



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 Issue: VII Month of publication: July 2016

DOI:

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Energy Management System in Buildings using Programmable Logic Controller

Manivannan.T¹, Rajeshkannan.C², Manikandan.A³, Dineshkumar.R⁴, Murthy. S. E⁵
^{1,2,3,4}B.E/EEE, Knowledge Institute of Technology, Tamilnadu, India.

⁵Assistant professor/EEE, Knowledge Institute of Technology, Tamilnadu, India.

Abstract: All Buildings have some form of electrical and mechanical services in order to afford a comfortable living environment for human beings. Energy Management System in Buildings (EMS) is to systematize the usage of electricity in the most effective way possible for tenants and commercial scholars. The EMS is a standalone automatic system that checks for the pre-set value and take control towards the operation. Its inputs are timers, current transformers and outputs such as on/off signals which are connected to the devices for the operations. Residence times for different areas are programmed with in the PLC, such that the plant is brought on and off to meet the occupier requirements. For shift wise operation in factories, it helps to save energy. The energy saving is the most important criteria, which is an important factor to be considered for the growth of the nation as well as the organization. The wastage of electricity usage is reduced here.

Key words: Current Transformer, PLC, SMPS

I. INTRODUCTION

Now a days, the usage of electricity is getting bigger. It becomes necessary to control the usage of electricity as well as to reserve the electrical energy for our future generation. Effective well utilized Building Management Systems (BMS) enables Building Managers to provide the optimal working environment with maintaining the costs to both landlords and tenants. Effective BMS extends the operational life of equipment and systems through reducing loads and operating hours. Maintenance and capital costs are therefore reduced and less embedded energy is consumed through equipment replacement and upgrades. Whether a new installation or upgrades of an existing system, it is likely that significant financial commitment is required in order to pursue a BMS project. It is therefore important to ensure that the BMS is properly designed and specified process is closely controlled. This project is intended to reduce the energy wastage automatically. In a developing country like India, it is mandatory to save the energy resources and enhance the power generation for future. In recent times street lights are turned on and off with respect to the intensity of sun light. LDR will be used to turn on and off all lights, but after a certain time period it is not needed to have all lights to be lighten up. In class rooms and industries during tea and lunch break, it becomes compulsory to turn off the lights

II. LITERATURE SURVEY

Poorva M [1] “Development of Microcontroller Based Classroom Automation” In this project the objective is to automatically control the load i.e. fan and light. During class hours, time is usually wasted in many ways such as temperature and light variation. The idea is to plant several sensors around the classroom and give a calculated feedback to the response that these sensors receive. An example would be having temperature sensors around the. Classroom that would detect the temperature and respond to any change by alternating the fan speed. For light control, there will be proximity sensors that would detect student’s presence and allows the lights to turn on if students are near that area.

P.Shunmugakani, [1] “Building Management System Using PLC”. Here we use proximity sensors as input, which sense persons entering the room.

The ladder program is entered with a proper condition which is given below, when a person enters the room proximity sensor switches and hence any one of the light and fan turns ON. Applicable for, Industries like car manufacturing, chemical industries, Buildings like Malls, Hospitals The sensitivity of the circuit can be adjusted by varying the pre-set value.

Dr.D.V.Pushpa Latha [1] PLC based Smart Street Lighting Control (IJISA, ISSN 64-722014, Issue 01) The discussion about the project says that Conventional street lighting systems in most of the areas are Online at regular intervals of time irrespective of the seasonal variations. The street lights are simply switched on at afternoon and turned off in the morning. The consequence is that a large amount of Power is wasted meaninglessly. As energy consumption is an issue oincreasing interest, possible energy savings in public street lighting systems are recently discussed from different viewpoints. The main difference from other computers is that

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PLCs are armoured for severe conditions such as dust, moisture, heat, cold etc., and have the facility for extensive input/output (I/O) arrangements. In the proposed paper, street lights are controlled using millennium 3 PLC taking the seasonal variations into consideration. It gives the information on whether the summer/winter time Change is active or Inactive. It is based on the seasonal changes

III. PROPOSED SYSTEM

A. Programmable Logic Controller – PLC

A Programmable Logic Controller (PLC) or programmable controller is a digital computer used for automation of typically industrial electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. PLCs are used in many machines, in many industries. In our project, we are using GENIE-NX PLC (General Industrial Control PLC) for overload prevention in conveyor.

B. Current Transformer

A Current Transformer (CT) is an electric device that produces an alternating current (AC) in its secondary which is proportional to the AC in its primary. Current transformers, together with voltage transformers (VTs) or potential transformers (PTs), which are designed for measurement, are known as instrument transformers. In our Project, it is used to measure the load current in the crusher unit and provide signals to PLC and VFD to control the conveyor movement. In case of Overload, the conveyor is stopped.

