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Smart Monitoring and Analyzing Process Level of Boiler Water Treatment Plant

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Abstract: ***Field instruments used in boiler water treatment plant are not able to access remotely and only able to control through central location Also the data are able to access through the internet only in the particular area. If any data lag or system failure occurs then it can be control only in the plant area. This becomes complex and cannot be applicable for all situation. To avoid such complexity happened due to system error and to monitor the system parameter remotely, a cloud based system from Siemen is used to connects plant, system and machines by IoT with advanced analytics and practically tested in Technocart Automation plant located in Ambattur, TamilNadu, India. This gives advance solution for monitoring the industrial parameter anywhere using Siemens Mindsphere and Mind connect nano Software.***

Keywords **: *IOT (Internet of Things), Siemens S7-400, Siemens Mindsphere and Mind connect nano Software, DCS(Distributed Control System), SCADA(Supervisory Control & Data Acquisition).***

I. INTRODUCTION

The main aim of any plant is to utilize maximum amount of resources and to produce cent percent product. But due to lack of resources availability or some system failure the necessary final product cannot achieved. In automation plant the product mainly depends on the data given to it. The data can be continuously monitored by the engineer to check the repeatability of the data. If there is sudden increase or decrease in data then it can be control by analyzing the change in parameter and report to the operator. It is not possible to monitor all the time and the monitoring and control can be done in or around the area. It is very difficult for monitoring during shutdown or during vacation. Before going to make new system it is more important to study the existing system. From this study , to know what kind of requirements are fulfill till date and how to make the system more advanced and efficient than previous one using the latest technology. According to Mr. Malikamber, Mr. Tamhankar [1] can build a system which can be used as supervisory control and data acquisition that is SCADA. For that they uses IEEE C37.1 standard. This system provides the monitoring and controlling of the different device present in the industrial environment. Mr. Zafar [2] pointed us towards the system in which can access the process control library from outside the college campus using web technology. Prof. Jaikaran Singh, Prof. Mukesh Tiwari, Mr. Manish Shrivastava [3] says that how the automation becomes an essential part of the industrial development. If replace the old running manual process of operations by new emerging automated technologies then the proposal efficiency is increased in great extent and able to produce high quality of product within a less time consumption than manual controlling. Most of the automated system based on the new emerging software technologies. Mr. Bulipe Srinivas Rao, Mr. N Ome, Prof. Dr. Srinivas Rao [4] proposed a system which is used for weather monitoring using Arduino development board. According to their research can monitor the weather conditions of location from anywhere using internet of things. But it is a system which only monitoring the weather condition. There is no any controlling part in the system. They used different sensor such as temperature, light, sound etc. Nashwa El-Bendary Saumya Banerjee, Mohamed Mostafa M. Fouad [5] proposed work on the wireless sensor network. By using WSN technology they built a system which is used in smart environment monitoring. Due to large increase in the overall population, increased industrial area, increased vehicles various toxic gases such as sulfur dioxide, nitrogen oxides are released in the air and pollution is increase. It may become dangerous for human life. So it has to be monitor and control.

This paper deals with monitoring the data in the plant instruments at anywhere by logging on to the cloud so that the data can be monitor anywhere and thus controlling can be takes place in plant and also working on the controlling part remotely. To achieve this first have to create account for login in the Mindsphere cloud service. Here used Siemens Mindsphere nano software to login to the cloud and then fetch the data to the cloud through controller s7-400. After the data is fetched to the cloud the data can be monitored anywhere by just log in onto it. This can also monitor the entire ongoing process in the plant using SCADA(Supervisory Control & Data Acquisition). The DCS(Distributed Control System) play important role in our project through which can take the connection from plant through cloud and to final control elements. Siemens mind connect is used to connect multiple connectivity layers including hardware and software. These are fast ,secure and easy to connect.

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Siemens Mindsphere is the cloud based open IoT operating system from Siemens that connects plant, system and machines by IOT(Internet of things) with advanced analytics. All other parameters such as pressure, temperature, flow can be monitored and control action take place within the plant. IoT is a new emerging technology which connects all the living or non living things of the world using internet.

IoT allows the communication between the people and thing anytime, anywhere using large internet network. To monitor and control such automation process ,here use concept of IoT. The data which is provided by different sensor such as temperature, speed, light, pressure are monitor using a web page or android mobile app. Thus can control this parameter by providing appropriate feedback command. Controlling device along with IoT are used to communicate between devices and web page.

