AUTOMATION OF OIL AND GAS REFINERY PROCESS USING PLC & SCADA

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Abstract

The automation process of oil and gas refinery process is an important role in providing security for workers, play the precision in the control of machines and the reduction in the workforce. Oil industry and refinery gas is mostly manual system with many risks, such as explosion hazards, fire hazards and lightning, radiation, etc. The industry of many of these processes is controlled in a conventional manner or a conventional control via DCS. Automation is the area safe, sturdy, economical and highly efficient and maintenance-free. The structure and the implementation of a specific SCADA / PLC are correct in an oil refinery process introduced. It consists of seven main units make: Oil drilling unit, separating plants, oil production units and gas, refineries, and storage units and the control unit. The products from the process petroleum refining come to in our daily lives with liquefied petroleum gas (LPG), naphtha, gasoline, kerosene and diesel, which have been widely used. The construction of a highly stable and reliable SCADA / PLC instead of DCS must identify the management and control of the automatic oil refining.

Keywords: Industrial Automation Systems, PLC, SCADA, RTU, Oil refinery process, Crude oil, Distillation.

1. INTRODUCTION

The oil & gas refineries are extremely important because the output products from crude oil refineries as LPG, Naphtha, Gasoline, Kerosene and Diesel have a great usage in our daily lives. SCADA screens which are connected to Programmable Logic Controller (PLC) by means of communication cables are used to monitor the operation such as monitoring of upstream process sections and main process sections which include wellheads, manifolds/gathering, separation, gas compression, metering, storage and export. The plant consists of seven main cycles with a large number of inputs and outputs signals connected to the AB PLC controller and also connected with the SCADA system based on (WINCC) software to monitor the system.[1]Applying the SCADA solutions has a positive impact on the operations, maintenance, process development etc. A SCADA software application is implemented on the oil and gas production &Refineries with the interface to the hardware to create a comprehensive real-time applications management environment for a modern production& refinery operation. [2]

The organization of this paper is as follows: Section 2presents the associated SCADA screen; Section 3 is devoted to the Windows operation, Section 4 presents the Results & Discussion and finally Section 5 presents the conclusions.

2. SCADA GUI system

As explained before, the oil & gas production and refinery process consists of five main units: drilling, separation of crude oil and water, oil & gas production, refining & metering & export. In this paper, three SCADA GUIs are designed to monitor and control oil refinery gas processes. [3]

