DATA ACQUISITION AND FAULT DETECTION IN WIND POWER PLANT USING SCADA

Major Project Report

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF TECHNOLOGY

In

Instrumentation And Control Engineering
(Control and Automation)

By

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NIRMA UNIVERSITY
AHMEDABAD-382481
May 2017

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Under the Guidance of

Prof. Ankit Sharma
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at

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May 2017

Declaration

-

This is to certify that

1. The thesis comprises my original work towards the degree of Master of Technology in Instrumentation and Control Engineering at Nirma University and has not been submitted elsewhere for degree.

2. Due acknowledgment has been made in the text to all other material used.

Kumari Jyotsna
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Undertaking for Originality of the Work

I, **Kumari Jyotsna** Roll.No. **15MICC04**, give undertaking that the Major Project entitled **Data Acquisition and Fault Detection in Wind Power plant using SCADA**submitted by me, towards the partial fulfillment of the requirements for the degree of Master of Technology in Instrumentation and Control Engineering (Control and Automation) of Nirma University, Ahmadabad, is the original work carried out by me and I give assurance that no attempt of plagiarism has been made. I understand that in the event of any similarity found subsequently with any published work or any dissertation work elsewhere; it will result in severe disciplinary action.

Signature of Student

Date:

Place: NU, Ahmadabad

Endorsed By

(Signature of Guide)

Certificate

This is to certify that the 3rd Review Report of Major Project on "**Data Aquisition and Fault Detection in Wind Power plant using SCADA"** submitted by **Kumari jyotsna (15MICC04)**, towards the partial fulfilment of the requirements for the award of degree in Master of Technology in and Control Engineering (Control and Automation) of Nirma University is the record of work carried out by her under our supervision and guidance. The work submitted has reached a level required for being accepted for examination. The results embodied in this major project to the best of my knowledge have not been submitted to any other University or Institution for award of any degree or diploma.

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Abstract

Working of plant requires lots of automation and hence there are various subsystems for its smooth operation. As wireless communication for SCADA system is a practical solution and is require for application when wired or line communications to the remotely deployed unit is prohibitively expensive or it is too time consuming to construct. In this paper I planned to present an approach for fault detection using available SCADA-data from wind turbines. Systematic analysis of data indicated clear distinctions between fault and no-fault conditions in relationships among several parameters. For this I have chosen Indusoft web studio platform to work.

This thesis deals with the technical details involved in interfacing SCADA with PLC in Wind Technology. It discusses the factors responsible for multi source and multi channel data recorder by remote Data Acquisition feature (Database generation) available in InduSoft SCADA that can record the data near the source of measurement. This software has all most all driver connectivity facility which will help to configure my PLC with InduSoft SCADA, by which data can transfer remotely. A personal computer system performs all duties as programming and data display. Also all channels will be synchronized and data acquisition occurred simultaneously.

Contents

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Chapter 1

Introduction

In recent years, Global wind Turbine installation and power generation from it has been rapidly rising[1], due to technology used in wind turbine and the proliferation of government policies supports the development of wind energy[2][1][6], as discuss in [3], wind energy is in the first place with the growth rate in renewable energy[3].

The greater part of the wind turbines are three-cutting edge units. Once the wind drives the cutting edges, the vitality is transmitted by means of the fundamental shaft through the gearbox (bolstered by the course) to the generator. The generator speed must be as close as conceivable to the ideal for the era of power. At the highest point of the tower, collected on a base or establishment, the lodging or nacelle is mounted and the arrangement with the bearing of the wind is controlled by a yaw framework. There is additionally a contribute framework every sharp edge. This instrument controls the wind power and some of the time is utilized as a streamlined brake. The wind turbine highlights a pressure driven brake to stop itself when it is required. At last, there is a meteorological unit that gives data about the wind (speed and heading) to the control framework.

Principle of Wind Turbine is, it captures the wind and convert it to electrical energy by using a generator. Once the wind drives the blades, energy produces and transmitted to the generator via the main shaft through the gear box (supported by the bearings). Wind Turbine foundation assembled on the top of the tower called housing or nacelle. Alignment of the nacelle is controlled by a yaw system with the direction of the wind. One more system used for blade called pitch system, control the wind power and sometime used as an aerodynamic brake.

Benefits: Wind Power lies in its minimum operational cost over other resources

Wind energy becomes a viable solution for energy production, in addition to other renewable energy sources[4][17]. As we know modern wind turbines are totally controlled by computers which are totally safe. Also as wind is a clean source of energy, power conversion does not pose any environmental hazard[5].

Power Generation calculations in Wind turbine
Power= (A)(p)(V)3
Where,

A= Swept area = p (radius)2 , m2
p = Density of air =1.2 kg/m3 (0.0745 Ib/ft3), at sea level, 20 C and dry air
V = Wind Velocity, m/sec [6].

1.1 Wind Formation

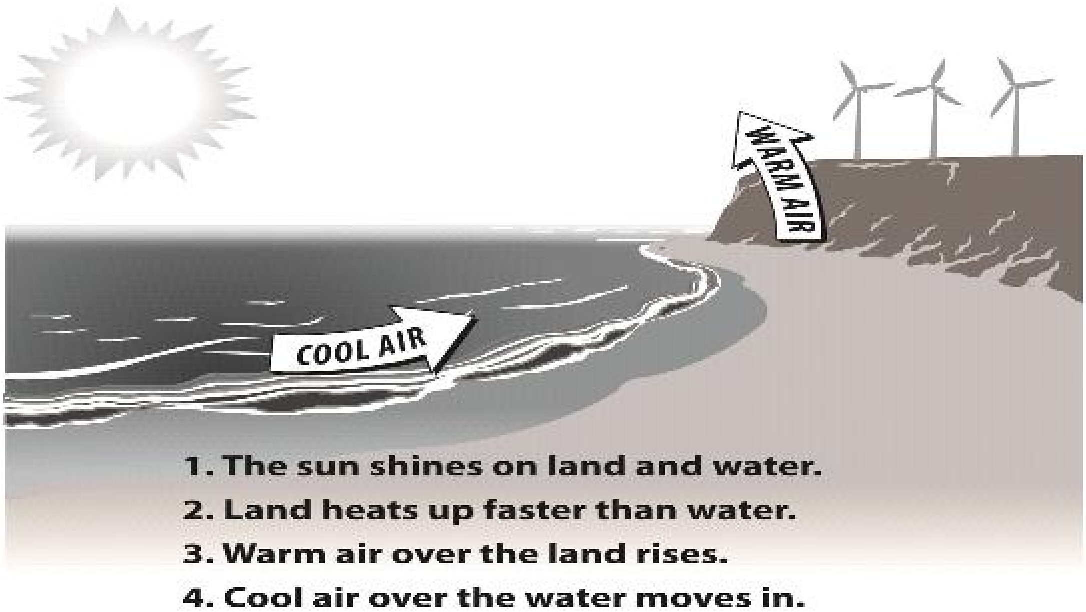


Figure 1.1: Wind Formation

1.2 Wind Turbine

Standard: A windmill catches wind vitality and after that uses a generator to change over it to electrical vitality

- An average 600 kW wind turbine has a rotor breadth of 43-44 meters, i.e. a rotor territory of somewhere in the range of 1,500 square meters.
- The rotor region decides how much vitality a wind turbine can collect from the wind.
- Since the rotor region increments with the square of the rotor breadth, a turbine which is twice as vast will get 22 = 2 x 2 = four fold the amount of vitality.

- To be viewed as a decent area for wind vitality, a region needs normal yearly twist velocities of no less than 20 km for each hour.

1.3 Turbine components

Main Parts

- Blades
- Hub
- Nasccel
- Tower

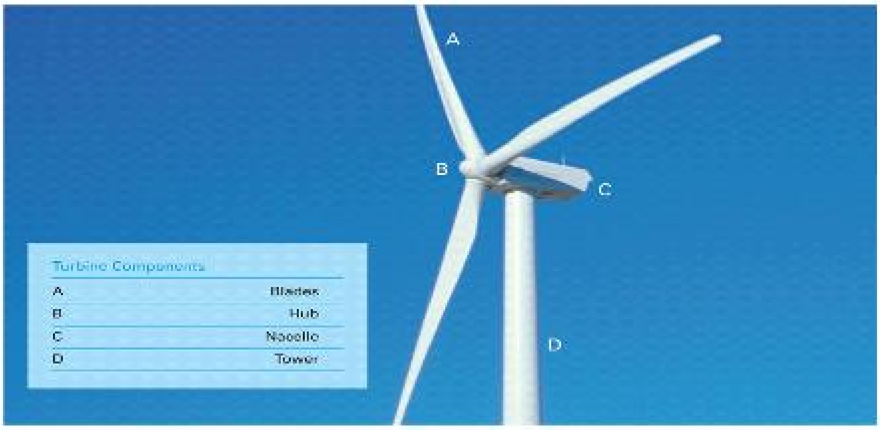


Figure 1.2: Turbine components

1.4 Description of the Components

Components:

Nacelle:
The rotor joins to the nacelle, which sits on the tower and incorporates the rigging box, low-and fast shafts and generator.

Rotor:
The cutting edges and the center point together are known as the rotor.

Hub:
The center of the rotor is joined to the low speed shaft of the wind turbine.

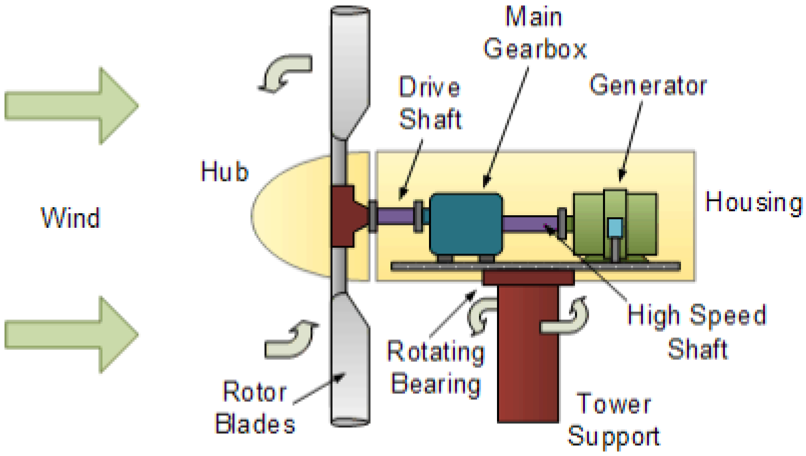


Figure 1.3: Description of the Components

Low-speed shaft:
The rotor turns the low-speed shaft at around 20 to 30 revolutions for every moment.

Gearbox:
The gearbox changes the low upsets of the rotor into high unrest for the generator.

High-speed shaft:
Drives the generator.

Transformer:
The transformer changes over the electrical power from low voltage (690 V) to a higher voltage reasonable for lattice association normally 22kV or 33kV.

Anemometer:
Measures the wind speed and transmits wind speed information to the controller.

Blades:
Lifts and pivots when wind is blown over them, making the rotor turn. Most turbines have either a few cutting edges.

Brake:
Stops the rotor mechanically, electrically, or using pressurized water, in crises.

Controller:
Begins up the machine at twist velocities of around 8 to 16 miles for every hour (mph) and stops the machine at around 55 mph. Turbines don't work at twist speeds above around 55 mph since they might be damaged by the high winds.

Chapter 2

Introduction of SCADA

SCADA: Wind farm supervisory control and data acquisition (SCADA) system allow local and remote control of basic wind Turbine function and collect data from the wind farm that can be used to analyze and report on the operational performance.Interface unit communication with turbine controller and provide interface the InduSoft SCADA system. It will require having local storage and processing to make the system less dependent on the reliability of the site communication network. The whole arrangement of SCADA system is shown below in figure

The site communication network can be on industry -standard protocol (Modbus/ Canbus /Profibus etc. or Tcp/Ip/ Ethernet Network)

2.1 Elements of SCADA System

Figure 4 demonstrates the significant parts of a SCADA framework. At the inside is the administrator, who gets to the framework by methods for an administrator interface gadget , which is at some point called "an administrator console".The administrator reassure works as the administrator's window into the procedure. It comprise of a video show unit(VDU) that show constant information about the procedure and a console for contributing the administrator's charges or messages back to the procedure. Other cursor - situating gadget, for example, trackball, mouse, or touch screen might be utilized. On the off chance that the framework is extremely basic, it might be adequate to have an arrangement of enunciator windows that copy the state of the remote procedure. Frequently, a capable of being heard flag for alerts will be incorporated.

