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oAn automatic method for economic consuming of power by using photo transistors

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Abstract

The method in this paper is used as an auto shutdown and shut up the system of light lamps without operator as it is needed, this technique gives an economic and automatic way for saving electric energy. Also it is possible to use it for safe using against thieves or undesirable persons. And for alarm system which be start automatically and instantly.

المستخلص

تستخدم هذه الطريقة كمنظومة إطفاء وإشعال اوتماتيكية لمنظومة مصابيح أضاءه دون الحاجة إلى وجود مشغل. إن هذه التقنية تعرض طريقة اوتماتيكية واقتصادية في استخدام الطاقة الكهربائية. كذلك من الممكن استخدامها لجوانب أمنية ضد اللصوص والأشخاص ا لغير مرغوب فيهم كذلك تستخدم كمنظومات الإنذار التي تعمل بصورة تلقائية عند حدوث السبب لحظيا.

1-Introduction

Application of photo cell was used and still now used for control, as control of opening and closing the doors, alarm system, etc. Also several researches, recently, tried to develop a new methods for getting electric energy such as wind power, solar energy etc. The aim is to find a method for avoiding the high cost of fuel which is used in conventional sources [1]. For economic use of electric energy, there are different ways such as two way switches which are used in stairs of building, or timing delay switches and so on. All these methods need to operator. In this method we use a new system for automatically shut down or shut up a lighting system at the instant of needing (without introducing of any operator). This method is very useful in several projects such as several floors building, hospitals, long hall office etc. The principle control of the system depend on the (Infrared radiation (IR) which can be get by using a so called light emitting diode (LED) and optical (photo) transistor which has an effect on the operation of a silicon transistor that Controls the operation of a relay, via it, several lamps can be switched on.

2- Suggested system

The system in this paper depends up on the sensitivity of photo transistor, according to the light, thus it can be used as a switch which turn on or turn off a contactor via its auxiliary contact points, in this control the other contactors which can be used to put on and put off a certain number of lamps (or save devices like alarm system) for a certain time using a time delay relay. The elements of this method are very cheap and can be found in Iraqi market.

3-Elements explanation

3-1-photo transistor

The photo transistor is a light sensitive transistor of collector-base PN junction. It can be exposed to incident light through a lens in the transistor package. In the case when there is no light, there is a small thermally generated collector – emitter leakage current, $I_{CEO,}$ which is called the dark current and is typically in (nA) range when light strikes the collector base PN junction, base current (I_B) will be passed .This action produces a collector current which will be increased with base current (I_B).The photo transistor behaves as conventional bipolar transistor [2]. The relation ship between the collector current and the light–generated base current in a photo transistor is

$$I_C = \beta_{DC}.I_B$$

We mention, her, that photo transistor is not sensitive to all kinds of light, but only to a light within a certain range of wave lengths. It is most sensitive to particular wave lengths [3]. As that from light emitting diode shown by the peak of the spectral response curve in fig (1)

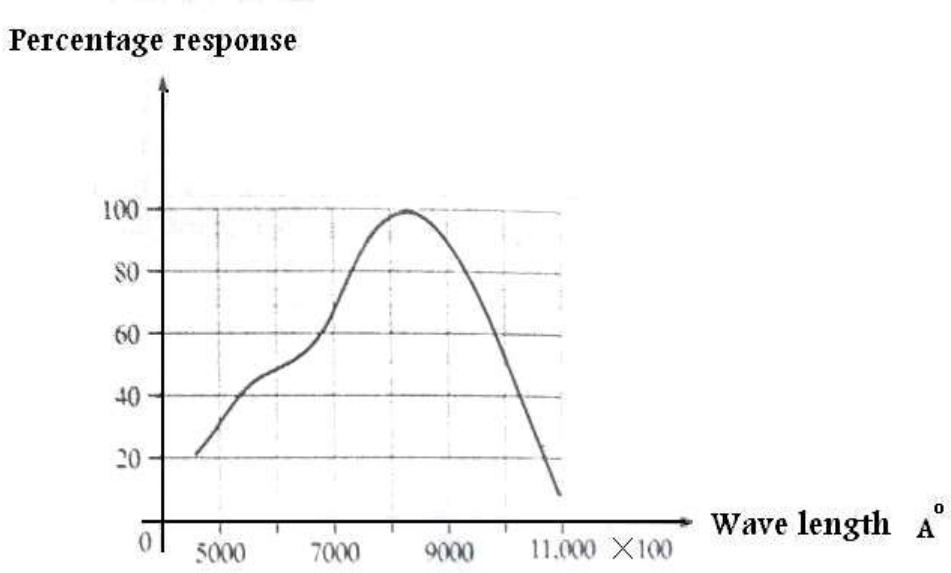


Fig (1) wave length of (LED)

