

Remote Control and Data Recollection of a Water Pumping System by Internet

T.S.U. Aldair de Luis Morales¹, T.S.U. Cristian Julián Hernández Hernández²,
T.S.U. Edgar Casique Hernández³, T.S.U. Rosalio Rodríguez Montiel⁴, T.S.U. Alejandro Bonilla Sanchez⁵,
M.I.C Ernesto Mendoza Vazquez⁶

^{1, 2, 3, 4, 5, 6}Technological University of Tlaxcala, Huamantla, Tlaxcala, 90500, Mexico

Abstract: *Today the world is advancing by leaps and bounds in terms of technology, whether for domestic or industrial use, since the main objective is to achieve a greater production by using minimum resources, this regarding economic matters, human resources, energy saving, or natural resources. Being this text about the development of a system which can be adapted to a wide number of problems such as remote control and data recollection, in order to take better decisions, all this through remote control by using Ethernet. As it was mentioned before, this project implements the usage of Ethernet for remote control and data recollection. This implementation is done a water pumping system in which the required liquid is controlled remotely. This means that the water tank can be full or emptying in real time according to what it is needed. This is done by a graphic language which was design with the appropriate software that allows a design by using to screens. Even though this project uses a water pumping system to control and recollect data by ethernet, this can be adapted and used to different industrial processes which require to be autonomous. This system of control and monitoring via Ethernet can be adapted to different processes in the industry that need a remote control to achieve autonomy in addition to the automation of the process where this project is applied.*

1. Introduction

The main objective in any company is to have a higher production with the lowest usage of resources, in order to achieve this, it is necessary to have reliable systems that allow to control with ease the devices that are within the zone, with the objective to obtain a better production according to the planned goals.

The technology that allows extensive development, management, monitoring and remote control for a large range of systems in many capacities, including general networks and remote data storage is the ethernet, the aforementioned technology offers an attractive option for the control of instruments due to their flexibility. With connectivity by means of ethernet, any company can control its instruments from anywhere through the network to which it is connected.

For this project standard LAN infrastructure must be electrically supplied all the time, allowing all the devices to be connected to the same cable of the network. By doing this, the need to use power outlets at the locations of the powered device is eliminated and allows uninterrupted power supplies to ensure 24-hour operation.

In order to do the above, it is necessary to follow a series of specific steps and indications that have been developed for the purpose of improving a high-performance system and to be able to adapt it to the needs of every user.

2. Theoretical Framework

In order to carry out the integration of the project, the following elements consisting of software or hardware were taken into account: LabVIEW, Arduino and LabVIEW extensions, which are: LINX and NI-VISA. And inside the hardware part were used for the prototype electropumps.

2.1 LABVIEW

LabVIEW is system engineering software that requires testing, measurement, and control with fast access to hardware and data analysis.

The LabVIEW programming environment simplifies hardware integration for engineering applications, so you have a consistent way of acquiring data from NI and third-party hardware. LabVIEW reduces the complexity of programming so you can focus on your engineering problem. LabVIEW lets you visualize results immediately with the integrated creation of click-and-drag user interfaces and integrated data viewers. To convert your acquired data into actual business results, you can develop algorithms for data analysis and advanced control with math IP and signal processing or re-use your own libraries from a variety of tools. To ensure compatibility with other engineering tools, LabVIEW can interact with or reuse libraries from other open source software and languages. (National Instruments, 2017)

2.2. ARDUINO

Arduino is an open source electronic platform based on easy-to-use hardware and software. Arduino boards can read inputs (light on a sensor, a finger on a button or a Twitter message) and turn it into an output, activate a motor, turn on an LED and post something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so, it uses the Arduino programming language (based on Wiring) and the Arduino Software (IDE), based on Processing.

Over the years, Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of manufacturers, students, hobbyists, artists, programmers and professionals, has gathered around this open source platform, their

contributions have added an incredible amount of accessible knowledge that can be of great help to newbies and experts alike .

Arduino was born in the Ivrea Interaction Design Institute as an easy tool for rapid prototyping, aimed at students with no experience in electronics and programming. As soon as it reached a wider community, the Arduino board began to change to accommodate new needs and challenges, differentiating its offer of simple 8-bit boards to products for IoT applications, laptops, 3D printing and integrated environments. All Arduino boards are completely open source, allowing users to build them independently and eventually adapt them to their particular needs. The software is also open source and is growing thanks to contributions from users around the world. (Arduino, 2017)

2.3. LINX

LINX is an open source Digilent project and is designed to facilitate the development of embedded applications using LabVIEW. LINX includes VIs for more than 30 of the most common embedded sensors as well as agnostic hardware APIs for accessing peripherals such as digital I / O, analog I / O, PWM, I2C, SPI, and UART.

