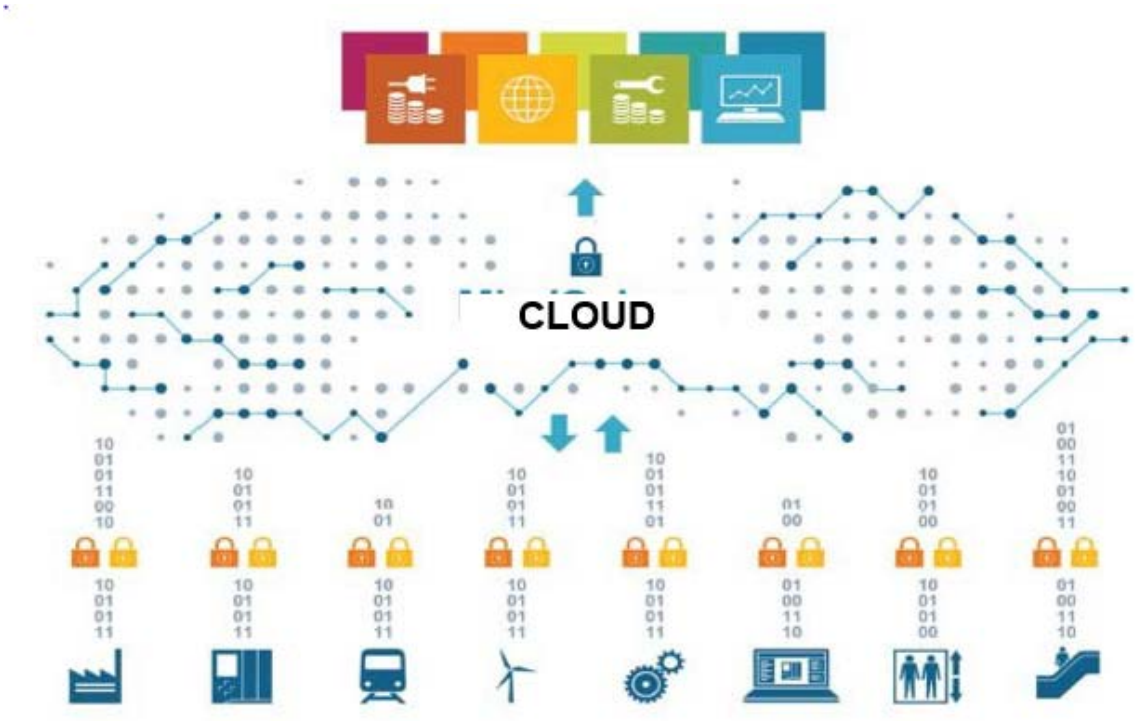
IoT – A.I. 2019 Workshop of II International Conference on Information Processing CIPI 2019

Industry 4.0 Project



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1. Introduction.

What is industry 4.0?

- Industry 4.0 also called the fourth industrial revolution.

  - Industrial revolutions are characterized by the emergence of new technologies and new ways of perceiving the world, which drive a profound change, in the economy and the structure of society.

  - **The first industrial revolution**.

    The arrival of the steam engine in the 1760s, encouraged the mechanization of industry, one of the first was the textile industry.

Figure 1.1 First Industrial Revolution

  - **The second industrial revolution.**
    The second industrial revolution came hand in hand with electricity and chain production, technologies that allowed mass production to which we are accustomed today.

