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REAL TIME SCADA MODEL FOR TAKING WATER FROM WELL AND PUMPING IN FARM AUTOMATICALLY

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Abstract:

In this paper we have developed an SCADA model for motor which is automatically start or stop depending on time or Volume. All the activities of motor like date, time, pressure and volume of water are recorded in a database system (SQL server 2008) and reports of the record are design in crystal report. The pressure Indication Transmitter, flow meter on /off switches are mounted on the panel and are attached to the input/output Modules of PLC (Programmable logic Control). The Ladder diagram program are made in unity pro 5.0 PLC software and downloaded in the PLC. In Ladder diagram automatic program for Start/Stop motor is done, the PLC takes the real time data and store in the memory.

The real time data which is store in memory is access by the SCADA software Wonderware Intouch 10.1 through the IO server software (MBENET) (Modbus TCP Protocol). The data can be monitored from the SCADA.

There is connectivity between the SCADA and data base SQL SERVER 2008, data are save in the SQL server 2008. There is a connectivity of SQL server 2008 with Crystal report 8.5 in which the reports are generated from a selected dates.

The model can work in SCADA manual mode or SCADA auto mode. In manual mode from SCADA the motor can be made Start or Stop through buttons. In Auto mode a time in Second is specify and for that time the motor will remain start and after that time the motor will be stopped. If the volume of water is specify the motor will be start till the motor pump out the require water from the well and will be stop.

KEYWORDS:

(SCADA, Unity Pro, Intouch, IO server, SQL Server, Crystal Report)

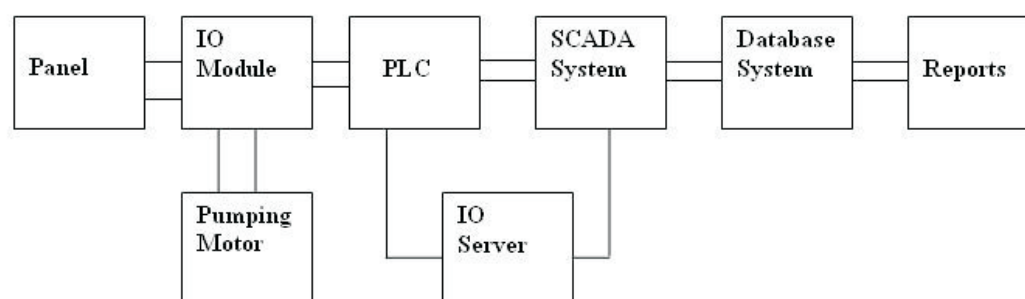
INTRODUCTION

SCADA has been as long as there have been control systems. The first SCADA systems as data acquisition by means of panels of meters, lights and strip chart recorders. SCADA's fundamental purpose is to remotely monitor a range of processes, collect real-time data and then perform analysis on the accumulated data. The foundation of SCADA can be researched back to the 1960's, when simple input and output devices were used to remotely monitor operations in industrial applications. Due to technology advancements, SCADA systems have now developed using advanced software, high performance microprocessors and wireless technology.

Supervisory control and data acquisition (SCADA) refer to the overall set of process Control system systems that remotely monitor and measure remote sensors from a centralized location. These sensors also typically possess some type of automated response capability when certain criteria are met.

WORKING OF MODEL:-

The main objective of our model is to take the water from well and pumping in farm automatically depending on time or volume. The block diagram of model is shown in the below figure



Block Diagram of SCADA Model of Motor which Start/Stop Automatically

As shown in block diagram the model consists of following blocks

- 1.Panel (switches , Meters)
- 2.IO module (DDI 1602,DDO 1602,AMI 0410,AMO 0410)
- 3.Programmable Logic Controller [PLC] (Modicon 340-20 modbus)
- 4.Pumping motor
- 5.IO server (Modicon MODBUS Ethernet)
- 6.SCADA system (Wonderware Intouch 10.1)
- 7.Database system (SQL server 2008)
- 8.Report(Crystal Report 8.5)

1)Panel (switches, Meters):

Panel is the first block in the model to which start switch, stop switch, pressure meter, flow meter is mounted. Switches work as a input unit where as meters are the output monitoring unit, when the water from the pumping motor is pump out the flow meter and pressure meter display the reading on their meters.

