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## Home Automation using PLC and SCADA

### Abstract

Home automation is an integral part of modern lives that help to monitor and control the home electrical devices as well as other aspects of the digital home that is expected to be the standard for the future home. Home appliance control system enables house owner to control devices Lighting, Heating and ventilation, water pumping, gardening system remotely or from any centralized location. Automatic systems are being preferred over manual system. This paper aims at automizing any home appliances. The appliances are to be controlled automatically by the programmable Logic Controller (PLC) DELTA Electronics DVP SX10. As the functioning of the Appliances is integrated with the working of PLC, the project proves to be accurate, reliable and more efficient than the existing controllers. It is a combination of electrical, electronic and mechanical section where the software used is Ladder Logic language programming. The visualization of the current status of the home appliances is made possible with the use of SCADA screen which is interfaced to the PLC through various communication protocols. Winlog visualization software is a powerful SCADA/HMI for industrial automation, process control and supervisory monitoring. This WINLOG SCADA software has the ability to Remote application deployment and change management. Also it has Modbus and OPC Connectivity and it is equipped with 3D GUI.

**Key words:** *Supervisory control and Data acquisition, programmable logical control (P.L.C).*

## 1. INTRODUCTION

Nowadays, the rapid development of information technology has brought powerful changes to the structure of automation system, and makes people to set a higher request to security, comfort and efficiency of home environment. Intelligent household devices have become a research focus in home automation industry, for how to let television set, refrigerator, lightings, alarm sensor, and other home devices work efficiently and easy to be used. Under such demand home appliances should not only operate by itself, but also with other devices together, i.e. they should be connected within a network for easy management. The smart grid concept includes the home/building automation system with better energy management and with superior quality of power

A home automation system integrates electrical devices in a house with each other. The techniques employed in home automation include those in building automation as well as the control of domestic activities, such as home entertainment systems, houseplant and yard watering, pet feeding, changing the ambiance "scenes" for different events (such as dinners or parties), and the use of domestic robots. Devices may be connected through a computer network to allow control by a personal computer, and may allow remote access from the internet. Through the integration of information technologies with the home environment, systems and appliances are able to communicate in an integrated manner which results in convenience, energy efficiency, and safety benefits.

In this paper we have concentrated on the control of "HVAC and Lighting system" in the home premises. The control of these systems is achieved by using various electronic circuitry .e.g. For HVAC system we used the PWM technique and for lighting load we had used the simple relay circuit. These electronic circuitry is controlled by the PLC and monitored by the SCADA.

