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Review Article

Automatic Emergency Light With Led

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Introduction

Growing demand for the saving of electricity. It is based on the principle of providing light when the power is cut off. This is accomplished by the use of automatic charger which gets charged when power supply exists. When the battery is fully charged it stops charging. In case of power failure, the LED glows automatically with the supply provided by the charged battery.

This project is working on two major processes:

1. It turns on automatically when the mains power fails, so you need not search it in the dark.
2. Its battery starts charging as soon as mains resumes.

This Emergency light is used mostly in village because there is the lack of electricity which is very required. In industries and as well as in household applications an emergency light is employed where there is frequent non uniform voltage distribution occurs. Many types of emergency lights from rechargeable torches to systems like generators are available in market. All of them require a switch to operate them when frequent power failure occurs.

The present one deals with a model which senses the mains as well as daylight to switch on the emergency light. There is no need to search the switch in the dark as it switches on/off automatically. This present one has one on/off switch on operating which the emergency light glows. In most of the emergency light there exists a drawback. The discharge level of the battery is not being controlled to a safe level. The batteries get discharged completely and lose their life rapidly. This is a very serious aspect in order to overcome this cut-off is provided and there exists a minimum discharge level which ensures the long life of batter.

Functional Block

Power supply block is connected with relay and if the supply is off it will turn of LEDs. When supply is on it charge the battery continuously. Power supply block is connected with relay and if the supply is off it will turn of LEDs. When supply is on it charge the battery continuously. When AC is on the flow shows that battery will be charge. When AC is off it turn on the LEDs

Power Supply

For converting 230V AC to 12V AC, 12-0-12V Transformer is used. It steps down the voltage from 230V to 12V AC. Now, to

convert 12V AC to 12V DC we use Bridge Circuit. There are four 1N4007 Diode is used to get 12V DC output. This is the function of Power Supply to convert AC to DC.

Relay

Relay is working as a Switch. There are three terminal NC (Normally Close) and NO (Normally Open) and Common. Here we connect. NC terminal to the rechargeable battery and Common terminal is Connects with the LEDs. Now if Power supply is on it connects with NO terminal and charge the battery and when there is no power supply NC terminal is connected with the battery and LEDs will be ON.

Rechargeable Battery

Li-ION battery is used to give 3.7V as Output and Maximum Voltage of the battery is 4.7 voltage Zener Diode of 4.5V is used to get 4.5V as an input. So that it can be measured how much time it will take to charge battery.

LEDS

10 LEDs are connected in parallel to get charge from rechargeable battery when power supply is cut off. It is on automatically when power supply is off.

Design Details

Transformer

A Transformer is a static apparatus, with no moving parts, which transforms electrical power from one circuit to another with changes in voltage and current and no change in frequency. There are two types of transformers classified by their function: Step up Transformer and Step down Transformer.
In this circuit the transformer used is of step down type which consumes 230 volts as input (primary side) and produces output of 12volts. This can be termed as 230votls primary, 12v secondary step down transformer.

Basic Principle of A Transformer

An electrical transformer works on the principle of Mutual Induction, which states that a uniform change in current in a coil will induce an E.M.F in the other coil which is inductively coupled to the first coil. In its basic form, a transformer consists of two coils with high mutual inductance that are electrically separated but have common magnetic circuit. The following image shows the basic construction of a Transformer

Figure (1): Basic Principle Of Transformer

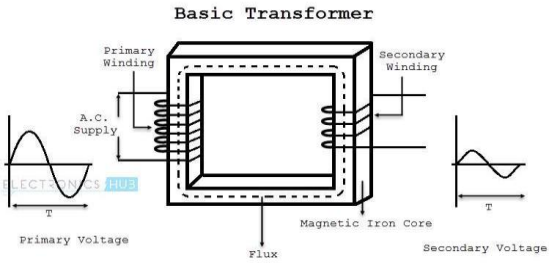
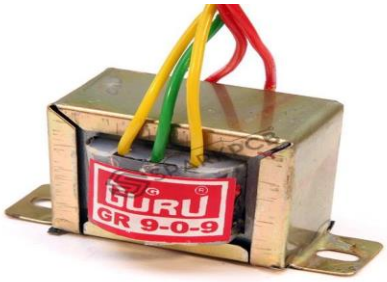


Figure (2): Step Down Transformer



Bridge Rectifier

A bridge rectifier is a type of full wave rectifier which uses four or more diodes in a bridge circuit configuration to efficiently convert the Alternating Current (AC) into Direct Current (DC).

