DESIGN AND CONSTRUCTION OF A LIGHT ACTIVATED SWITCH

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NOVEMBER, 2005.

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A PROJECT SUBMITTED TO THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING, SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF ENGINEERING (B.ENG.) DEGREE IN ELECTRICAL AND COMPUTER ENGINEERING, SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY FEDERAL UNIVERSITY OF TECHNOLOGY MINNA NIGER STATE.

NOVEMBER, 2005.

DECLARATION

I hereby declare that the project was carried out by Mr. Salami Babatunde .B. and that it has met the minimum standard deemed acceptable by the department of Electrical and Computer Engineering Federal University of Technology, Minna, Niger State.

Sign ---------------------------
Mr S.N Rumala
(Supervisor)

6/12/05

Date

Sign ---------------------------
Engr. M.D Abdullahi
(Head of Department)

08/02/06

Date

Sign ---------------------------
External Examiner

Date

DEDICATION

This project is dedicated to Almighty Allah (SWT) through His infinite mercy for given me knowledge, wisdom, physical strength and understanding to achieved my aims on this project work

Also to my beloved parents Mr. and Mrs. Raheem Salami, brothers and sisters for the support and prayer given to me during the project period.

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CHAPTER ONE

INTRODUCTION AND LITERATURE REVIEW

1.0 INTRODUCTION

The topic of this project is the design and construction of a light activated switch, one of the benefits of such a system is that may be incorporated into an audible and visible warning in form of an alarm or glowing lamp acting as a safety device.

Although, there exists many street lights that are using the operations, non has actually has the tendency to be used in dual ways like as a safety device, door openers, smoke and intrusion alarms, home light controls and in photography etc. The photo conductive control device requires little energy to attain conductivity, since its valence bond is completely filled with electrons are driven into conduction. This principle is used in devices known as photo-conductors. As the energy from light is received, the conductivity of the material increases. The applications of this device require good sensitivity, reliability and simplicity of operation.

In this project, the sensitivity of lights falling on the photo-conductor device controls the ON and OFF switching characteristics of the applied systems.

1.1 LITERATURE REVIEW

The development of transistors has made a large impact on electronics. The study of solid-state components led to the discovery of many devices that are photo-sensitive; they operate primarily in the absence or presence of light.

The properties of photo-sensitive devices and their performances are basically the physical properties of solid state elements.

With each passing days, new uses are found for the photo conductors. A typical photo-conductor that is discussed in this project is the Light Dependant Resistor (LDR). [1]

1.2 PROJECT OBJECTIVE

The main objective of this project was to ease stress of switching ON and OFF the system was basically to be working due to the presence or absence of light.

Likewise it can be incorporated into an alarm circuit system to be operated as a security and safety devices at home and industries.

1.3 PROJECT LAYOUT

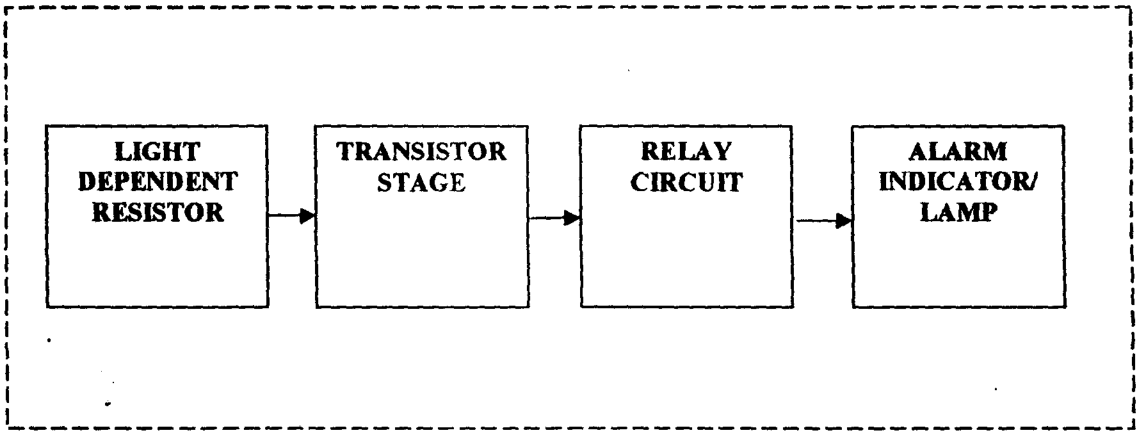
The system of the following elements, an LDR (Light Dependent Resistor) which is sensitive to the intensity of light falling on the device, resistors connected across a voltage source which setup voltage a divider. The two transistors 1 and 2 is meant for the setting of the relays circuit which generates an ON and OFF output characteristics of the switch, which may set off an alarm circuit indicators as the case may require.

Chapter two discusses the entire design of a light activated switch system. It also gives an insight into the applications of photo-conductive devices which the first was ON and OFF applications, where the device is used simply to detect the absence or presence of light.

The second was the optical analog applications where a varying light signal was converted into a corresponding varying electrical signal.

Also the construction, testing and the corresponding results were presented in chapter three. The chapter also discusses the alarm circuit used for the indication of presence or absence of light as the case imply.

Below is the block diagram of the light sensitive switch.



CHAPTER TWO

THEORY AND DESIGN

2.0 INTRODUCTION

Details design analysis and theoretical principles of the circuits, the components are extensively discussed in this chapter.

First and foremost, the power supply unit in which one has to consider the type of supply needed for the construction of the circuit and types of rectification to be employed, whether half-wave or full-wave rectifier. The type of current to be used, whether it is an A.C supply or D.C supply and the level of the voltage. Also the type of components used, their specific functions, their value and most importantly the type of cell used, whether primary (dry) or secondary (wet) cell.

2.1 POWER SUPPLY UNIT

The most important aspects of any electronics equipment is the power supply unit. And for the correct operation of such electronic equipment, suitable power supplies must be available. Generally, electrical power is often derived from alternating current system. Although many system however requires direct current system for operation. Hence, the process of conversion of the alternating power into unidirectional power cannot be left out is system design. Although some batteries like dry cells, take the advantage of portability and complete absence of A.C components in this operation. However there is a danger of leakage, which may damage system circuit through corrosion and their e.m.f is not constant throughout their life span.

To overcome such disadvantage, most commercial circuits are usually powered from the mains in order to avoid battery replacement and ensure constant performances at all times.

Thus, a circuit must be design to convert A.C to D.C voltage of design value; such a circuit is called the supply unit.

The purpose of any power supply unit is to supply the required D.C voltage and current with low level of A.C ripple, good, stability and correct regulation, irrespective of the charges in the main input voltage. This unit is divided into four (4) stages: -

i. Transformer Stage
ii. Rectification stage
iii. Filtering Stage
iv. Regulation Stage

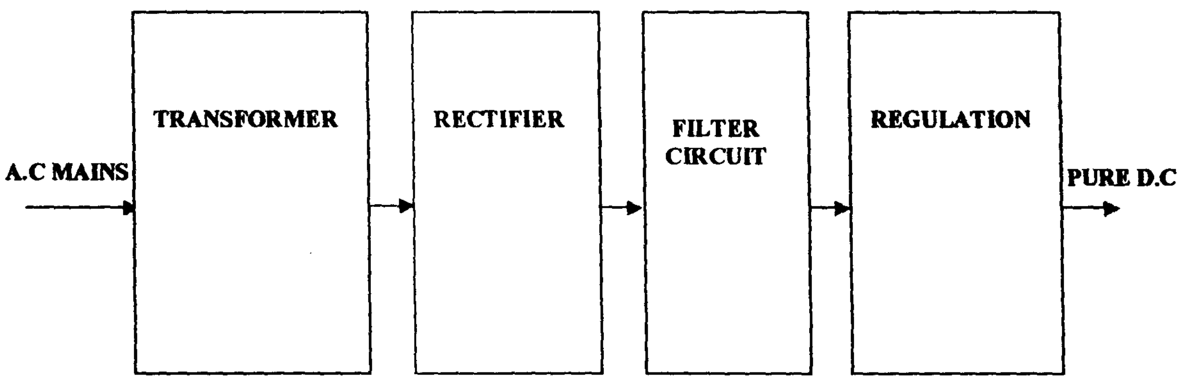


Fig. 2.0 Block Diagram of a Main D.C System.