## 2. COMPLETE BLOCK DIAGRAM OF HOME AUTOMATION SYSTEM

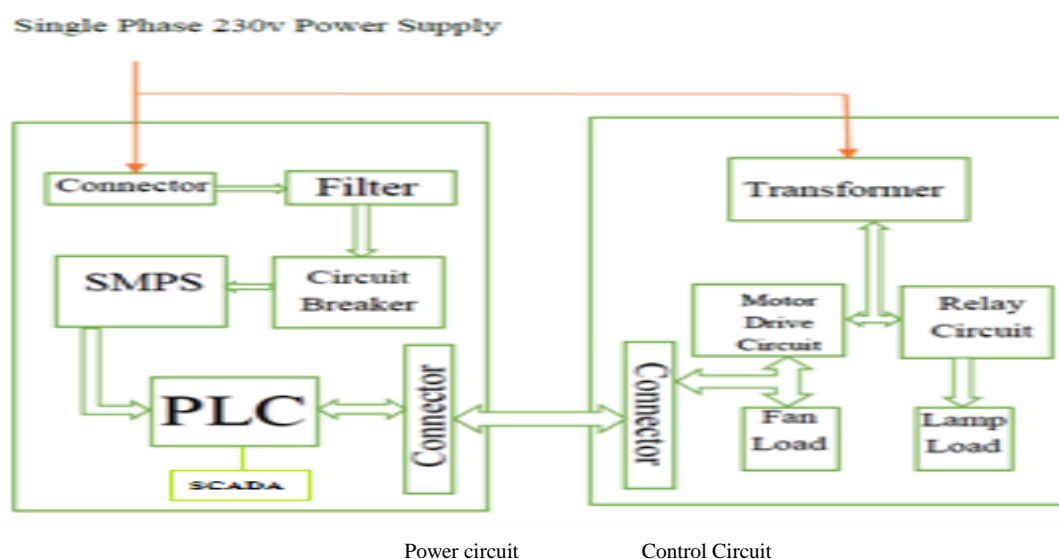


Fig.2.1 Complete block diagram of home automation system

## **2.1. MAIN COMPONENTS OF COMPLETE BLOCK DIAGRAM**

### **2.1.1 Hardware Requirements**

- 1) Programmable Logic Controller (PLC)
- 2) RS 232 To 485 Converter
- 3) Line Filter-single phase 0-230v
- 4) Miniature Circuit Breaker (MCB)- single pole 230v ac 2amp
- 5) Switched Mode Power Supply (SMPS) 0-25V DC
- 6) Voltage Regulators- IC7805, IC7812
- 7) Opto Coupler
- 8) MOSFET
- 9) Relay
- 10) Centre Tapped Transformer –input 230v ac ,output-12-0-12v
- 11) Fuse 0.5mA
- 12) BLDC Motor 12v DC
- 13) Lamp Load 230V 12W

### **2.1.2 Software Requirements**

- 1) Win log SCADA Software
- 2) Communication Protocols- MODBUS

## **2.2 WORKING OF THE SYSTEM**

Fig 2.1 shows the power circuit and control circuit diagram through which the Home Automation system can achieve the control of the equipment.

The single phase 230V supply is connected to the line filter unit; the main purpose of line filter is to remove the spikes from the input side and gives the pure sine wave at output side. After that this pure sine wave is fed to the miniature circuit breaker. The MCB is used to protect the device or circuit or to avoid the damage from overload or short circuit conditions. It detects any fault condition and interrupts current flow.

After that the output of the MCB is fed to the Switched Mode Power Supply (SMPS) used as a switching regulator to convert electrical power efficiently. An SMPS transfers power from a source like mains power to a load. A switched mode power supply is used as a supply regulator to regulate either output voltage or current by switching ideal storage elements. The SMPS has greater efficiency because the switching transistor dissipates little power when acting as a switch also it has smaller size and lighter weight.

The 24V output of the SMPS is fed to power the PLC. The PLC is interfaced with the SCADA software using WINLOG LITE communication protocol through which all control operations are performed and the current status of the equipment is visualized on the SCADA screen through the personal computer. The PLC operates on the ladder logic programming designed by the operator in which two provisions are available i.e. the equipment's are

operated through the SCADA or by manually as per the ladder logic is to be designed with the switches which are provided on the control panel. The control is achieved by following two ways:-

There are two modes of operation mainly:-

1. Controlling by the SCADA and
2. Controlling by manual switches

### 1] Controlling by the SCADA

As the PLC is interfaced with the SCADA software, all the equipment's are operated from the SCADA screen as it can be visualized by the operator . The desired control can be achieved by the single click of the buttons provided on the SCADA screen. When the operation is running through the SCADA software then it cannot be operated through the manual switches.

The output of the PLC is fed to the control circuits through the connecting wires. As two applications are to be controlled the output of the PLC is fed to these two applications. Here we have attempted the control of two systems

