Applying the supervisory control system and data acquisition (SCADA) to monitor production processes in Baghdad soft drinks company

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ABSTRACT

The research aims to apply the SCADA system to monitor production processes in Baghdad Soft Drinks Company, specifically the Dijla plant, cans production line (250 ML) to implement the system. The Baghdad Company's choice to implement the system came because the company has the infrastructure to implement the system as it has the first level of sensors and controllers related to the operations and also The second level of the PLC (Programmable Logical Controller) that collects data from the sensors and controls the operations in the production line, the DIA View SCADA program (2019) was used to create a monitoring screen and control the production processes, and the important production processes in the company were controlled. In the juice preparation phase and the centrally filled phase, the system was not limited to monitoring the equipment, ambient conditions and system parameters (temperature, pressure, level, etc.), but also exceeded the control of the production quantities of production processes accurately (the amount of sugar and water) to reach the highest efficiency and use the company's resources at the best level, including waste in the raw materials.

Keywords:

Analysis, Measure , Define, Control , Improve , Low water levels in the river, Plant Achammblan .

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1.Introduction

SCADA systems are necessary for industrial organizations because they help in maintaining the efficiency and processing of data to make decisions when a defect occurs in one of the stages, the (SCADA) system will give an alert of a defect in order to be treated, and the computer can summarize and show the information received and draw curves that show the values Similarity to information received over a specified period of time.

SCADA systems are used by industrial organizations and companies in the public and private sectors to control and maintain efficiency as SCADA systems are the backbone of many industries including:

•Industrial processes in all their variations, from manufacturing, production, electricity generation, refining and others.

•Infrastructure such as water treatment and distribution, oil pipelines, electricity distribution lines and large communication systems.

• Agricultural applications and modern irrigation systems.

2.Scientific research methodology

1-2 :Research problem

The main problem of Baghdad Soft Drinks Company / Dijla Factory is that it uses traditional systems based on in situ sensors associated with the PLC (Programmable Logical Control) system only to monitor and control each station and every production line, so it needs a large number of workers to monitor each station separately. High monitoring costs, as well as the problem of

accessing data on production and maintenance operations in real time to address them and make quick and smarter decisions.

Also, there are some stations that need constant monitoring and control, as it is difficult for workers to access them, such as temperature, pressure, water level, and other conditions surrounding the stations, which need to be monitored all the time.

2-2 :Research objective

The research seeks to achieve a set of objectives, including the following:

1 .Reduce costs and keep workers safe.

2 .Access to data and reports on production in real time through the provision of the HMI (Human Machen Interface), the human communication screen, including graphics, charts, and alarms in the central unit.

3 .Establishing a central unit for the SCADA system to link the stations with one unit linked by means of communication with the PLC in each station.

4. Monitoring the production lines and processes of the factory.

3-2 :Importance of Research

The SCADA system is one of the modern and advanced systems in the field of process control and control

Productivity and by using it, it makes the company achieve an advanced level of technology and automated control, and the importance of research comes from the tasks that the company's SCADA system achieves, namely:

1 .Keeping pace with technological development in terms of monitoring and control and the use of advanced systems.

2 .Controlling and controlling the production and industrial processes locally.

3 .Monitoring, data collection and processing.

4 .Direct dealing with devices, sensors, sensors, pumps and valves through computer operating system programs.

4-2 :Research Society and Sample

The Tigris lab at Baghdad Soft Drinks / Saffron Company was chosen to implement the SCAD system for several reasons, the most important of which are:

1 .Baghdad Soft Drinks Company is considered one of the most important industrial companies producing in Iraq.

2 .Baghdad Soft Drinks Company is one of the companies' subject to international control in Iraq, as it has a certificate of excellence from PepsiCo International.

3. The company's use of modern machines and advanced production lines makes it a good environment for the application of the SCADA system.

3 .Review the literature

1-3 :Production processes

(Jacobs & Chase) sees production processes as all the processes that are used to produce tangible products, at the higher levels to see what is needed to manufacture something and can be divided into three simple steps, the first step is to identify the parts that the product needs to manufacture, followed by the actual production of the product, then delivery Product to the customer. (Jacobs & Chase, 2018: 149)

Stevenson adds that the choice of production process is determined by answering the following two questions: (Stevenson, 2018: 244)

1 .How much diversity should the process be able to handle?

2 .How big of a process should you be able to handle?

The answers to these questions will serve as a guide for selecting the appropriate process.

