PLC AND SCADA BASED COLOR MIXING AND COLOR MAKING PROCESS

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***Abstract*—The aim of this research paper is to develop the PLC and SCADA based color mixing process and making a various types of colors by using different ratios. In this process we were used three different colors i.e. red, yellow and blue. These are the basic primary colors by using these we can make six or more colors. Now a day high quality demand is increases more and more for that purpose the system has to be automated in which for automation PLC is used because of it, its quality, efficiency will automatically increases and also the production rate will increase. The modern controlled processor i.e. PLC (programmable logic controller) is controlled the process and make it automated. With help of some electronic devices like solenoid valve, relay circuit, proximity sensors, stirrer motor, level sensors and dc motor the process is fulfilled. The SCADA (supervisory control and data acquisition) is used for monitoring the process.**

***Keywords*—** PLC, SCADA, color, automation, monitoring, control, bottle filling, quality, efficiency.

1. INTRODUCTION:

Red, yellow and blue. These are primary colors in art as well in design. In a industries or color making plant by using these colors can make many more colors, as follow red + yellow = orange, blue + yellow = green, blue + red = purple. These are secondary colors which are made by mixing of any two primary colors with precise ratio and also many more colors can make by combination of three or two colors with precise ratio. With the help of PLC(programmable logic controller), the process automatically works as per requirement selected color will make. The purpose of this paper is to resolve the problems while color making and color mixing and easily monitor with the help of SCADA (supervisory control and data acquisition).

The four tanks are used here, three for primary colors and one for cleaning of final tank in which color will mix. (in a cleaning tank water is used) with the help of solenoid valve color is fed into the final tank and mixed by using stirred motor and finally fed it into bottle by opening solenoid valve.

2. METHODOLOGY:

There are five tanks are used their, first tank is used for the red color, second tank is for the yellow color and one more color is remain which filled in third tank, the fourth tank is used for the cleaning purpose in which water has used to clean the final tank when every time new color is going to be make. The final tank means fifth tank is used for the mixing of color which is comes from the upper three tanks and mixed these in it. Solenoid valves are connected with each of tank and each of has contain level measurement sensor which are magnetic float type level sensors. That contain reed switch, when magnetic float comes in contact with reed switch it get ON and because of it we can measure high level and low level of each tank.

Each solenoid valves are connected to PLC as an output and each level sensors are the inputs of the PLC. One proximity sensor is used for bottle filling object detection purpose. Stirrer motor is connected with final tank for the mixing color.

When we select the required color through PLC controller it will perform a particular color ratio task in which with the help of solenoid valve color get filled in mixing tank, then the stirrer motor mix the color and make it as required final color with proper mixing of it.

At several level of tank, solenoid valve of final tank will get open with help of proximity sensor. The only condition is the bottle is below of final solenoid valve.

3. HARDWARE DESCRIPTION:

3.1 ALLEN-BRADLEY MICROLOGIX 1400 PLC:

24 V dc supply,11 digital inputs,7 digital outputs **c**an connect various inputs (digital) to the system and similarly connect to outputs on the field by means of wiring. This is micrologix series B PLC used for the controlling purpose od=f the process and automation purpose. It required 24vdc SMPS for the operation of process to actuate all the system.

FIG.1 PLC

3.2 POWER SUPPLY:

230 V AC supply, Output 24V DC and 12 VDC positive and negative is indicated on the supply unit itself.

FIG.2 SMPS

3.3 PROXIMITY SENSORS

FIG.3 PROXIMITY SENSOR

Proximity sensor is a sensor which operate an without any physical contact of object with it.it is a solid state electronic device.

The proximity sensor is used when:

- small object to be detect
- for fast rapid response of switch
- metalic as well non-metalic object has to be detect

3.4 INDUCTIVE PROXIMITY SWITCHES

PRINCIPLE OF OPERATION:

These types of switches work on the "Damped Oscillator" principle. During operation a frontally radiated electromagnetic oscillating field is projected from the sensing face. Any Electrically conductive material entering this field causes

damping of the oscillations. This change is detected by the in-built sensitive & reliable electronic circuit and is converted into an effective output signal.

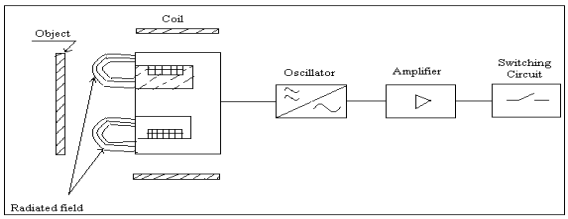

FIG.4 WORKING PRINCIPLE

3.5 SENSING OBJECT MATERIAL:

The standard inductive proximity switches can sense any metallic (electrically conductive) object. However there are special types of switches to sense either only ferrous objects or sense only non-ferrous (Cu, Al etc.) objects.

4. INTRODUCTION TO PLC

A programmable logic controller (PLC), It is programmable controller or solid state industrial computer.

a programmable controller is a black box with wires incoming signals in and wires sending signals out. It might also appear there is some magic being done inside that somehow decides when field devices should be turned on. In actuality, there is no magic. The PLC is a computer; however, without a set of instruction telling it what to do, it is nothing more than a box full of electronic components. Without any instructions, the PLC means a black box can do nothing. The program is the list of set of instructions and that tells the PLC to what to do.