Whether you are remotely controlling a KIT or Arduino chip via USB / Serial, Ethernet or Wi-Fi or deploying VIs to run on BeagleBone Black or Raspberry Pi 2/3, LINX and LabVIEW make it easier to visualize the data with which is working, debugging your code and creating advanced embedded applications faster than before. (National Instruments, 2017)

2.4. NI-VISA

Arduino is an open source electronic platform based on easy-to-use hardware and software. Arduino boards can read inputs (light on a sensor, a finger on a button or a Twitter message) and turn it into an output, activate a motor, turn on an LED and post something online. You can tell your board what to do by sending a set of instructions to the micro controller on the board. To do this, it uses Arduino. The Virtual Instrument Software Architecture (VISA) is a standard for configuring, programming and troubleshooting instrumentation systems that include GPIB, VXI, PXI, Serial, Ethernet and / or USB interfaces. VISA provides the programming interface between hardware and development environments, such as LabVIEW, LabWindows / CVI and Measurement Studio for Microsoft Visual Studio. NI-VISA is the National Instruments implementation of the VISA I/O standard. NI-VISA includes software libraries, interactive utilities such as NII/OTrace and VISA Interactive Control, and configuration programs through Measurement & Automation Explorer for all development needs. NI-VISA is standard across the National Instruments product line. With NI-VISA, you can be confident that your software development will not be obsolete as your instrumentation interface hardware needs to evolve into the future. (National Instruments, 2017)

3. Monitoring and Control Via internet.

The Project was carried out under a series of systematic steps which gave the desired result, these steps are described as software installation and configuration, additional programming to the program we want to control, process visualization and control of the same from a computer connected to internet.

- 3.1. Installation of NI-VISA and LINX,
- 3.2. Create a server and publish it
- 3.3. Parameter settings

3.1. NI-VISA and LINX Installation

In order to work and enable LabVIEW communication ports and interfaces, you need to install the standalone NI Visa software, so you have to access the following URL: <http://search.ni.com/nisearch/app/main/p/bot/no/ap/tech/lan/g/en/pg/1/sn/catnav:du,n8:3.1637,ssnav:sup/> to perform the download, you have to download the latest version and that corresponds to the architecture of your operating system. To be able to download, you need to register on the National Instruments page

- Proceeds to "execute as administrator".



Figure 1: File to execute

- Unload the installer by downloading it.



Figure 2: Steps of the NI - VISA installation

- Next, the installation is done by clicking on the "Next" option in subsequent windows and the corresponding terms are accepted.



Figure 3: Installation of NI – VISA

- To finish, a window will appear asking you to restart the computer, selecting the "Restart" option and ending the installation of the standalone software NI VisaSe continúa con el siguiente complemento el cual es LINX de National Instruments para LabVIEW

For this part LabVIEW has its own platform in which you can get the necessary add-ons which is the VI Package Manager is necessary to wait for the software to connect with their server and once the connection is established correctly, will show the list of add-ons available there is where Linx is located, you must download it and wait for it to start the automatic installation.

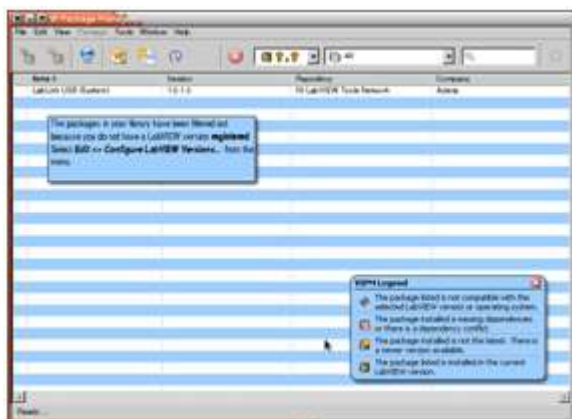


Figure 4: LINX installation

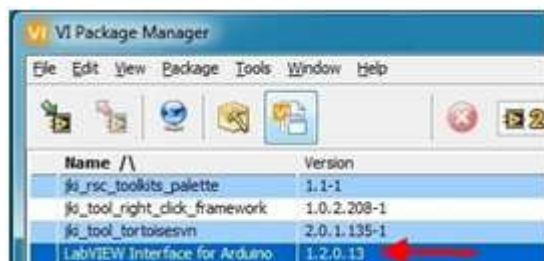


Figure 5: LINX module download

3.2. Create A Server and Publish it

In the development of interface you can control the different devices that make up the project, as they are, two pumps for the circulation of water, also the sensors that would be monitoring the levels of liquid in the respective containers. Using tools provided by LabVIEW, it was possible to use the WI-FI or Ethernet connection. In the section Tools, Options and Web server, you will find the server configuration which by default at the time of installing the software is disabled

and it is necessary to activate and save the changes.