The activity system that transforms inputs into valuable outputs. Processes use resources

(workers, machines, money, materials, energy and information) into goods and services shown in Figure (1). (Swink at el, 2014: 8)

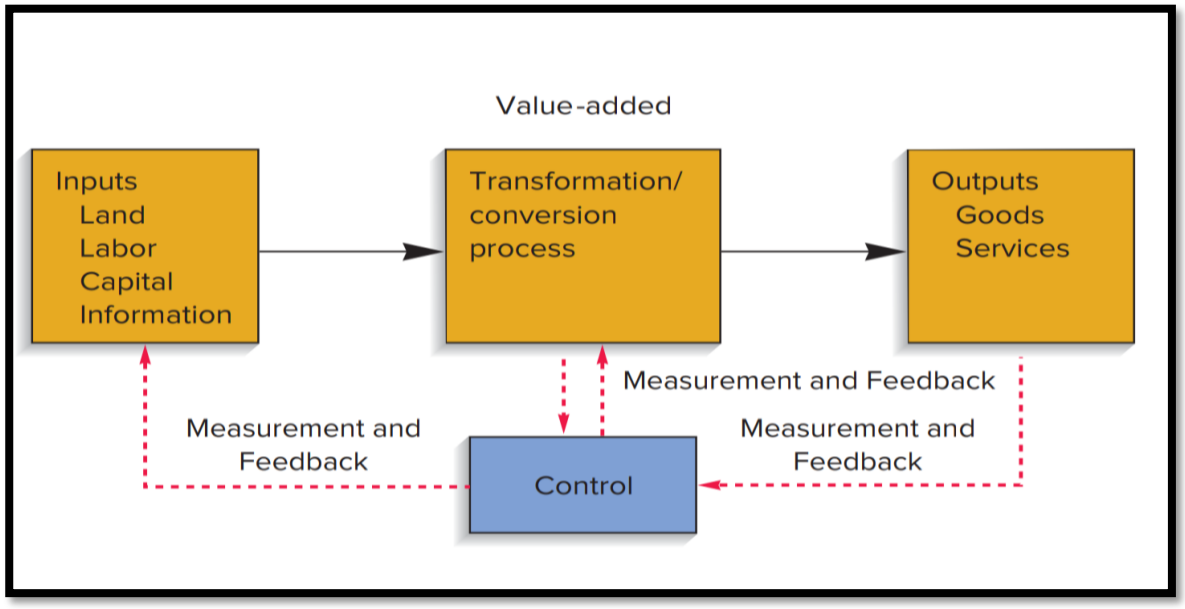


Figure (1) production system

2-3 :Types of production processes or systems

The type of production processes by which a product is produced or a service is provided depends on the type of product or service that the company provides to the customer, and also the policy followed by the company in meeting those needs. Generally, production processes are classified into two basic types:

1-2-3 :Intermittent Production System

Production facilities are characterized by flexibility so that they can deal with a large variety of products and sizes, this system can be used to manufacture those products where the basic nature of the inputs tends to change with changes in product design and production processes also require continuous changes. The intermittent production system includes the Project Production system, Job Production system and Batch Production system. (Jaipur, 2013: 11)

2-2-3 :Continuous Production System

The continuous production system is characterized by complex activities that must be carried out in a specific sequence within the estimated period and cost, in this system the production is stored and therefore it is necessary to do a sales forecast to estimate the potential demand for products and prepare the sales forecast schedule from the stock level, the inputs are standardized and the standard preparation process is adopted as well. The whole process can be standardized for a smooth production process. The continuous production system includes the Mass Production system and the Process Production system shown in Figure (2) (Jaipur, 2013: 11).