- 1) D.C. Motor Speed Control (fan load)
- 2) Lighting Control

#### 1. D.C. Motor Speed Control (fan load)

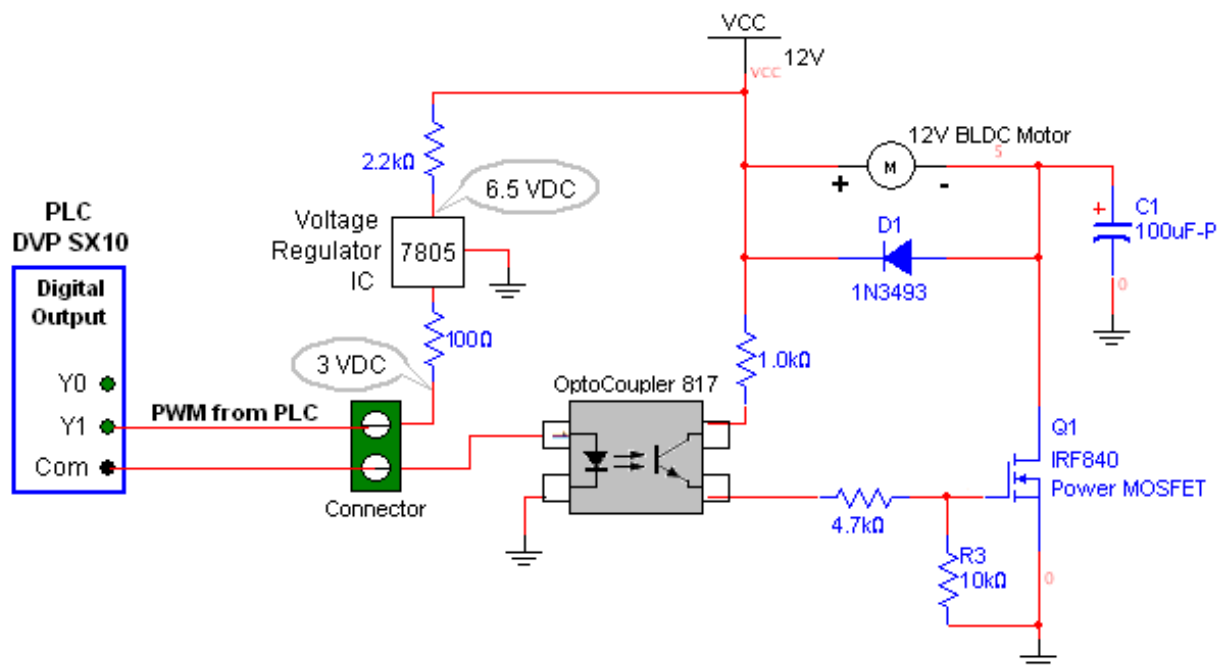


Fig 2.2:-Circuit of D.C. Motor speed control.

The circuit shown in Fig 2.2 for fan is called as ‘motor driver circuit’ which is used to drive the brushless DC motor of a fan. In the proposed system we have used the DC motor. This Motor we can be operated with the help of PLC through SCADA window. For the speed control of this motor Pulse Width Modulation Technique is been used.

In the speed control circuit a Voltage regulator IC is used to maintain the output voltage level at a constant value i.e., +5V regulated power supply which is used to feed the DC Motor. Also the optoisolator is used to prevent high voltages from affecting the system receiving the signal. And through the various resistors the 12 V D.C. supply is fed to the motor.

## 2. Lighting Control

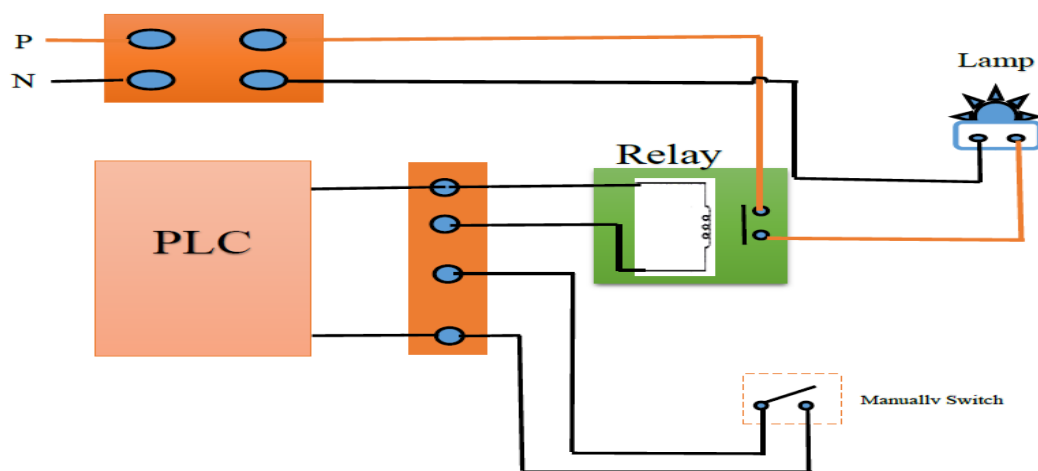


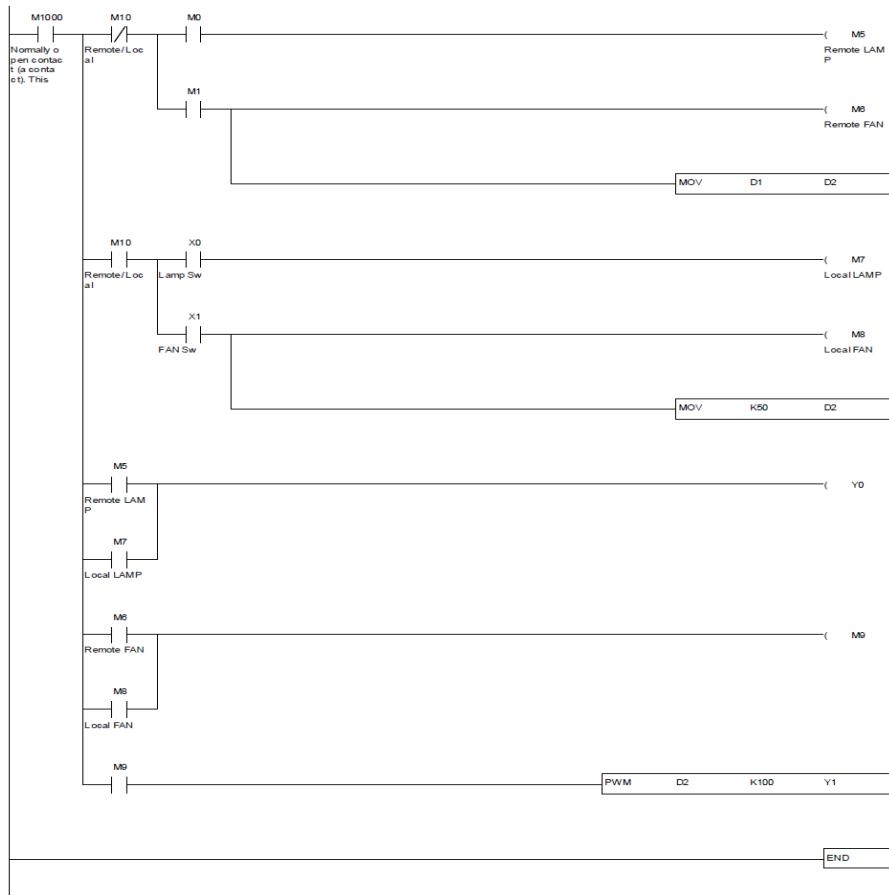
Fig.2.3:- lighting control circuit diagram

