A REPORT ON

"PLC PRGRAMMING & SCADA REPRESENTATION FOR FOOD PRODUCTION SYSTEM"

(INFORMATIVE REPORT)

2016-2017

SUBMITTED BY:

STUDENTS OF FINAL YEAR **ELECTRICAL**

UNDER THE GUIDANCE OF

Prof. IFTEKHAR PATEL

Anjuman-I-Islam's
KALSEKARTECHNICAL CAMPUS
School of Engineering and Technology
New Panvel

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Submitted To : Prof. IFTEKHAR PATEL

Submitted By :

NAME	ROLL NO.
KHAN ZEESHAN	13EE29
KHAN ANAS	14DSEE11
SHAIKH MUZAKKIR	13EE50
SHAIKH AZHARUDDIN	13EE47

Prof. IFTEKHAR P.	Prof. S. KALEEM	Dr. A. R. HONNUTAGI
(GUIDE)	(H.O.D)	(DIRECTOR)

ACKNOWLEDGEMENT

We would like to acknowledge the contributions of those who assisted in the preparation of this report.

We are particularly grateful for the work done by members of my group. Before we get into this report we would like to thanks to the members of the group who are a part of this report and have given their unending contribution from start to end of this report.

We would like to our **Prof. IFTEKHAR PATEL** for providing as the required guidance in process of preparing the report. We would also like to express our deep regards and gratitude to the director **Dr. ABDUL RAZZAK HONNUTAGI**.

Finally, I would also like to thanks GOOGLE and WIKIPEDIA for the same

PREFACE

We take the opportunity to present the report on **"PLC PROGRAMMING & SCADA REPRESENTATION FOR FOOD PRODUCTION SYSTEM"**. The objective of this project is to provide the PLC Ladder Diagram and SCADA representation of juice processing plant.

The report is supported by images, charts to bring out the purpose and message. We have made sincere attempt and taken every care to present this report in precise and compact form, the language being on simple as possible. We tried to explain the advantages of automation in food industry and supported our points by different examples.

The task of completion of project through being difficulty was made quite simple, interesting and successful due to deep involvement and dedication of group members.

CERTIFICATE

This is to certify that the report entitled "**PLC PROGRAMMING & SCADA REPRESENTATION FOR FOOD PRODUCTION SYSTEM**" submitted by **KHAN ZEESHAN, KHAN ANAS, SHAIKH MUZAKKIR, SHAIKH AZHARUDDIN** in partial fulfillment of the requirement for the award of Bachelor of engineering in "**ELECTRICAL ENGINEERING**" is an authentic word carried by them under my supervision and guidance.

DATE :

Examiner _____

Prof. IFTEKHAR P. _____

(Guide)

Prof. S. Kaleem _____

(HOD)

Dr. Abdul Razzak Honnutagi

(Director)

ABSTRACT

This paper proposes an idea about automation of Food Processing plant using the PLC & SCADA . In this plant Chocolate & Strawberry milkshake are prepared with the help of raw materials. The objective of this project is to convert the manual project into fully automated plant for achieving higher accuracy & high hygine, and to save time and raw material. Automated plant also helps to increase the quality of product. The system uses intelligent equipments on site which deliver physical parameters (Analog/Digital) to PLC & SCADA for easy monitoring of plant.

Automation is not a newer concept. Automation is the use of machines, control systems and information technologies to optimize productivity in the production of goods and delivery of services. A Programmable Logic Controller, PLC is a digital computer used for automation of electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. Simplification of engineering and precise control of manufacturing process can result in significant cost savings.

DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

DATE ……

PLACE ……

(NAME OF THE STUDENT)

KHAN ZEESHAN ……..

KHAN ANAS ……..

SHAIKH MUZAKKIR ……..

SHAIKH AZHARUDDIN …….

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CHAPTER 1

INTRODUCTION

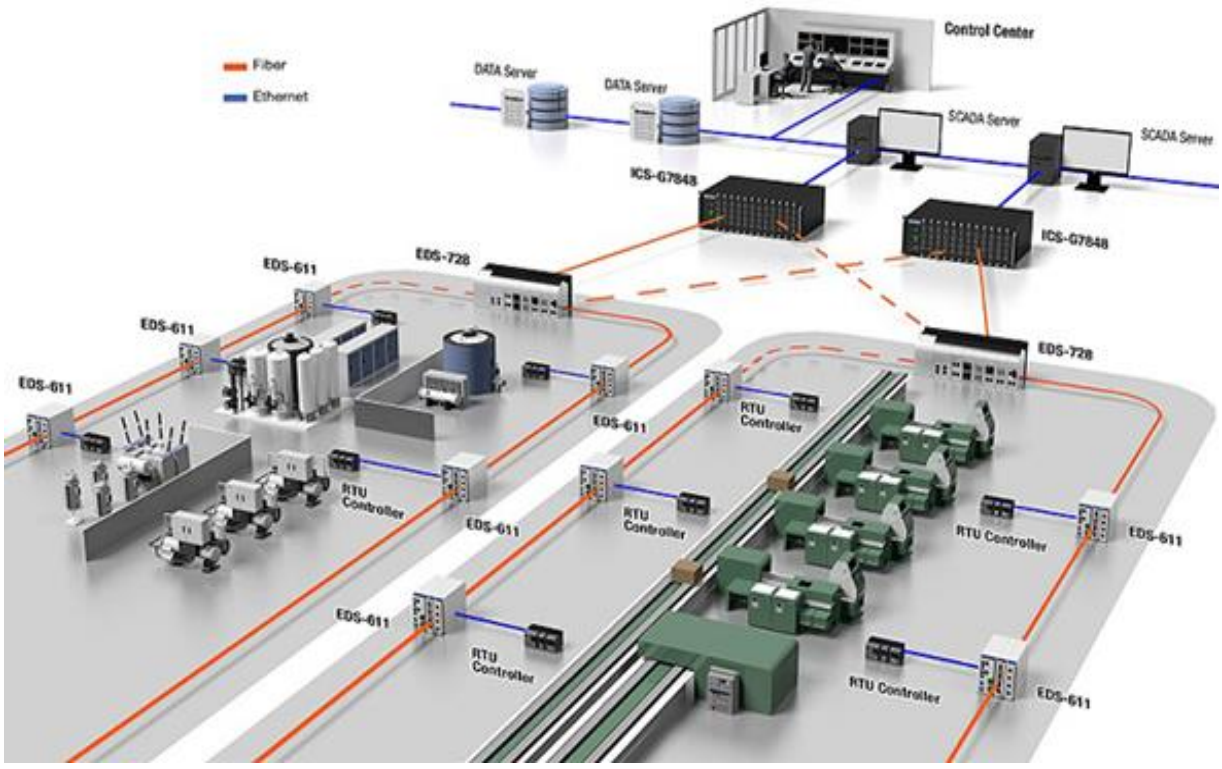
➢ AUTOMATION

"Automation" or "Automatic control", is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching on telephone networks, steering and stabilization of ships, aircraft and other applications with minimal or reduced human intervention. Some processes have been completely automated.

The biggest benefit of automation is that it saves labor; however, it is also used to save energy and materials and to improve quality, accuracy and precision.

The term "Automation", inspired by the earlier word automatic (coming from "Automaton"), was not widely used before 1947, when Ford established an automation department. It was during this time that industry was rapidly adopting feedback controllers, which were introduced in the 1930s.

Automation has been achieved by various means including mechanical, hydraulic, pneumatic, electrical, electronic devices and computers, usually in combination. Complicated systems, such as modern factories, airplanes and ships typically use all these combined techniques.



CHAPTER 2

HISTORY

Before the days of the PLC the only way to control machinery was through the use of relays. Relays work by utilizing a coil that, when energized, creates a magnetic force to effectively pull a switch to the ON or OFF position. When the relay is de-energized, the switch releases and returns the device to its standard ON or OFF position. So, for example, if I wanted to control whether a motor was ON or OFF, I could attach a relay between the power source and the motor. Then I could control when the motor is getting power by either energizing or de-energizing the relay. Without power, of course, the motor would not run, thus I am controlling the motor. This type of relay is known as a power relay. There could be several motors in one factory that need to be controlled, so what do you do? You add lots of power relays. So factories started to amass electrical cabinets full of power relays. But wait, what switches the coils in the power relays ON and OFF before the power relay turns the motor ON, and what if I want to control that? What do you do? More relays. These relays are known as control relays because they control the relays that control the switch that turns the motor ON and OFF. I could keep going, but I think you get the picture of how machines were controlled pre-PLC, and, more importantly, I think you start to see some of the problems with this system of electromechanical control via relays.

"So thereby invented the First **Programmable Logic Controller (PLC)**, started as a consultation project for the General Electric Company in 1968, thus the **PLC History** was born."

"Dick Morley. Richard (Dick) Morley"

"Dick Morley. Richard (Dick) Morley" was considered the **"Father"** of the programmable logic controller (PLC) since he was involved with the production of the first PLC for General Motors, the **Modicon**, at Bedford and Associates in **1968**. The Modicon brand of PLC is now owned by Schneider Electric."

