteristics are shown in Figure 2) is trained using the 75% of the examples, while the rest is used for testing. This way, we are able to correctly classify 98% of the database.



ImageInputLayer = [53 26 1]
convolution2dLayer = ([7,5] , 26)
reluLayer
maxPooling2dLayer(2,'Stride',2)
fullyConnectedLayer(18)
softmaxLayer

Figure 2: Example of two figures simply placed in an invisible two-column table.

We think the results prove that the chosen technique is appropriate for achieving good recognition results and, therefore, plan to extend the work to more types of porcelain ware and more symbols to be distinguish.

***Acknowledgement**: This study is supported by the Executive Unit for Financing Higher Education, Research and Innovation, through Project 50BG/2016, SIVAP Intelligent System based on Machine Learning and Computer Vision for the Optimization of the Manufacturing Process of Porcelain.*

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Analysis of Glaze Color in Porcelain Industry

Ovidiu Bagdasar[1)], Adriana Birlutiu[2)], Minsi Chen[3)], Lucian Popa[2)]
[1)] Department of Electronics, Computing and Mathematics, University of Derby, Derby, UK
[2)] Department of Exact Science and Engineering, 1 Decembrie 1918 University of Alba Iulia, Alba Iulia, Romania
[3)] Department of Informatics University of Huddersfield, Huddersfield, UK

Summary: In this work we analyze the glaze color in porcelain ware. This work presents the key aspects of the ceramic color reproduction and calibration on a production line, we provide an updated version of the experimental results given in [1], and we carry out some basic data analysis.

Keywords: color design, pigment, porcelain.

Motivation

The standard method to develop coloured glazes for porcelain ware, which is used in many companies is based on intuitive approaches which come from the experience and knowledge of lab technicians about the behaviour of pigments and the composition and type of glaze (opaque or transparent). The difference between the required colour and the developed colour is measured by means of a colorimeter. The entire procedure to obtain the required color involves a considerable number of experiments which are costly in terms of time and resources required.

This study aims to automatize the reproduction of a desired color from pigments (which is time-intensive), and the correction of colors on the production line (which is costly). We use a case study from industrial partner which is an important industrial player in the ceramics industry in Romania.

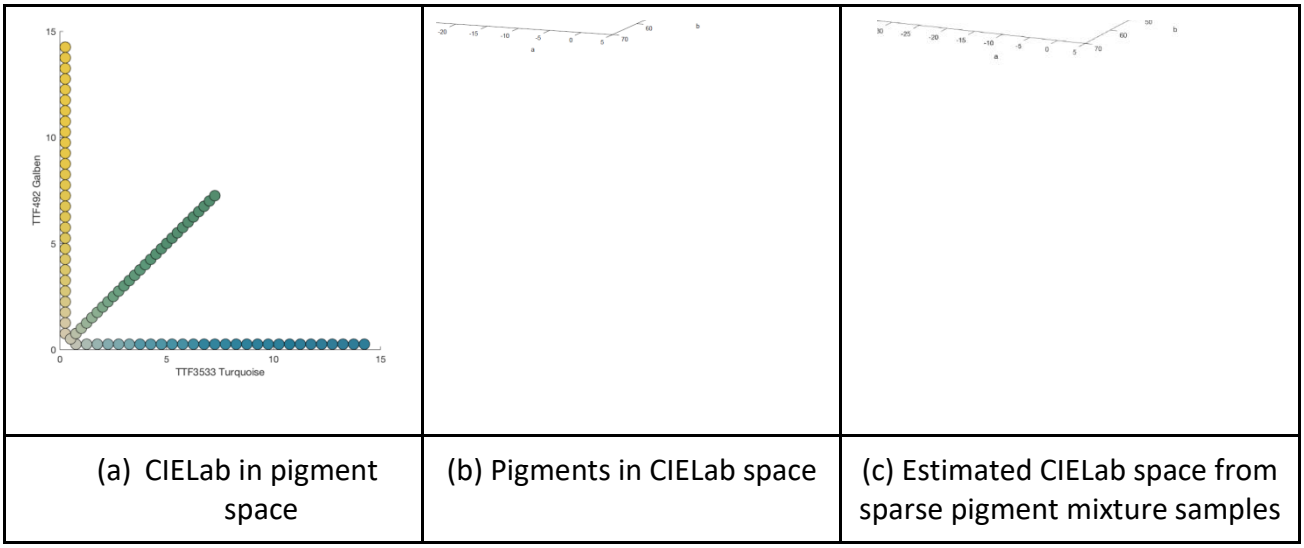
Modelling

In [2] it is proposed a new approach to develop coloured glazes produced for tile applications using Taguchi's method. The CIE (Commission Internationale de l'Eclairage) Lab colour space characterises a human perceivable colour by: Lightness (L), Green-Red (a), Blue-Yellow measure (b). The colour difference in the CIE-Lab space can be calculated by various standards, (e.g., CIE 1976 – Euclidean distance) [3].

Results

The data that we used were collected at the company's site. Two pigments, TTF492 (Yellow) and TTF3533(Turquoise), were used to create samples of a varying hues of yellow, green and blue respectively. In this work, we analyzed the collected experimental data, with the goal of building models that are able to accurately predict the pigment combination giving a certain L, a, b value.

In the pure colour experiment, two types of pigment, i.e. TTF492 and TTF3553, were used to create a number of colour samples corresponding to yellow, turquoise and green. Each reproduced colour was measured in CIELab space along with its corresponding amount of pigments applied. These resulted in a sparse sample set as illustrated in (a) and (b) from Figure 1. To approximate the reproducible sub CIELab space by this two pigments, we used an interpolation scheme based on the thin plate spline. (c) shows the estimated colours reproducible by any arbitrary mixture of these two pigments.



(a) CIELab in pigment space	(b) Pigments in CIELab space	(c) Estimated CIELab space from sparse pigment mixture samples

Figure 1. Two types of pigment, i.e. TTF492 and TTF3553, were used to create a number colour samples corresponding to yellow, turquoise and green. (a) and (b): sparse sample set. (c): the estimated colours reproducible by any arbitrary mixture of these two pigments.

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Effect of temperature on the parameters of a bulk heterojunction organic solar cell

Ana Bărar[1)], Marian Vlădescu [2)], and Paul Șchiopu [3)]
[1)] Electronic Technology and Reliability Department, Faculty of Electronics, Telecommunications and Information Technology, University "Politehnica" of Bucharest, Blvd. Iuliu Maniu 1-3, 061071, Bucharest, Romania, ana.barar@yahoo.ro
[2)] Electronic Technology and Reliability Department, Faculty of Electronics, Telecommunications and Information Technology, University "Politehnica" of Bucharest, Blvd. Iuliu Maniu 1-3, 061071, Bucharest, Romania, marian.vladescu@gmail.com
[3)] Electronic Technology and Reliability Department, Faculty of Electronics, Telecommunications and Information Technology, University "Politehnica" of Bucharest, Blvd. Iuliu Maniu 1-3, 061071, Bucharest, Romania, schiopu.paul@yahoo.com

Summary: This paper presents a study of the effect of temperature on the parameters of a novel polymer blend based organic solar cell, with a bulk heterojunction architecture. The variation of the short-circuit current density, the open-circuit voltage, fill-factor and power conversion efficiency with temperature will be analyzed. The electrical parameters of the equivalent electric circuit considered for modelling the solar cell in question will also be studied regarding their variation with temperature.

Keywords: organic semiconductor, organic solar cell, temperature, mobility

Motivation

Organic semiconductors are of increasing interest for the solar energy industry, due to a set of crucial advantages that they have compared to their inorganic counterparts, such as low fabrication costs, due to their unsophisticated fabrication technology [1, 2], and mechanical flexibility, which renders them suitable for a wide range of applications [2, 3].

However, organic photovoltaics present one major drawback, which is their low power conversion efficiency, compared to their inorganic alternative [3]. This low efficiency is a consequence of the high degree of structural disorder characteristic to organic semiconductors [4, 5]. Because of their lack of structural order, organic semiconductors have low charge carrier mobility, an aspect which also affects device performance [6, 7, 8].

In organic semiconductors, mobility has been considered to vary with temperature following an Arrhenius-like law [9]. However, Bassler et al. has proposed in [10] a different relation which takes into consideration both the structural and the energetic disorder present in this class of materials.

Results

By taking into consideration the dependency between charge carrier mobility and temperature, the influence of the temperature over the parameters of an organic solar cell, which consists of a bulk heterojunction fabricated using a novel donor polymer and PCBM as an acceptor polymer is studied. A one diode electric circuit has been considered as an equivalent model for this device. The total current density equation used for this study is deducted from this particular model [11, 12, 13, 14]. The electric circuit in question is illustrated in Figure 1.

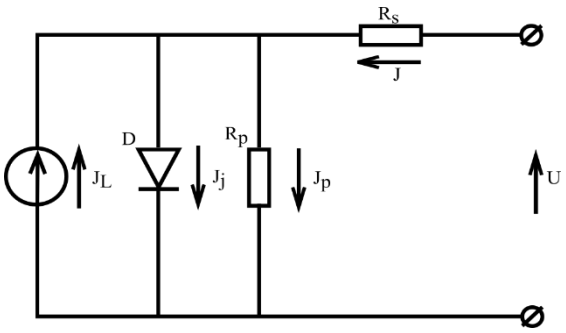

Figure 1: One-diode electric circuit considered as an equivalent model for an organic solar cell, where J_L is the illumination current density, D is a diode, R_p is the shunt resistance, R_s is the series resistance, and U is the applied voltage [11, 12, 13, 14]

Regarding their variation with temperature, the following characteristic parameters of the solar cell are analyzed: short-circuit current density, open-circuit voltage, fill-factor and power-conversion efficiency.

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Optoelectronic method for the determination of buprenorphine and its metabolite

Georgeta Marcela Bican [1)], Jeni Carla Colev [1)], Mihai Ionică [2)3)]
1) Doping Control Laboratory Bucharest Romania, bicanmih@gmail.com, carladone@yahoo.com
2) Department of Electronic Technology and Reliability,
Faculty of Electronics, Telecommunications and Information Technology,
University "Politehnica" of Bucharest, mihaiionica56@gmail.com
3) Military-Medical Scientific Research Centre Bucharest

Summary
Buprenorphine is an opioid used to treat opioid addiction, acute pain and chronic pain [1]. It can be used under the tongue, by injection, as a skin patch, or as an implant. Treatment with this drug requires detection and monitoring of these substances [1,2].
In the doping control of athletes, buprenorphine is a forbidden substance Buprenorphine is included on the Prohibited List of World Antidoping Agency (WADA) at the Sections S7 Narcotics [3,4].
For the analysis of these compound, the technique of choice is the liquid-chromatography tandem mass spectrometry technique (LC-MS/MS).
Due to the metabolism of the substance the identification of the target analyte and its metabolite norbuprenorphine is necessary.
According to the WADA Technical Document TD2018MRPL, minimum required performance levels (MRPL) for narcotics is 50ng/mL with the indication for buprenorphine concentration to be detected of 5 ng/ml [3,5].
The current work presents the optimization of the LC-MS/MS detection parameters of buprenorphine and main metabolite norbuprenorphine.

Keywords: buprenorphine, norbuprenorphine, LC-MS/MS, humane urine

Motivation
Buprenorphine is a powerful mixed agonist-antagonist analgesic used for heroin addicts [2]. Figure 1 shows the chemical structure of buprenorphine. The substance is metabolized in human urine to norbuprenorphine and to norbuprenorphine.
Liquid chromatography coupled to tandem mass spectrometry with an electrospray ionization interface (LC-ESI-MS/MS) was used in our study to establish in positive ionization mode the MS parameters, precursor ion, product ions for both buprenorphine and buprenorphine main metabolite norbuprenorphine [6,7]. The method developed using LC-MS/MS can detect and quantify low levels of buprenorphine and buprenorphine metabolite (ng/mL) in urine, with direct applicability to clinical and doping purposes.

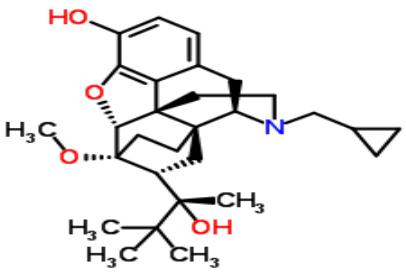

Figura 1. Chemical structure of buprenorphine

Results
For the detection of buprenorphine and buprenorphine metabolite norbuprenorphine, the urine sample is purified by liquid-liquid extraction (LLE) in ether at pH 9.
For analysis used a liquid chromatograph coupled with a triple quadrupole mass spectrometer, LC-MS/MS Agilent 1200SL/6410. A method has been developed to identify and confirm buprenorphine and buprenorphine metabolite.

The working parameters are as follows.
Column Zorbax 5µm SB-C18 (50 x 2.1mm diam., Size 5µm);
Mobile phase solvent A = 5mM ammonium formate, 1 ‰ formic acid in water,
solvent B = 5mM ammonium formate, 1 ‰ formic acid in 90% acetonitrile + 10% water;
Flow rate 0.3mL / min;
Gradient B 10% →40% in 2min, 40% →65% in 3min, 4min to 65%, 65% →10% in 10sec, 2min reechilibration to 10%; Injection volume 2µL;
Ionization mode ESI Positive;
Capilar 4000V;
Drying gas 8L/min N_2 at 3500C;
Nebulizer gas 40psi N_2;
Collision gas N_2 purity 5.0;
Analysis time 14min.
Figure 2 shows the extracted ion chromatogram of a blank urine sample spiked with compounds studied at a concentration of 5 ng/ml, multiple reaction monitoring transitions and retention times for anlysed substances.

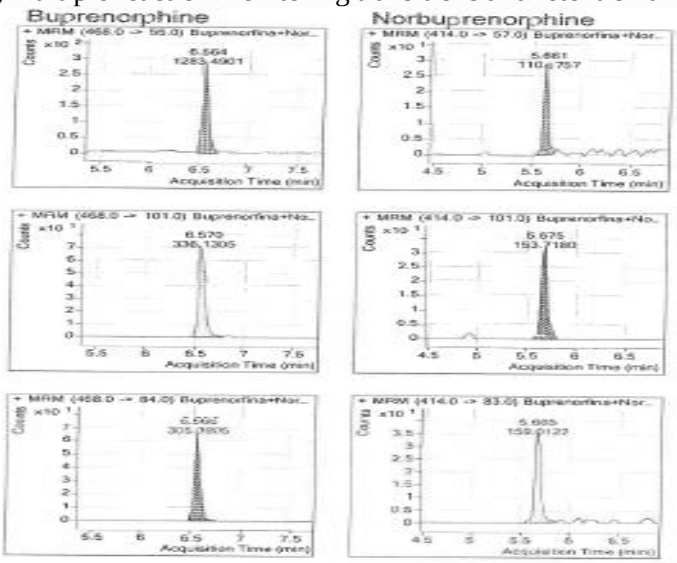

Figure 1. MRM transitions extracted from the LC-MS/MS chromatogram of
the buprenorphine and the buprenorphine metabolite (Sample preparation: LLE at pH=9 in TBME)

Acknowledgement
The authors wish to thank the Doping Control Laboratory of Bucharest for technical and scientific support, University "Politehnica" of Bucharest, Center for Military Medical Scientific Research of Bucharest for scientific support and Romanian Government for financial support.

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Semi-Automated Procedure for Waste Printed Circuits Boards Reduction

Adrian Burlacu[1)], Danut Irimia[2)], Ciprian Stamate [3)], and Ioan Doroftei [3)]
[1)] Dept. Automatic Control and Applied Informatics,
Technical University of Iasi, Iasi, Romania, aburlacu@ac.tuiasi.ro
[2)] Dept. of Energy Utilisation, Electrical Drives and Industrial Automation ,
Technical University of Iasi, Iasi, Romania, danut.irimia@gmail.com
[3)] Dept. of Mechanical Engineering, Mechatronics and Robotics,
Technical University of Iasi, Iasi, Romania, danut.irimia@gmail.com

Summary: This paper presents a semi-automated procedure for identification and disassembly of electronic and mechanical components in printed circuited boards. Its main objective is to increase the waste quality of no longer in use printed circuited boards. In order to solve capacitor extraction and screws removal a mechatronic flexible cell is designed. The cell includes a transportation system, a vision system and a manipulator robot with two custom made tools.

Keywords: artificial vision system, automated disassembly cell, waste PCB.

Motivation

The mass electronics sector is one of the most important sources of waste, both in terms of volume and materials content with dangerous effects on the environment [1,2]. PCBs are the most valuable component embedded into Electrical and Electronic Equipment (EEEs). The current amount of electronic systems is impressive while manual dismantling is a very common and non-efficient solution [3]. On average, waste PCB accounts almost from 3% to 5% of the overall weight of waste electrical and electronic equipment. At this time in Romania the implemented solutions for waste PCB reduction are in a research phase, with no existing technological procedures that can be replicated. The goal of the current research is to design a replicable semi-automated architecture for mechanical disassembly that will allow better management of waste printed circuit boards (WPCB) in the chemical decomposition stage.

The mechanical disassembly step is necessary in order to avoid unwanted problems [4]:

- risk of explosion when the extremely reactive inner of the Li batteries cams in contact with the leaching solution;
- risk of leaching solution contamination with extremely toxic polychloride-biphenyls presented in some cylindrical aluminum electrolytic capacitors;
- increased total time of leaching due to screws with high thickness;
- significant and unjustified consumption of leaching agent for the aluminum dissolution due to the small commercial value of aluminum and the difficulty of aluminum recovery from the resulting solution;

Results

The design of the first prototype aims at improving the WPCB reduction by using two separated phase: a mechanical one and a chemical one. The mechanical pre-treatment aims at removing parts of the following categories: batteries, aluminum sinks, capacitors, screws (figure 1).

The chemical phase is set to remove all exposed metallic parts simultaneous with the electrochemical lixiviants regeneration and the partial electrodeposition of the dissolved metals.

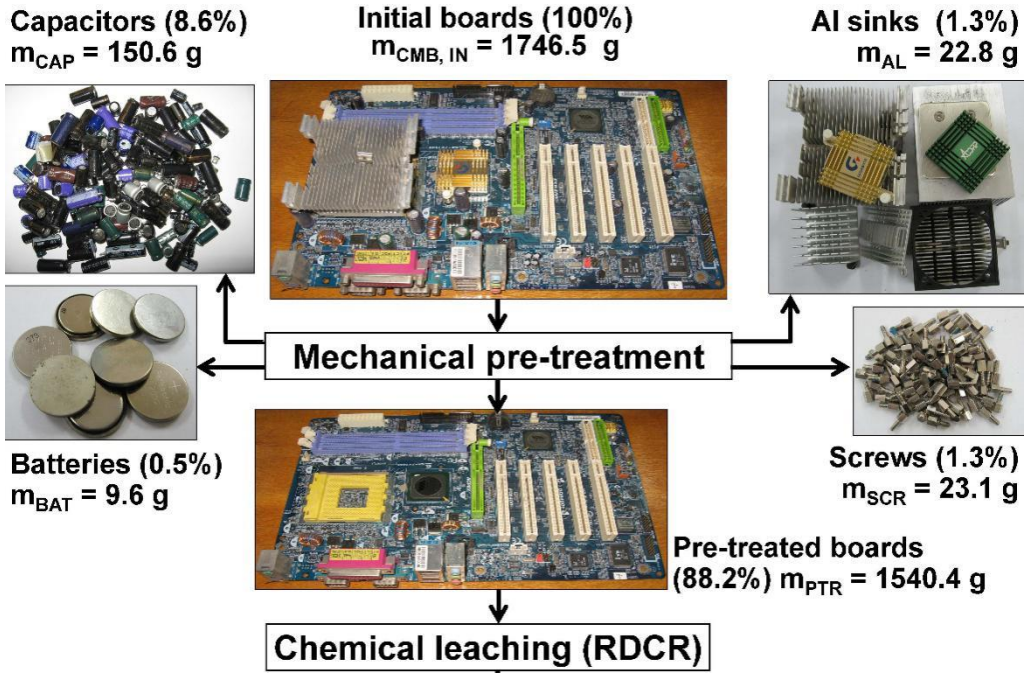

Figure 1: Flowchart of the semi-automated dismantling process [4].

The mechanical phase is completed using a semi-automated procedure. The procedure is structured in two parts. First, a worker will disassemble the PCB by removing the batteries and the aluminum sinks. Next, the worker will place the PCB on a custom built frame positioned on a conveyor belt. This frame will ensure that the PCB can be transported and further manipulated by a robotic arm.

The robotic arm will be guided by a computer vision system. This system will analyze the PCB and identify the capacitors and screws positions. Once their position is detected the robotic arm will pick one of the two custom tools to perform the removal of the desired parts. This sequence is completely automated and will considerably decrease the time of the whole procedure. The remaining WPCB will be transported to an area where chemical leaching will be used.

Acknowledgment

This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCDI-UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0562/TORA, within PNCDI III

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Decision balancing: processes implementation based on PIR sensor performances

Aurelian Costea[1)], Paul Şchiopu[2)]
[1)] Faculty of Electronics, Telecommunications and Information Technology, University Politehnica Bucharest Bucharest, Romania, aureliancostea@yahoo.com
[2)] Faculty of Electronics, Telecommunications and Information Technology, University Politehnica Bucharest Bucharest, Romania, schiopu.paul@yahoo.com

Summary: Technological evolution in the field of infrared sensors and the exponential growth of the complexity of the systems using them, makes decision balancing becomes increasingly important to implement solutions, to decide which devices a situation will be solved with. Components claim to have similar sets of functional parameters and reliability. It is incresingly dificult to have a well endorsed scientificaly detailed image to corectly, reliably and safely chose. Based on current development we present the highest ranked technologies in decision balancing.

Keywords: infrared detection, pir device, wavelength, beamsplitter detector, micro pyramids.

Motivation: Knowing and understanding the detailed needs of each of the situations, building step-by-step solutions and implementing them successfully in solving the situations at hand, keeping under control of all possible future evolutions of the system parameters, avoiding the system entering any unwanted or extreme situation, even predicted and documented one, known or not.

Results: To demonstrate the efficient selective detection, the developed 15 µm absorber was integrated with the commercial discrete pyroelectric sensor that was originally optimized for sensing IR radiation within the wavelength range of 2–20 µm, this kind of sensors having the typical voltage responsivity of 105 V/W at the noise equivalent power (NEP) around 1.0 × 10-9 W/Hz$^{1/2}$.

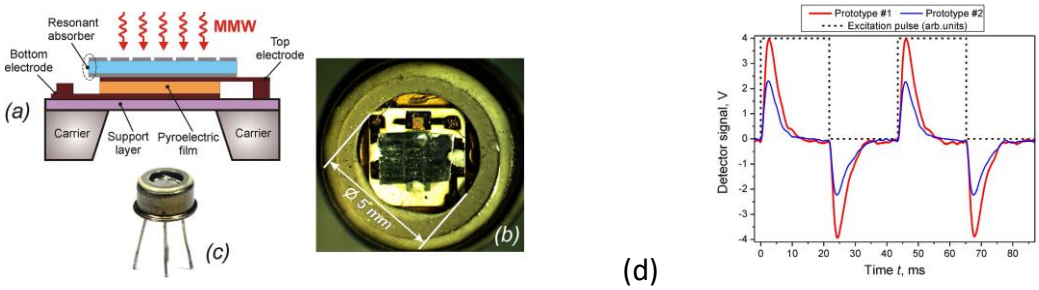
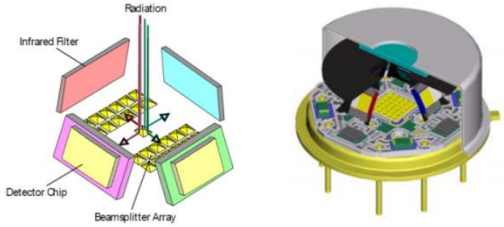


Figure 1: (a) Sketch of the pyroelectric sensor. (b) Photo of the sensor structure. (c) Appearance of the accomplished sensor. (d) Time response of the pyroelectric detectors with integrated resonant absorbers.

