Smart Industrial Control with Energy Management using Android System

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Abstract

Now a days industries are uses the HMI for controlling various parameters. If the controller wants to control the parameters then the controller has need to go at the industry. It is more consuming the time. To reduce this problem we will make this project. This project will supervise and control the industrial parameter like temperature, pressure, weight etc. by using the android phone through static IP or dynamic IP. In this system the PLC panel will receive the data of parameters and it will give the data to SCADA and there is interfacing between SCADA and android phone through VNC app and create the VNC server in computer. The energy management requires because in today's world, energy and demand costs have skyrocketed and certainly impact any industry's balance sheet. The system has main benefit is that the HMI will reduce and easily comfortable way to control the industrial parameters from any place. This project will use in that type of industry in which the temperature, pressure, weight etc. parameter has importance like ceramic industry, cement industry etc.

Keywords: Automation System, To Control Industrial Parameter Using PLC & Android System, Energy Management, Designing In SCADA, MCB, PLC, Scanner, Thermocouple

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I. INTRODUCTION

Most of industries are uses HMI for the controlling purpose of parameters means generally in the industry the parameters are controlling by manually and it is more time consuming. It means that for the purpose of controlling the industrial parameter the controller must need to go at each plant and then controller can control it. The energy management requires because in today's world, energy and demand costs have very high and certainly impact any industry's balance sheet. It is also important to understand the quality of the power being received. Poor power quality reduces productivity and is detrimental to equipment, which can drive down a company's profits. To reduce this problem we designed this project. This project will supervise and control the industrial parameter like temperature, pressure, weight etc.

We will use the android phone for the purpose of direct controlling the parameter of industry through static IP or dynamic IP from any place. The android phone is connected with SCADA which is installed in computer and there is interfacing between SCADA and android phone through VNC app and create the VNC server in computer and the computer is connected to PLC through RS232 communication protocol. And at PLC inputs and outputs are connected. The input data or value from the sensors and load cell or other input device is gives to the scanner and then PLC and PLC gives it to the computer then SCADA. Then through static IP or dynamic IP in the android phone we can show the status of industry and parameter and also control it. Then phone gives data to PLC to control it.
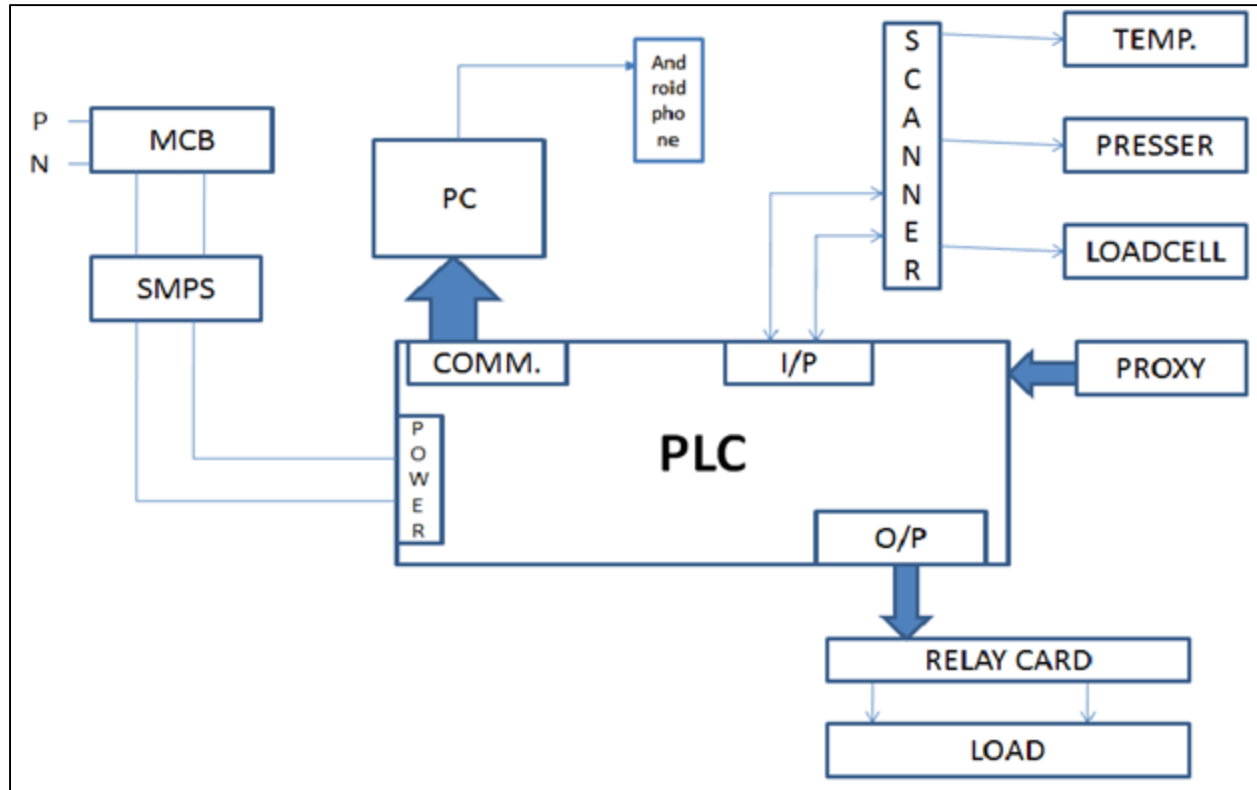
II. BLOCK DIAGRAM