Morley had a pretty clear picture of what he wanted this programmable controller to look like:

- No interrupts for processing
- Direct mapping into memory
- No software handling of the repetitious chores
- Slow (a mistake which Morley later realized)
- A rugged design that really worked
- Language (ladder logic came a few months later)

Morley took that memo to the team at Bedford, including Mike Greenberg, Jonas Landau and Tom Boissevain. Together, they worked on designing the unit that would be modular and rugged, using no interrupts. They called it the 084, since it was the 84th project for Bedford and Associates.

The mechanical and thermal design of the 084 made it stand apart from anything else any other company currently offered. It could withstand physical abuse, had no air inside and transferred air out through big metal fins so that no dirty air got inside to the electronics, meaning the device didn't have to be in a sealed cabinet.

The first PLC can be traced back to 1968 when Bedford Associates, a company in Bedford, MA, developed a device called a Modular Digital Controller for General Motors (GM). The MODICON, as it was known, was developed to help GM eliminate traditional relay-based machine control systems. Because relays are mechanical devices, they have limited lifetimes. They are also cumbersome, especially in large applications where thousands of them may exist. With so many relays to work with, wiring and troubleshooting could be quite complicated.

Since the MODICON was an electronic device, not a mechanical one, it was perfect for GM's requirements, as well as for many other manufacturers and users of control equipment. With less wiring, simpler troubleshooting, and easy programming, PLC technology caught on quickly.

PLCs are often defined as miniature industrial computers that contain hardware and software that is used to perform control functions. A PLC consists of two basic sections: the central processing unit (CPU) and the input/output interface system. The CPU, which controls all PLC activity, can further be broken down into the processor and memory system. The input/output system is physically connected to field devices (e.g., switches, sensors, etc.) and provides the interface between the CPU and the information providers (inputs) and controllable devices (outputs).

PLCs can be divided into at least three categories:

' **Full-size**, for top level applications requiring fast program execution with very short instruction cycle times. They are capable of supporting several CPUs for multiprocessing to provide more processing power. They offer the TCP/IP communication capability over general purpose networks to the supervisory workstations, and support field bus data transmission with equipment controllers.

' **Middle-size**, intended for industrial automated systems of medium power. They offer a large choice of analog and digital input/output modules. They are usually connected to a field bus on one side and to the equipment on the other side; their speed is not an important parameter, the amount of data transferred is small and the average price per function is low

' **Small** or **micro-size**, for direct interface with sensors and actuators. They are very simple electrically and mechanically and are sometimes integrated with the intelligent sensor itself, they are characterized by short reaction times and they transfer a small amount of data.

CHAPTER 3

"PLC"

A programmable logic controller (PLC), or programmable controller is an industrial digital computer which has been ruggedised and adapted for the control of manufacturing processes, such as assembly lines, or robotic devices, or any activity that requires high reliability control and ease of programming and process fault diagnosis.

They were first developed in the automobile industry to provide flexible, ruggedised and easily programmable controllers to replace hard-wired relays and timers. Since then they have been widely adopted as high-reliability automation controllers suitable for harsh environments. A PLC is an example of a "hard" real-time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result.

➢ FEATURES OF PLC :

PLC control system is that it regards PLC as control key component, utilize special I/O module to form hardware of control system with a small amount of measurement and peripheral circuit, to realize control to the whole system through programming.

1. High Reliability

Strong anti-interference quality and very high reliability are the most important features of PLC. In order to make PLC work stably in strong interferential circumstance. Many techniques are applied in PLC. Software control instead of relay control mode can decrease faults which are brought about by original electric contact spot outside working badly. Industrial grade components made by advance processing technology can resist interferences, and self diagnosis measures of watchdog circuit for protecting memory can improve performance of PLC greatly.

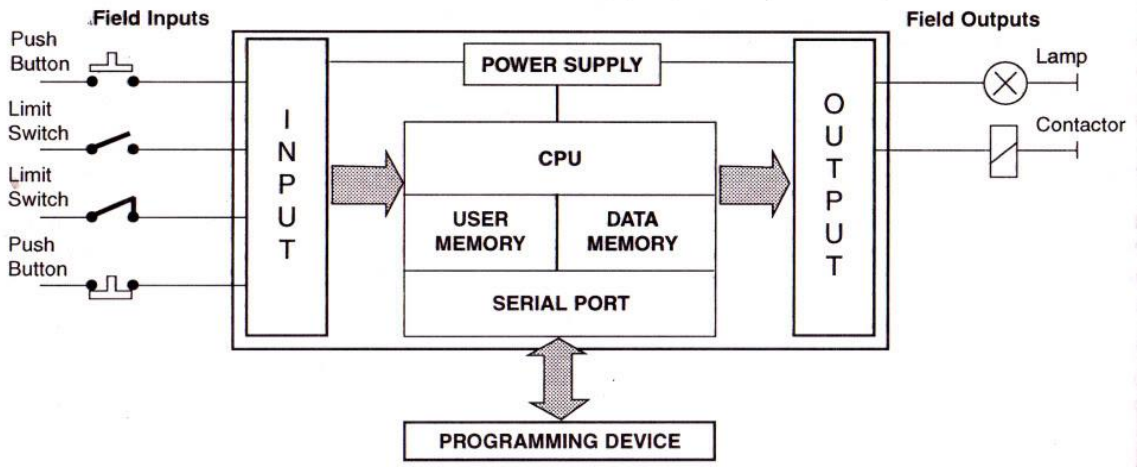
2. Good Flexibility

There are several programming languages for PLC including ladder diagram, SFC, STL, ST and so on. If operator can master only one of programming languages, he can operate PLC well. Every who want to use PLC has a good choice. Based on engineering practice, capacity and function can be expanded by expanding number of module, so PLC has a good flexibility.

3. Quality of Strong Easy-Operating

It is very easy to edit and modify program for PLC by computer offline or online. It is very easy to find out where the fault lie by displaying the information of fault and function of Self Diagnosing Function, and all these make maintenance and repair for PLC easier. It is very easy to configure PLC because of modularization, standardization, serialization of PLC.

➢ BLOCK DIAGRAM :



A simplified block diagram of a PLC shown in above Fig. It has three major units/sections.

- I/O (Input/Output) Modules.
- CPU (Central Processing Units).
- Programmer/Monitor.

The input section converts the field signals supplied by input devices/sensors to logic-level signals that the PLC's CPU can read.

The Processor Section reads these inputs, Processes the signal, and prepares the output signals.

The output section converts the logic level output signals coming from processor section to high level signals and used to actuate various output field devices.

The programmer/monitor is used to enter the user's program into memory and to monitor the execution of the program.

1) I/O Section:

The I/O section establish the interfacing between physical devices in the real world outside the PLC and the digital arena inside the PLC.

The input module has bank of terminals for physically connecting input devices, like push buttons, limit switches etc. to a PLC. the role of an input module is to translate signals from input devices into a form that the PLC's CPU can understand.

The Output module also has bank of terminals that physically connect output devices like solenoids, motor starters, indicating lamps etc. to a PLC. The role of an output module is to translate signals from the PLC's CPU into a form that the output device can use.

The tasks of the I/O section can be classified as:

- Conditioning
- Isolation
- Termination

- Indication

An electronic system for connecting I/O modules to remotely located I/O devices can be added if needed. The actual operating process under PLC Control can be thousands of feet from the CPU and its I/O modules.

2) CPU Section:

The Central Processing Unit, the brain of the system is the control portion of the PLC. It has three Subparts.

Memory System

Processor

Power Supply

- **Memory System:**

The memory is the area of the CPU in which data and information is stored and retrieved.The total memory area can be subdivided into the following four Sections.

- **I/O Image Memory:**

The input image memory consists of memory locations used to hold the ON or OFF states of each input field devices, in the input status file.

The output status file consists of memory locations that stores the ON or OFF states of hardware output devices in the field. Data is stored in the output status file as a result of solving user program and is waiting to be transferred to the output module's switching device.

- **Data Memory:**

It is used to store numerical data required in math calculation, bar code data etc.

- **User Memory:**

It contains user's application program.

- **Executive Memory:**

It is used to store an executive program or system software . An operating system of the PLC is a special program that controls the action of CPU and consequently the execution of the user's program. A PLC operating system s designed to scan image memory, interprets the instruction of user's program stored in main memory, and executes the user's application program the operating system is supplied by the PLC manufacturer and is permanently held in memory.

- **Processor:**

The processor, the heart of CPU is the computerized part of the CPU in the form of Microprocessor / Micro controller chip. It supervises all operation in the system and performs all tasks necessary to fulfill the PLC function.

It reads the information i.e status of externally connected input devices with input module.

It stores this information in memory for later use.

It carries out mathematical and logic operations as specified in application program.

After solving the user's program, it writes the result values in the memory.

It sends data out to external devices like output module, so as to actuate field hardware.

It performs peripheral and external device communication.