Beamsplitter Detectors – Even for the narrowest signal beams. The IR radiation entering through the aperture is divided by a beamsplitter in two or four parts (4 channel pictured). Each of the partial beams goes through an IR filter and finally hits a pyroelectric detector chip.



Detector Specification	Multi Color	Multi Color	Variable Color
Principal	Individual Windows	Beamsplitter	Tunable Fabry-Pérot Filter
Filtering	Parallel	Parallel	Serial
Area to be illuminated	Ø 9.5 mm	Ø 2.5 mm	Ø 1.9 mm
Spectral Range	(2 … 25) µm	(2 … 25) µm	(3.0 … 4.1) µm (3.9 … 4.8) µm (8.0 … 10.1) µm
Current Mode (available)	Yes	Yes	Yes
Voltage Mode (available)	Yes	Yes	No
Thermal Compensation	Yes	No	Yes

Figure 2: Principle of reflective beamsplittering , 3-D Design and Characteristics of the detectors.

The beamsplitters are made of gold plated microstructures for the four channel devices to achieve a homogeneous distribution of the radiance. The filters are mounted at a certain angle to obtain a normal incidence of the radiation. This configuration avoids drifts in the filter transmission curves to shorter wavelengths and the influence of the opposite filter (reflections), using four-sided micro pyramids.

Variable Color detector - Filters are fabricated with silicon bulk micromachining technology and wafer bonding. The back sides are anti-reflection coated. The fixed bottom carrier is equipped with control electrodes, whereas the upper reflector is suspended by springs (fig 3). Applying a voltage V_C to the electrodes creates an electrostatic force, which decreases the resonator gap d and, consequently, tunes the filter wavelength.

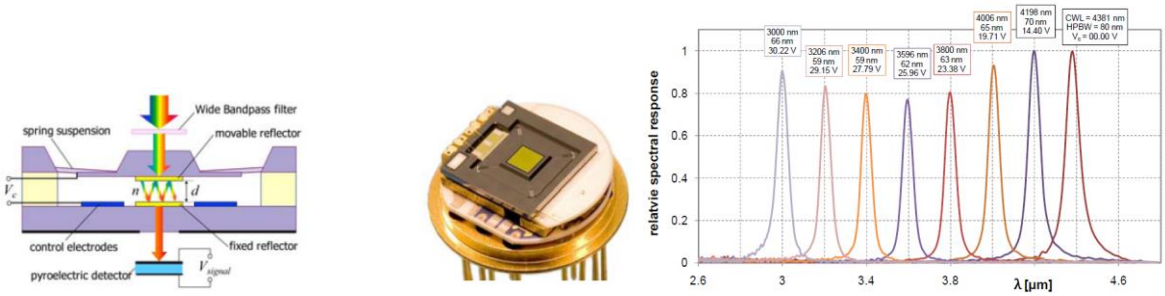


Fig 3: Schematic configuration (left), picture (middle), relative spectral response of a FPF detector (right).

The MOEMS FPF is integrated in a TO8 housing together with a pyroelectric detector (fig 3).

The improved multi-frequency band pyroelectric sensor - consisting of four ZnO pyroelectric layers with various thicknesses, and top and bottom electrodes, was built on a silicon substrate with a thermal-insulation (silicon nitride) layer to reduce heat and electric loss.

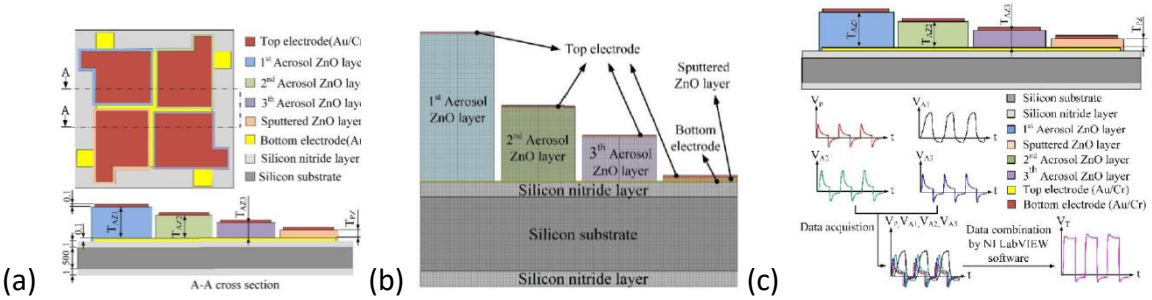


Fig 4. (a) Schematic diagram of the improved multi-frequency band pyroelectric sensor, (b) 2-D model for the improved multi-frequency band ZnO pyroelectric sensor, (c) Schematic diagram for electrical signal treatment procedure.

The frequency is very important to distinguish the ranges of low and high frequencies, and the pyroelectric element's thickness determines the value of the thermal time constant ($\tau_T = c' \times d \times A/G_T$) under the decided pyroelectric materials and electrode areas. Therefore, a thicker pyroelectric element increases the thermal time constant, which is suitable as the sensor for a low-frequency range. Unlike the thicker element, a thinner pyroelectric element reduces the thermal time constant, which is suitable as the sensor for a high-frequency range.

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Error Prediction Concept in High Reliable Off-grid Power Management Systems

György Györök[1)], Bertalan Beszédes [1)]
[1)] Alba Regia Technical Faculty/Obuda University/Székesfehérvár, Hungary
gyorok.gyorgy@amk.uni-obuda.hu

Summary: Electricity plays an increasingly important role in today's measuring, control and various robot applications. For optimal operation, it is essential to diagnose and condition the state of the machine's power supply. In the case of an off-grid power supply, it is necessary to check the technical suitability of all elements of the power supply chain. For reliable operation, it is necessary to estimate the status of the modules from the measured data. In order to ensure fault tolerance, the redundancy of the power supply chain modules in critical applications also needs to be ensured. This paper puts forward a microcontroller based embedded system, which measures and controls the redundant electronic units of the power supply line.

Keywords: reliability, robustness, adaptive, predictive, off-grid

Motivation

A fault-tolerant system, will work even if the system suffers some type of predefined failure. In critical and in non-critical systems, the handling of faults is very similar. The fault-tolerant behavior is implemented into the system, as a combination of hardware and software redundancy. Reliability is something that must be “built in”, not “tested in” [1].

Results

In this paper, after checking the theoretical solutions, it has been presented a useful real application, about a redundant power supply unit. This adaptive and robust solution, which has been prepared for error prediction, increasing the error-free running time, and strongly decreasing the maintaining time.

The individual and redundant power supply units provides a consistent, reliable operation. The cooperation between the modules is has been endured by a micro-controller based embedded system.

We believe that the proposed solution can be useful for civilian and industrial applications, where reliability is hardly required, even it is needs some extra hardware and software redundancy.

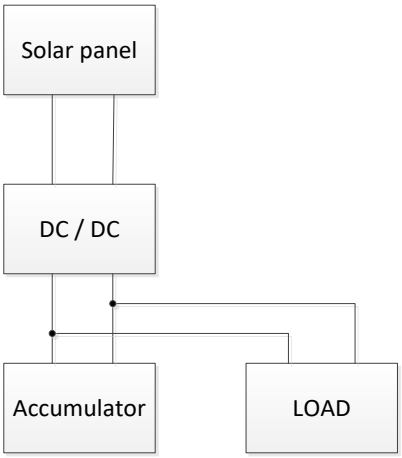

Figure 1: System architecture of a regular off-grid power management system

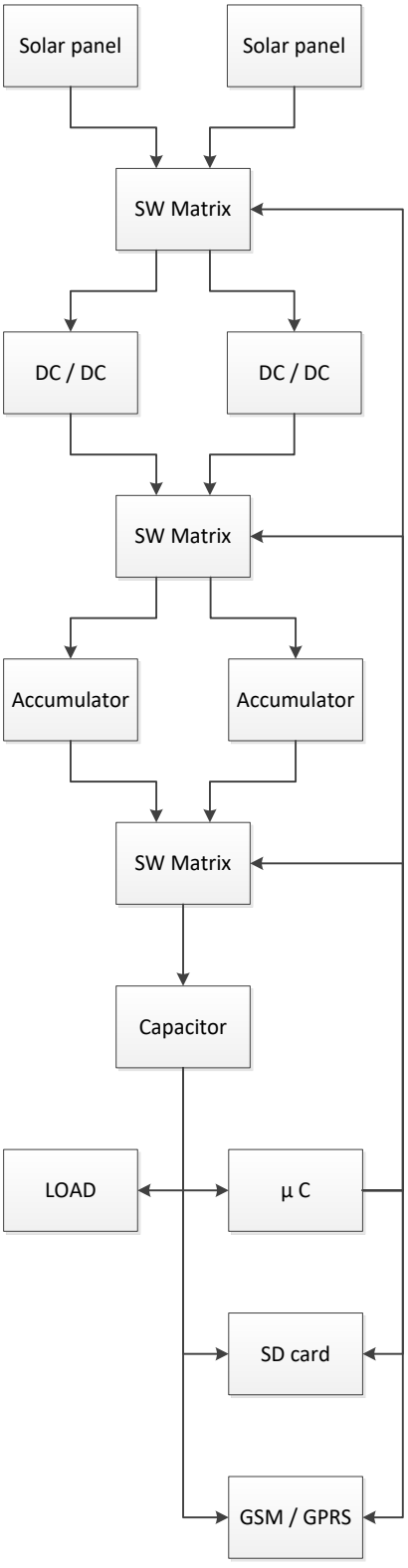

Figure 2: System architecture of the high reliable off-grid power management system

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A parallel between a Content Management System for the Internet of Things vs. a Corpus Linguistics Project

PhD Student Liana Boca[1)], Maria Loredana Boca[2)], Mircea Rîşteiu[3)]
[1)]Computers Department, Technical University of Cluj Napoca, Cluj Napoca, Romania and Department of Exact and Engineering Sciences, "1 Decembrie 1918" University of Alba Iulia, Alba Iulia, Romania, liana.boca@gmail.com
[2)]Department of Exact and Engineering Sciences, "1 Decembrie 1918" University of Alba Iulia, Alba Iulia, Romania, loredana_boca1@yahoo.com
[3)]Department of Exact and Engineering Sciences, "1 Decembrie 1918" University of Alba Iulia, Alba Iulia, Romania, mircearisteiu@yahoo.com

Summary: The analysis and processing of a large number of data has represented and still represents a significant challenge.
In any field, the issue of obtaining, collecting and then analyzing data arises.
The Internet of Things (IoT) is a network of networks consisting of an impressive number of objects / sensors / devices presented in the network, connected through the information and communications infrastructure (and this number continues to grow). [1]
With this in mind, the number of data that results from interconnecting devices or communicating certain information (different sensors) is also very high.
In computational linguistics domain massive corpora are collected and studied. In body analysis, linguists track and analyze the frequency of certain terms / words, perform registry analysis or analyze collocations. [2]
Extracting valuable information from big corpora requires databases, computational applications specifically designed for linguists, tailored to their needs so that data manipulation is easily done in a short time.

Keywords: Content Management System, Internet of Things, Internet of Things Devices, Computational linguistics, Database

Motivation:

Viewing data sent by a device in a clear, simple form to analyze is an important step for any domain.

Most often, is needed a graphical interface in which the data received from the devices / sensors is presented and the application offers some diagnosis and / or communication / warning facilities in case of need.

The idea of a Content Management System callable from a web browser is often the right solution, an application easily accessible to the required data not only for specialists who have knowledge in the hardware area but also for those who have in their tasks only data analysis and supervision of data transmission of a particular device.

The idea and creation of a Content Management System callable from a web browser for a Corpus Linguistics Project is part of the project *Universals and variants of English and Romanian*

business metaphors. A corpus-based conceptual mapping of contemporary journalese from a pedagogical approach (University of Alba Iulia, Romania)[1]

In this case, starting from the sizes of the corpora that needs to be analyzed not only by one person but by the team located in different places in Europe, there has been a need to create a data storage and access system for adding, editing and if it is necessary to delete them, a system has been designed, creating a database to be accessed by team members.

Results:

A Content Management System is an interface that allows users to publish content (usually on Web) which provides a simple, accessible website interface that can be used to add content to a page in a highly structured manner. [3] In the same time, a CMS is "a software application or set of related programs that are used to create and manage digital content". [4]

For the project *Universals and variants of English and Romanian business metaphors. A corpus-based conceptual mapping of contemporary journalese from a pedagogical approach* a database was created and a Content Management System (CMS) was designed to provide all the necessary features for all team members to manage the created corpuses without the need for HTML or PHP knowledge.

An IoT device could send data to a CMS and that way we could have Remote Control of a block heat and power plant, for example. Different data, such as real time remote monitoring of the power generator parameters, or control options such as switch On/Off the different parts of the device, alarm and notification system may be available in CMS. [5]

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[1] This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS – UEFISCDI, project number PN-II-RU-TE-2014-4-2785.

Creating a Content Management System for a Corpus Linguistics Project

PhD student Liana Boca[1)]

[1)]Computers Department, Technical University of Cluj Napoca, Cluj Napoca, Romania and Department of Exact and Engineering Sciences, "1 Decembrie 1918" University of Alba Iulia, Alba Iulia, Romania, liana.boca@gmail.com

Summary: Analysis and linguistics processing of large corpora represent a significant challenge. Massive corpora are collected and studied in computational linguistics domain and not only.
In body analysis, linguists track and analyze the frequency of certain terms / words, perform registry analysis or analyze collocations. [1]
Extracting valuable information from big corpora requires databases, computational applications specifically designed for linguists, tailored to their needs so that data manipulation is easily done in a short time.

Keywords: Content Management System, Computational linguistics, Database

Motivation:

This article is part of the project *Universals and variants of English and Romanian business metaphors. A corpus-based conceptual mapping of contemporary journalese from a pedagogical approach* (University of Alba Iulia, Romania)[2]

Within this project, the team has created two corpora consist of articles that appeared in the following newspapers: *The Economist*, *The Guardian*, *The New York Times* and *The Telegraph* for the corpora in English and *Adevărul, Jurnalul Naţional, Cotidianul, Capital* and *Ziarul Financiar* for the Romanian corpora, each corpora sum totaling over 500,000 words for each of the two languages.

Starting from the sizes of the corpora that needs to be analyzed not only by one person but by the team located in different places in Europe, there has been a need to create a data storage and access system for adding, editing and if it is necessary to delete them, this system has been designed, creating a database to be accessed by team members through a Content Management System callable from a web browser.

Results:

A Content Management System is an interface that allows users to publish content (usually on Web) which provides a simple, accessible website interface that can be used to add content to a page in a highly structured manner. [2]

For this project a database was created and a Content Management System (CMS) was designed to provide all the necessary features for all team members to manage the created corpuses without the need for HTML or PHP knowledge.

Basically, two roles can be defined for this CMS: the administrator (who created the database, created CMS, web pages, etc.) and the publisher who will have access to edit the content. [3]

[2] This work was supported by a grant of the Romanian National Authority for Scientific Research and Innovation, CNCS – UEFISCDI, project number PN-II-RU-TE-2014-4-2785.

The basis for creating this Content Management System is the needs of the team of linguists covering the way of access and the design, structure and all the sections (the articles, categories, metaphors, etc.) that can be edited.

Considering that both the database and the Content Management System were designed according to the requirements and needs of the linguists who are part of the UvaBu Met Project, they will be able to use the system very easily, having no problems to understand it.

A simple, clear, easy-to-use interface has been designed so that the content (the articles that are part of the two corpuses) is easy to manage.

Controlling access to the content management system is an advantage, with each user having access to the credential-based system. Only if the input data (user and password) is confirmed, it can have access to CMS and implicitly to the database.

Thus, the person using CMS can access and work on both the Romanian and the English corpus and can access different sections (author, article, category or annotation of metaphors) for each of these corpora. Obviously, the two corpora can be modified by those who have access to the database (based on credentials), and can add or delete articles at any time.

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Enhanced method for determining platinum quantity from biological samples for atomic absorption spectrometer with graphite furnace

Alexandra Andrada Bojescu[1)], Radu Alexandru Macovei[1)],
Maria Neicu[1)], Ruxandra Populeanu[2)], Paul Şchiopu[2)], Marian Vlădescu[2)], Mihai Ionică[2)3)]
[1)] University of Madicine and Pharmcy "Carol Davila" Bucharest, Romania
[2)]Department of Electronic Technology and Reliability,
Faculty of Electronics, Telecommunications and Information Technology,
University "Politehnica" of Bucharest, Romania
[3)]Military-Medical Scientific Research Centre Bucharest, Romania

Summary: Platinum (Pt) is a malleable, ductile, silver-white metal with atomic number 78 and an atomic weight of 195.09. Platinum is found in nature in metallic state, alloyed with small amounts of iron, copper, other platinum metals, and sometimes with little gold. This ore appears as granules or nuggets, weighing from a few milligrams to a few pounds, scattered in a silicate (olivine and piroxene).

Blood, hair, and urine was collected from patients admitted to the Clinical Toxicology Section. Blood samples from these patients were harvested on the anticoagulant (EDTA, Citrate). The urine was harvested from the urine volume for 24 hours. Expert literature recommends the determination of platinum blood levels in the normal population of the area as the amount of platinum present in the environment differs. For the statistical processing and interpretation of the results obtained on the studied lots, the Student Test was used. For determination of platinum in water and biological products an installation consisting of: Atomic Absorption Spectrometer Model AAS-880 - Varian; Atomizing in graphite furnace model GT 100 - Varian, Autosampler model PSD - Varian.

Keywords: platinum, urine, GF-AAS, Student Test

Motivation

Biological sample analysis is the most important application of atomization in a graphite furnace. The advantages of using this technique are the high sensitivity of the method and the very small amount of sample required for the measurement. In modern medicine, the determination of microelements is very important in the setting and / or treatment of certain conditions. Some of the elements, such as platinum, can cause poisoning. It has been found that a large number of diseases are associated with changes in the concentration of metal ions in tissues or fluids. Normal concentrations are maintained through a complex control system. The role of metals in the body can be considered from the point of view of surplus (intoxications), disturbances in control systems (metabolic disturbances), insufficiencies (diseases, sometimes genetic). Influencing metal ion control systems leads to illnesses, sometimes irreversible due to lack of knowledge of the cause.

Results

For all methods used for platinum determination, the New Rational calibration was finally set, giving the best correlation coefficient of the calibration curve points. The calibration curve,

Fig.1, was drawn in four points. Absorbance of the sample is determined by measuring peak amplitude.

Dose control of platinum compounds administered for therapeutic purposes is absolutely mandatory in children because the changes induced by this treatment in the evolution of metabolism and elimination of these compounds due to both the increase and the effects of nephrotoxicity of platinum compounds have not been established.

The GF-AAS method is a rapid, reproducible method with a very good sensitivity both for the monitoring of platinum compound treatment and for the monitoring of platinum-exposed personnel and its compounds.

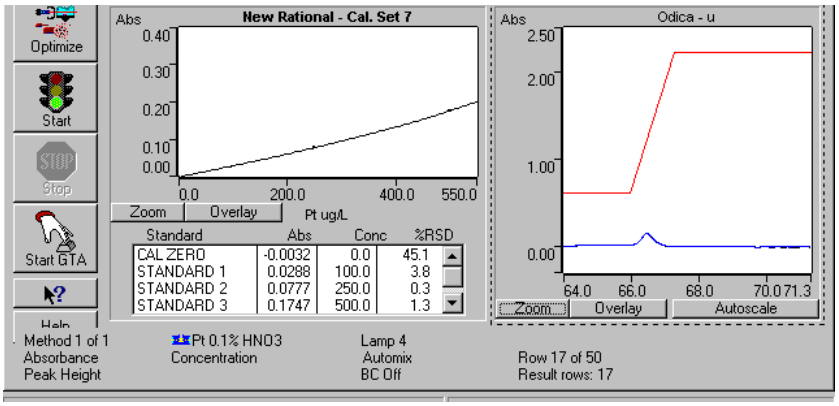

Fig.1. New Ration Calibration curve for our method

References

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Optoelectronic method for determining the amount of platinum from hair, urine and blood samples by atomic absorption spectrometer with graphite furnace at patients with chemotherapy

Alexandra Andrada Bojescu[1)], Radu Alecandru Macovei[2)],
Maria Neicu[1)], Ruxandra Populeanu[2)], Paul Şchiopu[3)], Marian Vlădescu[2)],
Mihai Ionică[2)3)4)]
1)University of Madicine and Pharmacy "Carol Davila" Bucharest, Romania
2) Department of Electronic Technology and Reliability,
Faculty of Electronics, Telecommunications and Information Technology,
University "Politehnica" of Bucharest, Romania
3)Doping Control Laboratory Bucharest, Romania
4)Military-Medical Scientific Research Centre Bucharest, Romania

Summary: Platinum (Pt) is a malleable, ductile, silver-white metal with atomic number 78 and an atomic weight of 195.09. Platinum is found in nature in metallic state, alloyed with small amounts of iron, copper, other platinum metals, and sometimes with little gold. This ore appears as granules or nuggets, weighing from a few milligrams to a few pounds, scattered in a silicate (olivine and piroxene).

Blood, hair, and urine was collected from patients admitted to the Clinical Toxicology Section. Blood samples from these patients were harvested on the anticoagulant (EDTA, Citrate). The urine was harvested from the urine volume for 24 hours. Expert literature recommends the determination of platinum blood levels in the normal population of the area as the amount of platinum present in the environment differs. For the statistical processing and interpretation of the results obtained on the studied lots, the Student Test was used. For determination of platinum in water and biological products an installation consisting of: Atomic Absorption Spectrometer Model AAS-880 - Varian; Atomizing in graphite furnace model GT 100 - Varian, Autosampler model PSD - Varian.

Keywords: platinium, urine, GF-AAS, hair, blood, chimioterapy

Motivation

Biological sample analysis is the most important application of atomization in a graphite furnace. The advantages of using this technique are the high sensitivity of the method and the very small amount of sample required for the measurement. In modern medicine, the determination of microelements is very important in the setting and / or treatment of certain conditions. Some of the elements, such as platinum, can cause poisoning.

Results

Several methods have been used to quantify platinum in both sample processing and analysis, processing and interpretation. Finally, different methods are presented for which the results obtained for different matrices and working methods of the plant are presented.

The advantages of the method developed by us is that the amount of platinum from the minimal concentration of microelement in the sample is obtained, which means that the sensitivity of the method is 2, 3 orders of magnitude compared to the other methods for all our samples of blood (Table 1), urine (Table 2) and hair (Table 3).

PROBE	1	2	3	4	5	6	7	8	9	10
(µg/l)	4.9	82.3	45.1	24.7	85.6	33.9	49.6	28.6	55.6	97.5
PROBE	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
(µg/l)	33.6	15.8	26.3	102.3	21.4	10.3	35.8	55.6	56.3	18.4	61.2

Table 1. Blood concentrations of Pt in patients with chemotherapy.

PROBE	1	2	3	4	5	6	7	8	9	10
(µg/l)	599.5	65.7	4906.7	121.6	897.2	755.3	245.6	1850.3	1623.2	369.4
PROBE	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
(µg/l)	558.7	697.2	198.6	215.8	856.3	2189.3	3125.2	225.9	448.6	789.6	1259

Table 2. Urine concentrations of Pt in patients with chemotherapy.

PROBA	1	2	3	4	5	6	7	8	9	10	11	12	13
(µg/g)	3	1.75	7.75	8.5	4.6	2.3	8.1	2.6	1.6	4.3	2.9	1.5	2.4

Table 3. Platinum concentrations in the hair of chemotherapy patients.