3-2 The light emitting diode (LED)

The symbol of a (LED) is shown in fig (2)

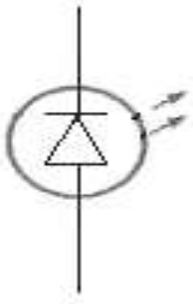
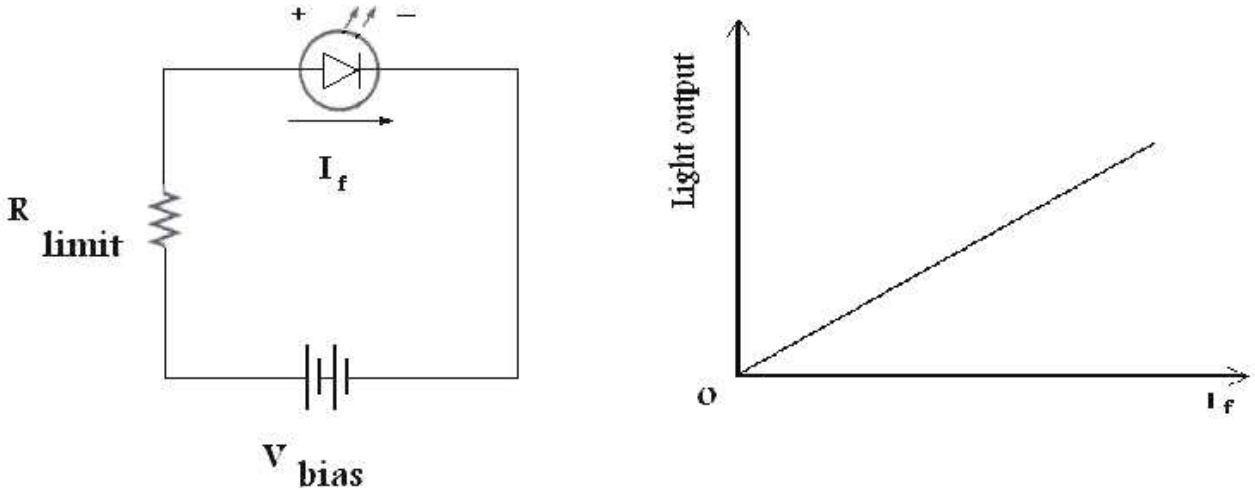


Fig (2) symbol of (LED)

The basic operation of light emitting diode is as follows: when the LED is forward- biased, the electrons from the N-type material in PN-junction recombine with holes in the P- type material. These free electrons are in conducting band at a higher energy level. These electrons release energy

in the form of heat and light depending on the exposed surface. A large exposed area permits the photons to be emitted as a visible light. The colour of light depends upon the type of LED Ga As LED (gallium arsenide) emit infrared Radiation which is not visible and it is used in this technique (silicon and germanium are not used because they are essentially heat producing material and are very poor for producing light). The forward voltage across the LED is considerably greater than for a silicon diode. We mention her that the typically max – forward voltage vf for LED is between 1.2v—3.2v depending upon the type. Reverse break down for the LED is much less than for a silicon rectifier diode (3v_10v). The LED emits light in response to sufficient forward current as shown in fig (3-a).

The amount of power output translated into light is directly proportional to the forward current as shown in fig (3-b)

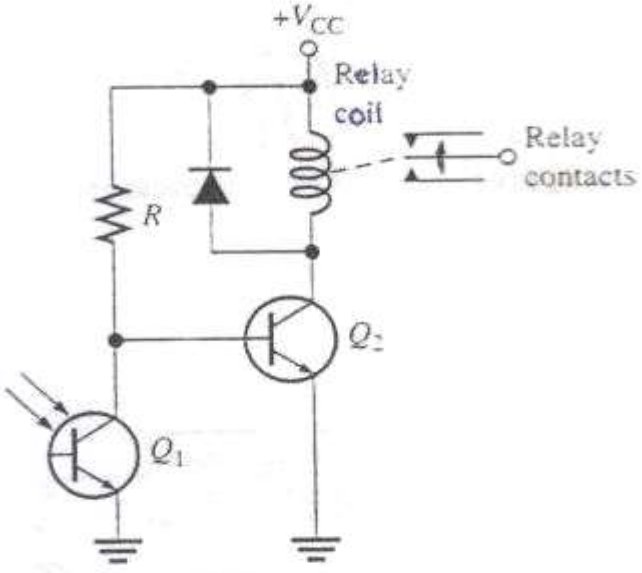


(a) Light emitting in (LED) by for word curve (b) light power output

Fig (3)

