PLC Based Home Appliances control System

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Abstract- This paper demonstrates a live implementation of the smart energy saving home using Programmable Logic Controller (PLC). PLC is one of the mostly used controllers as it is easy to operate and controls task according to the program which is already fixed. So here is a room where there's no need to operate the appliances through switches. The fans operate automatically according to temperature and lights get turned ON according to the intensity of light signal and the door operate automatically according to push button and water is filled in the tank according to float switch

Keywords- PLC, Relay (DPDT), SMPS, Infra-Red through Beam Sensors, LED Indicator, Temperature Sensor, Light Intensity Sensor,pushbutton,float switch.

I. INTRODUCTION

In this project we have automatically control a room with the help of PLC. This is the technique which not only reduces the human effort but also saves time. In this project the main aim was to reduce the electricity consumption . The working is such that when a person will reach the entry gate of the room and at the same time press the push button then the door is opened or closed using motors with the help of PLC ladder language.In this room IR(Infrared) sensors and LDR(Light Dependent Resister)are placed in one side and at the same time IR(Infrared) sensor and temperature sensor are placed in other side. IR sensor is used to produced the IR beam and the beam is mainly used to detect the object.LDR is based on the principle of Photo conductivity.If the light intensity is incresed then the light gets turn OFF.If the light intensity is decresed,then the light gets turn ON. If the room is too hot,then the sensor will sense the temperature and passes the information to the PLC controler.Then the PLC operate the fan automatically depending on the room temperature.The main condition of the light system is,when the person will reach the IR beam then the IR sensor is set the logical condition [1]and at the same time, if the light intensity is incresed then the LDR is set the logical condition[0].so finally resultant boolean function is [0](AND operation[If Either one states are TRUE,then the output is FALSE]).otherwise IR sensor is activily [1] and Light intensity is decresed, then the LDR is set the logical condition [1].Then the resultant output is [1]

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(AND operation[If Both states are TRUE ,then the output is TRUE]).The main condition of the fan system is when the person will reach the IR beam then the IR sensor is set the logical condition [1]and at the same time, if the temperature is incresed then the temperature sensor is set the logical condition[1].so finally resultant boolean function is [1](AND operation[If Both states are TRUE,then the output is TRUE]).otherwise IR sensor is activily [1] and the temperature is decresed, then the temperature sensor is set the logical condition [0].Then the resultant output is [0].(AND operation[If either one states are TRUE ,then the output is FALSE]).In Water tank filling system contains three kinds of levels like LOW LEVEL,HIGH LEVEL, OVERFLOW. The main condition of the Water tank filling system is, when the float switch will reach the LOW LEVEL sensor, then the sensor is set the logical condition [1] and at the same time the ON DELAY TIMER will start to operated and also report to the motor gets turn ON.when the water level will reach the HIGH LEVEL sensor states, then the sensor is set the logical condition [0] and at same time the OFF DELAY TIMER will start to operated and also report to the motor gets turn OFF.In the particular case,if the HIGH LEVEL SENSOR is not responsed,then the water get starts to overflow state.so these kinds of problem solved by using buzzer system with the help of switches used to stop the process. Thus in this busy schedule we don't need to put any efforts in switching ON/OFF the lights and fans. Thus it is saving valuable time and is economical by saving the bill of electricity.This automated room will lead to reduction of human movement as the human does not need to move for switching on the appliances such as lights, fans etc. Motivation of this project is that it's making the working of equipment happen automatically thus it not only reduces the human efforts but also saves our precious time. We have implemented the hardware in the room. In this modern time PLC is also used even in our transmission system. By using PLC we can easily automate any device and in this project we are automating the room. Thus, this technique becomes time efficient. In this room, there are one fan and light system and door and tank filling system. These all four appliances are automated.The push button is very important in the door system.Forexample,If the separated IR sensor is placed on the door in both entry and exit side there's some problems are occur in particular state, that is some one person not enter