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Optoelectronic method for determining a mixture of organophosphorus compounds involved in environmental contamination

1,2) Gina Caragea[12],2) Radu Alexandru Macovei[2],3) Paul Şchiopu[3],3) Marian Vlădescu[3],3) Ruxandra Populeanu,1,2,3) Mihai Ionică
1 - Military-Medical Scientific Research Centre Bucharest, Romania
2 – Clinical Emergency Hospital Bucharest, Romania
3 – Department of Electronic Technology and Reliability,
Faculty of Electronics, Telecommunications and Information Technology,
University "Politehnica" of Bucharest, Romania
4 – Military-Medical Scientific Research Centre Bucharest, Romania

Summary: Organophosphorus insecticides are very effective in treating crops of wheat, corn, potatoes, vegetables and fruits. These organophosphorus compounds (COP) are also very toxic to humans. Organophosphorus insecticides have a high remanence in soil, water and food. Much of these organophosphorus compounds have been banned lately in the EU. An optoelectronic gas chromatographic method coupled with mass spectrometry is used to determine organophosphorus compounds that may be present in food, soil or water samples.

Keywords: organophosphorus compounds, GC-MS

Motivation

Organophosphorus insecticides are very effective in treating crops of wheat, corn, potatoes, vegetables and fruits. COP identification is done with a GC-MS Varian system. Our purpose is to develop methods for determining multiple compounds involved in different types of contamination.

A standard mixture of seven organophosphorus compounds, shown in Table 1. was analyzed for the method. Identifying them in this standard mixture assures the user that they will be identified in any other sample analyzed under these conditions.

Table 1. Standard organophosphorus compounds mixture at a concentration of 0.4 mg / L for each compound, in dichloromethane.

Compound	MW	Retention time	CAS No
Ethoprophos	242	10,684	13194-48-4
Phorate	260	11,950	298-02-2
Diazinon	304	14,200	333-41-5
Disulfoton	274	14,600	298-04-4
Pirimiphos-methyl	305	17,550	29232-93-7
Chlorpyrifos	333	18,334	5598-15-2
Clofenvinfos	358	20,385	470-90-6

Results

In Fig. 1. the total ion chromatogram of the seven organophosphorus compounds sample is presented at a concentration of 0.4 mg / l.

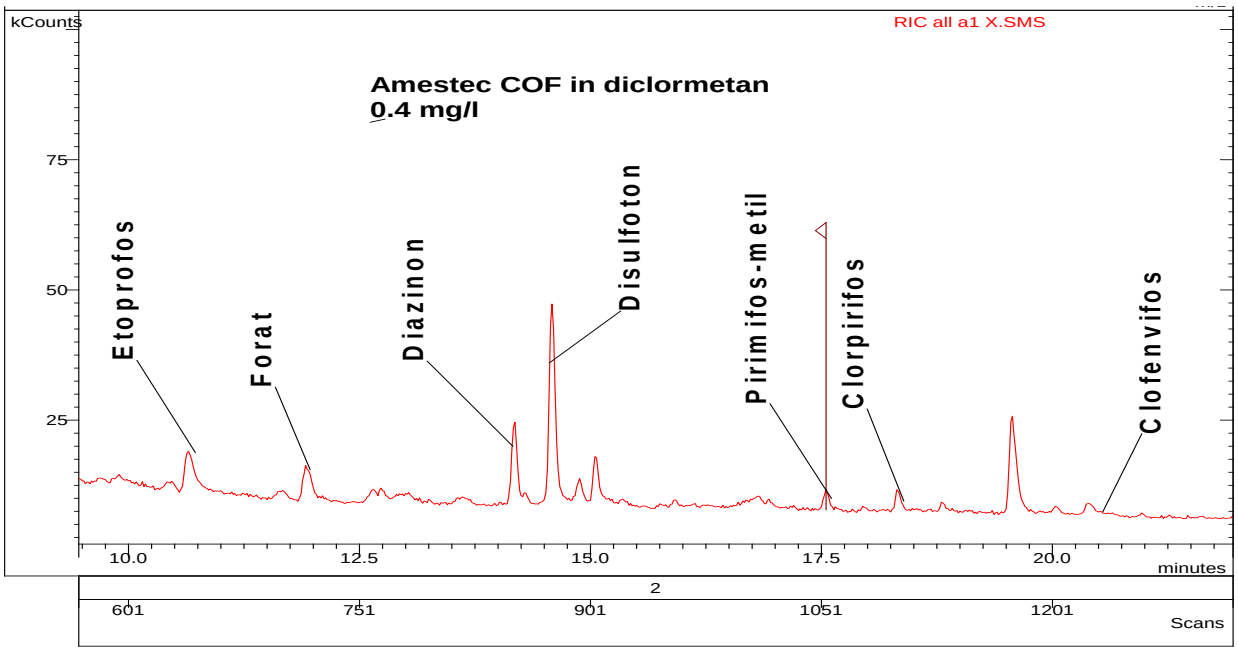

Fig. 1. Total ion chromatogram of the organophosphorus compounds mixture.

In the total ion chromatogram shown in Fig. 1, it is observed that all the organophosphorus compounds which were part of the mixture injected into the system were identified.

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Comparative study by simulation of Norton and Thevenin schemes

Dumitru Cioflica[1)], Adrian Tulbure[1)], Unal Kurt[2)], and Calin Petrascu [1)]
[1)] Department for Science and Engineering/ "1 Decembrie 1918"University of Alba Iulia
[2)] Faculty of Technology / University of Amasya
aditulbure@uab.ro

Summary: The electromagnetic field theory uses the term „*state*" of the field, while the electric circuits theory operates with the term „*operation mode/regime*" of the circuit. In the proposed paper the authors analyze two transient regimes, that take place in the current operation of the power grids: a) voltage applying on a electric line without load, assimilated to the charging of a capacitor and b) reducing the magnetic field of excitation circuit at the synchronous machine, assimilated to the discharging of a coil [1]. Starting from the normal basic model, the mentioned systems are mathematically modeled and simulated in MATLAB [2] in three variants: aperiodic, critical and periodical mode. At the end of the paper one present comparatively the evolution of the state variables *u(t), i(t)* at the terminals of the dipoles in different transient regimes.

Keywords: power supply system, modeling-simulation, transient regime, specific dipoles, state variables, Norton and Thevenin schemes.

Motivation

In the electric circuits theory and analysis, the simplifying procedure of the real network to the equivalent one is applied. Finally, a circuit consisting of elementary electrical dipoles with sources, resistors, coils and capacitors like in fig.1 is obtained [1]. In most cases, the variation of the state variables *u(t)* and *i(t)* should be known even from the design task. For a unitary analysis, the following convention can be adopted: coil as generator and the capacitor as consumer (model 1 / fig.1. left), respectively, the capacitor as generators and the coil as receiver (model 2 / fig.1. right).

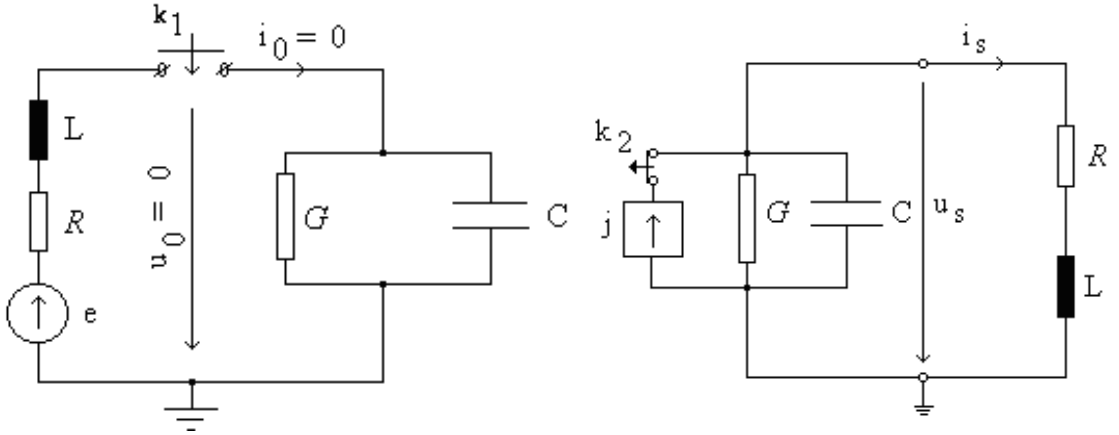

Figure 1: The normal basic model. (left) the equivalent diagram for model 1. [k1-open] and (right) the equivalent diagram for the model 2. [k2-closed]

Results

For mathematical modeling, the Carson-transform, which has some advantages over Laplace-transform, has been used. (The difference is the presence of the *s* operator [3]). The variables *φ(t),*

y(t) were expressed using the development theorem. For each case, the variation of time variant values at terminals was calculated using the following relations: (i.e. *u(t)* for capacitor case, fig.3):

$\varphi(t)=\frac{1}{1+RG}+\frac{1}{2LC}\left[\frac{e^{s_1 t}}{s_1(s_1+\alpha)}+\frac{e^{s_2 t}}{s_2(s_2+\alpha)}\right]$ (1.) where: $$u(t)=\varphi(t)\cdot e_0 \quad (2.)$$

Similarly, one can proceed to obtain the other values, *i(t)* for capacitor and coil, represented graphically below (fig. 2, 3, 5). The simulations results validate the correspondence between the electrical networks theory and the electrodynamics of energy sources with the Hertz oscillator theory and aspects of electromagnetic environment pollution.

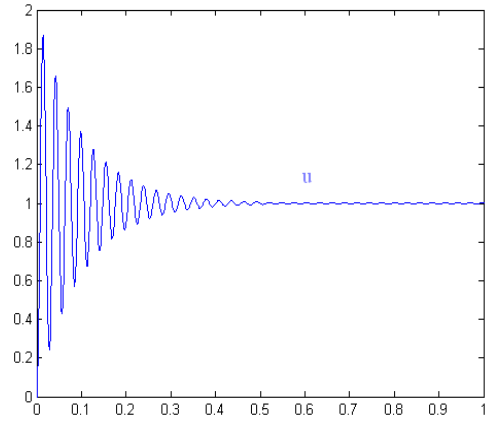

Figure 2: Voltage by capacitor charging in transient mode (periodic model $\alpha \cong 10s^{-1}$ şi $\beta \cong 224s^{-1}$)

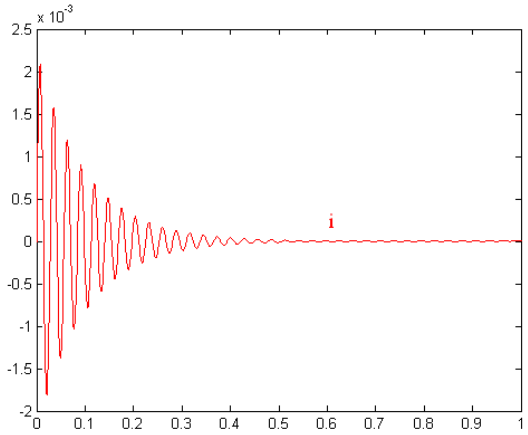

Figure 3: Current by capacitor charging in transient mode (periodic model $\alpha \cong 10s^{-1}$ şi $\beta \cong 224s^{-1}$)

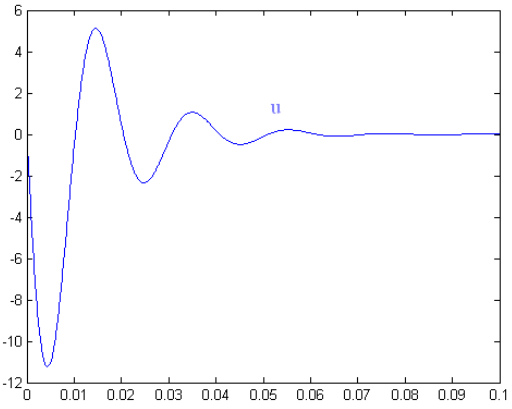

Figure 4: Voltage by inductance discharging in transient mode (periodic mod. α =$77s^{-1}$/ $\beta \cong 317s^{-1}$)

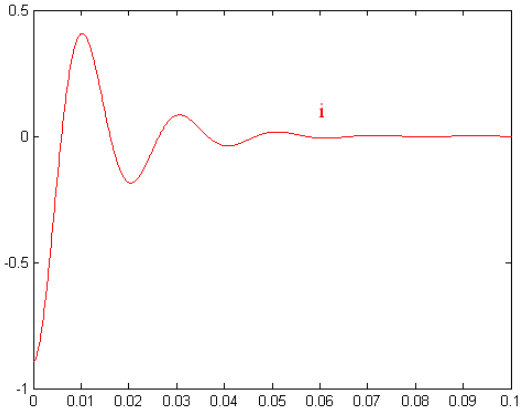

Figure 5: Current by inductance discharging in transient mode (periodic mod. α = $77s^{-1}$/ $\beta \cong 317s^{-1}$)

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IoT for production lines between the paradigm and reality

Elisabeta Mihaela Ciortea[1)],
[1)] Department of Exact and Engineering Sciences, "1 Decembrie 1918" University of Alba Iulia, Romania, mciortea@uab.ro

Summary: For the elaboration of this paper we have left the idea that both the layout and the efficient operation of a technological line involve decisions at all levels in the case of the cloud organization of the manufacturing. It can be transformed into a complex system with many variables collected from machines, processes and business that are processed in real time. The objective of this paper is to investigate the impact of IoT developing on a technological line. For this we will analyze the evolution of the manufacturing system paradigms to identify the requirements of the decision support systems in dynamic and distributed environments.

Keywords: manufacturing, IoT, technological line, stochastic, computer system.

Motivation

Data-based research and development of industrial products of future generations have the potential to estimate how to connect products used in the field and their role in real life. Linked product engineering leads to a fundamental change in how products are designed and executed.

IoT is widely considered as a future technological development of the century, a concept that states that everything will be connected to the Internet.[3]

When we want to analyze the impact of IoT, we chose a modern technological line, because both the evolution of manufacturing paradigms and computer systems will be addressed. [1].

Agents-based software technologies have given rise to a promising approach to the development of IoT systems used to facilitate the infrastructure, ie each object has to be represented on the Internet and can interact with other objects.[3]

In what concerns the evolution of paradigms, the production system directly involves production resources. In order to model the production system chosen for this work as production resources, I will only use machine tools and workers. The decision system applies to the design and operation of a production system. The activities specified in the decision system are:

- Defining the scope,
- Establishing the relational model (inputs, outputs, parameters),
- Data management,
- Making decisions at each level based on cloud information.

The functions of the computer systems must:

- To obtain static and dynamic data,
- Analyze data based on models,
- Ensure system planning and control.

The results of modeling and evaluating the performance of IoT systems are the basis for designing, planning and improving industrial systems. IoT modeling is to abstractly construct the IoT stochastic dynamic model to describe the relationships between process elements and IoT performance that lead to the results of the quantitative analysis of system performance. Modeling and evaluation will help identify the network bottleneck to improve the overall performance of the transport system presented in this paper. [2]

Petri Nets (PN) is a tool for modeling and evaluating performance for the discrete event dynamic system, especially for sequential, parallel and conflict relationships. [2]

In the second part of the paper we analyze the relations between the manufacturing and the infrastructure in terms of a stochastic system with discrete events. Thus, IoT is focused on the architecture of a production line, consisting of a set of modular components and the interaction between them. IoT is able to provide information on planning and control of manufacturing systems at all levels. The information unit was dealt with in each module.

Results

Traditional patterns are disturbed or expanded, and while some of the high features of this disruption are becoming clear, there are many industry-specific things. This means that the intelligent pioneer of IoT will check the value propositions and models existing on the market and update the information after which it will be improved on the basis of the results.

IoT offers opportunities for advancing production lines in delivering performance across distributed systems.

The emerging IoT infrastructure can support future production systems' information systems by engaging in cloud information analysis.

The limitations of these systems today are:

- Static computer architecture,
- Non-existent flexibility between hardware and software,
- Lack of system sustainability.

The implementation of IoT solutions as a means of improving the end-user experience has the role of increasing the perception and value of the global mark.

Modeling and assessing IoT performance builds on theoretical analysis, technological improvement and quantitative outcomes that can guide researchers to find performance paths, underpinning further improvement. In the study, it is proposed to model and evaluate performance based on PN expression. It is used to analyze the prototype system, and the detailed results of the analysis are presented. In the future, we will work on the modular modeling method for PN based on IoT, which can help build a more complex PN model using the bottom-up approach.

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Discrete-Time Periodic Signals Analysis using Code Composer Studio

Remus Dobra[1)], Mircea Risteiu [1)], Georgeta Buica [2)] and Florin Samoila [1)]
[1)] Dep. of Exact Sciences and Engineering, University "1 Decembrie 1918" Alba-Iulia, Romania
[2)] INCDPM "Aexandru Darabont", Blvd. Ghencea, no. 35 A, Bucharest, 6 county, Romania

Summary: The main objective of this paper is to develop arithmetic programming with 128 point fast Fourier transform (FFT) signal flow graphs. Fourier transform is a form of transforming the signal from time domain to frequency domain and it is an important analysis tool for signal processing. The calculated amount of discrete Fourier transform (DFT) is very large, FFT is a kind of fast arithmetic of DFT and FFT make the calculated amount change to (N/2)log2N steps from N2 steps of DFT.

Keywords: Fast Fourier transform, DSP controller, Signal Analysis, DSP arithmetic program.

Motivation

The application is developed based on the TMS320F2812 core of the DSP chip. Each file created in this project gets included at a specific point along the build. They get included by looking at the *main.c* in the active project configuration folder. This file can be directly loaded to a target device and debugged using Code Composer Studio. The software development flow is the straight path going from the C/C++ Source Files down to the Executable file through the Compiler, Assembler and Linker.

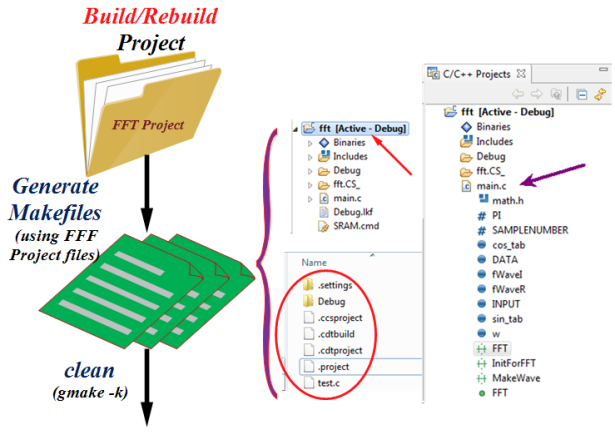

Figure 1: Active project configuration.

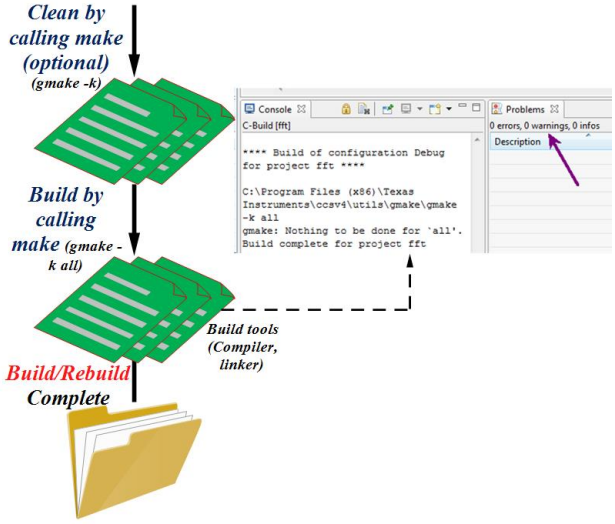

Figure 2: FFT build tool that generates the output files (used for FFT Graph)

Results

The designed project use FFT arithmetic process on 128-point FFT signal flow graphs of the TMS320F2812 by using the C++ program, in a project named ***fft.ptj***. The expected extension of a source file is ***main.c*** written in C++ program. Numerous modules are joined to form a complete

program by using the linker SRAM.cmd. The linker creates an executable object named ***fft.out*** module that will be downloaded to TMS320F2821 device.

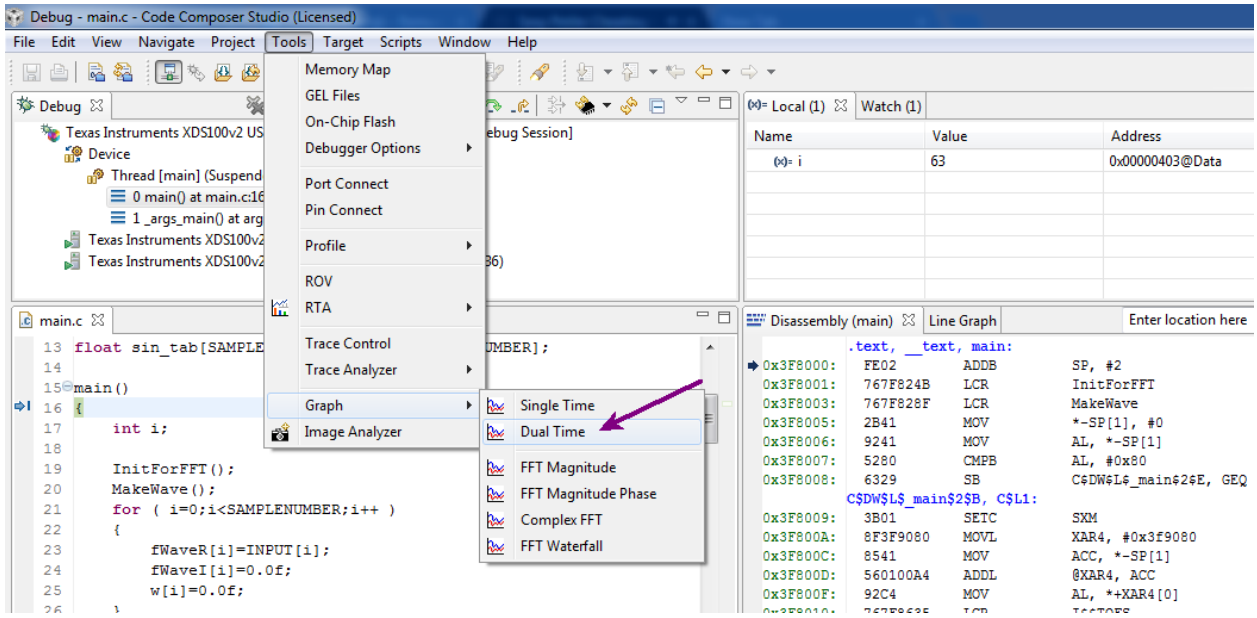

Figure 2: Graphical interface of the CCS for loading the main.c program into the DSP internal storage.

Click the Run debug shortcut - > make the program to Run to the breakpoints, watch window variables change. Set ok and observe the waveform of the INPUT signal sequence (INPUT array) and the output sequence (DATA array) after FFT transformation are shown in next figures.

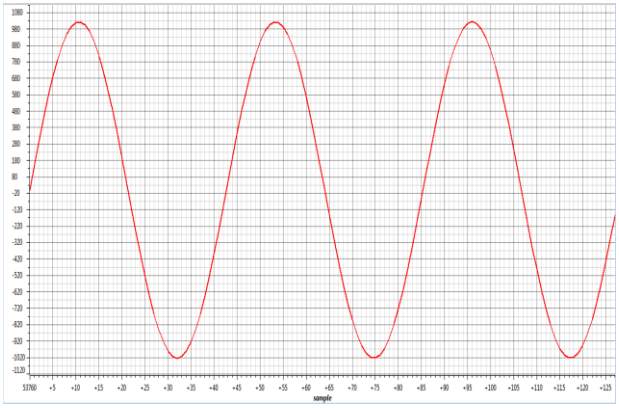

Figure 3: Waveform of the INPUT signal sequence (INPUT array).

