DESIGN AND CONSTRUCTION OF A BURGLARY DETERRENT USING THE LIGHT DEPENDENT RESISTOR (LDR).

PRESENTED

BY

EDAFIOVO ONORIODE LUCKY

MATRICNUMBER 97/5070EE

DEPARTMENT OF ELECTRICAL/COMPUTER ENGINEERING

SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY,

MINNA.

NOVEMBER, 2004

DESIGN AND CONSTRUCTION OF A BURGLARY DETERRENT USING THE LIGHT DEPENDENT RESISTOR (LDR).

PRESENTED

BY

EDAFIOVO ONORIODE LUCKY

MATRIC NUMBER – 97/5929EE

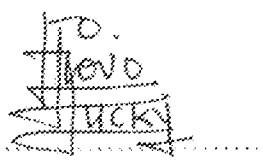
IN PARTIAL FUFILMENT OF THE REQUIREMENT FOR THE AWARD OF THE BACHELOR OF ENGINEERING (B.ENG) DEGREE IN THE DEPARTMENT OF ELECTRICAL/COMPUTER ENGINEERING, SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY (SEET)

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA NIGER STATE.

NOVEMBER, 2004.

DECLARATION

I, EDAFIOVO ONORIODE LUCKY hereby declare that this project was designed, and constructed by me under the supervision of Eng. M. D. ABDULLAHI and has not been submitted elsewhere for the award of Bachelor Degree.



EDAFIOVO. O. LUCKY

3rd Dec. 2004

DATE

CERTIFICATION

This is to certify that this project was carried out by EDAFIOVO ONORIODE LUCKY Matriculation number 97/5979EE of the Department of Electrical/Computer Engineering, Federal University of Technology Minna, Niger State, Nigeria.

Engr. M. D. Abdullahi
Project Supervisor

Date

Engr. M. D. Abdullahi
Head of Department

Date

External Examiner

Date

DEDICATION

This project is dedicated to my Father – Chief EJOVI JOHNSON PDAFIOVO for his Challenge and inspiration through my University Carrier.

ACKNOWLEDGEMENT

My utmost credit for this work goes to the Almighty God for granting me the vigor to achieve this degree at last. I also love to express my profound gratitude to my Supervisor Engr. M. D. ABDULLAHI for his timely and logical contribution to this work. Worthy of mention here is Mr. S. N. RUMALA for his assistance in this work also.

Further, my greatest indebtedness goes to my uncle, Mr. AFATAKPA .A. FRANCIS whose contribution towards my successful academic career cannot be quantifies. My regards also to Evvg. Johnbull Ejovi, Mrs. Christiana Edafiovo, Mrs. Vivian Afatakpa, Umukoro I. Ufirona and a host of others.

I also commend my friends some of whom are Edjere Oghenevwoke, and Efemudu Messiah for their effort, I remain grateful to you all and pray God for his infinite mercy and blessings to replenish you all..

ABSTRACT

The burglar deterrent using the light dependent resistor (LDR) or photo conductive cell circuit employs the characteristics of the photo conductive cells whose conductivity is a function of the incident electromagnetic radiation. The spectral response of the commercially important types matches the human eye, hence, the application of the cell where human vision is a factor, such as street light, indoor light, security light and iris control for cameras to mention a few.

TABLE OF CONTENTS

CHAPTER FIVE

CHAPTER ONE

1.0 GENERAL INTRODUCTION

1.1 INTRODUCTION.

Many people feel anxious about leaving their homes unattended at night and during holidays, because of the risk of being burgled. Records of burglar theft abounds in our environment day after day with majority of its victims being shift workers who returns to their home very late each night, and in some cases even run night shift.

The next victims of this heinous scourge in the society are the students leaving around most institutions of higher learning today. Facts have shown that many at one time or the other returned from holiday's to meet their apartments burgled.

In the industries, the fear of burglaries and related offences is a major reason behind the positioning of security lights at strategic locations within and outside the premises with a view to keeping a lighted environment especially at NIGHT. The rationale behind a lighted environment is to ward off or discourage the burglar and other criminals from such an environment who prefer to operate in the dark-at night. Available records reveals that our contemporary world is the one where burglaries are becoming fairly regular if not an order of the day, hence, the need to scotch it if it can not be totally eradicated.

This had led the electrical electronics engineers/designers to design a number of security devices/circuits, some of which are: - The personal alarm, Cycle theft alarm, burglar alarm, and a host of others

The design and construction of the burglar deterrent using the light dependent resistor (LDR) falls into this group also. This is a device/circuit system, which detects nightfall and in turn responds by turning ON, the living room light (like every other light). It operates as if the

occupant or someone is around, who performed the ON operation and possibly OFF the light when it is dew to go OFF. It therefore could be used domestically and in the industry for lighting purposes.

1.2 HOW THE PROJECT IS TO BE CARRIED OUT

Since this project is designed with the immediate environment in view, it is my intention to produce an economically and affordable project, hence, its components are sourced from the local electronics market. The project is basically in three phases, the power pack phase, the sensory phase and the Controlled phase or the output phase. Therefore, this project was carried out in these three phases simultaneously.