II. IMPLEMENTATION

Figure 1 shows the block diagram of IoT based industrial SCADA system. In this first the raw water from sea or other sources with several dust and salt particles come to the raw water tank. Then these are sent to the filtering unit. In the filtering unit there is a separate unit for filtering out carbon and sand particles. After the filtering process completed it moves to the Reverse Osmosis(RO) unit. In this unit by reverse osmosis process the dust and other minute salt particles are removed and these water are suitable for drinking. These water get stored in the RO tank.

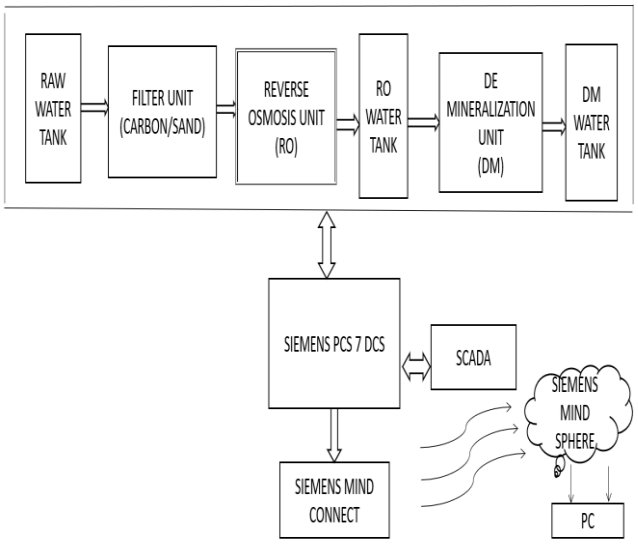

Fig.1 :Block Diagram of IOT based Industrial SCADA system

Then for using the water for industrial application the minerals in the water should be removed. This process done in demineralization unit shown in Figure 2. The unit consist of two separate tank one has Cations and other has anions. First the water flows to Cation tank in which it contain contains Cations which removes the negatively charged particles such as chlorine. After removal of the anions it floes to the anion tank in which it removes the positively charged particles thus the water is now free from minerals. Then the water stores in the demineralized water tank. This water can be used by the industries. This entire unit consist of several flow meters, pressure gauges and temperature sensors. The entire process get power supply from DCS. The data are taken from these sensors to controller to Siemens Mindconnect. And these are monitored in the SCADA and the data from the controller are taken to the cloud and thus it can be monitored anywhere by logging into it. The control can be done within the plant.

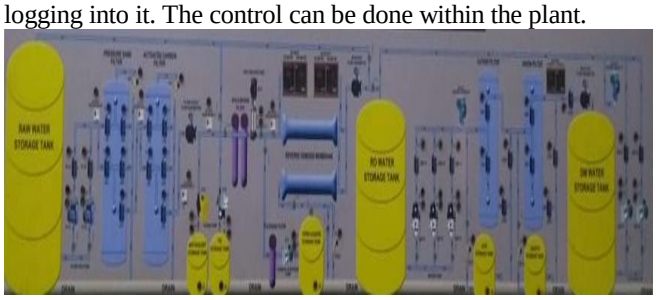

Fig.2: Demineralization & RO Unit (Technocart Automation)

The Components used are,

a. **SIEMENS S7-400**- Designed for system solution in the field of manufacturing and process Automation. This controller is ideal for data intensive tasks for industry. This is Fault tolerant, High speed and Password protection

b. **PROFIBUS**- Standard for fieldbus communication in automation technology and it is used by siemens- This is fast communication protocol and fast data transfer

c. **SIEMENS DCS**- Supports profinet where it provides powerful plant wide communication in real time in the area of big data. This is Cybersecure and Communicate faster

d. **SEMANTIC MANAGER 5.0**- Used to monitor and control a plant or equipment in industries such as telecommunications, water and waste control , energy , oil and gas refining and transportation.it comprises of computers ,networked data communications and graphical user interface for high level process supervisory control which also comprising of PLC and PID to interface with process plant or machinery. The use of this manager is also for operation of project driven process in construction.

III. FLOW CHART

The Figure 3 explain the procedure about how the data is send to the cloud and analyzed. First the plant start to run and the treatment process takes place. Then the data about the amount of steam and the water and other material can be monitored and it initialized. The sensors gave information about the flow, level and pressure and the controller process and send he data to the cloud through SCADA and then it can be monitored outside the plant. If any data change occur it immediately processed by controller and it gave information to the operator. Else complete the process.

IV. RESULTS

The objective of cloud based SCADA system is to increase their flexibility, cost efficiency, optimization, capability, availability and scalability of such systems. For this purpose industrial SCADA system utilize the benefits of cloud computing such as seimens mindsphere and mind connect.