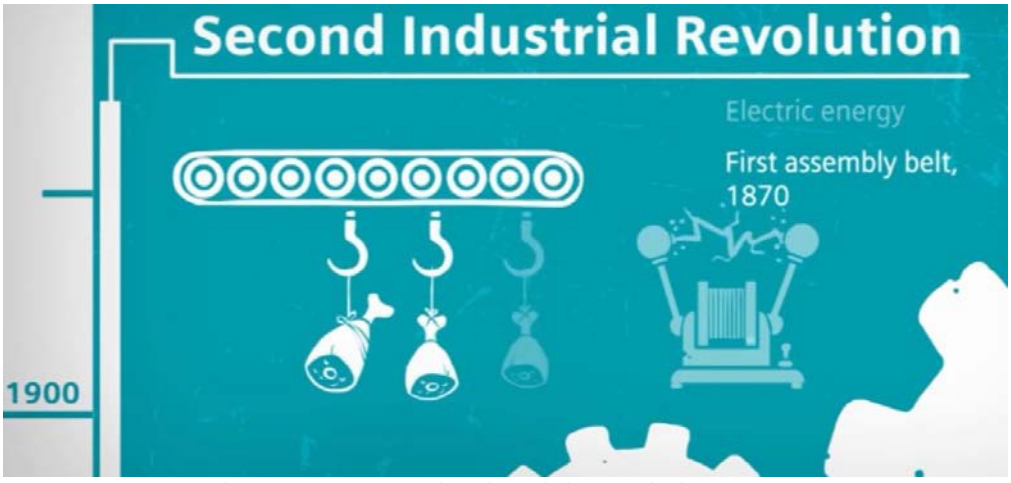

Figure 1.2 Second Industrial Revolution

- **The third industrial revolution.**

The third industrial revolution, also known as the digital revolution, began to take shape between the end of the 50s and 70s. During this period, humanity witnessed the increase in electronics, with the transistor and microprocessor.

This new technology led miniaturization, for industry this revolution led to the era of high-level automation, in production, thanks to two inventions, the PLC programmable logic controller and the robot.

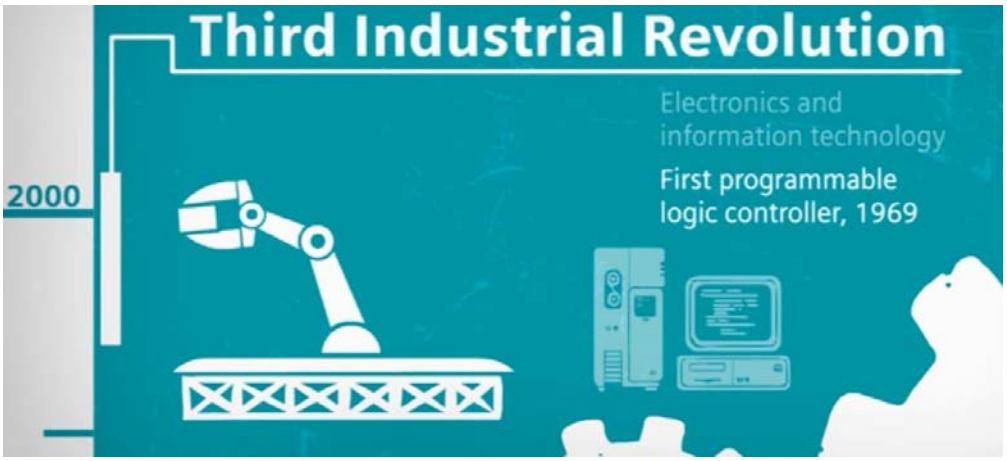

Figure 1.3 Third Industrial Revolution

- **The fourth industrial revolution.**

The fourth industrial revolution "Industry 4.0" corresponds to a new way of organizing the means of production, and the management of information generated by automation systems, PLC. Robot, SCADAs, etc. This information will help us make intelligent decisions.

The objective is to achieve an intelligent factory, "Smart Manufacturing", capable of greater adaptability to the needs and production processes, as well as a more efficient allocation of resources.

The technological bases on which this revolution is based are: internet of things (IOT), digital Twin, Smart Data, Big Data, Cloud.

The concept of Industry 4.0 was used for the first time at the Hannover fair in 2011, it was presented as a strategy to promote the digital revolution of the industries.

The use of cybernetic systems over the internet (virtual networks with the possibility of controlling physical objects), allows the transformation of production plants into intelligent factories, characterized by a continuous and instantaneous intercommunication.

The use of sensors provides the production lines with a self-diagnostic capability, which allows remote control and integration into the global production system.

Figure 1.4 Fourth Industrial Revolution

2. Project Industry 4.0, of a pharmaceutical laboratory.

Next, the industry 4.0 project of a laboratory will be exhibited.

Pharmaceutical laboratories are complex automation systems; in which you can see different applications of Industry 4.0.

A laboratory is composed of vital systems, production areas, raw materials warehouses, finished drug stores, refrigerated and non-refrigerated systems, dispatch area.

Next, the areas and applications are described in a general way, later we will develop an area in particular a line of packaging of tablets.