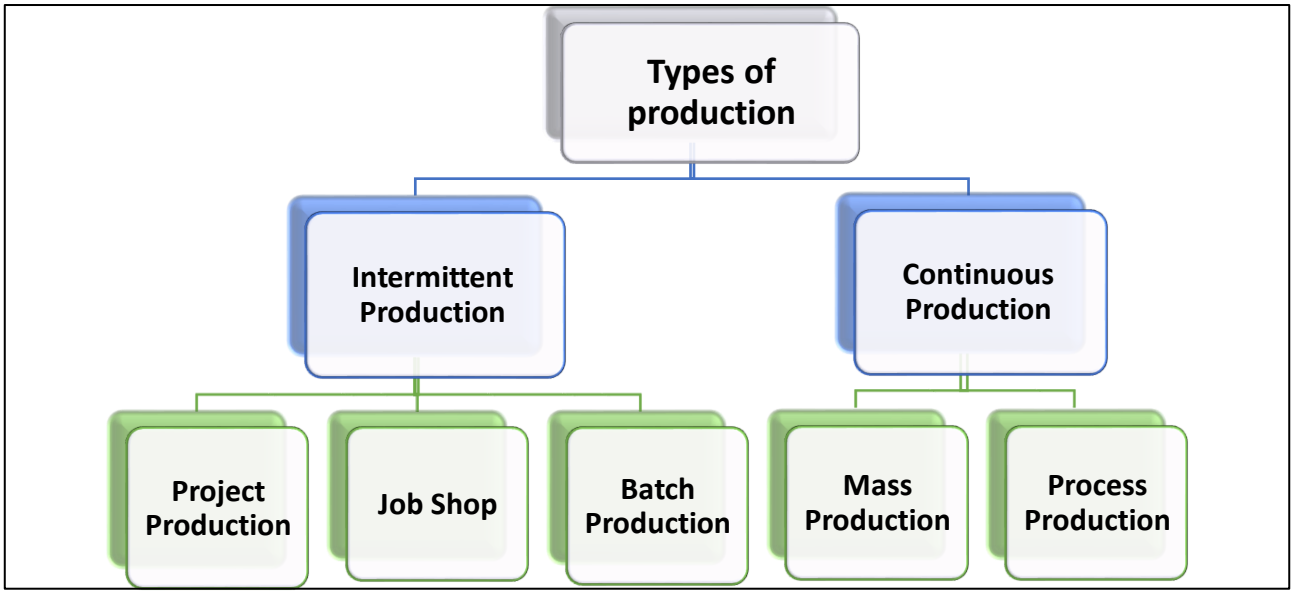


Figure No. (4) Types of production systems

3-3 :Aggregate Planning

The Aggregate production planning process represents a link between long-term planning and short-term planning in the company. Medium-term plans are designed to be consistent with the long-term plans and strategies of senior management, and to work within the resource constraints determined by strategic decisions. The challenge is to bring these plans to match the demands of an ever-changing market.

Medium plans are the job of an operations manager, working with other functional areas of the company, Aggregate planning deals with medium plans, which are usually measured in months.

Short-term planning (less than three months) is also the domain of operations managers, who work with production supervisors to break down total production plans into weekly, daily, or hourly schedules. (Heizer et al, 2017: 532), Total Production Planning also called Sales and Operations Planning (S&OP) works On determining the quantity and production time during a period of time extending from (3-18 months), where a plan is prepared in which the available resources are gathered in a general framework by the operations managers to meet the expected demand for the company's products, by adjusting production rates, workforce size, stock levels and energy All available and related inputs. The main objective of overall planning is to reduce costs during the established planning period. (Muhammad, 2019: 37).

4-3 :Control over production

The production control procedures can change with any change that takes place in the organization, in the quantity of production, stages or production processes, and if these procedures within their general framework remain unchanged, and the forms and procedures of production control differ according to the type of activity, pattern Production type and according to the size of the organization. (Al-Karkhi, 2014: 121), the purpose of the control process is to achieve the appropriate quality and quantity at the required time and then follow-up to ensure the implementation of the plan (Marklund & Eriksson, 2014: 13), as the outputs of the operations are monitored and compared to the plan that indicates what the work center is supposed to do. , Deviations from this plan are taken into account through the re-planning activity and the necessary interventions that are made (in a timely manner) to the Operations Center, which will ensure that the new plan is implemented as

shown in Figure (4) (Slack and Jones, 2018: 282).