2)IO module (DDI 1602, DDO 1602, AMI 0410, and AMO 0410):-

IO module (Input output) is a unit which is attached on the rack of the PLC to which the input output devices are connected. IO module is of two types, analog IO module and digital IO module. For input and output there is a separate module. In this model four IO module are used

- a)DDI 1602 which is a digital input module having 16 input ports.
- b)DDO 1602 which is a digital output module having 16 output ports.
- c)AMI 04010 which is a analog input module having 4 channels.
- d)AMO 0410 which is a analog output module having 4 channels.

Switches are connected to the digital input module (DDI 1602), the pumping motor is connected to digital output module (DDO 1602) and the meters are connected to analog input module (AMI 04010).

3)Programmable Logic Controller (PLC):-

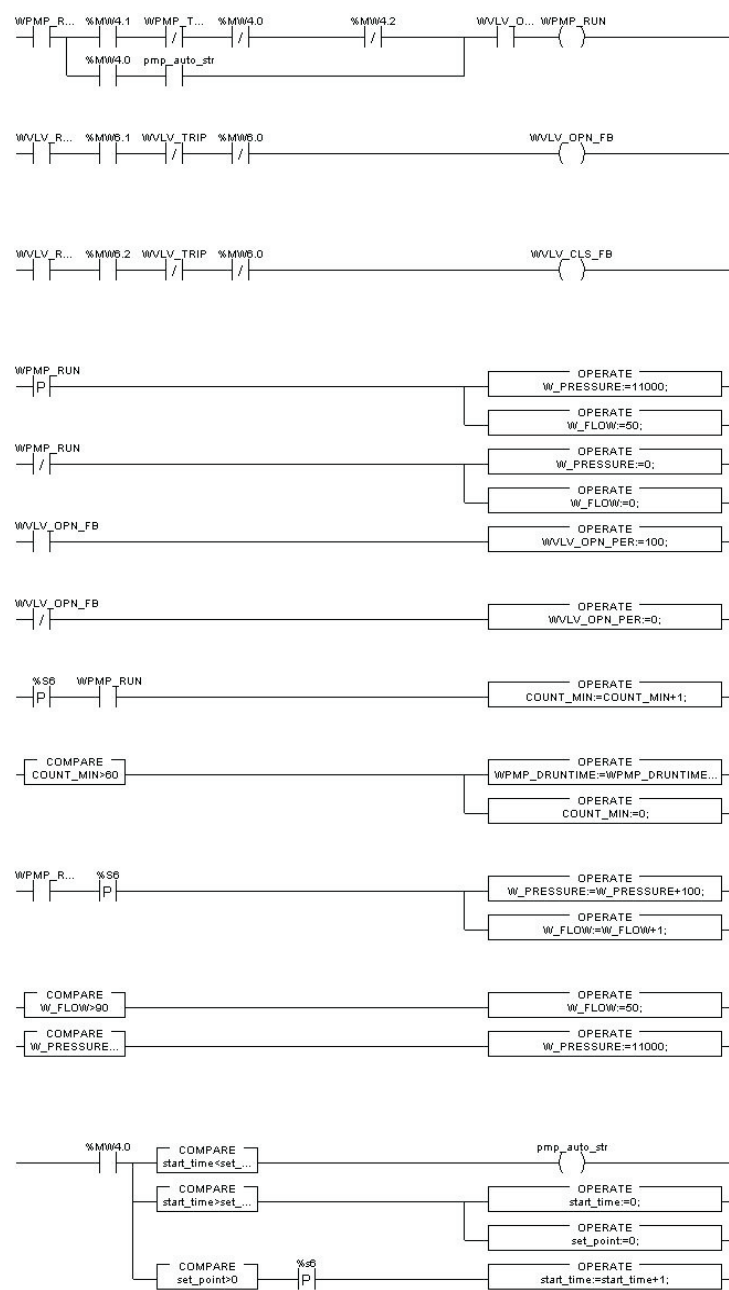
Programmable Logic Controller, or PLC, is more or less a small computer with a built-in operating system (OS). This OS is highly specialized to handle incoming events in real time, i.e. at the time of their occurrence. The PLC has input lines where sensors are connected to notify upon events (e.g. temperature above/below a certain level, liquid level reached, etc.), and output lines to signal any reaction



to the incoming events (e.g. start an engine, open/close a valve, etc.). The system is user programmable. It uses a language called "Relay Ladder" or RLL (Relay Ladder Logic).