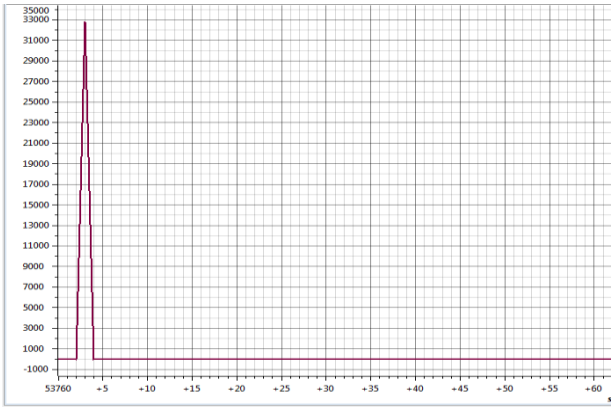

Figure 4: Sequence (DATA array) after FFT transformation.

We have carried out the implementation and optimizations of the FFT on the TMS320 core architecture. The results demonstrated that, compared with the conventional microcontrollers, DSP architectures can achieve excellent results with respect to both the speedup and the absolute performance for DSP problems like the FFT.

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Gas-Chromatography –Tandem Mass Spectrometry (GC-MS) method for the identification of 2-Phenylethylamine, N-Methylphenylethylamine and B-Methylphenylethylamine in human urine samples

Manuela Dobrescu[1*)], Mihai Ionica[2),3)]
[1)]*Doping Control Laboratory Bucharest*
[2)]*University "Politehnica" of Bucharest*
[3)]*Centre for Military Medical Scientific Research*

Keywords: GC-MS, 2-Phenylethylamine, N-Methylphenylethylamine and B-Methylphenylethylamine , sample, urine

Summary: 2-Phenylethilamine (2-PEA) is a primary amine,a central nervous system stimulant in humans. It is an endogenous compound found in small amounts in human blood and urine. It is biosynthesized from the amino acid L-phenylalanine by enzymatic decarboxylation via the enzyme aromatic L-amino acid decarboxylase.

N-Methylphenylethylamine (N-MPEA) is a neuromodulator derived from phenetylamine. It has been detected in few amounts (<1 µg over 24 hours) in human urine. In human body is produced by phenylethanolamine, N-methyltransferase with phenetylamine as a substrat. It is a positional isomer of amphetamine.

B-Methylphenylethylamine (B-MPEA) is an organic compound of the phenetylamine class and a positional isomer of amphetamine. It is a good antihypotensive and bronchodilatator. N-MPEA and B-MPEA are present in some Acacia species, such as A.Rigidula. Due to stimulating effects on the human body some athletes decide to take large amounts of this substances on different paths. N-MPEA and B-MPEA are especially administered orally . In orally ingested, 2-PEA is metabolized under the action of enzymes to phenylacetic acid. Therefore, in order to obtain an increased blood concentration that reaches the brain, athletes swallow very large amounts, or resort to other methods such as intravenous injections. This practices are dangerous to health and may even be fatal.

Motivation

WADA included Phenetylamine and its derivatives on the Prohibited List in the section S6 "Stimulants", subsection b "Specified Stimulants" .

By technical document TD2018MRPL, WADA has regulated the MRPL value of this asubstances in athletes urine at a 100 ng / ml but should not be reported below 50% of the MRPL.

Under these conditions, an identification method of Phenetylamine and its derivatives , was required .

The present degree has purpose the developing and validating a Gas-Chromatography- Tandem Mass Spectrometry (GC-MS) method accurate, rapid and easy to identify 2-PEA, N-MPEA and B-MPEA in human urine sample.

The extraction of this compounds is accomplished by the liquid-liquid extraction process with an organic solvent. Liquid-liquid extraction is a method of separation consisting of the selective transfer of substances from an aqueous liquid phase into liquid organic solvent (TBME). The principle of liquid-liquid extraction is based on the fact that the separated substances have a low affinity for the aqueous phase and a high affinity for the organic phase. Under mechanical agitation conditions, at pH = 11-12, active principles pass into the ether layer. As internal standard, diphenylamine (DFA) is used.

For identification, the method are monitored the mass fragments characteristic of the compounds of interest – m/z 91, 65, 121 and 51for 2-PEA; 44, 91, 65 for N-MPEA; 105, 91, 77 for B-MPEA and the ion corresponding to the internal standard -m/z 169.

Results

For GC-MS method for the qualitative determination of this substances in human urine samples, the Agilent Technologies GC/MS system is used. The method has the following analytical parameters:

Chromatographic column: DB-5MS, J&WScientific (5% phenyl-dimethylpolysiloxane), 25m length, 0.25mm internal diameter, 0.25 µm film thickness;

Carrier gas: Helium-constant flow 0.8 ml/min;

Injection parameters: injection mode split- 1:10;
injection volume 2 µl;

injection temperature: 300^0C

Temperature program: 100°C (0 min.)→20°C/min → 145°C (3min) → 20°C/min→ 165°C (3 min.) → 20°C/min→ 320°C (3.10 min.)

Detector parameters: ionization mode: EI (Electronic Impact);
interface temperature: 300^0C;
SIM aquisition mode;

Ions monitored: m/z 91, 65, 121 and 51for 2-PEA;
m/z 44, 91, 65 for N-MPEA;
m/z 105, 91, 77 for B-MPEA
and the ion corresponding to the internal standard -m/z 169.

Chromatographic separation time: 19.10 min.

The integration parameters of the method are presented in the **Table 1**:

Table 1: The integration parameters

Tipul de integrare	**Integrator Event Name**	**Value**	**Time**
ChemStation Integrator	Initial Area reject	0	Initial
	Initial Peak Width	0.021	Initial
	Shoulder Detection	OFF	Initial
	Initial Threshold	8.0	Initial

2-PEA is an endogenous compound that is commonly found in urine at concentrations below 20 µg / ml. For this reason, validation of the method was performed using a synthetic urine matrix. In view of these considerations, the study of the "matrix interference" parameter was no longer required.

The evaluation of the results is done according to the criteria of technical documents TD2015IDCR and TD2018DL. The validation parameters are presented in the **Table 2**:

Table 2: The validation parameters

Validation parameters	**Results**
Specificity	Compliant
Identification capacity	Compliant
Robustness	Compliant
Carryover	Not observed
Liniarity	Compliant
Detection limit (LOD)	50 ng/ml

Acknowledgement: The authors wish to thank the *Doping Control Laboratory Bucharest, University "Politehnica" of Bucharest , Centre for Military Medical Scientific Research* for technical support and *Romanian Gouvernment* for financial support.

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Learning basics of Java programming language through automatic generation of quizzes

Alexandru Ene[1)]
[1)] Department of Electronics, Computers, Communications and Electrical Engineering, University of Pitesti, Romania, alexandru.ene@upit.ro

Summary: Quizzes are largely used for online evaluation or self evaluation of students. Most of quizzes have a fixed database of questions and, repeating the test, the same questions will be presented to the user. In order to avoid the repetition of the same questions, one direction in modern e-learning, is the automatic generation of multiple choice questions [1]. Another direction is known as parameterized questions. A parametrized question is a pattern of a question created by the designer of the quizz, which has parameters that, at presentation time, will be randomly initialised [2]. The advantage is that the same type of question can be repeatedly used in the quizz, with different parameters.

In [2], the authors present a client server application based on parameterized questions for testing the student on the knowledge of Java programming language. The main type of question is based on computing a value from a sequence of Java instructions. The parameters that appear in instructions can be randomly initialised. The correct value of the result is determined by running the parameterized program on the server. This result is comparated with the value introduced by the user of the quizz.

In this paper, there are other types of parametrized questions for Java language that are used and there is also a new, automatic way of verifying the correctitude of an answer. The correctitude is verified using regular expressions. A regular expression defines a pattern that will be used to perform a search in a text [3].

Keywords: Automatic quiz generation, parameterized questions, regular expressions, Java language.

Motivation

In Java programming language there are a few basic issues that must be accurately learned by the student that starts learning this object oriented programming language. Some of these basic issues are about how an object is instantiated based on its constructor, how a public method is called from another class based on its signature and on class constructor, and how public and static method is called, based on its signature and on class name. The more examples of these elementary operations in Java are presented to the students, the better they understand this modern programming language. In this paper it is presented an automatic way of generating random questions concerning these basic issues. These questions are presented to the student and he has to edit his answers. The paper also presents an automatic way of verifying the correctitude of the answers. The advantage of this automatic way of generating and verifying tests is that when the test is repeated there will be always new questions and the student cannot use the answers that he memorised at the previous test.

Results

The author developed a Java application that automatically generates parameterized questions. Here are some examples of parameterized questions, automatically generated by the software application:

Create the object obj from class A.

The signature of class A constructor is:

public A(int x, double y)

The number of parameters from constructor and their type can be randomly initialized.

The user of the quiz has to edit his answer using appropriate values for the parameters of constructor. As an example, a correct answer from the user could be the following:

A obj= new A(71, -12.5);

This answer is verified by the Java application that constructs a regular expression that verifies the correctitude of user's answer.

Another example of a different parameterized question:

In class A, there is defined a method that has the signature:

public static void f(int x)

How do you call this method from another class?

Here, the type of the result returned from the method and also the number of parameters of the method and their type can be randomly initialized.

This software application will be used for the students that begin to study Java programming language, next semester, in our faculty, at the laboratory hours.

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Aluminum Coating of Cotton and Polyester Textiles

Gözde Konuk Ege[1)], Hüseyin Yüce [2)] Nihat Akkuş [2)]
[1)] Department of Mechatronics/İstanbul Gedik University, gozde.konuk@gedik.edu.tr
[2)]Department of Mechatronics Engineering/ Marmara University of İstanbul,
nakkus@marmara.edu.tr

Summary: In this study, cotton and polyester textiles were coated Aluminum (Al) by using NANOVAK-NVTS-400 Magnetron Sputtering System. The textiles surfaces were coated with the Al material by RF magnetron sputtering and it is obtained 100nm coating thickness on the surface. Aluminum coated cotton and polyester textiles were imaged by using three-dimensional optical profilometer and optical microscope. This study has been done in Marmara University Mechatronics Engineering MEMS/NEMS/MOEMS research and development laboratory.

Keywords: MEMS, magnetron sputtering, textile coated, optical imaging

Motivation

In this paper, we present an application about the metal coating on the textile surfaces by using RF magnetron sputtering. NANOVAK NVTS-400 Magnetron sputtering system can deposit all metal, oxide, nitride (e.g Ni,Fe,Au,Zr,Ti,Si,SiO2, ZnO,TiO2,Si3N4,SiC) and semiconductor materials as successive layers by a sputtering method. The system can warm the 4" (100mm) sample uniformly to at least 500°C. It has turbo vacuum pump, thus it can create $2x10^{-7}$ Torr vacuum. This system has one piece of RF magnetron flexhead and one piece of DC magnetron flexhead sputtering sources. RF coating, DC coating, and thermal coating can be done with this system. In this application, RF deposition is preferred because of coating pots have a life span in the thermal coating and each pot can be used 3-4 times.

In Fig. 1. NANOVAK NVTS 400 Magnetron Sputtering System and Deposition Chamber are shown. Inside the deposition chamber, there are a RF gun, a DC Gun and a turbo fun. RF deposition is used in this application. For this reason, the DC gun was closed with a lid.

Fig. 1. NANOVAK NVTS 400 Magnetron Sputtering System and Deposition Chamber

All data entry of the system is done via the control panel. Control panel consists of three main group which are “Thickness Control”, “Vacuum Control” and “Gas Control”. NANOVAK NVTS400 Control Panel is shown in Fig. 2.

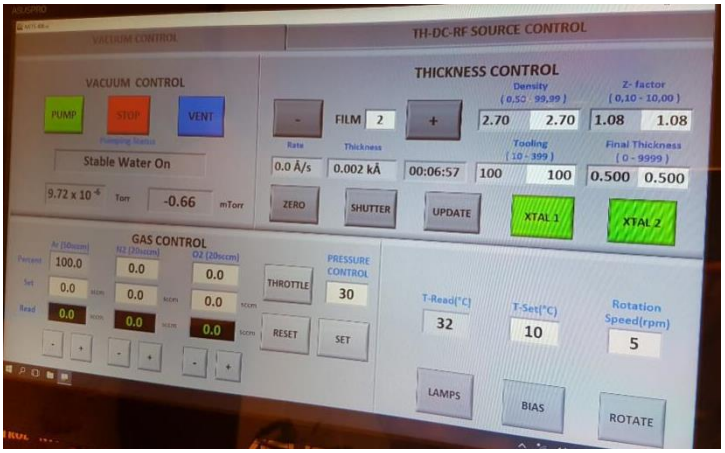


Fig. 2. NANOVAK NVTS400 Control Panel

Thickness Control Unit

Deposition thickness is measured by two thickness control sensor. These sensors are stated as XTAL1 and XTAL2 at the control panel in the thickness control part. These sensors measure the thickness of the coating on the right and left side of the substrate. If the both of the sensors are used together, the average of the two measurements is presented as thickness.

The required thickness of the deposition should be entered in the final thickness area. In our process, first of all, the thickness was specified as 50nm (0.500). After 50 nm deposition, the shutter was turned on and off, and the system run once again for 50 nm deposition.

To measure the thickness of the deposition, density of element used for deposition have to be entered to density area, therefore in this application, it was entered 2.70 g / cm^3 for Al element.

Vacuum Control Unit

First of all, gases used which are nitrogen, argon or oxygen have to be opened from the outside. In our process, nitrogen and argon gases are used. Gas pressure should be max. 2 bars. The system always has to be in a vacuum. Accordingly, the "VENT" button is pressed first to turn on the system. This process takes some time. Plasma is formed by argon gas in deposition chamber. When the temperature reaches 31°C, the "pump" button is pressed and waited for about 14 minute. The vacuum reaches 10^{-1} Torr the lights turn on and the device switches to the turbo pump. The system reaches 10^{-5} Torr in about 7 minutes due to the turbo pump and vacuum occurs after 14 minutes.

RF Sputter Source Unit

Since RF Coating is used in operation, information about coating speed should be entered in this section.

In our process, followings are entered to RF sputter source area.

- Set 1: 150 W, Set2: 250 W,
- Ramp Up: 2.0 W/s, Ramp Up: 2.0 W/s
- Time: 0.3 min Time 2: 300 min.

Reflected power’s value have to be 0.0 or 1.0. It should never exceed 2.0. Otherwise, the system will be damaged.

Gas Control Unit

The pressure value is entered to the gas control unit. The pressure was set at 30 mTorr to provide the ideal plasma environment.

Once the gas control settings are done, the necessary conditions are ready to press the “start” button to initialize the system. It must be known that the lower pressure will provide the better performance for the system. The gas is reduced by decreasing the pressure value. However, this value should be reduced in a controlled manner. Otherwise, gas may not flow into the system, which means that the coating process is stopped. In our process, the pressure was reduced to 6 mTorr and increased the coating rate to 0.9.

Results

The deposition study was designed for performing to use system and experianced to aluminum coating of cotton and polyester textiles. After the deposition process, aluminum coated cotton and polyester textiles were imaged with three-dimensional optical profilometer and optical microscope. Al coated cotton and polyester textiles is shown in fig. 3.

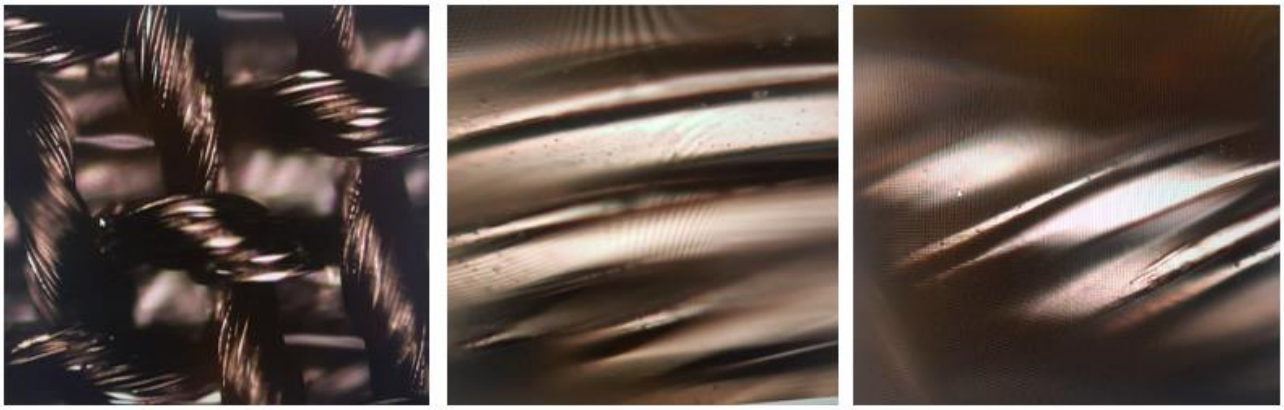
A. Cotton textile B. Polyester textile

Fig. 3. Al coated cotton and polyester textiles

Three-dimensional optical profilometer and optical microscope imaging results were obtained as following images.

Imaging results with optical microscope

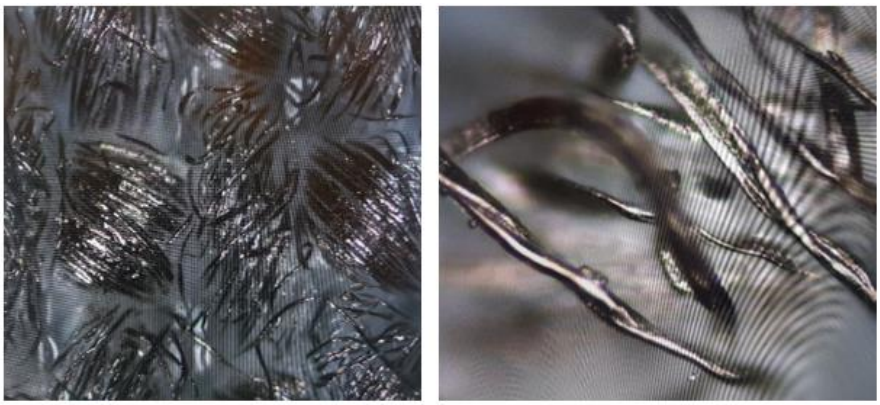
Optical microscope imaging shows that the polyester fabric fibers are coated with aluminum in Fig. 4.



A. Textile fibres nodes B. Textile fibres C. Textile fibre

Fig. 4. Optical Microscope Imaging of Polyester Textile

Optical microscope imaging shows that the cotton fabric fibers are coated with aluminum in Fig. 5.

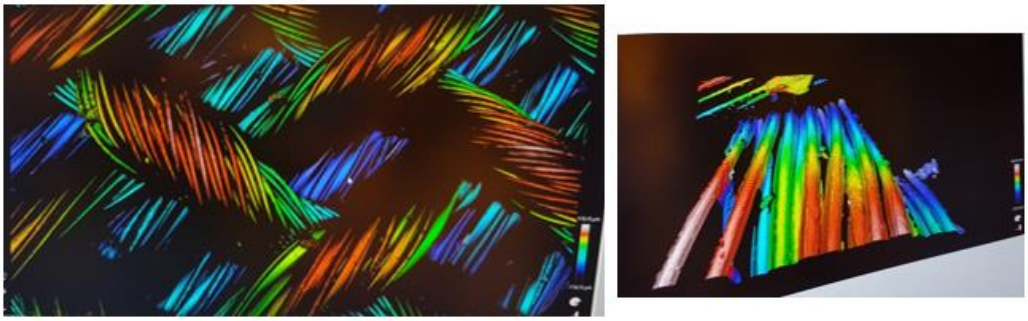


A. Textile fibres nodes B. Closer appearance of fabric fibres

Fig. 5. Optical Microscope Imaging of Cotton Textile

Imaging results with 3 Dimensional Profilometer

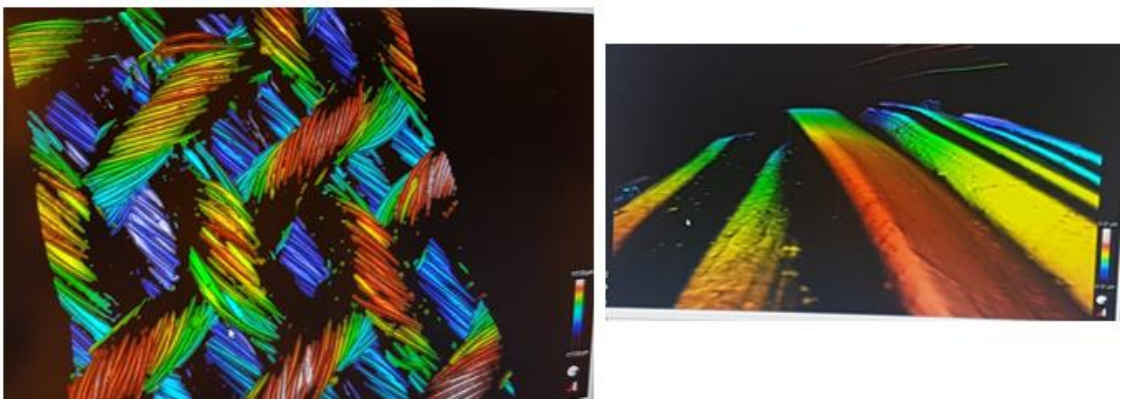
3D Profilometer imaging shows that the polyester fabric fibers are coated with aluminum in Fig. 6.



A. Textile fibres nodes B. Closer appearance of fabric fibres

Fig. 6. Optical Microscope Imaging of Polyester Textile

3D Profilometer imaging shows that the cotton fabric fibers are coated with aluminum in Fig. 7.



A. Textile fibres nodes B. Closer appearance of fabric fibres

Fig. 7. Optical Microscope Imaging of Cotton Textile

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Ultrasonic Distance Measurement for Safe Guidance of Visually Impaired People

Cristian Fărcaş[1)], Ionuţ Ciocan[1)], Gabriel Oltean[1)], Adrian Tulbure[2)]
[1)] Department of Applied Electronics, Technical University of Cluj-Napoca, Romania, cristian.farcas@ael.utcluj.ro
[2)] Department of Precise and Engineering Sciences "1 Decembrie 1918" University of Alba Iulia, Romania

Summary: This paper describes the implementation of a short range distance measurement method. Distance measurement is used in a large number of applications such as motion control in industrial applications, in vehicle control, in medical applications, etc. The proposed device use ultrasound sensors to detect objects in front of a blind person and helps to avoid obstacles. The distance from person up to obstacle is determined by echo ranging. The measured distance data is converted to digital data for the display and sound waves or into vibrations by a small eccentric motor. The user can get the distance between user and object. The frequency of motor vibrations is inversely proportionally with the distance up to the obstacle. Instead of the eccentric motor, one can use a loudspeaker that beeps intermittently at a rate inversely proportional to the distance to the obstacle. The frequency of the signal increases as the distance to the obstacle decreases. The user can calibrate the device according to his or her own preferences. We used a LCD to display the distance for calibration of device. The LCD display can be optional. The proposed apparatus is a useful tool for allowing the blind pedestrians to avoid obstacles and to walk safely.

Keywords: distance measurement, obstacles detection, ultrasonic sensor, visually impaired pedestrians, electronics factory.

Motivation

According to [1], an estimated 36 million people are completely blind, and 216.6 million people have moderate to severe visual impairment (of the 7.33 billion people alive in 2015). All of this visually impaired peoples, while moving from one place to another, are faced with obstacles such as infrastructure or many other obstacles in the way (like cars that are parked on the footpath, trees, benches, etc.). To move safely, blind people use devices or artifacts to help them to move. The most commonly artifact is the white cane used to find obstacles [2].

