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Comparison of Boiler Control Using Wireless Bridge Between PLC , SCADA , Wi-Fi

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Abstract

In this paper the concept of monitoring, recording and controlling of few parts of boiler is discussed.

PLC,SCADA and Wi-fiare used to provide control for the parameters.PLC andSCADA are connected with a wireless medium, that is, the Bluetooth module. It can control all the parameters over a particular distance. For short distance this method will give best result. In case of long distance the controller producesAnnoyance in the performance of the system. Moreover the PLC and SCADA won't provide control for long distance.In order to carry away this problem Wi-fi is used. By using this method the Boiler parameters can be controlled from anywhere in the world provided with the internet connection. It can control all the parameters over a long distance.In this paper a contrast of PLC, SCADA and Wi-fi control is done on the basis of analysis.

Keywords: SCADA, PLC, Bluetooth, wireless Power transmission, Wi-Fi

Introduction

The boiler control which is the most important part of any power plant, and its automation is the precise effort of this paper. Conventional equipment systems are prone to errors due to the involvement of humans in the data collection and processing using complicated mathematical expressions. Thus what we require is a system that collects raw data, processes it and presents it in values which can be verified and compared with the standard values.

[1] .Thus it provides a real challenge with systems involving. In this paper the good solution for boiler control over wide area is discussed. [2]The existing system have the wireless block consists of a Bluetooth module connected to OMRON PLC and the Bluetooth receiver present in the system containing SCADA software. The PLC is further connected to a process which is controlled by the SCADA system through wireless medium. This technique of operation can be used over a certain range of area, for example, it can be used in industries and plants.

The transfer of data from the application to the PLC is done using wire, whereas from the PLC to the system is done is wirelessly using Bluetooth. The process we operate is a boiler based process. In this process we control the parameters such as, temperature, level and pressure, and also show its effects on the process using SCADA software. In this project we use two types software's for the operation.Both connect with each other and operate uniformly and instantly for giving the desired output.

The two types of software's used are: (1) PLC CX programmer (2) SCADA Wonder ware In touch. PLC CX-Programmer, theprogramming software for all Omron's PLC series, is fully integrated into the CX-One software suite. This software creates a hostlink known as OMRON-Hostlink which creates the connection between the CX programmer and the SCADA Intouch. This software has the scan time of 0.4ms. In this software, we program or construct the ladder logic for the operation to be carried out. The SCADA used for this PLC is SCADA IntouchWonderware software. The SCADA is basically is used for the pictorial representation and monitoring and collection of data. In SCADA we create the design of the operation which needs to be operated and connect it with the OMRON PLC using OMRON hostlink. This connection is done by giving tag names to the respected design with respect to the input and outputs present in the ladder logic of the CX- programmer.

A wireless PLC/SCADA network has been set up to investigate the reliability of wireless communication systems in a local area network. It has been shown that the integrity of data flow can be maintained within certain limits of the signal strength in a coverage area of an Access Point. The wireless can successfully be applied in industrial operations provided a careful site surveys has been be conducted and the boundaries are determined to ensure adequate signal strength to avoid any possible dropouts however short lived they may be.

Problem Statement

The present system of transferring data from the PLC to the SCADA system is by using a RS-232 cable and a RS-232 to USB convertor. This process or phenomenon of transferring of data is a risky process[2]. In this transmission, there are chances of data loss due to attenuation, and also there might be chances of getting delayed output. The proposal of this project is to transfer the data from the PLC to SCADA using a wireless medium. For this purpose, we use a Bluetooth module for the transmission of data. The inputs of the application is given to the PLC, from here they are transferred to the system containing SCADA by Bluetooth and then, these data are processed in the system and again send back to PLC by Bluetooth and further to the

output present in the application or process to be operated. The wireless medium of data transfer is highly present and used in developed countries. These countries do not share these technologies easily with other countries, and therefore demand high for setting up these technologies in other countries. To avoid money loss this technique of wireless transmission. This medium of wireless transfer can avoid data loss, connect multiple processes, and also easily operate them without much difficulty. This medium of transmission also helps to get a wide circular range, so that a maximum number of connections are made possible. The Bluetooth forms an adhoc network, and thus forms a network connection without much relying on the pre-existing infrastructure of the program. The adhoc network forms a peer-to-peer network connection and thus can be used for smooth operation of the process. These techniques of transferring of data can be implemented in large scale and small scale industries to overcome the problems created by the wired system present currently in the huge number of plants. We use PLC for its smooth working, efficiency, short scan time and also for its instant output based on logical program, which is programmed into it. The process consists of the controlling of the flow of water from tanks to the heater and the control of heater coil to maintain temperature.