1.3 AIMS AND OBJECTIVES

Engineering is all about making life more comfortable through the application of science either for designing and construction or for the preposition of useful phenomenon for the benefit of man, hence, this project being one of such is set to accomplish the following.

i. To design a circuit that automatically regulates a lighting system.

ii. To construct the designed circuit.

iii. Test the constructed circuit and

iv. To present a detailed report on the project.

This project in its simplest form is a light dependent type that utilizes the light dependent characteristics of the light dependent resistor (LDR) as its sensory component. Depending on the manner of connection, it could either be light operated or darkness operated. The variation in its resistance under those conditions make its application especially in this project a huge success,

that is, the inherent resistive property of the LDR combined with other electrical components yielded this all important circuit.

Therefore, the economical importance's of this project are:

i. It can be used to turn ON security lights (at home as well as in industries) at NIGHT.

ii It can also be used for street lighting.

I sincerely hope therefore that anyone through this project will come to appreciate the usefulness and the need for the burglar deterrent in almost every home today.

CHAPTER TWO

2.0 LITERATURE REVIEW

There is hardly any area of present day human activity that does not depend in some way on electrical or electronic devices.

Most of these electrical/electronics devices are familiar to us-electric dry/Steam pressing iron, washing matching, factory robots, automatic doors, and remote control and intrusion alarm system just to mention but few. Without these numerous Electrical/electronics "servants" our lives would be very different and uncomfortable.

However, all these devices here referred, contain electronic control systems-that is, circuits which control the way the device operates.

A steam pressing iron for example uses electricity to heat an element, which applies heat to the cloths. The temperature of that element however, must be control. The circuit, which does this, contains a special component called a thermostat. This is an example of a very simple control system.

Additionally, the automatic washing machine is much more complex. It controls the flow of water into and out of itself. The temperature of the water, the speed of the rotation of the drum, and so on-in other words, the complete wash cycle. Further, most sophisticated control systems however, belong to the robots. One example of the robotic device is the robot arm. These are increasingly taking over production processes in factories. Robots can work much faster than a human operator, performing a wide variety of tasks. They can work in dangerous environment, rarity make mistakes and never get bored. All these and many more to come only reminds us of the words of Roger L.Tokhein in his work titled "digital electronics, 5th edition" that "Electronics is among the most exciting areas of technical study. New developments are

reported weekly. Interestingly, most developments are based on the fundamentals learned in the first classes in electricity, analog and digital circuits…"

In the same vain, a senior lecturer in the department of Engineering, Hovering College of further and Higher education in the U.K rightly said "The world of electronics is fast changing and may appear a confusing and abstract collection of devices and circuits. There are, however, few areas and aspects of everyday life that are not affected in some way by 'electronics'. Cars contain more electronic circuitry than ever before and many 'electrical' appliances now have additional facilities and improvements that are, by nature electronic". To meet this increasing challenge of electronics, today's engineer and technician must be able to demonstrate both a theoretical and practical mastery of the subject.

In order to achieve this 'marriage' between knowing and doing, this project titled: - The design and construction of burglary deterrent Using the light dependent resistor (LDR) was conceived, in order o allay if it can not eliminate in totality the ugly menace of burglary theft in our society today.

2.1 MODE OF OPERATION.

The light dependent resistor (LDR) is the prime mover in this circuit because this is the sensor that triggers the circuit into action. This is a semiconductor device whose resistance varies inversely with the intensity of light that falls upon it.

Nevertheless, useful applications of this property were properly diagnosed and applied by the electrical/electronics engineer in the designed and construction of a variety of circuits some at which are: -

i. A light-operated relay circuit.

ii. The darkness-operated relay circuit.

Interestingly, the mode of operation of the burglar deterrent using the LDR is based on the operating principles of the darkness-operated relay circuit. That is one in which a relay is deenergized when light falls on the LDR and in responds trip OFF the lighting system. While with insufficient light (darkness) incident on the LDR energizes the relay which in responds turns ON the lighting system, hence, the circuit is an automated one without the limited operating effort of man which may yield negative output at times.

The block diagram of the burglar deterrent using the LDR is thus shown below.