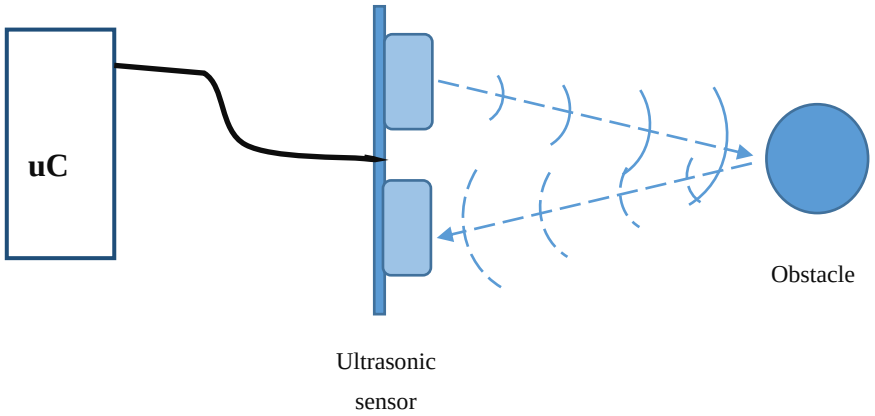

Figure 1: Ultrasonic sensor working priciple.

Ultrasonic sensor operation is based on the propagation time measurement of an ultrasonic signal between the transmitter and the object (Fig. 1). The maximum distance is based on the nature of the transducer (piezoceramic, electrostatic, etc.) and frequency.

Results

We propose a device able to detect any obstacles at distances between 3cm and 4m. The device can be mounted on a glove, as in Fig. 2. The primary goal of the proposed apparatus is the safe guidance of persons with visual disabilities. This device is based on information taken from an ultrasonic proximity sensor HC-SRO4 (consisting of two sensors to be easier to program and quickly analyzed information to be taken) connected to a microcontroller PIC18F458, as in Fig. 3.

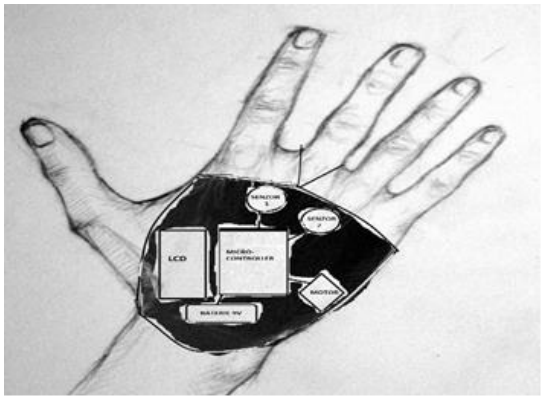

Figure 2: The proposed device on a glove.

Figure 3: Ultrasonic proximity sensor HC-SRO4

The device has a relatively small size and low weight and can be used by both, adults and children. The transmitter sends a 10µs signal to the top, then a series of 8 pulses of 40kHz. The receiver expects echo: if the answer is between 150µs-25ms, an obstacle is detected; if the time is over 38ms, nothing is detected.

When an obstacle is detected, it is displayed distance to the object on the LCD and motor vibrates at different intensities. As the obstacle is closer, the motor receives a higher voltage, which leads to stronger vibrations. The user is alerted via a motor fitted with an eccentric shaft. As the distance is getting smaller, the vibration frequency and intensity increases.

The distance is calculated using the formula:

$$L=c\cdot\Delta t/2 \quad (1)$$

where: L is the length,
c is the speed of sound in air (344 m/s at ambient temperature of 20°C), and
Δt is the difference in time from the broadcast-up to receive.

Time is halved because the distance is traveled both ways. One must also consider the speed of sound is affected by air density and density is mainly affected by temperature and altitude.

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Continuous Operation Monitoring of Electronic Circuits with Embedded Microcontroller

György Györök
Alba Regia Technical Faculty/Obuda University/Székesfehérvár, Hungary
gyorok.gyorgy@amk.uni-obuda.hu

Summary: With more advanced equipment, it is possible to query the technical condition by connecting a computer. It's enough if we only think of a car, when we can get to know the full history of the car with the possible acute problems. Unfortunately, such an option is not possible at electronic systems, electronic circuits or electronic equipment. Often the life expectancy of a single electronic device, the quality parameter, based on statistical probability, depends on the switch-on time or production date. Particularly important is the state analysis of a circuit in cases where direct human life or catastrophic failure depends on the good functioning of a circuit. Enough if we only think of the airbag driver electronics of both cars, which has a malfunction of both states (opens the airbag when it does not have to, or does not open the airbag when it needs to go off) it can cause a great deal of trouble. In our present article, we recommend a microcontroller diagnostic procedure that can be mounted next to the circuitry, which performs a continuous monitoring of the circuit. Possible malfunctions can be predicted, or alarms can be anticipated, or simply a goodness parameter can be generated.

Keywords: embedded microcontroller, circuit simulation, digitally represented circuit, state analysis.

Motivation

We want to design test systems in which circuit breaks can be typed and modelled. At current phase of researcher want to check the measurement system itself with the errors we generate.

Results

In one of our proposed solutions, together with the physical circuit, we digitally model a circuit. The digital circuit is able to operate with constant network characteristics without apparently aging. If such a virtual circuit is continuously compared to a physical circuit, then a time-varying state value is obtained for the parameters of the physical circuit that deviate from the relevant values of the digitally generated circuit [2]. The proposed architecture (Fig. 1) is connected to the monitorised, controlled circuit by an analogue and digital surface. The figure shows an embodiment when comparing different points of a hybrid circuit with the corresponding points of a digitally simulated circuit. To do this, a built-in microcontroller and its inputs are connected to the desired circuit points through an analog multiplexer and digital multiplexer [4]. The circuit simulation in a microcontroller environment naturally depends on the size of the circuitry, which generates a device-dependent processor resource requirement, one of which may be to simulate the circuit on a desktop computer for the optimum voltage of each point, for example, in a table, then comparing with the microcontroller the voltage values of the polled points together with the corresponding points of the physical circuit [1]. In the figure, a circuit is simulated and real time functions of the built circuit (Fig. 3, 4), are relevant. In this circuit, we tried to build the most commonly used solutions in the circuit, the failure of which is statistically common [3].

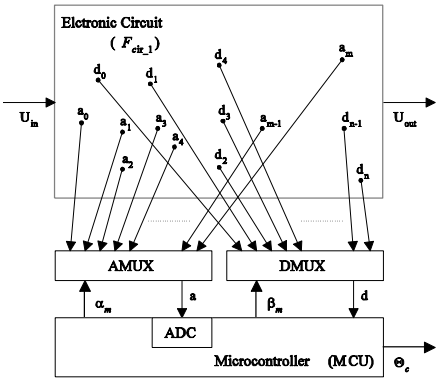

Figure 1: Proposed embedded microcontroller architecture

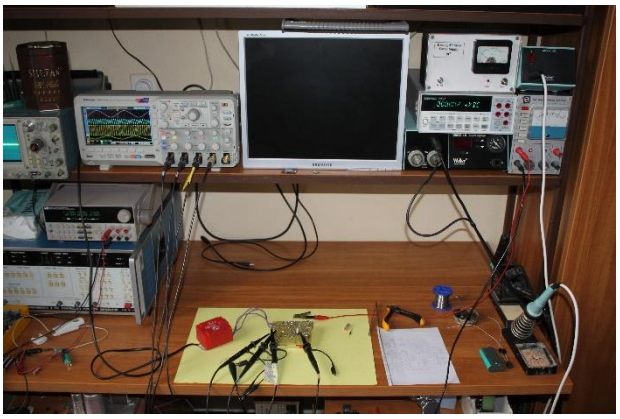

Figure 2: Measuring environment.

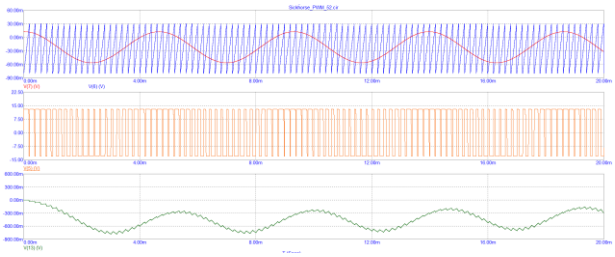

Figure 3: The time function of important points in the simulated circuit.

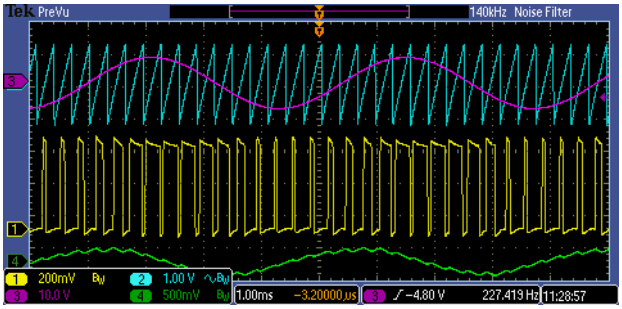

Figure 4: The time function of important points in the real circuit.

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THE SIGNIFICANCE OF dLED LIGHTING TECHNOLOGY APPLICATION

Fuad, Hadžikadunić[1)], Amna, Bajtarević [2)]
[1),2)] Faculty of Mechanical Engineering of University of Zenica, Bosnia and Herzegovina,
[1)] hfuad@mf.unze.ba, [2)] amna_bajtarevic@hotmail.com

Summary: The contemporary world scene, in addition to other challenges, faces two fundamental problems: 1. lack of energy and insecurity in its supply, 2. environmental pollution and climate change caused by excessive and irrational energy consumption. But, there has been a situation of complete disregard between the requirements of energy efficiency and the protection of the environment. One such example is the requirement to reduce electricity consumption in the field of lighting technology, which has resulted in a ban on the production of classic light bulbs in 2012 and in European countries simultaneously with the promotion of the use of ''saving'' bulbs. Due to facts that: each saving lamp contains 30 mg of mercury (the toxicity limit is 0.05 mg/m^3), 1g could contaminate up to 30,000 liters of water, annualy - soil and water in the world are contaminated with 25,000 tons of mercury, in America for example, annually allocates 500 million "saving" bulbs to solid waste, ..., it may be recognized the inadequacy of the imposed law, regardless of slightly lower electricity consumption by using "saving" bulbs. "State of the Art" in the field of LED lighting technology is the only worldwide patented dLED lighting technology. With saving el. energy up to 95% (no transformer and heating, no mercury and lead), ..., the application of this technology makes a significant contribution to environmental protection.

Keywords: dLED lighting technology, solid waste, water protection, energy efficiency, environmental protection.

dLED - SIYA^{TM} LIGHTING TECHNOLOGY

Reducing energy consumption and eliminating energy waste are among the most important goals of the European Union. Significant and uncontrolled growth of the world population on the one hand, and irrational consumption and pollution of natural resources on the other hand, today alarms the world public, Fig. 1.

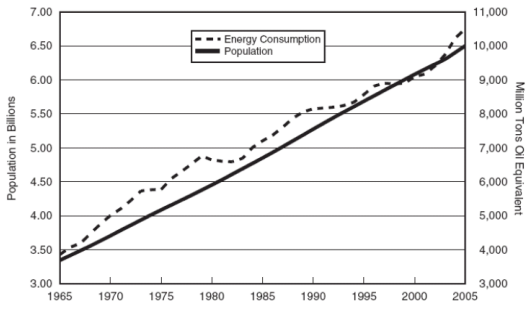

Figure 1: Population and energy consumption ratio.

Figure 2: CFL 'saving' lighting bulbs.

From the aspect of new capacity, wind power is 42% in the U.S., and in Europe 36% of new installations. In 2010., pure energy (wind and solar) provides only 1.5% of world needs, up from 0.1% in 1997. However, it is assumed that by 2040, 50% of world energy will come from renewable energy sources. It is estimated that by replacing all the bulbs with "saving CFL bulbs", carbon dioxide emissions throughout Europe could be reduced by 20 million tons per year.

However, each fluorescent tube or CFL bulb, Fig. 2., contains up to 30 mg of mercury, and the toxicity limit (PEL) is 0.05 mg / m^3, [1]. According to surveys (Environment Canada), the amount of mercury in only one fluorescent tube can contaminate 30,000 liters of water. In Canada, 80 to 100 million fluorescent tubes are deployed as solid waste every year. Only in U.S. every year, it puts on landfills, as solid waste, 500 million fluorescent tubes, or 12.000 tons, which pollutes air and the environment, of which only 1 million recycles. Nichia Corporation designed the first white high-gloss LED in 1995. But, the company Tesla Digital Inc. (Canada), for the first time in the world market promotes dLED lighting elements based on the patented SIYA^{TM} lighting technology, Fig. 4. Among other things, the most important features of dLED technology are, [3]: the possibility of using the solar cell concept, as well as the wind turbine; non-transformer illumination bodies (the only system in the world that applies plastic lamp housings since there is no heating); energy savings > 90 %, Fig. 3; 5 to 10 times longer lamp life > min. aprox. 15 years; the dLED lighting fixtures are 2 to 6 times more efficient than the world-famous LED torches on the world market; a programmable control system (additional savings through time management and number of lit lighting modules according to the need for volume and volume); no UV radiation and any thermal dissipation; no blindness effect; no sensitivity to change or drop voltage, etc.

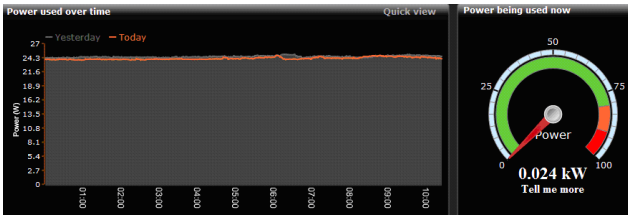

Figure 3: Energy consumption of dLED technology.

Figure 4: dLED ligting technology application.

Results

Application of dLED–SIYA^{TM} lighting technology PREVENTS on a monthly basis: discharge 140 kg / 300 lbs of CO_2 in the atmosphere, consumption of 370 liters / 100 gallons of water, environmental contamination with 100 g / 3.5 oz. toxic mercury, burning 80 kg / 170 lbs. coal, etc. According to current estimates U.S. (Department of Energy) potential energy savings, when replacing the complete lighting with so far known LED technology, would be $ 120 billion, the consumption of el. energy to ¼ and reduced CO_2 emissions by 246 million tons. With dLED technology, the savings would be bigger. Today's sales of LED bulbs make only 5% of the total lighting market (annual world lighting market amounts to $ 52 billion) mainly due to their price. The dLED lamps now move these boundaries because they have a longer lifespan (up to 100,000 hours), they have more energy savings (up to 95%), they do not have mercury, they do not have heating, they have a lower cost compared to the existing LED bulbs, possibility of directing the light and lightning reducing, are fully compatible with the RoHS standard [2], low maintenance costs, have the ability to connect to a solar or wind system, etc. So, the technology is far ahead of the current European ''solutions'' on energy saving and environmental protection in the area of lighting.

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Towards Zero Defect Factory through Machine Vision Integrated into Operational Workflows

Kadar Manuella[1)], Boca Maria Loredana [1)], Ricardo Jardim Goncalves[2)]
[1)] Department of Computer Science and Engineering/1 Decembrie 1918 Univeristy of Alba Iulia,
[2)] CTS, UNINOVA, DEE/FCT – Universidade Nova de Lisboa, Portugal
mkadar@uab.ro, boca_loredana1@yahoo.com, rg@uninova.pt

Summary: Driven by the aim to stop quality defects and process faults, more and more companies are striving to achieve the principle of a zero-defect factory. In order to create the necessary quality culture and to make production processes as accurate as possible new technologies like machine vision and human-computer interaction might be a solution. In this paper we present the machine vision approach to the development of individually tailored solutions for defect management within a sustainable zero-defect strategy.

Keywords: zero defect principle, machine vision, particle analysis, automated inspection.

Motivation

Zero Defects (ZD) concept was introduced in the American industry from the 1964 to the early 70s. It was designed as a management-led program to eliminate defects in industrial production [1]. Quality expert, Philip Crosby later incorporated it into his "Absolutes of Quality Management" and it enjoyed a renaissance in the American automobile industry as a performance goal more than as a program in the 90s. Although applicable to any type of enterprise, it has been primarily adopted within supply chains wherever large volumes of components are being purchased. In the new perspective of emerging technologies such as machine vision, human-computer interaction, deep learning applied in assisting human decision, the ZD principle has a new chance to become a feasible in almost any industry.

In this paper, we present technical approaches to automatically detect faulty products that can be applied to any operation flow within the production chain. The most common inspection tasks are detecting the presence or absence of parts in an image and measuring the dimensions of parts to determine if they meet specifications. Measurements are based on characteristic features of the object represented in the image. Image processing algorithms classify the type of information contained in an image as edges, surfaces and textures, or patterns. Different types of machine vision algorithms leverage and extract one or more types of information.

The steps to perform machine vision are presented in Figure 1 A. The first step is to locate object to inspect. In a machine vision application, measurements are extracted from regions of interest (ROIs) rather than the entire image. To use this technique, the parts of the object must always appear inside the ROIs defined. If the object under inspection is always at the same location and orientation in the images, defining ROIs is simple. Often, the object under inspection appears shifted or rotated in the image to be processed with respect to the reference image in which the object is located. When this occurs, the ROIs need to shift and rotate with the parts of the object of interest. During the measurement process, the coordinate system moves with the object when the object appears shifted and rotated in the image to be processed. This coordinate system is referred to as the measurement coordinate system. The measurement automatically moves the ROIs to the correct position using the position of the measurement coordinate system with respect to the reference coordinate system.

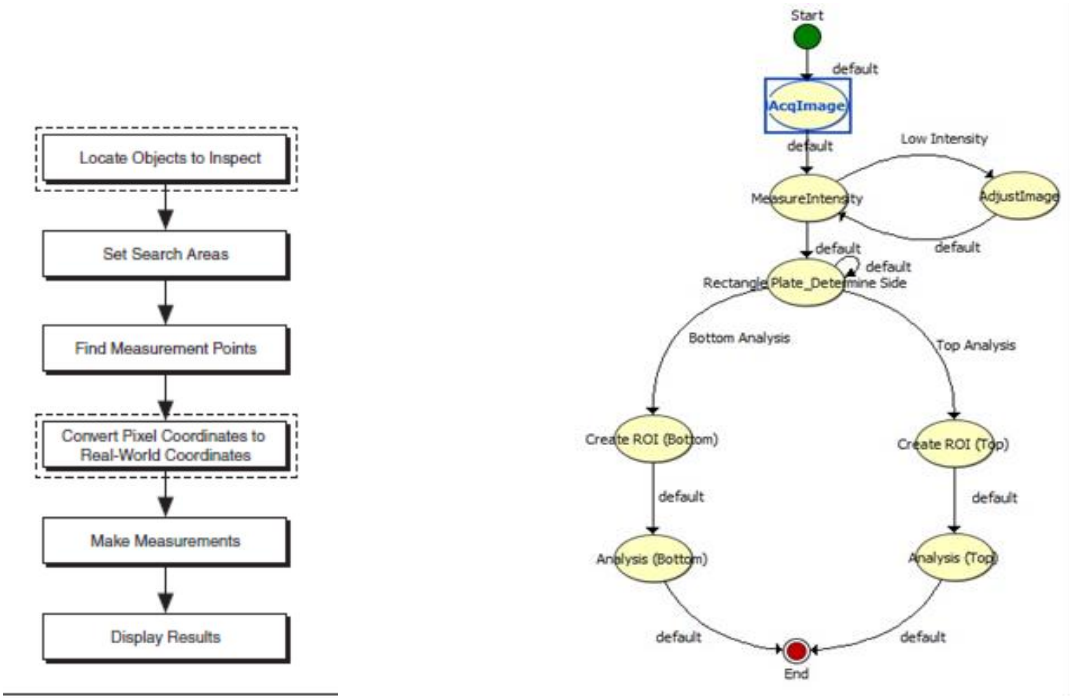

Fig. 1. A. Steps for Performing Machine Vision B. State diagram

Results

The case study was designed for performing particle analyses in Visual Builder for Automated Inspection software. The dataset was composed of 200 images that have been processed according to the steps presented in Figure 1A. The automated inspection has been created on the bases of an inspection state diagram Figure 1B. The inspection state diagram is a graphical representation of a finite state machine. Each state in the inspection is intended to contain a separate set of inspection steps. To access the functions in a state, one have to click the state in the state diagram. The currently selected state is highlighted in blue on the state diagram (Figure 1B). The default transition occurs if the transition requirements for other possible transitions are not met. Inspections have proved an accuracy of 95%. One of the conclusions is that ZD achieved automatically through machine vision inspections adds value to the product, improves profitability and reinforces competitive advantage of the company. Machine vision techniques have improved the facility's overall productivity, increased quality and reduced resource usage. The changeover to fully automated, continuous in-line inspection is a feasible solution proposed in this paper and exemplified in a case study for ceramic industry. This work was supported by a research grant of the Romanian National Authority for Scientific Research and Innovation, CNCS/CCCDI UEFISCDI, project number PN-III-P2- 2.1-BG-2016-0333, within PNCDI III.

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Microcontroller's using in monitoring the maintenance system of flexible manufacturing lines

Gheorghe Marc[1)], Alexandru Nițu[2)]

[1)]University "1 Decembrie 1918" of Alba Iulia, Department Science and Engineering, gheorghemarc@yahoo.com
[2(]SC.StarAssembly.SRL Sebeș, Maintenance Department, nitualex93@yahoo.com

Abstract— The paper presents a way of improving the interventions of the maintenance department made on the continuous manufacturing lines. The main purpose is represented by decreasing the times of stationaries of the machines and eliminating the loss of production. Using this system, the spent time for each planned reparation will also be decreased.

Keywords— microcontrollers, industrial communications, databases, electronic system for maintenance, management of defects

Introduction

At the moment, every manufacturing machine has a proper maintenance sheet which is used to track the last revisions and interventions made on the machine. This monitoring is made in a manual mode, that sheet being handwritten by the maintenance personnel after every procedure. This paper is about realising a new monitoring system of the maintenance processes in an automatic mode using an electronic device which communicates with a database.

The main types of maintenance operations

The main types of maintenance operations are: [1]

A. *Preventive maintenance*

This type of maintenance consists of two components:

Monitoring situation

This includes actions that detects defects - for example: visual, olfactory or ultrasound inspections.

Preventive maintenance

This includes actions that prevents defects – for example: adjustments, greasing, alignments and so on.

B. *Predictive maintenance*

This type of maintenance determines the status of the equipments in order to predict the frequency and the way that maintenance should be performed. This approach offers cost savings both in terms of energy consumption, spare parts and the costs generated by the downtimes of the equipment.

Most predictive maintenance inspections are performed while the equipment is running (daily routine), minimizing disruptions during the normal operations of the system.

C. *Proactive maintenance*

An efficient proactive maintenance program leads to an precise action plan and it's implementation in the right time.

Proactive maintenance is an effective way to reduce machine intervention times by increasing the reliability of the equipment and its time of proper operation.

D. *Corrective maintenance*

This type of maintenance is made when a fault appears on the equipments in order to restore it to the normal operating conditions. [2]

The classic system of monitoring the maintenance processes

The classic system used by maintenance department to track the specific processes is represented in the following block diagram:

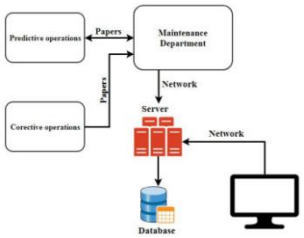

Fig. 1: The block diagram of the classic monitoring system

The server is used to store necessary documents for maintenance, like documentations of the machines, monitoring of the spare parts, maintenance specific procedures and lists for tracking all the maintenance operations that have been done on each equipment.