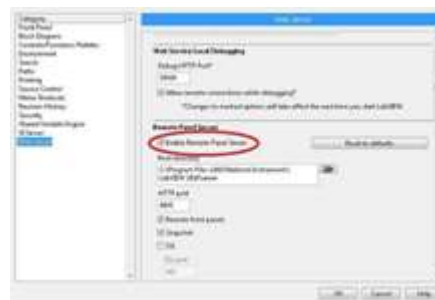


Figure 6: Enable the Ethernet option

After this, LabVIEW is ready to load a program and start with the remote connection. Once you have a ready program, go back to the Tool section and look for the tool called Web Publishing Tool, then a panel will appear to continue with the configuration and the panel will ask you to load the previously tested program.



Figure 7: Ethernet configuration.

In the first section you must load the program so that the software takes the necessary files, in the second option it is necessary to activate the section that says Request control when connection is established, this function is the one that will allow to control parameters and functions of the program once that it is online and working correctly.

As soon as the previous steps have been performed a more panel will appear in which parameters will be configured that later will help the standards of the assigned IP address

The following table shows the end of the configuration and finally shows the IP address with which it can be entered into the control panel of the program, the IP is composed of the path where the original file is hosted and the account with data from the computer where the IP address was generated.

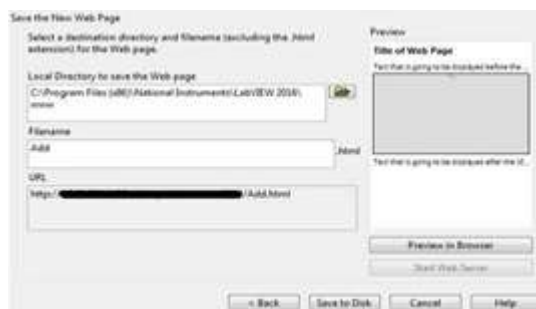


Figure 8: Obtaining IP

To conclude the configuration of the IP address that will be in charge of establishing the connection we choose the option Save to Disk and the connection of the program will be ready and we could connect immediately if it is wanted or to initiate the connection from a independent computer.

3.3. Parameter Setting

The possible errors that are presented have a solution, one of them is the following which is more common due to the new versions of the different web browsers as in the case of GoogleChrome and Mozilla Firefox. Since new versions and updates no longer support the components with which LabVIEW works and when the connection to the IP address in web browsers is initiated, an error screen is displayed. But there is a very convenient solution

To solve this problem we opted to use the browser that is installed by default in Windows operating systems since its architecture is ideal for the IP connection of LabVIEW Internet Explorer is fully compatible to make the connection then this way so practical resolves the error problem when trying to connect to IP addresses. And it is a method that is available to all users and that is because you do not need to install anything or resort to third-party programs, because the operating systems already have this default program and it does not require many resources in the operating system.

5. Results

With this project it is possible to monitor and control the amount and level of liquid contained in the tank from an open web page on a computer connected to the internet, so that there is no need to turn on and / or turn off the pumps manually. From the webpage you can display any of the three screens of the program screens for manual, automatic control or the settings screen.

5.1. Manual Controlscreen.

It has two switches one to turn on the filling pump and one for the emptying pump each with its respectived to indicate the ignition.

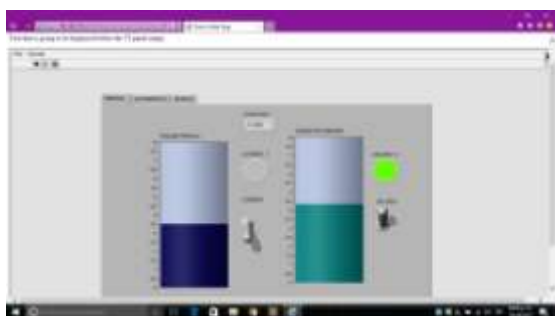


Figure 9: Manual control screen display.

5.2. Automatic Controlscreen

This display has two led, one to indicate if the container is being filled or is emptying in addition to a level control to be able to establish limit of filling of the liquid in liters (current, light, position, vibration, ultrasonic, humidity, proximity), irrigation systems, alarms or home automation and this

project can be implemented technology wi-fi to achieve direct connectivity between the computer and the monitored system.