There are many types of PLC , In these model a PLC simulator unity pro 5.0 is used , in which we use PLC CPU model of 340-20 modbus which has USB terminal port, memory card slot,1024 Discrete IO ports,256 analog IO ports. The ladder programming is done in the Unity Pro 5.0 software , all the input output ports are configure according to the connection made on the IO module and link with the memory address .The program in Unity Pro before running is to be “built “ which check for any error in the ladder program. After the built process the program is connect with the PLC which establishes the connection with the PLC. One's the connection is established the program is transfer to the PLC, now the PLC works according to the ladder program.

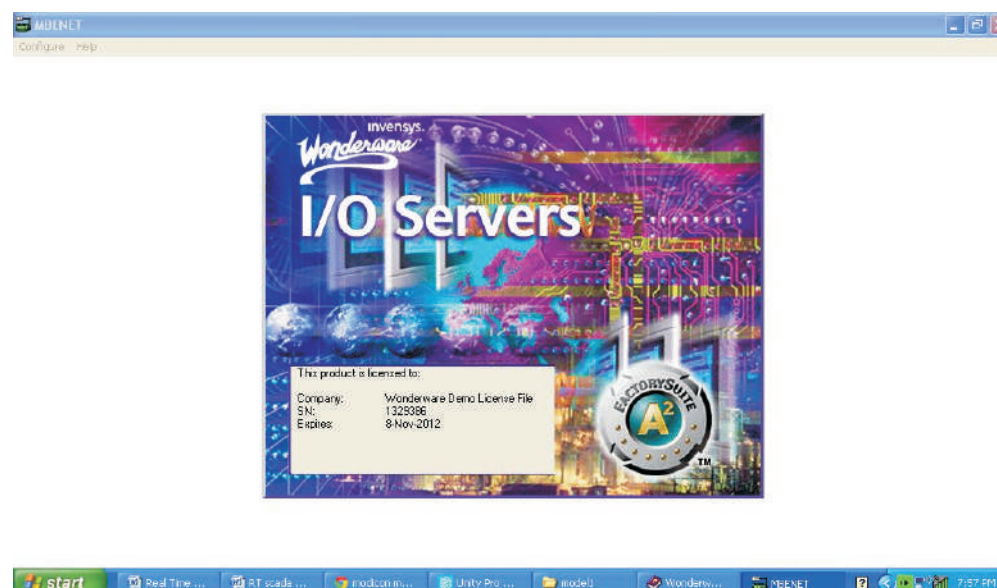
BELOW FIGURE SHOWS THE LADDER PROGRAM DIAGRAM



1)IO server (Modicon MODBUS Ethernet):-

The Wonderware Modicon MODBUS Ethernet I/O Server is a Microsoft Windows application program that allows access to data in Modicon PLCs (also referred to as devices) over an Ethernet network. The server requires only a standard 10BaseT Ethernet network card to access the Ethernet network. Each Ethernet Network Card provides an interface to as many PLCs as the Ethernet topology allows. The server supports Modicon Quantum (6-Digit) Automation Series controllers equipped with Quantum Ethernet TCP/IP NOE modules.

The function of the IO server is to provide the connection between the PLC and SCADA software Wonderware Intouch 10.1. While the server is primarily intended for use with Wonderware Intouch, it may be used by any Microsoft Windows program which is capable of acting as a Dynamic Data exchange (DDE).



5)SCADA system (Wonderware Intouch 10.1):-

The supervisory system (Wonder ware – Intouch) consist of an operator interface software (OIS) system which includes support for process supervisory control, data acquisition, alarming, trending, and management report generation.

It is based on the concept of fourth generation object based graphics and object based development. The OIS have an open architecture which allows the system to run in a multitasking environment with support for on-line, dynamic data exchange with other applications such as expert systems, spreadsheets, and database programs. The system have built-in flexibility to permit easy configuration of the system in accordance with the specific objectives of the end user as well as quick and easy modification of the end application by the user in the field.