The classic system of monitoring the maintenance processes is based on the following steps:

- checking on the database or the specific sheet of the machine if there is needed any predictive/preventive operation
- after every maintenance process made on one of the machines, the responsable of the process have to complete the sheet with all the details
- after completing the sheet of paper, the details of the process must be inserted once again, but this time into the database

The new system of monitoring the maintenance processes

The new system of monitoring the maintenance processes is based on the following block diagram:

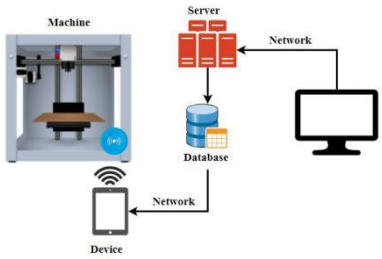

Fig.2: The block diagram of the new monitoring system

The monitoring device is used to scan the RFID tag of an equipment to get all the necessary details about it. When scanning the RFID tag of an equipment, on the display of the monitoring device appears a menu which allow the users to select what information needs about the scanned equipment, the informations being received using the network, for example: the documentation of the machine, the database with all the operations that have been done in the past, the specific procedures for that equipment, every type of maintenance and its specific operations and their history.

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Cost Effective Remote Control System for Analog Audio Mixers

Alina-Elena, Marcu[1)], Robert-Alexandru, Dobre [2)], and Marian, Vlădescu [3)]
[1)] Electronic Technology and Reliability Department, "Politehnica" University of Bucharest, Bucharest, Romania, alina_elena.marcu@upb.ro
[2)] Telecommunications Department, "Politehnica" University of Bucharest, Bucharest, Romania, rdobre@elcom.pub.ro
[3)] Optoelectronics Research Center (UPB-CCO), "Politehnica" University of Bucharest, Bucharest, Romania, marian.vladescu@upb.ro

Summary: At musical events, all the signals are summed using a sound mixer, then the resulting mix is delivered to the main sound system. In small or medium venues, the placement of the audio mixer is not optimum (in front of the stage). The sound engineer is in the situation in which he must make the required adjustments while being placed in a corner of the hall or right near the stage. The audience is mostly placed directly in the front of the stage. The different placement of the sound engineer and the majority of the public leads to differences between the sound heard by the audience and the mixer operator. To fix this problem, the sound engineer must be able to walk around the venue and adjust the mixer from a distance. The paper presents a system designed to allow the remote control of the audio signals entering the mixer using an Android application which can run on a phone or tablet. This allows a critical upgrade to analog audio mixers with much lower costs than the upgrade to a digital mixer would involve.

Keywords: audio mixer, Bluetooth, Android development.

Motivation

With the evolution of the music technology, digital audio mixers began to appear with more capabilities than analog audio mixers, including remote control. Unfortunately, they are much more expensive than the analog versions and no venue manager will soon find profitable investing in one, given the fact that the most venues already own an analog mixer and, even it cannot be remotely controlled, concerts are still organized. The audition quality is not the best.

An important element is that every analog mixer has a dedicated connector on every audio channel which allow the user to connect any audio processing device on that specific audio channel (i.e., "insert" connector). The proposed system is designed to use this connector to allow the remote control of the level of the audio signals using Bluetooth, giving the sound engineer the freedom to set the important parameters for an audio mixer from the position where the audience will hear it, resulting in a much better listening experience. To achieve this, the required hardware was designed, and a mobile phone or tablet application was developed in Android Studio development environment.

The total cost of the proposed system is comparable with the difference between an analog mixer and a digital one having the remote, being much cheaper to have this upgrade for an analog mixer than switch to a digital one. The venue managers would find it an attractive option to improve their business, while the sound engineers would be able to do a much better job.

Results

The proposed system was designed to allow the remote control of the audio signals entering the mixer using a mobile phone or tablet. It consists of a number of digitally controlled 62 dB attenuator [1] (the system is scalable), low-power dual-operational amplifier [2], a voltage regulator [3], a Bluetooth module and a microcontroller, as illustrated in Figure 1.

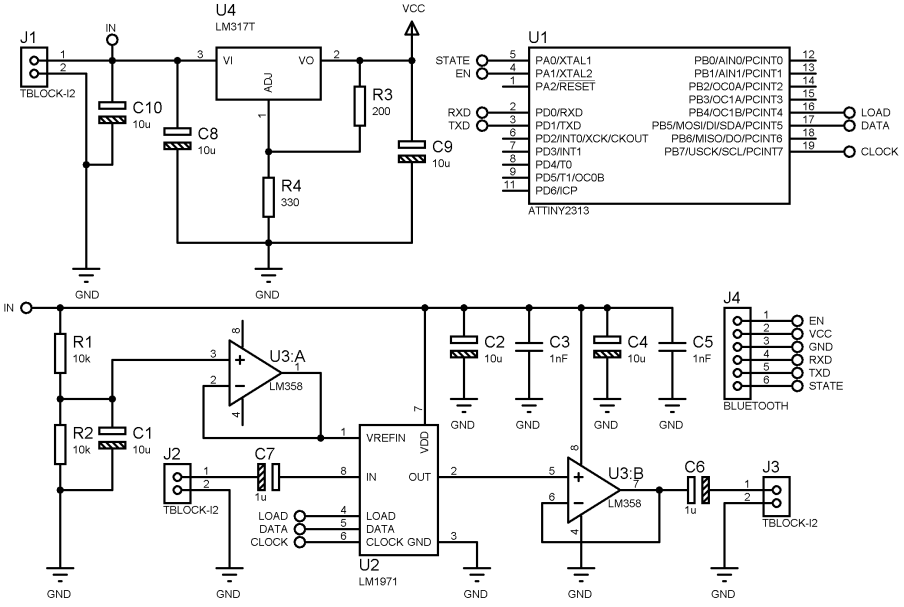

Figure 1: The schematic diagram of the proposed system.

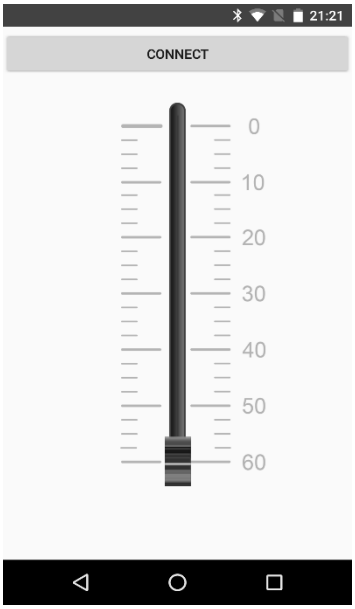

Figure 2: The Android application.

To control remotely the system through a Bluetooth communication, an Android application was developed in the Android Studio development environment, and its interface for one audio channel is shown in Figure 2. The mobile phone or tablet app features a “Connect” button used for making the connection between the Bluetooth module mounted on the proposed system and the Android application, and a slider used for selecting the desired values for the attenuation. The user sets the desired attenuation for each audio channel in the app, then the corresponding command codes are generated and sent over Bluetooth. The command code for each audio channel is represented by a string of characters, two indicating the channel and another two for the desired attenuation. The microcontroller receives the codes and sends the corresponding signals to the attenuators to set the required attenuation. The Bluetooth communication can be regarded as a RS232 radio tunnel, thanks to the used module (HC-05). The system is easily scalable, as the DATA and CLOCK lines are shared by the attenuators, and only the LOAD lines must be independent.

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[3] Texas Instruments, " LM317 3-Terminal Adjustable Regulator", Revision X, 2015.

Optoelectronic method for determinating the selective serotonin reuptake inhibitors

[1)]Maria Neicu, [1)]Radu Macovei,[2)]Paul Şchiopu,[2)]Marian Vlădescu,
[2)]Ruxandra Populeanu,[2)3)]Gina Caragea,[2)3)]Mihai Ionică
[1)]University of Medicine and Pharmacy "Carol Davila", Bucharest, Romania
[2)]Optoelectronics Research Center, University "Politehnica" of Bucharest, Romania
[3)]Medical-Military Scientific Research Center, Bucharest, Romania

Summary: Mass spectrometry is an optoelectronic method of identifying organic substances by comparing their mass spectrum of the analyte with the mass spectra deposited in the mass spectrum libraries of the system. High Pressure Liquid Chromatography (HPLC) coupled with Mass Spectrometry (MS) has as main objective the identification of drugs with a molecular molecule of less than 1500 amu [1]. To identify the biological products of antidepressants SSRIs have been deposited in the mass-spectra of the MI library, mass spectra obtained in a HPLC-MS interface with ElectroSpray Interface (ESI) or Atmospheric Pressure Chemical Ionisation (APCI). In the paper are presented the mass spectra of selective serotonin reuptake inhibitors (SSRIs) antidepressants: citalopram, escitalopram, fluoxetine, fluvoxamine, paroxetine and sertraline.

Keywords: HPLC-MS, ESI, APCI, SSRIs antidepressants

Motivation

SSRI antidepressants are drugs used to treat depression and anxiety. They interact with neurotransmitters. Neurotransmitters are the chemical substances involved in transmitting the nervous influx into the brain. It has been found that neurotransmitters can cause depression as a result of interference with the transmission of the nervous influx. These antidepressants prevent the accumulation of serotonin in the nerve cells. These types of antidepressants help regulate serotonin levels in nerve cells. It is used to treat major episodes of depression, panic attack with or without agoraphobia [2]. The identification and / or dosing of these drugs and / or their metabolites are intended to prevent intoxication with these drugs by adopting an optimal dose of antidepressant in the case of chronic treatment [3, 4].

If the amount of SSRI is not the right one, side effects such as tiredness, sleep disturbances, weight and sexual problems may occur. People who are under 25 years of age may have the desire to suicide. It is not clear whether use during pregnancy or breast-feeding is safe. The paper develops a method that determines the substance administered with the utmost precision [2].

Results

In order to obtain the mass spectrum, it is essential to determine the operating parameters of the installation: the ionization type, the operating temperatures, the scanning speed, the acquisition range and the operating voltage of the detector. In Fig. 1, the mass spectrum of citalopram is presented. These and the mass spectra of the other antidepressant SSRIs are deposited in the MI mass spectral library and can be used to interpret urine samples collected from patients who are receiving treatment with these substances.

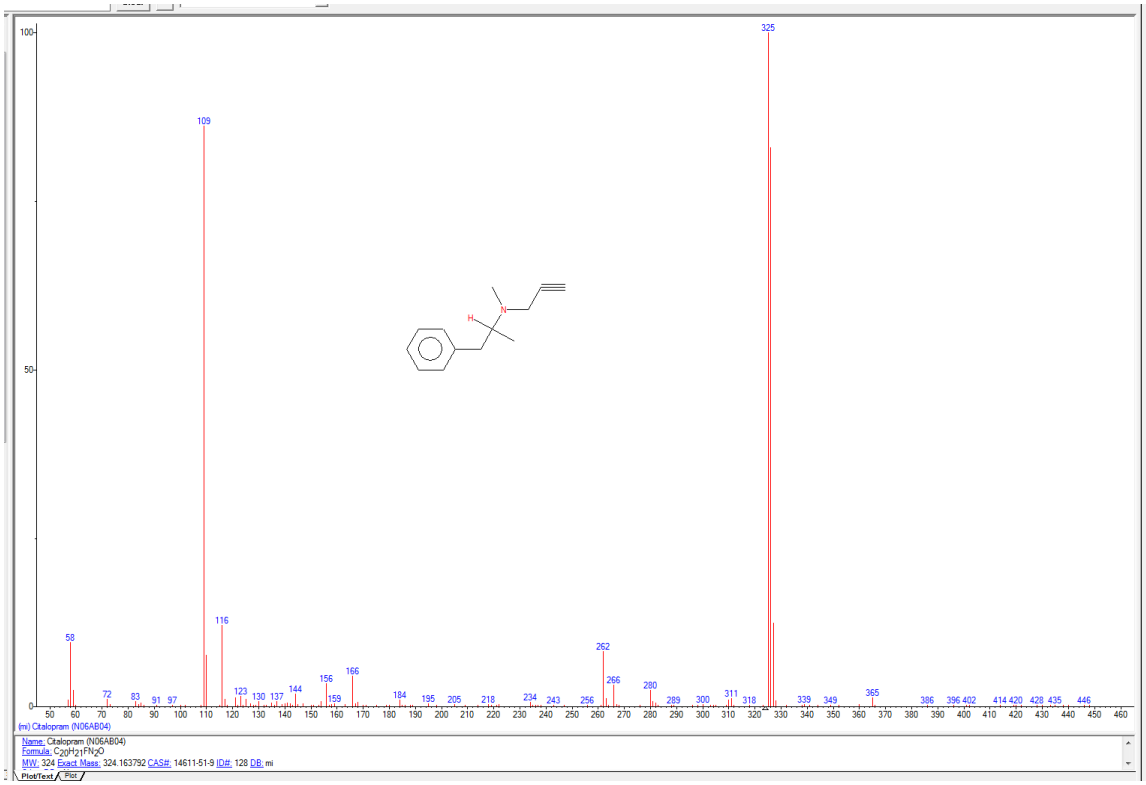

Fig.1. The mass spectrum of citalopram.

References

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Optoelectronic method for determining tramadol and its metabolites from urine samples

[1)]Maria Neicu, [1)]Radu Alexandru Macovei, [2)]Paul Şchiopu, [2)]Marian Vlădescu,
[2)]Ruxandra Populeanu, [2)3)]Gina Caragea, [2)3)]Mihai Ionică
[1)]University of Medicine and Pharmacy "Carol Davila", Bucharest, Romania
[2)]Optoelectronics Research Center, University "Politehnica" of Bucharest, Romania
[3)]Medical-Military Scientific Research Center, Bucharest, Romania

Summary: Tramadol is an opioid drug used to treat moderate to moderate pain, which has two different mechanism of action. The first is due to binding to the opioid receptor, and the second is due to the inhibition of serotonin and norepinephrine reabsorption. Due to its hallucinogenic effects, tramadol is also used as a substance of abuse [1]. It is necessary to identify tramadol and its metabolites in urine specimens either for correct dosing of the tramadol in pain therapy, for monitoring the effectiveness of addiction treatment, or for acute poisoning with this opioid compound [2]. An optoelectronic gas chromatographic method coupled with mass spectrometry is presented to determine tramadol and its metabolites in urine samples [3].

Keywords: tramadol, urine, GC-MS.

Motivation

Tramadol is an opioid drug used to treat moderate to moderate pain, which has two different mechanism of action. The first is due to binding to the opioid receptor, and the second is due to the inhibition of serotonin and norepinephrine reabsorption. Due to its hallucinogenic effects, tramadol is also used as a substance of abuse [1].

From a medical point of view, identification of tramadol and its metabolites in urine specimens is required either to establish an effective dose in the treatment of pain, or to monitor the effectiveness of addiction treatment or acute poisoning with this opioid compound [2].

The identification of tramadol and its metabolites is done with a GC-MA Varian system [2,3]. The working parameters of the GC / MS Varian system for separating and identifying tramadol and its metabolites in urine are presented below.

For gas chromatograph

- Injector temperature: 300 ° C
- Interface temperature GC-MS: 260 ° C
- He Flow rate on column: 1.2 mL / min
- Amount of sample injected - 1µL
- Capillary column DB-5MS (30 m, internal diameter 0.25 mm, film thickness 0.25 µm).

The column gas furnace temperature program is given in Table 1.

Table 1. Chromatograph gas furnace temperature schedule.

Temperature (°C)	**Rate** (°C/min)	**Hold** (min)
140	0.00	1
290	5.00	14.00

For the mass spectrometer

Temperature of manifold 80^0 C

Temperature of the 170^0 C

Ionizing current 20 µA

Acceleration voltage 70 eV
Purchase range 50 - 450 amu
Background noise correction 45 amu
Purchase speed 1 scan / s
Procedure:
0 - 5 min - closed filament;
5 - 45 min fool scan acquisition.

In the paper is presented the analysis performed for a urine sample, collected from a patient hospitalized in the ICU II Toxicology Section of the Bucharest Emergency Clinical Hospital.

Results

In Fig. 1. The total ion chromatogram of the patient's urine sample is presented in the ATI II Toxicology Section, where tramadol peaks, two metabolites and another opiate compound, dextromethorphan, are indicated. At the top of Fig. 1. the tramadol mass spectrum obtained with the optoelectronic method shown is given.

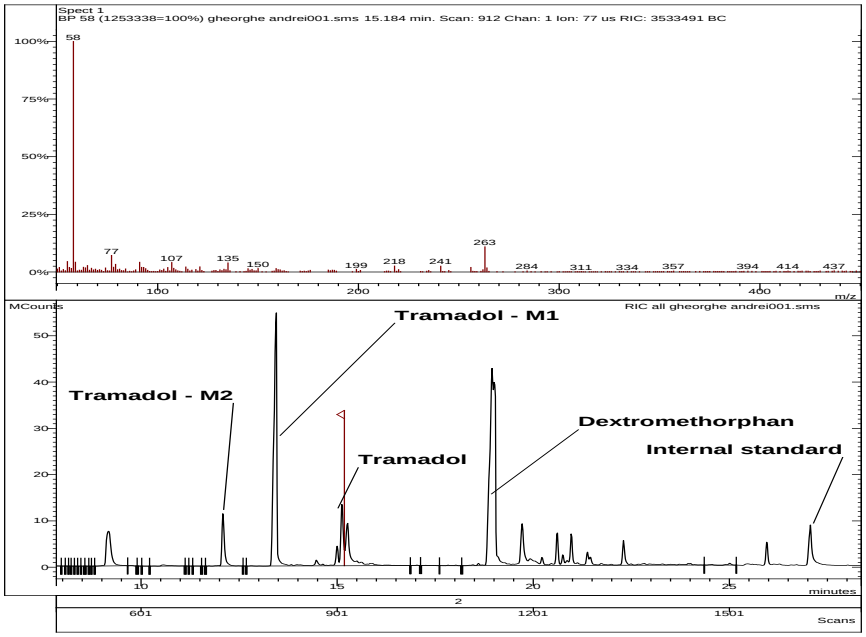

Fig. 1. Total ion chromatogram of the sample with tramadol, two metabolites and dextromethorphan.

References

[1] Voicu V., Macovei R. ,Miclea L., „Ghid de toxicologie clinică. Ed. Brumar Timişoara” (2012).
[2] Voicu V., Ionică M., Macovei R., Paul F., Florea D., Sârbulescu C., Miclea L., Creţu G., Caragea G., „Utilizarea sistemului GC/MS pentru diagnosticul analitic toxicologic în toxicologia clinică. Congresul Balcanic de Toxicologie Analitică,” 7 - 11 october 1998, Plovdiv – Bulgaria, (1998).
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Towards Automated Defect Detection in Porcelain Industry

[1)]Daniela Onita, [1)]Manuella Kadar, and [1)]Adriana Birlutiu
[1)]Department of Computer Science and Engineering/1 Decembrie 1918 Univeristy of Alba Iulia
danielaonita25@gmail.com, mkadar@uab.ro, adriana.birlutiu@uab.ro

Summary: In this paper we have investigated the use of integral Robot Vision (iRVision) technology for defect detection in porcelain industry. iRVision is a ready-to-use robotic vision package available for FANUC robots. We investigated defects which are located on the back of the plate. Here, we present an updated version of [1].

Keywords: defect detection, computer vision, porcelain.

Motivation

Defect detection is an important problem in the porcelain industry which is currently performed by employees. In this work we investigate a solution that will lead to the automatization of the defect detection in a porcelain factory. The types of defects that we investigate in this work are defects which are located on the back of the plate on the middle circle (some examples are shown on Figure 1). This is a more difficult problem than the defects that we investigated in [1] since here the contrast is not very strong.

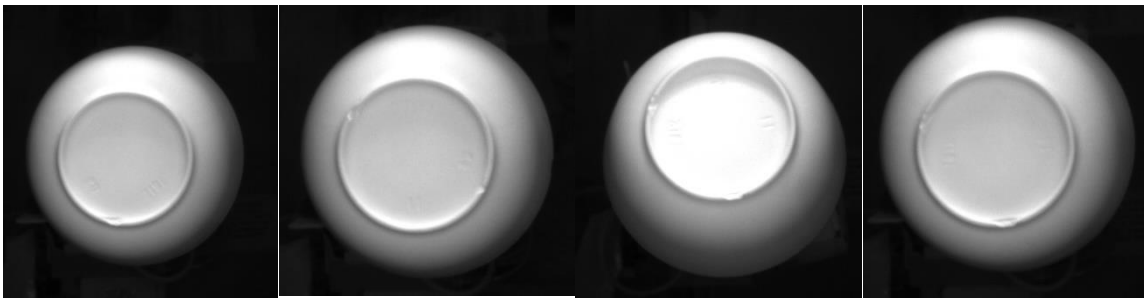

Figure 1: Sample of defects that we investigate in this work.

Results

The first step for the automated inspection is the preprocessing phase. Figure 2, left and middle images show an example of the results of applying different type filters. Using Image Preprocess Tool we applied *Sharpen* and *Blur* filters, each one for 5 times (the number of times a filter is applied influences the degree of preprocessing).

The second step is to select the best iRVision tools for our problem. We used *GPM locator tool* and *Surface flaw inspection tool*. *GPM locator tool* was used to detect the plate regardless of its position in the image and *Surface flaw inspection tool* was used to detect cracks on the surface of the plates.

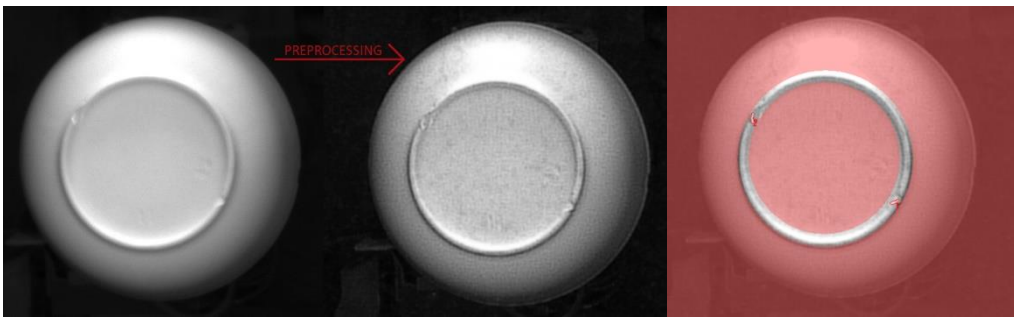

Figure 2: Left and middle image: Preprocessing phase. Right image: Mask applied for hiding uninteresting areas.

In order to automatically select the region of interest, we used a mask for hiding the areas that are outside the plate and also for masking the areas around the middle circle on the back of the plate (Right image in Figure 2).

Surface flaw inspection tool has several parameters that we used:

- *Run-time mask*: specifies an area of the search window that is not of interest for inspection.
- *Flaw color*: shows the color of the flaw in the surface. For flaw color parameter we used *white* value because the cracks are white in the plate surface.
- *Contrast threshold*: specifies how clearly the contour is perceivable in order to be considered as a flaw. We set it as value of 28.
- Two filters: *Blur* for 8 times and *Sharpen* for 3 times.

Figure 3 shows a passed and two failed inspections. For evaluation tool we set as variable the number of defects returned by Surface flaw inspection tool. If the number of defects is equal with 0 then the target passes the inspection, else it fails the inspection.

Figure 3: Detecting cracks on the back of the plates. Left image: Passed inspection. Middle and right images: Failed inspection.

