Power Saving System Using LDR And PIR Sensor

THET ZIN HTWE[1], AYE THANDAR TUN[2], CHAW SU AUNG[3]
[1, 2] *Engineering Physics Department, Mandalay Technological University*
[3] *Engineering Physics Department, Yangon Technological University*

Abstract- ***The objective of this project is to implement the system for power saving. This paper presents the implementation of the power saving system. For the power control system, detection method is used for a power ON/OFF automatically in respective place. There are four parts in this project: the solar panel power, voltage switching source, sensor stage, and the energized relay portion. In the supplying power, sensor unit is employed for switching stage. The heart of this project is sensor portion. The sensor unit consist the LDR (Light Depending Resistor) the PIR (passive infrared sensor). The task of LDR is to detect the approaching of human person based on the principle of light/dark sensing. PIR sensor detects the radiated heat of a person and these data converts to an electrical signal and this signal is sent to the switching for processing. This signal creates a specific voltage for the relay to activate the power switching. But nobody is detected the power is automatically turned off. As a consequence the constructed energy control system prevents energy wastage.***

Indexed Terms- ***Light Depending Resistor, passive infrared sensor, solar panel, switching stage***

I. INTRODUCTION

The requirement of automation systems has becomes increasing for many areas everyday due to its benefits. Automation systems can help to reduce the effort of human in many fields. For a power saving system, it is necessary to keep the minimal loss of electricity. Automatic power system ensures to control the consumption of electricity and waste of usage. So, today of most researchers are trying to search for the efficient and effective methods of automatic systems, and how to monitor and control different ways for power saving in which auto ON/OFF for electronics devices such as lights, fans, air conditioners, etc. Economization in Energy efficient buildings is comfortable with abundance of natural light. There is a social problem for most of the publicly and personal buildings in switching off light and other appliances if it's not necessary. Consumption of energy without necessity led to waste in electricity in many fields.

Much of energy is employed in such publicly and personal buildings and so it is required to control the consumption of electricity. The most consumption of energy is for illumination of light, fan, and cooling system and so on. Mechanical switches can cause the maximum power loss for such cases. Therefore, creation of advance technique is required to avoid waste of energy for the whole world. The energy control system should be applied in lecture halls, classrooms, laboratories, meeting room of most of schools and offices and any other residence. The electricity is important and essential energy in human life concerning with production, education, and many other fields. Increasing cost of production and distribution of electricity depends on the increasing consumption. The rise in energy costs urged the need in minimizing its consumptions. Reducing its cost is one of the important facts to be considered. To solve this problem, one of the attempts is to provide the automation system of power control.

Because of these facts, this energy saving system was to be implemented as a project. The system is constructed using LDR for controlling intensity of light and a motion sensor PIR for detection the body heat of humans. When somebody is in the room, which is detected by PIR sensor, the controlled system automatically switch on the light and some electronic device, but if the room is empty, the lighting system and any power switch will be closed up automatically.

II. TYPES OF SENSOR AND APPLICATIONS

A. LDR sensor

An LDR or light dependent resistor is also referred to as photo resistor, photocell, photoconductor. Because its resistance varies on the intensity of light (photon) falling on its surface. If the light falls on the resistor, the resistance of LDR will change.

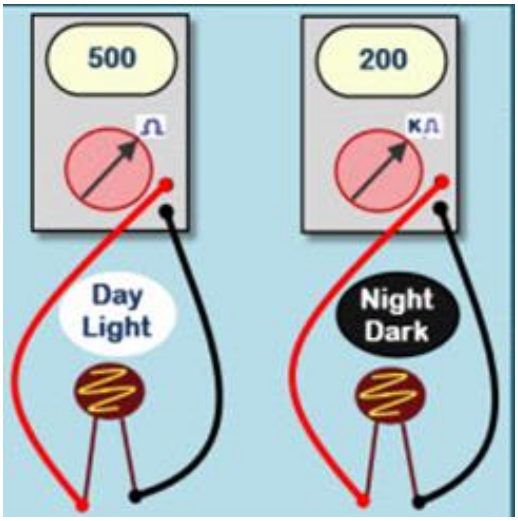

Figure 1. Principle of LDR sensor

When the light falls on the resistor, the resistance of LDR will change. These resistors are often utilized in many circuits where it is required to sense the presence of light. These resistors have a variety of functions and resistance.