The administrator's info gadget is typically a PC console, in spite of the fact that guiding gadgets, for example, touchscreens and mice are picking up in prevalence. For extremely fundamental frameworks, an arrangement of straightforward electrical switches might be adequate. The administrator interface with the ace terminal unit (MTU), which is the framework controller. A few enterprises utilize the expression "have PC" rather than MTU . Other utilize the expression "server".MTU have PC and server can be thought to be exchangeable. The MTU in present day scada framework is constantly in view of a PC. It can screen and control the field notwithstanding when the administrator is absent. It does this by methods for an implicit scheduler that can be modified to rehash guideline at set interims. For instance , it might be planned to ask for a refresh from every remote turminal unit (RTU) at regular intervals.

MTUs must speak with RTUs that are found far from the focal area. A SCADA framework may have as few as one RTU or upwards of a few hundred. There are two basic media of Correspondence, as appeared in Figure 2-1: arrive line, which appears as optical fiber link or electrical link and is either claimed by the organization or rented from a phone utility, and radio. In either case, a MODEM, which Modulates and DEModulates a flag on the transporter, is required. Some substantial frameworks may utilize a blend of radio and phone lines for correspondence. One of the recognizing elements of SCADA frameworks is that their procedures have a tendency to be straightforward. Therefore the measure of data moved over a SCADA framework has a tendency to be somewhat little. Frequently 300 bps (bits of data every second) is adequate. Aside from those utilized on electric utilities, few SCADA frameworks need to work at information rates over 2400 bps. This permits voice-review phone lines to be utilized, and this bit rate does not over-burden most radio frameworks.

Normally, the MTU will have auxiliary devices (e.g. printers and backup memories) attached to it. These devices are considered to be part of the MTU. In many applications, the MTU is required to send accounting information to other computers or management information to other systems. These connections may be via dedicated cables between the MTU and the other computers, but in new SCADA systems they predominantly connect in the form of LAN (local area network) drops. In most SCADA systems, the MTU must also receive information from other computers. This is often how applications programs, operation on their computers and connected to the SCADA computer, provide a form of supervisory control over SCADA.

Figure 4 demonstrates a RTU and its different associations. As specified, the RTUs speak with the MTU by a balanced flag on link or radio. Each RTU must have the capacity to comprehend that a message has been coordinated to it, to unravel the message, to follow up on the message, to react if important, and to close to close down to anticipate another message. Following up on the message might be an exceptionally complex method. It might require checking the present position of field hardware, contrasting the current position to the required position, sending an electrical flag to a field gadget that requests it to change states, checking an arrangement of changes to guarantee that the request was complied, and communicating something specific back to the MTU to affirm that the new condition has been come to. As a result of this intricacy, most RTUs depend on PC innovation.

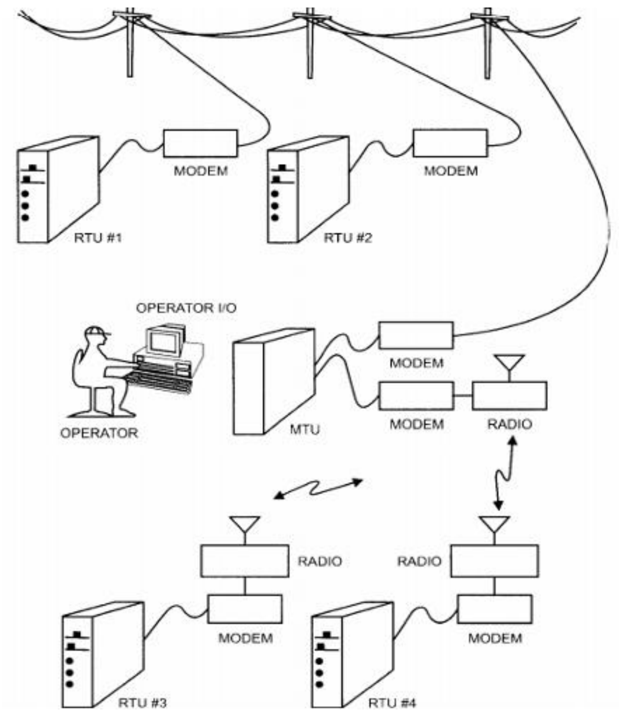


Figure 2.1: RTU and its various connections

2.2 SCADA Communication Protocols

Communication is very important in SCADA systems. Protocols implementation avoid miscommunication also authentication errors. In SCADA system protocol needed for transferring the data. Some of the SCADA protocols include Modbus RTU, RP-570, Profibus and Conitel. These communication protocols are all SCADA-vendor specific but are widely adopted and used. Standard protocols are IEC 61850 (in which T101 branched out), IEC 60870-5-101 or 104, and DNP3. These communication protocols are standardized and recognized by all major SCADA vendors. Many of these protocols is now improved and contain extensions to operate over TCP/IP.

Three of the most important parts of a SCADA system are Master Station, Remote Terminal (RTU, PLC, IED) and the communication between them. In order to have good communication between them, there must be a communication protocol. DNP3 and T101 are two of the most common protocols today. It is important to determine which protocol should be applied if you are planning a SCADA system.

These two open communication protocols that provide for inter-operability between systems for tele-control applications. Both are now competing within the world market. DNP is widely used in North America, South America, South Africa, Asia and Australia, while IEC 60870-5-101 or T101 is strongly supported in the Europe.

2.3 Wireless SCADA Communications

SCADA frameworks are made out of four noteworthy parts: the ace station or the focal controller, plc/rtu/ied (conveyed in remote stations), fieldbus and sensors. The design of SCADA framework that replaces the fieldbus with remote correspondence. Alongside the fieldbus, this setup is stretched out to the Internet. This setup is comparable with a private system so that exclusive the focal controller can have admittance to the remote resources. The focal controller likewise has an augmentation that goes about as a web server so that the SCADA clients and clients can get to the information through the SCADA supplier site.

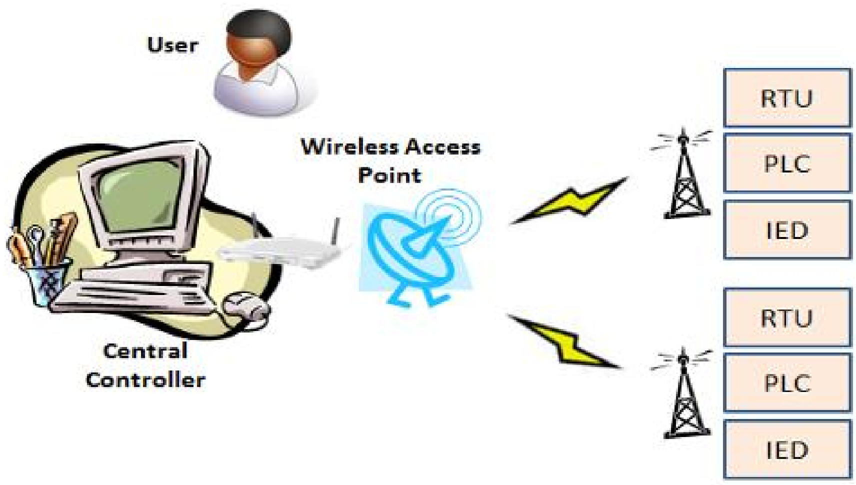


Figure 2.2: Wireless SCADA

AS the framework advances, SCADA frameworks are coming in accordance with standard systems administration advances, Ethernet and TCP/IP based conventions are supplanting the more established restrictive measures. Albeit certain qualities of casing based system correspondence innovation (determinism, synchronization, convention determination, condition reasonableness) have confined the appropriation of Ethernet in a couple particular applications, most by far of business sectors have acknowledged Ethernet systems for HMI/SCADA.

Chapter 3

SCADA Requirements in Wind Turbine

The Whole Planning Done for SCADA Network is done like this:

Wind farm supervisory control and data acquisition (SCADA) system allow local and remote control of basic wind Turbine function and collect data from the wind farm that can be used to analyze and report on the operational performance.

Interface unit communication with turbine controller and provide interface the scada system. It will require having local storage and processing to make the system less dependent on the reliability of the site communication network.

The site communication network can be on industry -standard protocol (Modbus/Canbus/Profibus etc or Tcp/Ip/Ethernet Network) The system can run on Windows and can be built from software components using standard,open interface (e.g OPC,ODBC,or web technology). All user access will be through standard Web browsers, allowing multi-user access and simple remote access without special software.

System should have extensive reporting facilities that allow users to build customized report from standard, verified options. Report can be created on demand or can be scheduled and delivered by email. This includes the facility for automatically generating daily, weekly, monthly and annual report.

3.1 System Components

The SCADA system is divided into following components:

1. Turbine controller interface
2. Site Network
   a. site server
   b. Physical layer

   c. Protocol
3. SCADA server
   a. SCADA server
   b. Database
   c. User interface
   d. Querying and reporting process

From technical point of view, the site network and the method of interfacing to the individual turbines are key to success of SCADA system.

Site Network- Physical Layer
Network is generally considered in term of physical layer and the protocol layer. The physical layer is the actual media for the network and the signal levels used. The protocol layer is how the physical layer is used to actually exchange information.
Fiber optic based Ethercat is the best option among different physical network option available (Multi- drop RS485 or Fiber optic daisy chained)

Site Network- Protocol Layer
TCP/IP Would be ideal choice, which is used as the network protocol with fiber optic based Ethernet.

Server
The SCADA Server is the central PC for the system. In Practice, there can be number of servers for a particular site connected over local area network (LAN, as installation increase at site.
Each server should be operated independently of the others to achieve scalability of system and no single data flow bottleneck, limit the loss of functionality only for that server as other server will be unaffected.

The SCADA server to use Windows Network System. Each SCADA server to runs a number of processes, namely,

- Modbus server to handle communications over the site communication network
- A SCADA service will control the polling of the site communication network
- ODBC compliant Data base to store all data recorded from the system
- A database querying and reporting module
- A User interface module
- A daily task process to perform routine tasks such as creating daily summaries of data, checking data for obvious errors and tidy/backup tasks

Chapter 4

Introduction of Indusoft Web Studio

InduSoft SCADA: SCADA is the technology that enables a user to collect data from one or more distant facilities and to send limited control instructions to those facilities[7].

InduSoft web studio is HMI/SCADA software which is very easy-to-use, powerful, and affordable. It is used for PCs, industrial panels, embedded and mobile devices. InduSoft have extensive reporting facilities that allow users to build customized report from standard, verified options. Report can be created on demand or can be scheduled and delivered by email. This includes the facility for automatically generating daily, weekly, monthly and annual report. It can Design the application in an integrated development environment and deploy/run it on multiple platforms, including any current Microsoft operating system- Windows CE/Mobile, Embedded, Desktop and Server Editions, Linux, VxWorks, among others[8]. Design the

Figure 4.1: Introduction of Indusoft

application in an integrated development environment and deploy/run it on multiple plateforms, including any current Microsoft operating system- Windows CE/Mobile, Embedded, Desktop and Server Editions, Linux, VxWorks, among others.

Figure 4.2: Indusoft Web Studio

4.1 Main Benefits

Competitiveness

- Support for manufacturer-independent platforms provide unique flexibility.
- Remote diagnosis with built-in-security feature allows efficient data analysis
- Open architecture empower the integration to different system

Figure 4.3: Competitiveness

Databases

- Productivity
- Mobile solution provide online data anywhere.
- Database integration allowed to web thin client charts provide meaningful information in reports, such as OEE, which drive actions to optimize the process
- Alarm management system reduces the time to fix abnormal condition.

Figure 4.4: Database

Cost management

- Most cost-efficient tool in the market.
- Intuitive single development interface reduces the development, deployment and maintenance cost.

Figure 4.5: Cost Management

TwinCAT software: : TwinCAT I/O supports many PC fieldbus card from various manufactures, so by using it, more than one fieldbus card can be operated in a single PC. It supports the master and slave functionality depending on selected fieldbus card. TwinCAT I/O includes the TwinCAT real time system for operating the fieldbus [9], which is helpful in our purpose.

TwinCAT PLC offers all the 6 languages (IL, FBD, LD, SFC, ST and CFC) in the IEC 61131- standard and has a powerful development environment for programs whose code size and data regions far exceed the capacities of conventional PLC systems.

Programming Languages

- Ladder diagram (LD), graphical.
- Function block diagram (FBD), graphical.
- Structured text (ST), textual.
- Instruction list (IL), textual.
- Sequential function chart (SFC), graphical.