Wonderware Intouch SCADA software has two modes

a)Window Maker in which the SCADA system can be design by using different controls, symbols, figures, photos etc and scribe are written on each controls and symbols. Like other front end programming language forms are created.

In this model we have created four Screen, Main Screen, Farm Screen, Graph screen and Report Screen.

b)Window Viewer in which the SCADA system is view i.e. the SCADA program what we have design are run.

c)SCADA OPERATION

SCADA Wonderware Intouch 10.1 is installed on a computer. Start windows XP Professional

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operating system with user name and appropriate password. Then Start Wonderware application. Procedure to start Wonderware application is as below.

1. Click on start programs Wonderware Factory suite IO Servers Modicon MODBUS Ethernet (MBNET)
2. After Modbus IO server starts go to next step.
3. Click on start programs Wonderware Window Viewer.
4. Main screen window will be open on desktop.

When window viewer starts, Main screen will appear. This screen shows status of currently logged user, Application directory, and communication status of SCADA with PLC etc

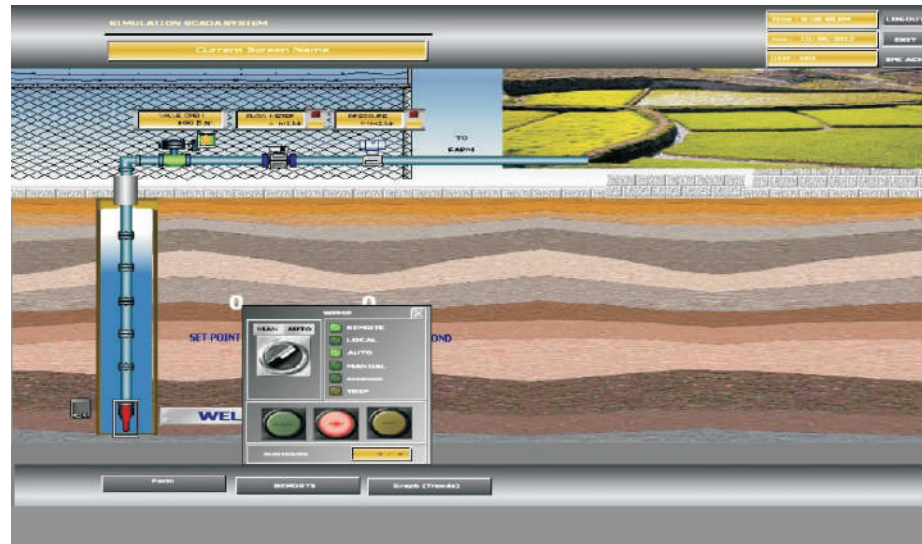


Click on login button. A Pop up screen will open as shown below where u can enter the User name and Password. After entering the user id and password press 'LOGIN' button



As soon as the user is logged in, with proper username and password, farm screen will be open with default Header and Footer

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The user can go to any area of the farm visible in the screen. For example by clicking on motor, it will open detailed screen of the motor. User can monitor the basic status of the motor from this screen. Similarly he may even monitor the state of well pumps, flow rate, Pressure. etc.

Header and Footer will be common for every screen. From header operator can know the status of current user; also from header operator can logout at anytime. Operator can exit from runtime if logged with proper security level.

Footer consist buttons for Overviews, individual process screens, Farm, Graph, Reports. Operator can navigate to any screen at anytime by clicking on buttons.

MOTOR POPUPSCREEN



Buttons-:

AUTO / MANUAL: Auto-off- Manual selection button. Selection will be disable if pump selected in Local mode from MCC.

START / STOP: Manual starts / stops Selection. Selection will be disable if pump selected in Auto Mode



from SCADA.
ACK: Reset fault button. For resetting fault from SCADA if pump is fail to run or trip. After resetting fault. FAULT / TRIP light will be Off in popup. Trip signal is from MCC. So operator has to first reset it from MCC and then from SCADA.

Status:-

REMOTE: This Display will show selection of equipment in REMOTE from MCC.
LOCAL: This Display will show selection of equipment in LOCAL from MCC.
AUTO: This Display will show selection of equipment in Auto from SCADA.
Manual: This Display will show selection of equipment in Manual from SCADA
Running: This Display will show running status.
Trip: This Display will show trip status.