This operation of resistor works is based on the principle of photo conductivity. It is nothing but, when the light falls on its surface, the photon in the incident light collides with the electron in the valence band. Because the photon of incident light has energy greater than the band gap of the semiconductor material, the electrons to jump out from the valence band to conduction band and it causes the electron flowing from the valence band to the conduction band and it appears as a current, i.e. the resistance of LDR decrease. So, when light falls on the LDR the resistance decreases, and increases when no light falls on the LDR. When a LDR is kept in the dark place, its resistance is high and, when the LDR is kept in the light its resistance will decrease.

B. PIR Sensor

There two types of PIR sensors: active type and passive type. As a feature of PIR sensor, it is a radiation source which is sensitive to interruptions of radiation sense. A passive PIR, which does not have IR source, acts as a motion detector. It receives infrared, not emits. The passive term refers for the fact that PIR devices don't radiate energy for detection purposes.

A passive infrared sensor (PIR sensor) work just by detecting infrared radiation (radiant heat) emitted by or reflected from objects. When one object moves across the setting area of PIR detector, it can detect heat of radiation emitted by an object, such as animal or human. Because of simple type, reliable, and low price, the PIR sensors have tons of benefits compared with other sensors. Passive Infrared Sensor (PIR) can be used as a useful module. For this feature, PIR sensors are commonly called simply "PIR", or sometimes "PID" which means that "passive infrared detector". They can measure infrared (IR) light radiating from objects in its field of view. Therefore, PIR sensors are mostly utilized in security alarms and automatic lighting applications. Generally, PIR sensor detects

Figure 2. Configuration of PIR sensor

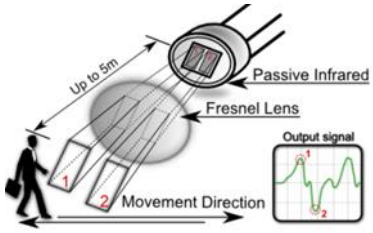

Figure 3. Working principle of PIR sensor for motion detector

any change in heat, and its output PIR becomes HIGH, whenever it detects any change.

For motion detectors, it is required to get approaching within a full 360± field of view. For directing the infrared ray from the outlying, it is necessary to adjust the narrower angular of the sensor point to reach the specified field of view. The motion detectors require complicated optical arrangements because of having limited field of view. Optical arrangements bring the incident radiation to the right sensor at the right angle to be perceived.

Motion detectors with wide fields of view have complexity and high in cost, and compact in physical size unit.

Areas of Applications of PIR Sensors

- All outdoor Lights for security system
- Multi Apartment Complexes
- For Basement or Covered Parking Area
- Shopping Malls for in-out system
- For garden lights switching
- Lift Lobb
- Common staircases

Features

1. Dual Element Sensor with Low Noise and High Sensitivity.
2. Motion Detection Complete with PIR
3. Delay Time Adjustable.
4. Supply Voltage – 5V.
5. Standard TTL Output.

III. WORKING PRINCIPLE OF THE SYSTEM

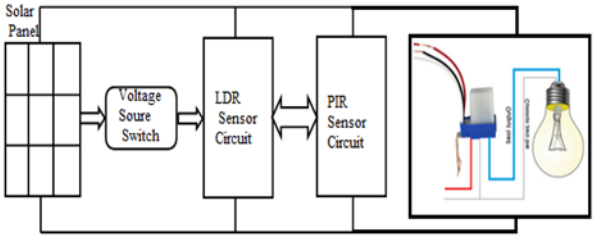

Figure 4. Block diagram of system

The detector senses an increase of IR energy when a person walks into the detector's field of view, and it sends out as a output signal. The block diagram of the built energy system is shown below in Figure 4.