It Performs self diagnostics.

- **Power Supply:**

The power supply provides power to memory system, processor and I/O Modules. It converts the higher level AC line Voltage to various operational DC values.

for electronic circuitry.

3) Programmer/Monitor:

The Programmer/Monitor (PM) is a device used to communicate with the circuits of the PLC.The programming unit allows the engineer/technicians toenter the edit the program to be executed.

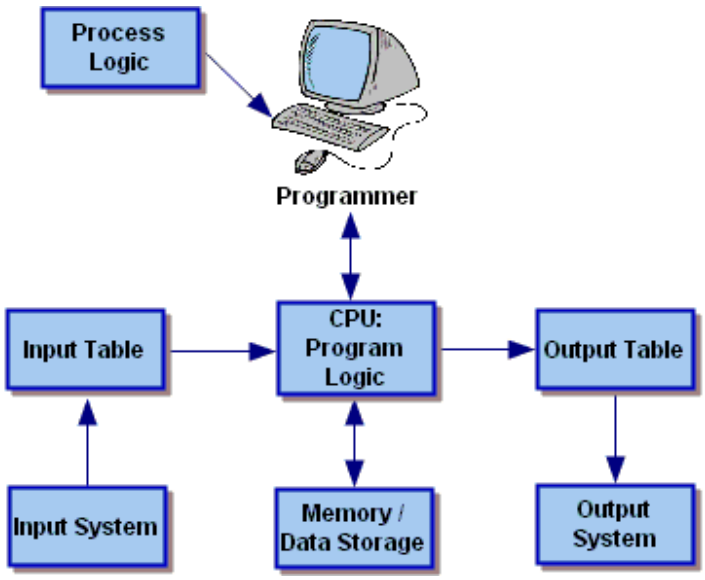
In its simplest form it can be hand-held device with membrane keypad for program entry, and a display device (LED or LCD) for viewing program steps of functions.

More advanced systems employ a separate industrial terminal or personal computers with type-writer type keyboard and CRT monitors. With the help of proprietary software, it allows programmer to write, view and edit the program and download it into the PLC. It also allows user to monitor the PLC as it is running the program. With this monitoring systems, such things as internal coils, registers, timers and other items not visible externally can be monitored to determine proper operation. Also,internal register data can be altered, if required. to fine tune program operation while debugging.communication between PM and PLC is done via a cable connected to a special programming port on PLC. connection to the personal computer can be through a serial port or from a dedicated card installed in the computer.

➢ DIFFERENT ASSEMBLY IN PLC :

- Processor or Central Processing Unit (CPU);
- Rack or Mounting;
- Input Assembly;
- Output Assembly;
- Power Supply;
- Programming Unit, Device, or PC/Software

We will start with explaining the physical components you see when looking at a PLC system – and then explore what goes on inside each part, and how the components relate to each other.



- **Rack Assembly:**

Most medium to large PLC systems are assembled such that the individual components – CPU, Input/Output, Power Supply – are modules that are held together within a rack.
In smaller PLC systems – all of these components may be contained in a single housing or "brick" – these smaller systems are sometimes referred to as "bricks" or "shoebox" PLCs.

- **Power Supply:**

The power supply provides power for the PLC system. The power supply provides internal DC current to operate the processor logic circuitry and input/output assemblies. Common power levels used are 24V DC or 120 VAC.

- **Processor (CPU) :**

The processor, central processing unit, or CPU is the "brain" of the PLC. The size and type of CPU will determine things like: the programming functions available, size of the application logic available, amount of memory available, and processing speed. Understanding the CPU can be a complex subject and we will tackle that in other articles.

- **Input/Output Assembly**:

Inputs carry signals from the process into the controller, they can be input switches, pressure sensors, operator inputs, etc. These are like the senses and sensors of the PLC.
Outputs are the devices that the PLC uses to send changes out to the world. These are the actuator the PLC can change to adjust or control the process – motors, lights, relays, pumps, etc.
Many types of inputs and outputs can be connected to a PLC, and they can all be divided into two large groups – analog and digital. Digital inputs and outputs are those that operate due to a discrete or binary change – on/off, yes/no. Analog inputs and outputs change continuously over a variable range – pressure, temperature, potentiometer.

- **Programming Device:**

The PLC is programmed using a specialty programmer or software on a computer that can load and change the logic inside. Most modern PLCs are programmed using software on a PC or laptop computer. Older systems used a custom programming device.

➢ **MODULES IN PLC :**

- **VACANT RACK :**

- **POWER SUPPLY :**

The power supply (PS) section gets its input power from an external 120VAC or 240VAC source (line voltage), which is usually fused and fed through a control relay and filter external to the PS. In addition, the PS has its own integral AC input fuse.

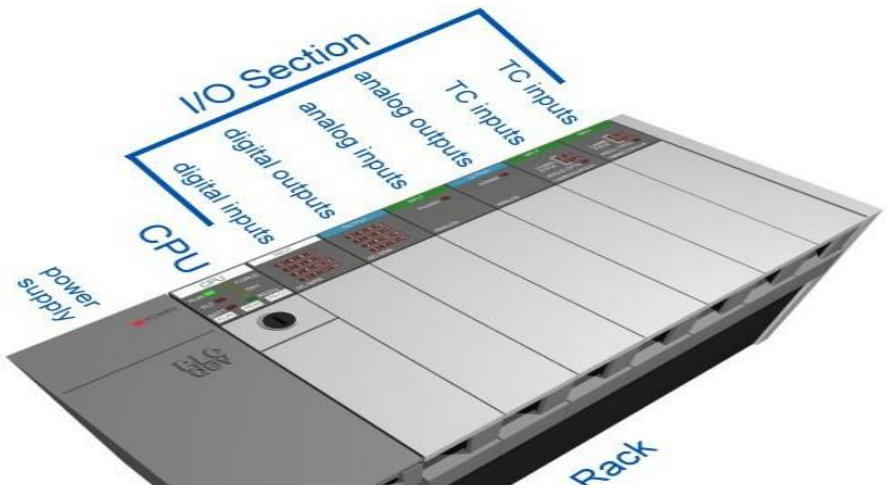
- **INPUT MODULE :**

It receives the peripheral sensing unit's signal and provides signal conditioning, termination, isolation and/or indication for that signal's state.

- **OUTPUT MODULE :**

The output module transmits discrete or Analog signals to activate various devices such as hydraulic actuators, solenoids, motor starters, and displays the status (through the use of LEDs) of the connected output points.

- **RACK FILLED WITH INPUT / OUTPUT MODULES :**

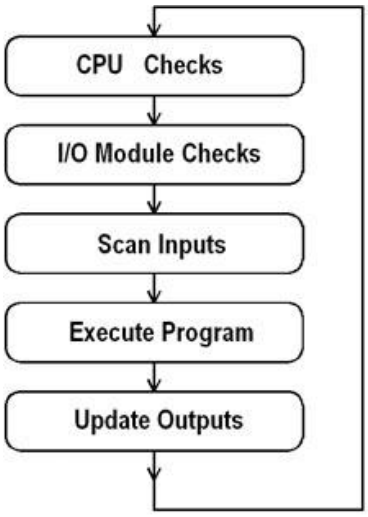


“NOW THIS IS HOW THE ACTUAL “PLC” LOOK LIKE AFTER PUTTING ALL THE MODULES IN THE RACK & THE SAME HARDWARE OF “PLC” IS USED IN THE INDUSTRIES MANUFACTURED BY SCHEIDER ELECTRIC.”

“PLC HARDWARE”

➢ SCAN CYCLE OF PLC :

PLCs operate by continually scanning programs and repeat this process many times per second. When a PLC starts, it runs checks on the hardware and software for faults, also called a self-test. If there are no problems, then the PLC will start the scan cycle. The scan cycle consists of three steps: input scan, executing program(s), and output scan.



Input Scan: A simple way of looking at this is the PLC takes a snapshot of the inputs and solves the logic. The PLC looks at each input card to determine if it is ON or OFF and saves this information in a data table for use in the next step. This makes the process faster and avoids cases where an input changes from the start to the end of the program.

Execute Program (or Logic Execution): The PLC executes a program one instruction at a time using only the memory copy of the inputs the ladder logic program. For example, the program has the first input as ON. Since the PLC knows which inputs are ON/OFF from the previous step, it will be able to decide whether the first output should be turned ON.

Output Scan: When the ladder scan completes, the outputs are updated using the temporary values in memory. The PLC updates the status of the outputs based on which inputs were ON during the first step and the results of executing a program during the second step. The PLC now restarts the process by starting a self-check for faults.