Hardware Description

A programmable logic controller (PLC) is a very common industrial control system which is used to control output device based on data received from input devices, such as sensors, processing it then send command to actuator such as motor. Also PLC is an important component in an Industrial control system (ICS) system[10].

Figure 4.6: BECKHOFF CX1020 Controller panel

The CX1020 Industrial PC becomes a powerful IEC 61131-3 PLC in combination with the TwinCAT automation software with up to four user tasks. Several servo axes can be controlled by required cycle time. It also executed the motion control tasks. Even special function can be realized such as flying saw, electronic gearbox and cam plate.

Also it has a visualization facility where we can create symbols to see the whole program in simple way or we can make the judgment by seeing the output very easily. The CX series systems of Embedded PCs Beckhoff form a top-hat rail unit in the control cabinet with combined PC technology and modular I/O level. The CX1020 version with higher CPU performance extended the CX product family.Direct connections of Bus Terminal and EtherCAT terminal are enabled by CX1020.EtherCAT property as a fast I/O system EtherCAT has optimum interaction with the CX1020 Embedded PC, for this purpose Embedded PC was developed. In EtherCAT operation, two Ethernet interfaces of the CPU module are not intended. Via the EK1110 (EtherCAT) extension terminal the EtherCAT connection is established.The CX1020 offers the same functionality as large industrial PCs offers with the TwinCAT software from Beckhoff as atop-hat rail IPC and in conjunction. In terms of PLC with minimum cycle time of 50 s, up to four virtual

IEC 61131 CPUs can be programmed with up to four tasks each .PLCs are also used for cyber security attacks. These can be classified into communication protocols improvement and firewalls, filtering methods, DMZ However, unlike typical IT systems, it is impractical and cost-effective to embrace several layers of mitigation due to performance and availability considerations.

PLCs are commonly found in SCADA system as field devices because it contains a programmable memory. PLC uses the user programmable interface and allows a customizable control of physical components.

Chapter 5

Introduction of Indusoft Work Window

After installing the Indusoft software, it will open the window like shown below, where all the option is available to generate the new project and all the work will be done in this window

Indusoft Screen Window

Figure 5.1: Indusoft Screen

5.1 Indusoft Developed Screen

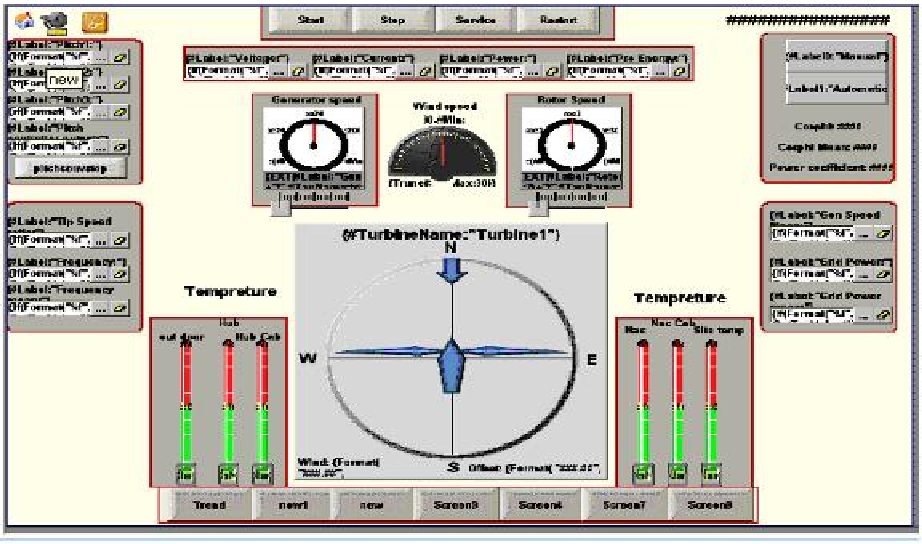


Figure 5.2: Developed Screen

Here, Developed Screen in InduSoft A/C to Wind turbine is shown below, where all the symbols has configured with variable. All the variables configured are also listed in above figure.

5.2 Variables Tagged in Indusoft

Figure 5.3: Variables tagged in Indusoft

5.3 Trends in indusoft:

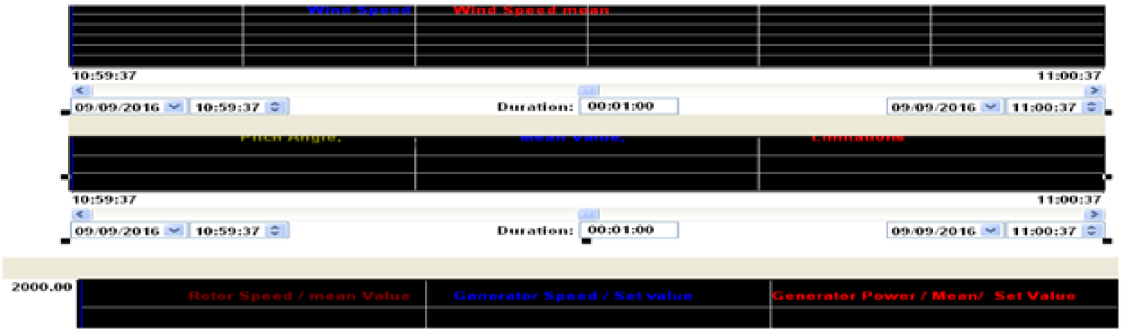


Figure 5.4: Trends in Indusoft

5.4 Some Important Symbol Description

1. Wind direction indicator

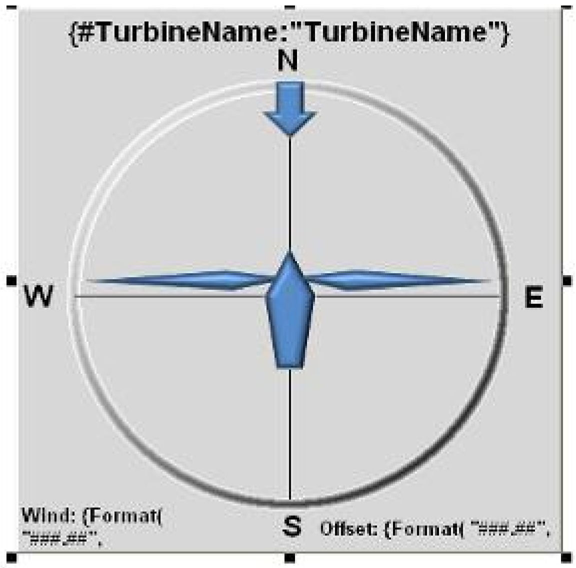


Figure 5.5: Symbol Description

Name: Wind direction indicator
Custom Properties: TagName(wind direction) or NacelleDirectionTag, WindDirectionTag, TurbineName
Range: - 0-360
Description: Two different wind direction indicators. One with wind direction only, the other with wind direction and nacelle direction with automatic offset calculation
Notes: Requires Enhanced Graphics to be turned on under Project -Viewer

Ideas for improvement:

- Different colors
- Add a display for wind speed

.

2.Slider Multi Color-01.sym

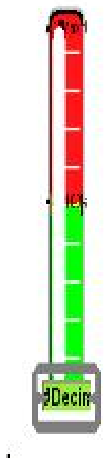


Figure 5.6: Slider Multi Color

Name: SliderMultiColor 01 sym
Range (if applicable): +/- 999 (maybe more)
Description:
This symbol displays a sliding display that shows the value as it changes value. The user can slide it to change the value

Notes:

1.These are made of 100

2.This symbol was created primarily for use on a PC running on a desktop or server operating system, but with some slight modifications, can be made to look great on Embedded Operating Systems. You will should have Enable Enhanced Graphics turned on in the Project-Viewer settings.

3.The developer can set the number of decimal points to display within the indicator. The developer needs to test to ensure the desired values are displayed as you add more decimal points

Chapter 6

Interface between Scada and TwinCAT PLC Software.

Interfacing the SCADA with TwinCAT is very important steps for this project; here some basic steps are mention. That steps are taken from references.

STEPS:

Project– CommunicationConfigure– AMS Id– Add
After following these steps Window will open as shown in below figure.

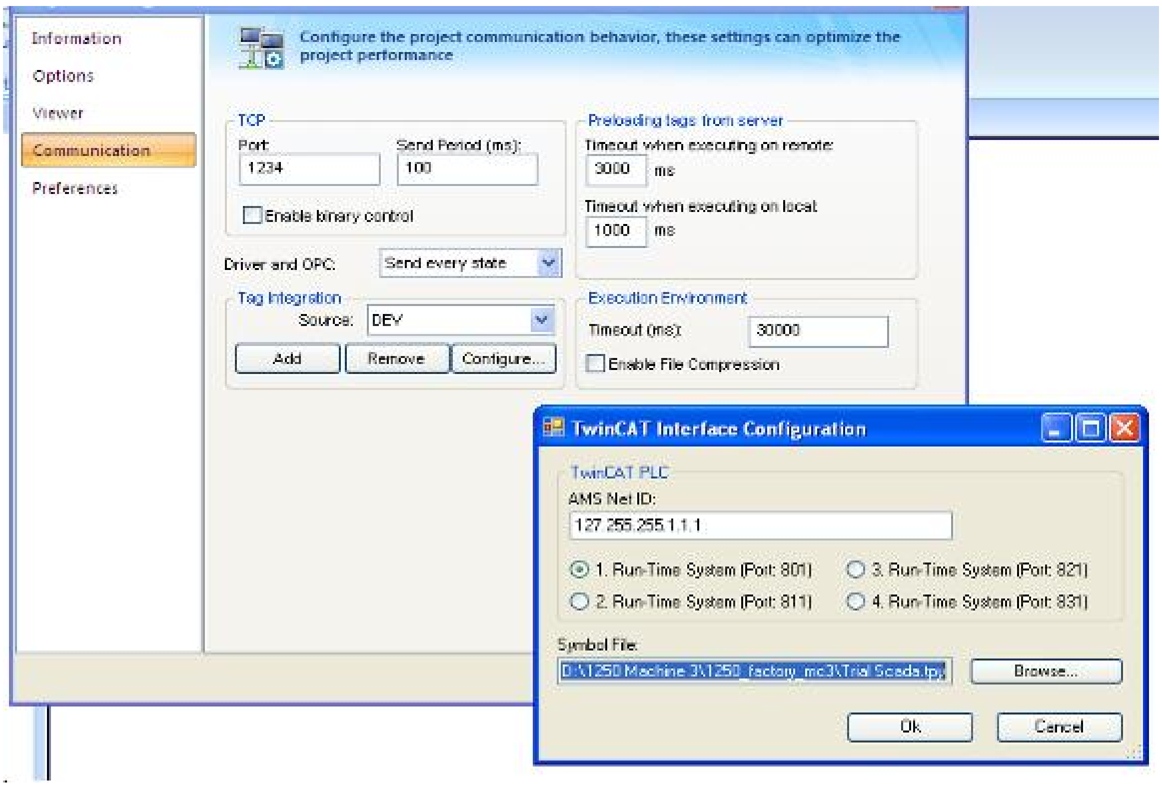


Figure 6.1: Configuring Twincat

After configuration completed, shown the all value tagged in SCADA developed screen from TwinCAT, which is shown below in figure6.2 also shown the value variation through Trending in figure 6.3