A. Solar panel Power stage

A PV solar array is getting used to charge a battery. A solar array may be a collection of solar cells. The solar array converts the solar power into electricity. The solar array uses Ohmic material for interconnections also because the external terminals. The output from the solar array is connected to the switch and from there, the output, is fed to the battery. A solar charge detector is fundamentally a voltage or current controller to charge the battery and keep electric cells from overcharging. It directs the voltage and current hailing from the solar panels setting off to the electrical cell. Just in case of the over charge, the facility from the solar array is bypassed through a diode to the transistor switch. Just in case of low charge, the availability to transistor switch is stop to form it in off condition and thus cut the facility supply to the load. Generally, 12V boards/panels put call at the ballpark of 16 to 20V, so if there's no regulation the electrical cells will damaged from overcharging. Generally, electric storage devices require around 14 to 14.5V to urge completely charged. A light detector are often used within a circuit to show on something (typically a light-weight bulb) when it's dark or light. A small light detector can be used within a circuit to turn on something (typically a light bulb) when it is dark or light.

B. Day/Night detector

Each of the gates is made into inverters by shorting it's both the inputs together, in order that the input logic level of the gates now gets effectively reversed at their outputs. Though one NAND circuit would be enough for implementing the actions, three gates are engaged as buffers for recuperating results and during a view of utilizing all of them as in any

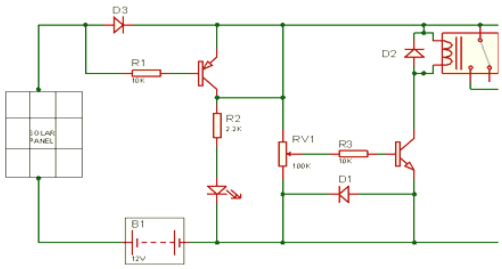

Figure 5.Configuration of Solar panel supply

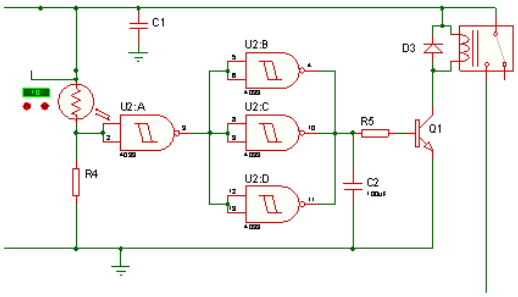

Figure 6.Circuit diagram of LDR Sensor

case three of them would be left idle. The gate which is liable for the sensing can be seen accompanied with the light sensing device LDR wired across its input and the positive via a variable resistor. This variable resistor is used for setting the triggering point of the gate when the light falling over the LDR reaches the desired specified intensity. As this happens, the gate input goes high, the output consequently becomes low making the outputs of the buffer gates high. The result's the triggering of the transistor and therefore the relay assembly. The connected load over the relay now flips into the intended actions.

C. PIR sensor circuit

The first PIR circuit diagram for sensing moving humans is shown below.

When the presence of a human, the sensor detects the infrared radiations emitted from human. This detected signal is converted into electrical pulses for trigger the transistor into conduction case, at this condition, the collector goes low. The CA3140IC has been found out as a comparator where its pin3 is assigned because the reference input while pin2 because the sensing input. The instant the collector of the transistor goes low, the potential at pin2 of the CA3140 becomes less than the potential

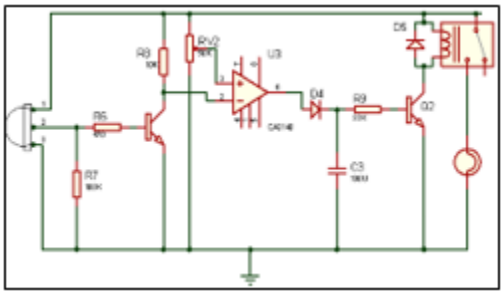

Figure 7.Circuit diagram of PIR

at pin3 This instantly makes the output of the IC high, triggering the relay driver stage consisting of the CA3140 transistor and a relay. The relay activates and switches ON the connected lamp. The capacitor 100 µF/25 V makes sure that the relay remains ON even after the PIR is deactivated possibly due the exit of the radiation source.