2.1.0 TRANSFORMER STAGE

Transformer is stationary apparatus for transferring electrical energy from one alternating current to another without change of frequency, through the medium of magnetic field. It could be also be generally said that, it serves the purposes of changing the output voltage with respect to input voltages.

The steel core consists of laminated sheet about 0.36mm thick insulated from another from this layer of varnish. The purpose of laminating the core is to reduce heat loss due to eddy current induced by alternating magnetic flux. The vertical portions of the core are "YOKE". The mean free path of the alternating flux calculated in the steel core was represented by dotted lines in the figure below. If the whole of the flux produced by the primary coil passes through secondary coil, the e.m.f induced in each turns was the same for primary and secondary sides.

Hence N_P and N_S were the numbers of turns of primary and secondary respectively

$$\frac{\text{Total emf induced in secondary}}{\text{Total emf induced in primary}} = \frac{N_S \text{ X emf per turn}}{N_P \text{ X emf per turn}} = \frac{N_S}{N_P}$$

When the secondary is open circuit, its terminal voltage was the same as the induced emf. The primary current was then very small so that the applied voltage V was practically equal and opposite to emf induced in primary coil.

Hence, $$\frac{V_S}{V_P} = \frac{N_S}{N_P}$$

Since the full load efficiency of the transformer is approximately 100 percent

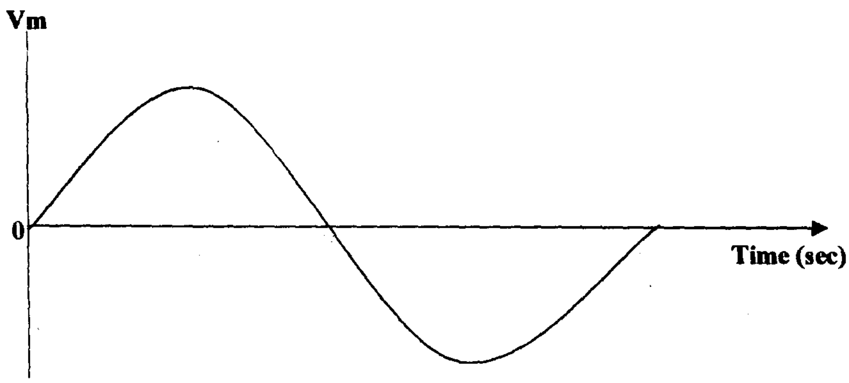


Fig. 2.1 Waveform of Input Voltage to Transform and Output Waveform

The only type of transformer used in this project construction working on a frequency of 50Hz, with a centre tapped. The step-down transformer, step-down A.C voltage from 220V to 12V (lower level D.C voltage) to suit the use of some of the electronic devices like diodes, transistors and others.

This is the type of transformer with more turns on the primary winding than on the secondary winding and was used to step-down voltage and current.

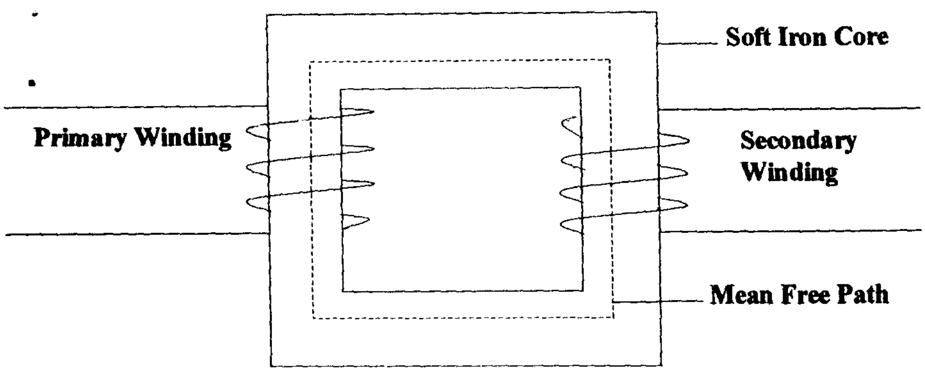


Fig. 2.2 Structure of Step-down Transformer

One of the main advantages of A.C transmission and distribution is the case with which an alternating voltage can be increased or reduced. For instance, the general practice in this country is to generate at voltage at about 11-23KV then step it up by means of auto-transformer to higher voltage for the transmission line. At suitable points other transformer are installed to some industrial consumptions. A medium size transformer has full load efficiency of about 97-98 percent, so that the loss at each point of transformation will be very small. Also, since there is no moving part, the amount of supervision required is practically negligible.

In this project, the transformer serves the following purposes: -

i. Step-down transformer isolates the equipment D.C power line from the mains supply.

ii. It also changed the level of A.C main voltage of lower voltage value (12V) required. [2]

The primary coil 'P' and secondary coil 'S' are wound on a limb coil. The ratio of secondary voltage to primary voltage $\frac{Ns}{Np}$ was determined by the numbers of turns on each winding, if the transformer is 100 percent efficient at transferring electrical energy from primary to secondary.

The ratio $\left(T = \frac{Ns}{Np}\right)$ is called "Turn Ratio".

Secondary p.d = Turns on secondary

Primary p.d = Turns on primary

In symbol,

$V_S = N_S$.. (i)

$V_P = N_P$.. (ii)

If N_S is twice N_P, the transformer is a step-up and V_S will be twice N_P and in step-down transformer V_S is lesser than V_P

$V_P > V_S$ ⟶ Step-down

$V_P < V_S$ ⟶ Step-up

And $\frac{Vs}{Vp} = \frac{Ns}{Np} = \frac{Ip}{Is}$

$\frac{Vs}{Is} = \frac{Ip}{Vp}$ and $NsIs = NpIp$

2.1.1 RECTIFICATION STAGE

The term rectification is defined as the process of a unidirectional current (D.C voltage) from the A.C main supply (A.C voltage) from the transformer secondary winding. Regardless of the type of rectifier used, the function of all rectifiers is the same, that is, they allow electron flow in only one direction. For single phase (1-4) rectification are three types of rectifier circuits; half-wave, full-wave and bridge-full wave rectification.

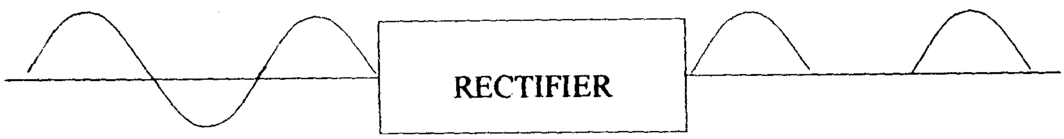


Fig. 2.3 Rectifier

2.1.1.0 HALF-WAVE RECTIFICATION

In half-wave rectification, only a singly diode connected in series with the A.C supply and the load, conducts only on one half of the cycle.

The diode conducts only during those alternate half cycles of the A.C supply Vs that make point A positive relative to point B and so the load current consists of a series of half sine-wave passes. The voltage Vp developed occurs the load resistance and has the same wave form as the load current.

The disadvantage of this type of rectifying circuit is that it has low efficiency. The load voltage, although unidirectional, varies considerably and is indeed zero for half the time. Such a waveform is only suitable foe simple applications, such as in battery charging. Since the variation will appear as noise at the output of any equipment fed by the supply when the diode is non-conductivity, the peak voltage across it, is known as the peak inverse voltage which is equal to the peak value of the transformer's secondary voltage. The D.C output of rectifier circuit is regarded to be as steady as possible and a great step towards this goal could be achieved if the load voltage could be prevented from falling to zero during alternating half cycles. One way of achieving this is to connect a capacity 'C' is parallel with the load as shown in fig 2.4 below.

