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استخدام المتحكم وجامع البيانات في مصانع السكر

SMART SCADA SYSTEM FOR MANUFACTURING SUGER PROCESS

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الاستهلال

قال تعالى:

قالوا سبحانك لا علم لنا إلا ما علمتنا

إنك أنت العليم الحكيم

الأية (32) البقرة.

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Unfortunately, it is not possible to list all of them in this limited space that he brought us Thanks to : Mahmoud Hajo Bannaga Mosab Abdalraheem.

And we would like to thank the most important people in our life, our families , that have been with us from the distance all the time.

ABSTRACT

Most Company faces many problems focuses in meeting outputs of each company's flexibility by specifications on this requires abundant in the production of non-stop in addition to what the system used is hampering the company's inability to meet the needs of the production inputs and prepare the necessary continuity in addition to, control the manufacturing.

SCADA system was developed to increase the performance of industrial control systems. One of the crucial problems in the SCADA system is data management.

This thesis proposed Integration approach that the two systems must share in the relational data structure and joint should be Functionally integrated at both the numerical and graphical level. Integration built on idea, SCADA and ERP system that always been dynamically connected so if there is a changing in state within one system, Integration between, Supervisory Control and Data Acquisition system (SCADA) and enterprise resource planning system (ERP) designed to address the shortcomings in the production and to increase production efficiency in industrial installations, the confrontation like in control and accounting systems challenges.

المستخلص

تواجه معظم الشركات الكثير من المشاكل التي تكمن في تلبية مخرجات بيانات عملية التصنيع لكل شركة من خلال المواصفات المطلوبة، بالإضافة الى ضرورة استمرار العملية وتمكين وفرة في الإنتاج دون توقف. الذي بإمكانه ان يعيق الشركة على تلبية احتياجات مدخلات الإنتاج وإعداد ما يلزم من تقارير لاستمرار العملية والسيطرة على التصنيع

وقد تم تطوير نظام التحكم الاشرافي لزيادة أداء أنظمة التحكم الصناعية، لكن من اهم المشاكل التي تواجه النظام هو كيفية إدارة بيانات العملية وتفسير معطياتها ولذا هذا النهج المتكامل للأطروحة يقترح أن يكون هنالك نظام يجب أن يشترك في بنية البيانات العلائقية والمشتركة لإدارة عملية الإنتاج كما يجب أن تكون متكاملة وظيفيا على المستويين العددي والرسوم البيانية بنظام التحكم الاشرافي نظام تخطيط موارد المؤسسات يمكن انت تكون البيانات دائما مرتبطة بشكل حيوي حتى إذا كان هناك تغيير في التفاصيل ، ونظام الحصول على البيانات كما ان نظام التحكم الاشرافي ونظام تخطيط موارد المؤسسات نظام إدارة الموارد مصممة للتصدي لكل أوجه القصور في الإنتاج وزيادة كفاءة الإنتاج في المنشآت الصناعية ومواجهة التحديات في مثل أنظمة الإدارة و المحاسبة.

.

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ABBREVIATIONS

AGC automatic gain control

BSS	basic server set
CDC	conference of decision and control
COM	component object module
CRM	customer relation management
CSV	comma sub rated values
DBF	data base file
DDE	dynamic data exchange
EATM	enterprise appliance transaction modules
ERP	enterprise resource planning
HMI	human machine interface
LAN	local area network
MES	manufacturing execute system
OLE	object linking and embedding
OPC	object linking and embedding for process control
PLC	programmable logic control
RAS	remote analysis system
RTU	Remote Terminal units
SCADA	supervising control and data acquisition
TCP	transmission control protocol
TIA	telecommunication industry association
UAT	universal access transceiver
WAN	wide area network
WINCC	windows control center
XML	extensible markup language

CHAPTER ONE

INTRODUCTION

1.1 Preface

SCADA is the technology that enables a user to collect data from one or most distant facilities and to send limited control instruction to those facilities. SCADA makes it unnecessary for an operator to be assigned to stay at or frequently visit remote location when those remote facilities are operating normally. SCADA include the operator interface and manipulation of application-related data, but it is not limited to that.

Most of the factories and industrial facilities working by full control system. SCADA is one of the most control systems deployed in the industrial master station, which have operate multi process.it Can be expressed as a production process displays in small screens that making it easier to follow the process productivity and knowledge of faults clearly.[1]

SCADA can be manage other system with it in administration of process such as ERP and MES, ERP system is an administrative system consists of assets and stores raw materials and factory contracts with sources of raw materials used and the Department of Public employees.[2]

Integration of the two systems together by a certain way until May system able to reduce manufacturing and increase the rate depending on the material stored thus ensuring continued production process and the safety of machinery. So that the real problem is how to connect these two systems together.

The problems in this project facing on the general production in industrial processes which are usually not technical problems as most are in resource and process report management system and how to write a thorough reports on the operational requirements of the plant and study personnel accounts and daily reports on the amount of production and conditions surrounding it as the use of the system to run the plant and system last administration completely separate process is in accurate, expensive and reduces production efficiency as the data is entered manually calculate quantities of crude output since they are too many and which therefore increases the cost and reduces efficiency.

The proposed solution is to design application process by using the SCADA system and manage this system with another system specified in administration of process, calculate the account and make supply chain report, and expected of success or fail of system.

The aims of this thesis are:

- To choose a one of manufacturing process designed by SCADA system in industrial field
- To design this manufacturing process by using SCADA simulator which is WINCC v6.0
- To design a management system of the process by using open ERP v7.0 simulator
- To integration between these two systems by using OPC server.

Methodology of system based on Study what does SCADA mean and why use it where and how does it work, and what is specific suitable industry environment to it run with more efficiency

After making a good idea to SCADA system, the next step is study WINCC version seven software by learning how to make tags, graphics, and trend and alarm system. In addition, how can get components from library to connect it with many tags. To program SCADA code by C language must get enough acknowledge and information about C-script.

Then study specific process such as sugar production and make idea about manufacturing operation and simulate it by WINCC to monitoring how does operation work from first step fresh cane until package and load sugar into trucks .

After that study ERP and software of it , study OpenERP v.7 framework and how does it work and how ERP increase efficiency of production operation in process

Then define integration and create a good idea about Advantages of integration between ERP and SCADA system, study OPC Server because it id the server which responsible about exchanging data between both of systems

This thesis is outlined as follows:

Chapter 2 discusses the literature review of SCADA and ERP system and integration method between them. In addition to the previous work related with this thesis is represented.

Chapter 3 discusses the topic of the design simulation of sugar process from a general viewpoint but also in the context of the WINCC simulator and ERP, The requirements for the integration solution are presented as use cases in sugar process.

Chapter 4 represents the algorithm of system and scenario of sugar process and discussion of system.

Chapter 5 review conclusion that summaries system operation and give suggestion for future research and educational activities.

CHAPTER TWO

LITERETURE REVIEW AND RELATED WORK

2.1 Background:

An increasing number of production companies and several industrial areas are looking for a flexible way to control an industrial process or equipment. In this way they use advanced communication technologies, highly integrated control and programming platforms for increase production and for minimize the costs. Thus, the concept of SCADA system was developed to increase the performance of industrial control systems. We can see in figure 1 that these are used to monitor and control different equipment from industries, such as: water distribution and waste water control, energy, oil and gas, temperature control, telecommunications, transportation systems, fire protection and security.[5]

This thesis is presented a flexible and low cost SCADA system for sugar factory process. According to the customer needs, the system is easily programmable and it can be remotely controlled. We can see that the system is modular, simple, flexible, user-friendly and adjustable to customer needs and with low cost.

2.2 LITERETURE REVIEW:

2.2.1 History of SCADA:

SCADA systems became popular in the 1960's as the need to monitor and control remote gear grew. Early systems were built from mainframe computers and required human oversight to operate. This made early system expensive to use and maintain. Today, with new technology, SCADA systems are much more automated. They can serve efficiently. This reduces cost and overhead to companies with network alarming needs. Supervisory Control, Data Acquisition, and Automatic Generation

Control, were used in Electric Utility power system control for over sixty years. Each had separate beginnings, went through several evolutions in implementation, and eventually came together with Network Analysis and other functions to become computer based Energy Management Systems. ***Connectivity of SCADA systems and ERP systems*** :

the need for integrating both SCADA and ERP systems is apparent. Gupta (1998) claimed that information from different systems can be integrated by utilising a Data Bridge.Therefore,some available Data Bridges to connect SCADA systems and ERP systems are reviewed. From the review, it is concluded that in general, the concepts of a Data Bridge are still far from ideal, because most only integrate the database or even copy the data directly from SCADA systems data base to the ERP systems data base. Bridging these two systems only by copying or integrating their databases will not solve the problem, because data from the SCADA systems is still raw. In addition, there has to be several steps to extract appropriate information, such as: Integrated Condition Monitoring, Asset Health and Prognosis, and Asset Risk Analysis.

This can also be seen from Bever's Plant Asset Management System (PAM) Framework (Bever, 2000 op cit Stapelberg, 2006). Thus, a new concept of Data Bridge is needed to integrate the ERP and SCADA systems in terms of the Data Acquisition and to incorporate the analysis results into the ERP system.

One of the crucial problems in the SCADA system is data. Until now, not many researchers in the SCADA area have been concerned with nested dsata problems. Nested data is data, which is influenced by other factors and cannot be assumed to be independent (Kreft et al., 2000). Several main methods havebeen proposed to address the SCADA data analysis problem, such as: Artificial Neural Networks (Kolla and Varatharasa, 2000, Weerasinghe et al., 1998), Fuzzy Logic (Liu and

Schulz, 2002, Venkatesh and Ranjan, 2003), Expert Systems (Kontopoulos et al., 1997b), Knowledge Base Systems (deSilva and Wickramarachchi, 1998a, de Silva and Wickramarachchi, 1998b, Teo, 1995, Vale et al., 1998, Comas et al., 2003), and Data Mining (Wachla and Moczulski, 2007). After reviewingthem, it has been found that few of these are practically effective in addressing the problem. Several additional problem have also been identified based on the review of the proposed methods..[4]

2.2.2 SCADA System:

A SCADA system means a system consisting of a number of remote terminal units (or RTUs) collecting field data connected back to a master station via a communications system. The master station displays the acquired data and allows the operator to perform remote control tasks. The accurate and timely data (normally real-time) allows for optimization of the operation of the plant and process. A further benefit is more efficient, reliable and most importantly, safer operations. This all results in a lower cost of operation compared to earlier non-automated systems.[7]

There is a fair degree of confusion between the definition of SCADA systems and process control system. SCADA has the connotation of remote or distant operation. The inevitable question is how far 'remote' is – typically this means over a distance such that the distance between the controlling location and the controlled location is such that direct-wire control is impractical (i.e. a communication link is a critical component of the system).

A successful SCADA installation depends on utilizing proven and reliable technology, with adequate and comprehensive training of all personnel in the operation of the system. There is a history of unsuccessful SCADA systems – contributing factors to these systems includes inadequate integration of the various components of the system, unnecessary complexity in the system, unreliable hardware and unproven software. Today hardware reliability is less of a problem, but the increasing software complexity is producing new challenges. It should be noted in passing that many operators judge a SCADA system by not only the smooth performance of the RTUs, communication links and the master station (all falling under the umbrella of SCADA system) but also the field devices (both transducers and control devices).[6] The field devices however fall outside the scope of SCADA in this manual and will not be discussed further. A diagram of a typical SCADA system is given opposite in figure 2-1.

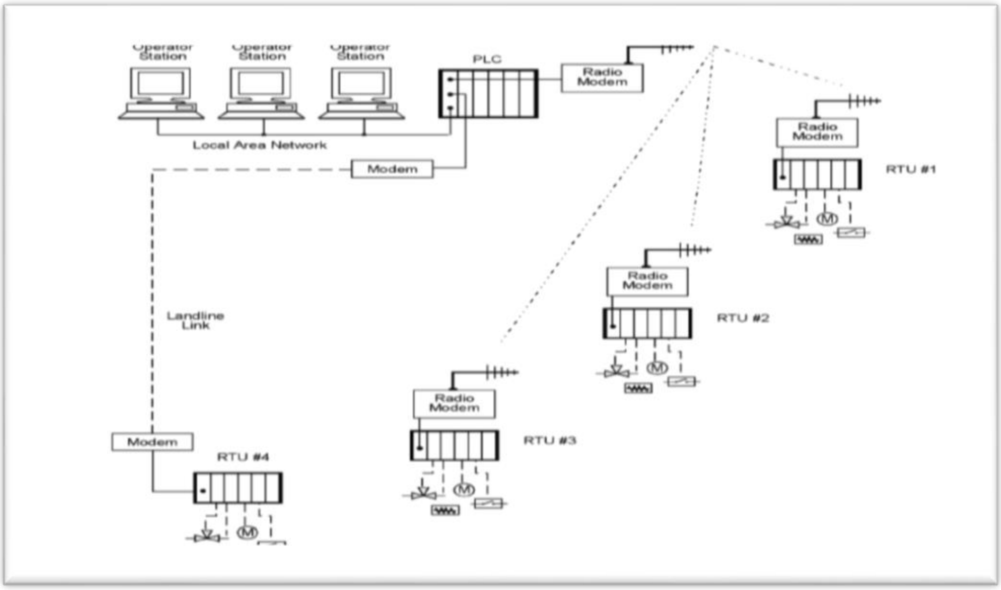


Figure 2-1: A diagram of a typical SCADA system

2.2.3 SCADA components:

SCADA represent an acronym for Supervisory Control and Data Acquisition. The main objective of a SCADA system is to help human operator to control and to command an automated process; this means that SCADA is a supervisory system. SCADA system is composed by the

Following subsystems[8]:

- A human-machine interface or HMI represents a device which helps the human operator to process data, and so, the human operator monitors and

Controls the process.

- A supervisory (computer) system which acquiring data on the process and in the same time it controlling the process.

- Remote terminal units (RTU) are connected to sensors and converting sensors signals to digital data and sending these to the supervisory system.

Also in a SCADA system we can use programmable logic controller (PLC), like field devices, because they are more economically, flexible and configurable than RTU.

- Communication infrastructure connecting the supervisory system to remote terminal units. A typical system SCADA is presented in figure 2-2.

