LabVIEW Integration for automation processes optimization and biometric identification

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***Abstract*—In this report we present a basic methodology for the application of LabVIEW in a context of industrial process optimization, particularly by simulating and integrating automation concepts in the operation of an object conveyor belt.**

The operation conveyor system depends on two basic autonomous processes or components, first a user authentication that triggers the start of the mechanism, by means of biometric identification, in this case the application of a voice recognition module. Secondly, a section to identify the colors of the elements that will be transported (white, blue or red), according to these, and a Pulse Width Modulation (PWM) a specific speed will be given to the conveyor belt.

Throughout the document the efficiency of the method will be demonstrated by analyzing various procedures, tests, observations and results that were obtained using LabVIEW software applications, the LINX open source project, and their integration to Arduino Nano and UNO hardware platforms and myRIO Programmable Logic Controller and its different modules (Real-Time and Field-Programmable Gate Array), in each of the stage of the project.

***Index Terms*— automation, LabVIEW, PLB, PWM, FPGA, biometric identification, color recognition.**

I. INTRODUCTION

Autonomous processes are widely applied in today's industrial and technological sectors of our society, automation is present in areas such as security, military, health care, information technology, space exploration even in basic industrial production lines and household appliances. Its core concept is based on the technology by which a process or procedure is performed with minimal human assistance using various control systems for operating equipment, they compare a measured value of a process with a desired set value, and processes the resulting error signal to change some input to the process, in such a way that the process stays at its set point despite disturbances **[1]**.

This project focused on the simulation of an industrial process by applying simulations and basic concepts of automation using sensors, PLCs and a LabView software development environment, the LINX project and the Real-Time and FPGA modules.

This research used the national instruments software, LabView as a core Integrated Development Environment, in the development of the Control Program of the proposed automation system, for the development of the Guided User Interface and for integration with external hardware such as Arduino, and the Myrio PLC or components like sensors and gearmotors.

II. OBJECTIVES

A. GENERAL

Simulate and automate the process of authentication and color recognition of a token for four employees.

B. SPECIFIC

1. Implement Voice Recognition in a system authentication.
2. Simulate an automation process using Labview that can be applied to a real context
3. Create a functional prototype of a conveyor belt implementing MyRio, Arduino and a color sensor module.
4. Implement a PWM control using MyRio Daq to control a gearmotor

III. PROCESS DESIGN (SCADA)

A. LabVIEW software development Module (GUI - Programming)

In the development process stands out the use of programming techniques such as parallel processes programing, state and events machines in order to achieve the fluidity and efficiency of certain modules and the program resource consumption. For example the staff authentication module and the color identification system always run in parallel and each of them is subdivided into states. The first has verification, write and read states and the second has one state for the identification of each color (blue, white and Red) and a color classification section.

B. MyRIO (RT and FPGA) Module (Color Identification and Pulse Width Modulation)

LabVIEW FPGA module was designed to run complex systems smoothly, by providing a highly integrated development environment, IP libraries, a high-fidelity simulation, and debugging features. In this specific situation is especially useful due to some of its features like analog / digital Inputs and Outputs (signal generation and measurements), and the possibility of code parallel operation.

The first prototype for the Color Identification module for this project was developed with the LabVIEW FPGA module. Despite the fact that the system operated correctly and identified the colors with precision according to a predefined range and their "frequency", there were problems with the integration of this FPGA module with the other elements of the program (simulation and voice recognition) because these were developed in the Real Time Module of LabVIEW which caused a conflict (only one module can run on myRio in a given time) and could not be executed on myRio. The idea was finally scrapped due to technical impossibility.

C. Arduino Module (LINX - Color Identification)

LINX is an Open Source project, created by Diligen and it is designed to facilitate the development of embedded applications using LabView. It allows access to peripherals such as digital and analog I/O, PWM, I2C in different development boards as Arduino Uno and Arduino Nano.
This module facilitates the programming of the TCS-230 color sensor by having functions that are not available in the MyRio module.

D. Color sensor (TCS-230)

The TCS-230 module works with an 8x8 array of photodiodes distributed in 4 color filters. The behavior of this module can be changed using four control pins (S0, S1, S2 and S3) according to the table 1

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TABLE I
OUTPUT FREQUENCY SCALING AND PHOTODIODE TYPE SELECTION

S0	**S1**	**Output Frequency Scaling**	**S2**	**S3**	**Photodiode Type**
L	L	Power down	L	L	Red
L	H	2%	L	H	Blue
H	L	20%	H	L	Clear (no filter)
H	H	100%	H	H	Green

The common Output Frequency Scaling used in Arduino is 20% and the LabView code should change the Photodiode Type in a sequence for each color to be measured (RGB and clear in some cases) because the sensor only have one OUT signal.

IV. REPORT ANNEXES

V. CONCLUSION

The slow learning curve for the use of myRio and especially the lack of official or specialized documentation made the development of the investigation project difficult and the work progress slow. We can't implement FPGA module with the rest of the project that was developed in Real Time. Nevertheless, we could find solutions for each problem we faced. One of the most difficult modules was the voice recognition but we achieved to develop software with 60% of assertiveness.

VI. CONTRIBUTIONS TO THE CLASS

The topic of the project allow us to focus our knowledge and skills related to the subject on an empirical problem that may arise in a business or industrial context. It was really interesting to use concepts of automatization and control process from the class (especially since every concept review in class was necessary) or external sources in the development of our project and in the different difficulties that we had along the way.

Even though, it was difficult to implement the voice recognition requirement, because knowledge in areas like machine learning and artificial intelligence is required. And these subjects or related topics are not a prerequisite for Automation and Process control.

REFERENCES

[1] Groover, Mikell (2014). *Fundamentals of Modern Manufacturing: Materials, Processes, and Systems*.
[2] Dejan, Nedekovski (2016). Arduino Color Sensing Tutorial - TCS3200 Color Sensor. Available in: https://howtomechatronics.com/tutorials/arduino/arduino-color-sensing-tutorial-tcs230-tcs3200-color-sensor/
[3] Annexes: https://docs.google.com/document/d/1zzsDgFHoTEDBv36kqsRQEvVorTOl4cuAllCWoNXGDvA/edit?usp=sharing
[4] Project Video: https://docs.google.com/document/d/1zzsDgFHoTEDBv36kqsRQEvVorTOl4cuAllCWoNXGDvA/edit?usp=sharing