Each time the diode conducts the current that flows charges the capacitor and the voltage across the capacitor building. During the intervals of the time where the diodes are non-conducting, the capacitor discharges through the load resistances and prevents the load voltage from falling to zero.

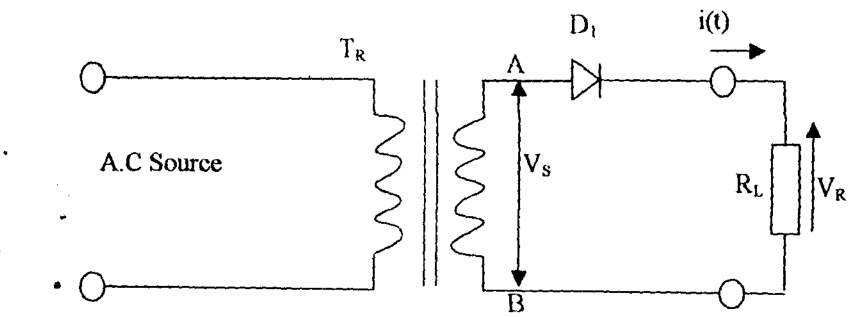


Fig. 2.4(a) Half-wave Rectifier Circuit.

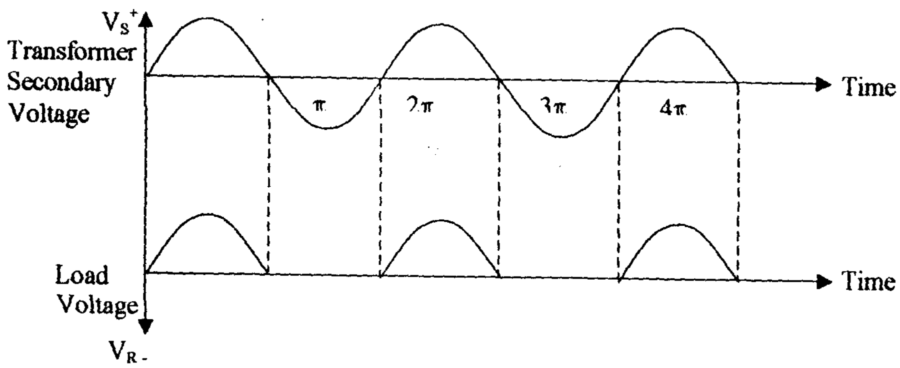


Fig. 2.4(b) The Half-wave Rectifier Voltage with Resistance Load Waveform

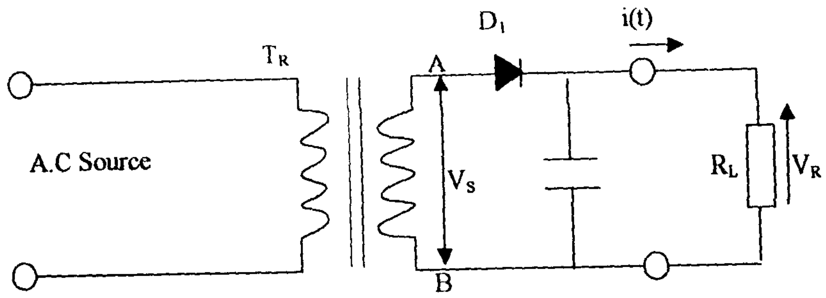


Fig. 2.5(a) Half-wave Rectifier with capacitor Circuit

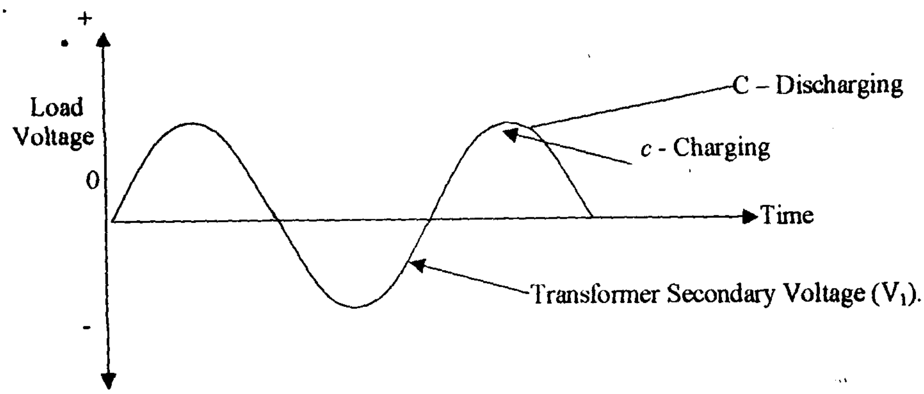


Fig. 2.5(b) Half-wave Rectifier with Resistance Capacitance

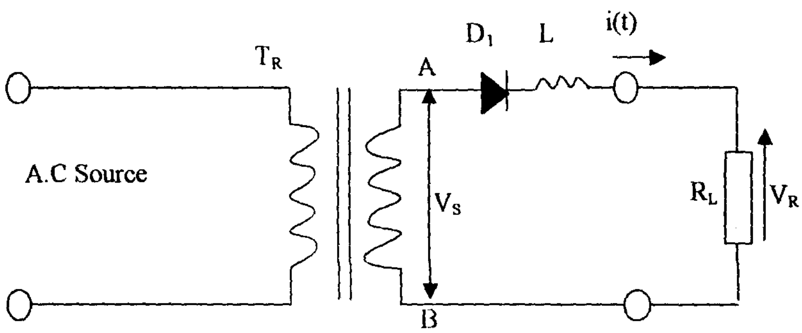


Fig. 2.6(a) Half-wave Rectifier with Inductor Circuit

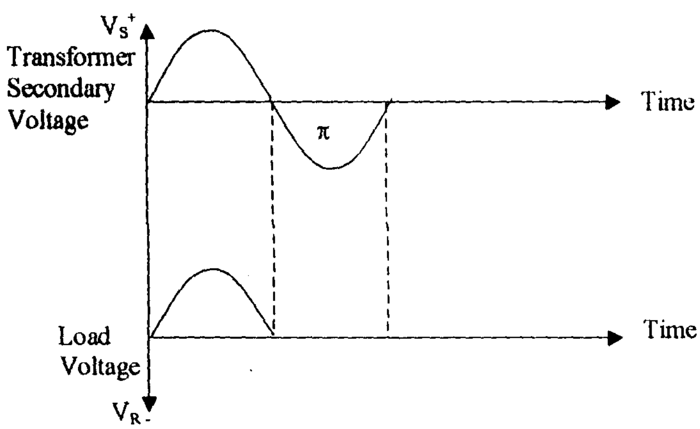


Fig. 2.4(b) The Half-wave Rectifier with an Inductive Load

The deserve output voltage which is applied to the series combination of diode and load Ri is given mathematically below: -

$$V = Vm \sin wt$$

$$i = \frac{V}{Ri} = Vm \sin wt \quad for\ 0 < wt = T$$

$$i = 0 \quad for\ T < wt < 2T$$

Since the purpose of certification is to obtain a unidirectional current, the D.C component of the load current is the average values or: -

$$idc = \frac{1}{2T} id(wt) = \frac{1}{2n} \frac{Vm \sin wt}{R1d(wt) + \phi}$$

$$idc = \frac{1}{2n} \frac{Vm}{R} [-\cos wt]\phi = \frac{Vm}{Rl} = \frac{imaz}{n}$$

2.1.1.1 FULL-WAVE RECTIFICATION

In full-wave rectification, two diodes are involved, each conducting on alternative cycle due to conduction of electrons in the load throughout the cycle which give much higher efficiency. However center-tapped transformer with secondary loading must be used. This is one of the types of rectification employed in this project (to rectify current flowing into the charging unit). Because it also has ability to produces approximate varying and reference voltage.