IV. OPERATION OF THE WHOLE SYSTEM

In the operation of the system, this system is divided into four parts. There is a particular operation to do for each part. The first part is the solar panel. This part consists of battery for storing the charge, solar charge controller which performs the controlling the charging process and together control for power supply for the circuit. The supply of power for each part is to be fed from the battery or from the mains. In the solar charge controller, the function of PNP transistor is to detect for day or night depending on the voltage form the solar panel. The power of energy can be achieved from the solar panel feeding through the base of the transistor and the produced voltage of photovoltaic cell is holding off during the day time.

The second part is a circuit of voltage source switcher. It decides to supply the power to the circuit from the battery voltage or the AC power source depending on the battery voltage level. An energetic relay is employed as a switching for supplying the power to the circuit without interruption.

The third part is the light/night detector circuit. Depending on the light incident on the LDR, it triggers the relay for activation. As a operation, it is required a small delay in the sensing process. Because the suddenly changes in the intensity of light affect the trigger the circuit. In this circuit, for the delay time, a capacitor C2 is attached at base of the transistor Q1. The transistor Q1 is for triggering the relay unit. To operate the transistor Q1, the output of CD4093IC is connected to the transistor Q1.

Finally, the final part is the PIR sensor circuit. It is fed to the base of the transistor Q2. Based on the output of the PIR sensor, Q2 works in its operation. When PIR detects the presence of a human being in its vicinity, it produces a high output. If Q2 gets the high data from PIR, it activates the relay and the connected lamp gets power and lit up. If the human moves away, the there is no power and the light switch off automatically. The PIR sensor is the most important element for sensing to detect the human presence in a room.

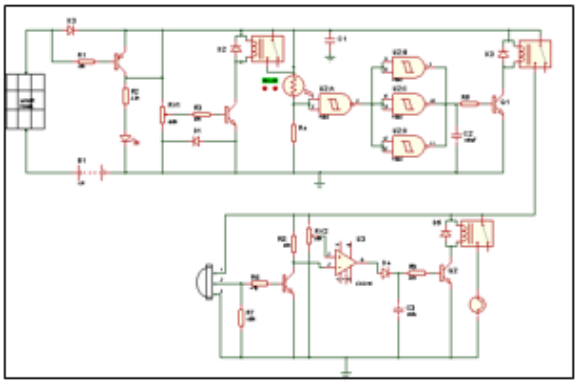

Figure 8.Circuit diagram of the whole system

V. RESULTS AND DISCUSSION

The PIR and LDR sensors are actually a core sensor and can be extremely sensitive and difficult to optimize. In the testing of the constructed circuit, a person was made to enter the detection range of the PIR sensor; the relays energizes and switched ON as the PIR sensor was activated and its generated output that was sent to the op amp. As soon as the person left the detection range of PIR sensor, the relays makes turned OFF. When the relays got high pulse for turned ON, the power system is active in the detection range of the sensor without any intruder, The PIR sensor initializes its stabilization within the delay period of 3 to 5 minutes for proper function. When there was no person in the detection range of the system, the relays automatically turned OFF taking delay time of 3 or 5 minute. The sensor takes the same 5 minutes for a person might have left the range of detection. Consequently, the system of automatically power switching provide the waste of electric energy.

CONCLUSION

This system provide the power saving by using PIR and LDR sensors which can detect the presence of human and work as an automatic operation for power swing system. The relay circuit activates the power switch to work properly. Therefore, the implemented module is functional and this model system can be useful for energy saving purpose. As a future work, the project will be implemented using microcontroller for good efficiency in the operation.

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