

# Beverage Preparation and Bottling Unit using PLC & SCADA System as a Proposed Automation for a Small Scale Industries

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**Abstract:** During this industrialization, small scale industries play an important role for fulfilling the process immediate needs of the society. In a challenge to competitive industrial world, a system must be flexible, efficient and cost effective; so automation in industries is very much essential. The concept of automation is so versatile that it can bring radical development in almost every field. A prototype of commercial “Beverage preparation and bottling unit using PLC & SCADA and show its visualization on SCADA screen”, controlled using programmable logic controller (PLC) is proposed and the whole process is monitored using supervisory control and data acquisition (SCADA) and projected here as introduction to automation. Demand of new beverages is increasing day by day in the market so this project provides the method of preparation of soft drinks like cold coffee and ice tea in a new approach by implementing automation using PLC&SCADA for its preparation, bottling and packaging. The objective of this work is to encourage small scale industries for the implementation of automation in beverage preparation and its bottling plant. This work will provide low power consumption, low operational cost, less men power, accuracy and flexibility to the system and at the same time it will save the operational time of an industry.

**Keywords:** PLC, SCADA, Automation, Conveyor, Sensors, Valves.

## I. INTRODUCTION

This research is to design and develop the “New approach for small scale beverage preparation and bottling unit using PLC&SCADA. We can operate and control automatically the beverage preparation and its bottling unit by using PLC. We can monitor the parameter of the process in the plant using SCADA technology because SCADA system is used as supervisor or monitor for the process through an animation. In this plant several operation will run simultaneously by the help of PLC. In the first process the pump feed the water to the process water tank from the purified water reservoir. In the second process the liquid concentrate of different beverages (cold coffee and ice tea) are mixed with the purified water in their respective tanks. In the third process the bottles filled with the beverages moves to the packaging unit by a conveyor which will be by a conveyor motor. These are all automated processes leads to more accuracy and flexibility of the system.

## II. PLC USED AS A SYSTEM CONTROLLER

The operation of a programmable controller is relatively simple. The input/ output (I/O) system is physically connected to the field devices that are encountered in the machine or that are used in the process control. These field devices may be discrete or analog input/output

devices, such as limit switches, pressure transducers, push buttons, motor starters, solenoids, etc. The I/O interfaces provide the connection between the CPU with the information providers (inputs) and controllable devices (outputs).

During its operation, the CPU completes three processes: (1) it reads, or accepts, the input data from the field devices via the input interfaces, (2) it executes, or performs, the control program stored in the memory system, and (3) it writes, or updates, the output devices via the output interfaces. This process of sequentially reading the inputs, executing the program in memory, and updating the outputs is known as scanning.

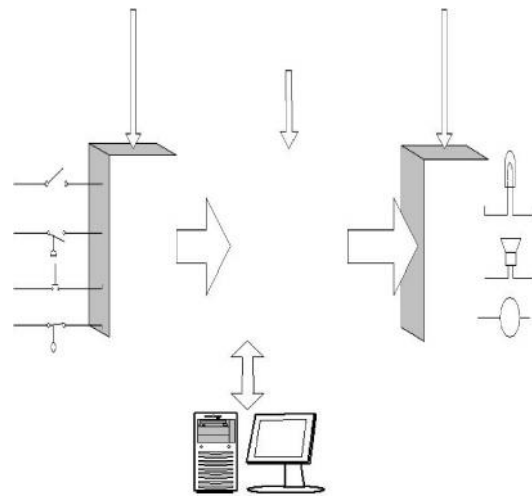


Figure 1: Basic PLC Operation Process

### III. MODERN SCADA SYSTEMS

SCADA stands for Supervisory Control and Data Acquisition. As the name indicates, it is not a full control system, but rather focuses on the supervisory level. As such, it is a purely user friendly software that is positioned on top of hardware to which it is interfaced, in general via Programmable Logic Controllers (PLCs), or other commercial hardware modules, SCADA encompasses the collecting of the information, transferring it back to the central site, carrying out any necessary analysis and control and then displaying that information on a number of operator screens or displays. The required control actions are then conveyed back to the process.

### IV. PLC AND ITS RELATED SOFTWARE

Here, with hardware of PLC manufacturer Allen Bradley Micrologix 1000 Analog have used. The programming software for this PLC is RSLOGIX500 of the version 7.30.10(CPR9). In Allen Bradley Micrologix 1000 Analog model of PLC, there are total 11 inputs and 8 outputs. The MicroLogix 1000 micro-PLC can handle a wide variety of big-time applications at 32 I/o or below, while using only a fraction of the space of a full size controller. RS-232 communication channel allows for simple connectivity to a personal computer for program upload, download and monitoring using multiple protocols, including DF1 Full-Duplex.