Bridge Rectifier Schematic

Figure (3): Bridge Rectifier

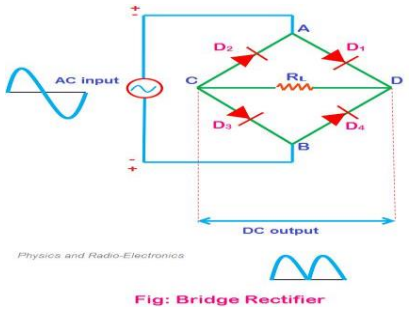


Fig: Bridge Rectifier

The construction diagram of a bridge rectifier is shown in the below figure. The bridge rectifier is made up of four diodes namely D1, D2, D3, D4 and load resistor RL. The four diodes are connected in a closed loop (Bridge) configuration to efficiently convert the Alternating Current (AC) into Direct Current (DC). The main advantage of this bridge circuit configuration is that we do not require an expensive center tapped transformer, thereby reducing it's cost and size.

Figure (4): Bridge Rectifier IC

Capacitors

A capacitor is a passive two-terminal electrical component used to store energy electro statically in an electric field. The forms of practical capacitors vary widely, but all contain at least two electrical conductors (plates) separated by a dielectric (I.e. insulator). An ideal capacitor is characterized by a single constant value for its capacitance. Capacitance is expressed as the ratio of the electric charge Q on each conductor to the potential difference V between them. The SI unit of capacitance is the farad (F).

Figure (5): Capacitors

LED

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a basic PN-junction diode, which emits light when activated. When a fitting voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons Here 10 LEDs are connected in parallel to get charge from rechargeable battery when power supply is cut off. And it will on automatically when power supply is off.

Figure (6): Light Emitting Diodes

Light Dependent

Resistors

Photo resistors, also known as light dependent resistors (LDR), are light sensitive devices most often used to indicate the presence or absence of light, or to measure the light intensity. In the dark, their resistance is very high, sometimes up to 1MΩ, but when the LDR sensor is exposed to light, the resistance drops dramatically, even down to a few ohms, depending on the light intensity. LDRs have a sensitivity that varies with the wavelength of the light applied and are nonlinear devices. They are used in many applications but are sometimes made obsolete by other devices such as photodiodes and phototransistors. Some countries have banned LDRs made of lead or cadmium over environmental safety concerns.

Figure (7): Light Dependent Resistors

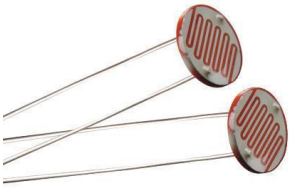
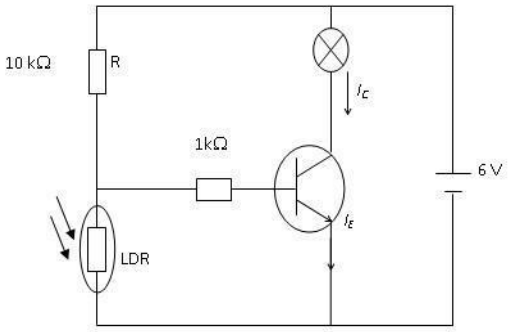


Figure (8): Principle Of LDR



The circuit shown above shows a simple way of constructing a circuit that turns on when it goes dark. In this circuit the LDR and the other Resistor form a simple 'Potential Divider' circuit, where the centre point of the Potential Divider is fed to the Base of the NPN Transistor.