SCADA GUI consists of:-

- Oil Drilling
- Separation of Crude oil & Gas
- Oil & various products Production
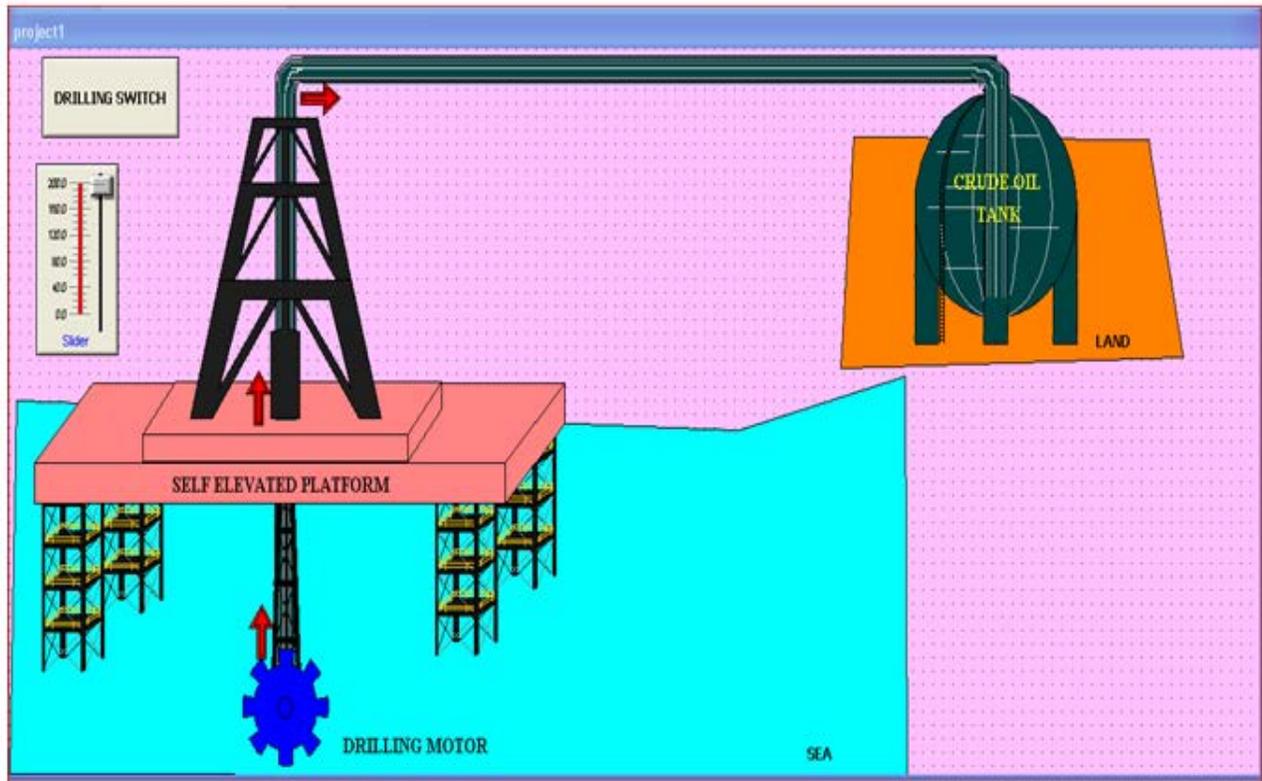- Refinery
- Metering & Export
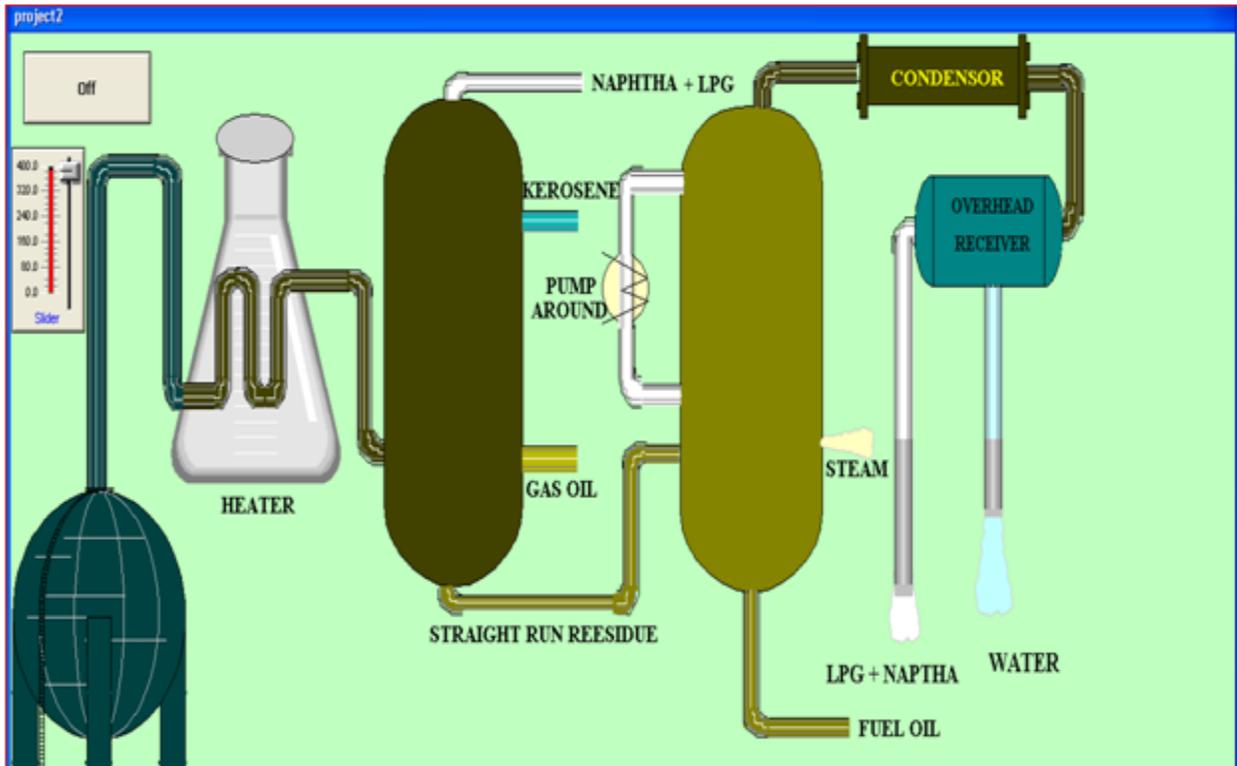
Figure 1: Drilling of oil at sea Bed