Fig. 1: Block Diagram

The working of the block diagram is that first the power gives to SMPS through MCB. Then the SMPS gives power to PLC. There is connected a computer to PLC. The PLC gives the data to computer and in the computer there is SCADA installed by that we can observe or monitor the parameter readings and we can show the status of industry. There is connection between PLC and computer using RS232 communication protocol. The Android phone connected to the SCADA through static IP or dynamic IP. After scanning the data or value of temperature, pressure, load, etc. are gives at the input of PLC. There is connection between PLC and scanner using 485 communication protocol. At the output of PLC the relay card is connected and through it load is connected with PLC. The relay card is gives the input to the load and load is working by the input of PLC.

III. PANEL DIAGRAM

The fig. shows the panel diagram of smart industrial control system with energy management using android system. There are three input device thermocouple, load cell & pressure sensor. There is on switching device proxy sensor is directly connected to PLC. There is also four output device heater, lamp, blower & d.c.motor. As shown in fig the input device is connected to scanner at terminal c1, c2&c3. And 230v power gives to the scanner at line & neutral terminal. There is connection between scanner and PLC through RS485 communication cable. The input devices are connected to relay card. Input device's one terminal is connected NO contact of relay and other is neutral of 230v and its line terminal is to common contact of relay.

The other input device's connection like lamp & blower are same like heater. But connection of d.c.motor is different. In this we use 12v d.c.motor so first we need convert 24v into 12v. So we use 7812IC. The connection of 7812IC is as shown in fig. The relay card connected to PLC & SMPS. The negative terminal of relays' is connected to output of PLC y0, y1, y2 & y3 and the positive terminal connected to +24v of SMPS. There are three terminals black, blue & brown of switching device proxy. The black is connected to x0 input of PLC blue is to negative of SMPS and brown is to +24v. PC is connected to PLC through RS232 communication cable. And there is connection between PC and android phone through IP.
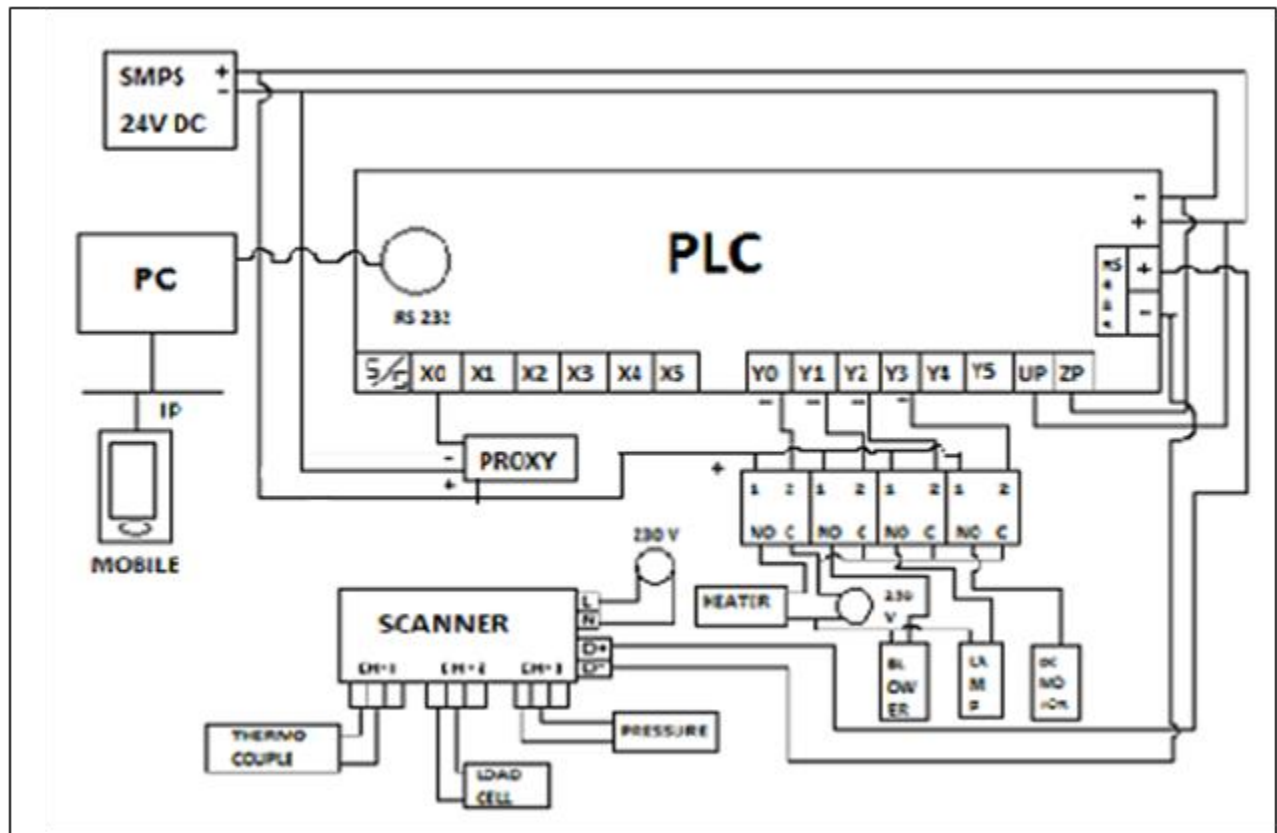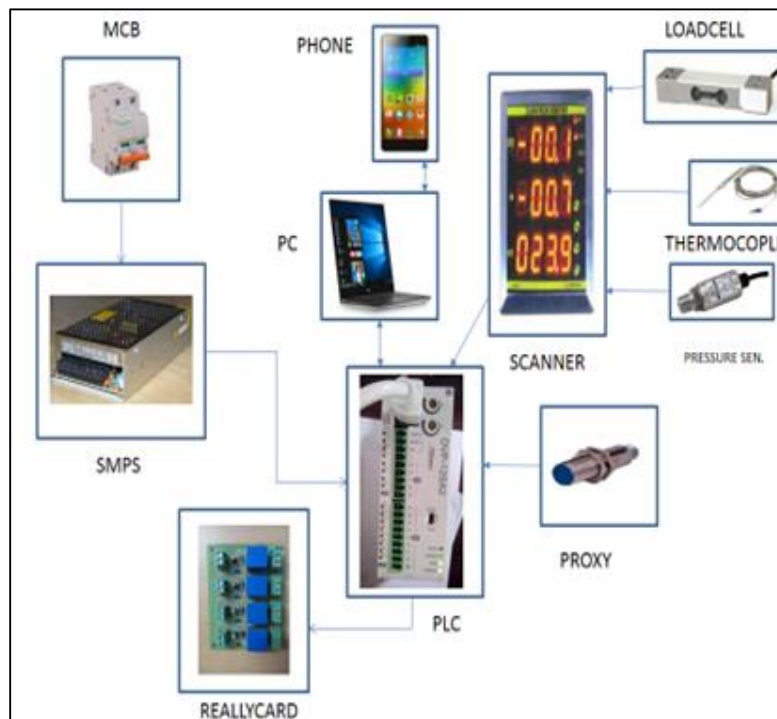
Fig. 2: Panel Diagram