Control of Boiler Using PLC

A. Process

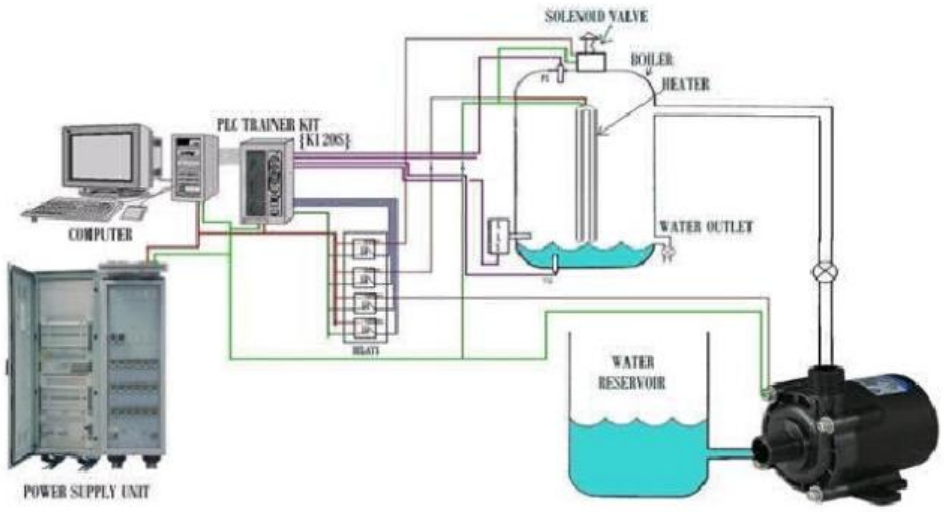

Figure 1: Diagram of boiler control using PLC

The process starts with manual feeding of water into the source tank. Then the low level sensor in the source tank is in the on state. Also the low level sensor of the process tank is also in the "on" state. This causes the pump1 to turn "on", thus causing the water from the source tank to move into the process tank. This increases the level

of water in the process tank causing it to activate the high level sensor present in the process tank. Now, when the high level sensor gets activated, the pump1 turns "off", causing an interruption in the flow of water from the source tank to the process tank. Also the low level sensor in the steamer is in "on" state. Now, when the high level sensor of the process tank and the low level sensor of the steamer are in "on" state, the pump2 automatically turns "on". This causes the flow of water from the process tank to the steamer. Also the water flow from the process tank to the steamer is interrupted after the boiler reaches a particular set point defined by the user/operator. Once the water level in the steamer reaches the defined set point, the pump2 turns "off". This prevents the flow of water from the process tank to the steamer to get interrupted. Also the steamer consists of a temperature sensor that senses the temperature and gives its analog value to the PLC. The level sensors from the source and the process tank and from the steamer are connected to the LM324 comparator block, which is also connected to the ULN2803. These values are given to the PLC for using I/O modules (Input / Output modules). The values from the PLC are transferred to the SCADA operating system using Bluetooth medium of wireless transfer.The data's are logically analyzed and sent back to the PLC which performs the required function, by controlling the water level and temperature. SCADA system consists of software required for interfacing which is known as PLC CX-programmer. The CX-programmer used ladder diagram for its operation. This ladder diagram for the process is given below:

B. Ladder Diagram

This is the first page of the program. In this page we make use of the inputs, memories and output icons for the neat representation of the program. In the first rung we make use of a start button for starting the process and the emergency stop button as normally closed contact, so that in case of emergency we can stop the process directly by just hitting the emergency stop button. In the second rung we have configured connections for the program to be operated in the automatic format. In the third rung, we have configured connections for the program to be operated in the manual mode. In the 4th, 5th, 6th and the 7th rung we have given memory allocation addresses for the four types of sensors we use. In the 8th rung we have given connections for the activation of the heater. Finally in the last two rungs we have given connections for the outputs, which are pump1 and pump2.