- **MANUFACTURER OF PLCs :**

CHAPTER 4

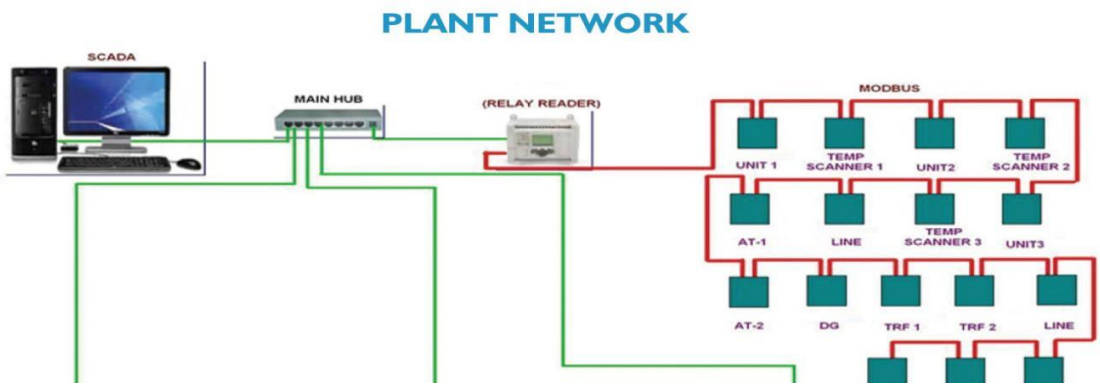
"SCADA"

(Supervisory **C**ontrol **A**nd **D**ata **A**cquisition**)**

➢ WHAT IS SCADA ?

Supervisory Control And Data Acquisition (SCADA) is a control system architecture that uses computers, networked data communications and graphical user interfaces for high-level process supervisory management, but uses other peripheral devices such as programmable logic controllers and discrete PID controllers to interface to the process plant or machinery. The operator interfaces which enable monitoring and the issuing of process commands, such as controller set point changes, are handled through the SCADA supervisory computer system. However, the real-time control logic or controller calculations are performed by networked modules which connect to the field sensors and actuators.

The SCADA concept was developed as a universal means of remote access to a variety of local control modules, which could be from different manufacturers allowing access through standard automation protocols. In practice, large SCADA systems have grown to become very similar to distributed control systems in function, but using multiple means of interfacing with the plant. They can control large-scale processes that can include multiple sites, and work over large distances. It is one of the most commonly-used types of industrial control systems, however there are concerns about SCADA systems being vulnerable to cyber warfare / cyber terrorism attacks.



- **FEATURES OF SCADA :**

- **DYNAMIC PROCESS GRAPHIC :**

  Mimics the entire process on a screen.

- **REAL TIME AND HISTORICAL TREND :**

  The trend play very important role in the process operation. If your batch fails or the plant trips, you can simply go to the historical trend data and do the analysis. You can have better look of the parameters through the trend.

- **ALARMS :**

  Have a critical role in automation scada supports 4types of alarms like LOLO,LO,HI,,HIHI.

- **DEAD BAND :**

Value of dead band defines the range after which a high low alarm condition returns to normal.

- **RECIPE MANAGEMENT :**

  When you have different products to manufacture, you just have to load the recipe of the particular product.

- **SECURITY :**

  One can allocate certain facilities or features to the operator, process people, engineering dept the operator, process people, engineering dept and maintenance dept and maintenance dept.

- **DATABASE CONNECTIVITY :**

Most manufacturing units go for enterprise resource management or management information system as data plays a very important role in the business cycle.

- **APPLICATIONS OF SCADA :**

SCADA is widely used in different areas from chemical, gas, water, communications and power systems. The list of applications of SCADA can be listed as follows :

1. Electric power generation, transmission and distribution: Electric utilities use SCADA systems to detect current flow and line voltage, to monitor the operation of circuit breakers, and to take sections of the power grid online or offline.

2. Water, Waste Water Utilities and Sewage: State and municipal water utilities use SCADA to monitor and regulate water flow, reservoir levels, pipe pressure and other factors.

3. Buildings, facilities and environments: Facility managers use SCADA to control HVAC, refrigeration units, lighting and entry systems.

4. Oil and Gas Trans & Distributions.

5. Wind Power Generation.

6. Communication Networks.

7. Industrial Plans and Process Control.

8. Production Department.

9. Quality Department.

10. Maintenance Department.

11. Enterprises Information.

12. Engineering Department.

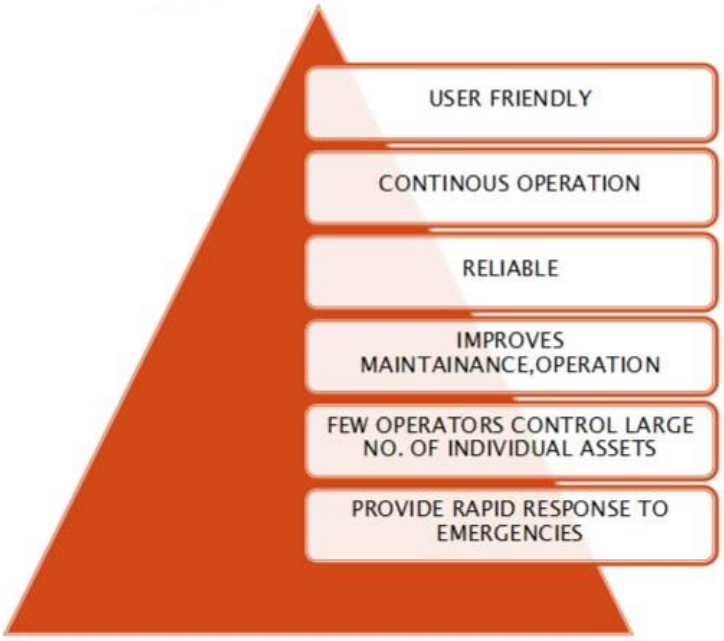
13. Manufacturing Department.

14. Home Automation.

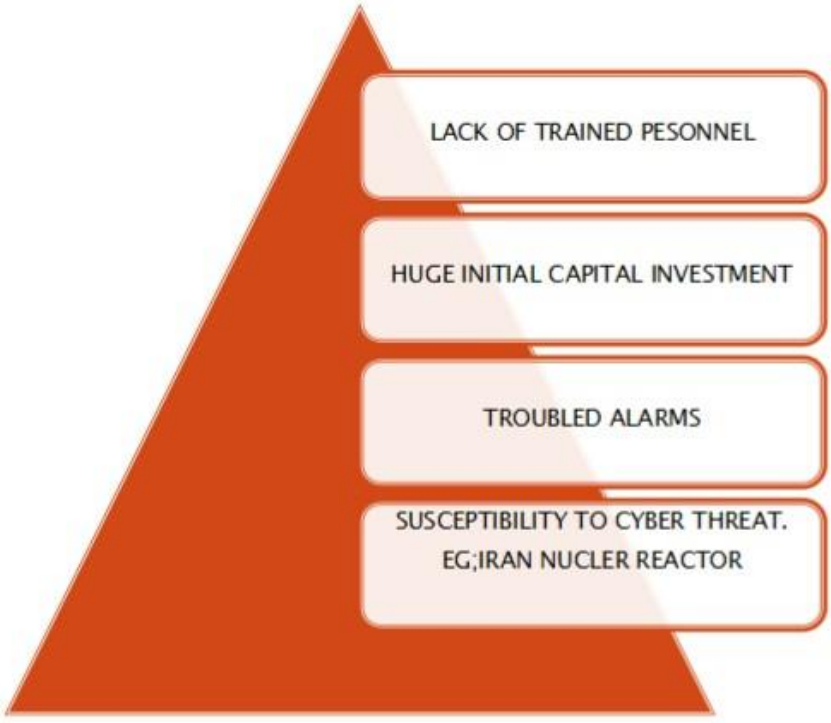
15. Distribution Stations.

- **SCADA CONTROL ROOM OF THE PLANT :**

- **ADVANTAGES :**



- **SHOTCOMINGS :**



- **SCAAD MANUFACTURER AND NAME OF THE SOFTWARES :**

CHAPTER 5

ABOUT PROJECT

➢ FOOD PROCESSING PLANT

Food processing dates back to the prehistoric ages when crude processing incorporated fermenting, sun drying, preserving with salt, and various types of cooking (such as roasting, smoking, steaming, and oven baking), Such basic food processing involved chemical enzymatic changes to the basic structure of food in its natural form, as well served to build a barrier against surface microbial activity that caused rapid decay. Salt-preservation was especially common for foods that constituted warrior and sailors' diets until the introduction of canning methods. Evidence for the existence of these methods can be found in the writings of the ancient Greek, Chaldean, Egyptian and Roman civilizations as well as archaeological evidence from Europe, North and South America and Asia. These tried and tested processing techniques remained essentially the same until the advent of the industrial revolution. Examples of ready-meals also date back to before the preindustrial revolution, and include dishes such as Cornish pasty and Haggis. Both during ancient times and today in modern society these are considered processed foods.

➢ BENEFITS :

Benefits of food processing include toxin removal, preservation, easing marketing and distribution tasks, and increasing food consistency. In addition, it increases yearly availability of many foods, enables transportation of delicate perishable foods across long distances and makes many kinds of foods safe to eat by de-activating spoilage and pathogenic micro-organisms. Modern super markets would not exist without modern food processing techniques, and long voyages would not be possible.

