MONITORING AND CONTROL TECHNIQUES OF THE INSTALLATIONS ON SMART FACTORY

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Abstract: *The modern factories are developing into intelligent environments in which the gulf between the real and digital world is becoming smaller and smaller. Connecting production line to the internet everyday environment is developing into a vision of the smart factory for the factory environment. Smart Factory technology is a good choice for people, not only care about security and comfort, but energy saving as well and control the line of productions. In this project, a smart factory energy management it is a technique based on a set of sensors and actuators. It minimizes the domestic energy waste and can be adapted according to the user habits. Smart factory contains internal network and intelligent control. The internal network can be built via wire or wireless communication technique between sensors and actuators .The intelligent control means the entire factory is managed or monitored by internet services. Smart factory is the integration of technology and services through network for a better quality of production. Integrating the factory services allows operator to communicate with controller, by using a single button in interface of web to control the various systems according to preprogrammed scenarios or operating modes.*

Keywords: *smart factory, control, sensor*

1. Introduction

The industrial environment is setting an ever-increasing challenge to developers of embedded controls, mainly driven by increasing complexity and more demanding requirements.

Factory automation networks, whether small or large, need an intelligent network infrastructure for availability and scalability, IP Multicast, quality of service (QoS), and network security. The network foundation hosting these technologies for a factory network needs to be robust, scalable, secure, and manageable and must provide high availability. This network foundation is designed to run a convergence of commercial and industrial applications over a common IP infrastructure, with due consideration for QoS, bandwidth, latency, and high performance in automation applications.

The Arduino controller can "sense" the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. The microcontroller on the board is programmed using the Arduino programming language and the Arduino development environment (based on Processing).

2. Network communication

The Arduino Ethernet board has a number of facilities for a good communication with a computer or another Arduino board..

The development of a smart factory requires a network technology that would connect all the sensors and devices with the central processing board.

The Arduino Ethernet board offers the possibility to create a webserver, connecting it to the wired network.

2.1 Website design

It was essential to identify the purpose of the website, so that the appropriate layout, structure, types of information and the language style could be chosen.

The graphical layout of the website was created using html. The tool prototype was created according to the main goals - to provide a simple

structure that would allow easy usage and to make various extensions and additions possible. These goals were achieved and a prototype that allows for easy creation for different animations. More items and functionality can be added in an easy way.

Remote connectivity is a key capability for intelligent lighting and motors systems. Intelligent devices can automatically manage some aspects of their operation to improve efficiency and quality. However, unless the equipment can communicate with a centralized controller, such intelligence has to be pre-programmed and can only maximize the efficiency of that single piece of equipment.

By networking the various components in a lighting system, the operation of equipment can be coordinated across an entire installation. This enables a whole new class of functionality, including remote dimming, remote shutoff and emergency control. For example, operators can adjust lighting intensity of an entire installation of factory, rather than have to individually adjust each light or motors.

2.2 Control with mobile telephone

It's possible to remote control the factory, via iPhone, iPad, iPod Touch, Windows Smartphone/PDA, or Android device. Set lighting levels from 0-100% with a sliding scale–or use quick scene buttons, view real time video of surveillance cameras, conserve energy by adjusting heating and cooling and view humidity and outdoor temperatures, arm or disarm the alarm, view a security log to monitor activity, Power on/of production line.

3. Application example

In this simple example we are only using the very basics of the template system, (display text and action buttons) but you can instantly see the power of this system. It's easy to read, to operate and provides all the information that the user needs about the system.

In this example, we implemented a simple interface to see and experience the small application. The interface is easy to use, and offers all the information that the user needs to control the fully automatic line.

A picture of the pattern of technological processes is shown below.

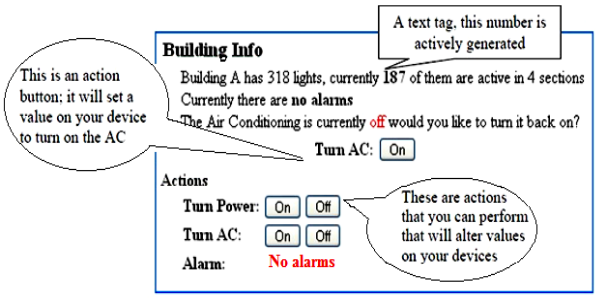

Figure 1: *Example web interface*

In figure 2 is shown the web interface where can be seen the monitoring and control system of technology operations in factory.

Figure 2: *The Web interface*

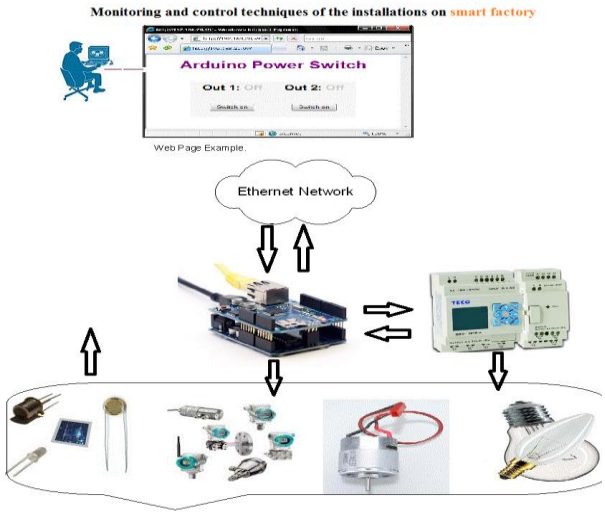

Figure 3: *Connecting devices with web interface*

3.1 The packing line

The evolution of the technological process is automatically monitored, local and remotely through a programmable logic controller, PLC. The principal parts of the process are:

a) pneumatic unloading and transporting of the raw materials in feeding points (Discharge line);

b) receiving and collecting materials, pneumatic transported (Receiver);

c) mixing materials for 25 minutes (Blender);

d) storaging in buffer bunker before dosing (Buffer);

e) filling in dose and packaging;

f) sealing bags using a sewing machine specialized in this type of closing;

g) lateral inscription bags with additional identifiers - jet burner.

h) laying the sealed, labeled, checked and engraved bags on pallets.