The operation is like that if we want control the parameter of industry so we need to give the command to android phone it gives to SCADA through IP. Then SCADA gives it to PLC through RS232 cable. And it works as we give the command to phone.

IV. WORKING MODEL

Fig. 3: Working Model

In the fig. there is shown the working diagram of this system. There is shown the connection between object. In this system in any plant if there is need to control the parameter like temperature, pressure, weight, etc. of the industry then it gives the notification on phone then we gives the command for control it. The whole operation is like as. First the input devices like thermocouple sense the temperature of it ranged area, pressure sensor sense the pressure of air or other, load cell for measure the weight of object, proxy sensor measure the distance of any object from it. This input devices gives this data to the scanner but proxy gives data directly to PLC it has no need of scanner. And the scanner gives data to PLC.

The PLC operates at 24v and it got the 24v from SMPS. This all data we can show on PC in SCADA system. The PLC is directly connected to PC through RS232 communication cable. And the connection between scanner and PLC is through RS485 communication cable. And the PC is connected to android phone by using of IP. For control the parameters through phone we can control by only using of VNC app. Because of the android phone cannot support SCADA parameter directly. So we have need to install VNC in phone. So if in industry there is need to control parameters then we need to command to phone it gives to SCADA then it gives to PLC. PLC gives it to relay card where at the load is connected and it works at follow the given commands. It means if temperature is low and we need high temp. then give command and heater is on and control the temperature process is same like other parameters. We can also set the values of parameters which we actually need.

V. HARDWARE

A. PLC

Fig. 4: PLC [1]

Programmable Logic Controller (PLC) is a control system using electric operations. It's easy storing procedures, handy extending principles, functions of sequential/position control, timed counting and input/output control are widely applied to the field of industrial control.

Delta's DVP series programmable logic controllers offer high-speed, stable and highly reliable applications in all kinds of industrial automation machines. In addition to fast logic operation, bountiful instructions and multiple function cards, the cost-effective DVP-PLC also supports various communication protocols, connecting Delta's AC motor drive, servo, and human machine interface and temperature controller through the industrial network in to a complete "Delta Solution" for all users.

The 2nd generation DVP-SA2 series slim type PLC offers bigger program capacity and executing efficiency, offering 100 kHz high-speed output and counting functions. It is extendable with DVP-S series left-side and right-side extension modules. [1]

Programmable logic controllers (PLCs) have been an integral part of factory automation and industrial process control for decades. PLCs control a wide array of applications from simple lighting functions to environmental systems to chemical processing plants. These systems perform many functions, providing a variety of analog and digital input and output interfaces; signal processing; data conversion; and various communication protocols. All of the PLC's components and functions are centered around the controller, which is programmed for a specific task. The basic PLC module must be sufficiently flexible and configurable to meet the diverse needs of different factories and applications. Input stimuli (either analog or digital) are received from machines, sensors, or process events in the form of voltage or current. The PLC must accurately interpret and convert the stimulus for the CPU which, in turn, defines a set of instructions to the output systems that control actuators on the factory floor or in another industrial environment.