***Acknowledgment**: This work was supported by a research grant of the Romanian National Authority for Scientific Research and Innovation, CNCS/CCCDI UEFISCDI, project number PN-III-P2-2.1-BG-2016-0333, within PNCDI III.*

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[2] R. Baeta. Automated Quality Control in Ceramic Industry. Dissertation. Mechanical Engineering Department, Instituto Superior Tecnico, Lisboa, Portugal, 2013.

[3] FANUC Robot series R-30iB/R-30iB Mate CONTROLLER iRVision Inspection Application Operator‘s Manual

Methods for increasing the sensitivity and signal-to-noise ratio in mass spectrometry for the determination of cocaine and ethylbenzoylecgonine in urine

[1)]Ruxandra Populeanu, [1)]Marlena Vicleanu, [1)]Andreea Raluca Băjănaru,
[2)]Radu Alexandru Macovei, [1)]Marian Vlădescu, Gabriela Anghelescu[3)], Genica Caragea[2,4)],
Mihai Ionică[1,4)]
[1)]Department of Electronic Technology and Reliability, Faculty of Electronics,
Telecommunications and Information Technology,
University "Politehnica" of Bucharest, Romania
[2)]Clinical Emergency Hospital Bucharest, Romania
[3)]Departament of Forensic Pathology/Clinical Hospital Târgovişte, Romania
[4)]Military-Medical Scientific Research Centre Bucharest, Romania

Summary: Mass spectrometry is an optoelectronic method of determining organic substances by comparing their mass spectrum with mass spectra found in system libraries. In the case of biological products, substances of interest, biotic or xenobiotics, may be "*hidden*" from the background of the analyzed matrix noise, which alters the major aspect of the mass spectrum obtained and faces the impossibility of their identification. A gas chromatograph coupled with mass spectrometer (GC-MS) Varian, was used to develop the application. Authors presented two methods for increase the sensitivity or the signal/noise ratio for identification the cocaine and their metabolite ethylbenzoylecgonine (EBE).

Cocaine is an drug abuse with major toxic effects on the body. Treatment is complex,but its main effects may occur in the heart and cause the patient to die. For proper treatment of poisoning, it is necessary to identify the presence of this and its metabolites in the urine. Thepresence of the ethylbenzoylecgonine (EBE) metabolite, gives information about the time of poisoning.

In order to obtain the MS/MS spectrum of cocaine (Fig.1) we have used the parent ion 303 and for obtaining the MS/MS spectrum of ethylbenzoylecgonine (Fig.2) the parent ion 317.

Keywords: GC-MS, cocaine, ethylbenzoylecognine, urine

Motivation

In the last years, the drog-abuse substances have reached a very high growth and they have been consumed in combination, some of them even lethal. Because of their chemical complexity, but also because they are administrated in combination with other substances, it is very important that the method we develop should be suitable to detect only the substance of interest and not any other, even if they are present in the analyzed sample.

Our target is to develop more efficient methods for the most used drog-abuse substances in Romania. That being said, we have begun our studies in the Laboratory of ATI Section of Emergency Hospital “Floreasca” from Bucharest about 2 years ago and we have developed methods for detecting certain substances. With another words, we want to build our owns methods and our own mass-spectrums.

Results

The only ways to compare our result are the libraries Wailey and NIST of the mass-spectrometer. These are results obtained for the first time in the world of science in order to determine substances. In our result, we can see that the ions parents and the ion-cromatograms are very close to the ones from the libraries for both methods MIS and MS/MS. It is very important that the method we develop should be suitable to detect only the substance of interest and not any other, even if they are present in the analyzed sample.

In the figures 1 and 2, we can see the mass spectrums of cocaine and EBE. The ion parents are easily seen because the two spectrums are without any noise.

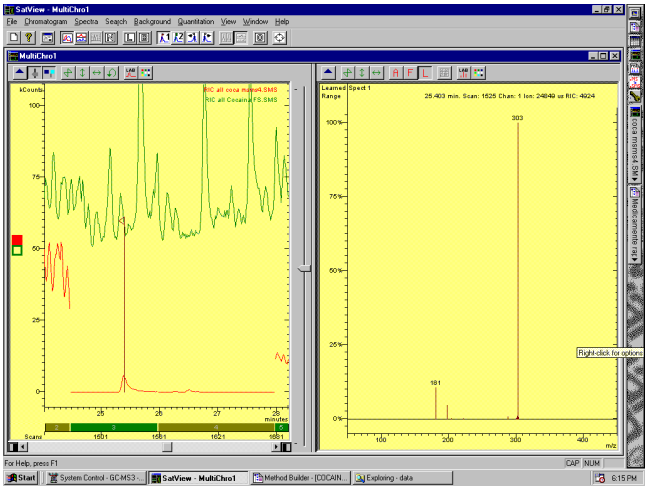

Fig. 1. The mass-spectrum of cocaine

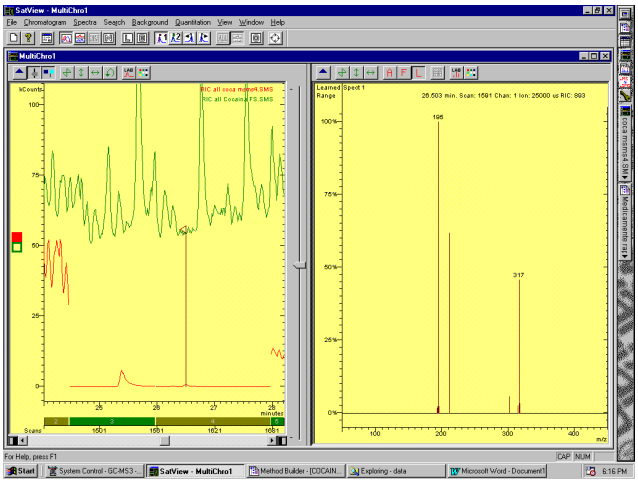

Fig.2. The mass-spectrum of ethylbenzoylecgonine

References

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[4]. Avram O. Studiul particularităţilor în intoxicaţiile acute cu substanţe de abuz. Cercetări clinice şi paraclinice. Teza de doctorat. UMF “Carol Davila”, Bucureşti (2015).

Optoelectronic method for improving the signal-to-noise ratio of the mass spectrometer for determinating methadone and its metabolite

[1)]Ruxandra Populeanu, [1)]Marlena Vicleanu, [1)]Andreea Raluca Băjănaru,
[1)]Radu Alexandru Macovei, [1)]Marian Vlădescu, [1)3)]Mihai Ionică
[1)]Department of Electronic Technology and Reliability, Faculty of Electronics, Telecommunications and Information Technology, University "Politehnica" of Bucharest
[2)]Clinical Emergency Hospital Bucharest, Romania
[3)]Military-Medical Scientific Research Centre Bucharest, Romania

Summary: Mass spectrometry is an optoelectronic method of determining organic substances by comparing their mass spectrum with mass spectra found in system libraries. In the case of biological products, substances of interest, biotic or xenobiotics, may be "*hidden*" from the background of the analyzed matrix noise, which alters the major aspect of the mass spectrum obtained and faces the impossibility of their identification. A gas chromatograph coupled with mass spectrometer (GC-MS) Varian, was used to develop the application. Authors presented two methods for increase the sensitivity or the signal/noise ratio for identification the methadone and its metabolite.

Methadone is an opioid used in medicine as an analgesic and antidependent maintenance in opioid dependent patients. It is used in the detoxication and maintenance treatment as an oral substitute for heroin or other opiate drugs. Methadone belongs to the category of special-drug with very high dependence potential and low lethal dose.

In order to obtain the MS/MS and MIS spectrums of methadone, we have used the parent ion 310 and for obtaining the MS/MS and MIS spectrums of its metabolite the parent ion 265.

Keywords: GC-MS, drog abuse substances, methadone, metabolite, urine

Motivation

Substances of abuse have become increasingly complex and consumed today in dangerous combinations, which in some cases can lead even to death. The only method for determining the substance consumed by the patient is through mass spectrometry. Mass spectrometer is a laboratory device that at the time of purchase comes with a software library of spectra from the most known substances to the most recently invented. Our goal is that the developed optoelectronic methods determine the substance to be as accurately as possible, and the only verification that can be done is through direct comparison and search of substances in the Willey and NIST libraries, so the spectra we get are the most related to those in libraries. In our case, methadone has the libraries mass-spectrum described in fig.1.

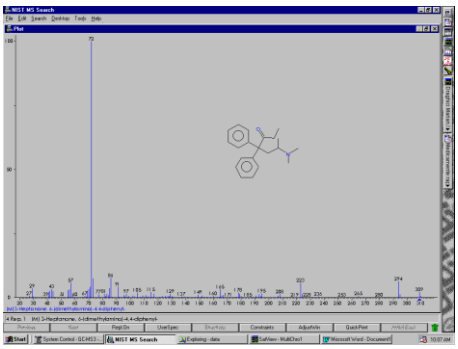

Fig.1. The mas-spectrum of methadone described in libraries

Results

The methods we have developed refer to the chosen mass domains (50-400), the ionization electrical tensions, the currents and the temperatures in the enclosure so as to obtain both the parent ion to be dissociated to obtain the mass spectrum of the mass spectrum (MS/MS), highlighting both methadone (Fig.2) and its metabolite (Fig.3).

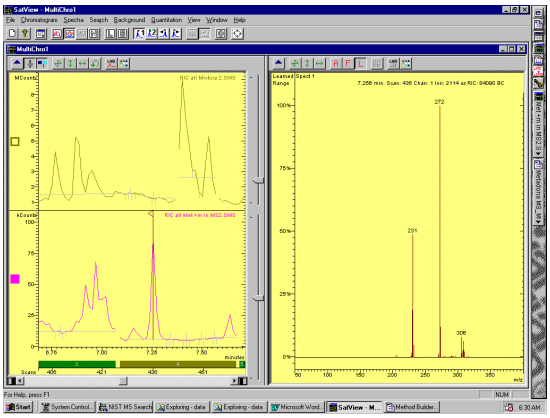

Fig.2. MS/MS of methadone

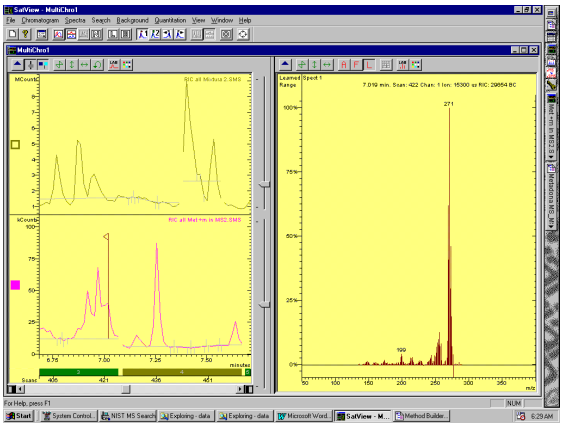

Fig.3. MS/MS for the metabolite of methadone

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Digital Signal Processing Embedded System for USB Communication

Mircea Risteiu [1)], Remus Dobra[1)], Anca Antonov [2)] and Florin Samoila [1)]
[1)] Dep. of Exact Sciences and Engineering, University "1 Decembrie 1918" Alba-Iulia, Romania
[2)] INCDPM ”Aexandru Darabont”, Blvd. Ghencea, no. 35 A, Bucharest, 6 county, Romania

Summary: The universal serial bus (USB) has become a standard for interfacing external devices and equipment to personal computers (PCs). In this paper, the USB connectivity on the TMS320F28012 of the digital signal controller is achieved using the CY768001. This inner does not have a microprocessor, but it integrates a USB2.0 transceiver (physical layer), a USB2.0 serial interface engine SIE (link layer, to implement bottom layer communication protocol), a 4kB FIFO and voltage adjuster.

Keywords: DSP controller, USB communication, Code Composer Studio.

Motivation

We used the CY7C6800 because he can support high speed (480Mb/s) or full speed (12Mb/s) transmitting, it adopts 33V operation voltage and 24MHz external oscillating frequency, it can select 8 bit or 16 bit bus mode, with synchronous and asynchronous FIFO interface. Figure 1 presents the software design flow within Code Composer Studio for performing the USB communication experiment.

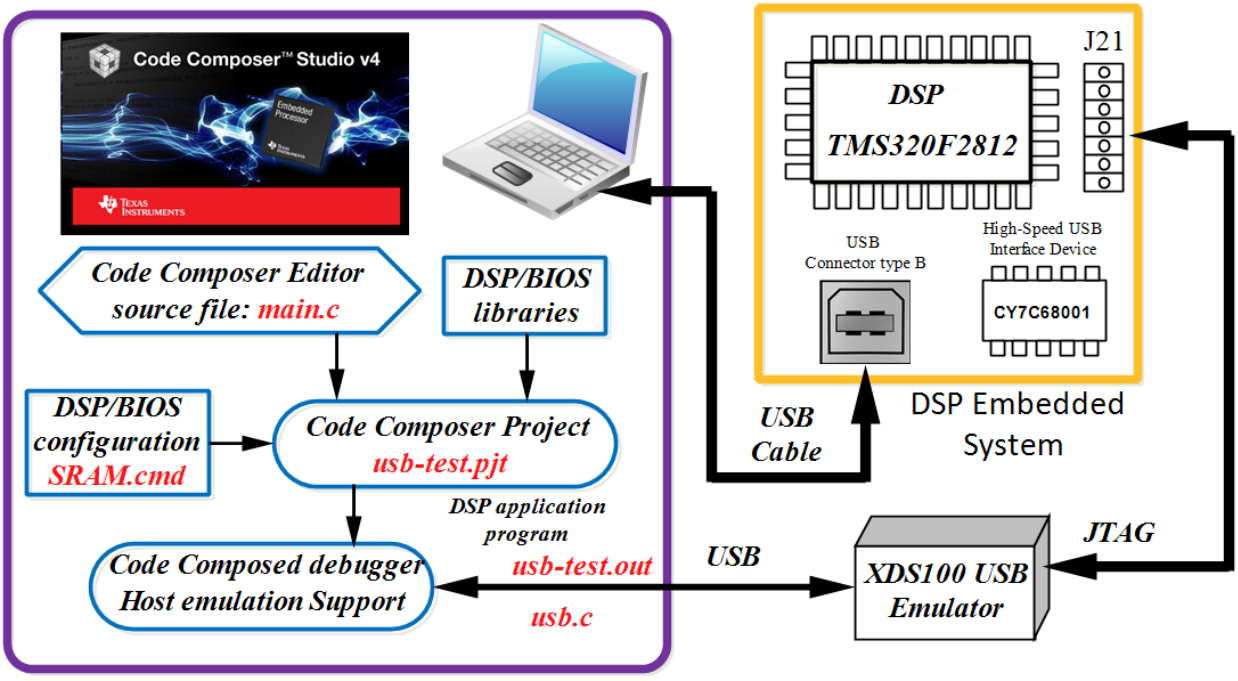

Figure 1: DSP Embedded System physical debugging setup for USB communication.

In the USB communication experiment, the CCS debugger reads the Target Configuration File, creates a Debug Configuration and uses the information in these two files to connect to the JTAG debugger and communicate to the DSP target.

Results

The USB communication experiment for DSP embedded systems was developed in code composed studio. The paper presents a communication architecture for a digital controller based on DSP to be used in embedded systems.

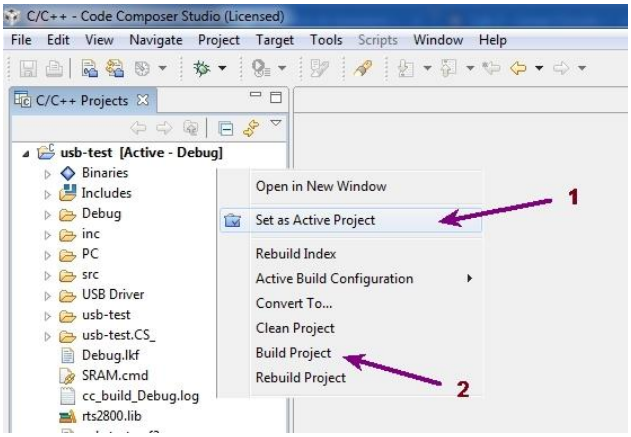

Figure 2: Code Composer Studio building the USB project.

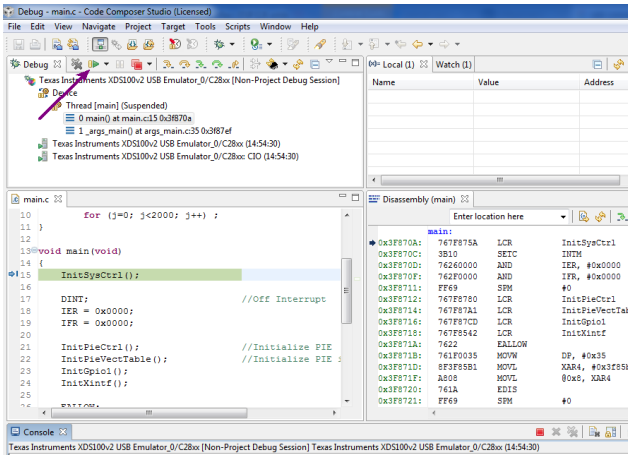

Figure 3: Graphical interface for running the developed USB project

The Cypress USB driver CY3684 EZ-USB FX2LP DVK Setup was installed on the target PC. Enter into the *.inf file to set up the correct USB device that we will use during this experiment. Under the [Device] line, you need to change the VID and PID numbers according to the information regarding your USB driver, from Device Manager.

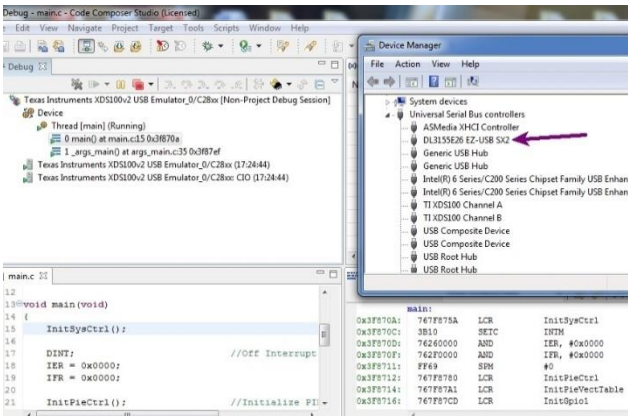

Figure 2: Graphical interface of the software manager for CY3684_EZ-USB_FX2LP_DVK.

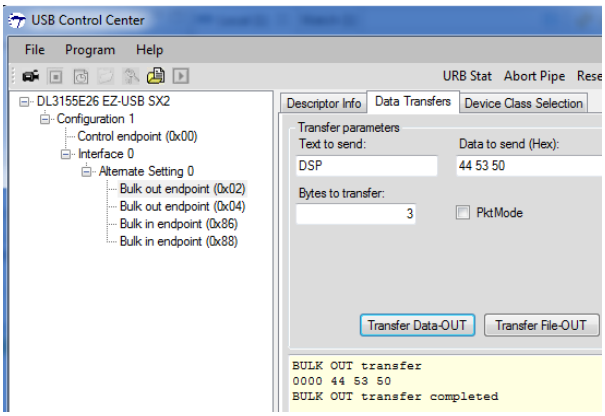

Figure 3: Graphical interface for USB control of developed DSP system

The conceived architecture has CAN-bus communications to expand system with others subsystem, and a compact flash interface to storage data and DSP program, improving platform to boot alone.

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Cross Platform Embedded Setup Design for Electronic Control Unit

Mircea Risteiu [1)], Remus Dobra[1)], M. Ayaz Ahmad [2)] and Florin Samoila [1)]
[1)] Dep. of Exact Sciences and Engineering, University "1 Decembrie 1918" Alba-Iulia, Romania
[2)] Physics Department, Faculty of Science, P.O. Box 741, University of Tabuk, 71491, SAUDI ARABIA

Summary: The Electronic Control Unit has become a standard for managing the entire hardware activity inside of all ignition engines. Now ECU must face also the management requirements in multi- processing units in the cars. The paper is focused on developing an open platform system that will work with the ECU and it is dedicated to test high pressure fuel injection system. The implementation is a dsPIC microcontroller embedded setup communicating via CAN bus, FlexRay, and HiL-API. It uses the standard high pressure sensors, uses the AT communication language, and it is validated by KTS 500 tester of Bosch via EOBD interface. Through this setup we have elaborated a method to re-calibrate the Bosh inkectors.

Keywords: dsPIC controller, optimized design, injection tester,

Motivation

The injector is a complex mechatronic system (see Fig.1). It is a combination of: mechanic system, hydraulic system, and control algorithm of electrical system. Because, the injector is the core part in Diesel Engine system we are focused in our approach to create flexible tester of this component. Next part will be focused on relationships and synchronization of different parameters during injector's work in a period.

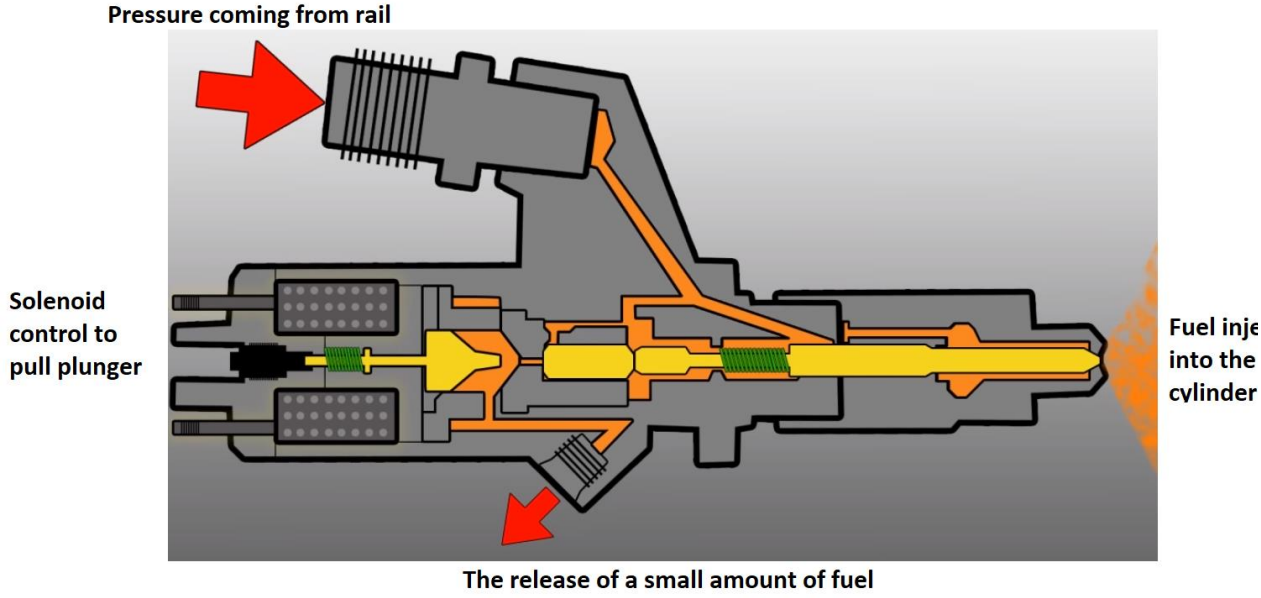

Figure 1: The core component of the Diesel Engine System- high pressure injector.

The high pressure tester will follow the injector characteristic of the injected fuel according with pressure and lifework, in the most recent safety and reliability standards. In our implementation we read data via EOBD II interface and we compare results with KT500 tester.

Results

The quality of the fuel injected into the engine's cylinder is according with: pressure of the fuel in common rail (we read digital data from its sensor), the dimension of the nozzle (type of injector- according with its catalog specification), time of nozzle opening (time of energized solenoid- PWM control from dsPIC) in one cycle. Through a certain number of injection pulses we are automatic calculating the quantity of fuel injected on one fire. This specific calculation will e used later into the ECU algorithms to establish the time of pilot injection.

