Smart Energy Saving in Public Places using PIR

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Abstract:**This paper demonstrates a live implementation of the smart energy saving in public places using passive infrared sensor (PIR sensor). It is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. In this modern era, we cannot do anything without electricity therefore the issue of saving power is very important for us. It is often seen that electric power is misused especially in public places as a result of lack of awareness and proper maintenance. So we have designed a model where there is no need to operate the appliances through switches; anyone enters a certain room or hall and appliances (fan, light etc.) get switched on automatically and get off when he or she leaves the room. PIR sensor identifies the presence or absence of people and works accordingly to reduce the electricity consumption.**

Keywords---PIR, Relay, Arduino, SMPS, Temperature Sensor, Light Intensity Sensor.

I. INRODUCTION

In this project we have automated 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 is to reduce the electricity consumption. The working is such that when a person will reach the entry gate of the room the lights get automatically turned ON while the fan gets turned ON as per the room temperature. If it is hot, the sensor will detect the requirement and the fans will also get turned ON. 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 is a single gate for entry and exit both. So there are two through beam sensors installed at the gate for sensing the entry and exit. A temperature sensor and light intensity sensor is also installed in the room. The working of our room is in two modes. There is a single gate for entry and exit both. So there are two through beam sensors installed at the gate for sensing the entry and exit. A temperature sensor and light intensity sensor is also installed in the room. 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 four 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 Allen Bradley, Micrologix 1000 of 10 I/O s. For converting 220V AC to 24V DC, switched mode power supply is used.

II. MAINS

Our main objectives is summarized as follows-

- In case of smart rooms, User Friendly.
- Increase efficiency on the use of power.
- Easily fixable by electrical engineers for any improvements.
- Make a space more efficient and reliable by using the most appropriate hardware components.
- Develop a user friendly interface of control panel.

III. SYSTEM DESIGN

This room is fully automated. There is no need of any kind of human efforts. This is associated with user friendly environments for the users. It is energy efficient and economical. PLC is used of 10 I/O.

A. PLC

Fig.1 PLC used for the project

A programmable logical controller. PLC is a digital computer used for automation of typically industrial electromechanical processes. It is a solid state user programmable control system which functions to control logic, sequencing timing, arithmetic data manipulation and counting capabilities. It can be viewed as an industrial computer that has a central processor unit, memory, input output interface and a program-mic device. The central processing unit provides the intelligence of the controller. It accepts data, status information from various sensing devices such as- limit switches, proximity switches, which executes the user control program stored in the memory and gives appropriate output commands to devices such as solenoid valves, switches etc.

B. Power Supply

We are 5using switch mode power supply. This supply converts the 220V AC to 24V DC with the current rating of 2A. A regulator, which control the output value of SMPS.

A switched-mode power supply is an electronic power supply that incorporates a switching regulator to convert electrical power efficiency. SMPS transfers power from a source, like mains power to a personal computer (load), while converting current and voltage 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 into the high dissipation transitions, which minimizes wasted energy. Ideally, a switched-mode power supply dissipates no power.

Voltage regulation is achieved by varying the ratio of on-to-off time. In contrast, a linear power supply regulates the output voltage by continually dissipating power in the pass transistor. The higher power conversion efficiency is an important advantage of a switched-mode power supply.

Switched-mode power supplies may also be substantially smaller and lighter than a linear supply due the smaller transformer size and weight.

C. Relay:

Relay can break an electrical circuit =, by interrupting the current or diverting it from one conductor to another. The most familiar form of relay is manually operated electromechanical device with more than one sets of contacts can be in one of the two states: either "closed" meaning the contacts are touching and electrically can flow between them, or "open" vice versa. Relay we used is DPDT relay. It operate on 24V DC supply which is controlled by PLC.

Working of Relay:

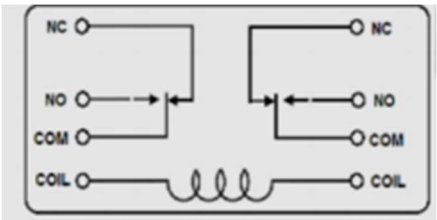


Fig. 2: Connection Diagram of Relay

Here 6 DPDT Relays are used to provide switching action to the components installed. The first 2 relays are used for light and fan operations in automatic i.e. PLC mode. Likewise, other 2 relays are used for operation in manual mode with the help of switches. Through beam sensors installed on the gate of entry and exit are also switched the help of relays, one relay for the entry purpose and the other for exit.