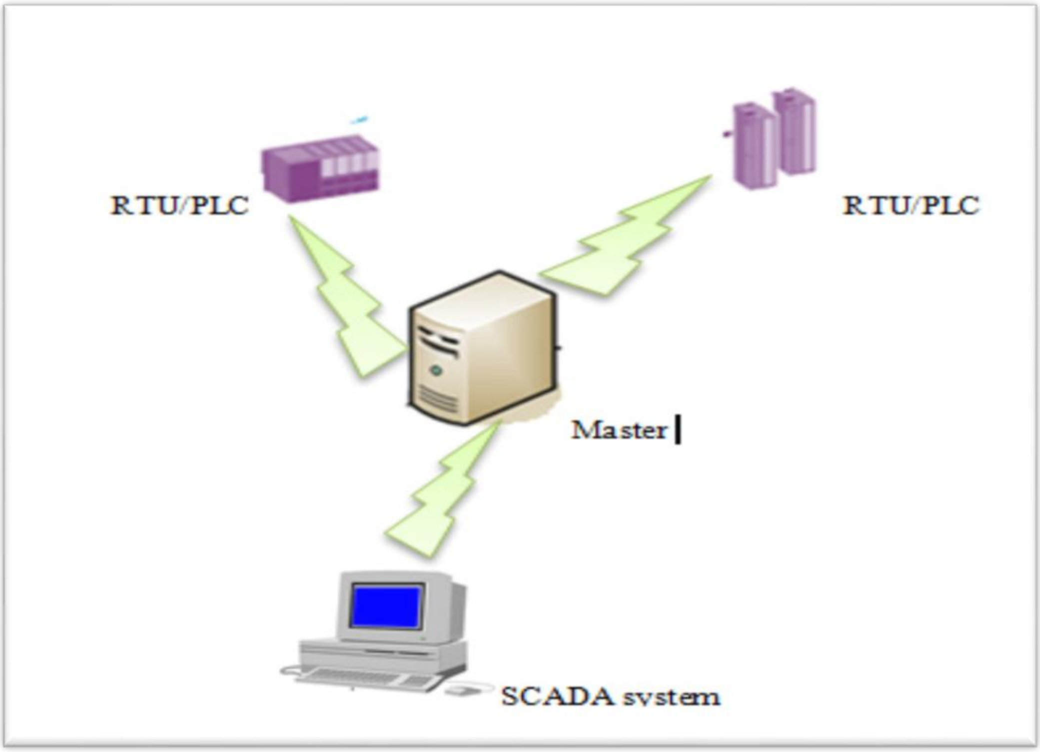


Figure 2-2: A typical system SCADA

The SCADA system is composed by two main hardware components, namely:

1. SCADA server-master, which is connected to the process through the programmable logic controller (PLC), and is designed to monitor the whole manufacturing process.

2. Client, which is networked to the server and depending by the orders received from it continue the manufacturing process and perform communication with human operator.[6]

The SCADA system represents an automation process used to collect data from the manufacturing process and their transmission to a "central computer" in order to ensure monitoring and control process.

2.2.3.i SCADA HARDWARE:

A SCADA system consists of a number of remote terminal units (RTUs) collecting field data and sending that data back to a master station, via a communication system. The master station displays the acquired data and allows the operator to perform remote control tasks. The accurate and timely data allows for optimization of the plant operation and process. Other benefits include more efficient, reliable and most importantly, safer

Operations. This result in a lower cost of operation compared to earlier non-automated systems. On a more complex SCADA system, there are essentially five levels or hierarchies:

• Field level instrumentation and control devices
• Marshalling terminals and RTUs
• Communications system
• The master station(s)
• The commercial data processing department computer system[10]

The RTU provides an interface to the field analogue and digital sensors situated at each remote site. The communications system provides the pathway for communication between the master station and the remote sites. This communication system can be wire, fibre optic, radio, telephone line, microwave and possibly even satellite. Specific protocols and error detection philosophies are used for efficient and optimum transfer of data. The master station (or sub-masters) gather data from the various RTUs and generally provide an operator interface for display of information and control of the remote sites. In large telemetry systems, sub-master sites gather information from remote sites and act as a relay back to the control master station.[11]

2.2.3.ii SCADA Software:

SCADA software can be divided into two types, proprietary or open. Companies develop proprietary software to communicate to their hardware. These systems are sold as 'turnkey' solutions. The main problem with this system is the overwhelming reliance on the supplier of the system. Open software systems have gained popularity because of the

Interoperability they bring to the system. Interoperability is the ability to mix different manufacturers' equipment on the same system. CITECT and Wonder Ware are just two of the open software packages available in the

Market for SCADA systems. Some packages are now including asset management integrated within the SCADA system.[12] The typical components of a SCADA system are indicated in the next figure 2-3.

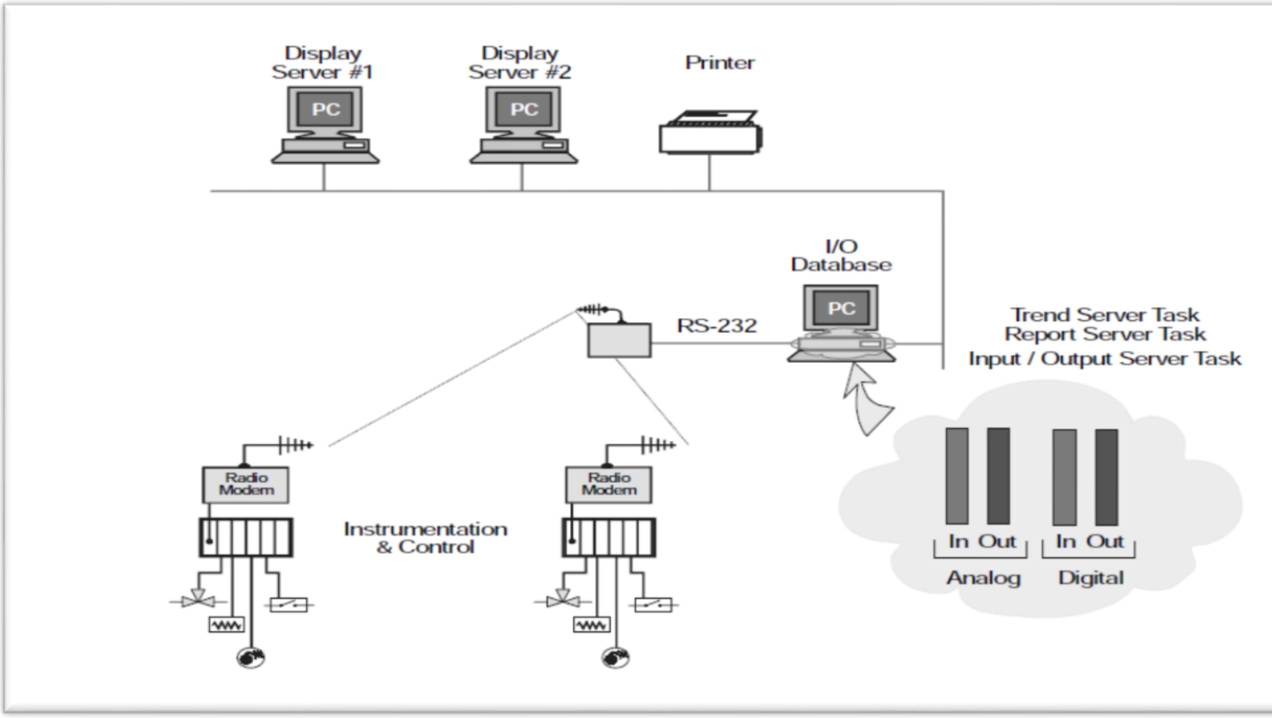


Figure 2-3: The typical components of a SCADA system

The Key features of SCADA software are[9]:

- **User interface**
- Keyboard
- Mouse
- Trackball
- Touch screen

- **Graphics displays**
- Customer-configurable, object orientated and bit mapped
- Unlimited number of pages
- Resolution: up to 1280 × 1024 with millions of colours
- **Alarms**
- Client server architecture
- Time stamped alarms to 1 millisecond precision (or better)
- Single network acknowledgment and control of alarms
- Alarms are shared to all clients
- Alarms displayed in chronological order
- Dynamic allocation of alarm pages
- User-defined formats and colours
- Up to four adjustable trip points for each analog alarm
- Deviation and rate of change monitoring for analog alarms
- Selective display of alarms by category (256 categories)
- Historical alarm and event logging
- Context-sensitive help
- On-line alarm disable and threshold modification
- Event-triggered alarms
- Alarm-triggered reports
- Operator comments can be attached to alarms
- **Trends**
- Client server architecture
- True trend printouts not screen dumps
- Rubber band trend zooming
- Export data to DBF, CSV files
- X/Y plot capability
- Event based trends
- Pop-up trend display

• Trend gridlines or profiles

• Background trend graphics

• Real-time multi-pen trending

• Short and long term trend display

• Length of data storage and frequency of monitoring can be specified on a per-point basis

• Archiving of historical trend data

• On-line change of time-base without loss of data

• On-line retrieval of archived historical trend data

• Exact value and time can be displayed

• Trend data can be graphically represented in real-time

• **RTU (and PLC) interface**

• All compatible protocols included as standard

• DDE drivers supported

• Interface also possible for RTUs, loop controllers, bar code readers and other equipment

• Driver toolkit available

• Operates on a demand basis instead of the conventional predefined scan
method

• Optimization of block data requests to PLCs

• Rationalization of network user data requests

• Maximization of PLC highway bandwidth

• **Scalability**

• Additional hardware can be added without replacing or modifying existing
equipment

• Limited only by the PLC architecture (typically 300 to 40 000 points)

• Access to data

• Direct, real-time access to data by any network user

• Third-party access to real-time data, e.g. Lotus 123 and Excel

• Database

• Network DDE

• DDE compatibility: read, write and exec

• DDE to all IO device points

• Clipboard

• Networking

• Supports all NetBIOS compatible networks such as NetWare, LAN Manager,
Windows for Workgroups, Windows NT (changed from existing)

• Support protocols NetBEUI, IPX/SPX, TCP/IP and more

• Centralized alarm, trend and report processing – data available from anywhere
in the network

• Dual networks for full LAN redundancy

• No network configuration required (transparent)

SCADA systems, software and protocols 67

• May be enabled via single check box, no configuration

• LAN licensing is based on the number of users logged onto the network, not
the number of nodes on the network

• No file server required

• Multi-user system, full communication between operators

• RAS and WAN supported with high performance

• PSTN dial up support

• Fault tolerance and redundancy

• Dual networks for full LAN redundancy

• Redundancy can be applied to specific hardware

• Supports primary and secondary equipment configurations

• Intelligent redundancy allows secondary equipment to contribute to processing load

• Automatic changeover and recovery

• Redundant writes to PLCs with no configuration

• Mirrored disk I/O devices

• Mirrored alarm servers

• Mirrored trend servers

• File server redundancy

• No configuration required, may be enabled via single check box, no configuration

• Client/server distributed processing

• Open architecture design

• Real-time multitasking

• Client/server fully supported with no user configuration

• Distributed project updates (changes reflected across network)

• Concurrent support of multiple display nodes

• Access any tag from any node

• Access any data (trend, alarm, report) from any node

2.2.4 Architecture of SCADA System:

There are three generations of SCADA systems, as follows:

1. First generation – monolithic.
2. Second generation – distributed.
3. Third generation – networked.

In the first generation, networks did not exist at the time SCADA was developed. Because of this, SCADA systems represent independent systems with no connectivity with other systems.[7]

The next generation of SCADA system involves Local Area Networking (LAN) technology for distribute the processing across multiple system. Each station has a different function and through the LAN, shared information with each other in real-time.

The third generation is similar with the second generation. Also, it has multiple stations connected and these station sharing master station functions. The major improvement of this third generation represent the use of Wide Area Network (WAN) protocols such as the Internet Protocol (IP) for realized the communication between the master station and communications equipment.

In figure 2-4 presented the architecture proposed for SCADA system.

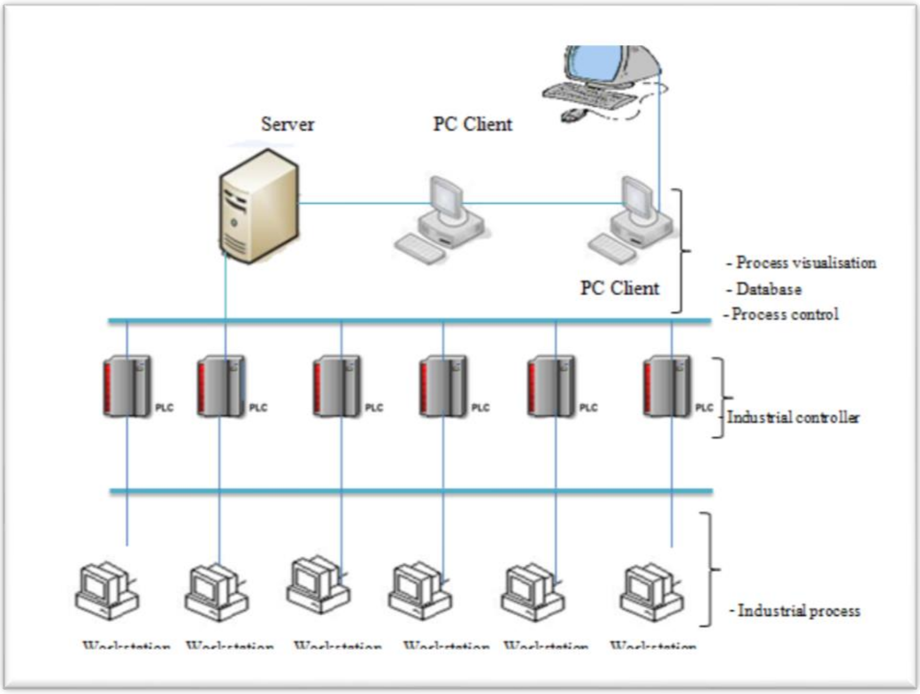


Figure 2-4: the architecture proposed for SCADA system

This architecture was developed on three levels, namely:

- Level 1, where is conducted the whole industry process that will be supervised.

- Level 2, where there are industrial controllers: the PLCs that are connected with each workstation of the industrial process.
- 3. Level 3, is the one, on which there is process visualization, data acquisition and control of the whole manufacturing process.