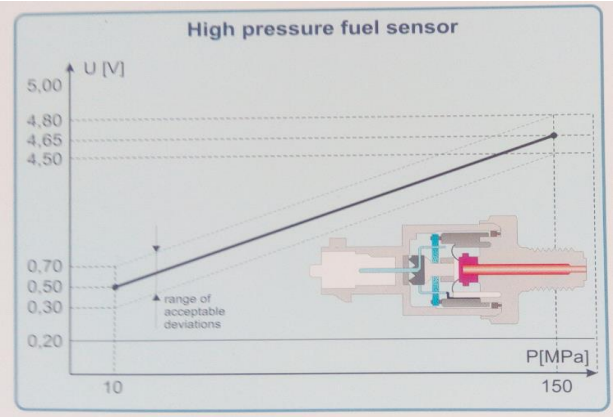

Figure 2: KT500 screen capture of generated voltage as a measure of pressure

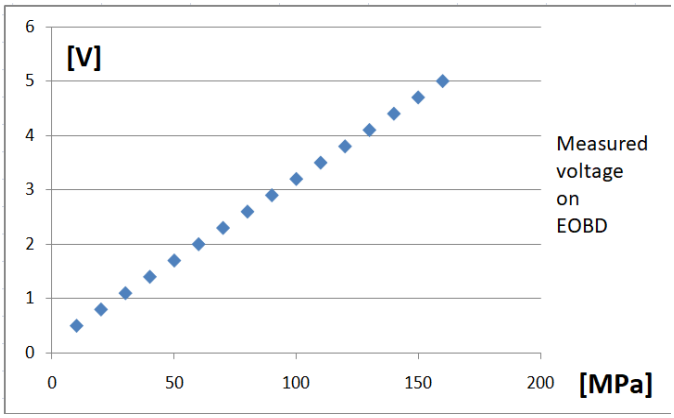

Figure 3: Measured pressure on EOBD for injector evaluation on its characteristics

On the 180000 km injector we have obtained values of voltage (stored in a CSV file) like in figure 3. The linearity errors of measurements are in a range of +/- 5%.

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Industry 4.0 Pilot Laboratory

Károly, Széll[1)], and Attila, Sáfár [2)]
[1)] Alba Regia Technical Faculty, Óbuda University, Székesfehérvár, Hungary,
szell.karoly@amk.uni-obuda.hu
[2)] Alba Regia Technical Faculty, Óbuda University, Székesfehérvár, Hungary,
safar.attila@amk.uni-obuda.hu

Summary: By introducing the concepts of the Internet of Things (IoT) and the Cyberphysical System (CPS), industrial automation is undergoing significant changes. These concepts are not entirely new, but in recent years they have become more and more penetrating into industrial automation, placing automation systems in a very different light. They support the latest trends, such as higher level interconnection of system components, cognitive automation, and information gathering and processing in cloud-based applications. The application of IoT's and CPS's ideas in industrial automation has led to the definition of Industry 4.0, where 4.0 refers to the fourth industrial revolution allowed by Internet technologies to create smart products, smart production and smart services. This paper introduces the industry 4.0 pilot laboratory at Obuda University, Alba Regia Technical Faculty.

Keywords: Industry 4.0, IoT, digitization, smart manufacturing, OPC UA

Motivation

Industry 4.0 as the fourth industrial revolution is an active field in modern automation [1]–[3]. The most important question in this topic: How do machines communicate? Based on the Reference Architectural Model Industrie 4.0 (RAMI4.0) we have chosen Open Platform Communications Unified Architecture (OPC UA) as standardized communication protocol [4].

What is OPC?

The word is an acronym for Open Platform Communications (OPC). The whole OPC is about interoperability and standardization. While the traditional OPC solved the interoperability problem of the device at the control level, the same level of standardization required the Enterprise layer. The classic OPC is based on Microsoft DCOM, which may be vulnerable to these layers. The urgency of simplicity, maximum interoperability, and security has led the OPC Foundation to create a unified data communication method for parts of DA, HDA, A & E, and existing OPC specification security. OPC is a standard issued by the OPC Foundation. In another words OPC means OLE for process control. The basic objective of the OPC standard is to enable hardware manufacturers to create software drivers (OPCs) and software vendors to create applications (so-called OPC Clients) that use standard data exchange. This makes it possible to use the software and hardware of different vendors together. The most widely used version of OPC is version 2. This replaces the earlier version 1 standard. Allows suppliers of industrial-controlled hardware for the production of drivers (so-called OPC servers) and visualization software vendors such as SCADA (so-called OPC Clients) methodology for data exchange.

What is OPC UA?

OPC Unified Architecture (OPC UA) is an extension of the highly successful OPC communication protocol. It enables data collection and information modeling as well as reliable and reliable communication between the site and the company (Fig. 1.).

The most important features and benefits of OPC UA:

- Platform is neutral, executable on all operating systems
- Future-ready and legacy-friendly
- Easy to configure and maintain
- Provides Service-based technology
- Gives Increased visibility
- Allows Greater connectivity
- Ensure Higher performance

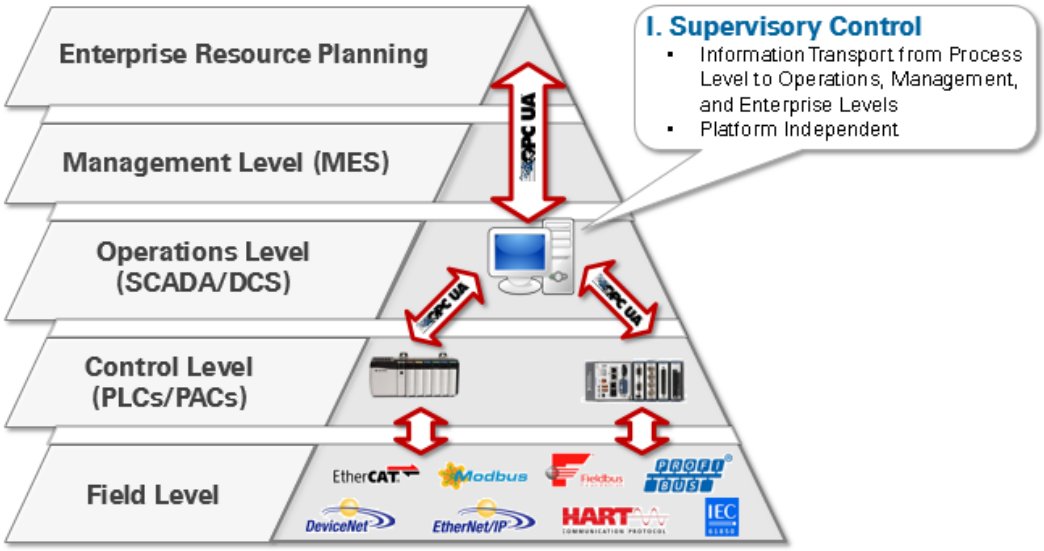

Figure 1: OPC Unified Architecture [5]

Results

The implementation of the industry 4.0 pilot laboratory enables the cognition of the following processes and activities for our students:

- Smart manufacturing
- Internet of things
- Cyber-physical systems
- Big data
- Quality management
- Robust industrial solutions

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Power supplying investigation for smart factory components

Adrian Tulbure[2)], Manuella Kadar[)], and Adriana Barlutiu [3)]
[1) 2) 3)] Department for Science and Engineering/ "1 Decembrie 1918"University of Alba Iulia
aditulbure@uab.ro

Summary: In order to deliver competitive products in the globalization era more and more factories are turning on to the integrated automation. In this way, traditional automated processes add elements of artificial intelligence actuators: cameras, sensors, memories, etc. Practical implementation requires the fulfillment of several conditions in terms of energy supply, and technical data security.

In this paper, the authors perform an experimental investigation of the energy flow absorbed from the power grid by a robotic manufacturing line in the porcelain industry. The paper deals in details with specific energy of the main consumers: manufacturing line, manufacturing center, robot and digital camera. The paper proposes some recommendations regarding the energy optimization of the analyzed system.

Keywords: intelligent power supplying, experimental investigations, energy measurement in real time, manufacturing robot, smart factory.

Motivation

The porcelain industry is a major consumer of electricity and heating energy. By optimizing the consumer operations mode and reducing the specific energy consumption, the competitiveness level of this branch can be increased. In this paper the authors carry out a consumption analysis, identifying location and areas with critical energy consumption and strong reduction potential. Energy analysis is achieved from complex to simple, from the whole (process center, fig.1 /left) to detail (robot with camera, fig.1 /right). By combining inductive and capacitive consumers and adapting the operations mode of the center, considerable energy effects can be achieved.

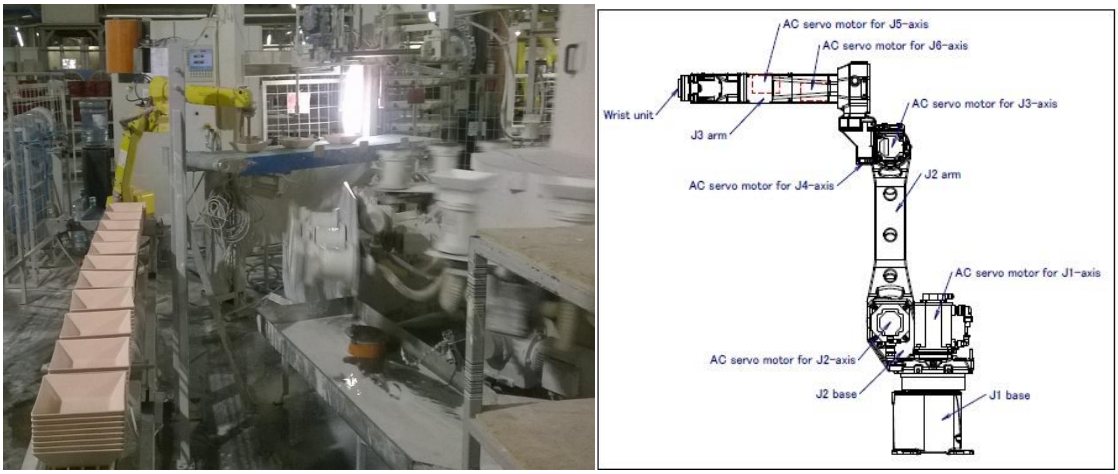

Figure 1: The porcelain manufacturing process.
The basic industrial line (left) and the electromechanical robot configuration (right)

Results

The paper presents systematization of the electrical parameters stored for different periods and operating states, time-dependent: voltage, current, powers, phasors and frequency-dependent as well: THD and THC. The main element on the manufacturing line is the programmable manipulator robot. It has 6 mobility axes (fig.1/right) and can reach any position in own work area and in any operating mode. The inertia moments of the drives are decreasing, respectively, their reaction time increasing up to approx. 600 grd/sec. Consequently, it absorbs variable power with a maximum up to 2500 W (fig. 3).

For real-time recording of energy parameters, the analyzer is connected through sensors between the power grid and the robot's power converter (fig.2). The measurements are carried out on three phases and on the earth conductor.

The results (fig.3.) show some asymmetry at the machining center, which at the robot's interconnection is no longer so distinctly (fig.3/top and bottom).

Center	P_{1c}=1,88kW,	P_{2c}=0.81kW,	P_{3c}=0.85kW,	P_{Tc}= 3.54kW	(1.)
Robot	P_{1r}=0,17kW,	P_{2r}=0.18kW,	P_{3r}=0.14kW,	P_{Tr}= 0.49kW	(2.)

By experimental measurements made "*in situ*", the distorted harmonic regime, specifically for the drives with static power elements was confirmed.

Figure 2: The measurement bench. Current and voltage sensors between power grid and robot.

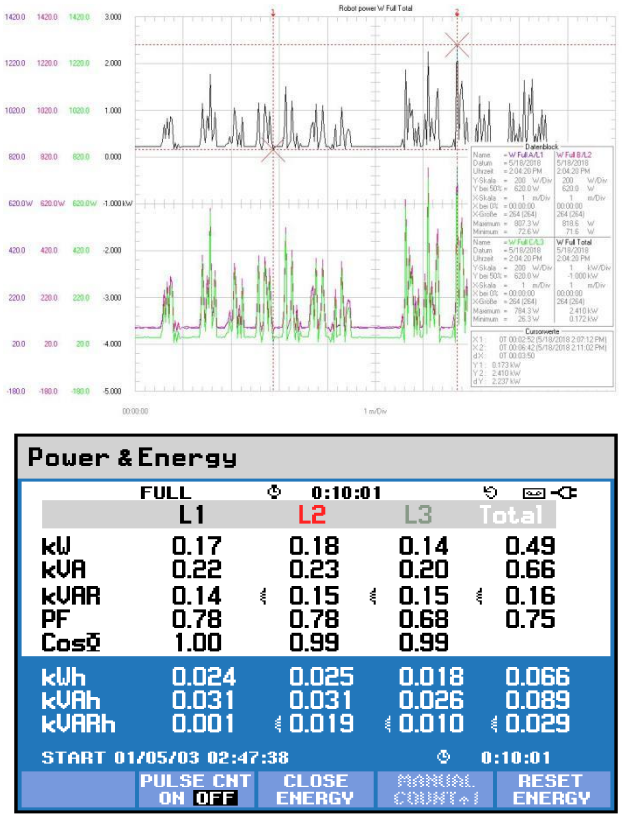

Figure 3: Power and energy measurement. [top] Power evolution. [down]-Phase distributions.

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Advanced Navigation of Automated Vehicles in Smart Manufacturing

Peter UDVARDY, Associate Professor Phd eng. [1)], Károly SZÉLL Associate Professor Phd eng. [1)],
[1)] Alba Regia Technical Faculty, Óbuda University, Hungary, udvardy.peter@amk.uni-obuda.hu,
szell.karoly@amk.uni-obuda.hu

Summary: Smart manufacturing or also known as Industry 4.0 is the current trend in automated manufacturing. It includes IoT, cloud technologies, super-flexible automation and cooperative human-robot interaction to name a few aspects. Utilization of Autonomous Guided Vehicles is crucial in successful smart manufacturing. Our presentation reviews the most widely applied navigation strategies and current research directions related to AGV control.

Keywords: smart manufacturing, intralogistics, AGV,

Motivation

Autonomous Guided Vehicles or Automated Guided Vehicles (AGVs) consist of two main parts namely the vehicle and the controlling system. Navigation is an important part of this system which means exact positioning and path tracking. The navigation method depends on the industrial environment type, inner and outer application need different approaches and techniques. Each technique has advantages and disadvantages and the optimal solution depends on the exact knowledge of parameters.

Generally, only one sensor is used but sometimes more sensors are needed for a more precise positioning. More sensors can be used one after another or simultaneously depending on the environment. When more sensors are used simultaneously and the parameters ensure more information it is called sensor fusion. Using sensor fusion not only more but better quality information can be gained.

Laser navigation system is based on the triangulation method. The Laser emits signals from the AGV and if at least three reflections come back the position and heading of the AGV can be calculated from the directions of the reflected laser beams [1].

Path determination and path tracking are crucial points of AGV systems. Path abrasion can be decreased by using a freer moving path. It is also important to define the extent of preparatory works for path defining and navigation (such as marks, beacons, cords, etc.). The main goal is the collision-free routing using the optimal navigation method. Navigation can be different considering the circumstances. The main navigation methods are:

- Natural navigation
- RFID based localization
- Machine vision based navigation
- Inductive fixed guideline
- Magnetic tape guidance
- Light coding
- Laser navigation system.

Recently, new techniques use blue light source instead of white light to generate 3D-point-cloud. As a result, a higher resolution is achieved and thus, the measurements can be more accurate [2].

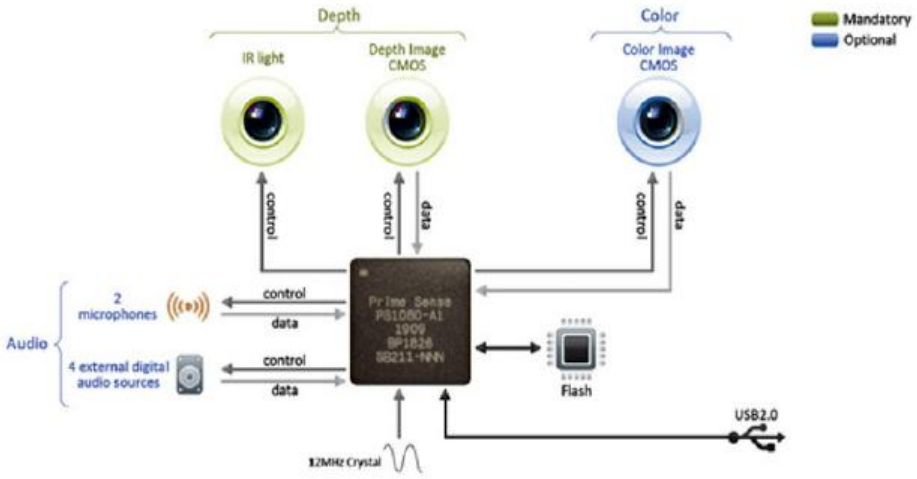

Figure 1: PrimeSense reference design [2]

Sensor fusion techniques have long been used to enhance the accuracy of positioning. One of the sensor fusion solutions can be the following approach that combines the Ultra-Wideband indoor positioning system and an Inertial Navigation System. The sensor fusion algorithm consists of two different parts: the first one is the delay compensation block which compensates the delay in positioning calculation coming from the indoor positioning system and the other block is an extended Kalman Filter (EKF) which combines the dynamic models of movement from the indoor positioning system with the inertial navigation system measurement data. This sensor fusion approach delivers 1kHz position update rate in real time operation with 3,7 centimeters error in linear movements and 1.7 degrees in rotation movement [3].

Conclusions

Our paper is a general overview survey that introduces the role of AGV's in intralogistics and the navigation and positioning possibilities of these machines. The AGV's are parts of Industry 4.0 and this paper supports education.

We can conclude, that the navigation techniques are in continuous development, during navigation process fewer structured signals and markers or guides are used and the recognition of the environment by sensors come more and more into view.

Some special industrial applications or warehouse solutions require wired path installation to the floor but generally these techniques are not up-to-date, not flexible at all and cost a lot.

Sensor fusion can improve navigation accuracy on the one hand and on the other hand it can be used for an environment where both inner and outside navigation is necessary.

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Optoelectronic methods for screening of GHRP-1 and it's metabolite in urine samples

Jeni - Carla Colev [1)], Bogdan Berghes [1)], Mihai Radu[1)], Georgeta Marcela Bican [1)], Marian Vlădescu [2)], Mihai Ionică [1), 2), 3)],
[1)] Doping Control Laboratory Bucharest
[2)] Optoelectronics Research Center (UPB-CCO),
Faculty of Electronics, Telecommunications and Information Technology,
University "Politehnica" of Bucharest
[3)] Centre for Military Medical Scientific Research
marian.vladescu@upb.ro

Summary: GHRP-1 is a synthetic peptide drug. It acts as growth-hormone secretagogue receptor agonist. GHRP-1 has performance enhancing potential and is prohibited for athletes in section S2: Peptide Hormones, Growth Factors, Related Substances, And Mimetics of WADA (World Antidoping Agency) Prohibited List. In this work we developed and validated a screening method for GHRP-1 and it's metabolite from urine on LC-HRMS (liquid chromatography coupled with high resolution mass spectrometry) (Q Exactive Plus from Thermo Scientific) and LC-MS/MS triple quadrupole (liquid chromatography coupled with mass spectrometry) (ABSciex QTrap 5500). The validation parameters evaluated were limit of detection, matrix effects, identification criteria, specificity, carry-over and extraction recovery. The evaluated parameters are in accordance with WADA technical documents, both methods being applicable for doping control application.
Keywords: small peptides, LC-HRMS, LC-MS/MS, metabolite, screening

Motivation

Detection of GHRP-1 and other growth hormone secretagogues in urine samples was intensively studied. GHRP-1 parent compound is completely metabolized and it's administration can be determined only by detection of it's metabolite. Since the limits of detection required for doping control purposes are very low (1ng/mL) according to WADA technical documents[1,2], liquid cromatography coupled to tandem mass spectrometry (LC-MS/MS) technique preceded by an extensive sample preparation proved adequate due to it's high sensitivity and selectivity and many works were published using LC-MS/MS triple quadrupole[3].

Evolution of mass spectrometry led to development of high resolution mass spectrometry (HRMS). Liquid chromatography coupled with HRMS (LC-HRMS) proved useful in detection of growth hormones secretagogues due to it's increased sensitivity and selectivity and several works were published using LC-HRMS for detection of GHS[4,5].

This work presents a comparison between LC-MS/MS triple quadrupole and a quadrupole-orbitrap hybrid LC-HRMS.

Results

For method development the instrumental parameters were optimized for each substance. For LC-MS/MS method the following parameters were optimized automatically by the mass spectrometer software using direct injection of reference material into the mass spectrometer using a syringe pump: declustering potential (DP), collision energies for each precursor-product ion pair (CE) and collision cell exit potential (CXP). For LC-HRMS only collision energies were optimized using direct infusion by syringe pump. The parameters are disclosed in Tables 1, 2 and 3.

Table 1. Ion source parameters for LC-MS/MS triple quadrupole and LC-HRMS.

LC-MS/MS triple quadrupole		LC-HRMS parameters	
Parameter	Value	Parameter	Value
Curtain gas	30	Sheath gas	48 Arbitrary units
Ionization potential	5500V	Auxiliary gas	11 Arbitrary units
Source Temperature	500ºC	Sweep gas	2 Arbitrary units
GS1	50	Spray voltage	2500V

GS2	50	Capillary Temperature	256ºC
CAD	Medium	Auxiliary gas heater	413ºC
EF	10		

Table 2. Mass spectrometry parameters for LC-MS/MS triple quadrupol.

	GHRP-1		GHRP-1 Metabolite	
Transition	478.3>129.1	478.3>209.1	442.8>335.1	442.8>406.1
Declustering potential	136	136	76	76
Collision energy	27	27	35	27
Collision cell exit potential	12	18	26	26

Table 3. Mass spectrometry parameters for LC-HRMS.

	GHRP-1		GHRP-1 Metabolite	
Transition	478.250>129.100	478.250>209.103	442.730>129.100	442.73>110.072
Collision energy	30	30	25	25

On both equipments we used the same flow of 0.3mL/min. Solvent A was ultrapure water with 0.1% formic acid and 5mM amonium formate and solvent B was acetonitrile:water 9:1 with0.1% formic acid and 5mM amonium formate. The gradient in solvent B is presented in the Table 4.

Table 4. HPLC gradient.

Step	Total Time (min)	A (%)	B (%)
0	0.00	95	5
1	2.00	60	40
2	5.00	35	65
3	6.00	35	65
4	6.01	95	5
5	9.00	95	5

For validation were used artificial samples created by spiking negative urines with the compounds of interest. For an accurate comparison between the two equipments the samples were processed in the same manner. Briefly, 2mL of samples were loaded on SPE cartridges, eluted with an ammonia/methanol mixture, evaporated to dryness in a vacuum rotary evaporator and reconstituted with water: acetonitrile 95:5. The results of the validation are presented in the Table 5.

Table 5. Validation parameters.

Validation parameter	LC-MS/MS		LC-HRMS	
	GHRP-1	GHRP-1 Met	GHRP-1	GHRP-1 Met
Limit of detection	1ng/mL	1ng/mL	1ng/mL	1ng/mL
Identification criteria	Compliant to TD-IDCR2015	Compliant to TD-IDCR2015	Compliat to TD-IDCR2015	Compliat to TD-IDCR2015
Specificity	Compliant	Compliant	Compliant	Compliant
Matrix effect	Compliant	Compliant	Compliant	Compliant
Carry-over	Not observed	Not observed	Not observed	Not observed
Recovery	28%	53%	----	-----

Acknowledgement

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