With full-wave rectification of an A.C source, both half cycles are inverted to give a unidirectional load current.

The secondary windings of the input transformer Tr, was accurately centre-tapped so that equal voltage are applied across the waveform that makes point A positive with respect to point B, and D_2 does not and current flow in the load in the direction indicated by the arrow.

When point 'C' is positive to point B and point A is negative to point B, D_2 is conducting and D, does not and current flows in the load in the same direction as before.

The waveform of the current and hence of the load voltage V_R, is shown in fig. (2.6) below.

The P.I.V is $2V\phi$

A more constant value of load voltage can be obtained by the connection of a capacitor across the load as shown across the load as shown fig. 2.6 below. The action of a reservoir capacitor is exactly the same as in the half-wave circuit but now the capacitor rests to discharge through the load, but provided the time constant is not short, the load voltage has not fallen by much before the next charging pulse occurs. The load voltage attains a mean value only slightly less than the peak voltage appearing across one-half of the input transformer secondary windings.

As before, the ripple content of the load voltage increase with in load current and can be reduced by the use of a suitable filter network.

The full-wave circuit has a number of advantages over the half-wave circuits: -

a) It is more efficient

b) Just a little if any D.C magnetization of the transformer core occurs.

c) The ripple voltage is at twice the supply frequency, i.e at 100Hz. The increase in the ripple frequency makes it easier to reduce the percentage ripple to a desired level. The disadvantages of the circuit is the used for a centre-tapped transformer and for two diodes. [3]

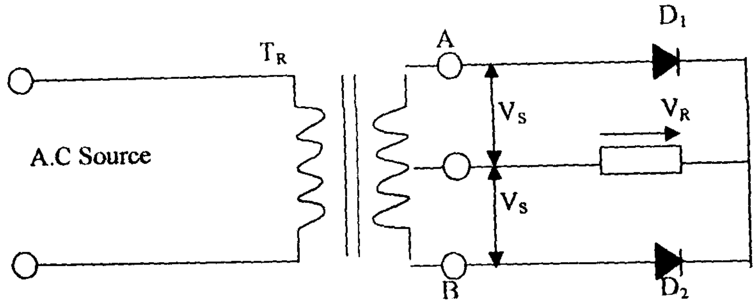


Fig. 2.7(a) Full-wave Rectifier Circuit

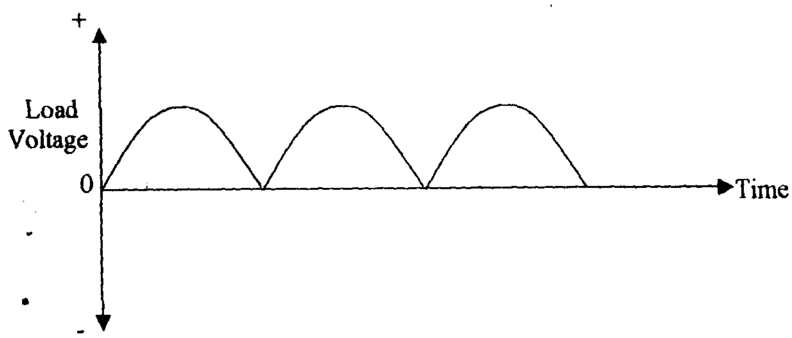


Fig. 2.7(b) Full-wave Rectifier Voltage Waveforms

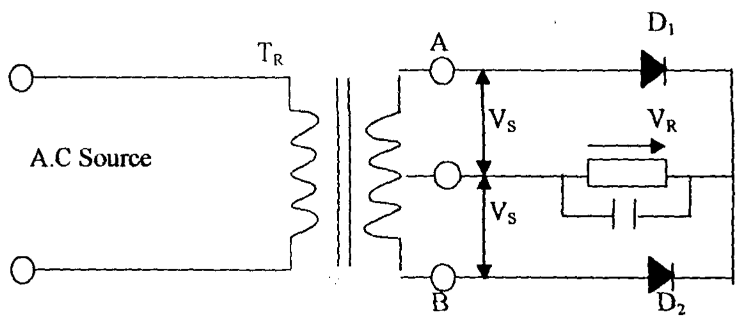


Fig. 2.8(a) Full-wave Rectifier with Capacitance Load Circuit

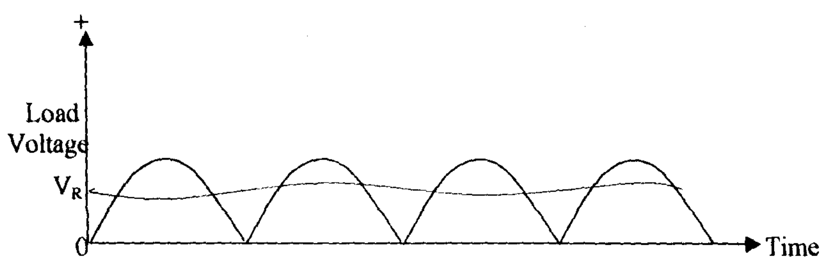


Fig. 2.8(b) Full-wave Rectifier Resistance Capacitance Load Waveforms

2.1.1.2 BRIDGE FULL-WAVE RECTIFICATION

In the bridge full-wave rectification, for diodes in one encapsulated unit over the whole cycle without centre-tapped transformer is used. Just as used in this project to rectify current entering the switching device (relay). The disadvantages of using circuit of full-wave rectification just describe above, is that the transformer secondary windings must produce twice the voltage of that used in the half-wave rectifying circuit, because only half the winding was at any time. This problem can be solved by using four diodes in what is termed a bridge rectifier.

Since the bridge rectifier circuit requires four center-tapped input transformers. During these half cycles of the input that make point A positive with respect to point B, diodes D_2 and D_4 are conducting and diodes D_1 and D_2 are non-conducting; current therefore, flows from point A to point B through the D_2, the load R_L and D_4.

When point A is negative relative to point B, D_1 and D_3 are conducting and D_2, D_4 are non-conducting; current then flow from point B to point A through D_3 the load R_1 and D_1.

Both current passes through the load in the same direction and so a fluctuating unidirectional voltages is developed across the load having the waveform as shown in (fig. 2.9b) above.

The variations in the load voltage can be reduced by connection of a capacitor across the load; the load voltage waveform is form.

When higher D.C voltages are required, the bridge circuit has some advantages over the circuit using a centre-tapped transformer.

The peak inverse voltage (P.I.V) of each diode is only equal to the peak secondary winding is not required; and the current rating of the transformer is less.

This mean that a smaller and hence a cheaper transformer can be used. [4]

The current through the load resistance is always in the same direction as D.C component is twice as large as in fig. 2.9a below.

The bridge rectifier from half-wave rectifier can be mathematically illustrated as shown below.

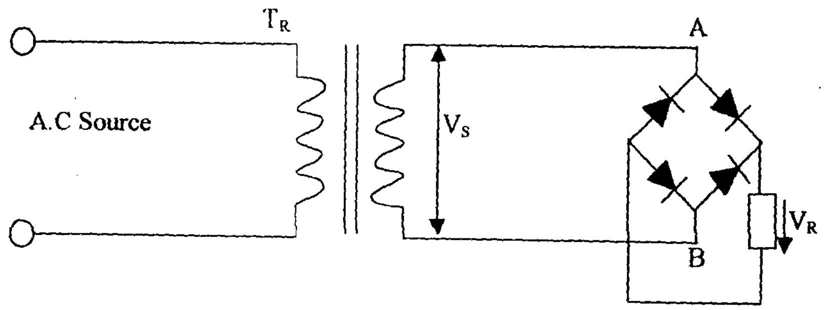


Fig. 2.9(a) The Full-wave Bridge Rectifier Circuit.