C. RTC

A RTC (Real Time Clock) is present in the PLC which is used to provide commands according to the instructions given to the PLC such as the operating time and avoiding the operation at unnecessary situations.

D. Switched-Mode Power Supply

A Switched-mode power supply is an electronic power supply that incorporates a switching regulator to convert electrical power efficiently. Like other power supplies, an SMPS transfers power from a source, like mains power, to a load, such as a personal computer, while converting voltage and current characteristics. In our Project, it is used to convert 230V AC signal to 24V DC signal to provide supply to PLC and Current Transformer.

Block diagram

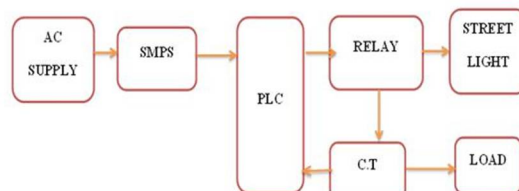


Fig.1 Block Diagram OF BMS using PLC



Fig.2 Prototype model proposed system

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IV. EXPERIMENTAL SETUP

During tea breaks and lunch breaks they might turn off. Or else it will make an unnecessary energy consumption which is not good for the country as well as to the organization. Because, it is an un desired expenses for the organization and a huge loss for the nation. So, during those times just visible lights are enough. In such cases, this project with above ladder diagram will be much helpful. I1 is the EB Supply. Q1 and Q2 are the two class rooms. ϕ_1 is the morning tea break, ϕ_2 is the lunch break, ϕ_3 is the timing after class, ϕ_4 is the evening break. $\phi_1, \phi_2, \phi_3, \phi_4$ is normally open.

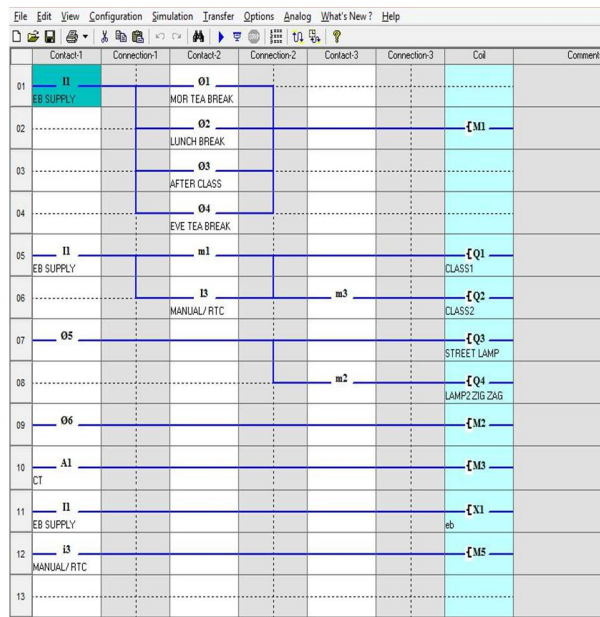


Fig.3 Simulation Diagram for Proposed System

For the lights in highway, schools, colleges, malls this will be an effective method for automation of lights and energy saving. Because after a time period people use public places rarely. In those timings only visible light intensity is enough just to view the site. It uses two input coils

ϕ_5 and ϕ_6 , Q3 and Q4 is output to control street lights. An extra coil M1 is used here. It is for time setting after which lights with zigzag arrangement alone switched on. Q3 is for normal glow of all street light and Q4 is for zigzag arrangement. As after a certain time period, lights with zigzag arrangement only made to glow, it improves the capacity of lights and effective way to consume low power. The zigzag arrangement of light can also be modified so that the life time of all lights are improved.

In general while using distribution generator as a source, the load should be maintained within the limit. The load level should not exceed the maximum capacity of the generator. If it exceeds, then the generator has to run more than its rated value which may lead to generator failure, increased cost of diesel, and un desired expenses. To limit this, the above ladder diagram will be helpful. From the DG, the loads are connected through a current transformer. The current transduces is noted as A1 in the ladder diagram. It has fixed current rating, when it exceeds the fixed value it automatically turn off the load which is mentioned.

V. CONCLUSION

There are various technologies available today that can help to reduce energy consumption and electricity cost of buildings. The project Energy Management System in Buildings using PLC has the advantages of simple operation and user friendly. PLC is used for automation, controlling and monitoring. This project ensures less maintenance, reduces risk factor and increases the efficiency of electricity usage. Occupants can install a EMS to automate building functions such as maintaining the temperature which can obviously reduce the cost of operating the building.

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