D. LED

We have used 3 LED indicators in the project. The first indicator is installed with the reset switch to signify the user if he resets the system.

The other 2 indicators are used with the changeover on the control box to indicate which mode he is using i.e. manual or automatic mode.

E. Through Beam Sensors: (TBS)

It is installed at the gate sensor entry and exit. It the sensor able to detect the presence of nearby objects without any physical contact. A TBS sensor often exits a beam of infrared and looks for changes in field or return signal. The object being sensed is often referred to as the sensor's target. A sensor consists of an emitter and a receiver. Infrared beam is emitted by the emitter and received by the receiver. If any obstacles come in between them, then the receiver senses obstacle and gives the signal. These sensors work on the supply of 24V DC. These sensors are of NPN type.

F. Temperature sensor:

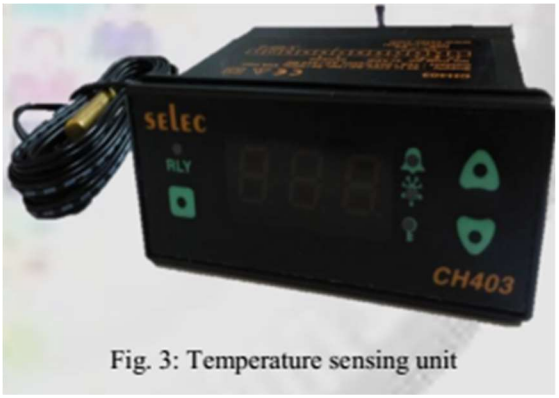


Fig. 3: Temperature sensing unit

The temperature is getting measured by sensor and the output is transferred to the controller. Controller decides the action of output relay acc. To temperature which is preset by the user.

G. Light Intensity Sensor:

LDR is used. LDR measures and analyses 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 gets produced as true (1) condition.

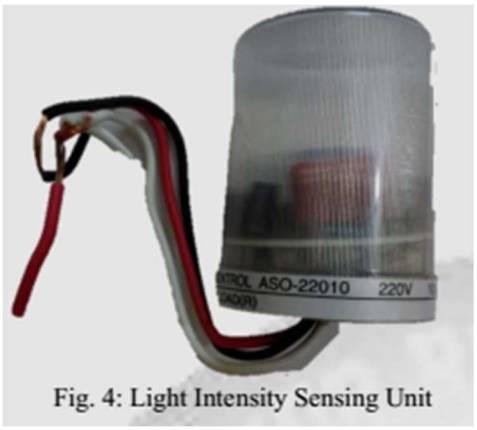


Fig. 4: Light Intensity Sensing Unit

H. PLC Programming:

Ladder logic is the most common programming language used to program PLC. So the program is made in such that when the person passes through both the sensors ON/OFF. In case, he passes

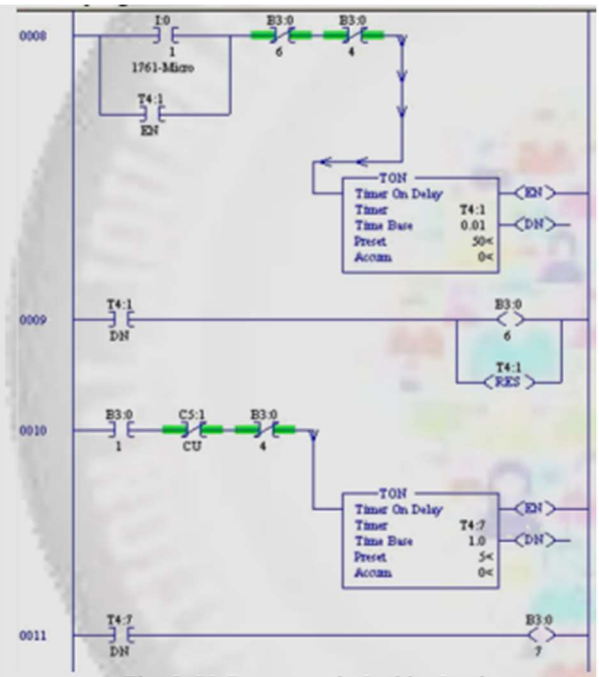
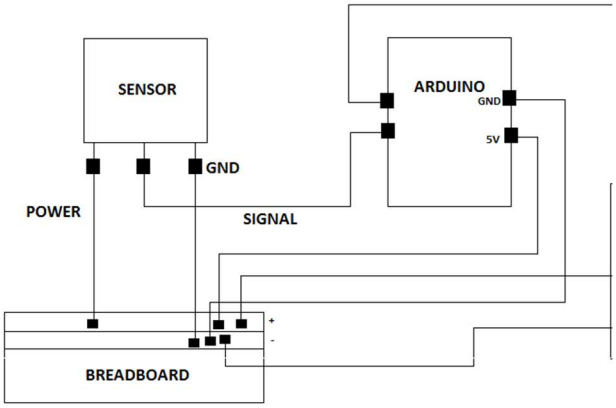