in the room but still he/she stay on the door(ENTRY) as well as cut the IR beam signal.In the particular case,the door will automatically opened (or) closed.so this is the major drawback of the system.These problems can be solved by using push button.The process of push button is,once he/she press the button,then the door is automatically opened using motor with the help ladder language and again press the push button the door is automatically closed.The working of our room is in two modes. First one is manual mode, in which all the appliances get turned on/off through switches. The other mode is automatic mode i.e. PLC mode. In PLC mode, all the appliances of the room get turned ON/OFF automatically through PLC switching. There is a control panel in the room and all the controls are established here. A changeover is installed for switching between PLC mode and manual mode. There are two LED indicators present indicating that which mode is in use. Other controlling consists of toggle switches. These switches are for presetting the appliances to control in PLC mode. Besides these features, energy is also used efficiently in this project. All the appliances are in use only when there is a need by any user. At the idol state, these components remain off. So energy consumption reduces. We have used PLC of Intra Logix L20 PLC. For converting 220V AC to 24V DC, switched mode power supply is used.

II. BASIC APPROACH FOR SMART HOME

The main objectives of our project can be summarized   asfollows:
*To design and develop smart room which is user friendly.
*To understand the energy consumption associated withroom   and   to   reduce   it.
*To make a program, which should be easy to understand   by   an   electrical   engineer.
*To use the most appropriate hardware components that would make the room more efficient and reliable.
*To develop a user friendly interface of control panel.
*This room is fully automated. There is no need of any kind of human efforts. This is associated with user friendly environment for the users. It is energy efficient and economical. PLC is used of 8 INPUT and 8 OUTPUT

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A.PLC

FIGURE.1:INTRA LOGIC L20 PLC

A programmable logic controller, PLC is a digital computer used for automation of typically industrial electromechanical processessuch as sequencing, timing control,counting,arithmetic,data manipulation etc. It can be viewed as an industrial computer that has a central processor unit, memory, input output interface and a programming device.The central processing unit provides the intelligence of the controller. It accepts data, status information from various sensing devices like limit switches, proximity switches, executes the user control program stored in the memory and gives appropriate output commands to devices such as solenoid valves, switches etc.In this project we have used INTRA LOGIX L20 PLC with 8 INPUT & 8 OUTPUT as shown in Fig. 1.

B. Power Supply

We are using Switch mode power supply. This supply converts the 220V AC into 24V DC with the current rating of 2 Amperes. There is a regulator also, by using which we can control the output value of SMPS. SMPS transfers power from a source, like mains power, to a load, such as a personal computer, while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy. Ideally, a switched-mode power supply dissipates no power. This higher power conversion efficiency is an important advantage of a switched-mode power supply.

C. Relay

In electrical engineering, relay is an electrical component that can break an electrical circuit, by interrupting the current or diverting it from one conductor to another. The most familiar form of relay is a manually operated electromechanical device with one or more sets of electrical contacts, which are connected to external circuits. Each set of contacts can be in one of two states: either "closed" meaning the contacts are touching and electricity can flow between them, or "open", meaning the contacts are separated and the switch is non-conducting. Relay we used is DPDT *(double pole double throw)* relay. It operate on 24V DC supply which is controlled by PLC.
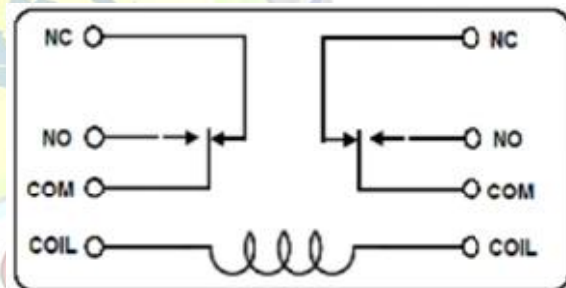

FIGURE.2:CONNECTION DIAGRAM RELAY

In this project, 8 DPDT Relays are used to provide switching action to the components installed. The first 2 relays are used for the lights and fans operation in automatic i.e. PLC mode. Likewise, other 2 relays are used for operation in manual mode with the help of switches. The push button installed on the gate for entry and exit are also switched with the help ofrelays, one relay for the entry purpose and the other for exit.Like wise 2 relays used for water tank filling system,one relay for low level detection and the other for high level detection.overflow can be indicated with the help of buzzersystem.If the tank get overflow,then the water filling process will be stoped with the help of timer system.