However these benefits are accompanied by numerous critical tasks. Major security risks related to industrial SCADA system in the cloud may vary from one scenario to another.

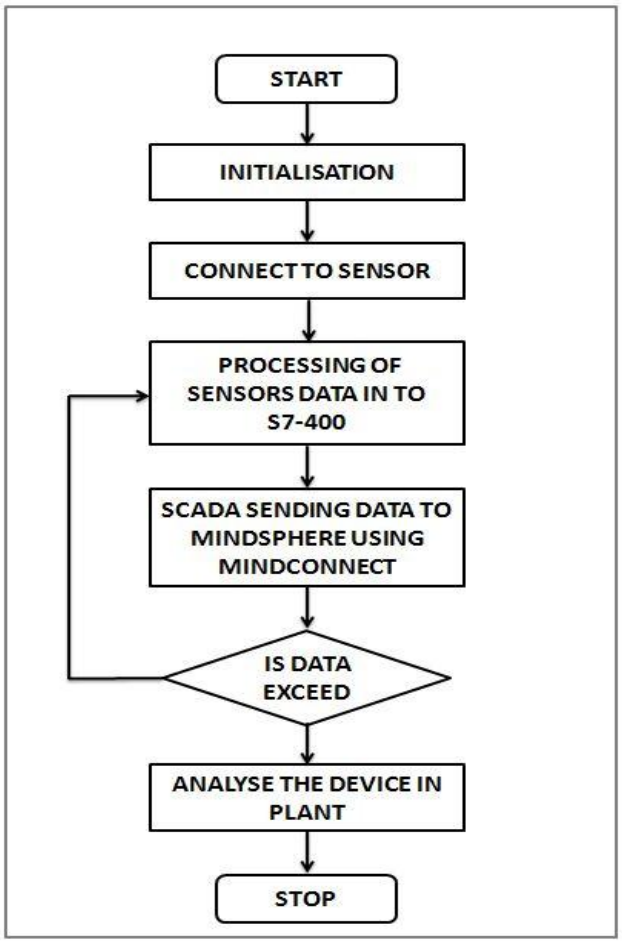

Fig.3 : Flow Chart

In such environment, the nature of data is such that it must be stored on servers for backup or sharing purpose and these servers are mostly managed by the owner or the management of the plant to keep the confidential data and the other information secretly with proper login id and password. The result is that the privacy of data on these cloud servers cannot be guaranteed, as the data may or may not be shared with other people. Therefore such security breaches must be considered before integrating SCADA with cloud environment. Thus this porjct highlight the accessing of data of the plant in the remote places with at most secure and can able to monitor continuously and thus when something go wrong can be easily analysed and give report to the plant and thus correspondingly the control action takes place. The main is that security. Proper logging into the cloud and private accessing able to overcome the problem .

The figure 4 shows the process takes place and the data is collected through the various process and the field devices and these are send to the siemens controller to the IO module and to the minesphere from which the user can able to login and check the data from which any deviation takes place it can be immediately controlled it gives detailed information about the data including its data type and its address. the place from where the data can be fetched that can be uploaded on to the cloud and thus the country and the place can also be given on to the cloud for the security purpose from which other cannot be able to access on to it.

The figure 5 and 6 is the request and aspects that can be made to upload on to the cloud so that the user can able to view the data with utmost secretly and no changes can be done on to it and it can just monitor the data and the control can be done at the plant or the process industries. The failure of the field device can also be monitored within the remote places through cloud.

