Implementing SCADA System by Using Rexroth WinStudio for Automated Industrial Process

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Abstract: **This paper represents controlling and monitoring of machine failures that happen a lot over the industry; the injuries are due to the collapse of machines or monitoring, irregular checking, and machine controlling. These accidents are very harmful to individuals working in a factory environment. To handle such situations, machine failure and monitoring can be detected by using the SCADA system with the help of IOT, to handle the system parameter mechanically. This paper provides modern solutions for controlling and monitoring machine faults from anywhere, anytime by using the internet which will boost worker safety in the industries.**

Keywords: **IoT, PLC, SCADA, WINCC.**

1. Introduction

PLCs or programmable logic controllers are microcontrollers that take inputs from several sensors distributed through the factory. PLC will take actions to control the procedures taking place from the manufacturing line. In order to boost productivity and efficiency in a variety of situations, Developers will develop software applications every day.

SCADA stands for Supervisory Control and Data Acquisition. As its name indicates, it isn't a complete control system, but rather focuses on the supervisory level. it's a pure software package that's positioned on top of hardware to which it's interfaced, generally, through Programmable Logic Controllers (PLCs) or other business hardware modules, SCADA systems are used not just in industrial processes: e.g. steel making, electricity generation (nuclear and conventional) and distribution, chemistry but also in certain experimental facilities like nuclear fusion. However, SCADA systems evolve rapidly and are now penetrating the market of plants with a variety of I/O channels of several SCADA systems won't run to on DOS, VMS, and UNIX; in recent years all SCADA vendors have moved to NT and some additionally to Linux, the process/system/machinery that you want to track and control. For instance, a power plant, a water system, a network, a network of traffic lights, a network of SCADA devices, or other field devices that interfaces with the system through detectors and control outputs. This network provides you the capacity to control and measure specific elements of them.

2. Software and Hardware Used

Indra Control XM Hardware (PLC): it is a real time-capable I/O processing flexibly adjustable ability to suit the requirement. The design enables a vast range of programs and simplifies handling. Consistent and high-performance engineering with IndraWorks engineering in the range empowers the greatest increase in efficacy and machine optimization. Installation of this hardware is done by moving through IndraWorks engineering software and pinging its IP address and select open core interfacing and select an Ethernet project is made and finally going online in IndraWorks engineering.

WinStudio: WinStudio is your visualization module of this powerful IndraWorks application framework for performance and engineering. With Win Studio you can make your individual software quickly and economically — using one instrument for all programs. Win Studio's usage with the options from Rexroth and the entire PC ensures performance and optimum functionality. The flexible licensing model distinguishes between development and runtime versions. Using the development version, you can personalize your software and use them on runtime versions as often as you desire. This strategy allows you to always have the adaptation offering a high level of efficiency.

1. Easy project planning of this machine visualization.
2. Auto-screen scaling.
3. Clear selection of items by using the Project Explorer.
4. Dynamic generation of web pages.
5. Project planning without the understanding of high-level languages.

IndraWorks engineering (software):
Rexroth IndraWorks provided by BOSCH REXROTH which supports all Rexroth products. IndraWorks will help to tackle all PLC-based automation and drive commissioning tasks in a uniform and intuitively operable software environment. All of the basic tools required, including the homogeneously

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integrated CoDeSysV3, are available on a continuous basis. User are you able to enjoy quick and transparent access to all or any the functions and system data of the automation components, IndraWorks will offer continuous operation supported technologies and extensive wizards for the project planning of controls and drives.

3. Methodology

SCADA system includes the subsequent components like local processors, operating equipment, PLCs, instruments, link-attached terminal unit, intelligent electronic devices, master terminal units, or host computers and a PC with a human-machine interface. The block diagram of the SCADA system shown in the figure represents the basic SCADA architecture. The SCADA systems are different from distributed control systems that are commonly found in plant sites. When distributed control systems cover the plant site, the SCADA system covers much larger geographic areas.

The above figure depicts an integrated SCADA architecture that supports TCP/IP, UDP, and other IP based communication protocols as well as industrial protocols like Modbus TCP, Modbus over TCP, or Modbus over UDP. These all beat cellular, private radio, or satellite networks. In complex SCADA architectures, there's a spread of wired and wireless media & protocols involved in getting data back to the monitoring site. This allows the implementation of powerful IP based SCADA networks over a landline, mixed cellular, and satellite systems. SCADA communications can utilize various ranges of wired and wireless media. The choice of existing communication depends on the characterization of a number of factors. The available communications at the remote sites are existing communications infrastructure, polling frequency, and data rates. These factors impact the ultimate decision for SCADA architecture. Therefore, a review of SCADA systems evolution allows us to raise understands many security concerns.
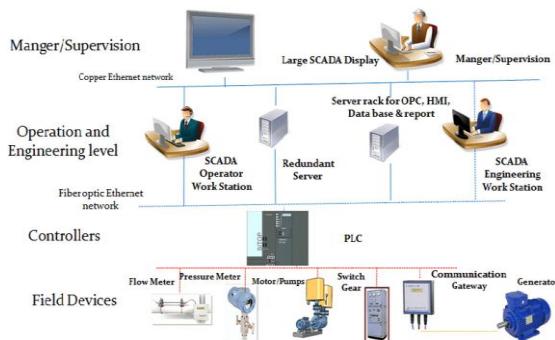