➢ PERFORMANCE PARAMETERS :

When designing processes for the food industry the following performance parameters may be taken into account:

- Hygiene, e.g. measured by number of micro-organisms per mL of finished product
- Energy efficiency measured e.g. by “ton of steam per ton of sugar produced”
- Minimization of waste, measured e.g. by “percentage of peeling loss during the peeling of potatoes”
- Labour used, measured e.g. by “number of working hours per ton of finished product”
  Minimization of cleaning stops measured e.g. by “number of hours between cleaning stops”

- **COMPONENTS**

These Are The Main Components Used For The **"PLC PROGRAMMING & SCADA REPRESENTATION FOR FOOD PROCESSING PLANT".**

- PLC
- SCADA
- HMI
- CONVEYOR BELT
- HEATER
- MOTOR
- SOLENOID VALVE

CHAPTER 6

PROJECT WORK

In this project **("PLC Programming & SCADA Representation For Food Production System")** there is 3 stages on which the whole process are depending / working. Those three stages are shown below :

- **STAGES :**
  - ✧ **"CLEANING MECHANISM"**
  - ✧ **"SYRUP PRODUCTION"**
  - ✧ **"DRINK PRODUCTION"**

Let we understand each process one by one and will try to get then that how they are working and which type of hardware & software materials they are containing and the parameters too.

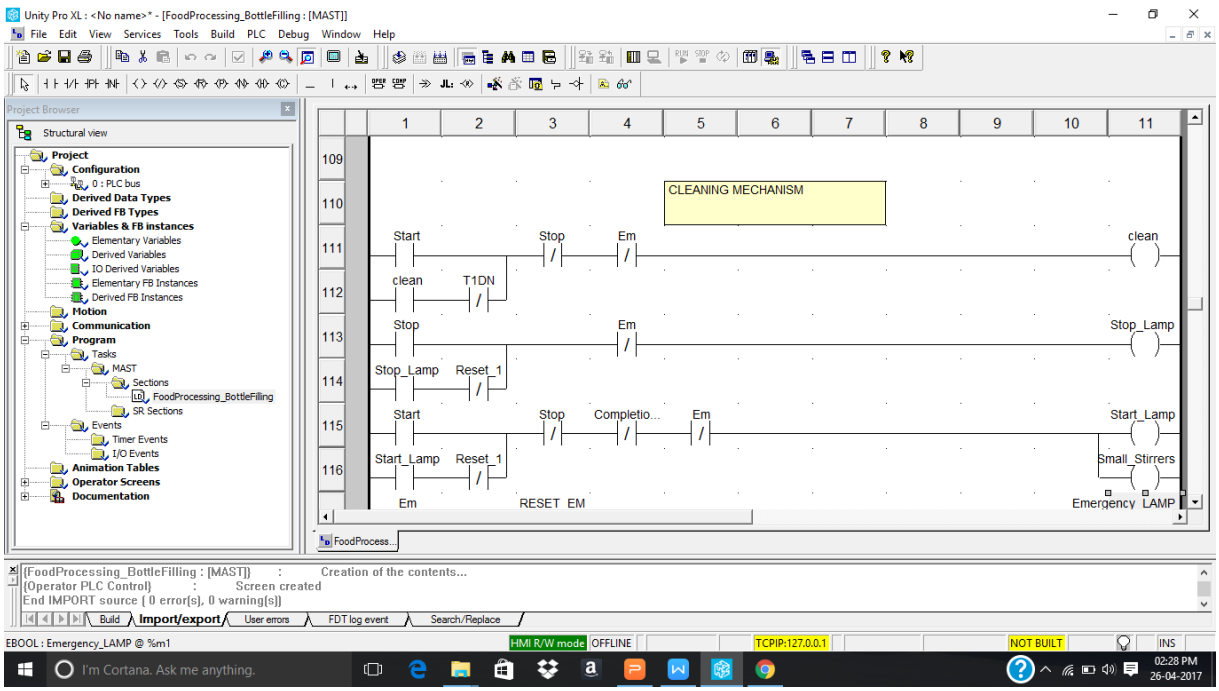
- **CLEANING MECHANISM :**

In the **Cleaning Mechanism** we have made the program in the **"Unity PRO XL"** PC software in the form of Ladder Diagram which the help of which we give the command toh the mechanism in the factory to clean all the tanks coming in the process of that particular operation like if we want to made an Apple Milk Shake and we need some tanks like; tank for the slices of apple, sweetening agent tank, Mixing tank, Milk tank, Main tank. So before starting the process we need all the related tanks to be cleaned such that they don't even have 1% of the bacteria or germs.

To clean all the tanks we need much amount of water and that water is drawn from the main water tanks situated near to all the tank which is larger than all other tanks as it contains big amount of water.

When the water has been supplied to every tanks which we are cleaning then each tank have a mechanical hardware inside them called Stirrer. Stirrer work the cleaner of the tank which rotates 360 degrees all the times and make the water to cover each and every part in the tank so the tank cleans properly. To clean then completely every tanks have a Heater attached to them which make the coming water heated are with the help of the heated water can remove the micro bacteria in the tank. Once the cleaning in the tank is been done the water is drwan out of tank with the help of pipes situated at the bottom of every tanks.

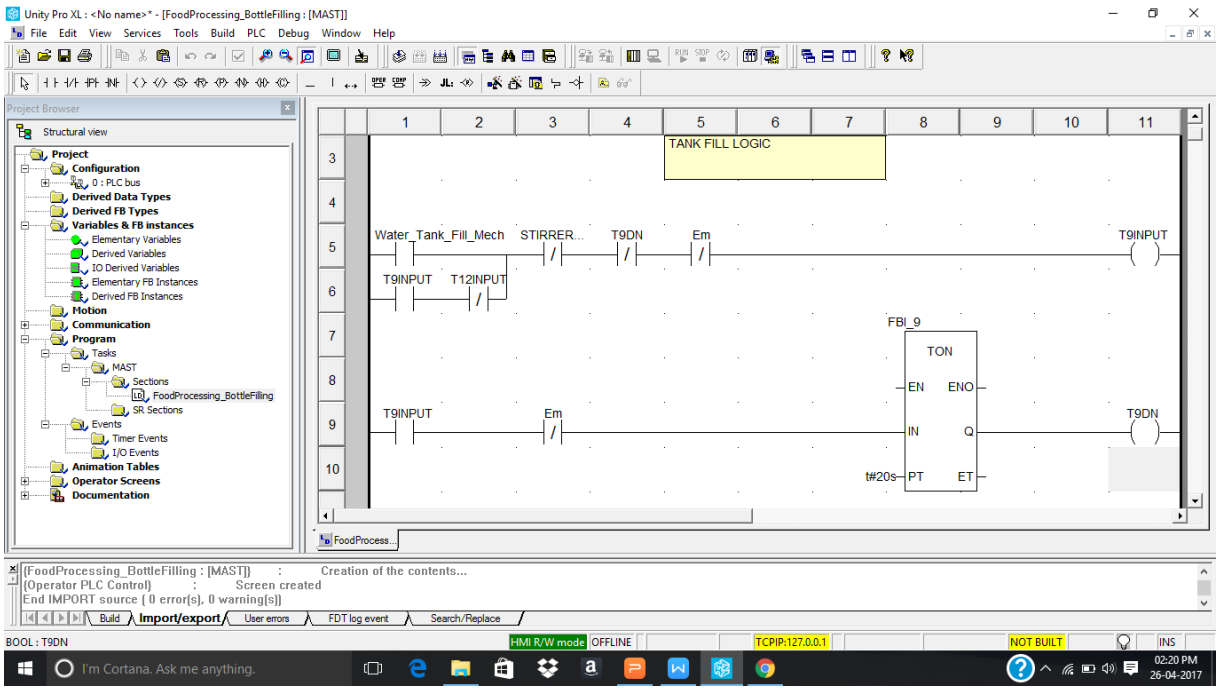
Have a look of the Screen Shots of the Ladder Programmings of Cleaning Mechanism made on the **“Unity Pro XL”** software :



The Screen Shot of the cleaning mechanism is showing the Rungs Of Ladder Programming as the first Rung is having a Start Button which is giving the output to the “Clean” followed by the latching as shown in the picture. Like that all Rungs are having their differnet meaning of functions.

In our project we are cleaning the Main Tank, Chocolate Tank, Strawberry Tank, and Milk Tank. So we made the Ladder Program for cleaning process in “11 Rings” with the help of 3 TON Timers. The timer are needed in the process because we have to put a particular time for the cleaning process, once the time is completed the stirrer in the tanks stops rotating and the bottom pipes becomes open automatically to drain the water.

Since we have understood and made the Ladder programming for the Cleaning Process and for giving command to the process to supply the water from the main water tank to all other tanks we have to make the program for that also. So the Screen Shot for that particular programming is shown :



The process of tank filling is having 2 TON Timers in the Ladder Diagram along with the sensors. The sensors are connected on each tanks to manges the water level flowing into the tanks.