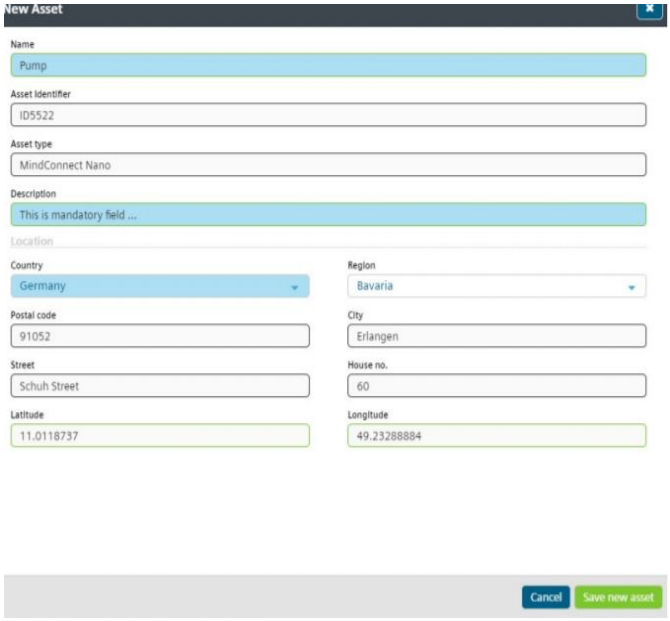

Fig.4 : Entering Information for a new asset

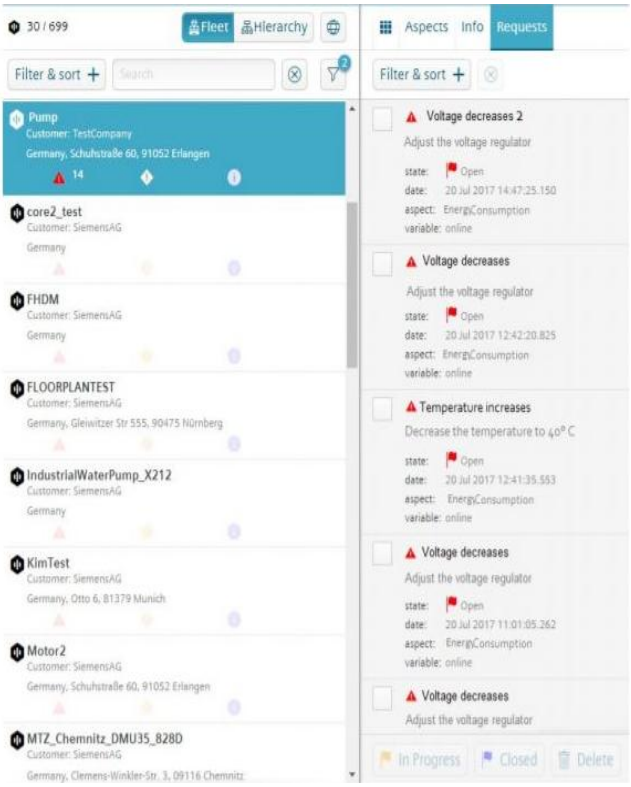

Fig.5: Viewing Request

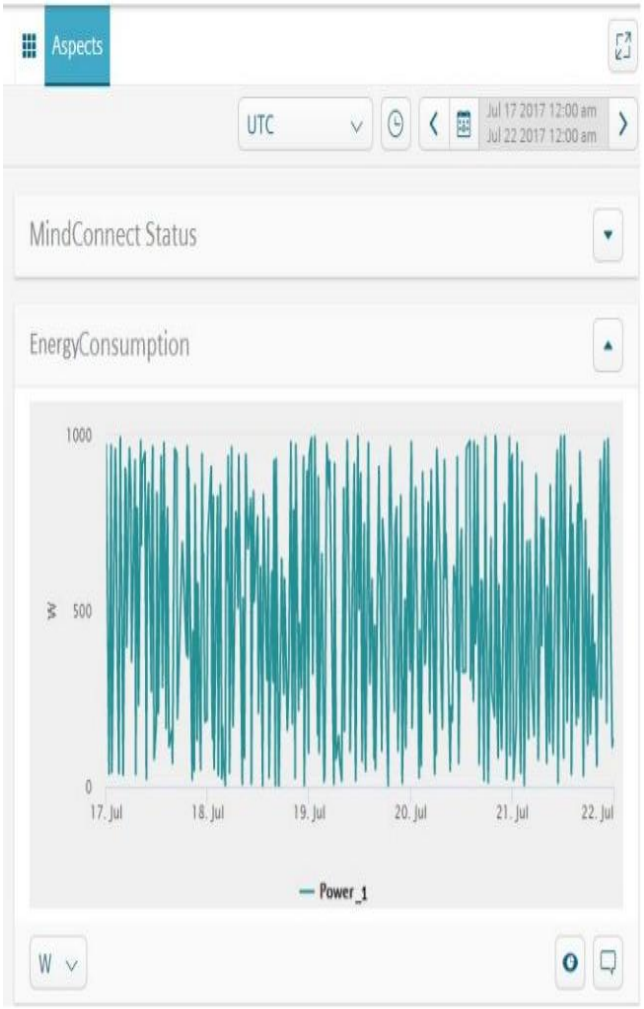

Fig.6: Viewing aspects

The status of the energy consumption in the plant can also be monitored and hence the overheating can be reduced thus prevent the device from overheating. This calculates the energy consumed by taking the amount of power consumed in watts multiplied with time consumed using the Equation 1.

ENERGY = POWER X TIME ***(1)***

V. CONCLUSION

1) Thus the data is monitored through cloud
2) The control is done in plant
3) The results are predicted
4) The data changes are done based on the plant operation
5) Controlled the failure of the device
6) Data ranging are monitored and Analyzed.

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