This SCADA system architecture was developed in order to see if it can integrate any element of a manufacturing system. The SCADA system involves two main elements, and these are:

- The system / the manufacturing process which will be supervised and controlled.
- An intelligent equipment network which interfaces with the first system using sensors and control mechanisms thus enabling possibility of advanced monitoring and controlling of process from manufacturing system.[8]

A SCADA system needs to perform a range of function. Among them, we can mention data acquisition, which is realized through analogue and digital sensors that interfaces directly with the industrial process; data communication through the network, realized by PLC and data presentation, which is made by master station / server, which is the center of the entire system. This has a graphic interface and with this, the user has access to all the data from the process and he can change it, if he wants.[8]

2.2.5 Benefits of SCADA System:

Typical considerations when putting a SCADA system together are[11]:

• Overall control requirements

• Sequence logic

• Analog loop control

• Ratio and number of analog to digital points

• Speed of control and data acquisition

• Master/operator control stations

• Type of displays required

• Historical archiving requirements

• System consideration

• Reliability/availability

• Speed of communications/update time/system scan rates

• System redundancy

• Expansion capability

• Application software and modelling Obviously, a SCADA system's initial cost has to be justified. A few typical reasons for implementing a SCADA system are:

• Improved operation of the plant or process resulting in savings due to Optimization of the system

• Increased productivity of the personnel

• Improved safety of the system due to better information and improved control

• Protection of the plant equipment

• Safeguarding the environment from a failure of the system

• Improved energy savings due to optimization of the plant

• Improved and quicker receipt of data so that clients can be Invoiced more

Quickly and accurately

• Government regulations for safety and metering of gas (for royalties & tax etc).

2.2.6 SEIMENS WINCC:

WINCC is an open SCADA visualization system that allows you to connect different control systems. Industrial communication with WINCC means that within a communication link, process values from the controller are exchanged with the operator control station via Power Tags.[13]

SIMATIC WINCC provides a complete basic system for operator control and monitoring. It provides a number of editors and interfaces that allow you to create highly efficient configurations for your specific application. All relevant configuration data is stored in a WINCC project. The WINCC Basic system already contains all the editors and Smart Tools you will need to perform the different configuration tasks.[14]

2.2.6.i WINCC Application:

WINCC communication peers can be any component of a network that is in a position to communicate with others and to exchange data. In the SIMATIC environment, these can be the central modules and communication modules in the automation system (AS) and the communications processors in the computer. WINCC comes with a number of available communication channels for connecting different SIMATIC S5/S7/505 controllers (for example, with the S7-Protocol Suite) by means of different bus systems, as well as for ALLEN BRADLEY, Ethernet IP, and Modbus TCP/IP.

WINCC also comes supplied with open communication channels such as PROFIBUS DP/FMS and OPC (Openness, Productivity and Collaboration, previously called OLE for Process Control). Because all controller manufacturers also provide OPC servers for their specific hardware, the options for interfacing with WINCC are virtually unlimited.[13]

2.2.6.ii WINCC in Totally Integrated Automation:

In response to increasing competitive pressure for innovation, it is more important today than ever before to bring cost-effective, high-quality solutions to market as quickly as possible. Moreover, the only way to guarantee success is to achieve an innovative edge over the competition.

Totally, Integrated Automation (TIA) provides just the architecture you need to achieve this in all industries and at all corporate levels:

- Management level
- Operations management level
- Control level
- Field level

Thanks to the unique integration of TIA, you can take advantage of the unrivalled interaction of all Siemens products and systems - even across different versions.[15]

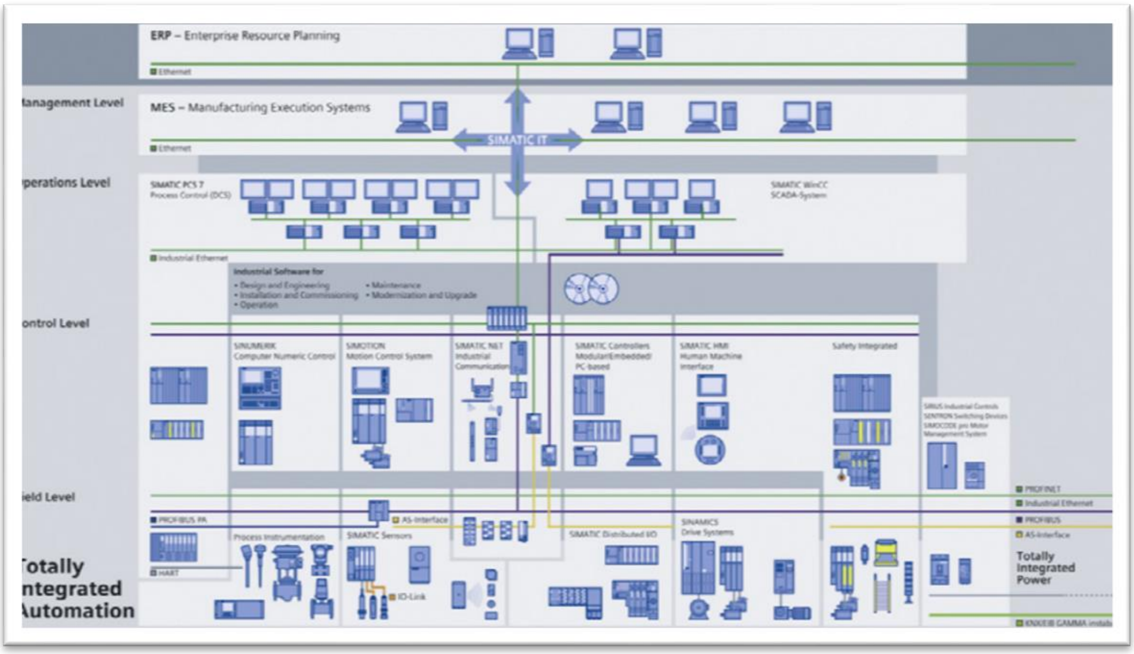


Figure 2-5: Totally integration Automation

The hardware and software components from the TIA modular system reduce engineering costs, lifecycle costs, and total cost through integration:

● Integrated engineering: Configure and manage all components of WINCC and STEP 7 on one shared platform, SIMATIC Manager.

● Integrated communication: Plant-wide tag selection dialog box for WINCC tags and STEP 7 symbols, shared message configuration, use of previously defined communication In addition, TIA helps you avoid duplicated effort and sources of error. In concert with other TIA components, integrated engineering and communication make it possible to perform system and process diagnostics of errors during operation.[13]

2.2.6.iii Integrated in Process Control System:

Integrated data management and communication enables the seamless integration of WINCC into SIMATIC PCS 7. As the flagship of company-wide TIA networks, PCS 7 automates process control technology in all industries.[15]

2.2.7 Integration of ERP and WINCC:

The architecture of proposed for SCADA system With WINCC/Connectivity Pack, you have direct access to archive data of WINCC systems via OLE DB. In addition, the "Connectivity Pack" license activates the WINCC OPC Server, which is available in every WINCC runtime. The OPC server enables External OPC clients to access WINCC online and archive data (see OPC servers). The WINCC OPC DA server is already included in the basic system. The open OLE DB standard is the interface for accessing different databases. The data in each specific database is accessed via the respective database provider. In addition to the standardized OLE DB interface, WINCC offers a special WINCC OLE DB Provider, which gives local or remote clients direct, transparent access to the following WINCC archive databases:

● Message archives, process-value archives, and user archives

● Archive databases of the long-term archive server (WinCC file server)

● Archives of the WINCC/Central Archive Server (CAS) Access to databases in the following programming languages can be integrated via the WINCC OLE DB interface[16]:

● C#

● VB.NET C# and VB.NET access the databases via the ADO.NET Programming interface (.NET Framework). This requires the Visual Studio 2005 or .NET Framework 2.0 programming environment. The WINCC/Connectivity Pack comes supplied with examples of database access via C# and VB.NET. OPC (Openness, Productivity and Collaboration, previously OLE for Process Control) provides standardized, vendor independent interfaces for data access:

● OPC is based on Windows COM (Component Object Model) technology, among other things. COM objects are distributed transparently in the local network. Clients access them via DCOM (Distributed Component Object Model).

● By contrast, OPC XML is based on data exchange via XML with the platform-independent, XML-based SOAP (Simple Object Access Protocol). SOAP is used to enable applications to communicate with each other via the Internet or in heterogeneous computer networks by means of HTTP (HyperText Transfer Protocol).[17]

2.2.7.i Requirements of Licensing:

● "ConnectivityPack" license for access with a WinCC installation at the location of the online and archive data

● "ConnectivityStation" license for access without a WinCC installation

● Client Access License for every client without a WinCC license

● Internet Information Service IIS for the WinCC OPC XML server Application With WinCC OLE DB Provider, you can access the WinCCspecific archive structure in the Microsoft SQL Server database from outside. This enables you to connect WinCC to any number of applications from third-party providers. With WinCC OLE DB, you can display, browse, or evaluate archive data:

● Calculate statistical values using archive data

● Find process errors

● Optimize processes

OPC defines a standardized procedure used by Windows based applications to exchange data, for example, data exchange between WinCC and the production level or corporate management level. An OPC HDA client is used for the following purposes:

● Analysis and evaluation of archived data

● Statistical process control of archives from different OPC HDA servers

An OPC A&E client can be used for analysis and joint evaluation of messages from different WinCC OPC A&E servers.[19]

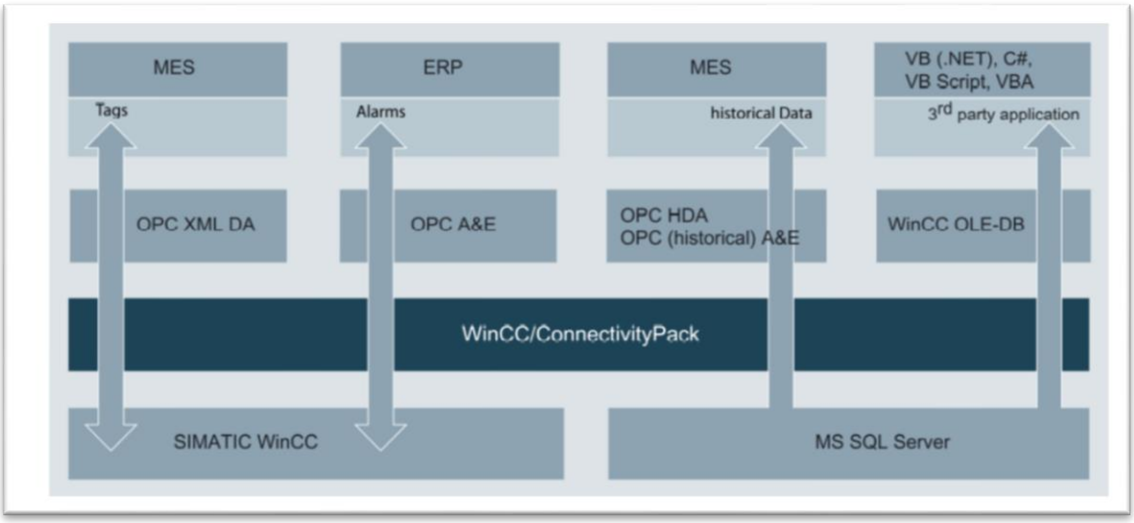


Figure 2-6: the architecture of simple integration

2.2.7.ii Structure of WINCC Connectivity Pack:

Turn any PC into a Connectivity Pack client by installing the Connectivity pack software with the Client Access License (CAL) or with the following WINCC software:

- WINCC/Connectivity Pack client
- WINCC Basic System
- Web Navigator Server
- Data Monitor Server
- Connectivity Pack Server

To access databases with WINCC OLE DB, you can write your own applications. With WINCC OLE DB, you can only access process value archives transparently. The Export- Import Wizard of the SQL Servers can be used to decompress WINCC process data for access with standard SQL queries via the MS OLE DB Provider.[18]

2.2.8 Enterprise Resource Planning (ERP):

ERP is an industry acronym for Enterprise Resource Planning. Broadly speaking, ERP refers to automation and integration of a company's core business to help them focus on effectiveness & simplified success.

An ERP System automates and integrates core business processes such as taking customer orders, scheduling operations, and keeping inventory records and financial data. ERP systems can drive huge improvements in the effectiveness of any organisation.

ERP System automates and integrates core business processes such as taking customer orders, scheduling operations, and keeping inventory records and financial data. ERP systems can drive huge improvements in the effectiveness of any organisation by[20]:

- assisting you in defining your business processes and ensuring they are complied with throughout the supply chain;
- protecting your critical business data through well-defined roles and security access
- enabling you to plan your work load based on existing orders and forecasts
- providing you with the tools to give a high level of service to your customers
- translating your data into decision making information

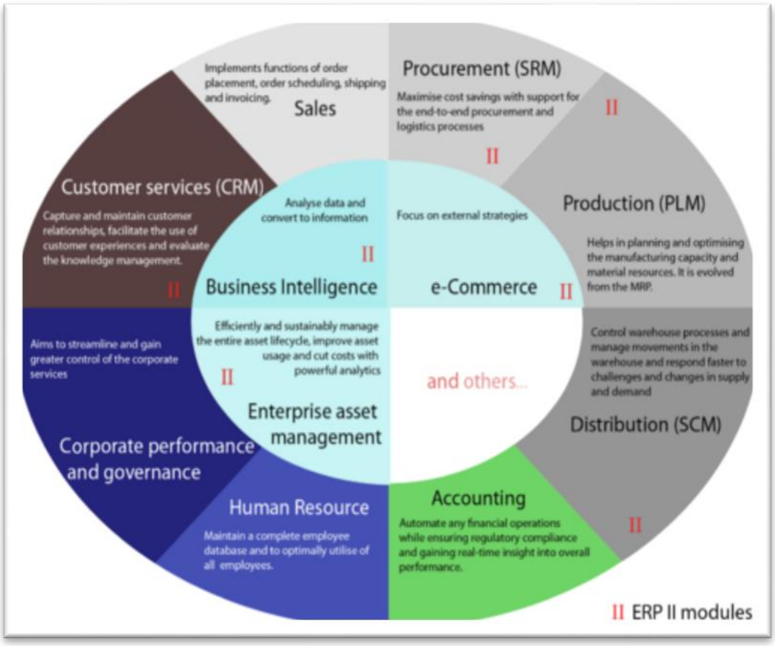


Figure 2-7: II ERP II modules

2.2.8.i Benefits of ERP System:

- Integration across all business processes - To realize the full benefits of an ERP system it should be fully integrated into all aspects of your business from the customer facing front end, through planning and scheduling, to the production and distribution of the products you make.