➢ SYRUP PRODUCTION :

This process is lengthy because we make the whole process this particular section only. We make the mixing of the actual material of any food like Fruits with the with Sweetening Agent (which is the paste of Sugar and less amount of water and it's in the for of somewhere liquid.

In the Syrup Production there is 2 Process :

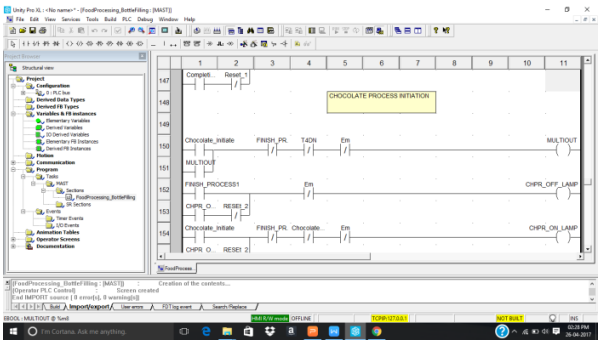
- ✓ **CHOCOLATE SYRUP**
- ✓ **STRAWBERRY SYRUP**

1. CHOCOLATE SYRUP :

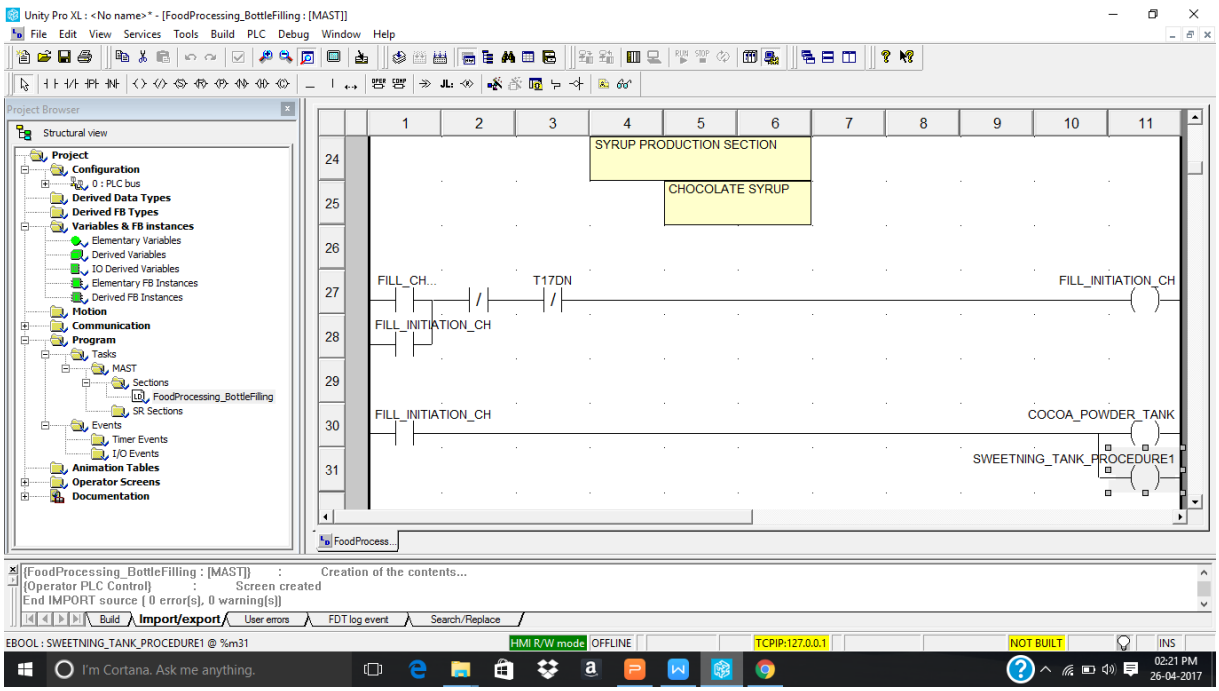
In the **Chocolate Syrup Production**, the process starts from pouring the actaul Chocolate in the Chocolate Tank where it is made in powdered form with the help of Augur (Circular Cutter) covering the full area inside the tank. It is optional because in the case of if the company is taking the actual Chocolate Material in the form of Hard form or Powder form, if it is in the form of powder then no need of Sharpen Augur in the tank.

Once the hard Chocolate material converted in the powder form then we give the command to the process to give that powder to the "Mixer Tank" with the help of **"HMI"** screen situated very near to the plant. While the powdered Chocolate is pouring into the Mixing Tank, one more ingredient in to come in the Mixing Tank along with the Chocolate Powder is "Sweetening Agent" which is the light liquid paste of Sugar for the sweetening purpose of the Syrup. After coming both the materials i.e. Chocolate Powder & Sweetening Agent in the Mixing Tank (which is usually large in size), two stirrer is connected inside thus tank also to mix the Chocolate Powder and the Sweetening Agent properly.

Some good quality Heaters are also connected to the Mixing Tank to make the mixed material in required temperature and some Sensors are connected too, to make give signals to the heater to vary its temperature. Once the mixing process is done then the Chocolate Syrup is ready to go in the main Chocolate Tank from where it will mixed with the Milk and then will filled in the Bottle to drink, we will know more about this in the Drink Production Section.



Have a look of the Screen Shots of the Ladder Programmings of Chocolate Syrup Production made on the **"Unity Pro XL"** software :



The Rungs of the Ladder Programming of Chocolate Syrup Production is shown in the picture and the programming for that contains 3 TON Timer. The process explained in the paragraph of the Chocolate Syrup Production is written in the the program with the help or Ladder Logic Circuits.

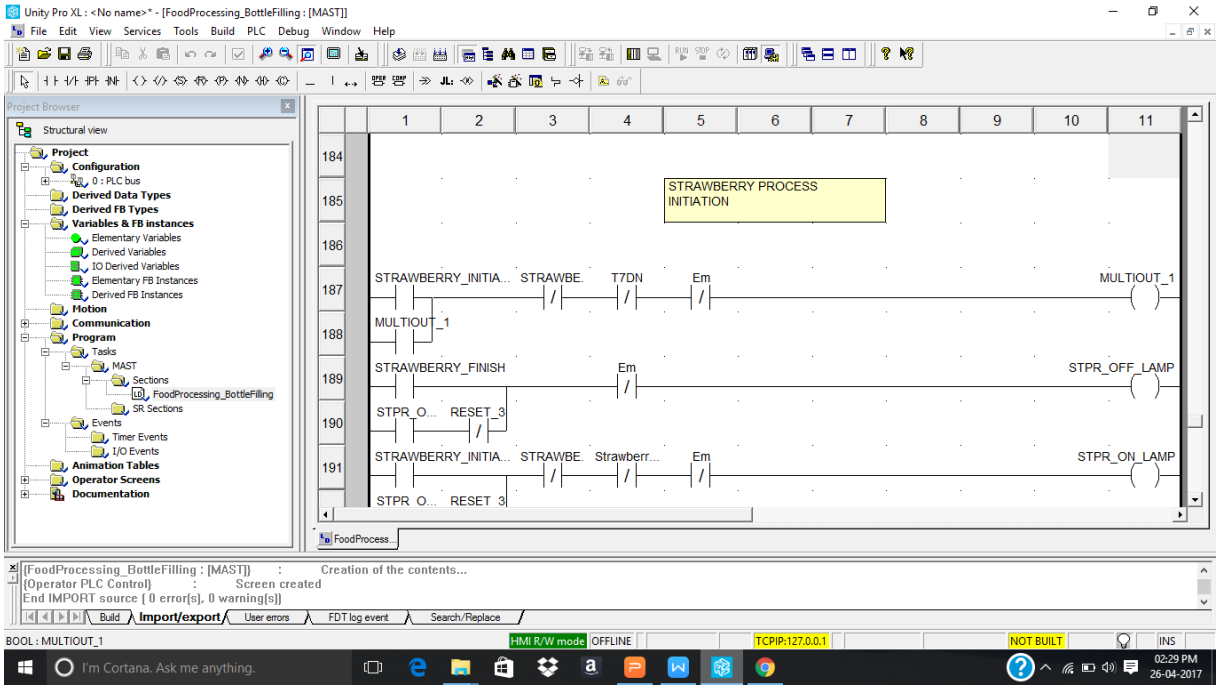
2. STRAWBERRY SYRUP :

In the **Strawberry Syrup Production**, the process starts from pouring the actaul Strawberry Fruit in the Strawberry Tank where it is made in paste form with the help of Augur (Circular Cutter) covering the full area inside the tank. It is optional because in the case of if the company is taking the actual Strawberry Fruits in or Powd form of Strawberry, if it is in the form of powder then no need of Sharpen Augur in the tank.