When the light level decreases, the resistance of the LDR increases. As this resistance increases in relation to the other Resistor, which has a fixed resistance, it causes the voltage dropped across the LDR to also increase. When this voltage is large enough (0.7V for a typical NPN Transistor), it will cause the Transistor to turn on. The value of the fixed resistor will depend on the LDR used, the transistor used and the supply voltage.

DC Battery

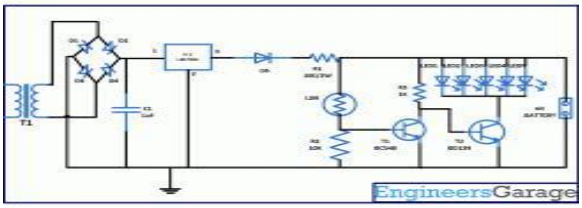
A battery converts chemical energy into electrical energy by a chemical reaction. Usually the chemicals are kept inside the battery. It is used in a circuit to power other components. A battery produces direct current (DC) electricity

Figure (9): DC Battery

Li-ION battery is used to give 3.7V as Output and Maximum Voltage of the battery is 4.7 voltages. Zener Diode of 4.5V is used to get 4.5V as an input. So that it can be measured how much time it will take to charge battery.

Circuit Explanation

Figure (10): Circuit Diagram With Operational Details



Transformer

For Converting High AC voltage to Low AC voltage we used 12-0-12V Transformer.

Bridge Circuit

To convert 12V AC to 12 V DC, we use 4 Diode 1N4007. It has High Current Capability and Low Forward Voltage Drop. The value of capacitor is 470µF. So we get rectified output.

Figure (11): Bridge Circuit

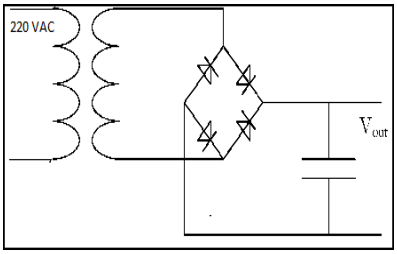


Figure (12): LDR Schematic

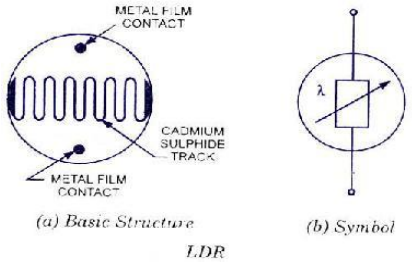


Figure (13): LDR Working Characteristics

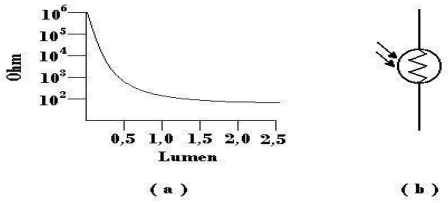
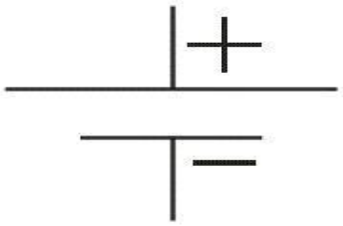


Figure (14): Rechargeable Battery



For Rechargeable battery, Nominal Voltage of Li-Ion battery is 3.7 Voltage. Standard capacity is 1950mAh. Charging voltage is 4.2V.Constant current 0.2C5A.

Features

Simple: Simple circuit. Components are easily available and low cost.

Automatic: Automatically switches ON when the mains fails and turns OFF when mains power resumes. Also has its own battery charger which when fully charged stops charging automatically.

Convenient: Makes our lives simpler, convenient to use.

Economical: Energy consumption is very less, proves to be more economic for the consumer.

Scopes of The Automatic Led Emergency Light Are:

Longer Lasting battery that works approx. 8 hours. Power is available; it senses and switches off the LEDs (lamp) instantly. Easy to use.