In lighting control system relay controls a circuit by a low power signal with complete electrical isolation between control and controlled circuits. Through this relay the load can be protected from the damage as it is isolated when any abnormal condition is occurred at the circuit. The motor drive circuitry requires 12 V D.C. supply so it is obtained by the rectifier circuit. In this rectifier unit the IC 7812 used as a voltage regulator and is used to regulate the voltage up to 12 V after is completely rectified. The centre tap transformer is used to give the output of 12-0-12 V and is fed to the rectifier circuit for its processing.

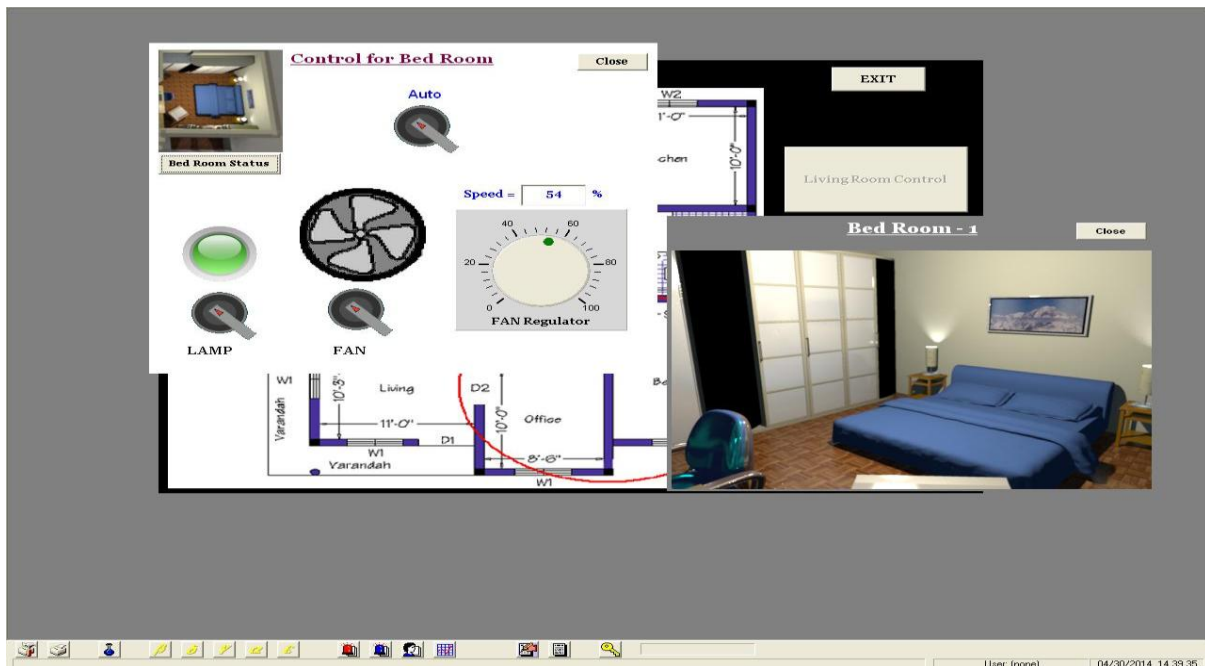
### 2] Controlling by manual switches

The control of appliances can also be achieved by the manual switches. By selecting ‘manual control mode’ in the ladder logic the appliances can be controlled using the ON/OFF switches provided on the panel. Again the result of current status will be displayed on the screen.