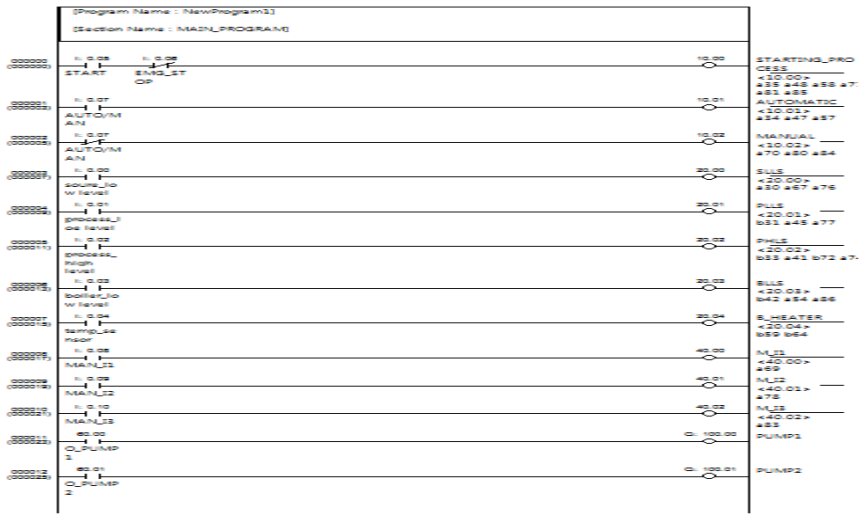

Figure 2: Main page of ladder diagram

This is the second page of program for the process. This page of program is fully automated. This means that this process does not need any manual attendance, and it operated just with a single start button. Nowhere in the process, there is any activation of switch by an external force.

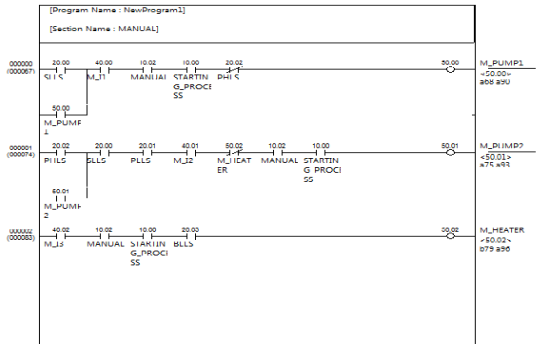

Figure 3: Manual page of ladder program

This is the third page of the program for the project. In this page, the program is based on manual activation. This program is used just for the purpose of safety. If there is any mal-function in the automatic system, then this manual mode is used.

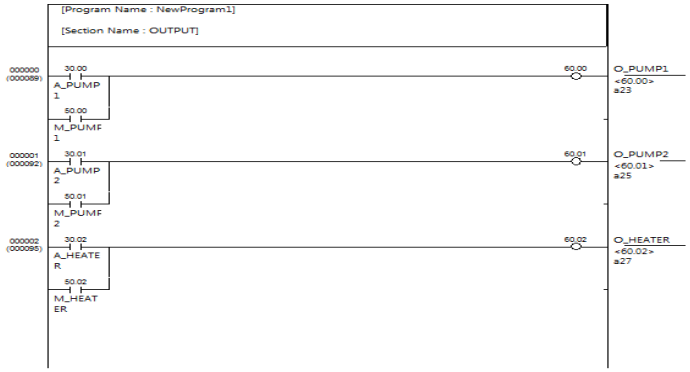

Figure 4: Manual page of ladder diagram output

This forms the fourth page of the program of the project. This page consists of an output which gets activated by the switching actions taking place in the 1st, 2nd and the 3rd pages of program.

