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Automation of Commercial Building Using PLC

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Abstract: International reports show about 25 to 35% energy saving potential in commercial buildings. Many buildings in India, situated in different climatic zones are energy inefficient since they were not constructed following energy conservation building codes and techniques of solar passive architecture. It is impractical to redesign and reconstruct such buildings. In such cases retrofitting of utilities provides a cost effective solution than going for altering the existing building structures. The aim of our project is to present the results generated from a detailed energy audit study conducted in an commercial buildings to propagate the awareness of energy saving potentials in Indian buildings. Based on data collection and measurement undertaken, the present case study envisages many energy-saving measures to be considered for implementation towards achieving the energy saving potential in the identified areas. The identified areas were Air conditioning, Lighting, UPSs, Power factor improvement and installation of Energy Management System (EMS).
Commercial Automation means automation of commercial building. Increasing profitability is the essence of the sustainability of a commercial building or space. There are different methods of commercial automation Microcontroller based, IOT based, IED based, and PLC based automation out of that we are considering Programmable Logic Controller (PLC) based automation.
Keywords: PLC (Programmable Logic Controller), Sensors-Proximity Sensor, Illumination Sensor, Rtd, Current Transformer, Potential Transformer.

I. INTRODUCTION

Business Automation implies computerization of business building. Expanding productivity is the pith of the manageability of a business building or space.

There are diverse techniques for building automation Microcontroller based, IOT based, IED based, and PLC based mechanization out of that we are thinking about Programmable Logic Controller (PLC) based computerization.

A. Traditional Strategy

The term mechanization, propelled by the prior word programmed, was not broadly utilized before 1947, when Ford built up a robotization office.

It was amid this time industry was quickly receiving criticism controllers, which were presented in the 1930s. Computerization can be characterized as the innovation by which a procedure or technique is performed without human help.

As it were, Automation or programmed control, is the utilization of different control frameworks for working gear, for example, hardware, forms in production lines, boilers and warmth treating broilers, exchanging on phone systems, controlling and adjustment of boats, air ship and different applications and vehicles with negligible or decreased human mediation, with a few procedures have been totally mechanized.

B. Different Types of Tools for Automation
1) ANN – Artificial neural system
2) DCS – Distributed Control Network
3) HMI – Human Machine Interface
4) SCADA – Supervisory Control And Data Acquisition
5) PLC – Programmable Logic Controller
6) Instrumentation
7) Motion Control
8) Robotic

C. Components and it's Rating

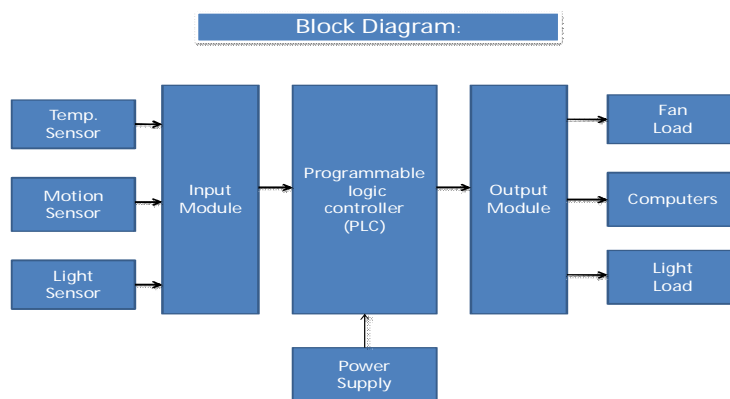| SR.NO	COMPONENT	NUMBER OF REQUIREMENT
1	PLC	1
2	ETHERNET CABLE	1
3	CT	1
4	PT	1
5	RTD [PT 100]	1
6	CONNECTING CABLE	AS PER REQUIREMENT
7	TRANSMITTER	1
8	SMPS	1
9	ISOLATION TRANSFORMER	1
10	AI-561 MODULE	1