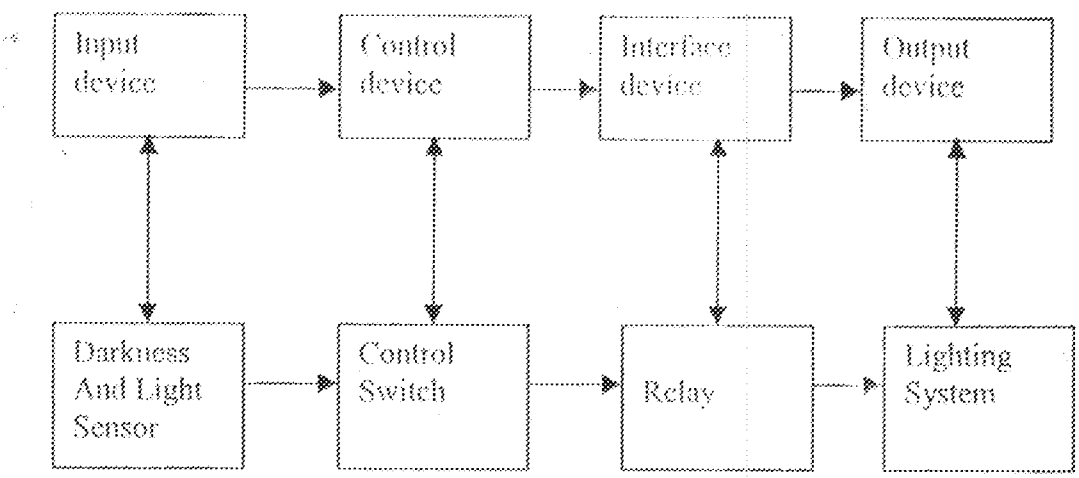


Fig. 2.0 Block diagram for an Automatic light activator.

CHAPTER THREE

3.0 CIRCUIT'S PRESENTATION AND ANALYSIS.

3.1 THE STABILISED POWER CIRCUIT.

The purpose of a stabilized or regulated power supply is to keep the d.c output constant despite variations in the a.c supply voltage and the d.c load current. A very good power source for electronics circuits is of course, a battery, and indeed this is the only supply used for portable equipment. The disadvantage is the cost, so where possible it makes good sense to use the readily available and cheap a.c mains supply and convert it to the required d.c, a good idea which is also utilized in this circuit.

A good starting point is the consideration of the power supply as a unit comprising of a series of blocks as shown in fig 3.1.1 below: -

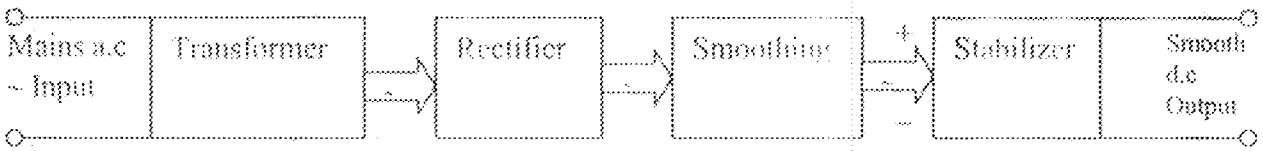


Fig 3.1.1 Block diagram of stabilized power supply.

3.2 THE TRANSFORMER.

This takes the main supply voltage and steps it down to the required voltage e g. 240V to 15V a.c (Fig 3:8:2b). There are, of course, occasions when the mains supply voltage is too low for some applications in which case a step up transformer would be used.

3.3 THE RECTIFIER

This is the part of the circuit responsible for the conversion of a.c voltage into a unidirectional or d.c voltage. The diode is the chief component for this work. The type of rectifier employed here is the full-wave bridge rectifier.

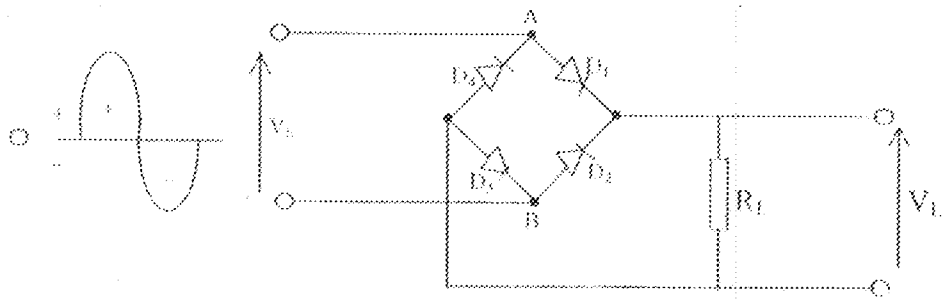


Fig 3.3.1

During the positive half-cycle, A is positive with respect to B. So, D_1 is forward biased and current flows through D_1, R_L and D_2 to B (fig 3.3.1).

During the negative half-cycle, A is negative with respect to B. So, B is positive with respect to A. Therefore, D_2 is forward biased, so current flows through D_2, R_L, D_4 to A (fig 3.3.1)