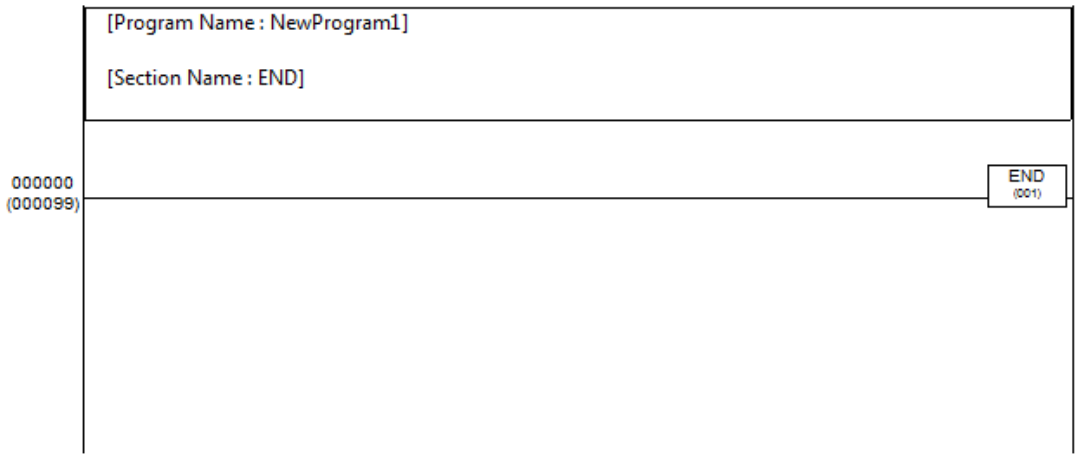

Figure 5: End page of ladder diagram

This page is the last and the final page of the program. This page marks the end of the program. The PLC scans the program and when it comes across the "END" statement it stops scanning further.

Control of Boiler using SCADA

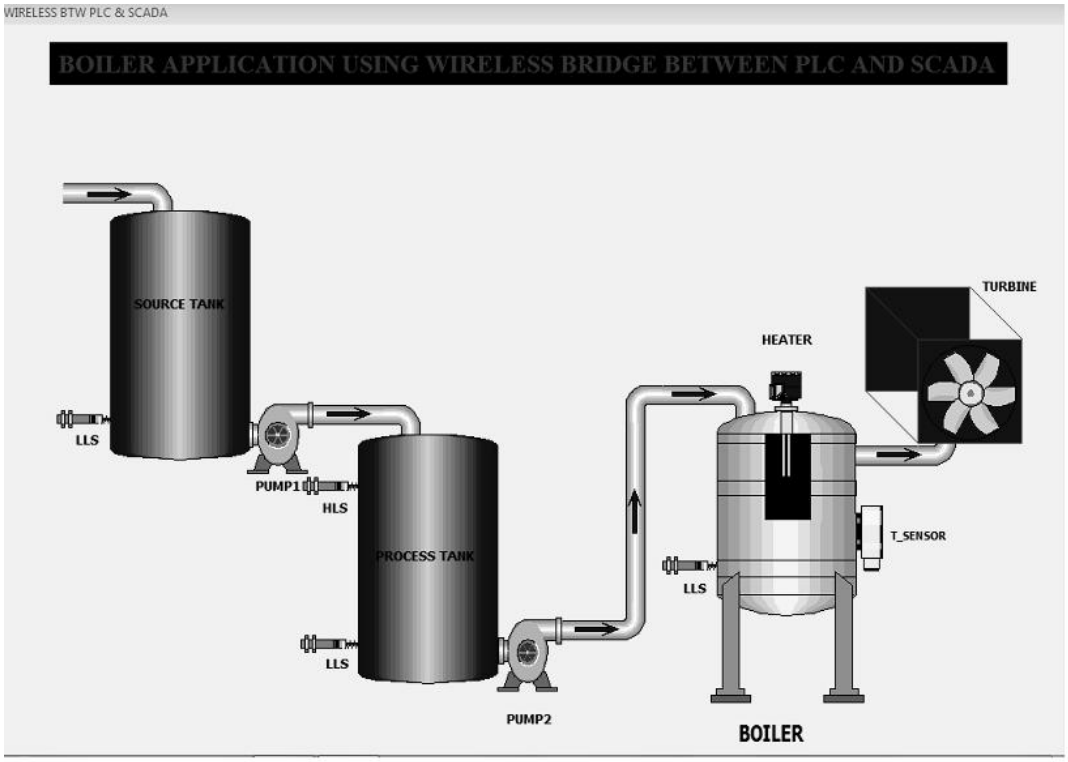

Figure 6: control of Boiler using SCADA

The data's are logically analyzed and sent back to the PLC which performs the required function, by controlling the water level and temperature. SCADA system consists of software required for interfacing which is known as PLC CX-programmer.