Copy the AMS Net ID like this

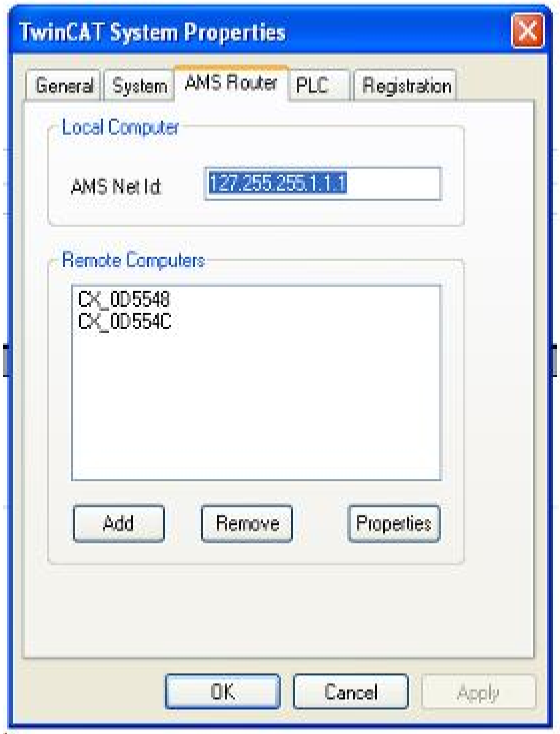


Figure 6.2: AMS Net ID

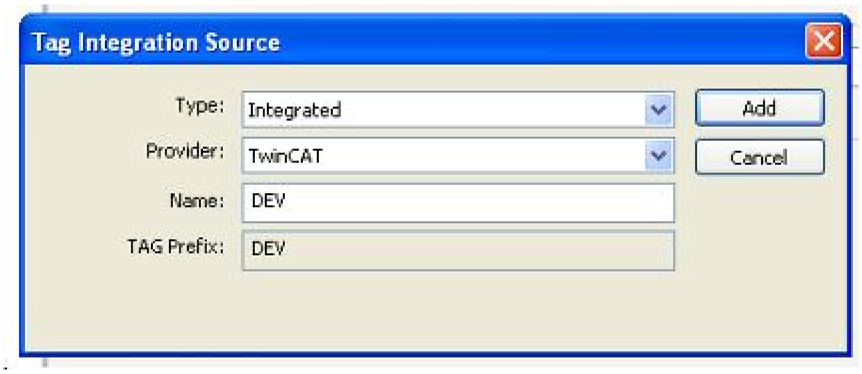


Figure 6.3: Tag Integration Source

6.1 Indusoft Run Screen

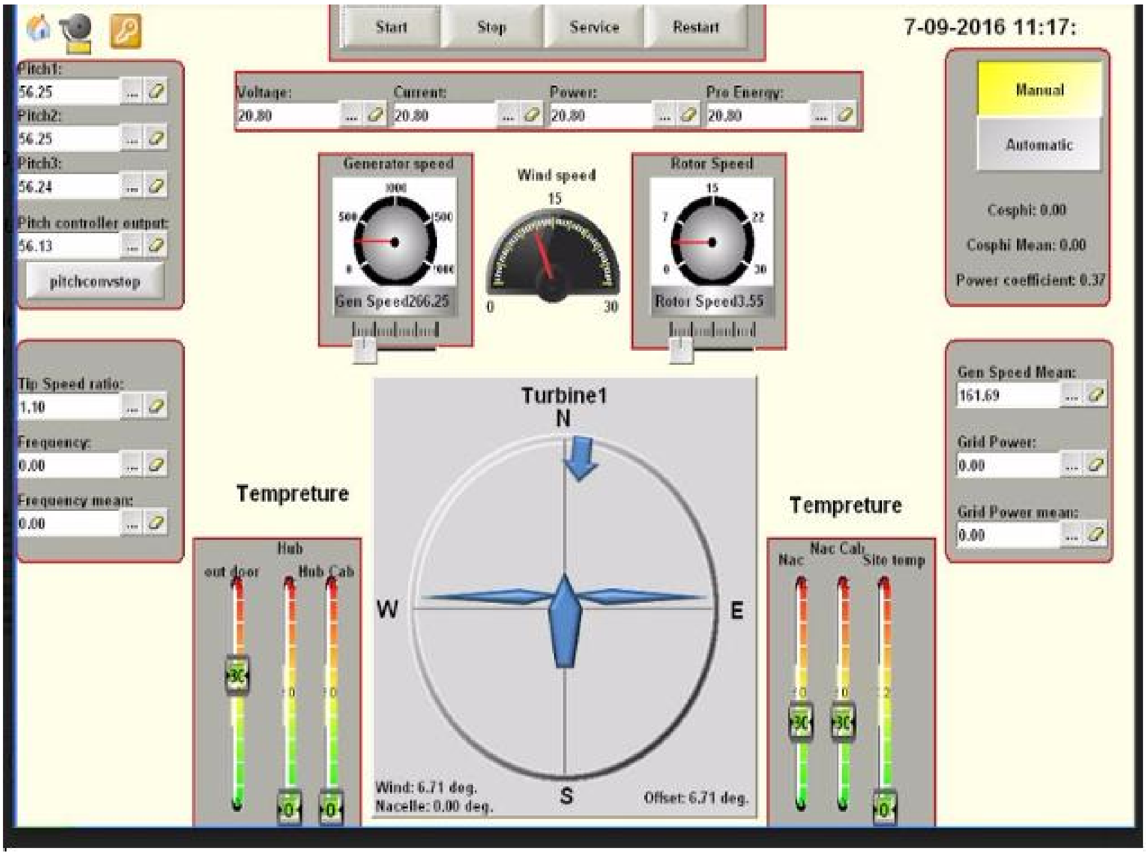


Figure 6.4: Indusoft Run Screen

6.2 Trends Run Screen

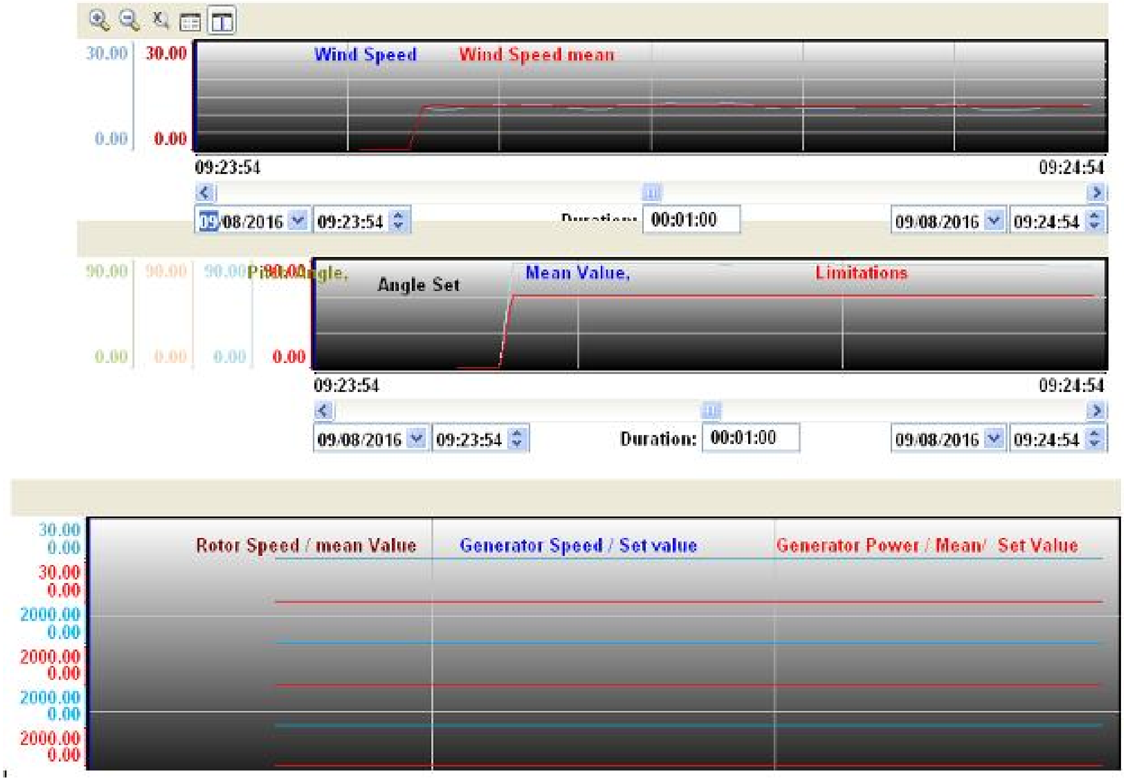


Figure 6.5: Trends Run Screen

Chapter 7

Report Generation

To generate Report through SCADA, need to follow some steps given below.

Steps: Tasks – Double click on Reports – Insert – Window will open like this..

here easily can write things which need to show in report also it has a link with word file where all the data or information will be shown, while configuring the report generation file we can decide the file format, The format as required, can be written here in this window, the same page will display along with the InduSoft run screen. Now, To Developed Report screen, take one button properties give some name command type: Built in Language then tag the variable and give the expression from help window.

Take 2nd Button in screen (for viewing the report): properties some name or view report hyperlink in URL type the location of ms or word file.

To display the report page, we just have to click the button view click, the report page will display.

Here we can write what we need to show in report or we want to be written in word file. The format we required , we can write it here in this window, the same page will display along with the indusoft run screen.

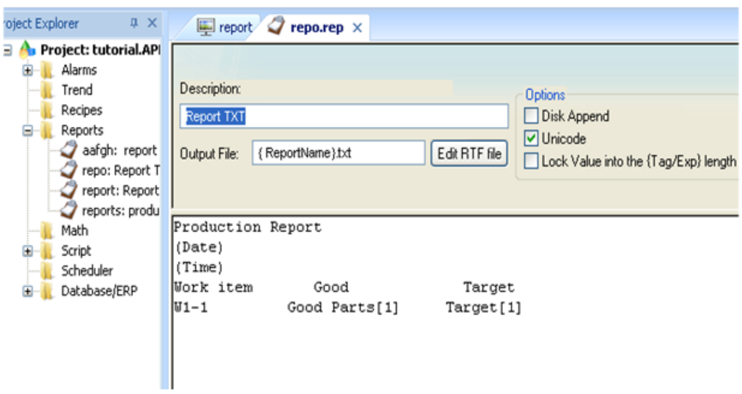


Figure 7.1: Report Generation

Below shown figure is for Database spy status bar, where have tagged our targets in 1st one and in 2nd one we have tagged our Good parts

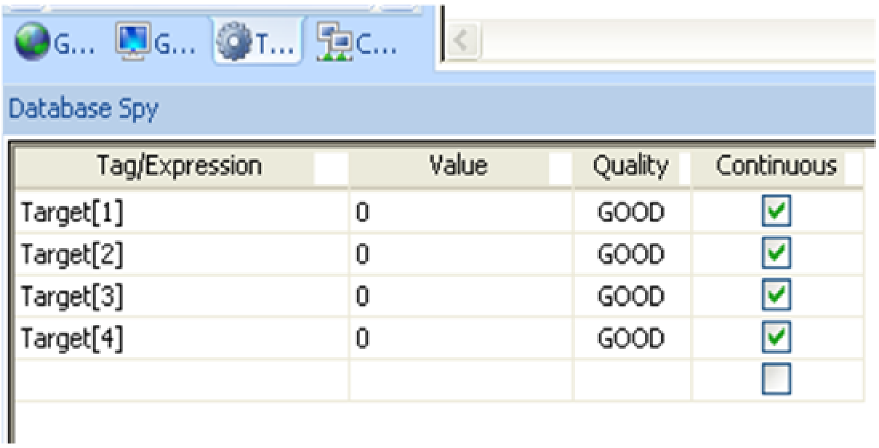


Figure 7.2: Database Spy Status bar

Now, To Developed Report screen, take one button – properties – give some name – command – type: Built in Language – then tag the variable and give the expression from help window as shown below