3.2 Motor Control

Motors are still one of the main consumers of electricity in industry. A lot of energy can be saved by running electrical motors at optimal performance and with optimal energy-efficiency.

The electric motor can be controlled with PWM impulse. The Arduino board generates low voltage PWM impulses that in turn are supplied to a driver that amplifies them to the required voltage.

The process information is collected thru various sensors that are connected to the Arduino inputs. This information is then used to reduce the idle time to a minimum.

3.4 Monitoring the technological process

To better monitor the flow and equipment it used surveillance cameras when some sensors are damaged.

Figure 4: *The monitoring with video camera of the fabrication line*

In figure 4 is shown the monitoring with video camera of the technological line.

3.4 The representation of the plant process flow

The significant parts of the fabrication line are:

1. Power M.P. level 1;
2. Receiver M.P. at level 1;
3. Power M.P. Level 4 (ingredients fat and flavor);
4. Mixer;
5. Tank calming;
6. Dosing and packaging of finished product.

Conclusions

The smart factory model was created to fulfill various purposes: to ease the production process, to overlook it on one single interface and to minimize idle times.

The initial investments for this type of technological flow if rather high, but they are paid off in a short period of time.

The Smart Factory model was created focusing on the improvements that technology brings to industry.

Standardization of the control and metering for gas, water and electricity supplies: This can make it easier to save energy by using Smart Systems. If metering is done remotely, standards are a help.

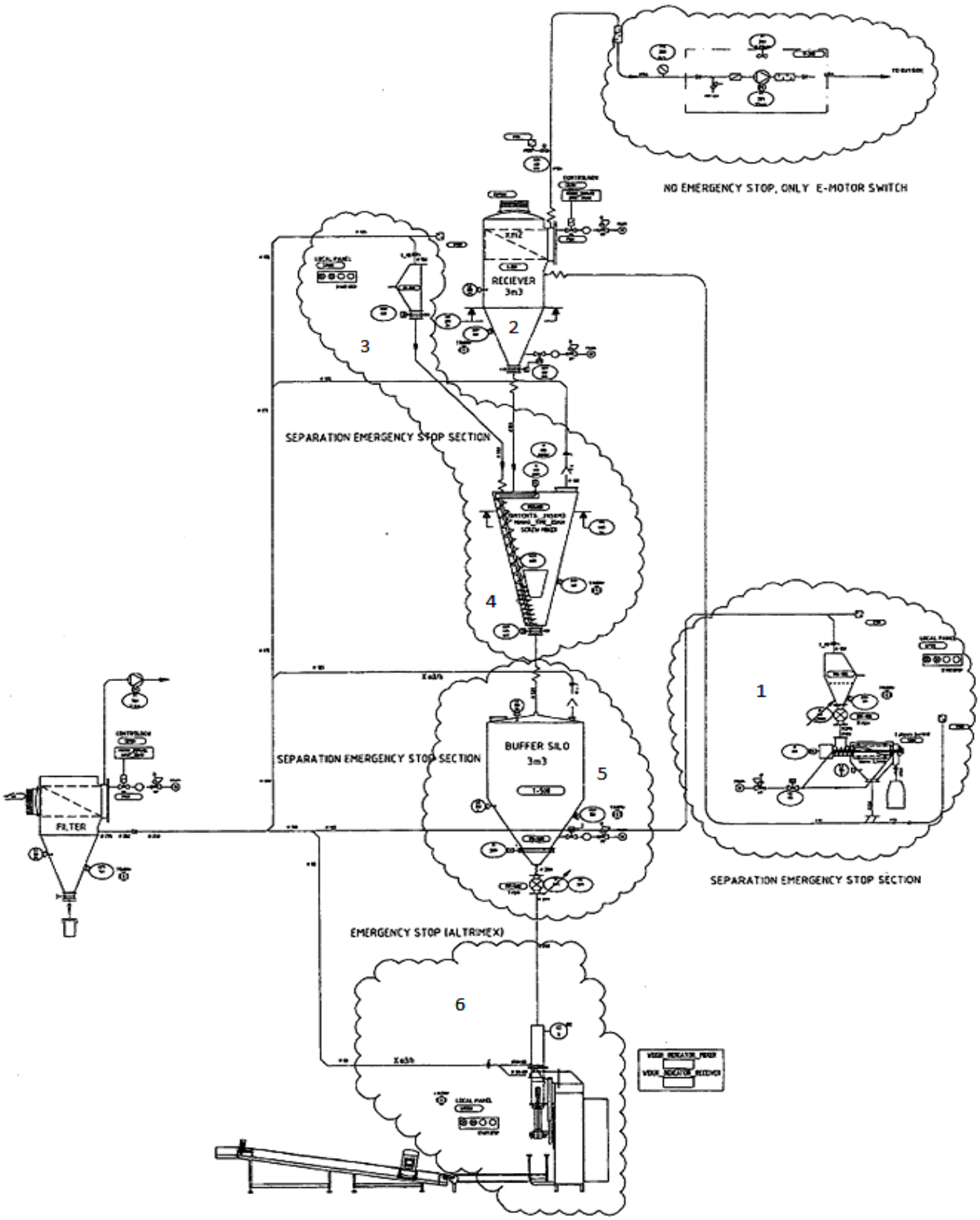

Figura 5: The representation of the plant process flow

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