Proximity Sensors - Proximity Sensors are available in two type's namely 1) Inductive sensors 2) Capacitive Sensors, Inductive Sensors are cheaper and allow detection of metal objects whereas capacitive sensors are costly and allow detection of metal, plastic and glass objects as well.

Variable frequency drive- Adding a variable frequency drive (VFD) to a motor-driven system can offer potential energy savings in a system in which the loads vary with time. VFDs belong to a group of equipment called adjustable speed drives or variable speed drives.

## V. PROCESS OPERATION

### i) Description using SCADA system

This work represents a complete application of automation. The various process of this system is controlled by PLC and monitored using SCADA. PLC and SCADA are the heart of the system. The system is controlled according to the programmed PLC. To monitor the processing of the entire plant SCADA is used. Figure 2 shows the SCADA view of the whole process.

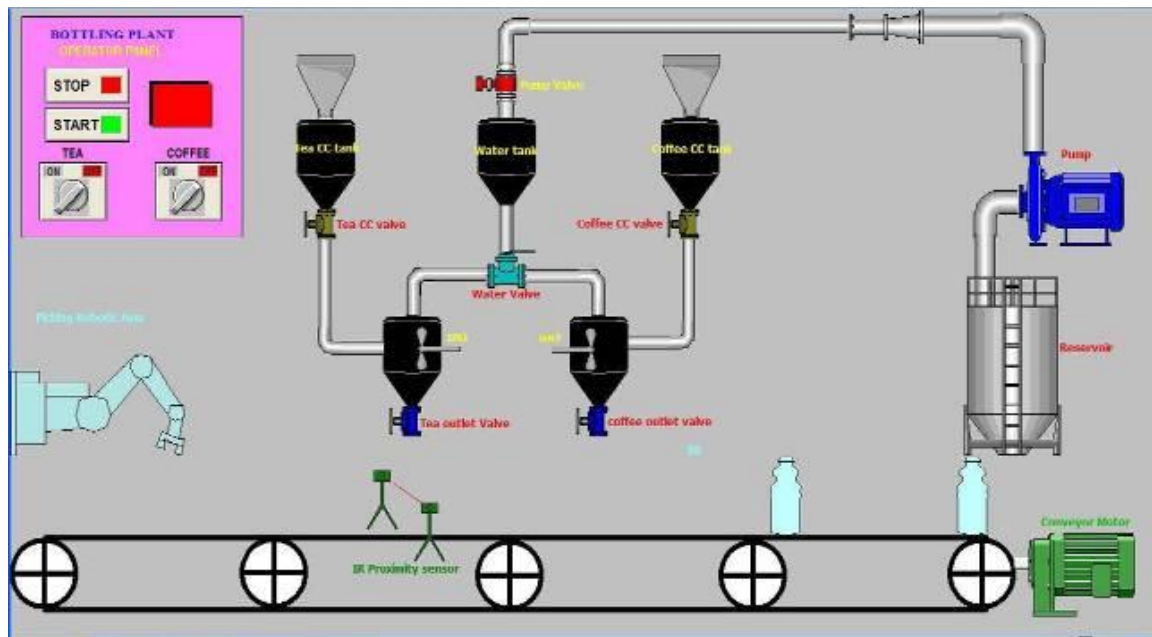


Figure 2: Process Monitoring through SCADA Screen

This is specially designed for the preparation of beverages like cold coffee and ice tea we are using purified water, liquid concentrate for beverages. In the above process when we switch on all the switches (Start, tea, coffee) then the liquid concentrate are start fill in their respective tank and the water tank is filled by the help of pump from the reservoir. Then the water valve open automatically and the water pass to the two mixing tank for a given time which was already programmed as per the tank volume and our requirement. Then the valve of the two beverages tank open and the concentrate liquid for the beverages are pass to their respective mixing tanks for a given amount of time. The ratio of two different liquids will decided as per the required mixed liquid that we needed in the bottle. Timer is set in the programmed for the valves opening and closing as per the tanks volume. There is a stirrer motor is also fitted to mix these two liquids of definite amount in the mixing tank, when the mixing of the water and the concentrate liquid completed then the stirrer motor stop.

Then in the next process the conveyor motor starts and the filling bottles comes right below to the outlet valve of tea and coffee. The position of the bottles detects at the exert point by a Proximity sensor at that time conveyor motor stops and filling process starts for a given amount of time then the filling stops and conveyor motor starts. Then the bottles go to the packaging unit by a robotic arm or by a conveyor belt. This process continues till mixing tank is empty. Then the whole process starts again. The opening and closing of the all solenoid valves are controlled by the timer range used in the program me.

ii) PLC Ladder Program of process operation

All the process of the above plant is describe in the ladder programming of the PLC.