The water flow from the process tank to the steamer is interrupted after the boiler reaches a particular set point defined by the user/operator. Once the water level in the steamer reaches the defined set point, the pump2 turns "off". This prevents the flow of water from the process tank to the steamer to get interrupted. Also the steamer consists of a temperature sensor that senses the temperature and gives its analog value to the PLC. The level sensors from the source and the process tank and from the steamer are connected to the LM324 comparator block, which is also connected to the ULN2803. These values are given to the PLC for using I/O modules (Input / Output modules). The values from the PLC are transferred to the SCADA operating system using Bluetooth medium of wireless transfer.The data's are logically analyzed and sent back to the PLC which performs the required function, by controlling the water level and temperature. SCADA system consists of software required for interfacing which is known as PLC CX-programmer.

Control of Boiler Using Wi-Fi

Wi-Fi is increasingly becoming the preferred mode of internet connection all over the world. To access this type of connection, one must have a wireless adapter on their computer. Wi-Fi provides wireless connectivity by emitting frequencies between 2.4GHz to 5GHz based on the amount of data on the network. Areas which are enabled with Wi-Fi connectivity are known as Hot Spots. One can use advanced softwares like Wireless on to detect and request connection to Hotspots. To start a Wireless connection, it is important that the wireless router is plugged into the internet connection and that all the required settings are properly installed.

In this paper Wi-fi is used for controlling the boiler parameters. Wi-fi works with no physical wired connection between sender and receiver by using radio frequency RF technology, a frequency within electromagnetic spectrum associated with radio wave propagation[10]. When an RF current is supplied to an antenna, an electromagnetic field is created that then is able to propagate through space.

The controller used here is a computer which includes a wireless adapter that will translate data sent into a radio signal. Internet control system that can manage the main **central heating and hot water** requirements. The controller consists of PLC and SCADA module. It translates the data to the radio signal. This same signal will be transmitted, via an antenna, to a decoder known as the router. Once decoded, the data will be sent to the Internet through a wired Ethernet connection. As the wireless network will work as a two-way traffic, the data received from the Internet will also pass through the router to be coded into a radio signal that will be receipted by the computer's wireless adapter.

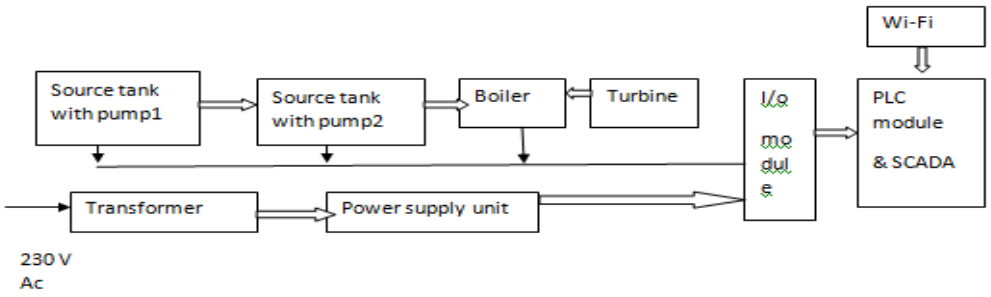

Fig 7: Control of Boiler using Wi-Fi

Conclusion

In this paper the control of boiler parameters by PLC, SCADA using Bluetooth and Wi-Fi are compared. PLC andSCADA are connected with a wireless medium, that is, the Bluetooth module. It can control all the parameters over a particular distance. For short distance this scheme will give best end result. In case of long distance the controller produces bother in the performance of the system. Moreover the PLC and SCADA won't provide control for long distance. In order to carry away this problem Wi-fi is used. By using this method the Boiler parameters can be controlled from anywhere in the world provide with the internet connection. It can control all the

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