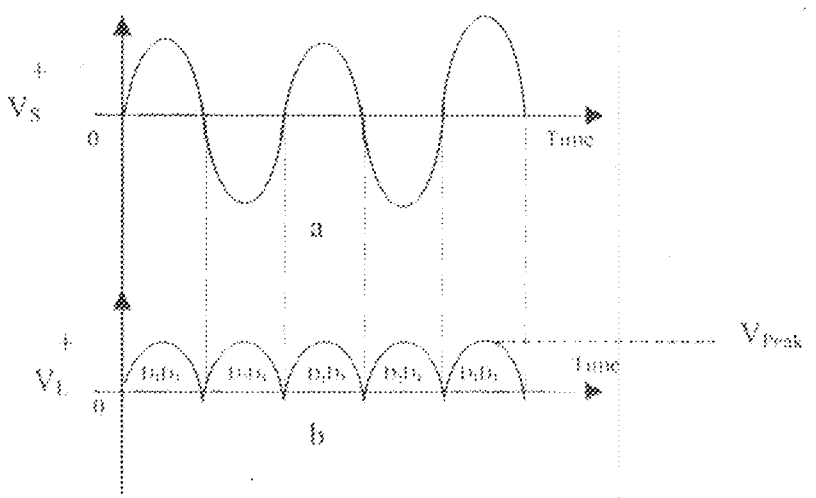


Fig 3.3.2 Diode waveforms.

As can be seen from fig 3.3.2, during both half-cycles of the supply two diodes are always conducting, which means that each diode is only subject to a maximum reverse bias voltage of V_{peak}.

3.4 SMOOTHING (FILTER)

The Unidirectional voltage produced by the full wave rectifiers consists of a series of positive half-cycles occurring at some prescribed frequency (fig. 3.3.2b). A reservoir capacitor(C_2) converts this "raw" d.c into a smoother version although with some element of a.c still present. This capacitor(C_2) in conjunction with resistor R1 form the filter (fig 3.4.1) which allows the d.c to pass while attenuating (reducing) the size of the voltage. The ripple voltage can not be completely remove because of the reactance of capacitor (C_2) however small it value may be there is always some ripple developed across R_L. The actual reactance (X_{c2}) can be calculated using.

$$X_{C2} = \frac{1}{2\pi f C_2} \quad \text{where } f = \text{ripple frequency}$$

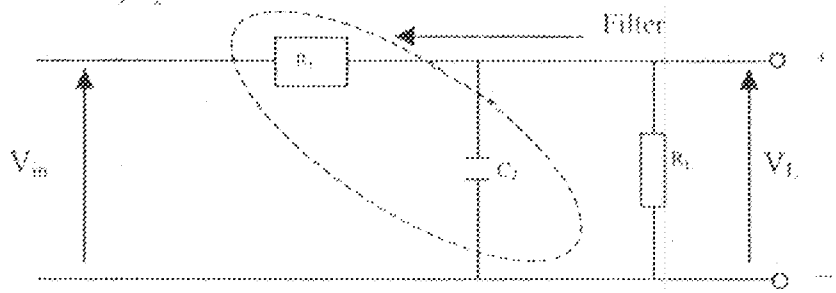


Fig 3.4.1 The low pass filter.

3.5 ANALYSIS OF THE POWER SUPPLY UNIT

The input to the power supply unit for this project is 220 V, 50 HZ a.c from the mains. This is stepped down to 15 V a.c before rectification. The transformer used is the 220V/15V step down transformer, it has only one output + 15 V and ground.

The rectified d.c voltage from the bridge rectifier is filtered by the pie (π) filter which comprises of 2200μF/25V capacitor, a 7mH inductor and 220μF/25V capacitor. A 7812-voltage regulator is employed here to stabilize the filtered d.c voltage at 12V d.c; this has the advantage of reducing the amount of ripple voltage in addition to keeping the output voltage constant. All used components are theoretically derived below: -

3.5.1 FILTER CIRCUIT CALCULATION

The capacitor ratings are chosen as follows: -

Xc_1 = Capacitive reactance = 1.5Ω

Xc_2 = Capacitive reactance = 15Ω

f = Frequency = 50Hz

From the relation

$$X_c = \frac{1}{2\pi fC}$$

$$C = \frac{1}{2\pi fXc}$$

$\therefore C_1 = \frac{1}{2} \times \pi \times 50 \times 1.5$

$C_1 = 2122\mu F$

Also,

$C_2 = \frac{1}{2} \times \pi \times 50 \times 15$

$\therefore C_2 = 212\mu F$

Hence the capacitors rated 2200μF/25 V and 220μF/25 V are therefore selected.

If we select an induction with resistance of 2.2Ω, 5W a preferred value or standard value for X_C closest to the chosen value of 1.5Ω. The inductance is calculated thus: -

X_L = inductive reactance = 2.2Ω

F = Frequency = 50Hz

From the relation

$X_L = 2\pi FL$

$$L = \frac{X_L}{2\pi F}$$

$$L = \frac{2.2}{2 \times \pi \times 50}$$

= 7mH

Hence, the 7mH inductor was chosen, from the relation

$$P = I_L^2 R$$

Where P = Power = 5w

R = Resistance = 2.2Ω

I_L = Current flowing through inductor

Substituting;

$$5 = I_L^2 \times 2.2$$

I_L = 1.508A

3.5.2 RECTIFIER CIRCUIT CALCULATION

The required output d.c is related to the maximum voltage V_{max} by the equation.

$$V_{dc} = Vmax - \frac{I_L}{4\pi fC}$$

But

$V_{dc} = 15\ V$

$I_L = 1.508A$

$f = 50Hz$

$C = 2200\mu F$

$$\therefore V_{max} = 15 + \frac{1.508}{4 \times \pi \times 50 \times 2200 \times 10^{-6}}$$

$= 15 + 1.09$

$= 16.09\ V$

The peak inverse voltage (PIV) rating of each of the four diode is equal to V_{max} (the maximum voltage across the secondary of the transformer).