Once the hard Strawberry Fruit is converted in the paste form then we give the command to the process to give that paste to the "Mixer Tank" with the help of **"HMI"** screen situated very near to the plant. While the Srawberry paste is pouring into the Mixing Tank, one more ingredient in to come in the Mixing Tank along with the Strawberry paste is "Sweetening Agent" which is the light liquid paste of Sugar for the sweetening purpose of the Syrup. After coming

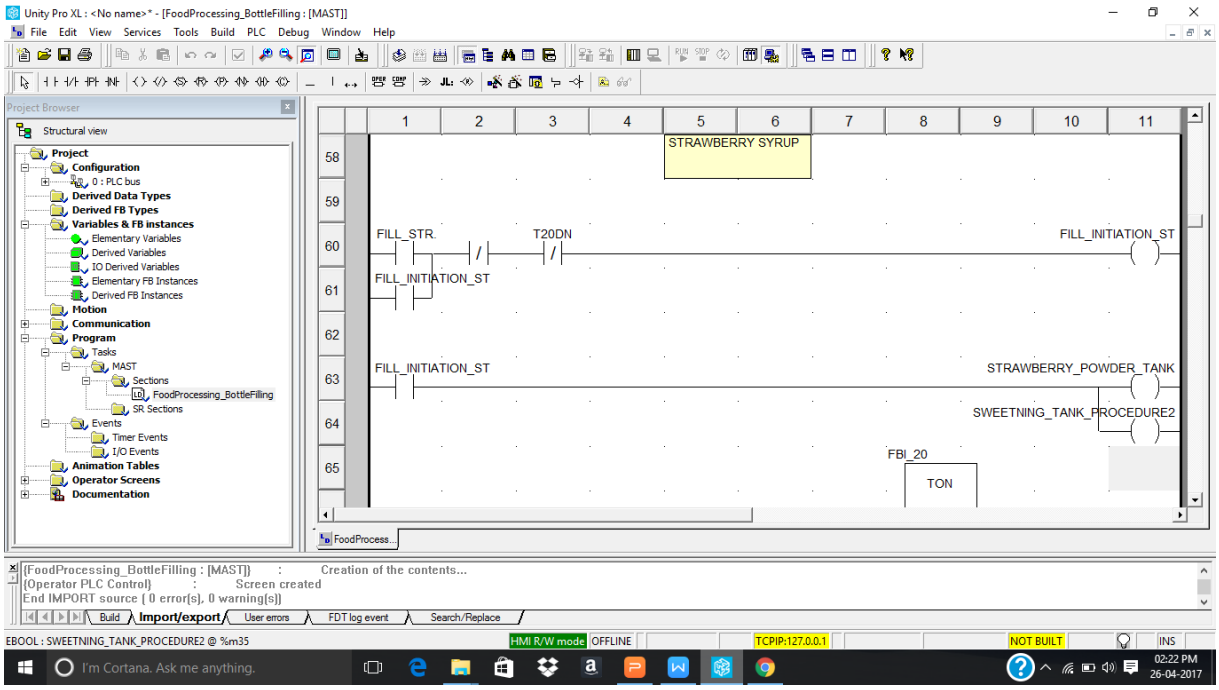
both the materials i.e. Strawberry Paste & Sweetening Agent in the Mixing Tank (which is usually large in size), two stirrer is connected inside thus tank also to mix the Strawberry Paste and the Sweetening Agent properly.

Some good quality Heaters are also connected to the Mixing Tank to make the mixed material in required temperature and some Sensors are connected too, to make give signals to the heater to vary its temperature. Once the mixing process is done then the Strawberry Syrup is ready to go in the main Strawberry Tank from where it will mixed with the Milk and then will filled in the Bottle to drink, we will know more about this in the Drink Production Section.



The picture is showing the Initiation of Strawberry Process from the taking of actual Strawberry Fruit to the Mixing of the Strawberry Paste and the Sweetening Agent. The Ladder Programming of the Strawberry Process Initiation is having 2 TON Timer along with the start and stop buttons.

Have a look of the Screen Shots of the Ladder Programmings of Strawberry Syrup Production made on the **"Unity Pro XL"** software :



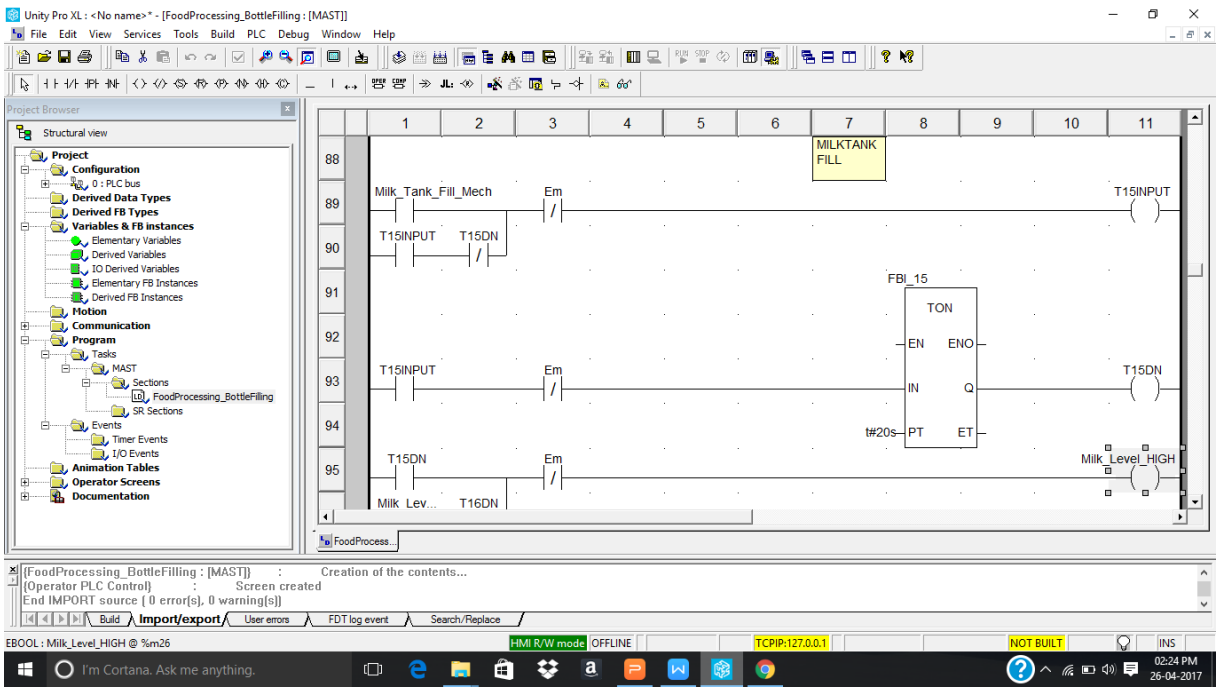
Now we have made the programs for the Syrup Production of Chocolate & Strawberry. Now both the Mixed materials are now ready to the final mixing with the milk in the "Master Tank" after which the complete syrup is ready to be filled in the bottles and hence ready to drink also.

➢ DRINK PRODUCTION :

We are done with the cleaning process where proper cleaning of all the takes are take places and after than we have made the Ladder program for the Syrup Production of Chocolate Syrup as well as Strawberry Syrup that how they work and which parameters they take, now we are coming to the **"Drink Production"** where we are programming to take the mixed Chocolate / Strawberry Syrup with Milk and making them mixed in a separate tank and after that pouring that complete syrup in Bottles.

So, in the Drink Production main roll plays by the **"Master Tank"** which is much much large in size as compared to other tanks as it yet to have mixed Chocolate Syrup / Strawberry Syrup as well as the Milk from the separate Milk Tank for the taste purpose and for making the syrup healthier and to increase the quantity of the syrup too.

Have a look of the Screen Shots of the Ladder Programmings of Drink Production made on the **"Unity Pro XL"** software :