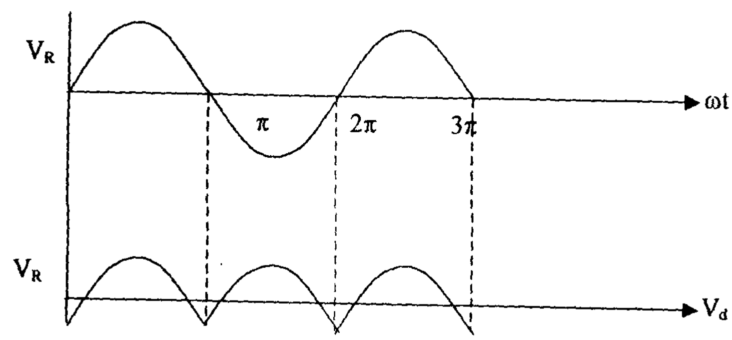


Fig. 2.9(b) The Full-wave Bridge Rectifier Waveform

The D.C component of full-wave rectifier is given by

$$Idc = \frac{1}{2\pi}\int_0^{2\pi} Id(wt)$$

Where I = instantaneous value of current voltage

$$V = Vm \sin wt$$

$$Therefore, I = \frac{V}{R} = \frac{Vm \sin wt}{R}$$

Where, R = load resistance

$$Idc = \frac{1}{2\pi} \int_0^{\pi} Id(wt) + \int_0^{2\pi} Id(wt)$$

$$= \frac{1}{2\pi} \int_0^{\pi} \frac{Vm \sin wtd(wt)}{R} + \int_{\pi}^{2\pi} \frac{Vm \sin wtd(wt)}{R}$$

$$= \frac{1}{2\pi} \frac{Vm}{R} [\cos wt]_0^{\pi} + \frac{1}{2\pi} [-\cos wt]_{\pi}^{2\pi}$$

$$= \frac{1}{2\pi} \frac{Vm}{R} [4]$$

$$= \frac{2Vm}{\pi R}$$

$$= \frac{2 \mathrm{Im} ax}{\pi}$$

Where, Imax = peak to peak current

V_m = peak to peak voltage

2.1.2 FILTERING STAGE

This is the unit at which high harmonic frequency which may be present in the circuit was got rid of, thus the output waveform closely approximate a sine wave. Electronic equipment for instance, their power supply unit must provide them a D.C voltage of minimum ripple content. To reduce these ripple voltage to tolerable level, it is generally aid its load. The circuit can have either a capacitor, an inductive (choke), input filter; all are smoothen out the pulses (A.C ripples from the rectifier).

However, to achieve low amplitude of ripple, a very high electronic capacitor must be employed. The simple capacitor connected in shunt across the load to reduce ripple and therefore a simple filter that was most adequately suitable for this project work. [5]

Since the desire result of rectification is direct current of rectifier circuit obtain large alternating components of rectification.

We define ripple factor 'r' shown below: -

$$r = \frac{Iac}{Idc} = \frac{Vac}{Vdc} = \frac{r.m.s.valueofa.c.component}{r.m.s.valueofa.c.component}$$

Since the total power is the sum of power dissipated by direct and alternating component, therefore:

$$I^2 r.m.s.R_L = I^2 d.c.R_L + I^2 a.c.R_L$$

$$I^2 a.c = I^2 r.m.s. - I^2 d.c$$

And,

$$r = \sqrt{\frac{I^2 r.m.s.I^2 d.c}{Ic}}$$

$$r = \sqrt{\left(\frac{Ir.m.s}{Idc}\right)^2 - 1}$$

If the ripple factor is low, the circuit is performing the conversion from alternating current to D.C current. Filter circuit may take various forms but the basic arrangement used for this project is show below.

The value for the capacitor must be large in order to present as small as reactance as possible to the pulsating rectified output and to store efficient charge so that current may be maintained in the load during the period that the rectifier is not conducting.

For the kind of load used in this project, a capacitor of with 470Nf – 1000Nf are commonly used.

All rectifiers have peak current ratings and there ratings can be exceeded if the value of C is too large causing damages to the rectifiers. For any given rectifier and associated circuit the maximum value of C that can safely be used is specified by the manufacturer data sheets.

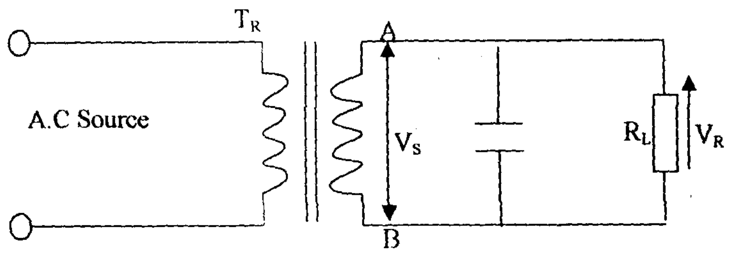


Fig. 2.10(a) The Filtering Circuit

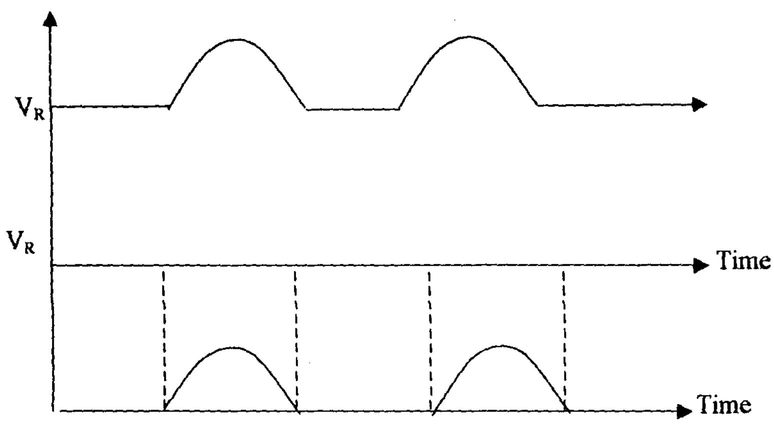


Fig. 2.10(b) Ripple Filtering Waveform

2.1.3 THE REGULATION UNIT

This is the unit where stabilized, standard or reference voltages was provided. The two types of regulation commonly used are; linear regulation and load regulation. Their function is to keep the output voltage constant irrespective of input current charges.

Zener diode is connected in various ways to perform this operation as used in this project work.

Resistance when forward-biased and behaves almost as an insulator when reversed-biased.

Hence, it was used as a rectifier for voltage entering both the charge unit and switching unit in this project.

CHAPTER THREE

CONSTRUCTION, TESTING AND RESULTS

3.0 INTRODUCTION

This is the chapter in which the previous chapter will be made to see the light of the day, that is, where life will be put into the theory and design of the project just discussed. Before the construction of this project, several things were taken into consideration of which most important, the theory and design of each stage.

First and foremost, the circuit was first of all built on a solder less bread board which made it possible to make changes when the need arises and made easier to locate bugs. It was later transferred on to the Vero board where careful component soldering was done.