- Automation enhances productivity - By automating aspects of business processes, ERP makes them more efficient, less prone to error, and faster. It also frees up people from mundane tasks such as balancing data.
- Increase overall performance - By integrating disparate business processes, ERP ensures coherence and avoids duplication, discontinuity, and people working at cross purposes, in different parts of the organisation. The cumulative positive effect when business processes integrate well is overall superior performance by the organisation.[21]
- Quality Reports and Performance Analysis - Analysis on ERP will enable you to produce financial and boardroom quality reports, as well as to conduct analysis on the performance of your organisation.
- Integrates across the entire supply chain - A best of breed ERP system should extend beyond your organisation and integrate with both your supplier and customer systems to ensure full visibility and efficiency across your supply chain.[22]

2.2.8.ii Functional Areas of ERP:

An ERP system covers the following common functional areas. In many ERP systems, these are called and grouped together as ERP modules:

- Financial accounting: General ledger, fixed asset, payables including vouchering, matching and payment, receivables cash application and collections, management, financial
- Management accounting: Budgeting, costing, cost management, activity based costing

- Humanresources: Recruiting, training, rostering, payroll, benefits, 40 1K, diversity management, retirement, separation
- Manufacturing: Engineering, bill of materials, work orders, scheduling, capacity, workflow management, quality control, manufacturing process, manufacturing projects, manufacturing flow, product life cycle management
- Order Processing: Order to cash, order entry, credit checking, pricing, available to promise, inventory, shipping, sales analysis and reporting, sales commissioning.
- Supply chain management: Supply chain planning, supplier scheduling, product configurator, order to cash, purchasing, inventory, claim processing, warehousing (receiving, put away, picking and packing).
- Project management: Project planning, resource planning, project costing, work breakdown structure, billing, time and expense, performance units, activity management
- Customer relationship management: Sales and marketing, commissions, service, customer contact, call center support — CRM systems are not always considered part of ERP systems but rather Business Support systems (BSS).
- Data services: Various "self–service" interfaces for customers, suppliers and/or employees.[23]

2.2.8.iii Advantages of ERP:

- The fundamental advantage of ERP is that integrated myriad businesses processes saves time and expense. Management can make decisions faster and with fewer errors. Data becomes visible across the organization. Tasks that benefit from this integration include:[citation needed]

- Sales forecasting, which allows inventory optimization.
- Chronological history of every transaction through relevant data compilation in every area of operation.
- Order tracking, from acceptance through fulfilment.
- Revenue tracking, from invoice through cash receipt.
- Matching purchase orders (what was ordered), inventory receipts (what arrived), and costing (what the vendor invoiced).
- ERP systems centralize business data, which:
- Eliminates the need to synchronize changes between multiple systems—consolidation of finance, marketing, sales, human resource, and manufacturing applications
- Brings legitimacy and transparency to each bit of statistical data
- Facilitates standard product naming/coding
- Provides a comprehensive enterprise view (no "islands of information"), making real–time information available to management anywhere, any time to make proper decisions
- Protects sensitive data by consolidating multiple security systems into a single structure.[24]

2.2.8.iv Benefits of ERP

- ERP can improve quality and efficiency of the business. By keeping a company's internal business processes running smoothly, ERP can lead to better outputs that may benefit the company, such as in customer service and manufacturing.
- ERP supports upper level management by providing information for decision making.
- ERP creates a more agile company that adapts better to change. ERP makes a company more flexible and less rigidly structured so

organization components operate more cohesively, enhancing the business—internally and externally.

- ERP can improve data security. A common control system, such as the kind offered by ERP systems, allows organizations the ability to more easily ensure key company data is not compromised.
- ERP provides increased opportunities for collaboration. Data takes many forms in the modern enterprise. Documents, files, forms, audio and video, emails. Often, each data medium has its own mechanism for allowing collaboration. ERP provides a collaborative platform that lets employees spend more time collaborating on content rather than mastering the learning curve of communicating in various formats across distributed systems.[25]

2.2.8.v Disadvantages of ERP:

- Customization can be problematic. Compared to the best-of-breed approach, ERP can be seen as meeting an organization's lowest common denominator needs, forcing the organization to find workarounds to meet unique demands.[43]
- Re-engineering business processes to fit the ERP system may damage competitiveness or divert focus from other critical activities.
- ERP can cost more than less integrated or less comprehensive solutions.
- High ERP switching costs can increase the ERP vendor's negotiating power, which can increase support, maintenance, and upgrade expenses.
- Overcoming resistance to sharing sensitive information between departments can divert management attention.
- Integration of truly independent businesses can create unnecessary dependencies.

- Extensive training requirements take resources from daily operations.
- Due to ERP's architecture (OLTP, On-Line Transaction Processing) ERP systems are not well suited for production planning and supply chain management (SCM).
- Harmonization of ERP systems can be a mammoth task (especially for big companies) and requires a lot of time, planning, and money.[44]

Recognized ERP limitations have sparked new trends in ERP application development. Development is taking place in four significant areas: more flexible ERP, Web-enabled ERP, inter-enterprise ERP, and e-business suites.[24]

2.2.8.vi Process Preparation in ERP:

Implementing ERP typically requires changes in existing business processes.[21] Poor understanding of needed process changes prior to starting implementation is a main reason for project failure.[22] The difficulties could be related to the system, business process, infrastructure, training, or lack of motivation.

It is therefore crucial that organizations thoroughly analyse business processes before they implement ERP software. Analysis can identify opportunities for process modernization. It also enables an assessment of the alignment of current processes with those provided by the ERP system. Research indicates that risk of business process mismatch is decreased by:

- Linking current processes to the organization's strategy
- Analysing the effectiveness of each process
- Understanding existing automated solutions.

ERP implementation is considerably more difficult (and politically charged) in decentralized organizations, because they often have different processes, business rules, data semantics, authorization hierarchies, and decision centers. This may require migrating some business units before others, delaying implementation to work through the necessary changes for each unit, possibly reducing integration (e.g., linking via Master Data management) or customizing the system to meet specific needs.

A potential disadvantage is that adopting "standard" processes can lead to a loss of competitive advantage. While this has happened, losses in one area are often offset by gains in other areas, increasing overall competitive advantage. [26]

2.3 Related Work:

In 2010 by Aalto University School of Science and Technology **F**aculty of Electronics, Communications and Automation title Jouko Virta, upload paper ‘APPLICATIONINTEGRATION FOR PRODUCTION OPERATIONS MANAGEMENT USING OPC UNIFIED ARCHITECTURE**’**. This paper has been written at the laboratory of Information and Computer Systems in Automation at the School of Science and Technology at the Aalto University and is a part of the POJo research project. In order to achieve the required efficiency, the integration of manufacturing operations management must be implemented between the information systems. This may mean both vertical and horizontal integration in the company system hierarchy. The integration is however, a complex task and some techniques have been developed to Simplify the many problems .OPC Unified Architecture (OPC UA) is a new standard for communication in industrial applications developed by the OPC Foundation. An important motivation for OPC UA has been the drawbacks of the previous OPC specifications. Because of this, OPC UA contains several important enhancements, for example the service- Oriented architecture (SOA), data security and configurable information models. The configurability of the information models makes it possible to utilize standardized data models, e.g. ISA-95 and ISA-88, in conjunction with OPC UA. However, there are not yet many experiences how the mentioned standards should be used with OPC UA and what would be the actual benefits of this.[27]

After that, paper in 2013,Master's thesis (YAMK) Business Information Systems, Turku university of applied sciences written by Ari Lietzen,' DESIGNING USER ACCEPTANCE TESTING PLAN FOR ERP IMPLEMENTATION' The user acceptance testing (UAT) is one of the success factors in ERP (Enterprise Resource Planning) implementation. ERP systems can be very complicated with integrated business processes. ERP software is one of the most important business applications in the company. Companies carry out business processes with ERP. One of the critical business applications to the companies is ERP software. Many ERP implementation projects have failed during the past years. One of the most common reasons is the lack of testing. Therefore, it is very important to carry out UAT during the ERP implementation. The study starts with an overview of the company and SATEL Oy commissioned it. The objective of this study was to examine the theory of the UAT and to design the user acceptance-testing plan for ERP. The theory section examines ERP implementation and testing principles. The focus area of the theory section is to find out how to design a user acceptance testing.[29]

In this year in 2013 Jose Angel Gomez, LITH-ISY-EX-ET-0246-2002 2002-05-04, TEKNISKA HÖGSKOLAN LINKÖPINGS UNIVERSITET, Department of Electrical Engineering Linköping University S-581 83 Linköping, Sweden,' Survey of SCADA SYSTEMS and visualization of a real life processes'. in the labotek, an undergraduate course laboratory at the department of electrical engineering, of Linköping's university, there is implemented a factory of toy cars made with Lego. his factory simulates the assembly line of cars and is constituted by a plc (programmable logic controller) that controls the process, a pc connected to the plc, a control panel that is used to act on the factory and the own factory built entirely with Lego. With this project it is sought to study, which is the most appropriate software tool to carry out the visualization on a computer of this process and to develop a SCADA system that allows this visualization.[23]

In this paper by Prof. Dr. Detlef Zuehlke, July 6-11, 2008, Proceedings of the 17th World Congress the International Federation of Automatic Control Seoul, Korea' SMART FACTORY FROM VISION TO REALITY IN FACTORY TECHNOLOGIES', the resulting requirements for design, setup, and operation of our factories become crucial for success. In the past, we often increased complexity in structures and control systems resulting in inflexible monolithic production systems. However, the future must become "lean" – not only in organization, but also in planning and technology! We must develop technologies, which allow us to speed up planning and setup, to adapt to rapid product changes during operation, and to reduce the planning effort. To meet these challenges we should also make use of the smart technologies of our daily life. The Smart Factory initiative was founded by many industrial and academic partners to create and operate a demonstration and research test bed for future factory technologies.

Many projects develop, test, and evaluate new solutions. This presentation describes changes and challenges, and it summarizes the experience gained to date in the Smart Factory approach.[28]

CHAPTER THREE

SYSTEM DESIGN AND SIMULATION

This chapter represent system design and concept that used in process design. The system design consist of three layer, first one is represent the concept of simulator used in process design which is a WINCC v6.0 .the second layer represent special method used in integration of wincc with another application using special method of integration (connectivity pack) that can make a connection between enterprise resources planning system (open ERP v7.0) which is define in the layer three.

3.1 Block diagram:

In this figure 3-1 below see the block diagram of management of system layers of overall process which represent a full integrated control process system.

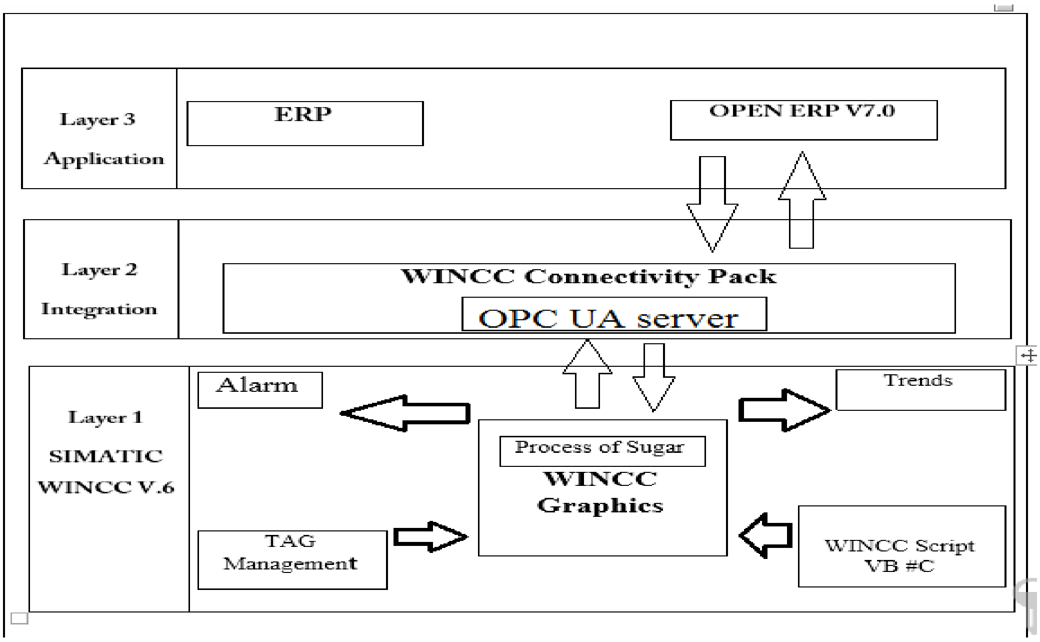


Figure 3-1: the block diagram of management of system layers

3.2 Used case:

The used case here about Sugar cane process as one of most application of SCADA system. The design of sugar process system starting from the first layer of plant containing machines of crude cane and tanks to mixer until ending with packaging. This process will discuss by details in chapter four.Figure3-2 illustrate this process steps

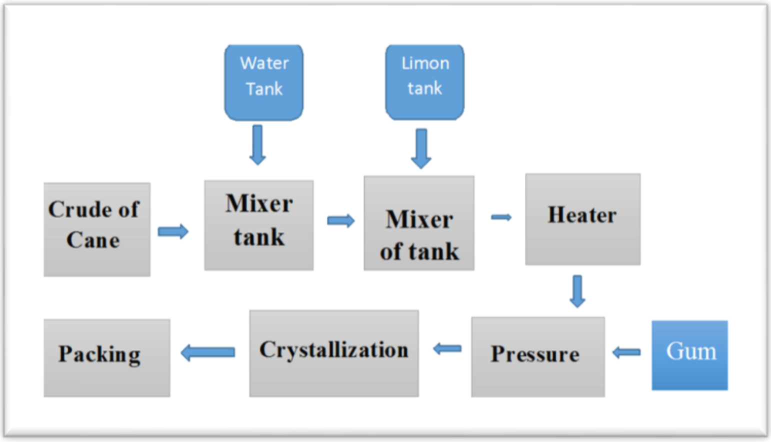


Figure 3-2: the block diagram of process

This process simulated by SEMATIC WINCC v6.0 in graphic designer tools and management it using tags and source code written in c language script.

3.3 SIMANTEC WINCC V6.0:

WINCC is powerful HMI system for use under Microsoft Windows 2000 and Windows XP. HMI stands for "Human Machine Interface", i.e. the interface between the human (the operator) and the machine (the process). The actual control over the process is performed by the automation system. WINCC communicates with both the operator and the automation system.[16]

3.3.1 WINCC Project Configuration Environment:

To develop and configure projects, special editors are provided that can be accessed from the WINCC Explorer. With each editor, a specific subsystem of WinCC is configured.