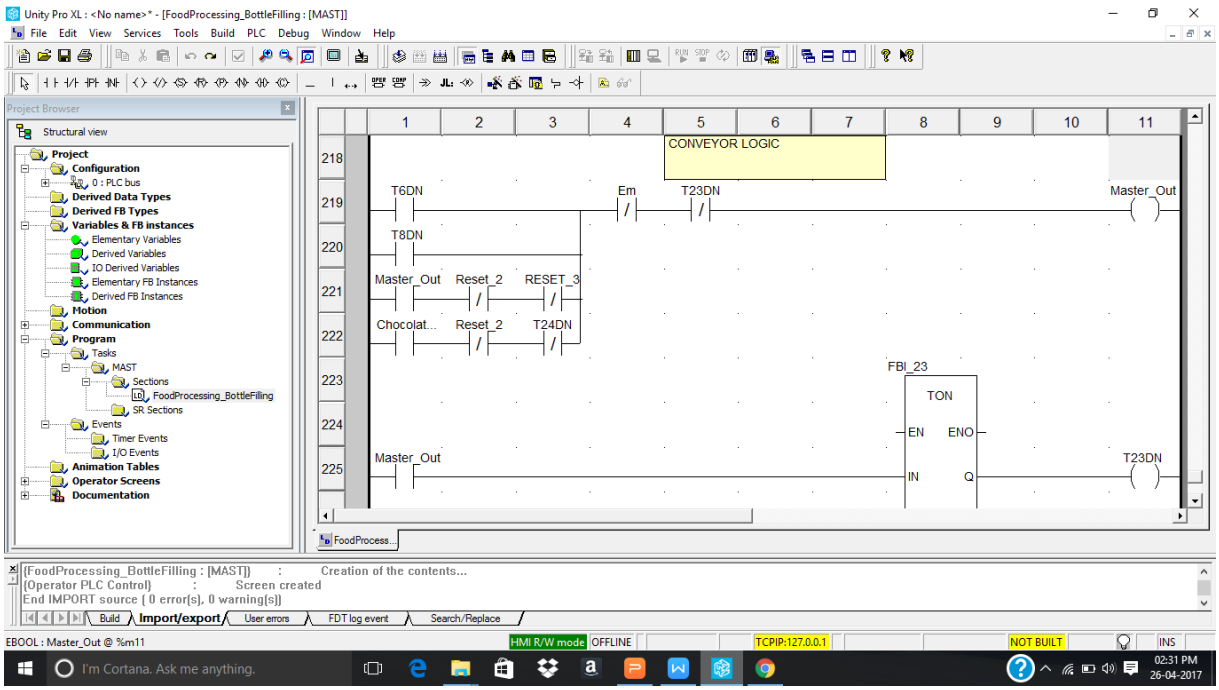
In the Milk Filling Process, we make the command to take a big amount of milk from outside to the Milk Tank as we need much amount of milk not only for Chocolate Syrup as well as for the Strawberry Syrup. So the Ladder Programming for Milk Tank Filling needs 2 TON Timer.

As the milk is a very sensitive liquid food so we need to make its temperature in the proper situation and the temperature of the tank too. So for that we have to connect good quality temperature sensors on the Milk Tank and for that we have to make the Ladder Logic for the inlet of th milk and for the sensors also that we have shown in the screen shot of the milk filling process. Once we have observed the temperature of the milk is normal and is capable to be used then we have to give the command to milk to flow to the Master Tank where the Chocolate / Strawberry uncompleted syrup is to be mix with the milk to make them to drink. Since the uncompleted Chocolate / Strawberry syrup and Milk is drawn in the Master Tank then as the Master Tank is big in size then it need more stirrer inside it so mix the syrup properly and completely. So we have taken 3 stirrer in this project and have wrote the Ladder programming for that.

➢ CONVEYOR LOGIC :

This is the very last process in the **"PLC Programming & SCADA Represenation For Food Production System",** i.e. Conveyor Logic.

Once the mixing of the uncompleted Chocolate / Strawberry Syrup and the Milk is done in the master tank then the uncompleted syrup is now become completed and the delicious **Chocolate Milk Shake** and **Strawberry Milk Shake** is ready to drink. Before to that we have to fill the Milk Shake in the bottles placed on the Conveyor Belt situated at the bottom of the V shaped Master Tank.



When we give the command of Milk Shake filling with the help of HMI, the conveyor belt start rotating and the bottles placed on the belt get filled by the Milk Shake one by one and hence the process completes.

In this particular section we need TON Timers in the Ladder Programming as we need to fill each bottles one by one so to stop the other bottles when one bottle filling is in the process then we have to stop the rotation of Conveyor Belt for the duration which is taking one bottle to be filled completely.

So the part of the Ladder Programming or Ladder Diagram is completed here and the role of SCADA Software is need to come in the front. And we will discuss the SCADA in the next section.

CHAPTER 7

SCADA REPRESENTATION

- **SCADA REPRESENTATION FOR FOOD PRODUCTION SYTEM :**

After having a brief discussion of the PLC section in the **"PLC PROGRAMMING & SCADA REPRESENTATION FOR FOOD PRODUCTION SYSTEM"** now we have to work on the SCADA Software which is more important now a days. And in the whole process the programming or representation of SCADA is difficult than programming of PLC.

In the market we do have so many companies which manufacture the software of SCADA and those SCADA sofwares are :

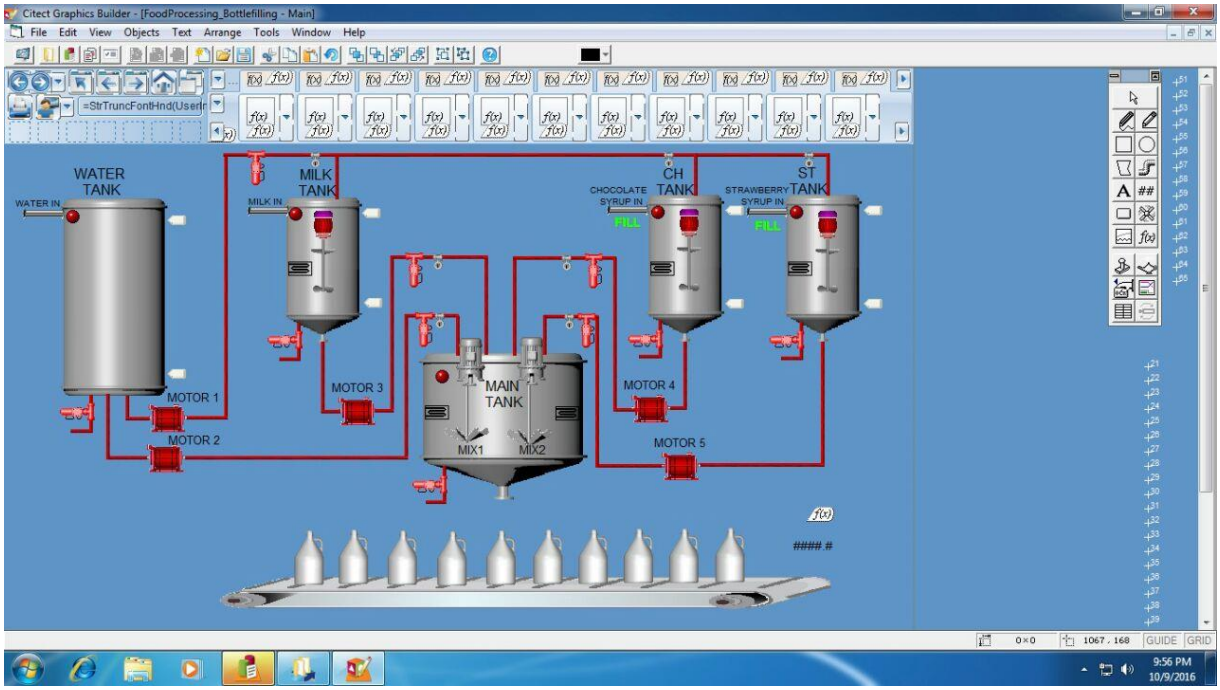
- ✓ ROCKWELL AUTOMATIONS
- ✓ MODICON SCHNEIDER ELECTRIC
- ✓ ASTRA
- ✓ WIN CC
- ✓ WONDERWARE IN-TOUCH
- ✓ FANUC
- ✓ I-FIX HMI/SCADA SOFTWARE

These are the short listed most popular SCADA manufacturing companies and the names of their software from which we are using **"CITECT SCADA 7.20 VERSION"** which is widely used because of its simplicity and is easy to understand and the designing of mechanism in this particular software is quite easy and the representations looks better and we have multi numbers of animation choices for any type of constructions.

In the SCADA representation section we have linked our Ladder Programming of PLC with this CitectSCADA Software and got the desired output in a beautiful manner. In the software we get to see the working process on the display itself. When we give the command of Cleaning Process then we can see the motor which drawing the water from water tank to the other tanks the that motor start blowing in the Green colour on the SCADA screen. The stirrers in the tanks starts rotating in horizontal direction and we can see that live process on the SCADA screen.

In the next section we will see the exact representation for our project i.e. "PLC Programming & SCADA Representation For Food Production System".

Have a look of the Screen Shots of the SCADA representation of the “PLC Programming & SCADA Representation For Food Production System” on the **“CitectSCADA”** software :



The picture of screen shot is showing the exact representation on SCADA screen where we can see there a big water tank at the left side from where water is supplied to all other tanks for the cleaning process. The red rectangular blocks on the screen is representing motors for the proper flow of liquid materials and the T & L shaped red thing is representing the “Solenoid Valve” to open & close of the pipe that that is also handled by the HMI.

Hence we have completed our project of **“PLC PROGRAMMING & SCADA REPRESENTATION FOR FOOD PRODUCTION SYSTEM”**.

CHAPTER 8

CONCLUSION

Hereby we conclude that, the most important of automation in today's world where critical processes from nuclear to aerospace are handled tirelessly with the help of control system requiring minimal human intervation. To have proper knowledge of automation one should have deep insight in its different components. Here in this project we tried to throw light on basic architecture with the help of PLC, SCADA, HMI and Implementing the design in software simulation environment showing how a food processing plant can be made. Supervisory Control And Data Acquisition is real time industrial process control system used to centrally monitor and control remote or local industrial equipment such as motors, valves, pumps, relays, etc.