2.1. In a laboratory the vital systems are the following:

- Energy
- Waters
- Climate

In these systems Industry 4.0, has much to contribute:

- Energy:
  - Control of energy through analyzers communicated with the supervision and control systems of the different areas of the laboratory. Storage of information in database and automatic generation of reports daily.
  - Lighting control, connected and turned off based on the production schedules, achieving significant economic savings.
  - Management of alarms automatic rearms of circuits, etc.
  - Control of the PSU connected with the supervision and control system, in this way, we have the information in real time of PSU. Being able to

act on them before it is necessary to use them before a power cut. The information will be stored in the database.
- Send alarms to mobile phones, tablet, e-mail, cloud.

- Waters:
  - A laboratory consumes a large amount of treated water, osmotized water, over heated and refrigerated water. This means a great waste in energy. With the use of speed variators we will control the operation of the pumps, achieving a great energy saving.
  - Through analyzers communicated with the monitoring and control systems, we can perform an analysis to optimize the performance of water control systems. Storing the information in database and automatic generation of daily reports.
- Climate:
  - One of the most critical systems of a laboratory is the climate, since of its correct functioning in the different white rooms, where the manufacture of the drug takes place, it depends that its result is optimal or not.
  - The control system, manage the tags, receive information, generate reports and store the information in the database with FDL certification, this is done automatically.

2.2. Laboratory production areas.

Statin that a laboratory of the biopharmaceutical industry is immensely large and with complicated processes then a tablet packaging line will be analyzed.

- **Tablet packaging line.**

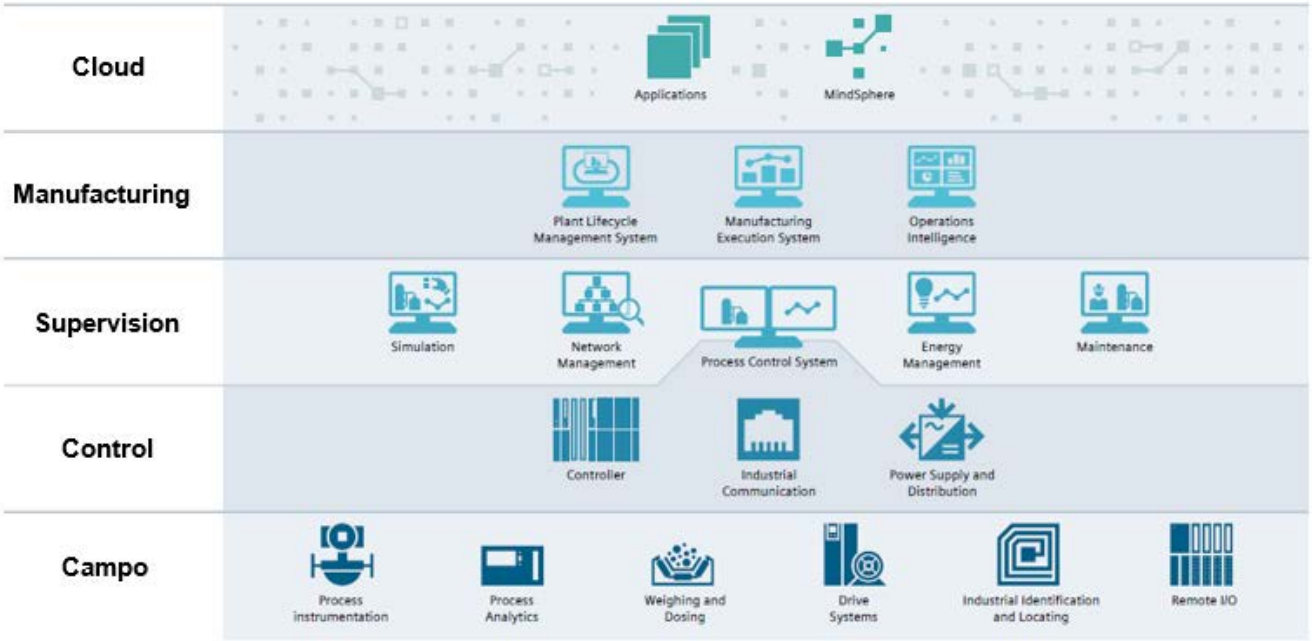

Figure 2.1 Overview of system architecture.