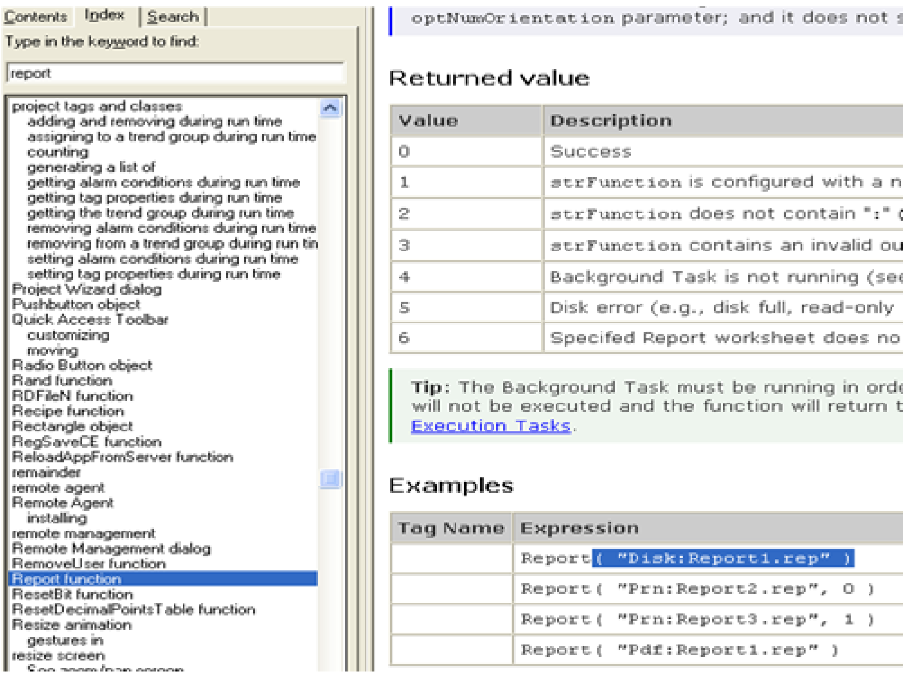


Figure 7.3: Report Screen Development

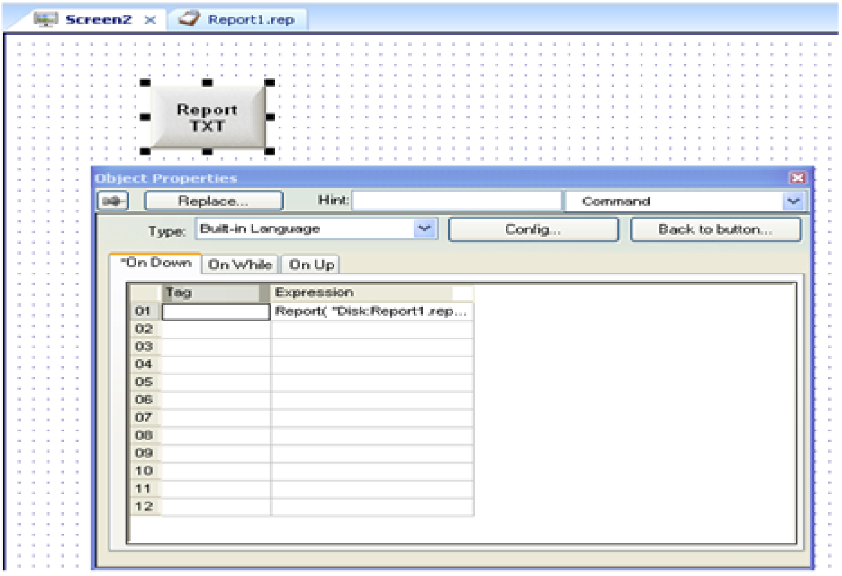


Figure 7.4: Report TXT

2nd Button in screen (for viewing the report): properties some name or view report hyperlink in URL type the location of ms or word file.

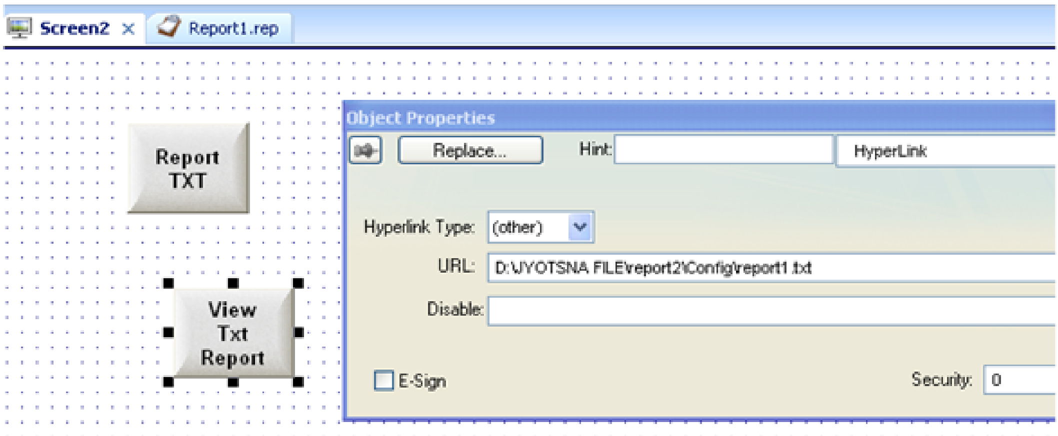


Figure 7.5: 2nd Button in Screen

7.1 Run Window of Report

To display the report page, we just have to click the button view click, the report page will display.

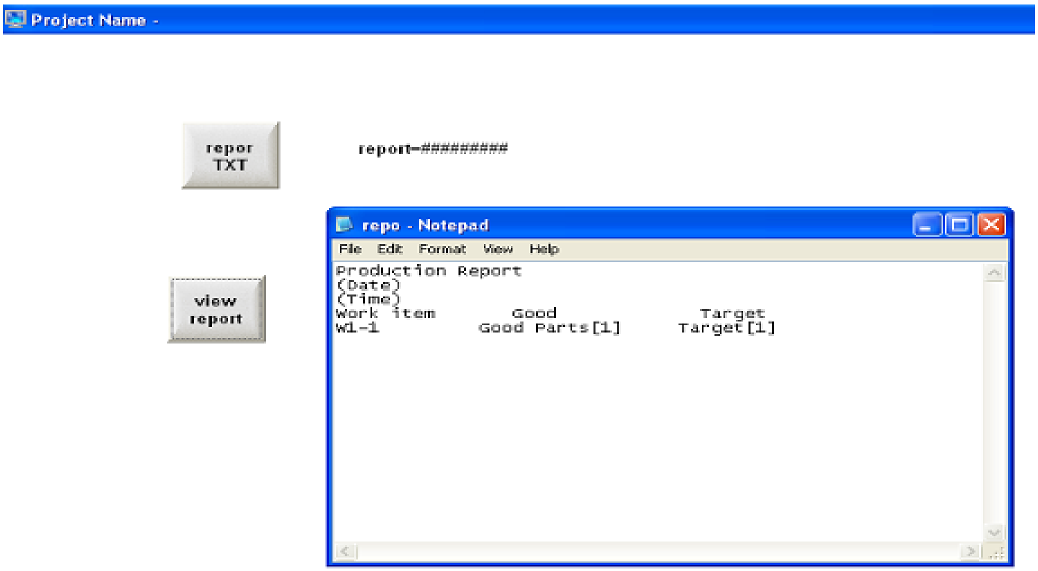


Figure 7.6: Run Window of Report

Chapter 8

Database Generation

Quality or Property of Database is depend on keyword selected in alarms while generating, it just a function used as per our need.

Alarms

- Alarming is a key component to HMI/SCADA
- Online/Historical storage and retrieval
- Alarm Worksheet configures tag alarm properties
- Alarm/Event control object
- Display Historical and Online Alarms
- Events

8.1 Descriptions in Alarm:

- **HiHi:** Alarm limit when tag value is too high: generates an alarm message when tag value is equal to or gretor than the HiHi value
- **Hi:** Alarm limit when tag value is high: generates an alarm when the tag value is equal to or gretor than the Hi value
- **Lo:** Alarm limit when tag value is low: generates an alarm when the tag value lower than or equal to the lo value
- **LoLo:** Alarm limit is too low: generates an alarm when the tag value is lower than or equal to LoLo value
- **Rate:** Determines the speed of variation rate for a tag.

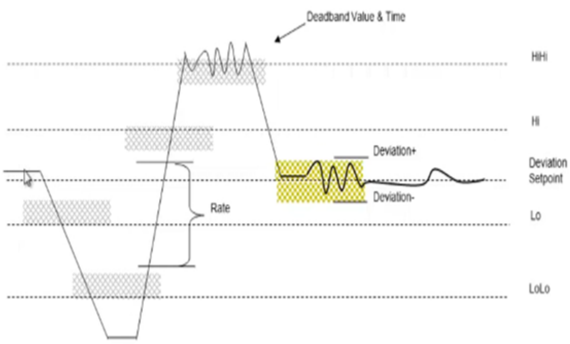


Figure 8.1: Speed of Variation Rate

8.2 Alarm Worksheets

- Up to 255 Worksheets
- Up to 32000 Rows

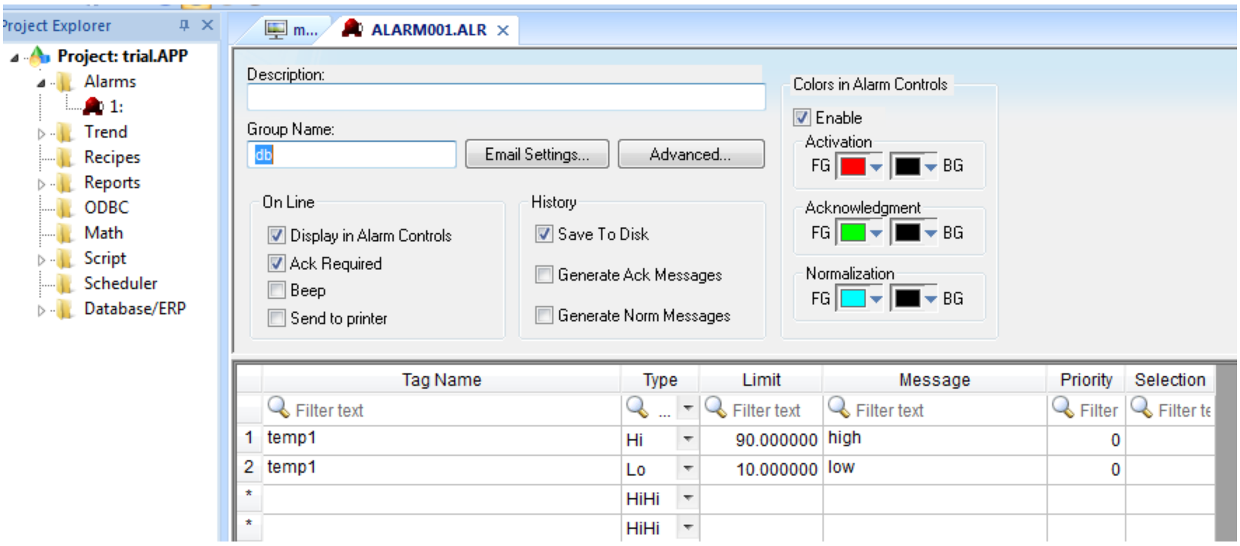


Figure 8.2: Alarm Worksheet

Now in Work window of Indusoft we have to design like that:

- We have to take one slider and one Alarm.
- In slider we have to set the limits for higher and lower, as we given in Alarm Work Sheet
- And same way in Alarm.

Main Window of Alarm

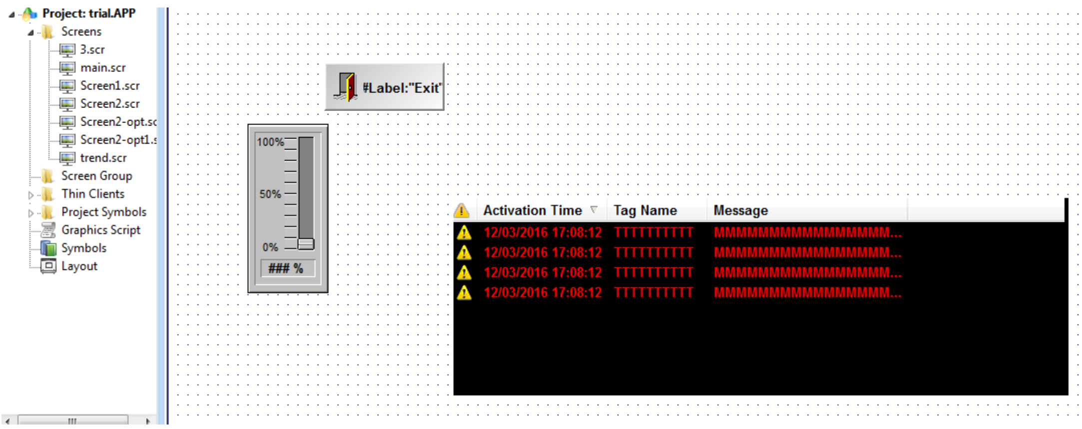


Figure 8.3: Alarm Window

Run Window of Alarm

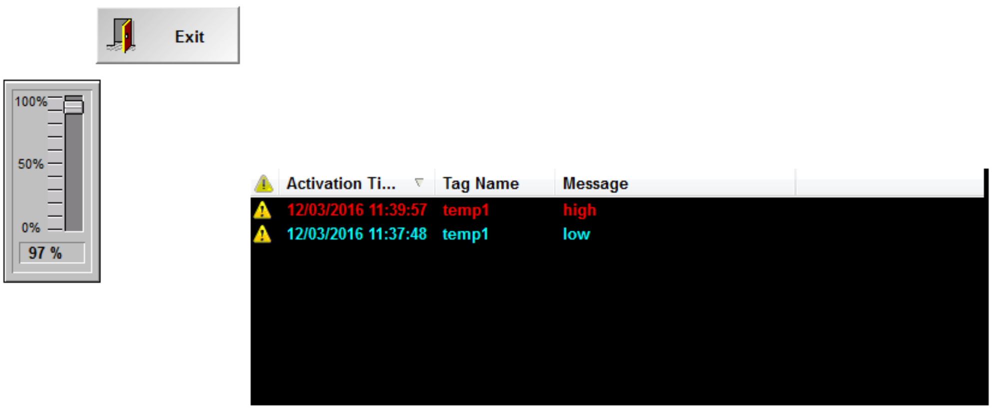


Figure 8.4: Run Window of Alarm

8.3 Database Configuration

Now we need to generate the Database and Alarm History in notepad, MS Office or any other form For that we need to configure the Alarm work sheet of InduSoft with the MS Office. No of time we will Run the InduSoft Window, The Output Data will be Stored in Word File, By which we can see the Data history, It also stored the value with time so that we can easily predict also, can store the data as per our Wish, like in mean value of each one hour or in average.