By standard, the acceptable PIV (since full wave bridge rectifier is used) is 4PIV.

That is,

$4 \times 16.09 = 64.36$

Thus the IN4002 diode with PIV = 100V were chosen for the rectification.

3.5.3 LIGHT EMITTING DIODE AND ITS CALCULATION

Special diodes are made which emit light. These are called light emitting diodes (or LEDs).

LEDs are used mainly as visual indicators (pilot lamp) that a circuit is working or an appliance is "ON". Like ordinary diode, LEDs allow current to flow only in one direction. Its purpose in this circuit is to indicate that the circuit is working.

Mathematically,

If LED voltage = 2 V

Series connected resistor voltage = 10 V

LED current = 10mA

The resistance of the series connected resistor is given thus

$$R = \frac{V}{I}$$

$$= \frac{10}{10 \times 10^{-3}} = 1000\Omega$$

Thus, a 2V, 10mA LED was chosen for this project along with a 1000 (1kΩ) series connected resistor.

3.6 VOLTAGE REGULATOR'S (STABILIZER)

It is highly desirable that, should the load on the power supply be increased (thus drawing more current) or, equally, the voltage from the rectifier rise for some reason, the output voltage remains stable. To provide this facility the supply is further fortified by the inclusion of a voltage regulator or a stabilizer (fig 3.1.1).

Although this could be achieved by the interconnection of a number of electronic devices, high performance integrated circuit type of voltage regulator or stabilizer(s) are now available in three pin versions. The 78xx is a series of positive voltage regulators, while the 79xx is a series of negative voltage regulators. The xx in these series represents the output voltage value of the devices. For example, 7805 and 7812 are + 5 voltage and + 12 voltage regulators respectively. These regulators ICs have a built-in short-circuit protection as well as protection from over heating. For this project, the fixed output voltage regulator or stabilizer employed is the 7812 type for the above stated reasons.

3.7 THE BURGLAR DETERRENT CIRCUIT

The circuit, which can detects nightfall and responds by turning "ON" the living room light and perhaps any other light could be made up of three basic electronic components, viz=The input component(s), the control component(s) and lastly the output component(s)

3.7.1 THE INPUT COMPONENT(S)

The major input component in this circuit is the "functionless detectors". These are photo conductive devices, and are known as the light dependent resistors (LDR), these are class of photo transducers, they operate on the principle that, when exposed to light, hole-electron pairs are generated in the material, and electrons jump into the conduction band, reducing the bulk resistance.

The materials most commonly usedl for visible light are Aluminium oxide ceramic substrate coated with a layer of cadmium sulphide (cds) or cadmium selenide (cds). The devices are made by a variety of techniques, such as sintering, firing, or by vapour, chemical or vacuum deposition. They are made with a large sensitive area, and need a high ratio of dark to light resistance, which typically varies from 10MΩ to 10KΩ. The spectral responds of cadmium sulphide is 0.6μm and for cadmium selenide, it is 0.72μm.

Most interestingly is the bi-directional (fig 3:10:1) application of the photoconductive cells and their ability to withstand high voltage and large dissipation. Their main disadvantage is that they are slow, the time constant for cadmium selenide being about 10ms and for cadmium sulphide about 100ms.

Nevertheless, an LDR also exhibits hysteresis, which means that, the conduction is a function of the cell's previous history of exposure to light intensity and duration. The hysteresis effect is

most noticeable at low light levels. The volt-ampere characteristics of the photocells may appear as the solid line in Fig 3:7:1a, but when light is applied to the cell, the curve shifts downward as shown by the broken line, which produces a corresponding increase in current and an output voltage can thus be developed across an output resistor.