Fig. 1. Architecture of SCADA

4. Steps Involved in this Process

Application: Pump control:

For Winstudio communication create a symbol file with the required PLC variables in IndraWorks software. Download the

Program into the PLC and bring the PLC to run the state. Create a new project using win studio software. To communicate PLC variables with WinStudio software, Link the symbol file created using IndraWorks software in a win studio project. Create required win studio tags corresponding to each PLC variable in Winstudio software. Develop the WinStudio screen as per the given application and link the components (inputs and outputs) on the screen to the win studio tags. Save and close all the screens developed or opened in win studio software and select the start-up screen as per the requirement. Run the application in Winstudio software. So the real-time data from the PLC can be monitored and controlled through the win studio screen.
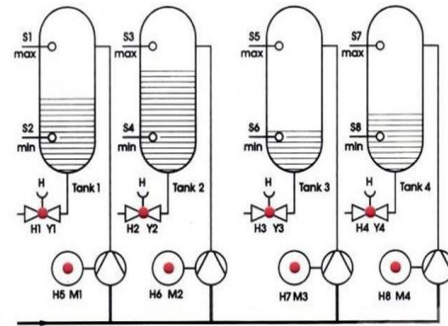
Fig. 2. Block diagram

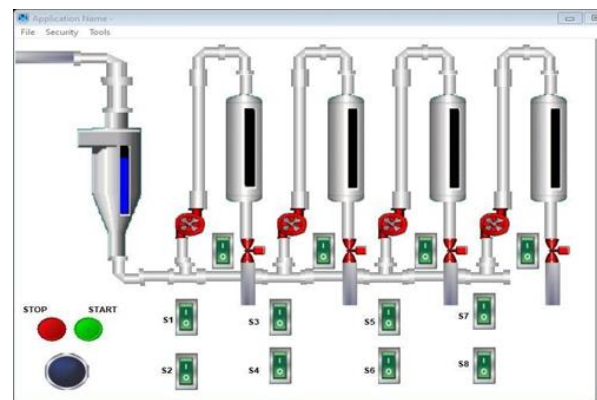## 5. Results

WinStudio animation screenshot:

Fig. 3. WinStudio animation screenshot

Working:

- In the above WinStudio animation, GREEN light indicates START and RED light indicates OFF.
- S1, S2, S3, S4, S5, S6, S7, S8 are sensor switches and TANK1, TANK2, TANK3, TANK4 are tanks that are connected with a valves and diffuser valve along with pump.

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- Automation process is started when pump is ON (press green light).
- When tank is empty, automatically sensor S2 will gets on and The water will start to fill in tank by pressing valve and when tank will fill maximum i.e. when TANK1 is full, it leads to sensor S1 on, when sensor S1 is on it will turns pump off automatically or it stops functioning of pump and turns off valve automatically and diffuser valve is used to drain out unwanted from the tank.
- In the same way, when tank is empty, automatically sensor S4 will gets on and The water will start to fill in tank by pressing valve and when tank will fill maximum i.e. when TANK2 is full, it leads to sensor S3 on, when sensor S3 is on it will turns pump off automatically or it stops functioning of pump and turns off valve automatically and diffuser valve is used to drain out unwanted from the tank.
- Similarly, when both sensors S6 and S8 is on, the water will start to fill in tank by pressing valve and when the tanks fill maximum i.e. when TANK3 AND TANK 4 is full, it leads to sensor S5 and S7 on, when sensor S5 and S7 is on, it will turn pump off automatically or it stops functioning of pump turns off valve automatically and diffuser valve is used to drain out unwanted from the tank.
- In the above problem statement, the loads values are given to each pump separately.
- For pump-1 the load is given as 3kw, for pump-2 the load is given as 2 kw, for pump3 the load is given as 7kw and for pump4 the load is given as 5kw and when whole pumps are connected it should not exceed above 10kw.
- All pumps will turn on when it is combined together except when pump3 and pump 4 is combined because it exceeds load value 10kw.

6. Conclusion

1. SCADA automation system reduces outage duration and increases the reliability of the power system.
2. SCADA system component availability is evaluated based on its performance criterion with a simple method during its operation rather than solely depending on their old databases, which are provided by the suppliers.
3. The suppliers of SCADA systems are having a monopolistic attitude so that the other suppliers are not able to integrate and upgrade in the existing systems.
4. The reliability of power system operation depends on its accuracy in modeling. The conventional models are based mostly on trial and error due to the complexity of the power system.
5. SCADA gives accurate power system information status in real-time and thus avoids modeling errors.

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