Figure 10: Automatic control screen display



Figure 11: Settings screen display

5.3. Settings Screen

This screen has two unique functions, the first is the STOP button that stops the program when necessary, and the other function is to select the port with which the communication with the Arduino card is established.

6. Conclusion

The importance of the Project is that it is a Project that can be adapted to different projects, processes or systems, since by making a change in the sensors of the variables that can be controlled and visualized, a completely different project is obtained, also that it is possible to adapt to varied processes whether it is the control of electrical machinery, sensors

References

- [1] Ing. David Porras LabVIEW Build Code. Get Answers Increase your Trust, Webinar Series for Developers
- [2] Fernando Pascual - Moisés Pérez Department of Electricity, OPC-LabVIEW
- [3] Enrique Ramón Rosas, Miguel Ángel Mendoza García, Luis Alejandro De La Cruz Velázquez. (2014), SOMI Instrumentation Congress Puerto Vallarta Mexico.
- [4] José Manuel Ruiz Gutiérrez (August 2012) Use of Labview for the Visualization and Control of the Open Hardware Platform Arduino Creative Commons Attribution 3.0 Unported License
- [5] LabVIEW (2008) Database Connectivity Toolkit User Manual National Instruments Corporate Headquarters 11500 North Mopac Expressway Austin, Texas

Author Profile



Aldairde Luis Morales, was born in the city of Huamantla, Tlaxcala, Mexico on October 7, 1995, course the career of university technician in industrial maintenance at the Technological University of Tlaxcala in Huamantla, Tlaxcala from the year 2014 - 2016 obtaining the title of Higher University Technician. To achieve this course a period of profession stays (2016) in the company Técnicas Unidas Oriente S.A. de C.V. in which the project "Manual of preventive and corrective maintenance to air conditioning equipment" was carried out. He is currently studying the engineering career in industrial maintenance at the Technological University of Tlaxcala.



Cristian Julián Hernández Hernández, was born in Tlaxcala, Tlaxcala, Mexico on April 13, 1996, the high school course at the Industrial and Service Baccalaureate Center number 3 in the maintenance specialty in the state of Tlaxcala. To then enter the technological university of Tlaxcala (UTT) where he graduated in 2016 as a senior university technician in industrial area maintenance, after doing internships in corporate Flo after presenting the thesis "process study to contribute to the correct application of maintenance". He is currently close to graduating from the Technological University of Tlaxcala as an engineer in industrial maintenance.



Edgar Casique Hernández: He was born in Huamantla Tlaxcala, on October 19, 1994. He studied the automotive maintenance specialty in the industrial and service baccalaureates center number 61 (2011-2014). continued with his academic preparation at the Technological University of Tlaxcala (2014-2016), in the Industrial Maintenance Engineering career, where he obtained the title as technician in industrial maintenance and made technical memory based on plastic injection machines. Work in maintenance planning at the company Grammer Automotive (2016).



Rosalio Rodríguez Montiel, was born in the city of Apizaco, Tlaxcala, Mexico on September 4, 1993. High school course at the Center for Technological and Scientific Studies of the State of Tlaxcala (CECyTE) 07 of San Andrés, Ahuashuatepec. He continued his studies at the Technological University of Tlaxcala, in the career of senior university technician in industrial area maintenance (2014 - 2016) obtaining the title of Advanced University Technician in Industrial Maintenance, for which course a period of professional internships in a company of industrial machineries where I carry out the project "Maintenance to a lathe ROMI-S200"



Alejandro Bonilla Sánchez, Originally from Nicolás Bravo Terrenate Tlaxcala, Mexico, was born on February 1, 1996, in the city of Huamantla, Tlaxcala. Course in high school at the Center for Technological and Scientific Studies of the State of Tlaxcala (CECyTE) 03 located in the municipality of Terrenate where he obtained the title of technician in industrial maintenance, continued his studies at the Technological University of Tlaxcala, located in Carmen Xalpatlahuaya Huamantla, Tlaxcala, where he obtained the title as Superior University Technician in Industrial Area Maintenance (2016) for performing his professional practices at STREGER SA of C.V. with the project of "Preventive maintenance to industrial machinery".



Ernesto Mendoza Vazquez, received the B.S. and M.S. degrees in Electrical Engineering from Shibaura Institute of Technology in Communication Research Laboratory (CRL), Ministry of Post and antennas,

mobile satellite communication systems, and wireless access network using stratospheric. He now with DDI Tokyo Pocket Telephone, Inc.