3-3 The operation cct of photo transistor and relays

The action of the photo transistor on the operation of system relay is shown in fig (4)



Darkness-operated relay circuit.

Fig (4)

The relay is de-energised when transistor Q2 is biased off that is when photo transistor Q1 is turned on by incident light (keeping it at this state).When incident light is cut off for any reason, transistor Q1 turns off and Q2 turns on and the relay will be energized. The system in this paper depends on these phenomena with extra control cct and timing delay relay which control the time of keeping relay coil to be energised when the reason of light cutting is released. In addition to that we mention that there is a so called photo Darlington which consist of a photo transistor connected in the arrangement shown in fig (5). This device has much higher collector current because of a higher current gain, thus it exhibits greater light sensitivity than does a regular photo transistor [4].

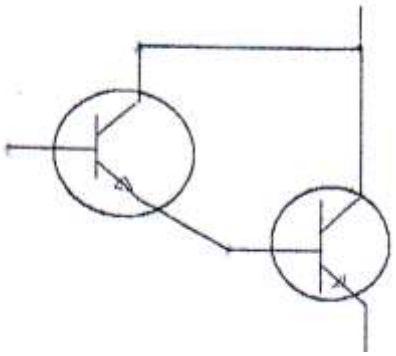


Fig (5) photo Darlington

4-System Operation

The system consists of one transformer (T) with several secondary windings, to achieve several voltage. Some times can be found combination of multiple primary and secondary trans [5] which can be used her and two rectifier units, one for the operation of transistor which was explained in (2-1 and 2-3) and the other for LED operation. The complete control and power cct for the system is shown in fig (6). When the light between LED and photo-transistor Q1 is cut off for any reason (for example some one is walking between). The photo transistor will be turned off, thus the contactor C will be turned off also and the contact point 1-2 of C (which are normally open) will be closed, energizing Q2,thus the contactor C1 will be energized and the contact points C1(1-2) will be closed, and the contactor C2 will be energized thus the contact points C2(43-44) will be closed keeping CI energized, when the photo transistor energized again (when the person leaves his place) and Q2 turned off. Now time delay relay d will be energized via 13-14 of C2 beginning the pre set time to start. After the pre set time (minutes) contact points 1-2 of d will be opened, this will turn off C2 and C 1 and thus the system returns to its original state.