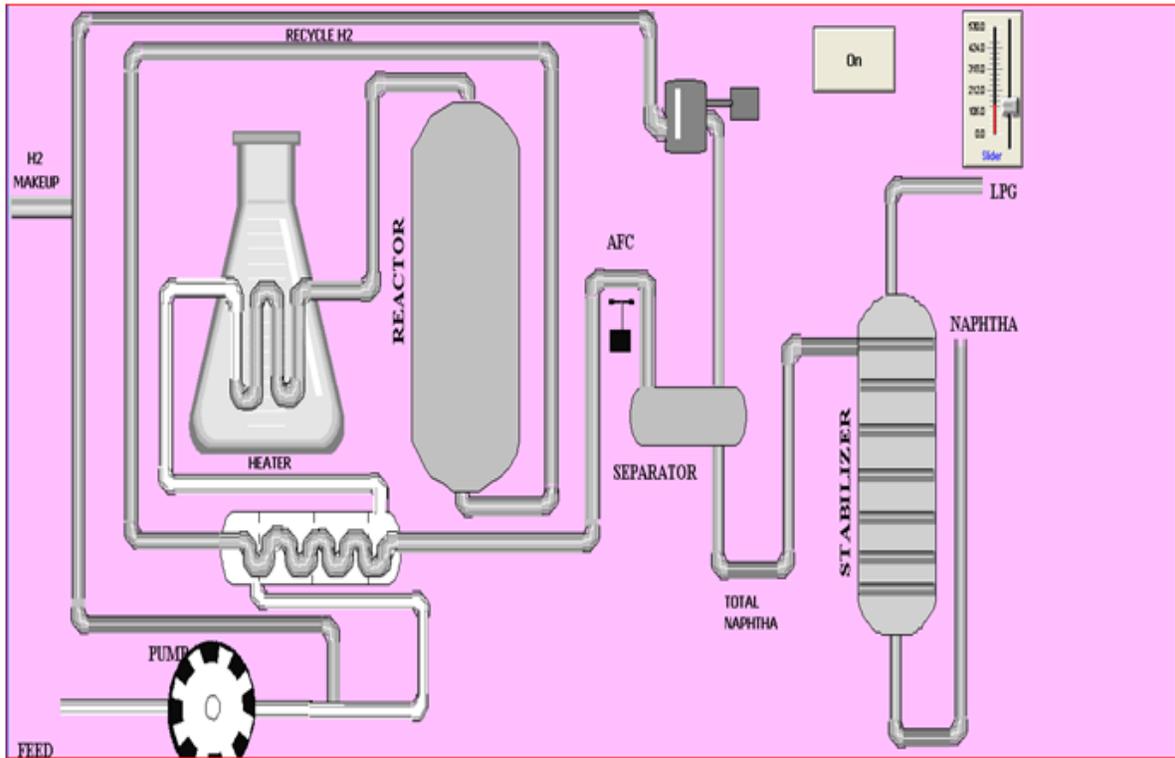

Figure 2: Separation unit for the separation of oil and water