All components lead was kept at minimum to prevent accidental short circuit. The circuit was carefully planned, minimizing errors and made troubleshooting easier. Finally the entire connection was carefully housed in a wooden box (compartment) and lighting bulb mounted by the side as shown below: -

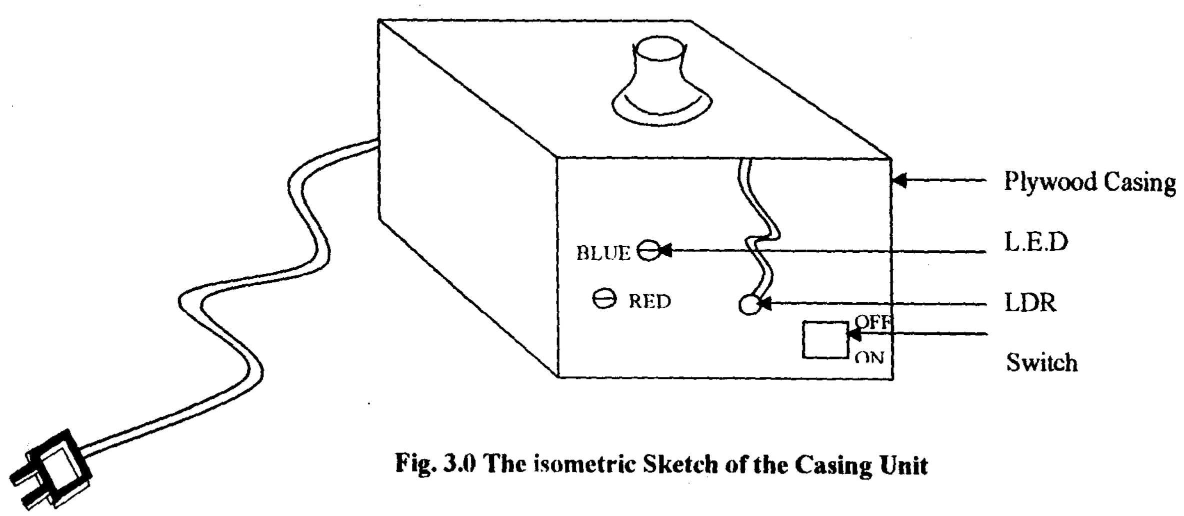


Fig. 3.0 The isometric Sketch of the Casing Unit

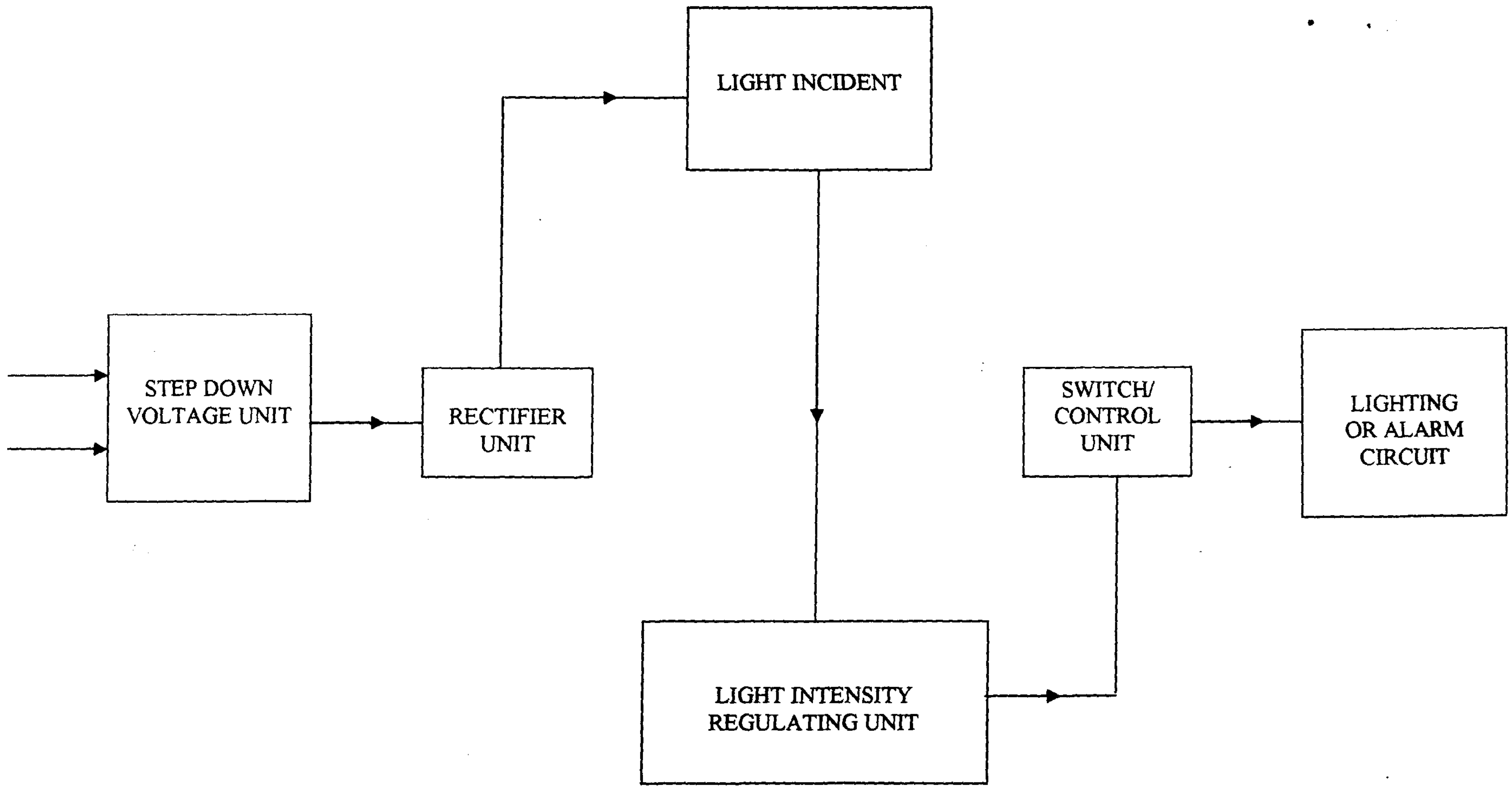


Fig. 3.1 Block Diagram of a Light Activated Switch

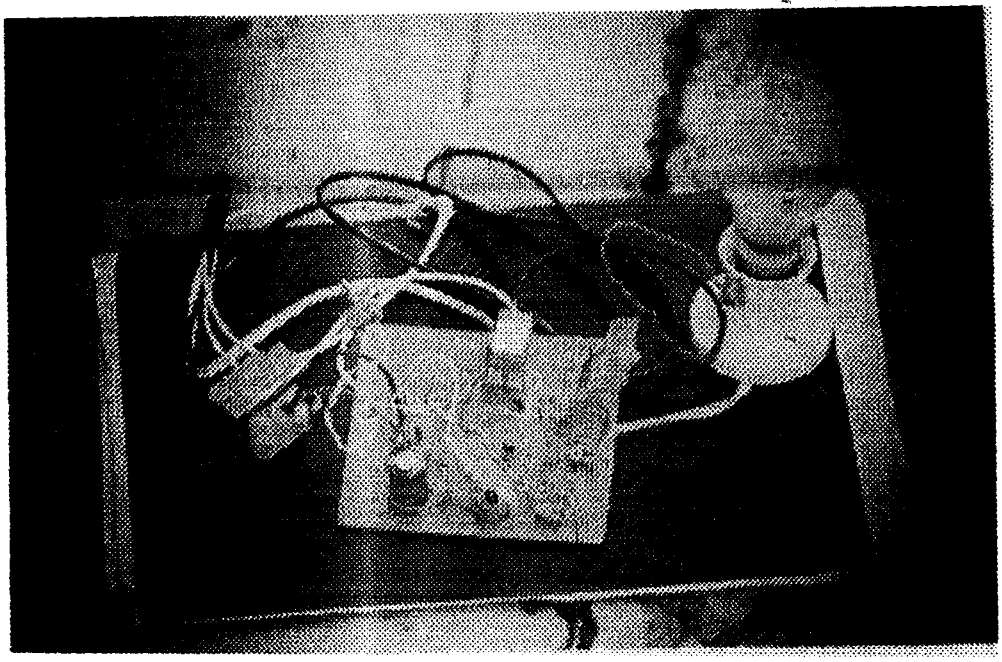


Fig. 3.2. Internal Circuitry of Light Activated Switch

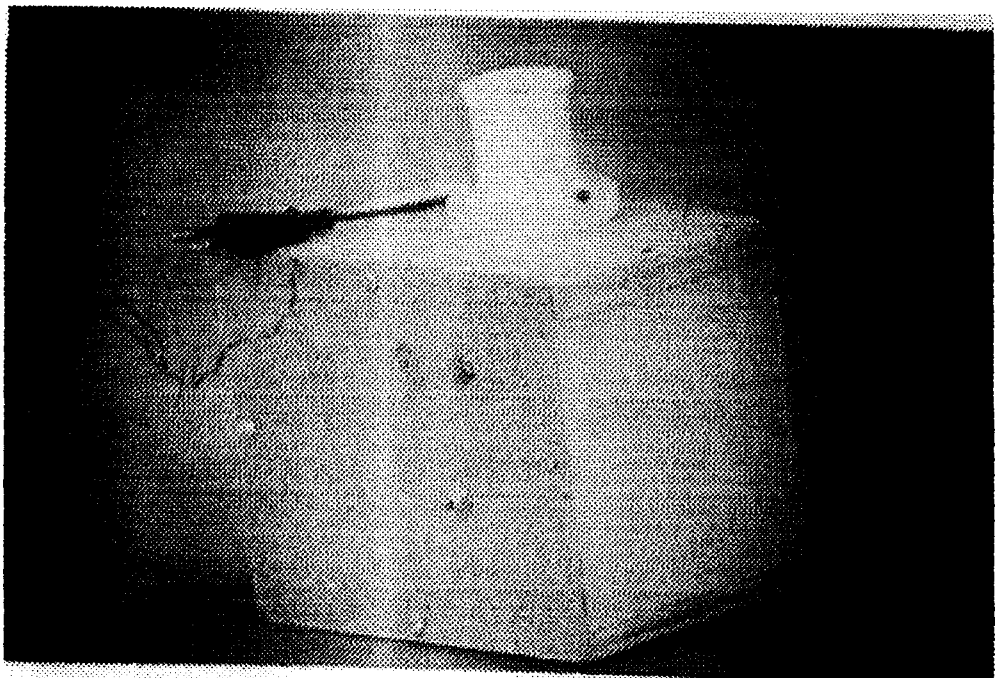


Fig. 3.3. Casing of Internal Circuitry of Light Activated Switch

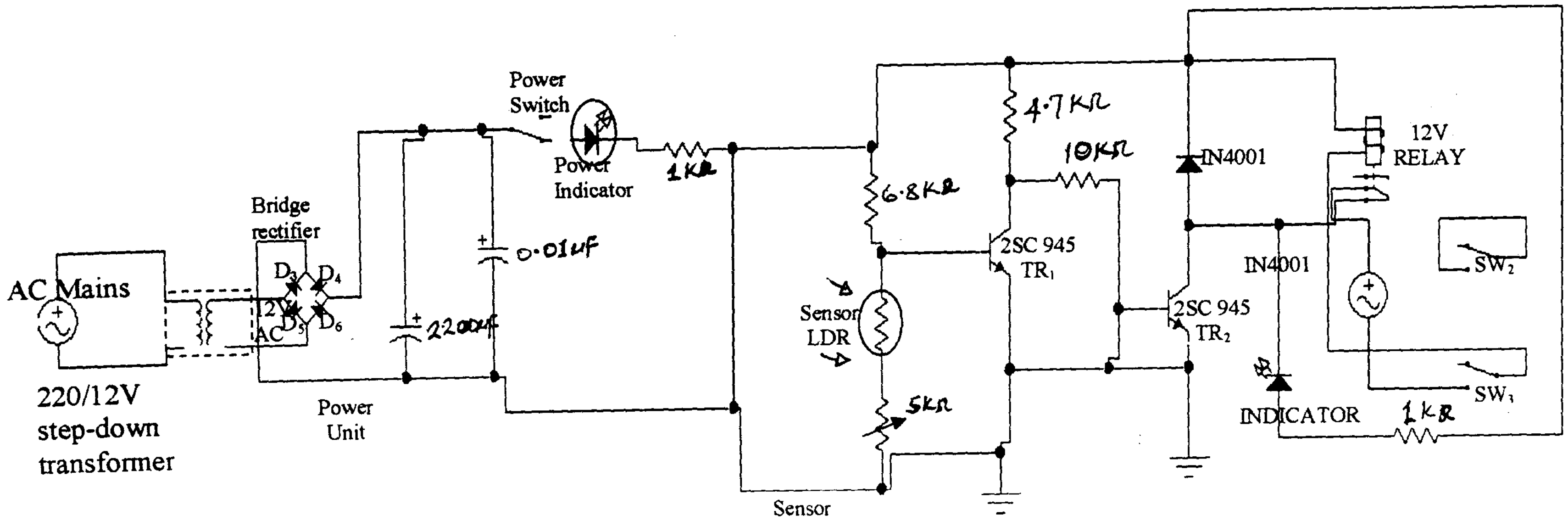


Fig 3.4: Circuit Design of a Light Activated Switch

The principle of operation of the light activated switch system can be divided into the following parts: -

a) The power (main) supply unit
b) The light incident unit
c) The light intensity regulating unit
d) The switching/control unit
e) The lighting/Alarm unit

3.1 THE POWER SUPPLY UNIT

This is where the main supply from the Power Holding Company of Nigeria (PHCN) gets to the circuit. The voltage that comes from the main source is a single phase i.e. 220V with 50Hz frequency, which needs to be stepped down and rectified before further usage.

The main supply unit consists of the centered-tapped step down transformer which serves two purposes; it isolates the equipment d.c power lines from the main supply and also changes the level of a.c main voltage (220V) to the lower d.c voltage (12V) required. Followed by transformer in this unit is for rectification diodes. They serve as the rectifier unit where traces of a.c voltage form the transformer secondary winding were converted into pulses of unidirectional current.

Out of the afore-mentioned three types of rectifier, the bridge rectifier was used in this project because it gives much higher efficiency in switching/control unit. The red light emitting diode connected to this unit is to indicate when supply is from the main source. To the LED is a 1kΩ connected to limit the amount of current that goes into the LED to protect it. [6]