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D. LED

We are used 3 LED indicators in the project. The first indicator is installed with the reset switch to signify the user if he/she resets the system. The other two indicators are used with the changeover on the control box to indicate which mode he/she is using i.e. manual mode or automatic mode.

E. Infrared Sensors

In this project, we are usingInfrared Sensorswhich are installed at the light&fan system sensing person entry & exit. It is a sensor able to detect the presence of nearby objects without any physical contact.The object being sensed is often referred to as the sensor's target. A sensor consists of an emitter and a receiver. An Infrared beam is emitted by emitter and received by the receiver. If any obstacle comes in between them, the receiver senses obstacle and gives the signal to the PLC. These sensors work on the supply of 24V DC. These sensors are of NPN type.

F. Temperature Sensor

Temperature Sensor is used for sensing the temperature in the room. The temperature is getting measured by sensor and the output is transferred to the controller. Controller decides the action of output relay according to the temperature which is preset by the user.

G. Light Intensity Sensor

A light dependent resistance (LDR) is used for the whole set up of light intensity measurement. LDR is a light-controlled variable resistor. The resistance of an LDR varies with increasing incident light intensity. A light dependent resistor works on the principle of photo conductivity. Photo conductivity is an optical phenomenon in which the material's conductivity gets increased when light is absorbed by the material. So the whole setup is light dependent device.This device is associated with measuring device and analyzes the light in the room.If the light intensity is more than 30 Lux in the room then it keeps the output value (0), but as the light intensity gets decreased then a proper output get produced as true (1) condition.

H. PLC Programming

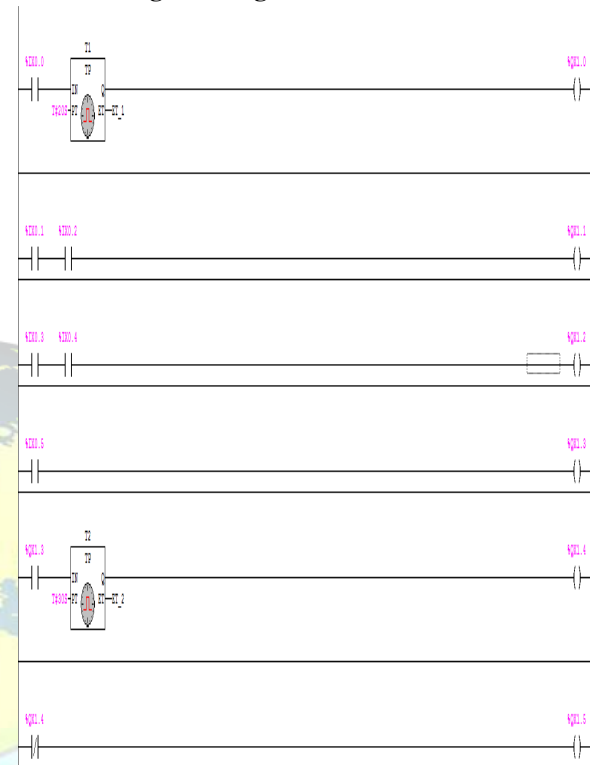FIGURE.3:LADDER LANGUAGE IN DOOR,LIGHT,FAN,WATER FILLING SYSTEM