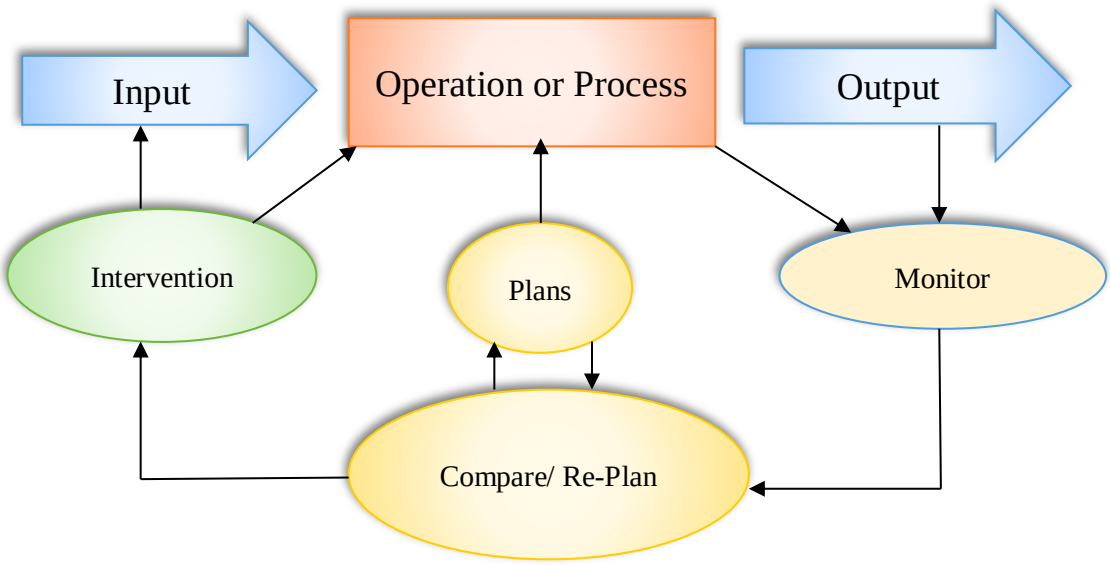


Figure (4) the production control process

4-3 :The SCADA System

The SCADA system consists of a number of remote units (Remount Terminal Unit RTU) that collect field data and send that data back to the main station, via a communication system that displays the main station the acquired data and allows the operator to perform remote control tasks, as it allows accurate and timely data The SCADA system is a very important application of computer technology that has achieved tremendous gains in productivity and efficiency,

as the SCADA system represents a group of computers and communication devices designed to work together for the purpose of controlling the process as well as the control leading Also, the functions of monitoring and recording alarm and diagnostic data so that the SCADA system can operate complex and large operations systems in a safe manner and maintain them by a relatively small staff (Al-Saffar, 2012: 7)

The accuracy of the process control system is crucial because it helps to improve the productivity of the process and prevent many problems, the goal of automatic control is to apply mechanisms to the process without continuous human interactions, and with the rapid technological development in the computer community, and because of the exorbitant labor cost and high productivity requirements Automatic control of the production process is becoming increasingly important in industry (Ji, 2013: 10).