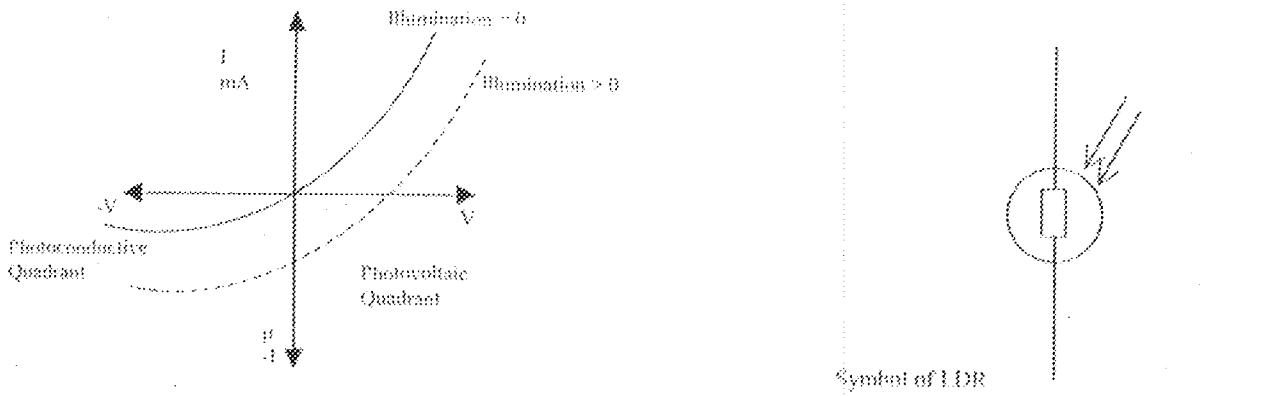


Fig 3:7:1a current-voltage characteristics of the photoconductive cells (LDR).

This output voltage is proportional to the amount of incident light. Hence, the essential elements of a photoconductive cell (LDR) are: - the ceramic substrate, a layer of photoconductive material, base pins to connect the device into a circuit, and moisture-resistant enclosure (glass window and metal case), see fig 3:7:1b.

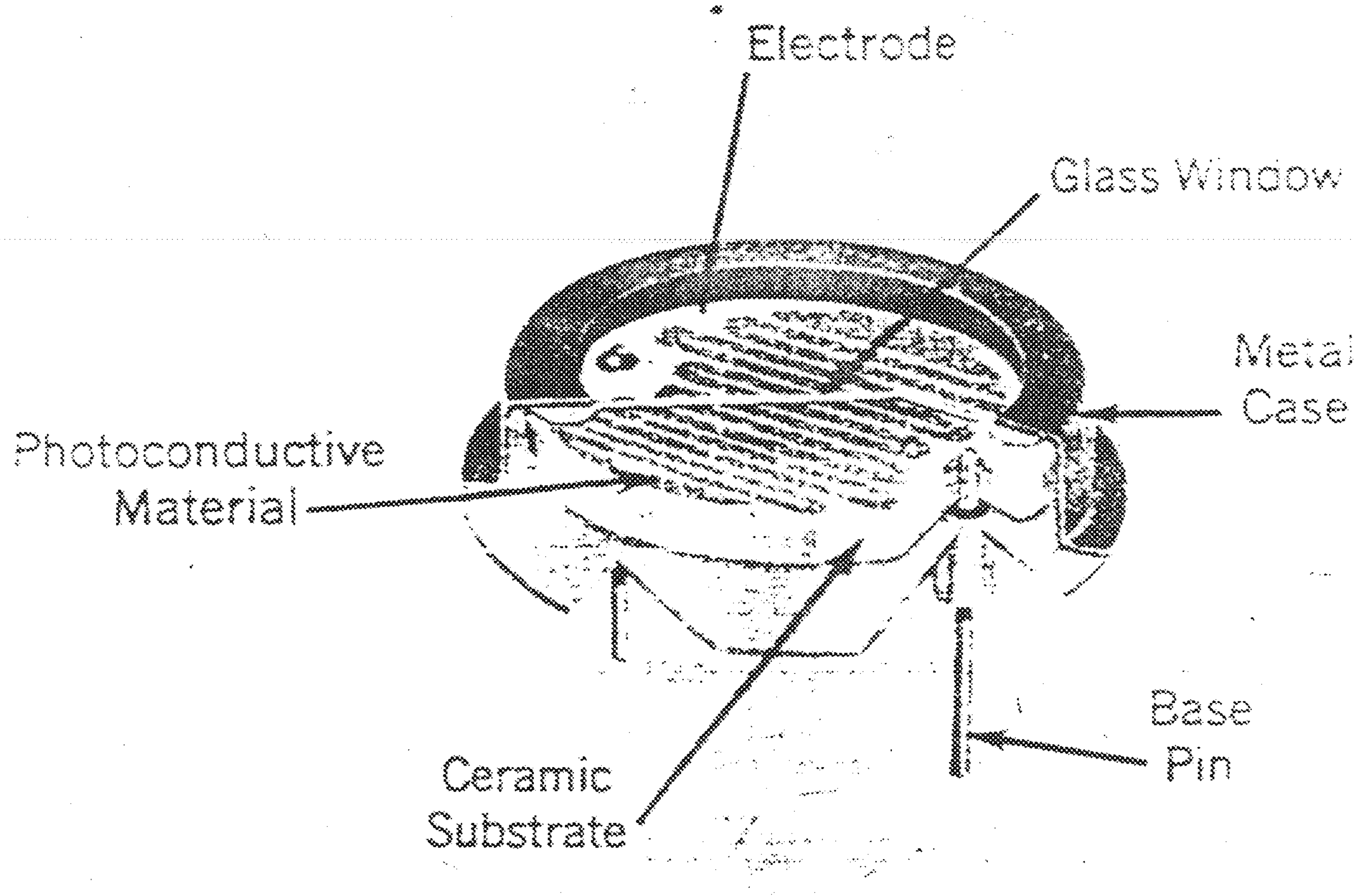


Fig. 3:7:1b Cutaway view of a photoconductive cell

From the aforementioned, a typical application of a practical on-off photocell (LDR) control circuit using the SQ2508 type is illustrated in Fig. 3:8:2h below: -

3.7.2 THE CONTROL COMPONENT(s)

The transistor(s) and the electromagnetic relay are the two major control components employed in this circuit.