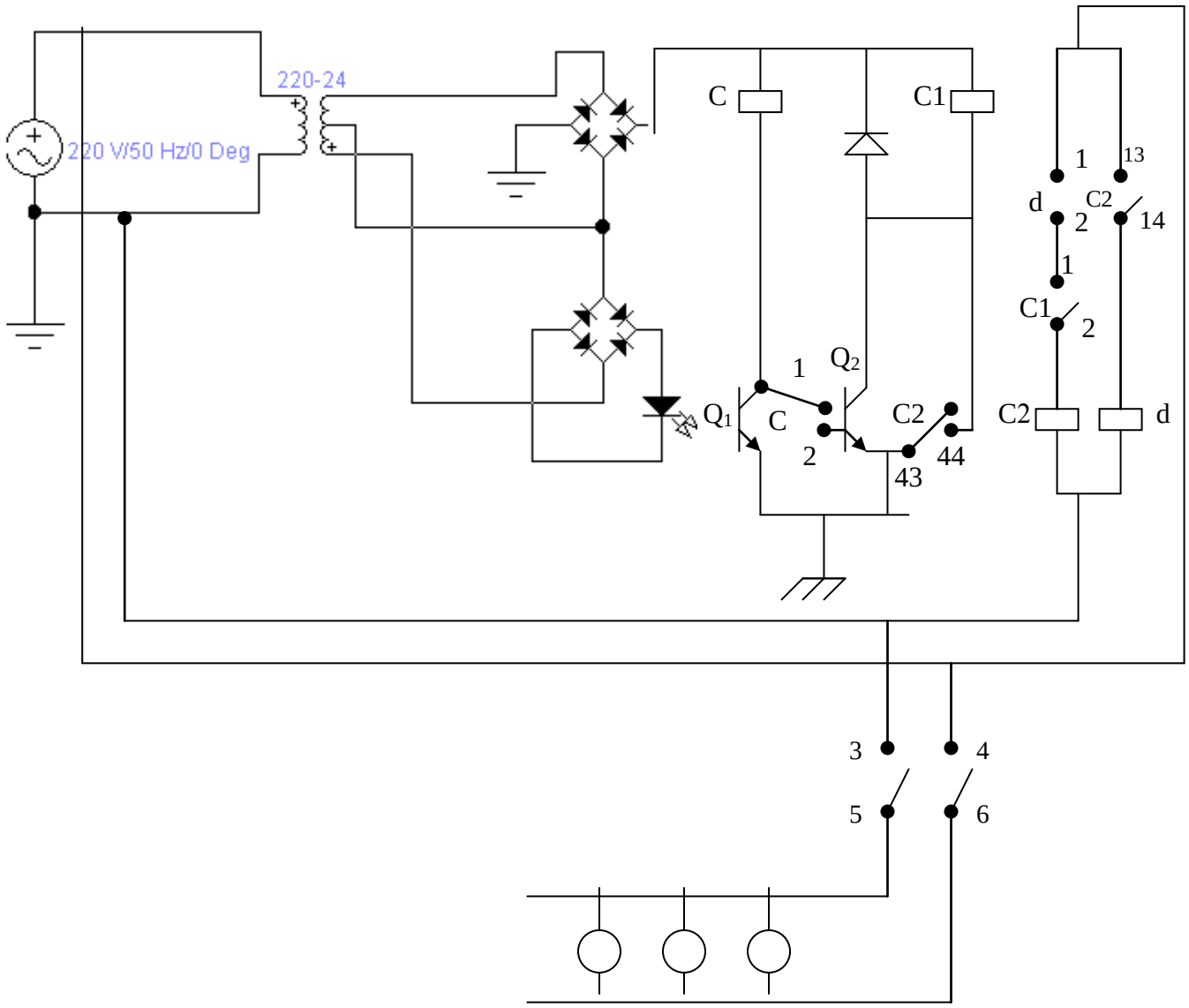


Fig (6) control and power cct.

Fig (7) shows the power cct for shut up or shut down the groups of lamps.

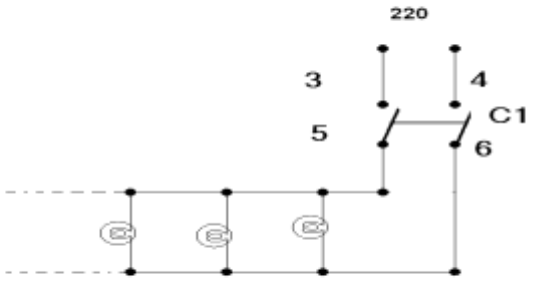


Fig (7) the power cct for the group of lamps

When the light between LED and photo-transistor Q1 is cut off for any reason (for example some one is walking between). The photo transistor will be turned off, energizing Q2; this makes C1 to be energized. And the contact points C1 (3-5, 4-6) fig (7) will be closed, these supplying the power to the lamps. At the same time the No (normally open) point 13-14 and 43-44 of C1 will be closed also. This is very important because when the person leaves his place the photo transistor will be energized again and Q2 will be turned off but C1 will be stayed energized via contact point 1-2 of time delay relay (d) and 13-14 of C1. Now time delay relay d will be energized via 43- 44 of C1, and 11-12 of C2 beginning to start pre set time. After pre set time (minutes) contact points 1-2 of (d) will be opened. This will turn off C1 and turn on C2 and at this instant (d) will be turned off because (11-12) of C2 become opened and thus the systems will return to original position.

The figure (7) and figure (8) show the practical model for this method in two cases, i.e in shut on and shut of situation

Figure(7)

Figure(8)

CONCLUSION

The method is very simple, versatile cheap and can be joined easily, it has also a long life and very small power needing for operation, long maintenance period it has a wide range of application it can be employed for example for safety purposes against thieves, for control of opening and closing the doors and so on, also it can be extended to be used in several applications in factories for producing control of several production machines.

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