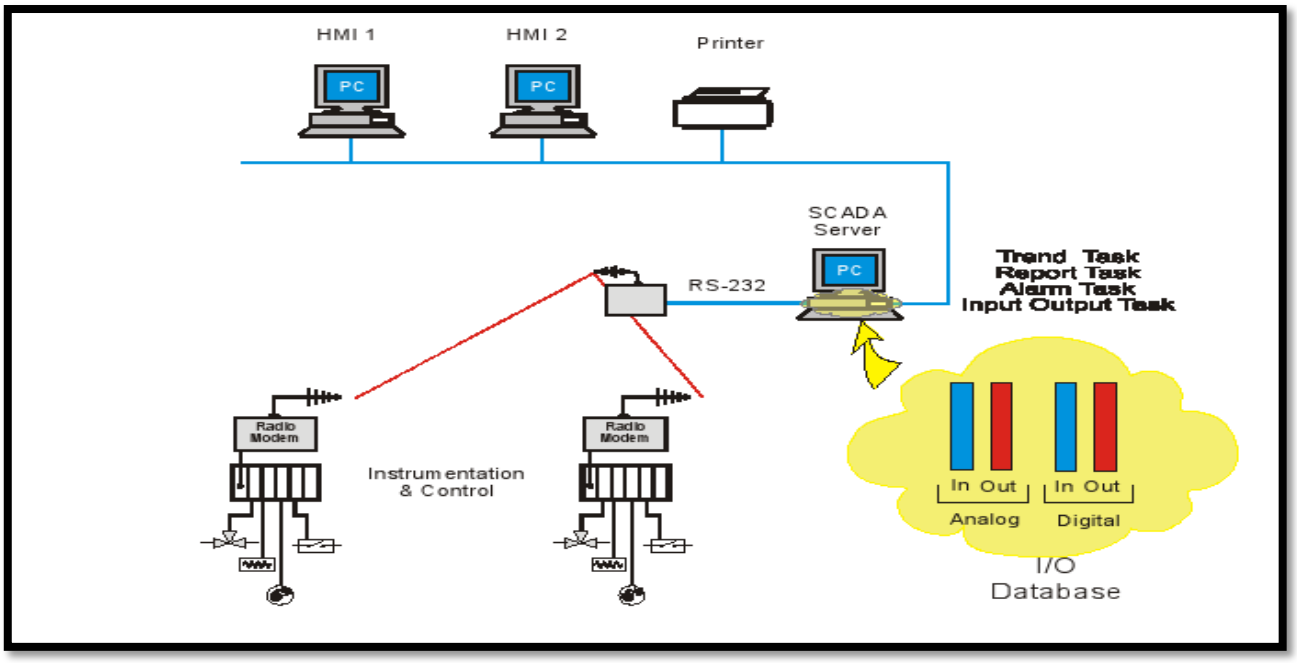


Figure (5) SCADA system architecture

4 .The practical side

1-4 :Mixed Strategy of Planning

The relationship between the overall production planning and the SCADA system is determined in the use of the SCADA system to monitor the implementation of the total plan and not only to monitor the conditions of operations and equipment, so in order for the system to work perfectly, the total planning must be done correctly, since the company does not use the outputs of the total planning correctly as it determines its production Depending on the orders received from the stock of finished goods in determining the production batch after the customer withdraws the product from the warehouse, which may make the company incur additional costs related to the stock, including the costs of storage, damage and others as well as the sudden fluctuation in customers' requests, so in this topic the overall planning strategies will be used to develop the plan Appropriate for the company to be an entrance to the SCADA system to monitor its implementation and compare it with the scheme through the data provided by the system. A mixed strategy was used that depends on the use of more than one strategy, and since the company maintains the level of employees, this makes it open to other options such as working overtime. Therefore, the solution will be as shown in Table No (1).

Table No. (1) the mixed strategy

Year	Month	workdays	Available capacity	Forecasting demand	Additional production	Overtime working hours	Final stock
2019	1	24	1341696	1539280	197584	2.356229727	0
2019	2	24	1341696	1556366	214670	2.559983782	0
2019	3	24	1341696	1585453	243757	2.906852223	0
2019	4	24	1341696	1679439	337743	4.027654551	0
2019	5	24	1341696	1712925	371229	4.426981969	0
2019	6	24	1341696	1732812	391116	4.664138523	0
2019	7	24	1341696	1761798	420102	5.009802519	0
2019	8	24	1341696	1780585	438889	5.233841347	0
2019	9	24	1341696	1753971	412275	4.916463938	0
2019	10	24	1341696	1748058	406362	4.8459502	0
2019	11	24	1341696	1737144	395448	4.715798512	0
2019	12	24	1341696	1687230	345534	4.120563824	0
Total		288	16100352	20275061	4174709	49.78426111	0

It is noticed in the previous table that employing workers overtime at a rate of about 50 hours during the day will make the company able to meet the demand completely as shown in Figure No. (1), without keeping any final stock.

2-4 :SCADA simulation of the juice preparation stage

Monitor and Control (HMI) monitors are programmed for the juice preparation process using DIA software View SCADA (2019) for the Delta company, which includes one of the packages used in the program, which is (Dop Soft), as shown in Figure (6).