First, is the transistor, this is a semi conductor device made up of three layers of n- and p- type semi conductor material. The three layers are called emitter (e), base (b) and collector(c). Transistors are available in a wide variety of shapes and sizes, but there are only two basic types:

1 Bipolar transistor – current operated devices

2 Field effect transistors (FETs) – voltage operated devices

When used in circuit transistors are generally used in one of two different ways:

I. Operating as an electronic switch

II. As an amplifier to increase electrical signals.

In its simplest form, the Bipolar-transistor could be considered to be two junction diodes joined back-to-back. The sandwich formed in this way could have the n-type material in the middle with p-type material on either side (pnp), or alternatively it could have the p-type in the center and n-type material either side (npn). The direction of the arrow on the emitter shows the direction of flow of conventional current for each type. For the transistor to operate as an amplifier it is necessary for two things to happen at the same time:

i. That the emitter and base junction is forward biased;

ii. That the collector base junction (perhaps surprisingly) is reverse biased.

As stated above, the transistor can be used as an electronic switch to turn a given load "ON" and "OFF" by a small control signal (supplied by the LDR in this case). The power level of this control signal is usually very small and hence it's incapable of switching the load (Relay in this case) directly. However, such a control signal is certainly capable of providing enough base drive current to switch a transistor "ON" or "OFF" and hence, the transistor is made to switch the load.

There are three types of transistor configuration (connection)

Viz: -

i. Common – base (CB) configuration

ii. Common – emitter (CE) configuration

iii. Common – collector (CC) configuration

The common emitter is employed in this circuit with the input signal applied between the base and emitter and output signal taken from the emitter of the first transistor and fed into the base of the second transistor and the resultant signal collected from the emitter of the second transistor (The Darlington Pair amplifier).

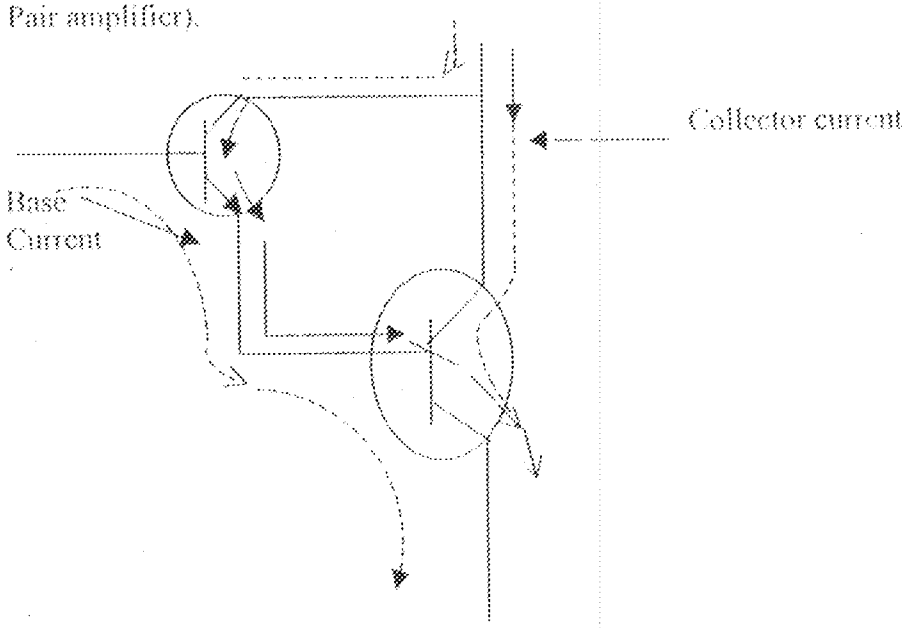


Fig 3:7:2 Coupling of two transistor-known as a Darlington Pair.

We have seen that a small current flowing in the base of a transistor will turn "ON" a larger collector current (fig 3:7:2). This is known as current amplification.

The ratio I_c/I_b i.e. (collector current)/(base current)

Is a measure of this amplification, which is call the transistor's current gain (bFE). For the transistor's used in this circuit (BC108)

h_{FE} = 110-800

Ic = 100mA

V_{CEO} = 20 V

V_{CBO} = 30 V

P_T = 360mW

Next is the relay, a relay is an electrically operated switch which is turned "ON" and "OFF" by an electro magnet. This is a good example of an interface device. An interface device provides a control link between two circuit functions, but keeps the circuitry separate.