- **Field elements.**

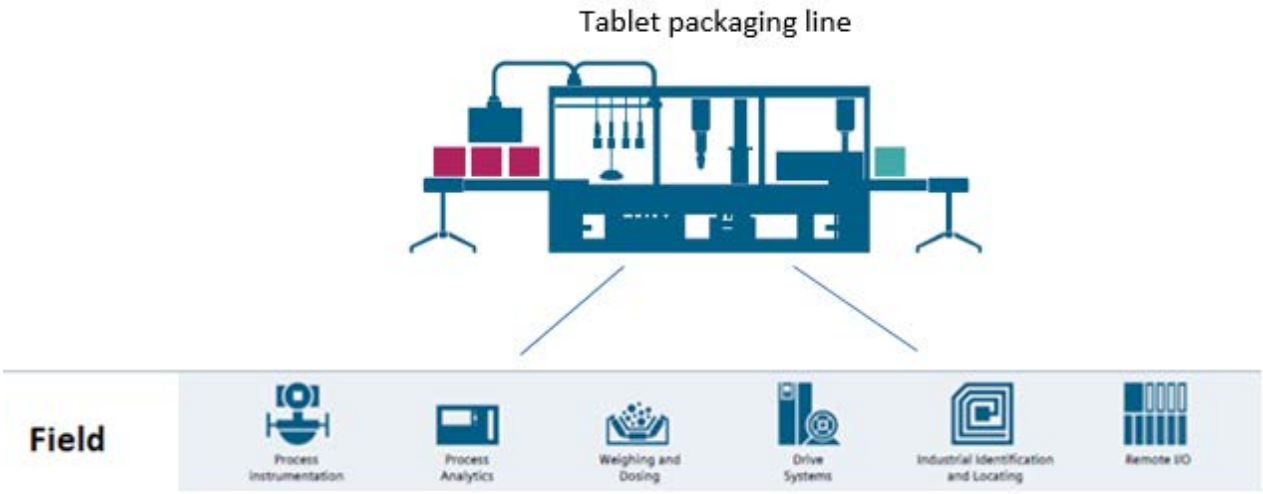

Figure 2.2 Field elements of a tablet packaging line.

In the architecture of the packaging line, the lowest part of the pyramid are the field elements: sensors, instrumentation, engines, counters, photocells. These elements are those that provide us with the status of the line and the process values thereof.

- **Control system.**

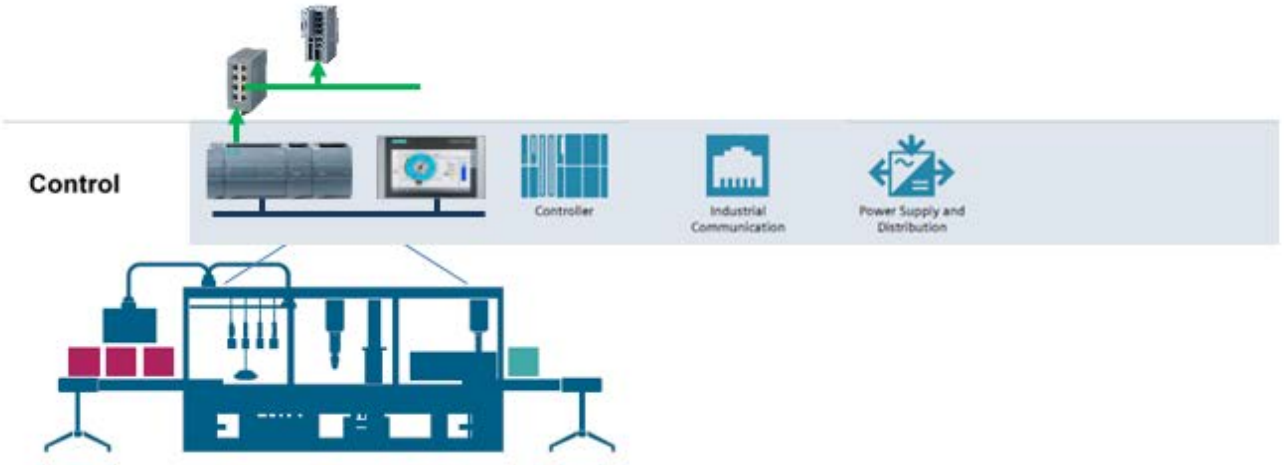

Figure 2.3 Control system of a tablet packaging line.

The packaging line is controlled by PLCs dealing with the automation tasks of the machine that is analyzed. There are also HMI terminals for the human-machine interface.