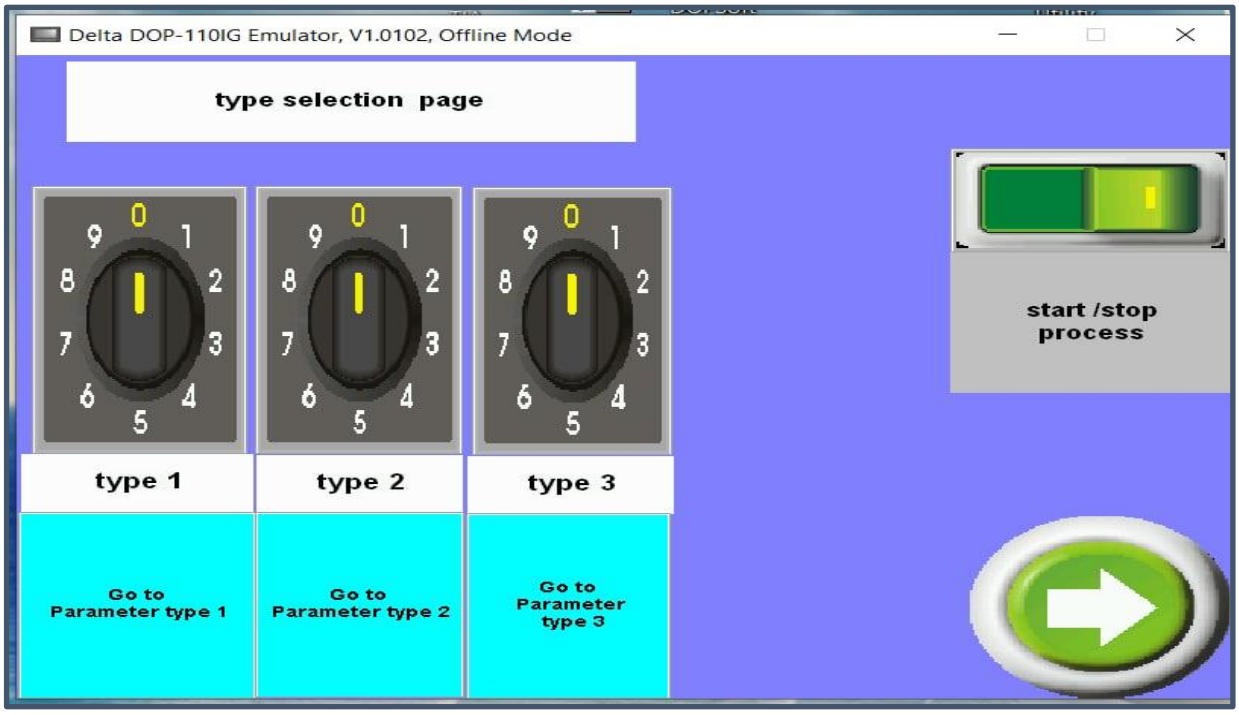


Figure (6) the control screen of the main mixing station

The previous figure shows the main interface of the juice station, which includes three quantities control stages The required amount of juice depends on the production plan. The system starts by calculating the amount of water and juice The required amount of the product needs it automatically, as these processes are sequential as it must be pressed Type1 to prepare the brix dissolved solution.

When clicking on the first page, it will open the screen for the stage of preparing the sugar solution dissolved in water (brix), which is shown in Figure No. (7).

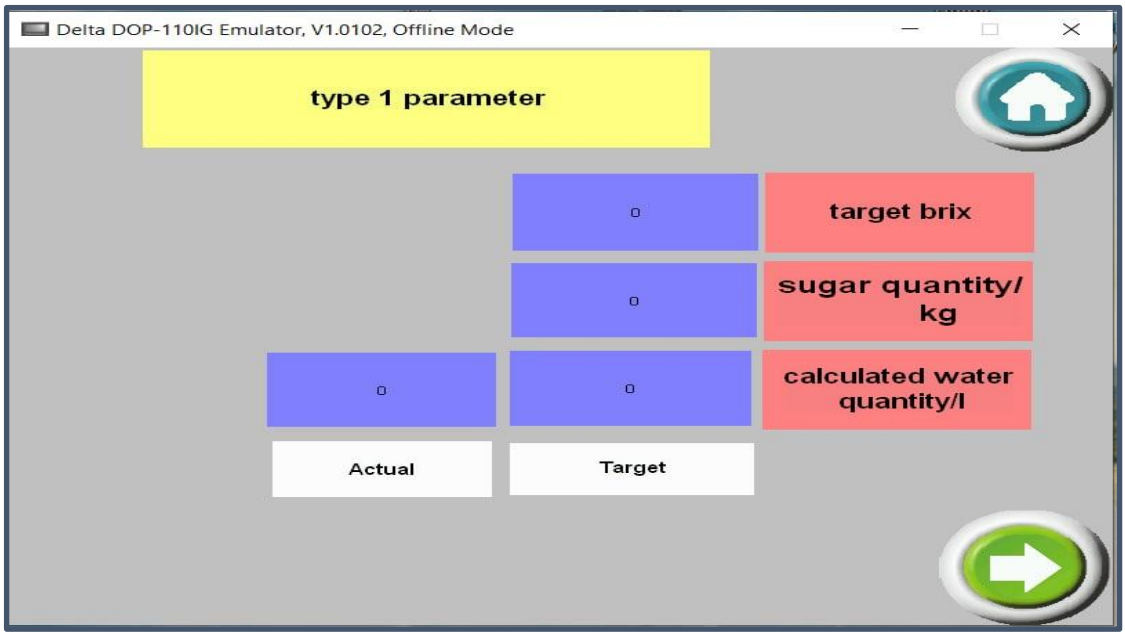


Figure No. (7) the first page for preparing the amount of dissolved solution

The amount of sugar required and the amount of water are calculated at this stage, depending on

the mixture of sugar solution required, which is usually found in companies that produce soft drinks (brix 60).