BLOCK DIAGRAM

Fig. Block diagram of PLC with sensors and load

D. Explanation

Processor Section: The processor unit of PLC consist of RAM, ROM, logic solver, user memory, CPU. CPU controls and monitors all operations within PLC. It makes decision and executes control instructions based on the program stored in memory.
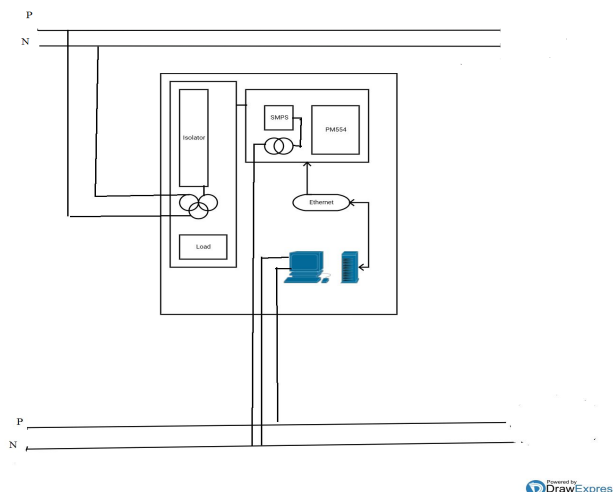
Input and Output Module: The input module is a mediator between input devices and central processing unit which is used to convert analog signal into digital signal. The output module is a mediator between output devices and central processing unit which convert digital signal into analog signal.

Power Supply: Power supply is given to the processor unit, input and output module through SMPS. Generally input supply required for PLC is 0-24 volt.

Memory Section: The CPU consist of memory section in which data and information can be stored. User memory is used to store user application program.

Programming Device: These devices are used for loading the user program into the program memory or for rewriting the program. Hand held terminal (HHT) or personal computer are programming devices commonly used in most of the PLC's.

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E.   Circuit Diagram

F.   Programming Languages Used in Plc

A program is a set of instructions developed by the user. User can develop a program and store it in the memory of PLC using programming languages. As PLCs have developed, programming languages have also developed with them. The IEC 61131-3 standard (International Electro-Technical commission) gives specifications for PLC programming languages. These languages include:

1)   Two graphical languages: Ladder Diagram (LD) and Function Block Diagram (FBD)
2)   Two text based languages: Structured Text (ST) and Instruction List (IL)
3)   Sequential Function Chart (SFC)

Ladder logic or diagram is a graphical system of symbols which is similar to relay control circuit diagrams. Engineers and technicians who are familiar to relay circuit diagrams can learn and use ladder diagrams easily. Thus the most commonly used language for PLC programming is Ladder Diagram or Ladder Logic.

Ladder logic Bit or Relay Instructions

Instruction	Symbol	Function
Normally Open or Examine ON	||	Tests for ON condition in a reference address
Normally Closed or Examine OFF	|/|	Tests for OFF condition in a reference address
Output Coil	( )	Turns ON real or internal output when logic 1(true)
Not Output Coil	(/)	Turns OFF real or internal output when logic is 1(true)
Latch Output Coil	(L)	Keeps an output ON once it's energized
Unlatch Output Coil	(U)	Resets a latched output
One Shot Output	(OS)	Energizes an output for one scan or less

Table No1 Ladder logic Bit or Relay Instructions:

G. Software used for Programming

There are various types of software's are used depending upon the manufacturer of the PLC. Here we are using Windows 7, 8, 10 and CoDesys software, ABB control builder plus 2.2.0, indusoft 2.0.

H. Component used for Automation of lab

Various types of component are used as input devices such as different types of sensors, switches, push button etc. In laboratory the main load is fan, light, computers. So, for automation of lab only temperature sensor, light sensor and accupancy sensor, motion sensor are required.

1) *PIR Motion sensor:* PIR (Passive Infrared Sensor) is a electronic sensor used to detect the movement of human being within a certain range. The PIR sensor circuit consists of three pins, power supply pin, output signal pin, and ground pin. It is having a dome like structure called as Fresnel lens. Generally, the PIR sensor power is up to 5 volt. The output of PIR sensor is digital output.


2) *Temperature sensor:* RTDs (Resistance Temperature Detectors) are temperature sensors that contain a resistor that changes resistance value as its temperature changes. They have been used for many years to measure temperature in laboratory and industrial processes, and have developed a reputation for accuracy, repeatability, and stability. Various ranges of RTD are available.