These PLCs receive the field signals, analyze them and proceed according to a control strategy and under the orders and supervision of the SCADA. The touch screens that exist on the line allows us to interact with the control system. In addition to showing in the screens the alarms, tags and process values in real time.

- **Supervision system (SCADA).**

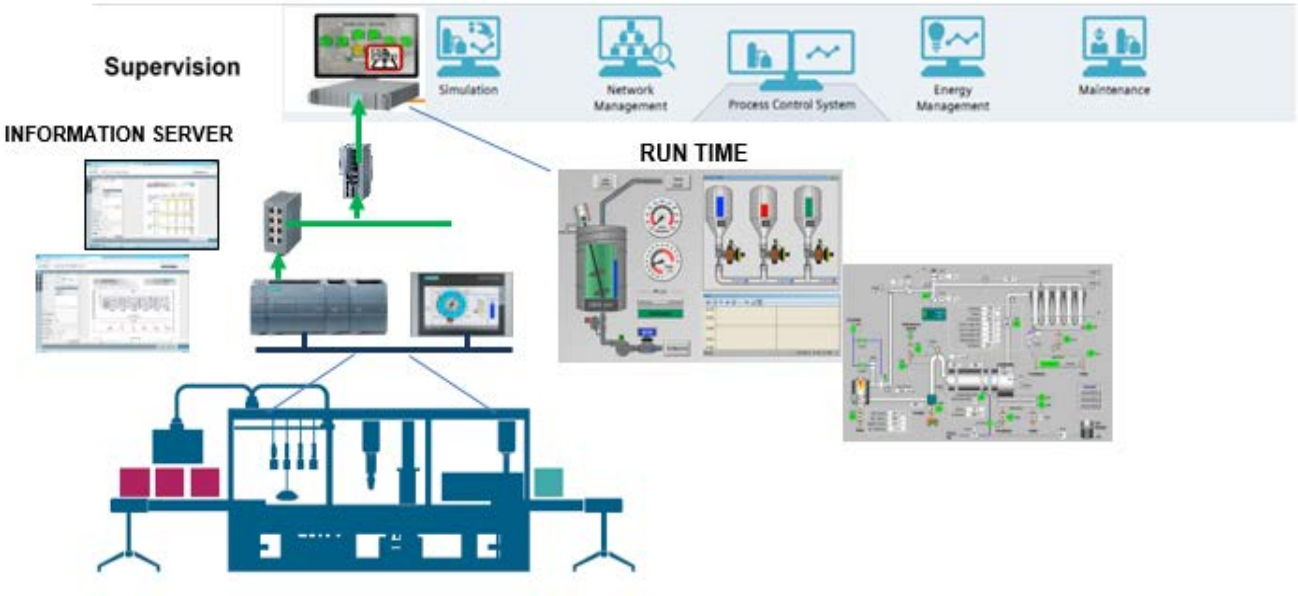

Figure 2.4 Supervision system of a tablet packaging line.

The laboratory supervision system monitors all systems and all production lines.

From the SCADA the operator displays the tablet packing line, modifies the tags, starts the process, stops the process, receives alarms, store data in databases with FDL certification.

Through a software used for the management of automatics reports “Information Server”, custom reports are made.

For example, each change of shift an email is send to the maintenance manager an Excel report with all breakdowns in the turn, at the beginning of this, in the end and if it has had an incidence of line stop.

Also in each change of shift, a report in Word is sent via email to the manager of the production, with the status of the lots manufactured by each line, as well as a report of the raw materials used in production.

At first time an email is sent to the laboratory director with a PowerPoint report with a graphic in which the up-time is indicated and the productions made, so that it has the maximum if information