B. THEROCOUPLE

Fig. 6: Thermocouple [2]

A thermocouple is an electrical device consisting of two dissimilar conductors forming electrical junctions at differing temperature. A thermocouple produces a temperature-dependent voltage as a result of the thermoelectric effect, and this voltage can be interpreted to measure temperature. Thermocouples are often used at high temperature and in reactive furnace atmosphere.[3]

C. Load Cell:

A load cell is a device that is used to convert a force into electrical signal. Strain gauge load cells are the most common types of load cells. Load cells are used for quick and precise measurements. The principle of operation of the Strain Gauge load cell is based on the fact that the resistance of the electrical conductor changes when its length changes due to stress.

A load cell usually consists of four strain gauges in a Wheatstone bridge configuration. The electrical signal output is typically very small in the order of a few millivolts. It is amplified by instrumentation before sending it to the measurement system. The output can be Digital or Analog depending on the application. [4]

D. Hardware Circuit:

Fig. 7: Hardware Circuit

There is shown the hardware circuit of this system. In it we can show the different components used in it. Four loads we used heater, lamp, blower & d.c.motor. We control the motor and rotate it as per our requirement by using trial & arrangement method. Because in this system our requirement that motor rotate reverse also and d.c.motor rotate continuously so we used this method and for that we needed extra relay. The motor operates at 12v so we need to convert the 24v to 12v for that we used the 7812IC. The connection is that 230v to the SMPS. Output of SMPS gives 24v and it distributes to components through relay card and MCB. The operation is like for temperature if the temperature is low of water or plant room or machine room then it gives indication on phone and we need to give command to control it. We give command to phone it gives to SCADA by IP then gives PLC by delta cable. Now relay card is connected to PLC and for control temperature heater is connected to relay card by given command the heater is on and take the temperature high. It same for high temperature but using cooler in place of heater. Same operation for pressure control for that we will use the blower. For control the weight we used the load cell. The vessel fixed on the load cell when we put the any weight on cell it sense and how we set the weight it senses that much load then load cell rotate and put down the load by using of d.c.motor. For proxy sensor it for the distance and counting purpose. When the load cell put load down there we fixed the proximity by that it cut the proxy sensor line and it counts. If we set the five count then when proxy counts five then the lamp is we used lamp for indication purpose in the project but in actual industry that is different like any window will open for packaging or etc. the connection between PLC and scanner is through RS485 cable and between PLC and PC is through RS232 and serial to parallel communication cable. And we used the VNC app in android phone because android cannot directly support the SCADA so we used VNC.

VI. MERRITS AND DEMARRITS

This project has many advantages compare to manual system. This project can be used to control various industrial parameters. We can control the parameters from a long distance, thus it gives ease of access. This project gives faster operation and efficient. There is no need to carry separate remote or any other controlling unit. In future it will be more accurate and speed of the process of controlling the industrial parameter.The output of this system is less time consuming.

The main disadvantage of this system is that if we want to control we must need the internet or Wi-Fi connection. Whenever we controlling through Wi-Fi if then then power failure condition is occur then we can't control that's why we required one UPS (Uninterrupted Power Supply) system. For controlling purpose we must require the android phone we can't control through simple java phone

VII. APPLICATION

This system has much application such as, for control the temperature of industry, for measurement of distance and control, for measure the accurate weight of object or job and reject the inaccurate job automatically, for control other various types of parameter in industry like paper, plastic, cement, etc.

VIII. FUTURE SCOPE

We make a system which gives desired and accurate output and in future this system will more accurate and perfect. This system will more helpful for owner or manager or authorized person of multi plant industries for control industrial parameters because in future by this system the whole industry will control.

IX. CONCLUSION

We make a system which gives accurate output and which is very beneficial for various types of industry. By this we can control the parameters like temperature, pressure, weight, etc of industry which are very important for industry through only one android phone form anywhere and any place. It means for control the parameters we don't need to go at the industry.

ACKNOWLEDGEMENT

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