The program is made such that when the person passes through the IR sensors then only the supply will get switched ON/OFF.IR sensor is activily [1] and Light intensity is decresed, then the LDR is set the logical condition [1].Then the resultant output is [1] (AND operation[If Both states are TRUE ,then the output is TRUE]).The main condition of the fan system is when the person will reach the IR beam then the IR sensor is set the logical condition [1]and at the same time, if the temperature is incresed then the temperature sensor is set the logical condition[1].so finally resultant Boolean function is [1](AND operation[If Both states are TRUE,then the output is TRUE]).In the door system, when the person once pressed the push button,then the pulse timer is activated to opened (or) closed the door in particular time period. In case, he/she passes through one sensor and step back, the preset value of timer given to the particular sensor resets it and the

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sensors come back to the initial stage resulting to less chance of errors. Also, reset switch is provided to initialize the whole program which includes the resetting of the accumulator bit in timers used.
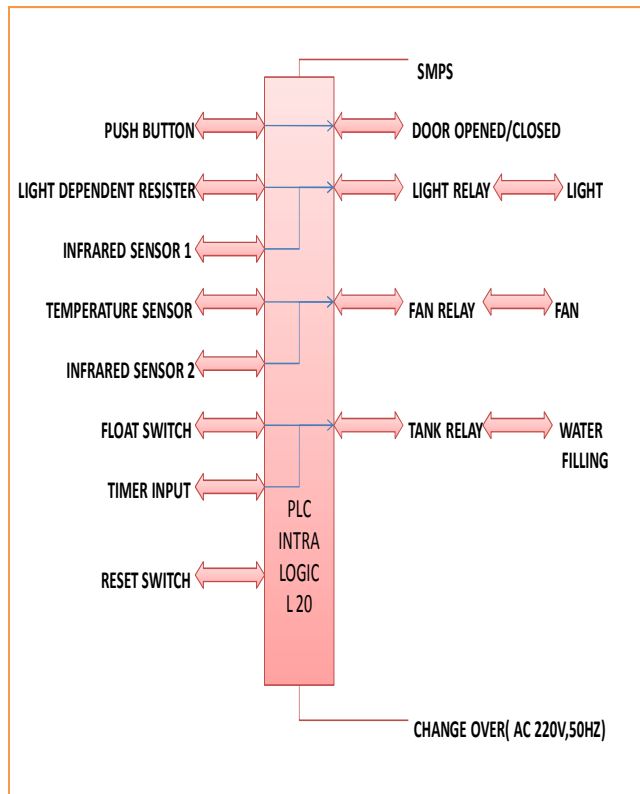
III. OVERALL BLOCK DIAGRAM

FIGURE.4:COMPLETE DESIGN

TYPE	DEVICE	ADDRESS
SWITCH 1	PUSH BUTTON	%IX0.0
SWITCH 2	LDR	%IX0.1
SWITCH 3	INFRARED SENSOR 1	%IX0.2
SWITCH 4	TEMPERATURE SENSOR	%IX0.3
SWITCH 5	INFRARED SENSOR 2	%IX0.4
SWITCH 6	FLOAT SWITCH	%IX0.5
SWITCH 7	PROXIMITY SENSORS	%IX0.6
TIMER	PULSE TIMER	T1
OUTPUT 1	DOOR OPENED/CLOSED	%QX1.0
OUTPUT 2	LIGHT ON/OFF	%QX1.1
OUTPUT 3	FAN ON/OFF	%QX1.2
OUTPUT 4	WATER LEVEL (LOW)	%QX1.3
OUTPUT 5	WATER OVERFLOW	%QX1.4

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**FIGURE.5:VARIOUS SENSORS INPUT &
          OUTPUT PINS**

IV.CONCLUSION

Smart Energy Saving home system completes the demands of Smart India very efficiently. It provides smart work, energy consumption control and easy at the same time. Thus it is completely smart and fully automated energy saving home appliances control system.

V. REFERENCES

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