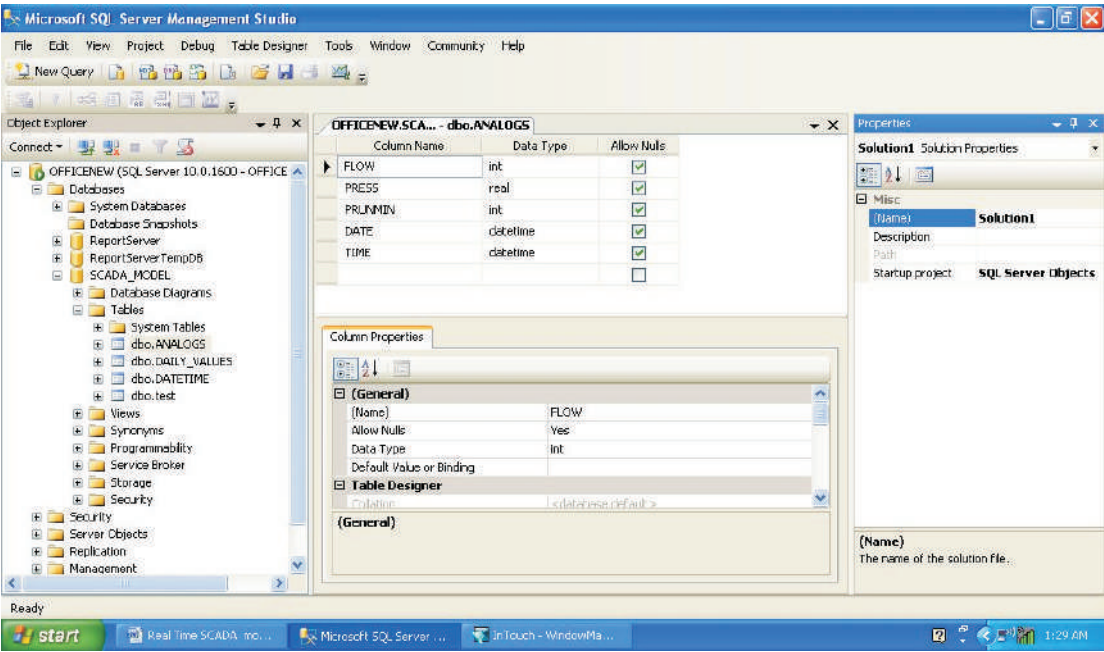
1)Database system (SQL server 2008):-

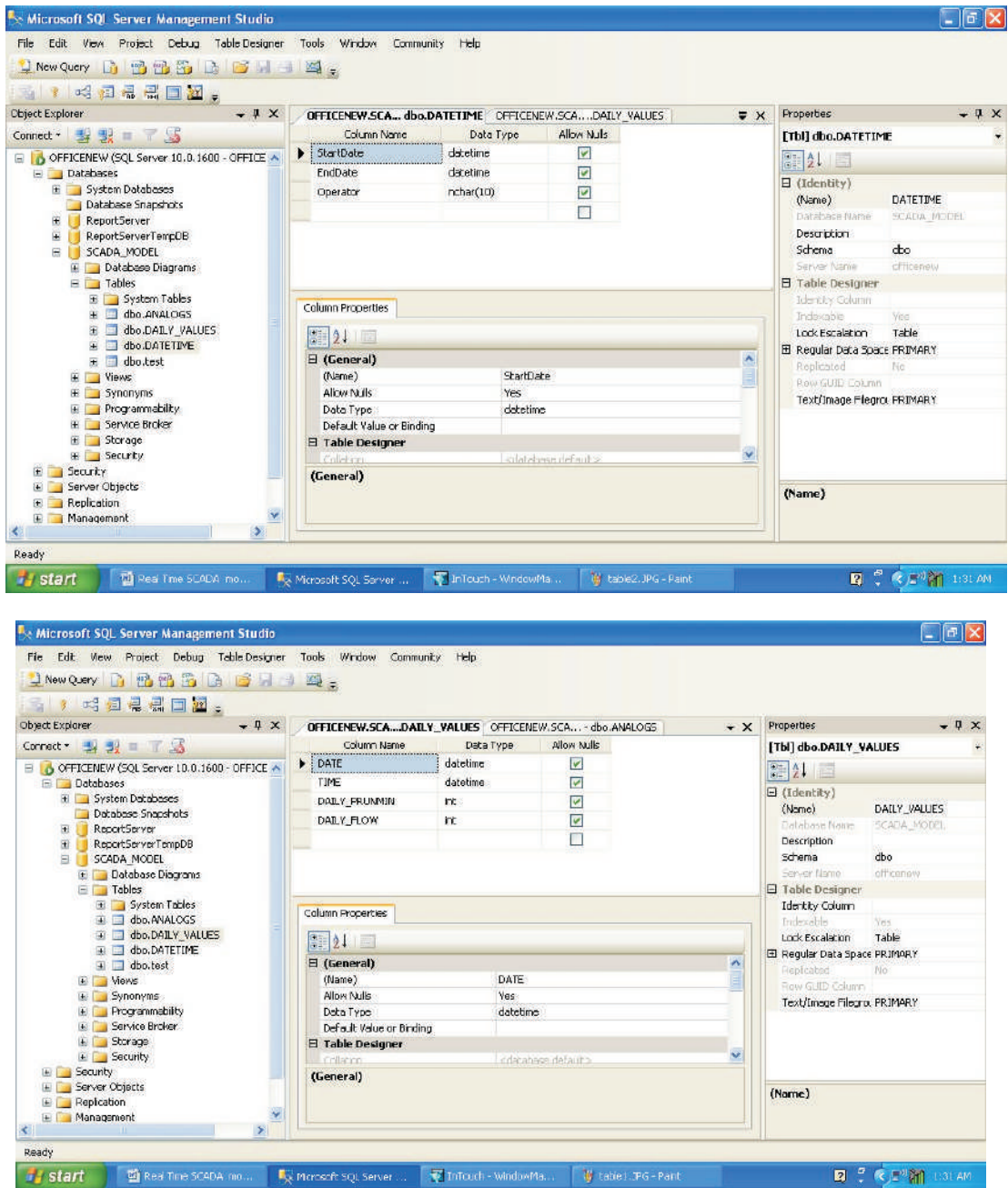
Microsoft SQL Server is a relational database server, developed by Microsoft: it is a software product whose primary function is to store and retrieve data as requested by other software applications, be it those on the same computer or those running on another computer across a network (including the Internet).

Microsoft SQL Server is a Relational Database Management System (RDBMS) designed to run on platforms ranging from laptops to large multiprocessor servers. SQL Server is commonly used as the backend system for websites and corporate CRMs and can support thousands of concurrent users.

SQL Server comes with a number of tools to help you with your database administration and programming tasks. SQL Server is much more robust and scalable than a desktop database management system such as Microsoft Access. Anyone who has ever tried using Access as a backend to a website will probably be familiar with the errors that were generated when too many users tried to access the database. Although SQL Server can also be run as a desktop database system, it is most commonly used as a server database system.

In these models SQL server 2008 database is connected with Wonderware Intouch 10.1 the real time data which are save in memory address of PLC are access by Intouch Wonderware are store in the tables created in the SQL server 2008 there are three tables created in these database name as analogs, daily_vales and datetime. The tables are shown in below figure.





1)Report(Crystal Report 8.5):-

Crystal Reports is designed to work with your database to help you analyze and interpret important information. Crystal Reports makes it easy to create simple reports, and, it also has the comprehensive tools you need to produce complex or specialized reports.

Crystal Reports is designed to produce the report you want from virtually any data source. Built-in report experts guide you step by step through building reports and completing common reporting tasks. Formulas, cross-tabs, sub reports, and conditional formatting help make sense of data and uncover important relationships that might otherwise be hidden. Geographic maps and graphs communicate information visually when words and numbers are simply not enough.