- **Manufacturing.**

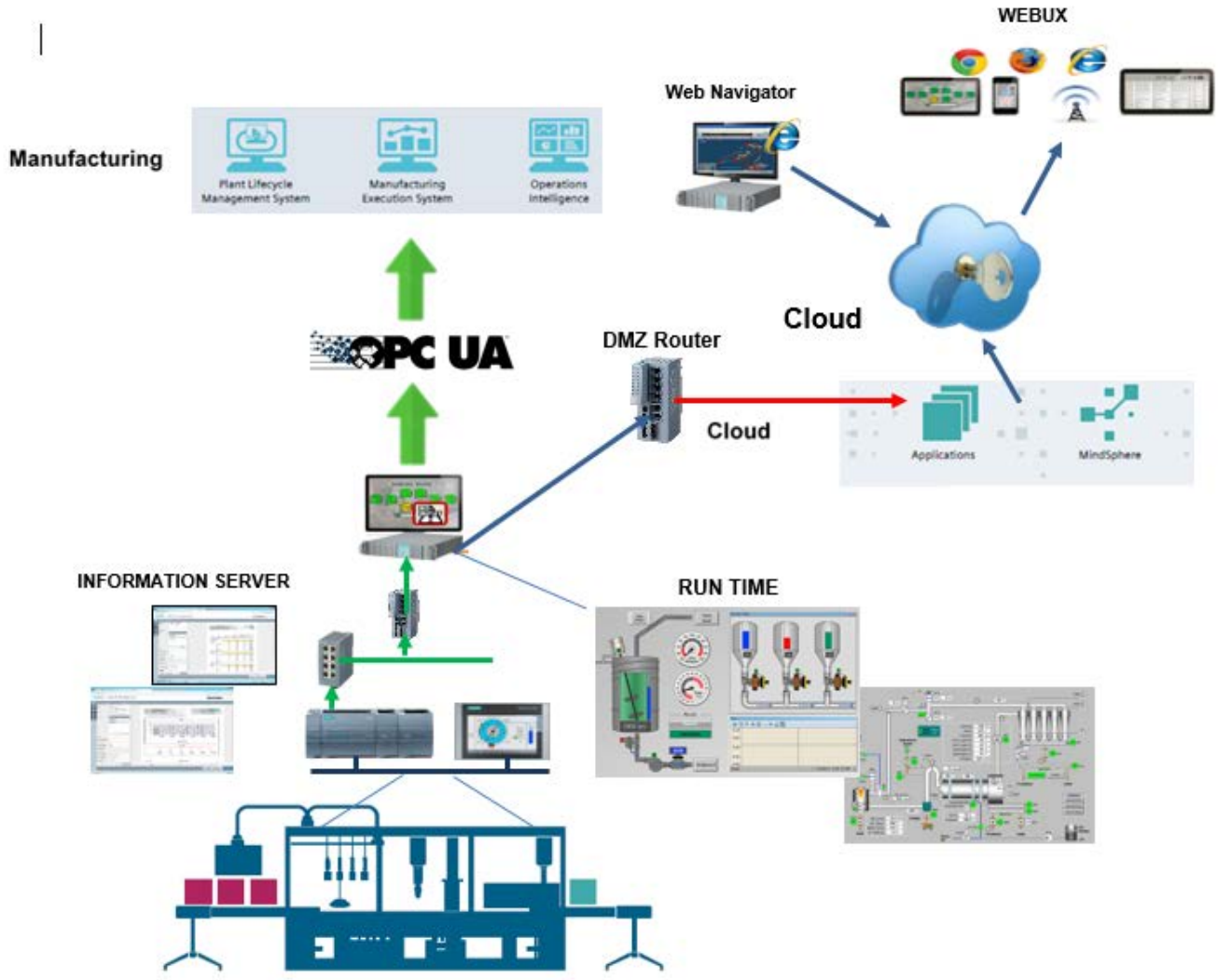

Figure 2.5 Manufacturing systems of a line packing.

El SCADA will be communicated with the MES and ERP systems through OPC-UA, in this way the automation networks and IT will be independent at all times insured as the safety of both.

The type of data to be exchanged will be defined by user of both parts IT – Industry 4.0.

- **Cloud.**

Using a web server called “Web navigator” and with a login control with user and password that is validated in the SCADA you can access this from any PC in the world. It can also be displayed in real if we had enable this option. As well as visualize the process, modify tags, turn off the light in a line, and turn off the lighting.

With the Web UX application you can access from any mobile phone from anywhere in the world and thus see the state of the laboratory in real time.

3. Conclusions.

In this work it has been reflected that Industry 4.0 or the Fourth Industrial Revolution is important for the advancement of the biopharmaceutical industry. The need to control in real time the production lines and the auxiliary systems, that influence the production process to improve and strengthen the decision making of the different administrative areas of the laboratories is imposed and in this way achieve better results. It is for this reason that this project is in the execution phase in one of the laboratories of Biocubafarma. The fundamental objective is to strengthen the industry with the use of the latest technologies and take it to the Fourth Industrial Revolution.

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