3) *Light sensor:* For lighting load control light sensor such as LDR is used. LDR (Light Dependent Register) is a light controlled variable resistor. The resistance of LDR decreases with increasing light intensity. In other words it exhibits photo conductivity. A photo resistor can be applied in light sensitive detector circuits. The resistance of an LDR may typically have the following resistances:

   Daylight: 5000 ohm
   Dark: 200000000 ohm
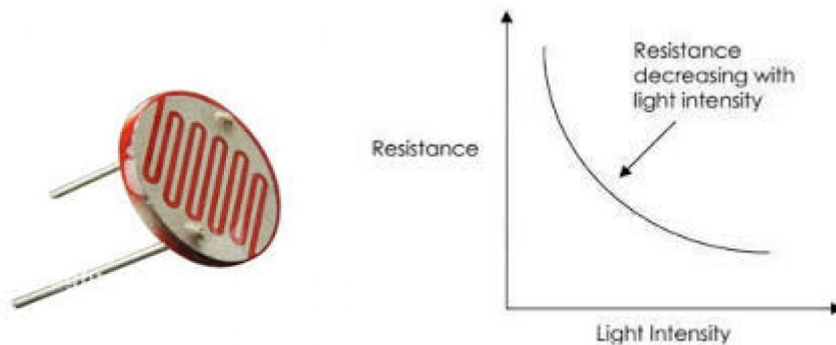
I. PLC Module

we are using PLC Module: ABB AC500 PM554 AI561.

The AC500 PLC range consists of various CPU's, I/O modules, communication modules, communication interface modules and accessories.

Fig. AC500 PM 554 AI561 Module

J. Specifications of AC500 PM 554 AI561 Module

1) Ambient Air Temperature

   Operation: o to 60^0 C

   Storage: -40 to $+70^0$ C

2) Analog Inputs: 4 channels, 0 to 20mA, 4 to 20mA, 0 to +5v, 0 to +10v, -2.5 to +2.5v, -5v to +5v, usable as digital input, 12bit +sign.

3) Digital I/O's:

   8 Digital inputs and 6 Digital outputs.

4) I/O Option:

   eCo-IO module with Onboard IO - 4AI

5) Voltage Required:

   Supply Voltage (DC): 24 V

   Supply Voltage (AC):100 to 240 V

6) Programming Software:

   AC500 ABB Control Builder Plus

7) Program memory: 128kb

8) Communication method: Ethernet

II. CONCLUSION

Commercial automation of the building was done to find out the energy consumption by various equipment installed in the building. This led to identification of opportunities for energy saving. Energy saving proposals that were cost effective was proposed.

REFERENCES

[1]. Swati C A, Hemanth Kumar S,Annnapa A R,"Smart street lighting system based on sensors using plc and scada " International journal of mechanical engg. And tech. ,issue 9,sept.2014.

[2]. Mehul S.Prajapati,Ashish G. Patel, "plc and scada based automation of commercial revers osmosis desalination plant" International journal of engg. Research and tech.,issue3,march 2014

[3]. Sezgen,A.O. and Y.J.Huang.1994 "lighting interactions and their effects on annual and peak HVAC requirements in commercial buildings"

[4]. .Janda,K. andBush,J.1994. "worldwise status of energy standards for buildings" energy policy,vol.19,no.1.

[5]. .Swati C A, Hemanth Kumar S,Annnapa A R:"Smart street lighting system based on sensors using plc and scada "international journal of mechanical engineering and tech issue 9 ,sept 2014.

[6]. Mehul S.Prajapati, Ashish G. Patel, "plc and scada based automation of industrial revers osmosis desalination plant" International journal of engg. Research and tech., issue3,march 2014

[7]. Sezgen, A.O. and Y.J.Huang.1994 "lighting interactions and their effects on annual and peak HVAC requirements in commercial buildings"

[8]. Janda, K. and Bush, J.1994. "Worldwise status of energy standards for buildings" energy policy, vol.19, no.1.

[9]. Haberl J.S., and Claridge D.E., "An Expert Systemfor Building Energy Consumption Analysis: Prototype Results" ASHRAE Transactions, 1979.

[10]. Fels, J., Special Issue Devoted to Measuring Energy Savings: "The Socrekeeping Approach, Energy and Buildings."

[11]. This paper provides an overview of a general energy conservation measures (ECMs) that can be commonly recommended for an industrial facility.

[12]. Bureau of energy efficiency guide books, book 1, chapter 03 "Energy Management and Audit", Pg. 55-56.

[13]. Yao-Jung Wen and Agogino, A.M., "Wireless networked lighting systems for optimizing energy savings and user satisfaction" . IEEE Wireless Hive Networks Conference, 2008.

[14]. This paper provides the information about Smart building management system, Wireless sensor/actuator network, Android application. Aim is to design the system as cheap as possible and also easy to install.

[15]. 13. Martirano, L., "Lighting systems to save energy in educational classrooms" . International Conference on Environment and Electrical Engineering, 2011.

[16]. Advantage of the proposed system is that, it performs a smart lighting using a network platform to make it more comfortable for the users.

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