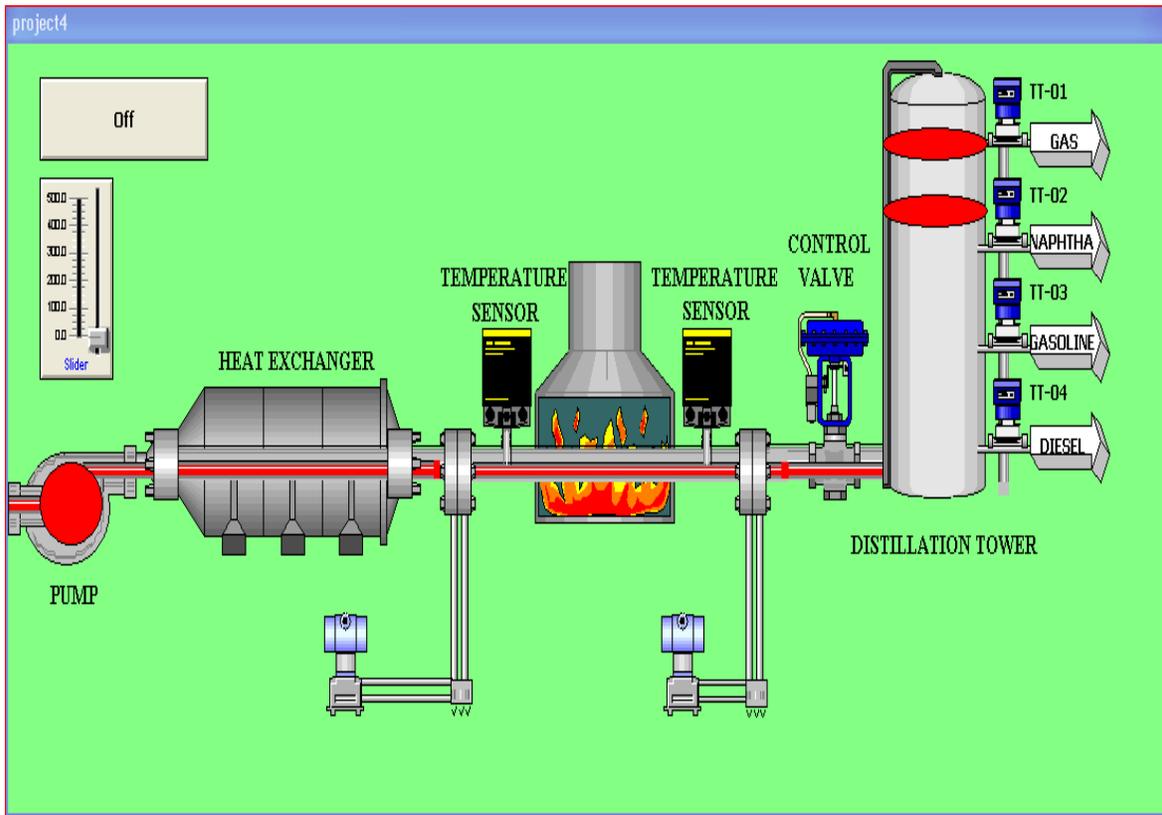**Figure 3: Oil & Gas Production**
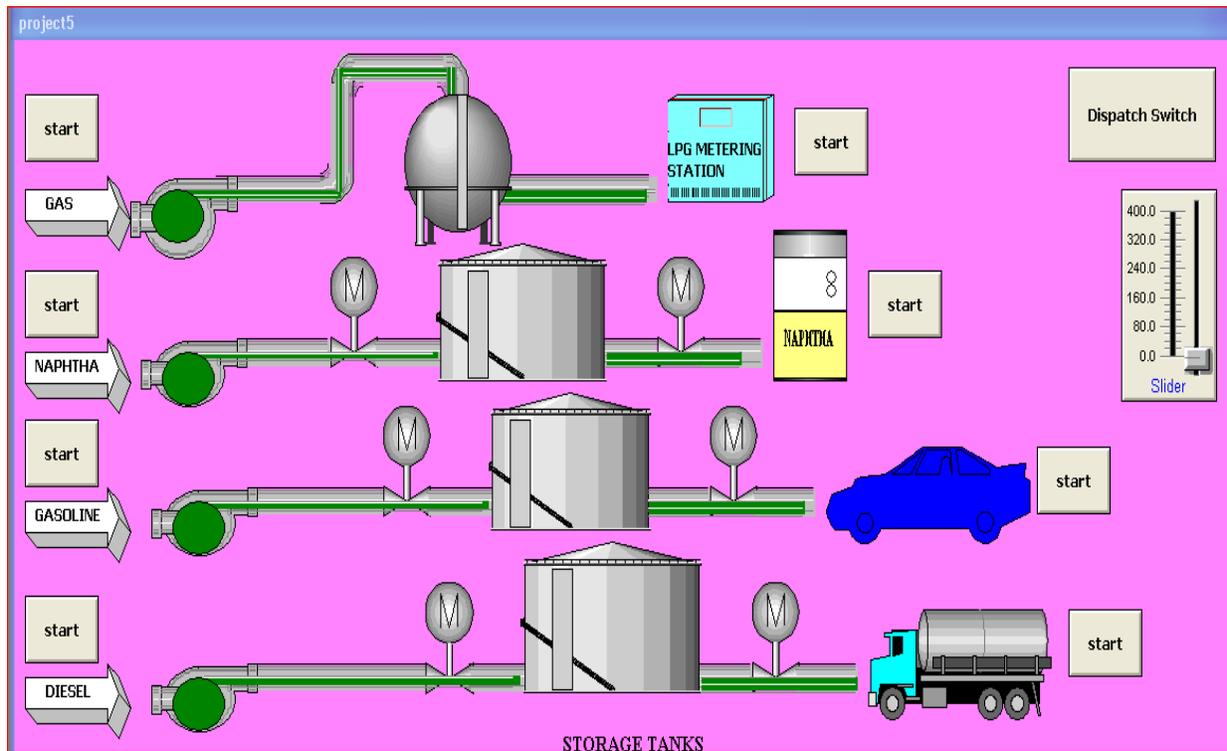