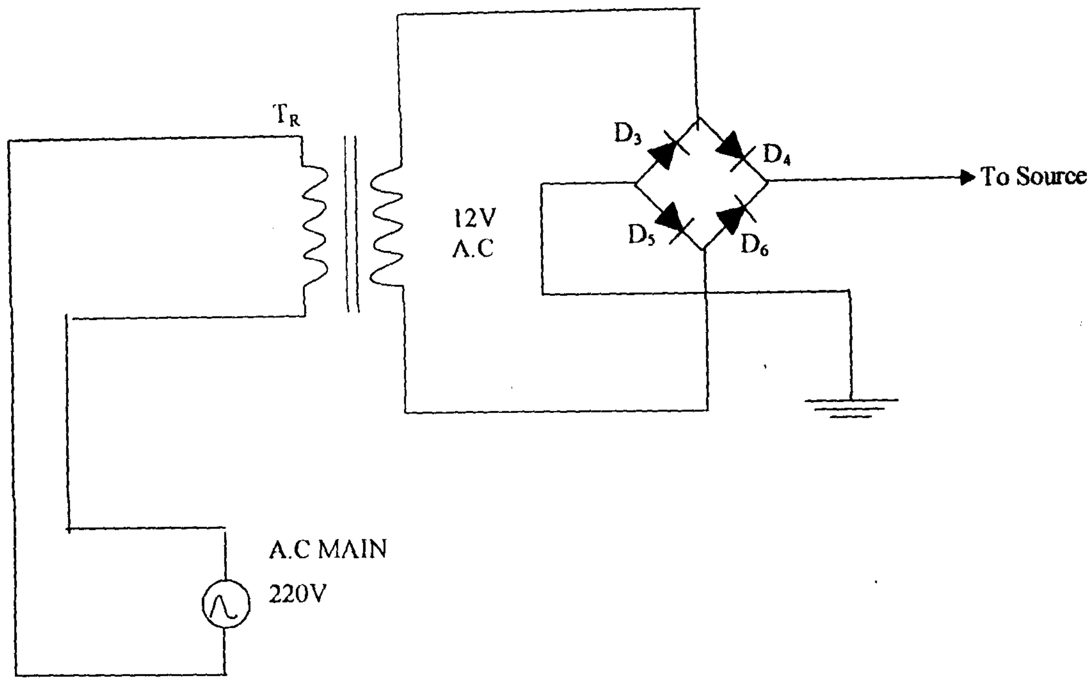


Fig. 3.3 The Power Supply Stage

3.2 THE LIGHT INCIDENT UNIT

The most sensitive part of this unit is the light dependent resistor which has very wide range of resistance – in bright light; the resistance may fall to just four hundred ohms (or less). In total darkness, the resistance is usually in the order of a few mega ohms. Between the negative and positive supply there is a "voltage divider". As it name implies, a voltage divider simply "taps off" a certain percentage of the voltage across the whole divider. A simple voltage divide consists of the two resistors as shown in the diagram, the bottom one is V_{R1} (Variable resistor) while the top one is R1. in fact, R1 doesn't have any part to play in the voltage divider. It was connected in series with variable resistor V_{R1}, so that the total resistance cannot be below 6.8KΩ even if V_{R1} is set to zero and to limit the current through the LDR and transistor, should the LDR'S resistance fall to a very low level.

3.3 THE LIGHT INTENSITY REGULATING UNIT

The voltage at the centre of the voltage divider (and, therefore, on the base of T_{R1}) is dependent on the setting R_{V1}, and the amount of light falling on the LDR. In darkness or very low light, the LDR is a very high resistor (much, much higher than R_{V1} even set at a maximum). So the voltage at the base T_{R1} was too low to turn it on.

When the light level arises, and the LDR resistance falls, the voltage at this point rises. The point was soon reached where the voltage rises high enough to turn on TR!, RV1 can be adjusted to balance out source of effects of the LDR, and so serve as a level control.

3.4 THE SWITCHING/CONTROL UNIT

This is the unit that operates ON and OFF of the relay. It also connects and disconnect some lines it also acts as the control link between the circuit and the a.c main supply in this project construction.

The direct current coming from the supply unit was first rectified using bridge full-wave rectification, before going into this unit. The unit consists of relay, and diode. It operates in such a way that, when the current energizes the relay coil, a magnetic field was set up which magnetize the coil terminal and current flows into the lighting/alarm unit, and when the light intensity on the LDR was lower than the regulating amount, the relay de-energizes and there by change over the light/alarm unit.

Relay itself is an electro-mechanical switch by design; a movable spring armature is mounted above the core of an electromagnet. When the core is energized, the amarture is altered and the contacts open or close by responding to a change in some physical quantities as current, voltage, frequency, light sensitivity, temperature and pressure etc. A relay in a normally closed position opens when activated and normally relay open relay closes when energized. One of the advantages of relay includes the rapid and positive switching control of machinery and device from a remote location. This provides afety for the operating. Since the relay operating voltage and current can be relatively small when compared to levels required for running the machine. [7]

3.5 THE INDICATOR CIRCUIT

The connection of the indicator circuit in this project construction was made by connecting light emitting diode in series with a 1kΩresistor which serves as a current regulator to the LED. In this project red and blue LED were used. The red LED indicator lamp glows when the main supply is ON and OFF, while the blue LED indicator lamp indicates the response or the sensitivity to the intensity of light falling on the circuit. The LEDS are connected in such a way that, the red LED takes its source from a.c main supply and the blue Led takes its own source from the TR1 in the circuit. These LEDS are composed with the convectional filament lamps operating fro significantly smaller voltage and currents. Most LEDS when a forward current between 5mA and 20mA was applied provides a reasonable level of light output. In order to limit the forward current to an appropriate value, it is usually necessary to include a fixed resistor in series with the LED indicator.

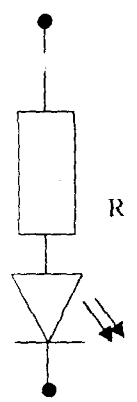


FIG. 3.5 An On Indicator Circuit

3.6 THE LIGHTING/ALARM UNIT

Since the output of this project is mainly to light up a connected circuit in form of bulb, fluorescent, alarm circuit or to cut off the circuit. This responds to the presence or absence of light on the circuit whereby the light or the alarm unit switches ON and OFF as the case may be to suit the necessary purposes.

As the appropriate voltage energizes the transistor, it automatically switch ON and OFF the relay, which controls the alarm and the lighting unit.

Likewise, the lighting unit was used to represent where the alarm circuit is to be connected, if it is to be used for alarm triggering circuit.

Therefore, the project can be used intermittently for either to lighting up a system or to switch on an alarm in response to the sensitivity of light.

3.7 TESTING

During the construction, the waveform was displayed using an oscilloscope after rectification and the required waveform was noted. Other components were also tested to confirm their values before used in the construction. Outputs at each of the stages were also tested.

Finally, the construction was connected to a.c mains and a certain source of light was shinned on the sensitive part of the system while the light source was varied using the appropriate variation in the rheostat regulation being used for the control of the light and the appropriate response by ON and OFF of the bulb shows the successful completion of the project. This shows that the aim and objective of the project was observed.

3.8 RESULTS

The d.c output of the bridge rectification of the direct 220V a.c supply was feed into the censor i.e. LDR in parallel with the variable resistor 5KΩ. The voltage divider at the interval between the LDR and 5KΩ sets the voltage point 0.6V which triggers ON the TR1 and TR2 in the absence of light i.e. darkness in which triggers ON the relay which also put ON the lighting or alarm circuit connected to it.

3.9 DISCUSSION OF RESULTS

Having designed the project circuit following al its theories of operation, the construction was success, although not without hitches anyway, but the aim of the project was achieved.

However, the output may not be perfect, due to assumption of a value and approximation of others concerning the component used.

The relay used has the ability to operate with a very small current, and to switch a large current ON and OFF.

As the light was incident on the LDR, the transistors switch ON the relay and OFF as the light is cut-out. But since the voltage that turn ON the transistor is not enough (about 0.6V) to turn ON the available 60watts bulb, but in a large power so as to have a higher voltage to put ON and OFF the light or alarm connected across the relay.

CHAPTER FOUR

CONCLUSION AND RECOMMENDATION

4.0 CONCLUSION

The design, construction and testing of a light activated switch that was carried out in this project shows that the photo-conductive properties of devices can enable them to be used in diverse applications. The fundamentals of its designs, that of its components and the basis of the operation are now well comprehend.

Likewise, multitude of control devices uses photo-conductive devices for their basis of operation. Alarm and safety devices use photo-conductors which have a constant beam of light focused on them.

If the beam of light is interrupted, the photo-conductor changes resistance. This change can be detected by an external system which sets off and alarm or shuts off a machine. And many of the street lights in use today have individual photo-conductive devices which control the lamp when the day light falls below or rises above a certain level.

Furthermore, the light activated switch can be used in diverse ways in industries, home and laboratories due to its reliability of operations.

4.1 RECOMMENDATION

Having completed the project construction, I hereby make the following recommendations for thee project's improvement:

i. The sensitive light incident unit should be handled with care and be directly towards the path of the light or darkness directions.

ii. Depending on the mode of operation that is, needed for either normally open or normally closed relay is recommended accordingly.

iii. The thyristor could be used instead of transistors for its high power circuit rating. And the corresponding relay is that sets ON or OFF the device should be used simultaneously.

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