The following graph summarizes the interaction between the WinCC subsystems. This provides important information relating to the sequence that is employed for configuration[15]. Figure 3-3 show the configuration

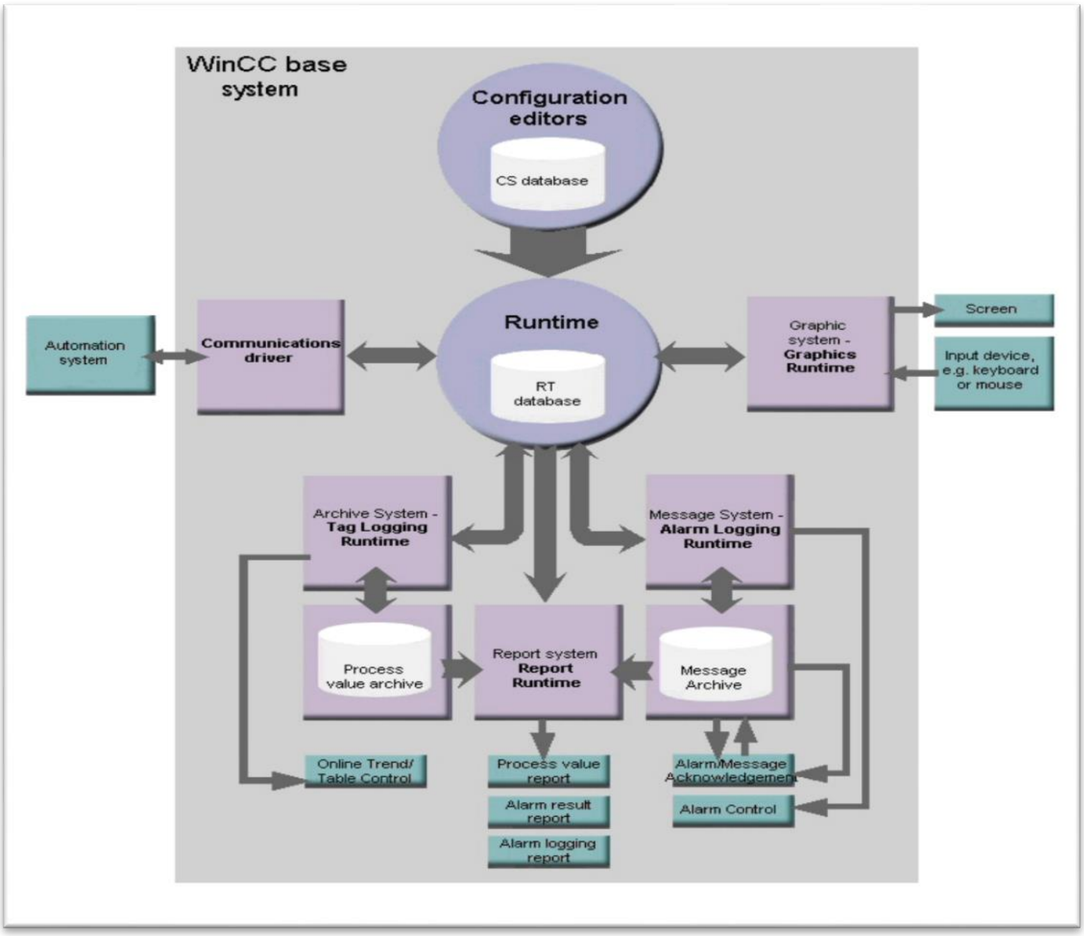


Figure 3-3: WINCC base system

The major subsystems of WINCC are:

- The graphics system - the editor for creating the screens is the Graphics Designer.
- The alarm system - the editor for configuring the alarms is named Alarm Logging.
- The archiving system - the editor for specifying the data to be

archived is named Tag Logging.

- The report system - the editor for creating the report layouts is the Report Designer.
- The communication system is configured directly in the WinCC Explorer.

All configuration data is stored in the CS database.[13]

3.3.2 WINCC Function libraries:

Using the editors in the Configuration software to create your project. All WINCC editors store their project information in the Configuration database (CS database).

In runtime, the project information is read out of the Configuration database by the Runtime software and the project is executed. Current process data is temporarily stored in the Runtime database (RT database)

- The Graphics System displays pictures on the screen. Conversely, it also accepts operator input, such as when the operator clicks on a button or enters a value.
- Communication between WinCC and the automation systems is effected by means of communication drivers, or "channels". The channels have the task of collecting the process value requirements of all runtime components, reading the values of the process tags out of the automation systems and, if necessary, writing new values into the automation systems.
- The exchange of data between WINCC and other applications might be performed by means of OPC, OLE.
- The Archiving System saves the process values in the process value archive. The archived process values are, for example, needed to display the temporal development of these values in

Online Trend Control or in Online Table Control.

- The individual process values are monitored by Alarm Logging. If a limit value is exceeded, Alarm Logging will generate a message which will be issued in Alarm Control. The message system also receives the acknowledgements made by the operator and manages the message states. Alarm Logging saves all messages in the message archive.
- The process will be documented by the Report System on request or at predefined times. The Process value archive and the message archive are accessed for this purpose.[13]

3.3.2.i Tags management:

Data are passed on in a WINCC project by means of tags. A tag has a data address and a symbolic name, which is used in the project. The data address is used in communication with the automation system.

WinCC works with two kinds of tags:

- Process tags
- Internal Tags

WinCC simplifies tag handling by means of two other object types:

- Tag groups
- Structure types[13]

3.3.2.ii The Graphics Designer:

The Graphics Designer is an editor for creating process pictures and making them dynamic. The Graphics Designer can only be started for the project currently opened in the WinCC Explorer. The WinCC Explorer can be used to display an overview of the pictures available in the current project.

For working with the Graphics Designer, the WinCC Explorer offers the following functions and configuration options:

Starting Graphics Designer

Creating and renaming pictures

Configuring object libraries and ActiveX controls

Converting libraries and pictures from older program versions

Configuring and starting runtime.[13]

3.3.2.iii Alarm Logging:

The "Alarm Logging" editor is responsible for message acquisition and archiving and contains functions for accepting messages from processes regarding their processing, display, acknowledgement and archiving.

Alarm logging Provides in-depth information about alarm and event states And Is used for an early warning of critical situations Results in avoidance and reduction of down times And Enhances quality to Provides specific documentation of alarm and event states[13]

3.3.2.iv WINCC Runtime:

With the runtime software, the operator can run and monitor the process. In particular, the runtime software has the following tasks:

- Reading of the data stored in the CS database.
- Displaying of the screens.
- Communication with the automation systems.
- Archiving of the current runtime data such as process values and alarm events.
- Running of the process, e.g. through specified set-points or activation/deactivation. [15]

3.4 INTEGRATION:

Communication between WINCC and the automation systems is effected via the respective process bus, e.g. Ethernet or PROFIBUS. Communication is managed by specialized communication drivers known as channels. WINCC has channels for the automation systems SIMATIC S5/S7/505 and manufacturer-independent channels such as PROFIBUS DP and OPC. Moreover there is a variety of optional channels available for all common controls as an option or add-on. Communication with other applications, e.g. Microsoft Excel or SIMATIC PRO TOOL, is effected with the assistance of the OPC (OLE for Process Control). When the WINCC OPC server is used, the data will be made available to other applications by WINCC. The data of other OPC servers can also be received by WINCC via the OPC client.[19]

Process tags form the link for data exchange between WINCC and the automation systems. Each process tag in WINCC corresponds to a certain process value in the memory of one of the connected automation systems. In runtime, the data area in which this process value is saved will be read out of the automation system by WINCC thus allowing the value of the process tags to be ascertained. WINCC is also able to write data back into the automation system. This data is then processed by the automation system. In this manner, you can use WINCC to control process.[17]

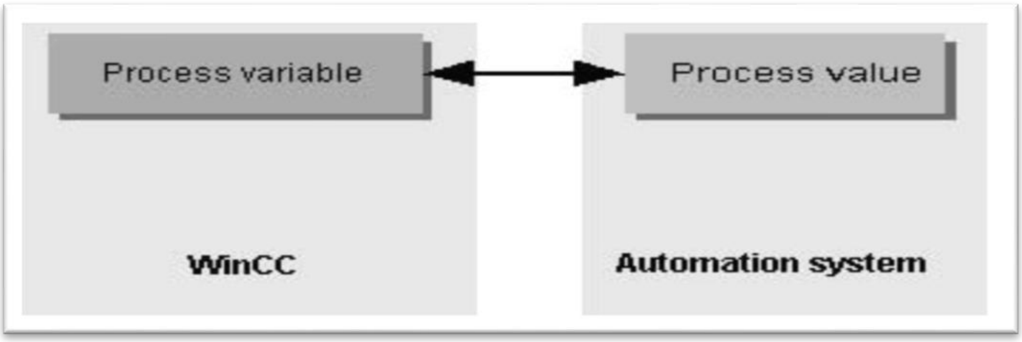


Figure 3-4: Data between WinCC and Automation

3.4.1 Communication by means of OPC:

OPC clients can access WINCC data through the integrated OPC servers. The following type of access are possible:

• Access to WINCC tags through the WINCC OPC DA server.

• Access to the archive system through the WINCC OPC HDA server.

• Access to the message system through the WINCC OPC A&E server.[18]

3.4.2 Technology of OPC SERVER:

OPC (OLE for Process Control) refers to a standard, manufacturer-independent software interface. The OPC interface is based on Microsoft Windows COM (Component Object Model) and DCOM (Distributed Component Object Model)

3.4.2.i COM:

COM is the standard protocol for communication between objects located on the same computer but which are part of different programs. The server is the object providing services, such as making data available. The client is an application which uses the services provided by the server.

3.4.2.ii DCOM:

DCOM represents an expansion of COM functionality to allow access to objects on remote computers.

This foundation allows standardized data exchange between applications from industry, administrative offices and manufacturing.

Up to that point, applications which accessed process data were tied to the access protocols of the communication network. The standard software interface OPC allows devices and applications from various manufacturers to be combined with one another in a uniform manner.

The OPC client is an application which accesses process data, messages and archives of an OPC server. Access takes place using the OPC software interface. An OPC server is a program which provides the applications from various manufacturers with a standard software interface. The OPC server is the middleware between the applications for handling process data, the various network protocols and the interfaces for accessing these data. Only devices with operating systems based on Windows COM and DCOM technology can use the OPC software interface for data exchange. At the present time, Windows NT, Windows 98, Windows 2000 and Windows XP use this software interface.[18]

3.4.3 OPC Specifications

The standard software interface OPC was defined by the OPC Foundation. The OPC Foundation is an alliance of leading companies in the field of industry automation. The OPC server from WINCC supports the following specifications.

- OPC Data Access 1.0a and 2.0
- OPC Historical Data Access 1.1
- OPC Alarm & Events 1.0.[18]

3.4.3.i OPC Data Access (OPC DA):

OPC Data Access (OPC DA) is the specification for managing process data. The WINCC OPC DA Server from WINCC V 6.0 conforms to OPC DA specifications 2.0 and 1.0a.

3.4.3.ii OPC Historical Data Access (OPC HDA):

OPC Historical Data Access (OPC HDA) is the specification for managing archive data. The specification is an extension of the OPC Data Access specification. The WINCC OPC HDA Server as of WINCC V 6.x corresponds to OPC HAD specification 1.1.

3.4.3.iii OPC Alarms & Events (OPC A&E):

OPC Alarm & Events is a specification for transmitting process alarms and events. The WINCC OPC A&E Server as of WINCC V 6.x corresponds to the OPC A&E specification 1.0.

3.4.4 Using OPC in WINCC:

WinCC can be used as both an OPC server and as an OPC client. During installation of WinCC, the following WinCC OPC servers may be selected for installation:

- WinCC OPC DA Server
- WinCC OPC HDA Server
- WinCC OPC A&E Server

The following OPC components are installed automatically:

- OPC Communication Driver (OPC DA Client)
- OPC Item Manager.[18]

3.4.5 Licensing:

In order to use the WinCC OPC HDA server and WinCC OPC A&E server, it is necessary to apply for a license, a so called authorization. The "Connectivity Pack" authorization must be installed on the WinCC server which is implemented as the WinCC OPC HDA server or WinCC OPC A&E server. Further information is available under "Authorization".[19]

3.4.5.i WinCC OPC DA server:

The WinCC OPC DA server makes the data from the WinCC project available to other applications. These applications may be running on the same computer or on computers in the networked environment. In this way for example, WinCC tags may be exported to Microsoft Excel.

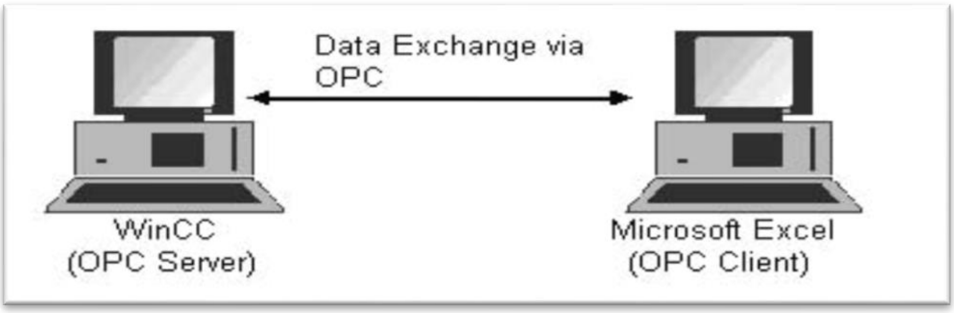


Figure 3-5: Data exchange WinCC and Microsoft Excel

The channel "OPC" does not require a separate communication group. The
channel "OPC" is an application which employs the OPC software interface to use an OPC server to access process data.

If WinCC is to be used as an OPC DA client, the "OPC" channel must be added to the WinCC project. Data exchange between the WinCC OPC server and the WinCC OPC client occurs via WinCC tags. To do this, a connection is set up in the WinCC project of the WinCC OPC client; it is used to handle access to the WinCC OPC server. wincc use as opc client ,also ERP as the another opc client ,thus OPC server is the middle layer between this two system as shown in figure 3-6 below.