Figure 4: Refining Process

Figure 5: Metering, Storage and Dispatch units

3. WINDOW OPERATION

The detailed operation of each unit is explained in this section. The operation of automating the process of oil & gas refinery

- Oil Drilling Unit :-

This window shows that when you press the Drilling switch button, drilling motor starts operating and Crude oil is taken from underground pipes and is then sent to Crude oil tank from where its further taken for processing.[4]

- Separation Unit :-

This window shows that Crude oil from tank is passed through heater where according to the different boiling point various products gets separated such as Naphtha, LPG, Kerosene, Gas oil and Straight run Residue which is again sent for further processing.[5]

- Production Unit :-

In this unit the separated crude oil as Straight run residue is fed into the heater so that the remaining water is removed completely and then through horizontal vessel and is fed again into the reactor from where LPG and Naphtha gets separated.[6]

- Refinery Unit :-

In this window distillation process happens as the crude oil is a final product. Distillation is a process in which heat is used to separate a mixture of hydrocarbons into two or more relatively pure products (or fractions) by the difference in their respective boiling points or boiling ranges. When a mixture of hydrocarbons is heated, the light components are the first to boil and go into a vaporized state. These vapors are cooled and condensed to form a fraction. Therefore, the purpose of crude oil distillation is primarily to split the crude into several distillate fractions of a certain boiling range.[7]

- Dispatch Unit: Pump discharge LPG, Naphtha, Gasoline, Kerosene and Diesel respectively from the distillation tower at the distillation unit and feed them to their storage tanks in the product storage/dispatch unit. The LPG metering station is used to measure the volumeof gas transferred from producing regions to consumption regions. [8]

4. RESULT AND DISCUSSION

Table 1: Comparison between conventional and suggested Method:

Conventional Method	Modern Method
Conventional Method used in the Oil & Gas Refineries was DCS for operating the industry.	Now Oil & Gas Refineries use PLC/SCADA to control the operations.
Operation time was more in this technique.	Operation time is reduced to much extent through this technique.
Safety of the workers was not ensured through DCS Controlling.	Safety is ensured through PLC/SCADA Controlling.
Scan time is slower through DCS Controlling.	scan time means monitoring the system, detecting the problems, and executing the actions is much faster than DCS
The DCS tends to be more expensive and tends to use proprietary hardware and software.	The PLC/SCADA is cheaper as compared to DCS and is reliable.
DCS system cannot stores huge amount of data and records.	The SCADA system can record and store a very large amount of data.
The DCS screens are less realistic than SCADA screens for the user and are not handy.	The SCADA screens are more realistic than the DCS screens for the user
It requires a DCS station and a separate controlling unit.	The operator can monitor the process of the plant from any place all over the world.

5. CONCLUSION

Before using a SCADA / PLC system for the control of oil and gas refineries DCS has been used until now in control. The real SCADA system to control the process oil refinery is designed to monitor and control the entire system instead of the conventional control by the DCS is presented in this document. A process of oil refinery consists of three main sections, the upstream process, midstream process, and downstream process are. Wonder contact (SCADA) system is used to design the five operation window of the applications is connected via scripting, and this software design, in which the input signals is coupled out of the field by use of hardware PLC (Allen Bradley), and the program or the configuration software is loaded into the PLC and the control via the SCADA is done by sitting, even in remote locations, which improves the safety of workers. [9] Used for the control of oil and gas refineries Before SCADA / PLC, DCS was it used in the control so far.

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