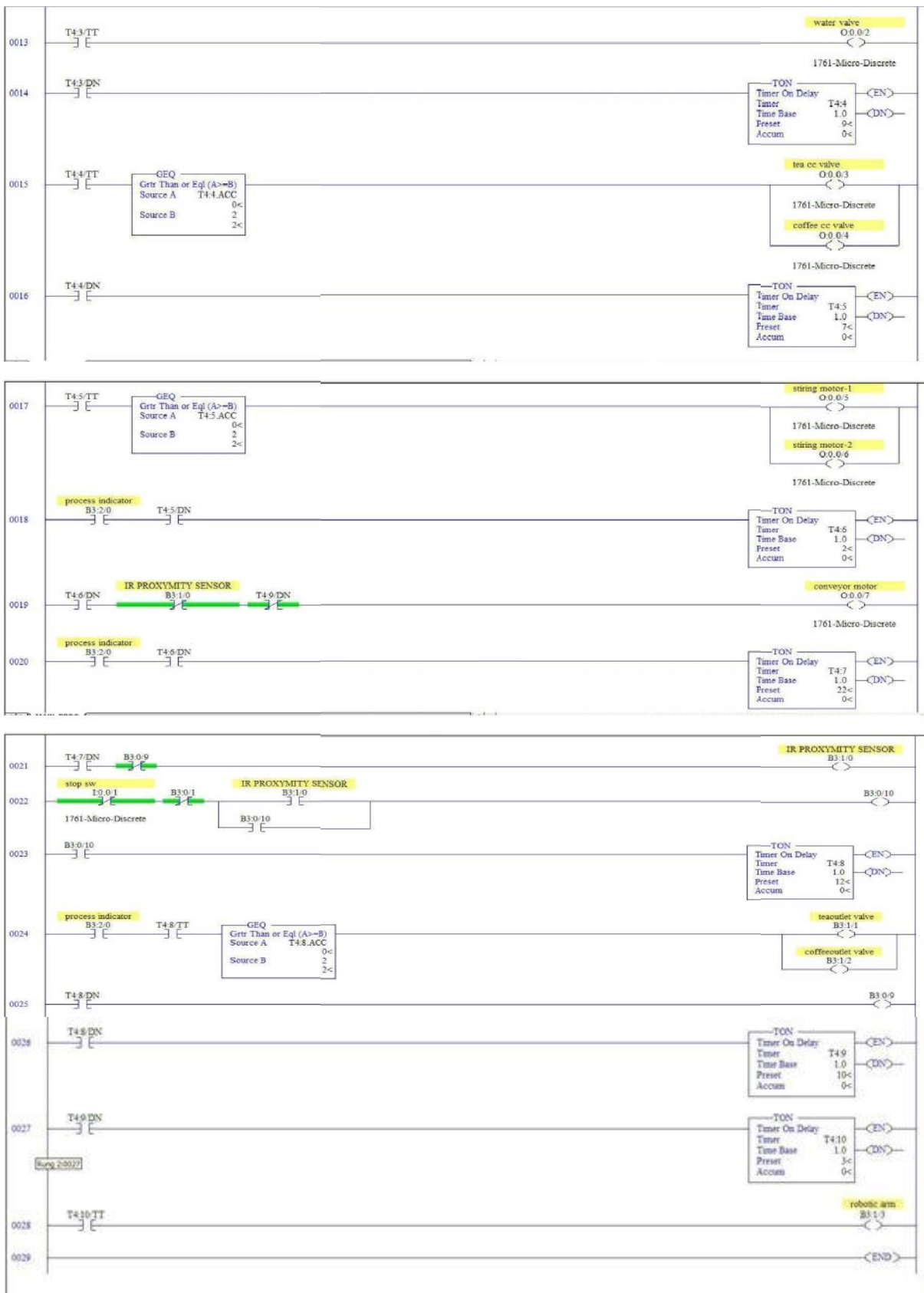


Figure 3: The PLC ladder logic for the plant



## CONCLUSION

Effort has been given for an automated way of beverage preparation and bottling in a small scale industry. In the above setup provides a great deal of application In the field of automation, in the field of mass production where all unit need to be processed and monitored in a short period of time which leads to increase in production. This paper presents a scope to small scale industries to introduce automation by help of PLC and SCADA in the field of beverage preparation and bottling plant. For the setup of a automated plant like this by using PLC and SCADA, the initial cost may be high but it offers many advantages that overcome its cost. It leads to high production rate, using of less men power, saving the operational time in the plant. Another additional feature of the proposed system is the use of SCADA that makes it controlled through a remote location. The complete monitoring is made by SCADA system. We can start and stop the system by using SCADA at the SCADA screen by sitting at a distance of the process. This concept helps in error detection in a process.

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