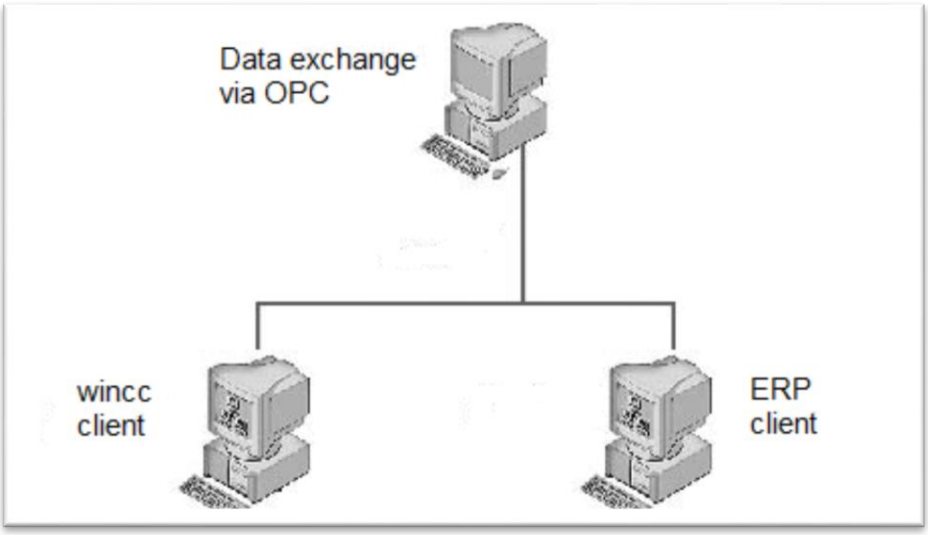


Figure 3-6: Data Exchange

The WinCC OPC server enables access to the WinCC runtime data via the OPC software interface. WinCC OPC servers support the complete range of function found in the OPC specification. Any software based on a particular OPC specification may be used as an OPC client. Thus for example the OPC client can be ERP system . Proprietary OPC clients may be created to best meet specific requirements.[19]

3.5 enterprise resource planning (ERP):

ERP software (or enterprise resource planning software) is an integrated system used by organizations to combine, organize and maintain the data necessary for operations. ERP systems merge an organization’s key operations, including the manufacturing, distribution, financial, human resources and customer relations departments, into one software system. Selecting an ERP software package and implementing it correctly can be an extremely complex and intimidating process for many executives and project teams. When the ERP evaluation and implementation is performed correctly, ERP software can revitalize an organization by streamlining and synchronizing its separate departments into one unified software system. When these tasks are done without focus and solid planning, the ERP software project can have severe repercussions that negatively effect the organization for many years to come.[23]

ERP provides an integrated view of core business processes, often in real-time, using common databases maintained by a database management_system. ERP systems track business resources—cash, raw materials, production_capacity—and the status of business commitments: orders, purchase_orders, and payroll. The applications that make up the system share data across the various departments (manufacturing, purchasing, sales, accounting, etc.) that provide the data.[21]ERP facilitates information flow between all business functions, and manages connections to outside stakeholders.[20]

Enterprise system software is a multi-billion dollar industry that produces components that support a variety of business functions. IT investments have become the largest category of capital expenditure in United States-based businesses over the past decade. Though early ERP systems focused on large enterprises, smaller enterprises increasingly use ERP systems.[23]

3.5.1 Connectivity:

ERP systems connect to real–time data and transaction data in a variety of ways. These systems are typically configured by systems integrators, who bring unique knowledge on process, equipment, and vendor solutions.[24]

3.5.1.i Direct integration:

ERP systems have connectivity (communications to plant floor equipment) as part of their product offering. This requires that the vendors offer specific support for the plant floor equipment their customers operate. ERP vendors must be experts in their own products and connectivity to other vendor products, including those of their competitors.

3.5.1.ii Database integration:

ERP systems connect to plant floor data sources through staging tables in a database. Plant floor systems deposit the necessary information into the database. The ERP system reads the information in the table. The benefit of staging is that ERP vendors do not need to master the complexities of equipment integration. Connectivity becomes the responsibility of the systems integrator. Also ERP can connected by OPC as client to OPC server to exchange data between other systems.[25]

3.5.2 Enterprise Appliance Transaction Modules (EATM):

These devices communicate directly with plant floor equipment and with the ERP system via methods supported by the ERP system. EATM can employ a staging table, web services, or system–specific program interfaces (APIs). An EATM offers the benefit of being an off–the–shelf solution.[22]

3.5.2.i Custom–integration solutions:

Many system integrators offer custom solutions. These systems tend to have the highest level of initial integration cost, and can have a higher long term maintenance and reliability costs. Long term costs can be minimized through careful system testing and thorough documentation. Custom–integrated solutions typically run on workstation or server-class computers.

CHAPTER FOUR

RESULT AND DISCUSSION

This chapter represent the simulation discussion in steps of operation process manufacturing starting from cane crusher, which connected, with valve and pumps to mixer tank, which is also connected with a water tank attached with valve open to flow water to the mixer in which cane juice in, then connect mixer tank through valve and pump to out mixed juice to another tank mixer 2 ,mixer2 tank connect with lemon tank by valve and pump, the out of mixer2 go through valve and pumps to heater .Main purpose of heater tank is to heat process to 100 degree which known by heat sensor which connect to heat tank. The out of heat tank go through valve and pumps to pressure tank to pressure the liquid Then connected to last tank by valve and pump. The product load to package on the truck. Figure4-1show the simulation of overall process.

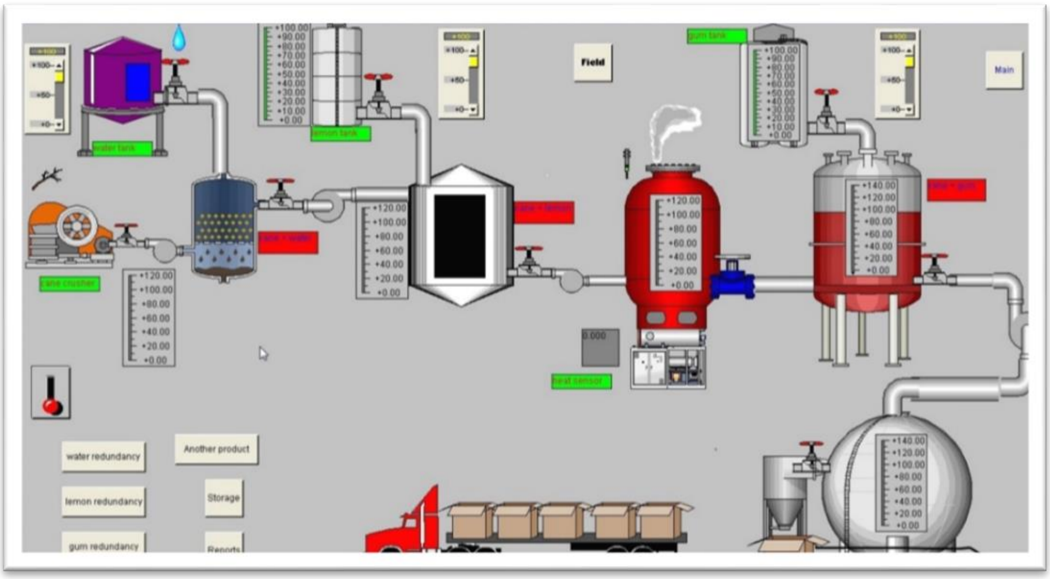
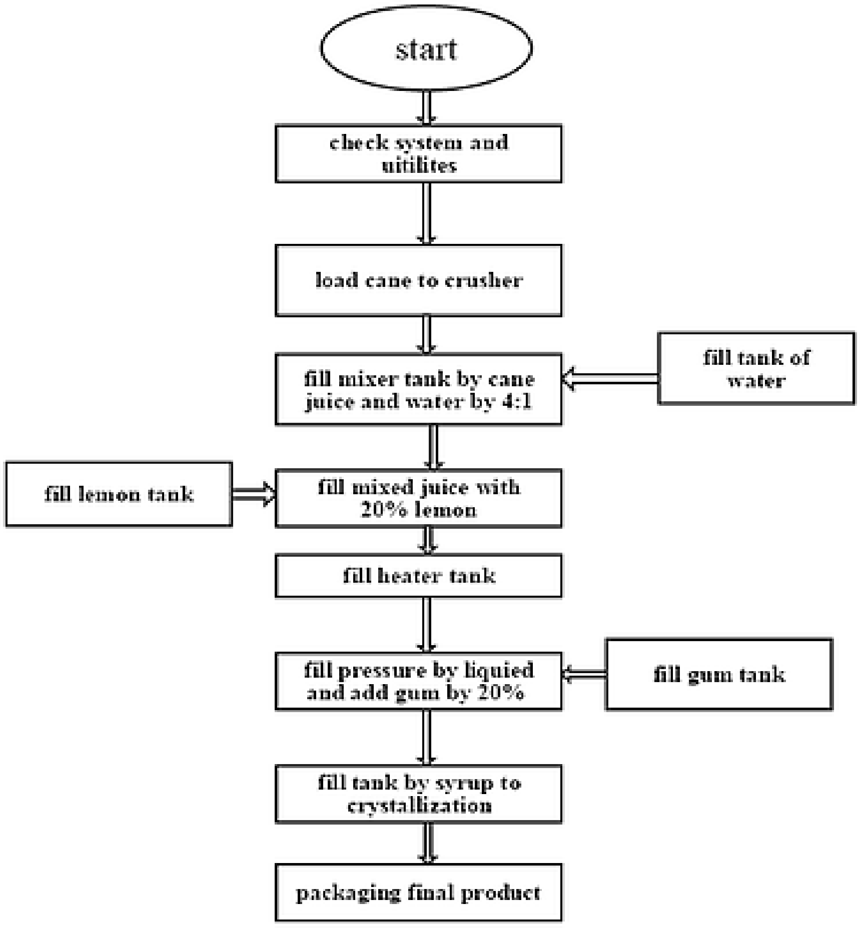


Figure 4-1: the simulation of overall process

4.1 Flow Chart of System:



4.2 Scenario of process:

In the first step of process there was no any action was taken yet and Switch is in state off but tanks of water, lemon and gum are full. As shown 4-1-i in figure below.

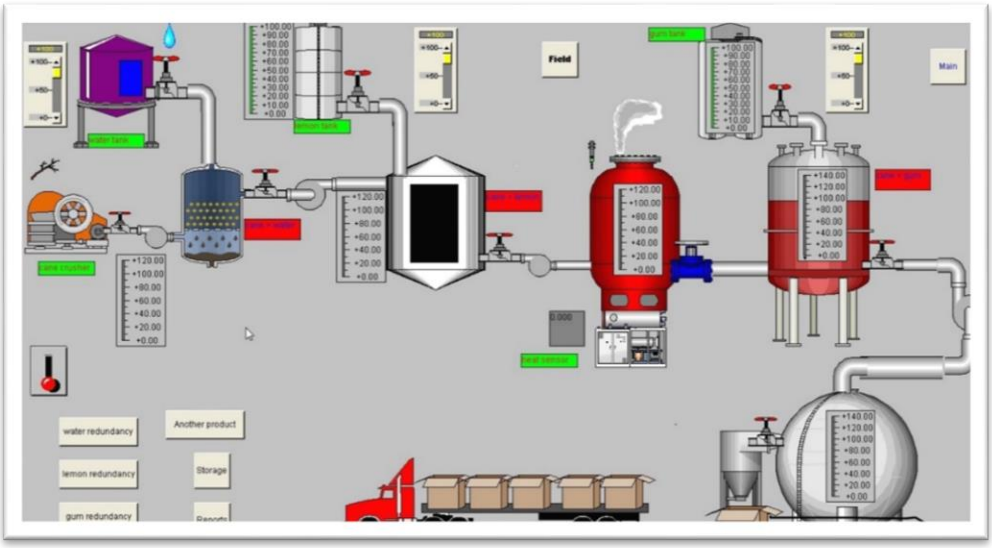


Figure 4-1-i: the simulation of overall process

When the operation is start and switch goes on the cane is be cleaning and upload to sugar cane machine and switch on and is start working. After few minute from crushing the valve switch on and mixer's tank fill by 80 liters of cane juice. The crusher operation and opening of valve is represent in green colour in the figure 4-2.

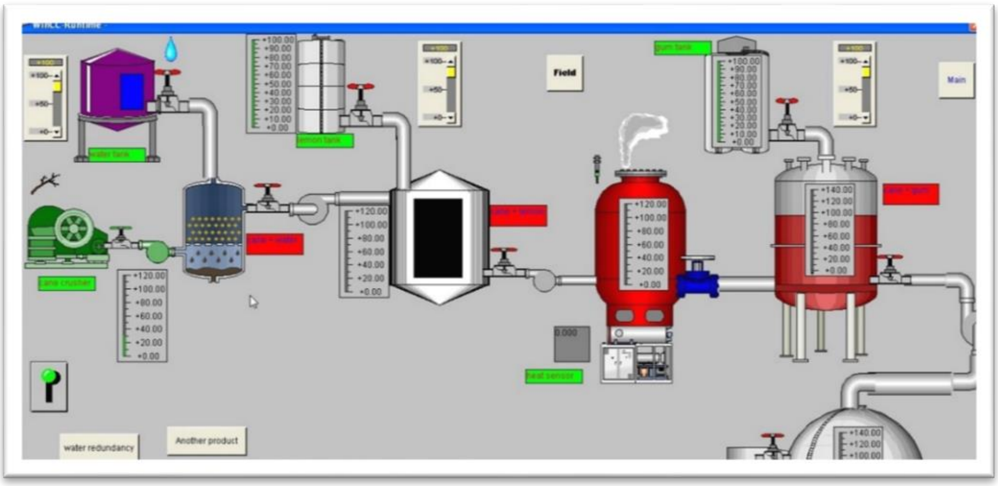


Figure 4-2: crusher operation

After this step the cane is go to another tank and mixed with water Then the crusher and valve switched off. water tank’s valve switched on and mixer1’ tank fill by 20 liter .and then switched off.shown in figure 4-3.