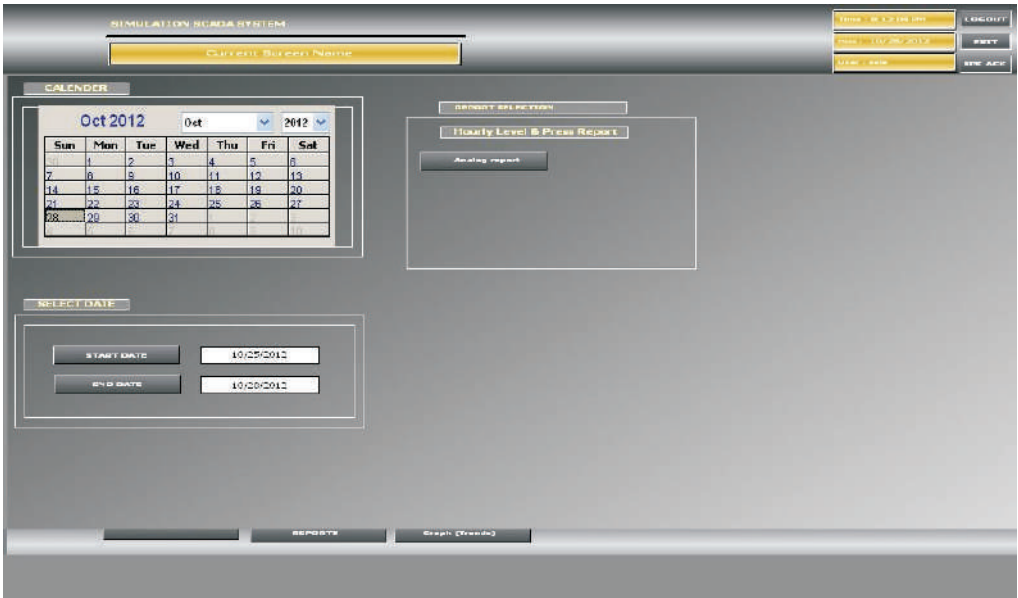
The flexibility of Crystal Reports doesn't end with creating reports — your reports can be published in a variety of formats including Microsoft® Word and Excel, Email and even over the Web.

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Advanced Web reporting lets other members of your workgroup view and update shared reports inside their web browser.

In this model the Reports screen can be accessed from the Reports button on the footer. From there operator can see or can print reports of individual sections and individual Parameters. For opening reports, appropriate user level logging required.



The reports are design in crystal report 8.5 the field of the report are date, time, flow and pressure. In database SQL server 2008 we have created three tables and from these tables the field like data, time, flow and pressure are taken. The data of date, time, flow and pressure is taken every one min and store in the SQL server 2008 database table.

Start date & end date for report can be selected from calendar. Upon selecting required report screen can be seen as shown below.



DATE	TIME	DAILY FLOWS (in m3)	
		Flow (M ³ /Hr)	Pressure (bar)
25-October-2012	11:32 pm	72	3.39
25-October-2012	11:33 pm	83	3.69
25-October-2012	11:34 pm	52	3.97
25-October-2012	11:35 pm	62	3.60
25-October-2012	11:36 pm	72	3.88
25-October-2012	11:37 pm	82	3.51
25-October-2012	11:38 pm	51	3.78
25-October-2012	11:39 pm	62	3.45
25-October-2012	11:52 pm	55	3.51
25-October-2012	11:53 pm	0	0.00
25-October-2012	11:54 pm	0	0.00
25-October-2012	11:55 pm	0	0.00
25-October-2012	11:56 pm	52	3.42
25-October-2012	11:57 pm	0	0.00
25-October-2012	11:58 pm	0	0.00
25-October-2012	11:59 pm	0	0.00
26-October-2012	12:00 am	0	0.00
26-October-2012	12:01 am	0	0.00
26-October-2012	12:02 am	0	0.00
26-October-2012	12:03 am	0	0.00
26-October-2012	12:04 am	0	0.00
26-October-2012	12:05 am	0	0.00
26-October-2012	12:06 am	0	0.00

Signature:_____

CONCLUSION:-

In this paper we represent a SCADA model for pumping motor which is automatically Start or Stop from SCADA software Wonderware Intouch 10.1 depending on time or volume. This model is completely automatically which control the pumping motor in well .Thus by using PLC and SCADA the real time data can be save and different reports can be generated .Thus the use of PLC with SCADA has

opened a door for a real time data in water distribution field.

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