As for the process monitoring screen, through which we monitor the status of the process and the surrounding conditions in terms of pressure, quantities and temperature, it can be illustrated in Figure (8), through which the quantities required to produce the sugar solution are controlled, as the pumps, sensors and valves are programmed depending on the desired goal, which is (brix 60) and the quantities for solution, sugar and water are shown in the previous screen.

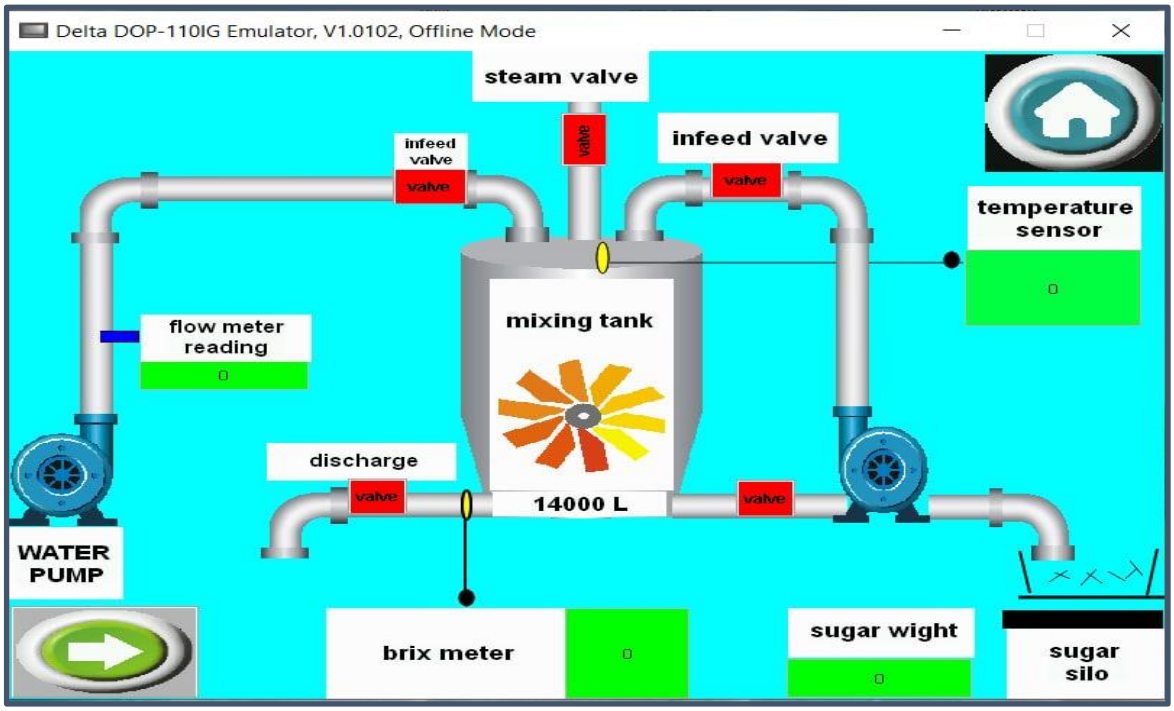
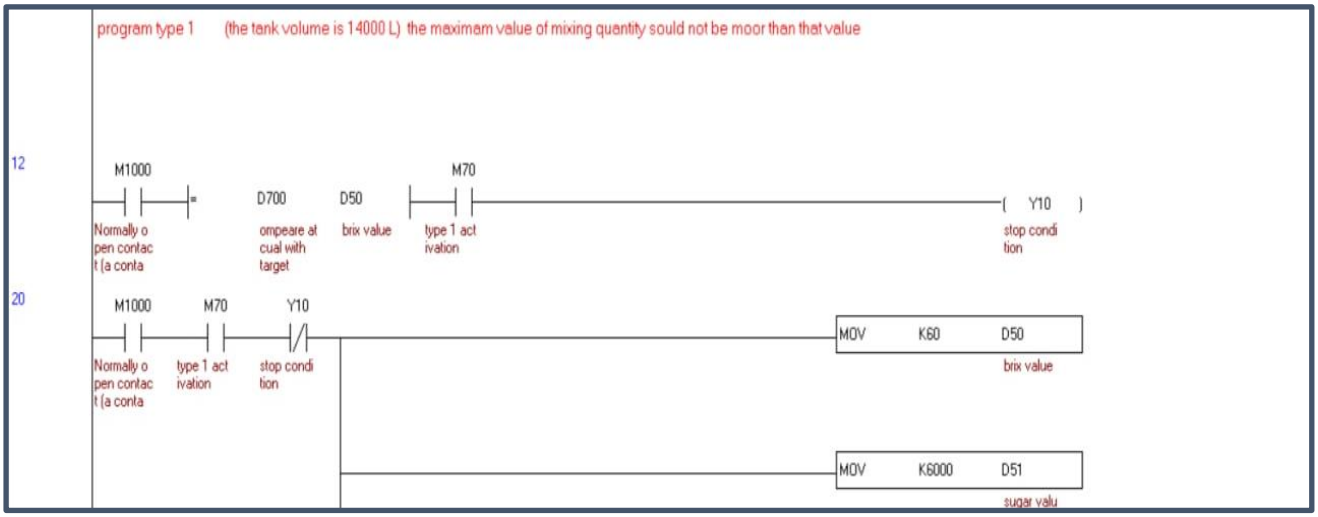