Now we need to generate the Database and Alarm History in notepad or MS Office. For that we need to configure the Alarm work sheet of Indusoft with the MS Office.

Steps to configure, is shown below:

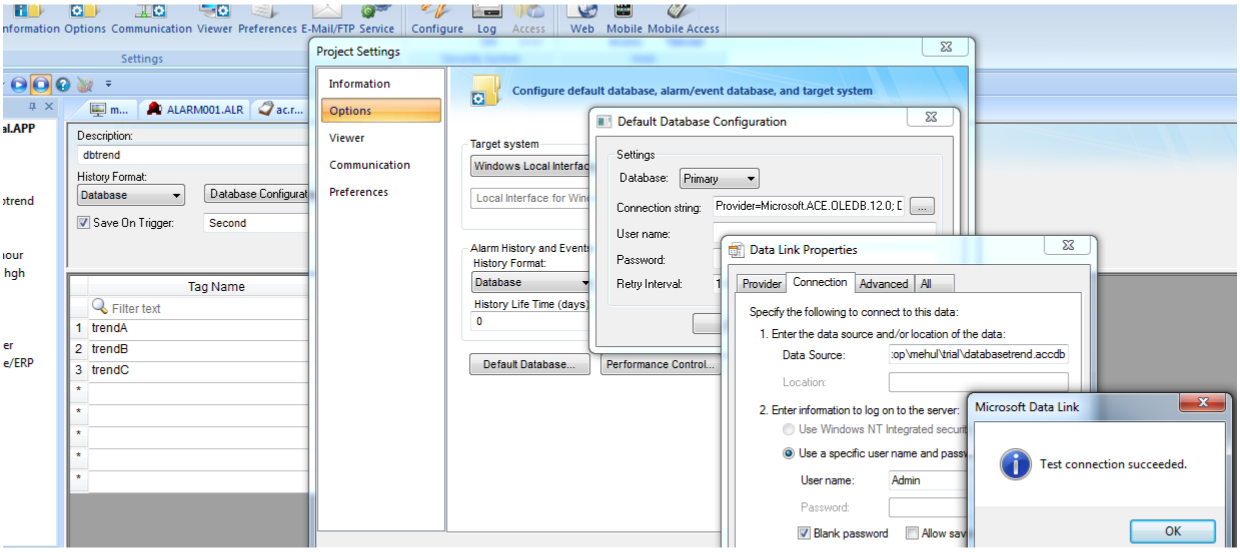
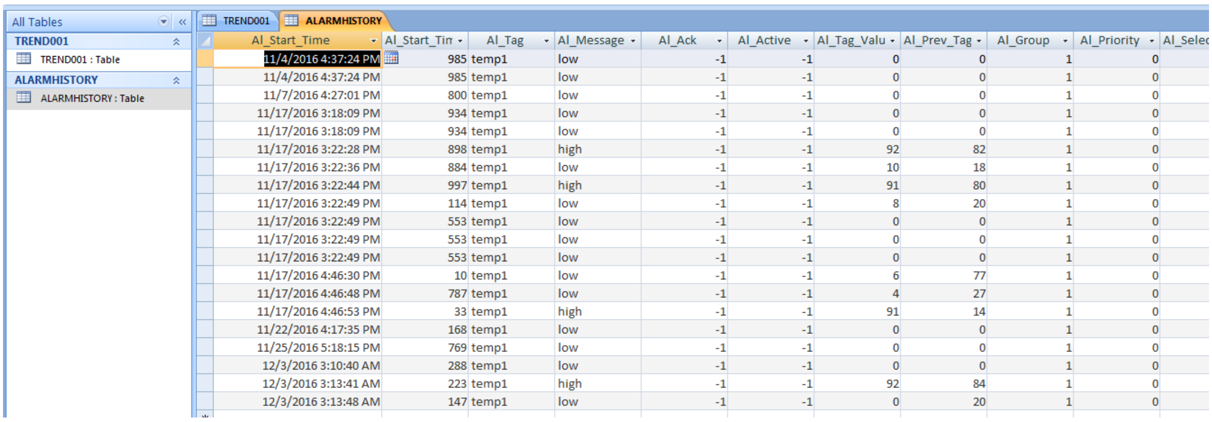


Figure 8.5: Database Configuration

- No of time we will Run the Indusoft Window, The Output Data will be Stored in Word File,
- By which we can see the Data history,
- It also stored the value with time so that we can easly predict,
- We can store the data as per our Wish, like in mean value of each one hour or in average.

After Configuration Generated Datasheet



Al_Start_Time	Al_Start_Tin	Al_Tag	Al_Message	Al_Ack	Al_Active	Al_Tag_Valu	Al_Prev_Tag	Al_Group	Al_Priority	Al_Selec
11/4/2016 4:37:24 PM	985	temp1	low	-1	-1	0	0	1	0	
11/4/2016 4:37:24 PM	985	temp1	low	-1	-1	0	0	1	0	
11/7/2016 4:27:01 PM	800	temp1	low	-1	-1	0	0	1	0	
11/17/2016 3:18:09 PM	934	temp1	low	-1	-1	0	0	1	0	
11/17/2016 3:18:09 PM	934	temp1	low	-1	-1	0	0	1	0	
11/17/2016 3:22:28 PM	898	temp1	high	-1	-1	92	82	1	0	
11/17/2016 3:22:36 PM	884	temp1	low	-1	-1	10	18	1	0	
11/17/2016 3:22:44 PM	997	temp1	high	-1	-1	91	80	1	0	
11/17/2016 3:22:49 PM	114	temp1	low	-1	-1	8	20	1	0	
11/17/2016 3:22:49 PM	553	temp1	low	-1	-1	0	0	1	0	
11/17/2016 3:22:49 PM	553	temp1	low	-1	-1	0	0	1	0	
11/17/2016 3:22:49 PM	553	temp1	low	-1	-1	0	0	1	0	
11/17/2016 4:46:30 PM	10	temp1	low	-1	-1	6	77	1	0	
11/17/2016 4:46:48 PM	787	temp1	low	-1	-1	4	27	1	0	
11/17/2016 4:46:53 PM	33	temp1	high	-1	-1	91	14	1	0	
11/22/2016 4:17:35 PM	168	temp1	low	-1	-1	0	0	1	0	
11/25/2016 5:18:15 PM	769	temp1	low	-1	-1	0	0	1	0	
12/3/2016 3:10:40 AM	288	temp1	low	-1	-1	0	0	1	0	
12/3/2016 3:13:41 AM	223	temp1	high	-1	-1	92	84	1	0	
12/3/2016 3:13:48 AM	147	temp1	low	-1	-1	0	20	1	0	

Figure 8.6: Datasheet

8.3.1 Trend in database

In Database Generation We can also add Trend, for that we have to put the variable in Trend worksheet, here we have taken three varible and for them three slider.