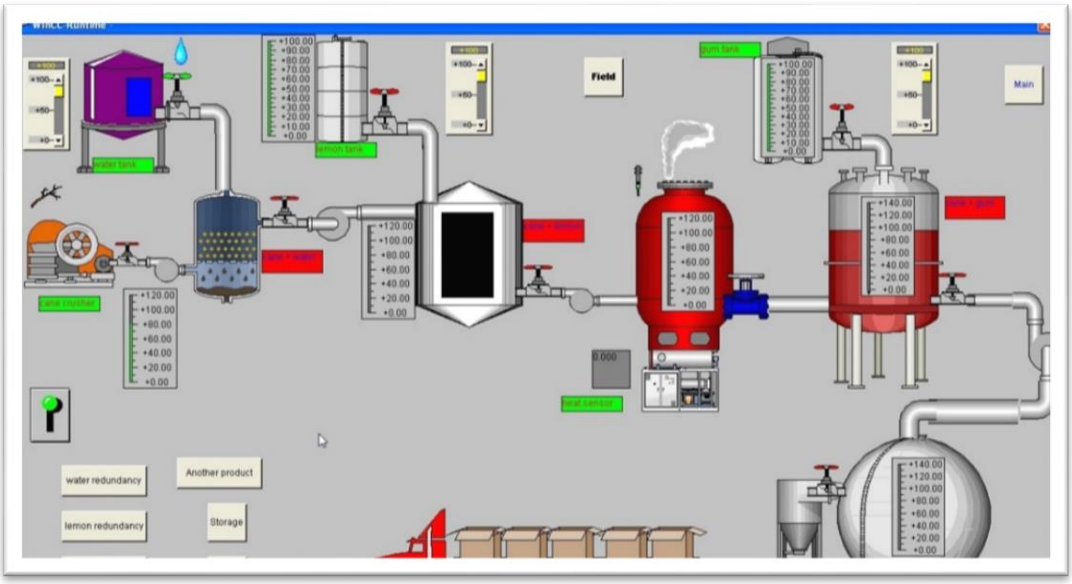


Figure 4-3: water fill operation

The next step is decrease mixer’s 1 tank by 20-liter go to another product’s tank as it shown in figure below.

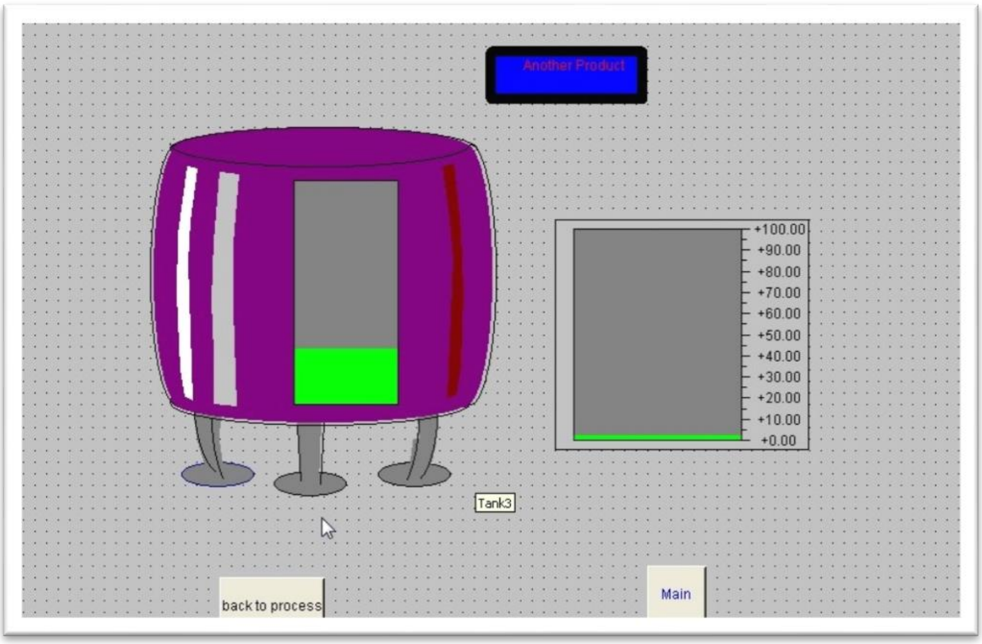


Figure 4-3.1: another product

After that mixer's valve and pump switched on that, represent by green colour. The liquid go to another tank to be and fill it by 80-liter .show in figure 4-4.

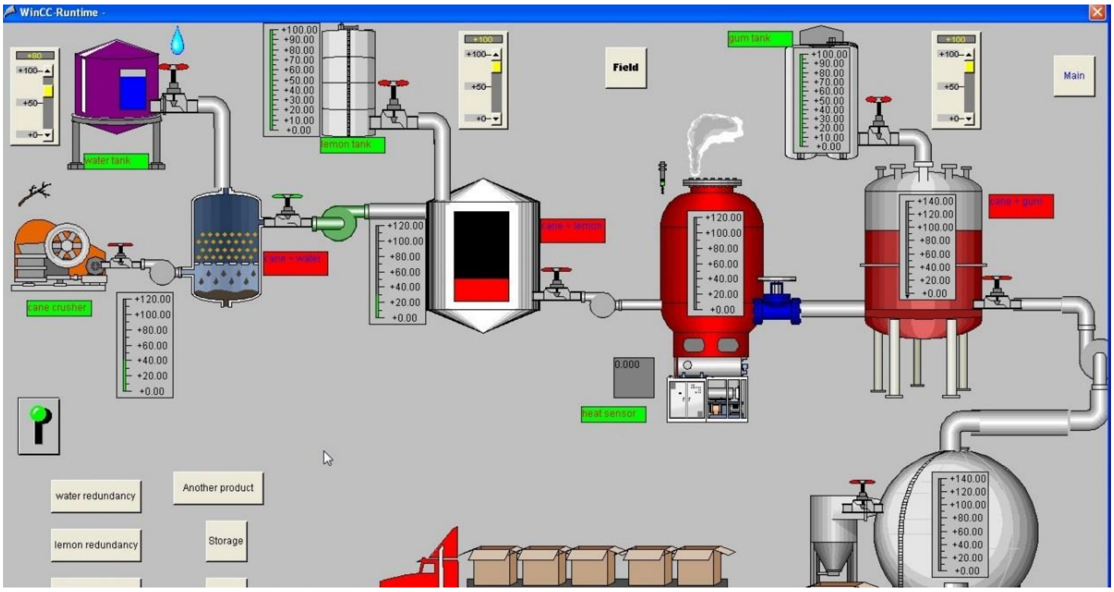


Figure 4-4: mixer 2 fill operation

Then mixer1's valve and pump switched off and lemon's tank valve switched on . lemon get in tank and fill it by 20 liter. shown in figure 4-4-i.

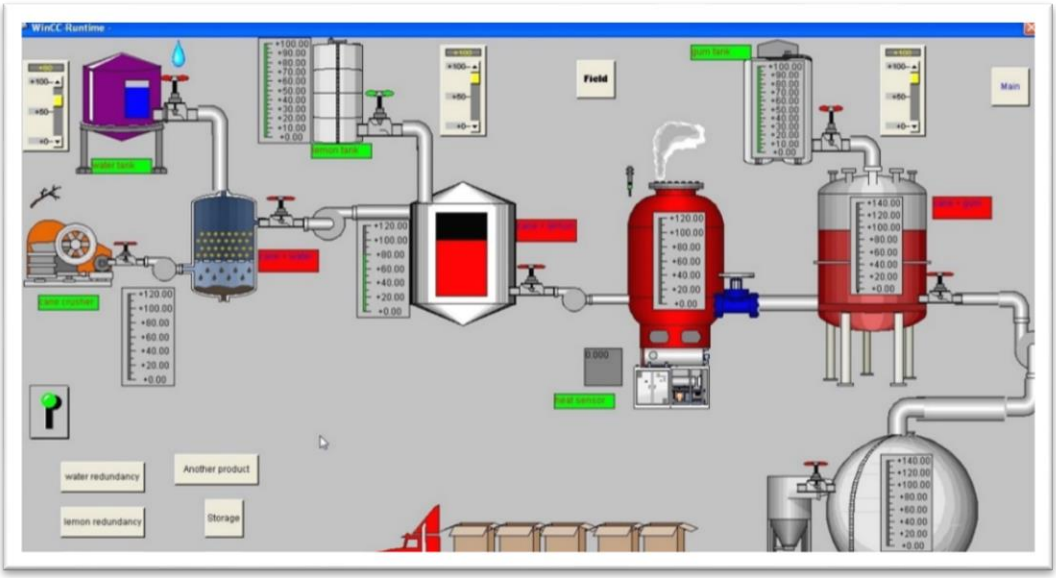


Figure 4-4.1: limon fill

In this time tank fill till 100 liter .lemon’s tank valve switched off ,and tank’s valve and pump switched on ,then the liquid go to heater’ tank fill it by 100 liter .after that heater which position is under heater’ tank start and sensor read the temperature of liquid, represent in figure 4-5.

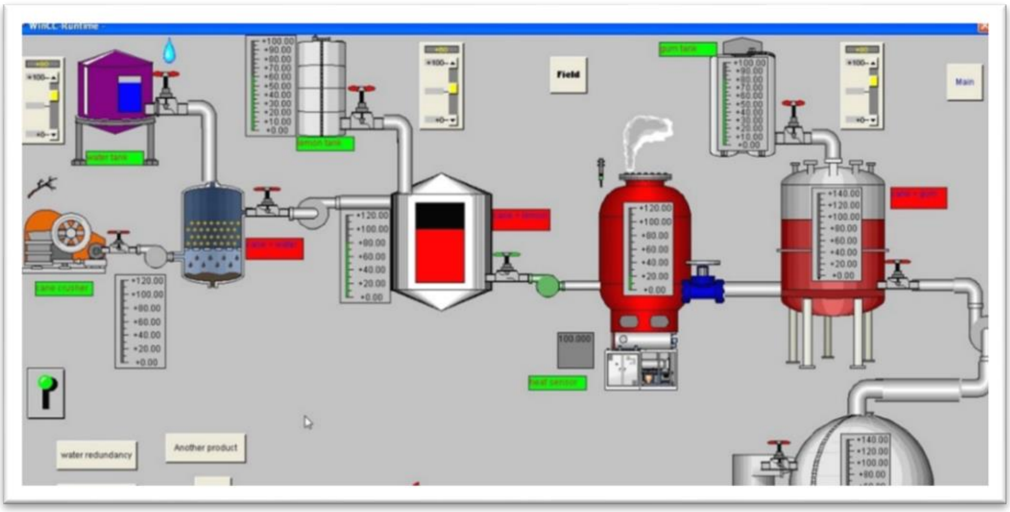


Figure 4-5: Heater fill operation

When temperature in heating tank reach 100 degree the heater machine switched off and vapours are shown indicate that the liquid reach the highest degree. After that heater’s valve switched on and pressure tank fill to 100 liter , then gum tank valve’s switched on and lemon fill pressure tank by 20 liter .

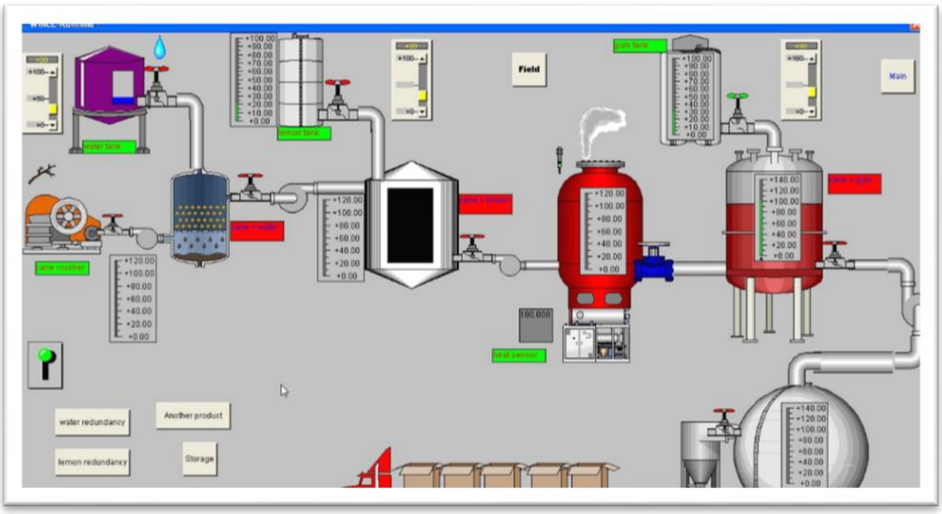


Figure 4-6: gum fill

Then lemon's tank switched off and pressure valve switched on and liquid go throw it to drying and crystallization tank as shown in figure 4-7.

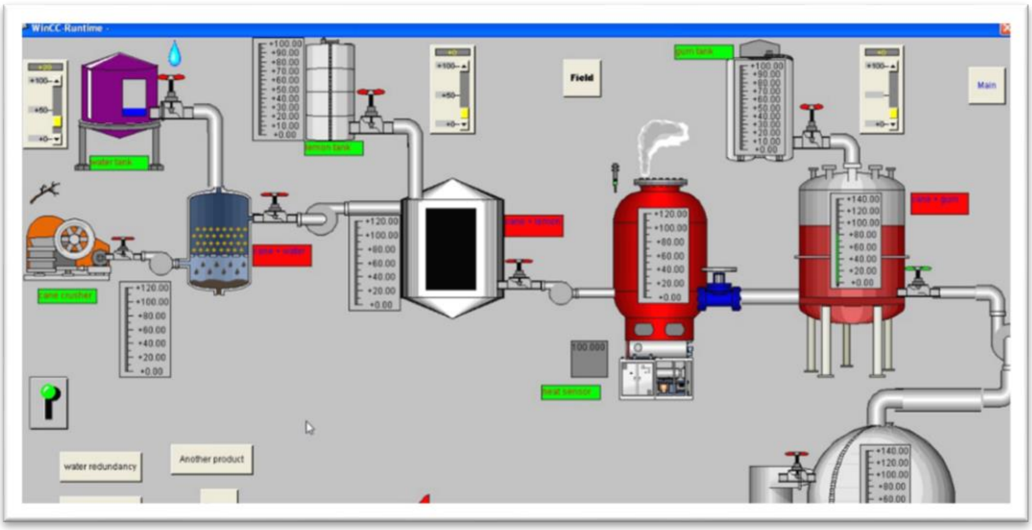


Figure 4-7 : last tank fill

The tank is load by 120 liter. and start processing until reach the final product and open its valve to package sugar in packages.