Figure (8): the preparation stage for the brix

As for programming the programmable logic controller and controlling this process, it can be illustrated in Figure (9).



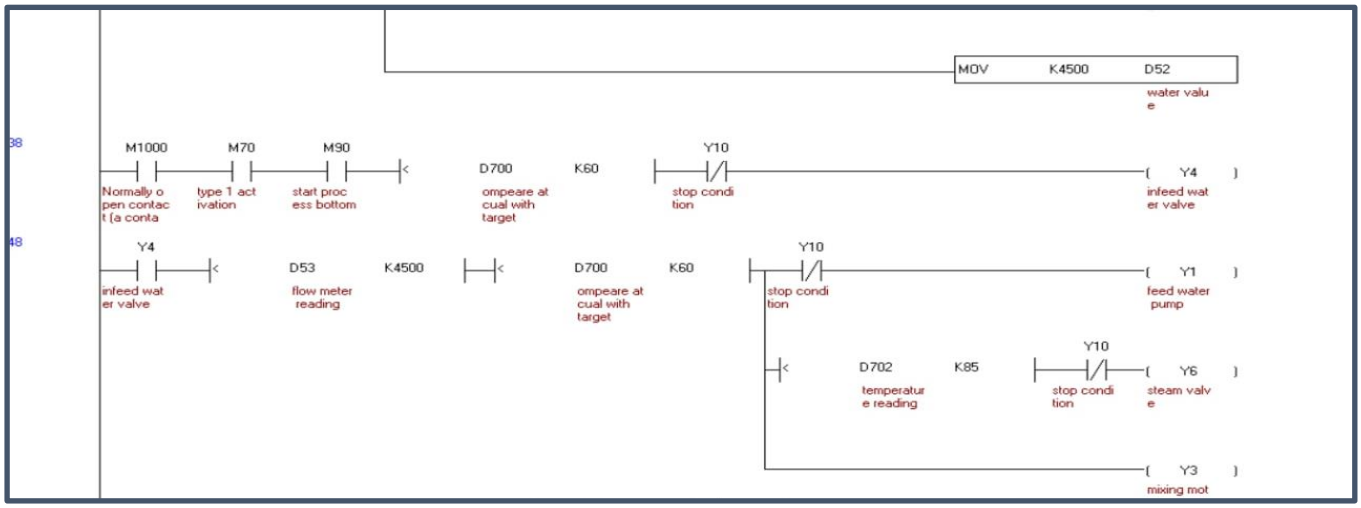


Figure (9) PLC programming for the stage of preparing the dissolved solution

5 .Conclusion

The system can be used in addition to monitoring process parameters (temperature, pressure, level, etc.) and the surrounding conditions of the process. It can also be used to monitor quantities of the production process.

The simulation of the SCADA system in the Tigris laboratory has been applied since the company has the required capabilities and basic infrastructure to use the SCADA system, as it has the first level of sensors and field controllers, as well as the second level of the PLC programmable control and monitoring devices that control the production processes.

The use of the SCADA system on the Tigris lab for the 250ml line of metal cans, especially for critical production processes such as the juice preparation process and the filling process, allowing observers to monitor and control them continuously, makes the decision-making process a quick and real-time process based on the data obtained from the system. Reducing the human cadre required to monitor production processes in the Tigris plant from 12 workers to 6 workers, and in the event that the system is applied to all production line operations, the number will be reduced to only two workers to monitor the production line, thus reducing costs related to observers, in addition to maintaining their safety.

The SCADA system needs trained human resources to handle the system and use it efficiently.

In order for the SCADA system to work in the best possible way, there must be an interest in planning the production capacity in order to achieve production with the highest efficiency and the lowest level of difference between demand and actual production, since the production plan will be an entrance to the SCADA system.

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