Uses at office, conference room, exhibition hall lighting
Uses at Direction Arrow Board for Bathroom

Advantages: The advantage are; it is easy to use, very low cost, save energy more and easy to install anywhere.
Efficiency: more light per watt than incandescent bulbs.
Color: can emit of an intended color without use of color filters.
Size: very small.
On/off time: light up very quickly.
Life time: long useful life time.

Disadvantages:
Cost: currently more expensive.
Health hazard: cool white LEDs can cause problems to eyes.

Applications:
Used as an alternative source at the time of power failure.
It is suitable for domestic applications.
Used in remote residential areas.

Comparison of Led Lamps With Other Lighting Technologies:

Figure (15): Comparison Of Led With Other Technologies

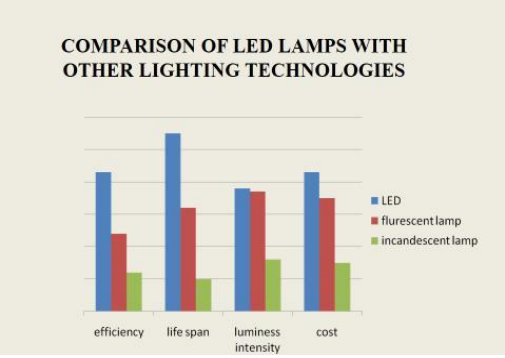


Figure (16): Results and Future Scope

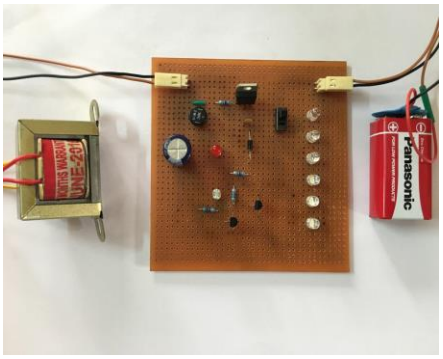


Figure (17): Circuit Without Power Supply

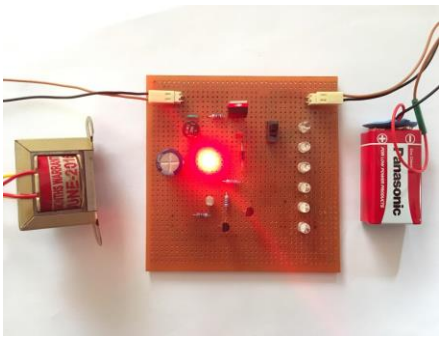
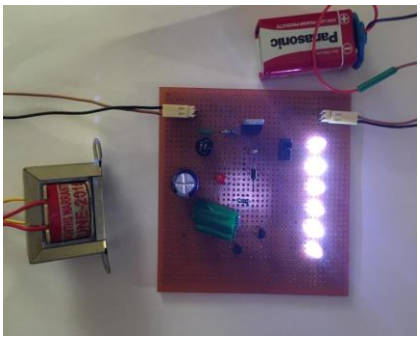


Figure (18): LED Output While Darkness Spread Over LDR



Result: The output of the LEDs is measured and tested battery backup is approx. 8 Hours. At the input of the battery the measured voltage is 4.5V through Zener Diode. Across Capacitor measured voltage is 12.15V DC and from calculated current is 12.15mA. Across Diode D2 voltage is 13.7V. This circuit can also be extended to a higher output voltage for which the charging voltage and the load are to be chosen accordingly. All the other components involved in the circuit are of same value.

Future Scope

The emergency light which uses IC is a reliable one comparing to other on IC emergency lights and there is an automatic feature by which itself get glows. This project can be adopted for mass production as cheap and efficient method.

Conclusion

The project was concluded to be innovative for the improvement of day today life. Device also adds a new look to the traditional lamps. The cost of implementing this circuit is also very less - an added advantage in using this circuit. Thus the implementation of automatic LED emergency light proves to be a cost effective and compact application in today's world of technological miniaturization. As of there has been an increase in the use of LEDs for the development of new applications, its promotion would lead to the enhancement of future innovations.

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