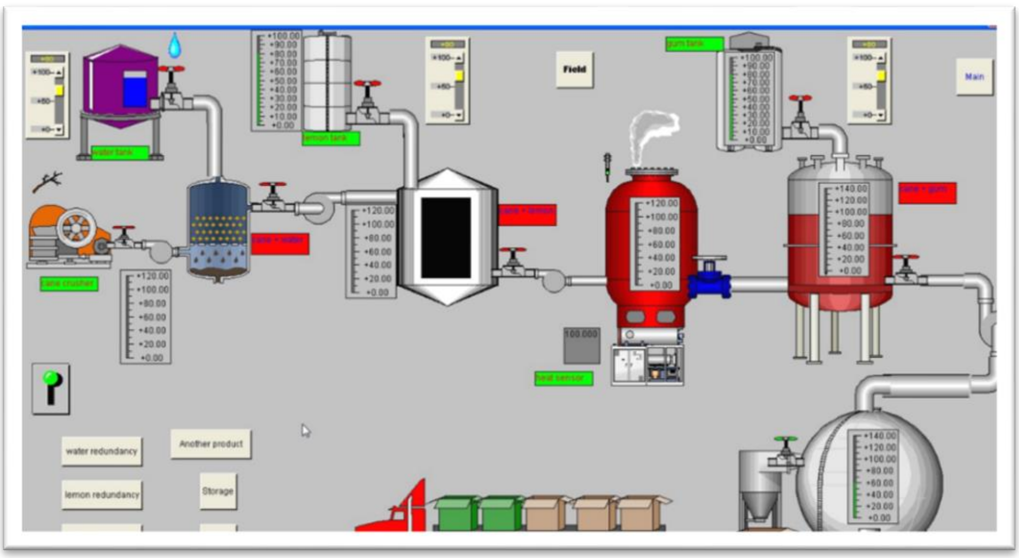


Figure 4-8 : packaging operation

When all package loaded automatically the operation restart from beginning Until all package fill and water ,lemon and gum tank empty .

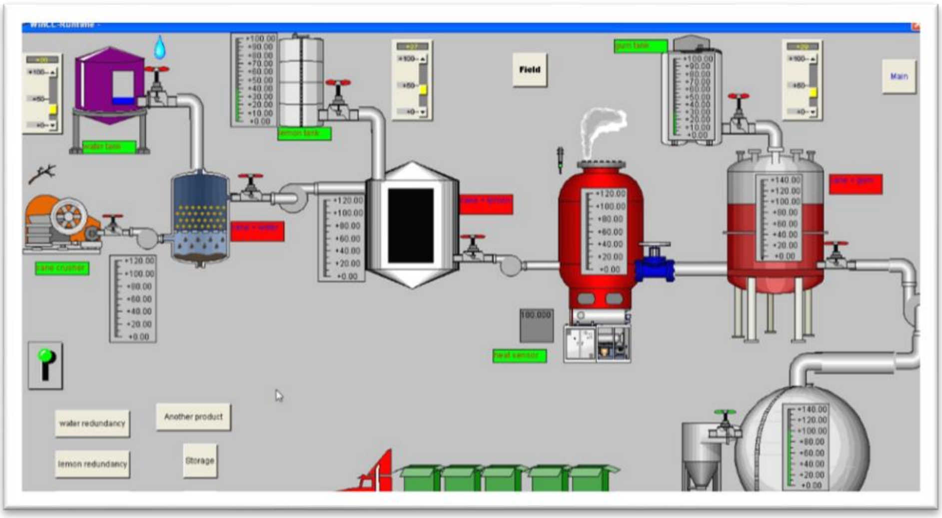


Figure 4-9: complete packing operation

We can read the operation trend of process and alarm and reports in figure 4-10.

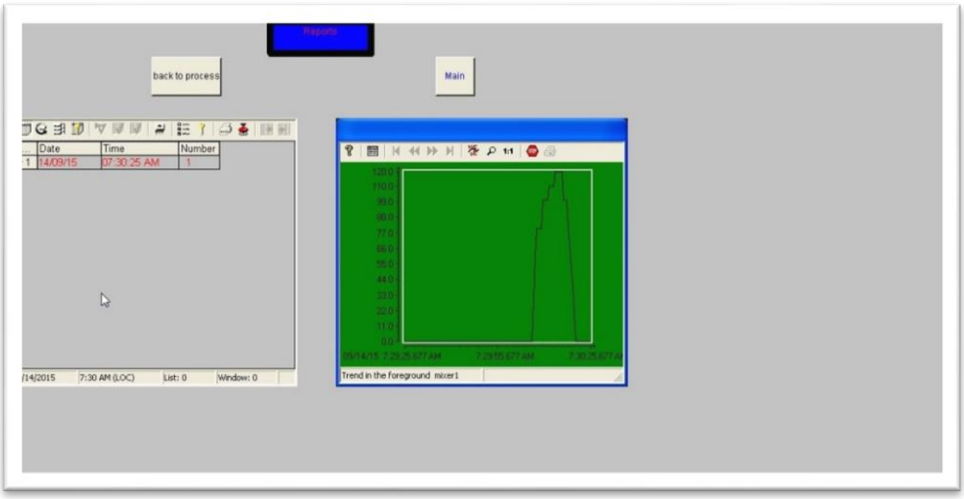


Figure 4-10: report and Alarm

CHAPTER FIVE

CONCLUSION AND FURTHER DISCUSSION

5.1 Conclusion:

In this thesis, represent one of SCADA application in sugar cane treatments companies. The system describe the flow process of sugar designed by using Semantic WINCC v6.0 and solve most problems facing in manufacturing level by simulate reliable design for it.

During the realization of this project and the requirement to integration open ERP v7.0 system with WINCC v6.0, due to diverse technical problems in make full system of administration and management which need assistance from specialist team in management designers , it was the part that more time will be taken for solving it in future.

5.2 Further Discussion:

In future research expects an enhancement of capabilities for application integration of SCADA system with ERP. As the integration of ERP requires massive amounts of data to be transferred, the performance of the OPC UA data exchange functionalities should be studied more extensively.

Since there are only few commercial systems providing OPC UA interfaces yet, it remains to be seen how well the configurable address spaces will be supported in ERP and PCS systems.

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APPENDIX

Source code:

```
#include "apdefap.h"
void OnClick(char* lpszPictureName, char* lpszObjectName, char*
lpszPropertyName)
{
#include "trigger.h"

BOOL value;
LINKINFO plink;
int x,w,y,m2,l,n,d,c,k,m3,p,t,g,f,s,z,b,a,h;
int m;
int o = 0;
signed int r;
y=100;
g=100;
l=100;
r=80;
SetTagSDWord("pack1",0);
SetTagSDWord("pack2",0);
SetTagSDWord("pack3",0);
SetTagSDWord("pack4",0);
SetTagSDWord("pack5",0);
SetTagSDWord("package",0);
//do{
while(r>=-1) {
```

```
if(o==1) {
SetTagSDWord("mokhlfat",0);
SetTagBit("pack1",0);
SetTagBit("pack2",0);
SetTagBit("pack3",0);
SetTagBit("pack4",0);
SetTagBit("pack5",0);
}

SetTagBit("crusher",0);
SetTagSDWord("crusher_valve",0);
SetTagSDWord("water_valve",0);
SetTagSDWord("mixer1",0);
SetTagSDWord("mixer2",0);
SetTagBit("mixer_valve",0);
SetTagBit("mixer2_valve",0);
SetTagSDWord("heater_1",0);
SetTagBit("smoke",0);
SetTagBit("heater_machine",0);
SetTagBit("heater_valve",0);
SetTagSDWord("presure_tank",0);
SetTagBit("pakage",0);
SetTagBit("lamporgine",0);
SetTagSDWord("gague",0);
SetTagBit("start",0);
SetTagBit("p1_1",0);
SetTagBit("p2_1",0);
SetTagBit("p3_1",0);
SetTagBit("p4_1",0);
```

```
SetTagBit("p5_1",0);

SetTagBit("gum_valve",0);
//do {
PDLRTGetPropEx(0,lpszPictureName,lpszObjectName,"Toggle",VT_B
OOL,&value,NULL,NULL,0,NULL,NULL);
//do{
if(value)
value =FALSE;
else
value = TRUE;
//do{
if
(PDLRTGetLink(0,lpszPictureName,lpszObjectName,"Toggle",&plink,
NULL,NULL,NULL))
{
  if ((plink.LinkType >BUBRT_LT_VARIABLE_INDIRECT) ||
(plink.LinkType < BUBRT_LT_VARIABLE_DIRECT)) return;
  else
  {
PDLRTGetLink(0,lpszPictureName,lpszObjectName,"Toggle",&plink,N
ULL,NULL,NULL);
    SetTagBit (plink.szLinkName,(short int) value);

   if(value)   {
       for(x=0;x<10000000;x++);
       SetTagBit("crusher",1);
    for(x=0;x<1000000;x++);
       SetTagSDWord("crusher_valve",1);
```

```
        for(x=0;x<100000;x++);
         for(m=0;m<=80;m=m+10)
{        SetTagSDWord("mixer1",m);
for(x=0;x<1000000;x++);    }
  SetTagBit("crusher_valve",0);
 SetTagBit("crusher",0);
        for(x=0;x<1000000;x++);
 SetTagBit("water_valve",1);
 for(y=y;y>=r;y=y-10)  {
SetTagSDWord("water_tank",y);
     for(x=0;x<10000000;x++);
//w=100-y;
m=m+10;
// for(x=0;x<100000;x++)
SetTagSDWord("mixer1",m);
for(x=0;x<1000000;x++);}
 SetTagBit("water_valve",0);
for(x=0;x<10000000;x++);
for(m=100;m>=80;m=m-10)  {
SetTagSDWord("mixer1",m);
     for(x=0;x<10000000;x++);
//a=100-m;
//h=h+a;
   // SetTagSDWord("mokhlfat",a);
        //for(x=0;x<1000000;x++); }
 for(x=0;x<1000000;x++)
SetTagBit("mixer_valve",1);
 for(k=80;k>=0;k=k-10) {
SetTagSDWord("mixer1",k);
```

```
      for(x=0;x<1000000;x++);
n=80-k;
SetTagSDWord("mixer2",n);
         for(x=0;x<1000000;x++);
 }
SetTagBit("mixer_valve",0);
SetTagBit("lemon_valve",1);
for(l=l;l>=r;l=l-10) {
    SetTagSDWord("lemon_tank",l);
      for(x=0;x<1000000;x++);
c=100-l;
n=n+c;
 //for(x=0;x<1000000;x++)
   SetTagSDWord("mixer2",n);
        for(x=0;x<10000000;x++);     }

 SetTagBit("lemon_valve",0);
 //for(x=0;x<10000000;x++);
SetTagBit("mixer2_valve",1);
for(n=100;n>=0;n=n-10) {
SetTagSDWord("mixer2",n);
for(x=0;x<1000000;x++);



p=100-n;
SetTagSDWord("heater_1",p);
         for(x=0;x<1000000;x++);
 }
  for(x=0;x<1000000;x++);
```

```
SetTagBit("mixer2_valve",0);
//SetTagBit("heater_machine",1);
  for(x=0;x<1000000;x++);
b=0;
  for(b=0;b<=100;b=b+10)
{
  SetTagSDWord("gague",b);
for(x=0;x<1000000;x++);
SetTagBit("heater_machine",1);
 for(x=0;x<1000000;x++);
SetTagBit("smoke",1);
 for(x=0;x<1000000;x++);
}
//SetTagBit("smoke",1);
 for(x=0;x<1000000;x++);
SetTagBit("heater_machine",0);
for(x=0;x<1000000;x++);
SetTagBit("smoke",0);
for(x=0;x<10000000;x++);
SetTagBit("heater_valve",1);
  for(x=0;x<1000000;x++);
for(s=100;s>=0;s=s-10) {
SetTagSDWord("heater_1",s);
      for(x=0;x<100000;x++);
t=100-s;
 SetTagSDWord("presure_tank",t);
         for(x=0;x<1000000;x++);}
for(x=0;x<1000000;x++);
SetTagBit("heater_valve",0);
```

```
for(x=0;x<10000000;x++);
SetTagBit("gum_valve",1);
for(x=0;x<1000000;x++);
for(g=g;g>=r;g=g-10) {
    SetTagSDWord("gum_tank",g);
      for(x=0;x<10000000;x++);
f=100-g;
t=t+f;
 //for(x=0;x<1000000;x++)
   SetTagSDWord("presure_tank",t);
        for(x=0;x<10000000;x++);     }
SetTagBit("gum_valve",0);
for(x=0;x<1000000;x++);
for(x=0;x<10000000;x++);
SetTagBit("presure_valve",1);
 for(t=100;t>=0;t=t-10) {
         SetTagSDWord("presure_tank",t);
      for(x=0;x<1000000;x++);

z=100-t;
         SetTagSDWord("last_tank",z);
         for(x=0;x<1000000;x++);

 }
SetTagBit("presure_valve",0);
for(x=0;x<10000000;x++);

SetTagBit("last_valve",1);
for(x=0;x<10000000;x++);
```

```
 for(z=100;z>=0;z=z-10) {
SetTagBit("pakage",0);
SetTagBit("lamborgine",0);
        SetTagSDWord("last_tank",z);
     for(x=0;x<1000000;x++);
if(z==80){
SetTagBit("p1_1",1);
 //for(x=0;x<1000000;x++);
}
if(z==60){
SetTagBit("p2_1",1);
// for(x=0;x<1000000;x++);
}
if(z==40){
SetTagBit("p3_1",1);
//for(x=0;x<1000000;x++);
}
if(z==20){


SetTagBit("p4_1",1);
//for(x=0;x<1000000;x++);
}
if(z==0){
SetTagBit("p5_1",1);
//for(x=0;x<1000000;x++);
}
      //  for(x=0;x<1000000;x++);
//SetTagBit("lamborgine",1);
for(x=0;x<1000000;x++);
```

```
 }
SetTagBit("last_valve",0);
//SetTagBit("lamborgine",1);
 for(x=0;x<1000000;x++);
if(r==80){
SetTagBit("pack1",1);
// for(x=0;x<1000000;x++);
}
if(r==60){
SetTagBit("pack2",1);
// for(x=0;x<1000000;x++);
}
if(r==40){
SetTagBit("pack3",1);
 //for(x=0;x<1000000;x++);
}

if(r==20){
SetTagBit("pack4",1);
 //for(x=0;x<1000000;x++);
}
if(r==0){
SetTagBit("pack5",1);
 //for(x=0;x<1000000;x++);
o = 1;
SetTagSDWord("package",1);
}
for(x=0;x<1000000;x++);
 GetLocalPicture("package.pdl");        //Return-Type: char*
```

```
for(x=0;x<1000000;x++);
r=r-20;
}}}
}
//while(y=!0);
}}
```