### 2.3 Ladder Diagram



### 2.4 SCADA Screen



The SCADA screen provides the current visualization of appliances in the home automation system. Here by using this SCADA screen we can control the lighting and fan using the switches provided on the screen.

The output or the current/running status indication is displayed on the screen. The regulator on the screen can be adjusted for the desired speed control of the fan.

### 2.5 Actual Image

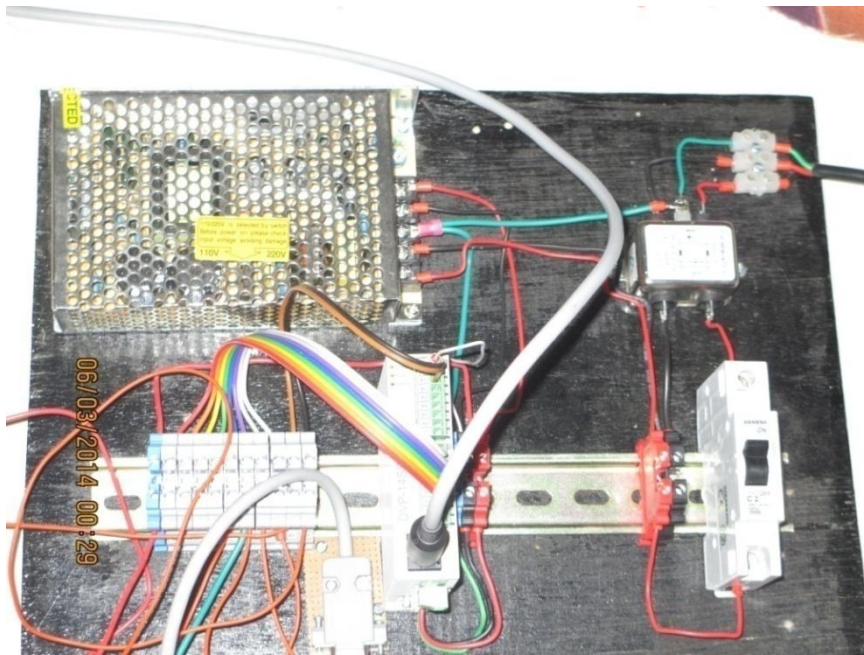


Fig 2.4 power circuit

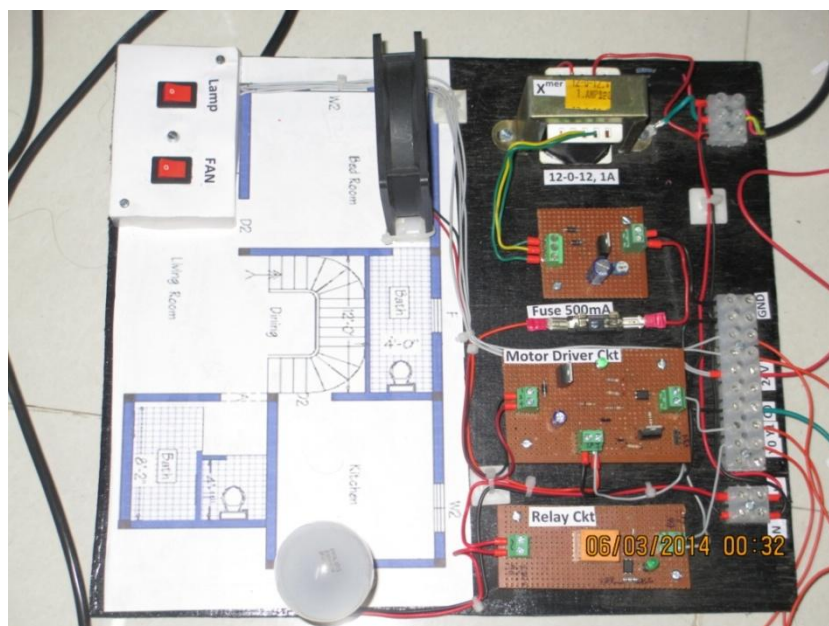


Fig 2.5 Control circuit

### 3. CONCLUSION

The proposed system can be extended to include many number of other appliances or systems of building or home automation like water sprinklers, ventilation systems ,burglar alarm and many more .To accommodate such systems more efficient PLCs with many more number of input /output has to be used which invariably will increase the cost of the system also.

The proposed system will be very helpful for physically challenged and home bound elderly people as the desired control of appliances can be made possible from a fixed central location. By using GSM/GPRS or by simple transmitter and receiver circuit remote control of the appliances is possible which will further enhance the utility of the proposed system.

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