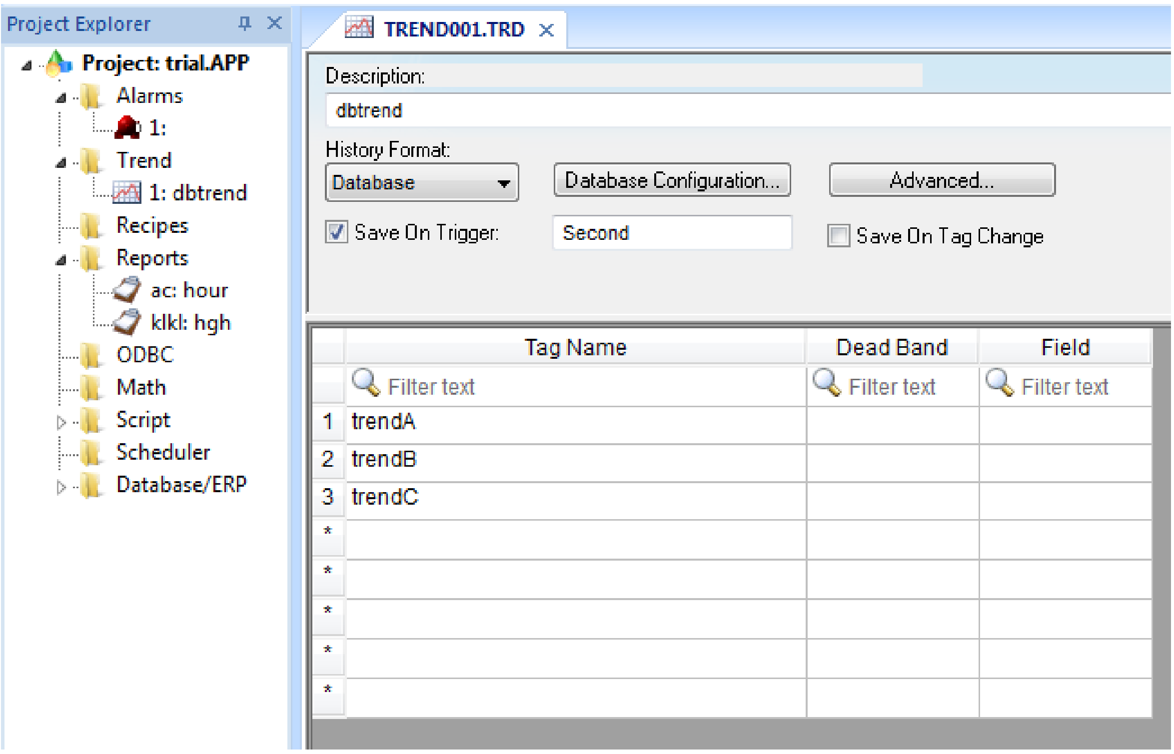


Figure 8.7: Trend Worksheet

This is the Screen Developed for Trending

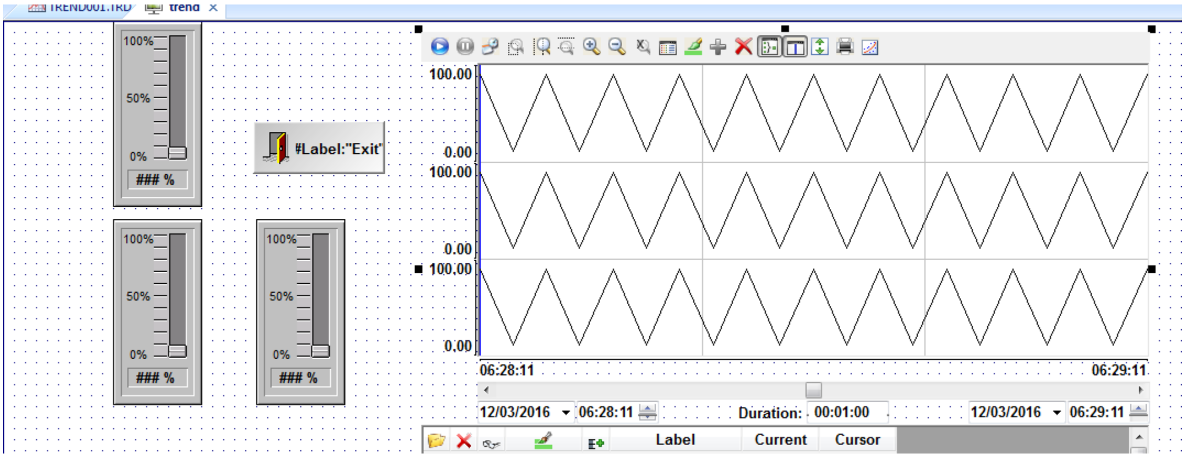


Figure 8.8: Trend Screen

Run Screen for Trend Database

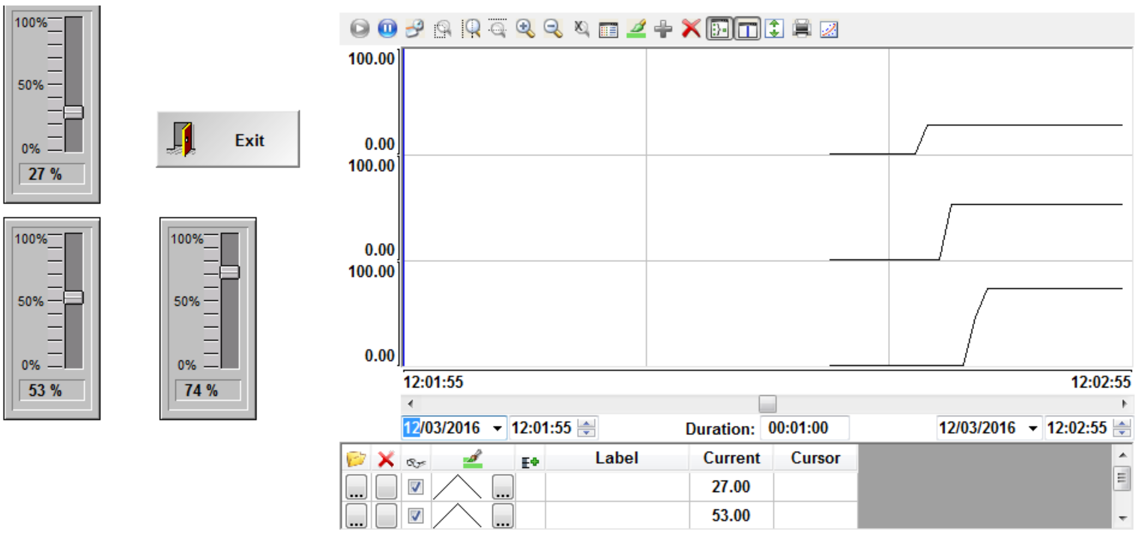
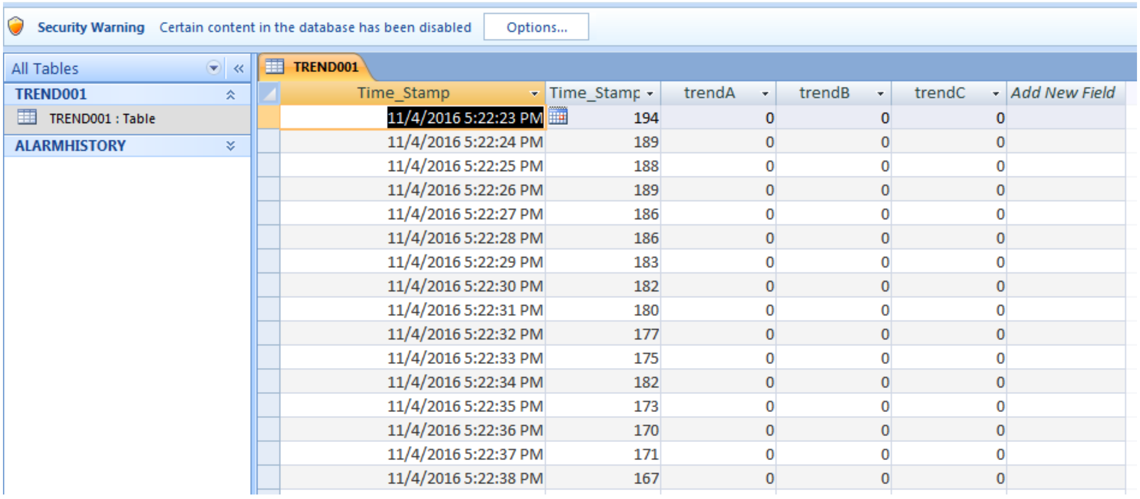


Figure 8.9: Run Screen for Trend Database

Generated Database for Trend value

Data saved here per second, we can change this setting and generate as per our Requirement



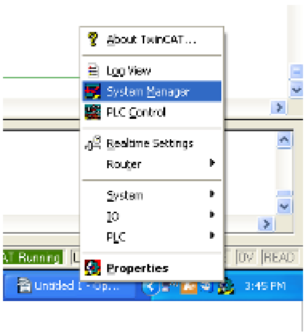
Time_Stamp	Time_Stamp	trendA	trendB	trendC	Add New Field
11/4/2016 5:22:23 PM	194	0	0	0	
11/4/2016 5:22:24 PM	189	0	0	0	
11/4/2016 5:22:25 PM	188	0	0	0	
11/4/2016 5:22:26 PM	189	0	0	0	
11/4/2016 5:22:27 PM	186	0	0	0	
11/4/2016 5:22:28 PM	186	0	0	0	
11/4/2016 5:22:29 PM	183	0	0	0	
11/4/2016 5:22:30 PM	182	0	0	0	
11/4/2016 5:22:31 PM	180	0	0	0	
11/4/2016 5:22:32 PM	177	0	0	0	
11/4/2016 5:22:33 PM	175	0	0	0	
11/4/2016 5:22:34 PM	182	0	0	0	
11/4/2016 5:22:35 PM	173	0	0	0	
11/4/2016 5:22:36 PM	170	0	0	0	
11/4/2016 5:22:37 PM	171	0	0	0	
11/4/2016 5:22:38 PM	167	0	0	0	

Figure 8.10: Trend datasheet

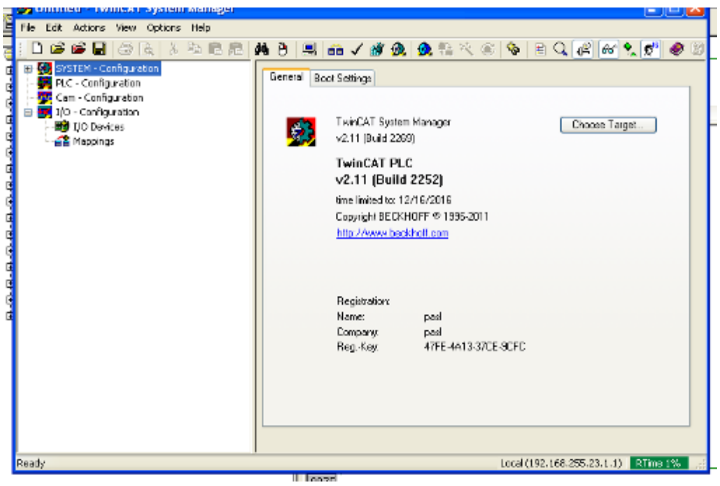
Chapter 9

Communication between SCADA and PLC hardware

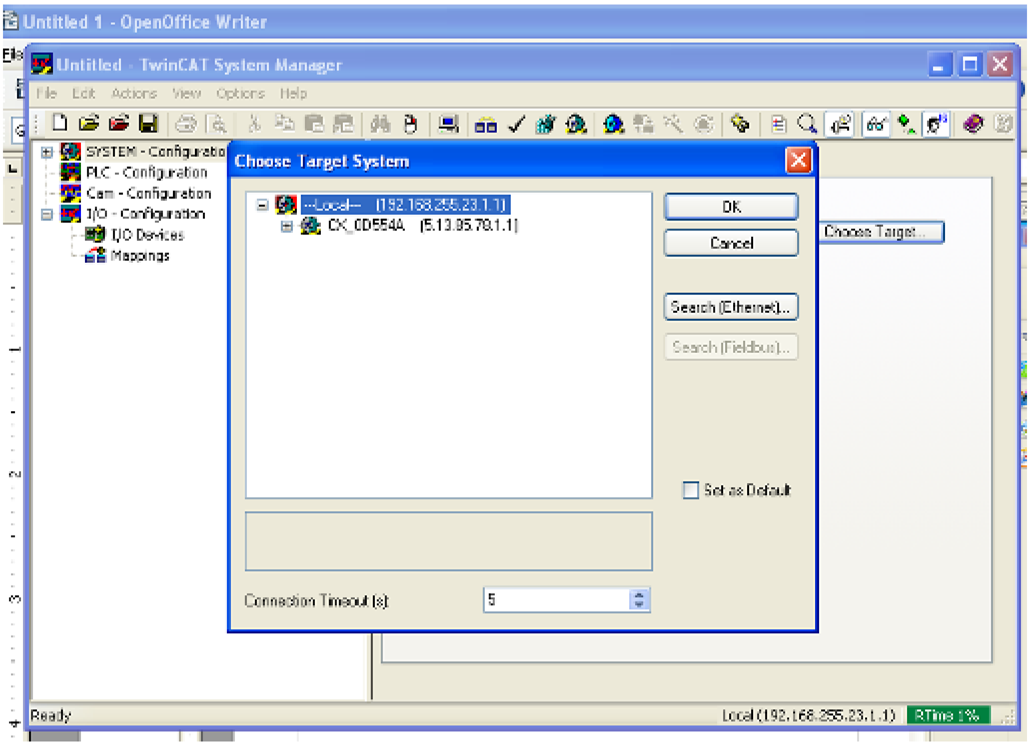
First of all we have to communicate with software PLC program with Hardware PLC
Steps:
Step1: Twincat PLC Manager system



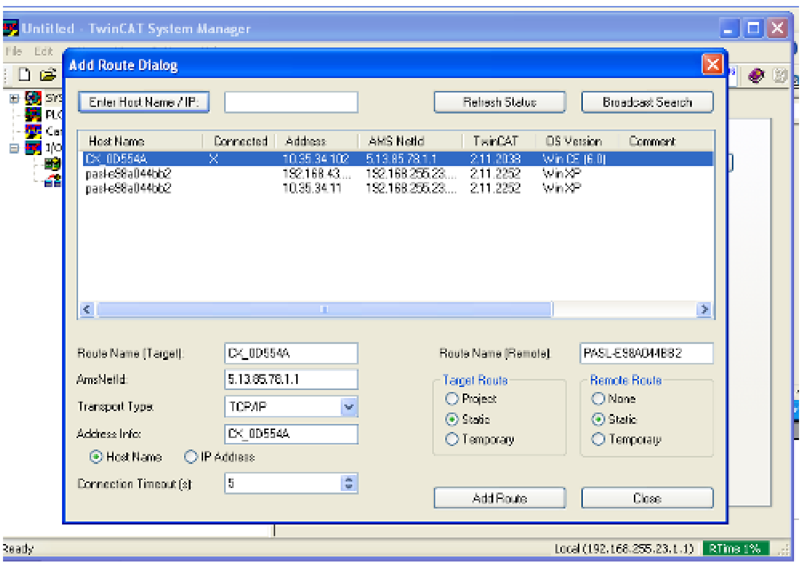
Step 2:



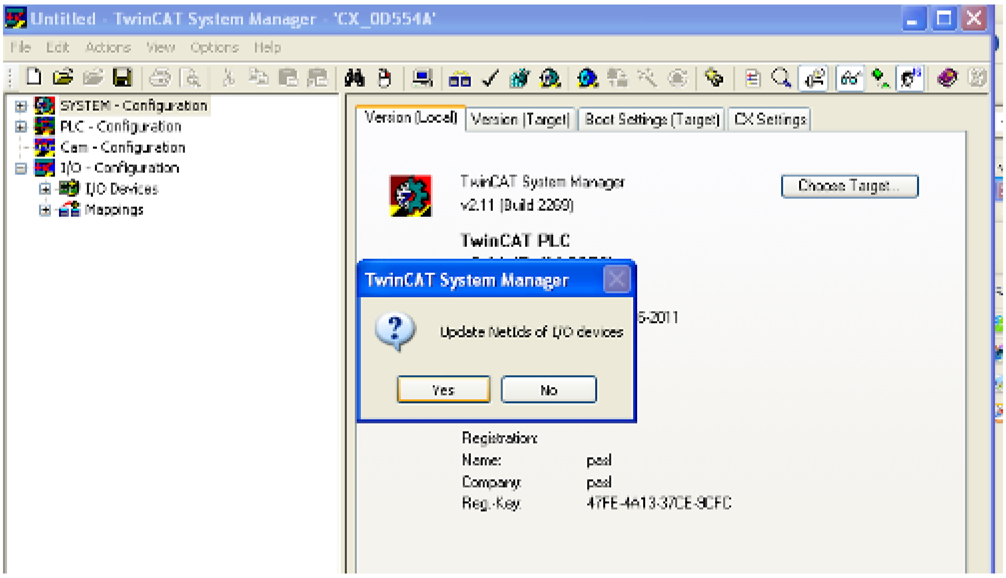
By clicking choose target, one window will appear with with the physical controller name, we have to select that and press ok.