Computers such as PLCs can be wonderful tools; however, although it might appear otherwise, they only do exactly what the human programmer told them to do.

4.1 WHAT IS A PROGRAMMABLE LOGIC CONTROLLER (PLC)?

The programmable logic controller (PLC), or programmable controller, can be classified as a solid-state member of the computer family. A PLC is an industrial computer in which it control devices like, push buttons, proximity or optical sensors, limit switches, float switches, and pressure switches, and so on, provide incoming control signals into the unit. An incoming control signal is called an Input.

The Incoming control signals or inputs, that are interact with instructions written in ladder program, according this PLC react with the incoming signals. The PLC will operate or monitor the field devices like motor starters, pilot lights, & solenoids. A controlling signal is nothing but a output signal. Figure 1 gives an overview of the interaction between SW 1 (the systems input), the PLC & its ladder program, & the pilot light output.

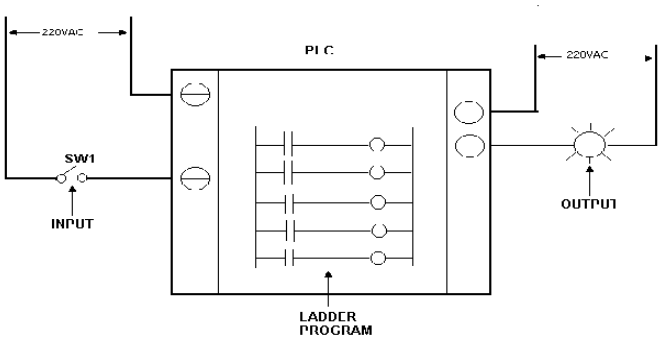

FIGURE-5 PLC INPUTS AND OUTPUTS

5. INTRODUCTION TO SCADA SOFTWARE:

SCADA is nothing but a "Supervisory Control and Data Acquisition". For controlling the process PLC, DCS, Micro controller and PID are used. To view the graphical picture of the process SCADA is to be used.

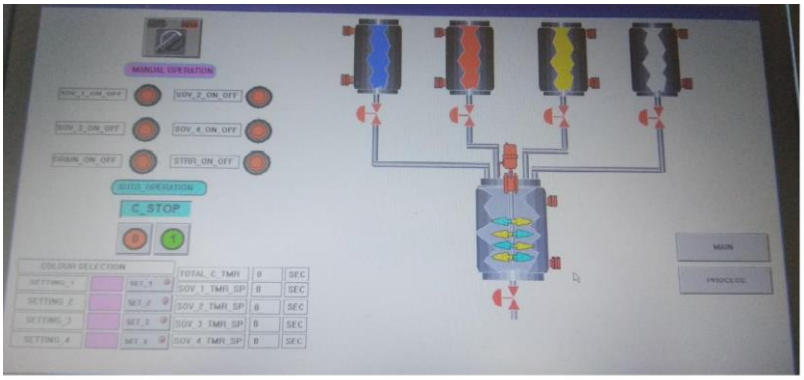

FIG.6 SCADA SCREEN

6. COMMUNICATION OF COMPUTER TO PLC

Allen Bradley PLC (Micrologix 1400) can be programmed by using software RS Logix 500 (version 8.1 or later). For the programming of process the software has to be installed in PC and then through communication USB port connect it with PLC. Then communicate the PC to PLC using RS logix Link. Then open the program and it can edit, change, or make a new program.

Steps to start communication:

1) Install RS logix 500 by the CD provided in the computer through which you want to communicate to PLC.
2) Fix the cable which provided to the PLC & connect other end of cable to computer.
3) Then click on the RS link Classic on the bottom toolbar of the computer. After clicking a screen will open on which click on the cable symbol "**Configure Drivers**". On that screen there is a drop below list, click on drop below list and select **Ethernet Devices**. Then click on **"Add New"** button, a default screen will appear click on **OK**. After that a screen will appear for configuration of port, Enter IP Address Which is avail/assign in PLC Controller

   EX, 192.168.001.100, Click on Ok Button
4) At the same enter **192.168.001.011** in you LAN network of your PC
5) **Open** RS link classic >Communication > RSWho>PLC block will be displayed on screen
6) Now the configuration is complete.

Follow following steps for establishing PLC-SCADA communication-

1) Install Siemens Simatic win CC software on the workstation PC.

2) Follow the required steps of installation and install and open the software.

3) The SCADA screen will appear on the PLC trainer kit.

4) Connect the Ethernet ports from the PC and the PLC to Data Link Switch, which is provided with the kit.

5) Set the PC IP address from Network center on the **PC. E.g. 192.168.1.011.**

6) Check the IP address for **PLC**, this is a fixed IP address. Like **E.g. 192.168.1.100**. The two IP addresses should be close to each other to enable the required communication. Test the connection through the software ad click on "**OK** ".

7) Now, the communication through Ethernet has been established. The parameters and testing can be done through the SCADA window.

7. MODEL PROTOTYPE:

FIG.7 MODEL PROTOTYPE

8. RESULT:

1. User can select any of color which shown in scada screen
2. User can find the time for mixing the color.
3. User can find stirrer motor time for color mixing.
4. User can find the time to take for bottle filling.

9. CONCLUSION:

In this process the color mixing, color making, and controlling of the process is done by using PLC as well as SCADA software. In this process we used three primary colors and made six different type of colors with different ratios.

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