Fig. 5: PLC program in Ladder Logic



through the sensor and step back, the present value of timer given to the particular sensor resets it.

Also, reset switch is provided to initialize the whole program which includes the resetting of the accumulator bit in counters and timers used. The below figure shows the block diagram of the system and the snap shots of real time project. FIGURE 6 shows the block diagram of the Smart Energy saving classroom.

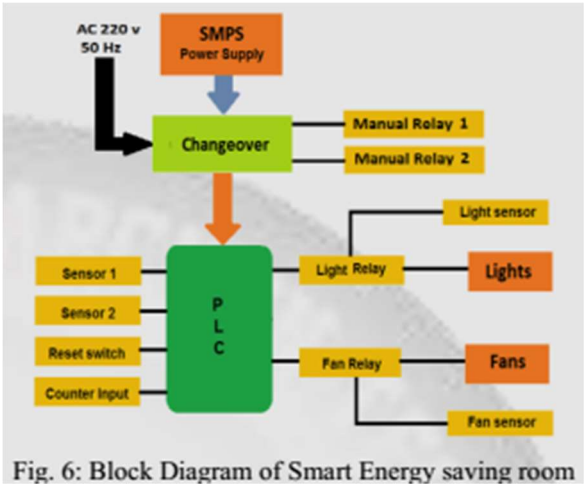


Fig. 6: Block Diagram of Smart Energy saving room

Figure 7 shows the internal view of the control box and the automatic mode is shown in Fig. 8. The automatic mode I.e. PLC mode is set upwards and hence the above LED indicator is glowing. The temperature controller is showing the current room temperature.

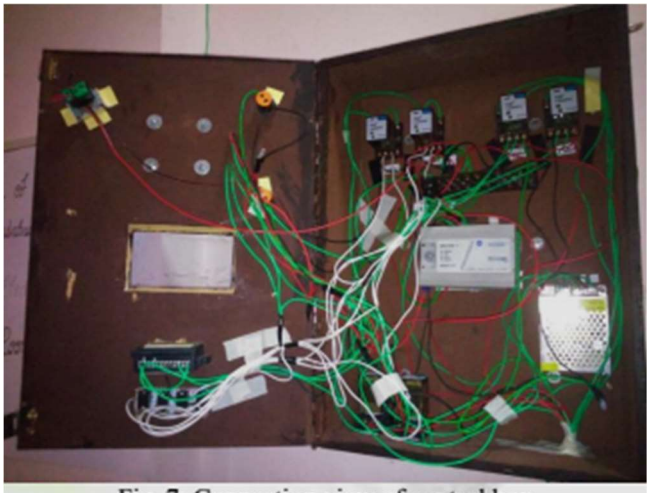


Fig. 7: Connection view of control box

Fig. 8: Control box running in PLC mode

IV. RESULTS AND DISCUSSION

Smart Energy Saving mode in Public places such as - Classrooms, completes the demands of energy control in Bangladesh. It could be used in our classrooms, mainly Laboratories as it is completely smart, improving and creates a fully automated energy saving classroom.

V. CONCLUSION

This can be updated further. A great phenomenon to work on and get started. Our project concludes the need of more maintenance and also reduces risk factor. Last but not the least, IT IS MORE EFFICIENT.

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