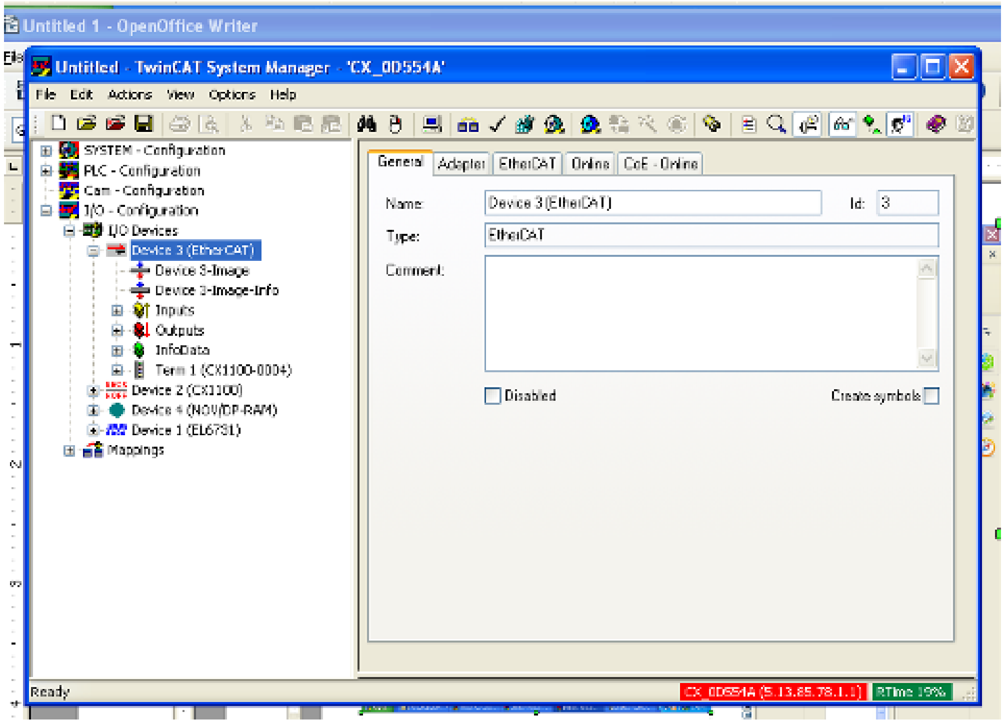
In Add Route Dialog all the hardware will show, we just have to select one
Step 3:



Step 4: Click yes

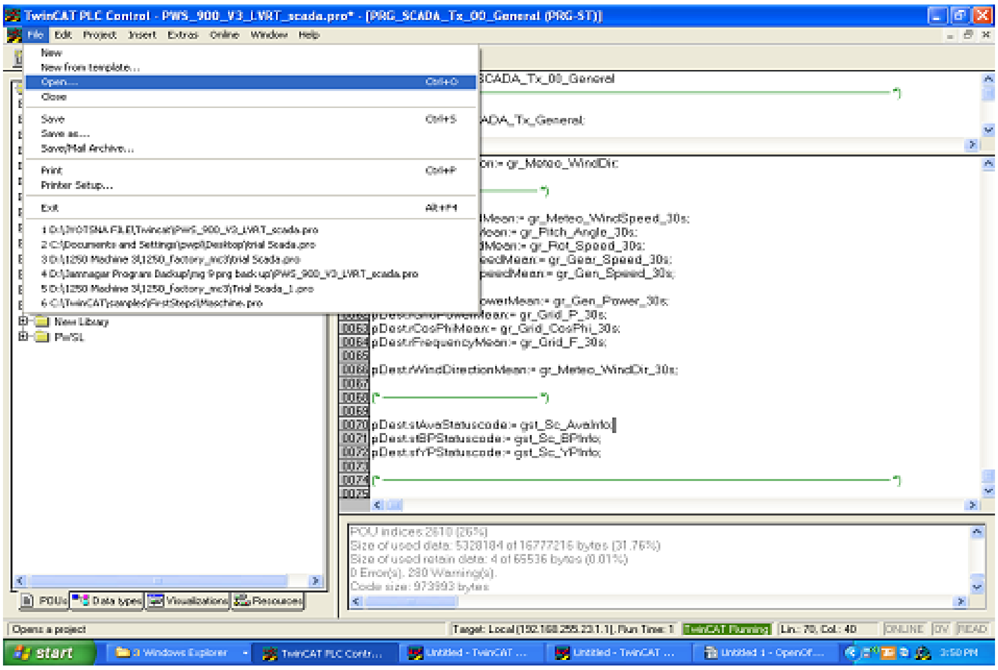


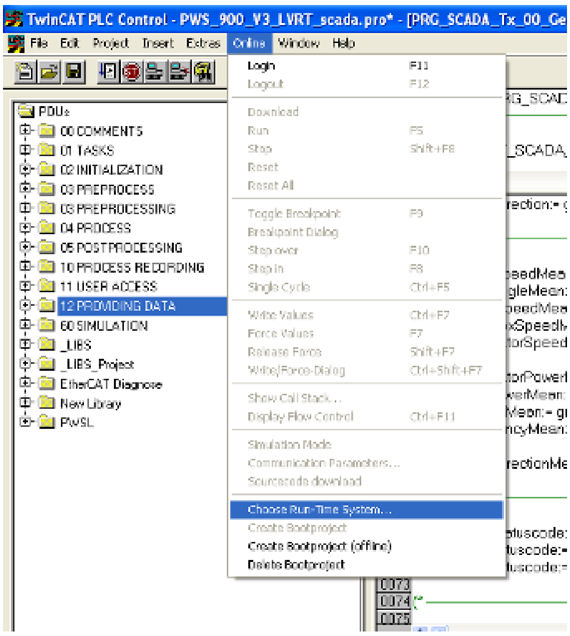
Now all the Hardware will show in the left side, with all the module.

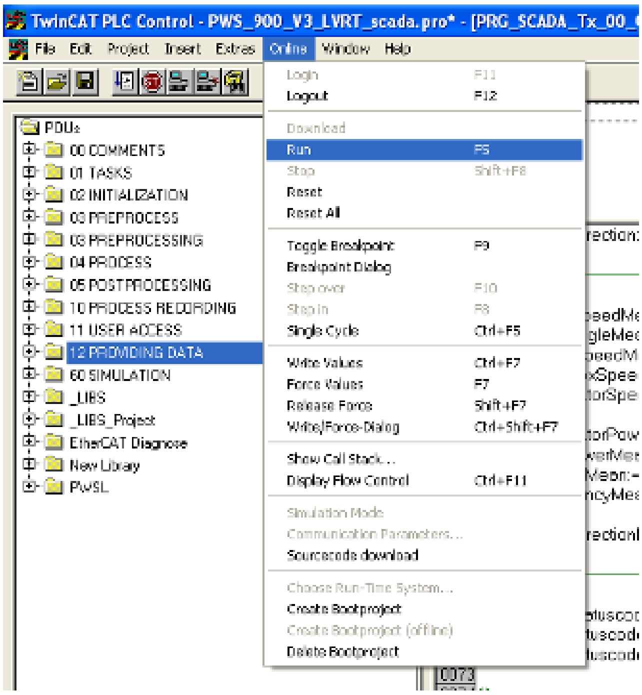


To Dump all program codes in Hardware, we have to Run the program

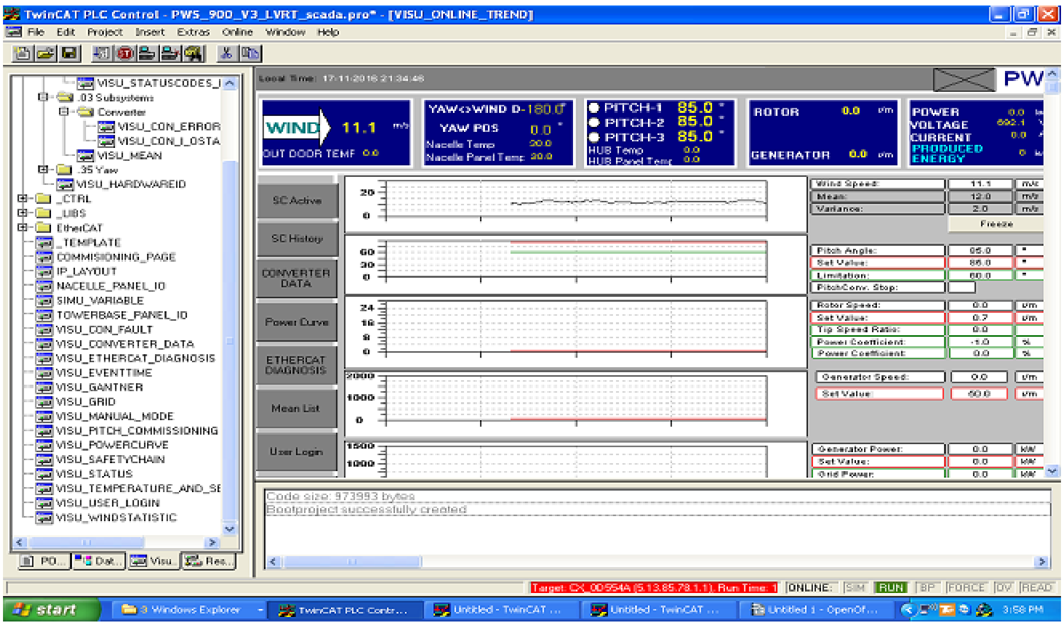
Steps to Run:







After Run the program, Visualization Window



9.1 Visualization in HMI

After getting configuration done, PLC program in PC is showing in hardware panel, since the program is already configure with SCADA it will communicate with hardware also just by changing the IP address.

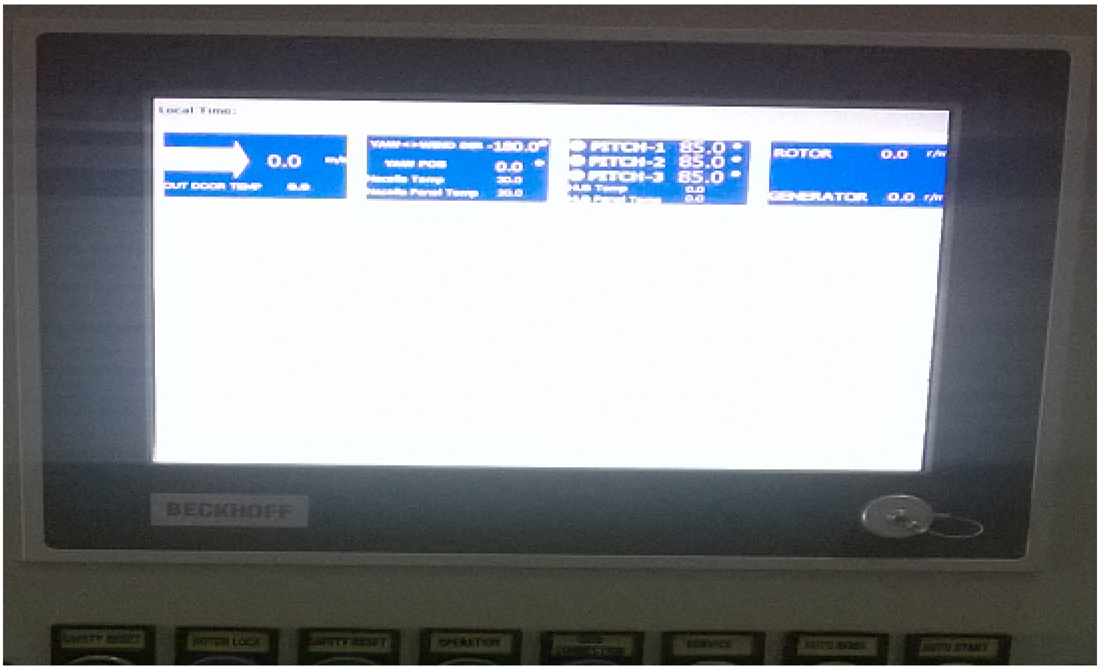


Figure 9.1: HMI Visualization

Chapter 10

Conclusion

Here we conclude that the working of plant requires lots of automation and hence there are various subsystems for its smooth operation. This subsystem depends upon their functional areas. This project presents implementation of communication architecture for SCADA System in Wind Turbine with InduSoft platform with this we can acquire the data from remote place also through wireless communication. As we know wind is clean source of energy and controlled by computers, it is totally safe that's why power conversion does not pose any environmental hazard.

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