An electromagnetic relay depends on the interaction of the magnetic field set up by a fixed coil carrying an electric current and a moveable steel armature. An electromechanical relay is most commonly achieved with the application of a specified voltage or current to its two input terminals. A coil in the relay translates the controlled electrical energy to mechanical energy, causing mechanical action of "opening" or "closing" the contacts. When current passage through the coil results in the contacts faces touching, the device is called an open-circuit relay because the contacts are normally open;

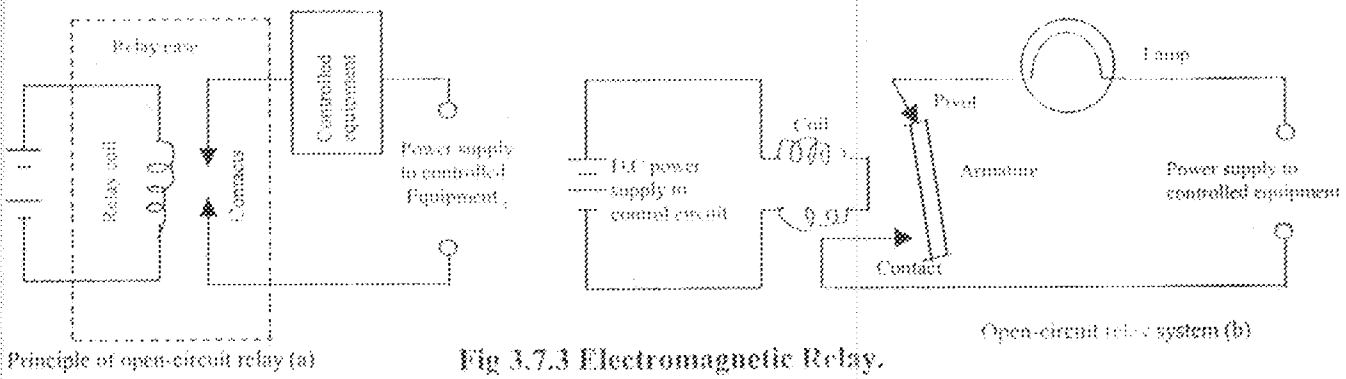


Fig 3.7.3 Electromagnetic Relay.

For this project, a 12V relay is being used to switch the indoor light (Lamp) "ON" at night, and "OFF" at the break of dawn.

Nevertheless, when a relay de-energizes, it releases a surge of electrical energy, which could destroy a transistor, but by connecting a diode across the transistor (Fig 3.8.2b), the energy is diverted away from the transistor, which is thus protected from damage.

3.8 THE OUTPUT COMPONENT(s).

3.8.1 "LIGHT.

Throughout the ages, man has produced heat as well as light through burning fuel, firewood, torch or wax candle, and more recently by electric current passing through a filament as in the incandescent lamp, through a suitable gas such as neon, in sodium or mercury vapour tubes or light due to fluorescent.

Good light is important in all buildings for efficient, convenient living, conducive working conditions and more especially for security purposes where high intensity illumination may be provided during the night to discourage thieves from perpetrating their nefarious activities under the cover of darkness.

The measure of light from a source at normal incidence on a surface is called illumination or illuminance (E). Its unit is the lux (LX), which is the illumination produced by one lumen per square meter or the uniform illumination on a surface at a distance of one meter from a point source of one candela.

Lumen (lm) is the unit of luminous flux (f), which is the amount of light (energy) radiated from a source. A lumen is $1/60^{th}$ of the luminous flux emitted by a black body radiator at the temperature of solidification of platinum; whilst the candela (cd) is the unit of luminous intensity (I), which is the measure of brightness of light emitted by a source in a given direction. A light meter is use to measure illumination in lux. Mathematically, this is expressed as

$$E = \frac{I}{d^2}(l_x)$$

Where

E = illuminance in lux.

I = Luminous intensity in candela

d = distance in meter.

3.8.2 LAMPS.

In domestic homes today, there are various artificial sources of illumination, the common ones are the incandescent lamps, the halogen lamps and the discharge lamps. Incandescent lamps has standardized designations, for example, A-19, PS-35, F-15 e.t.c. The letter designates the shape, while the numeral designates the diameter in eights of an inch. Thus an F-15 lamp has the simple F shape and 15/8inch in diameter.

Although this project was designed to operate on all the classes of lamps outlined above, the A-19 lamp is being used here for the purpose of portability.

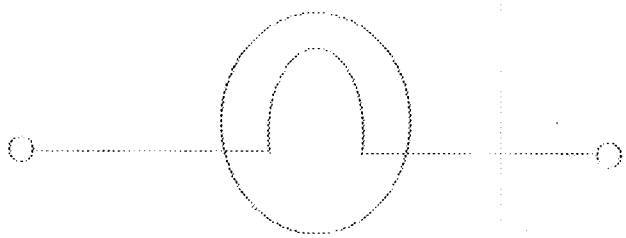


Fig 3.8.2a incandescent lamp.

Conclusively, Fig 3.8.2b below illustrates the complete circuit diagram of the burglar deterrent using the light dependent resistor (LDR).

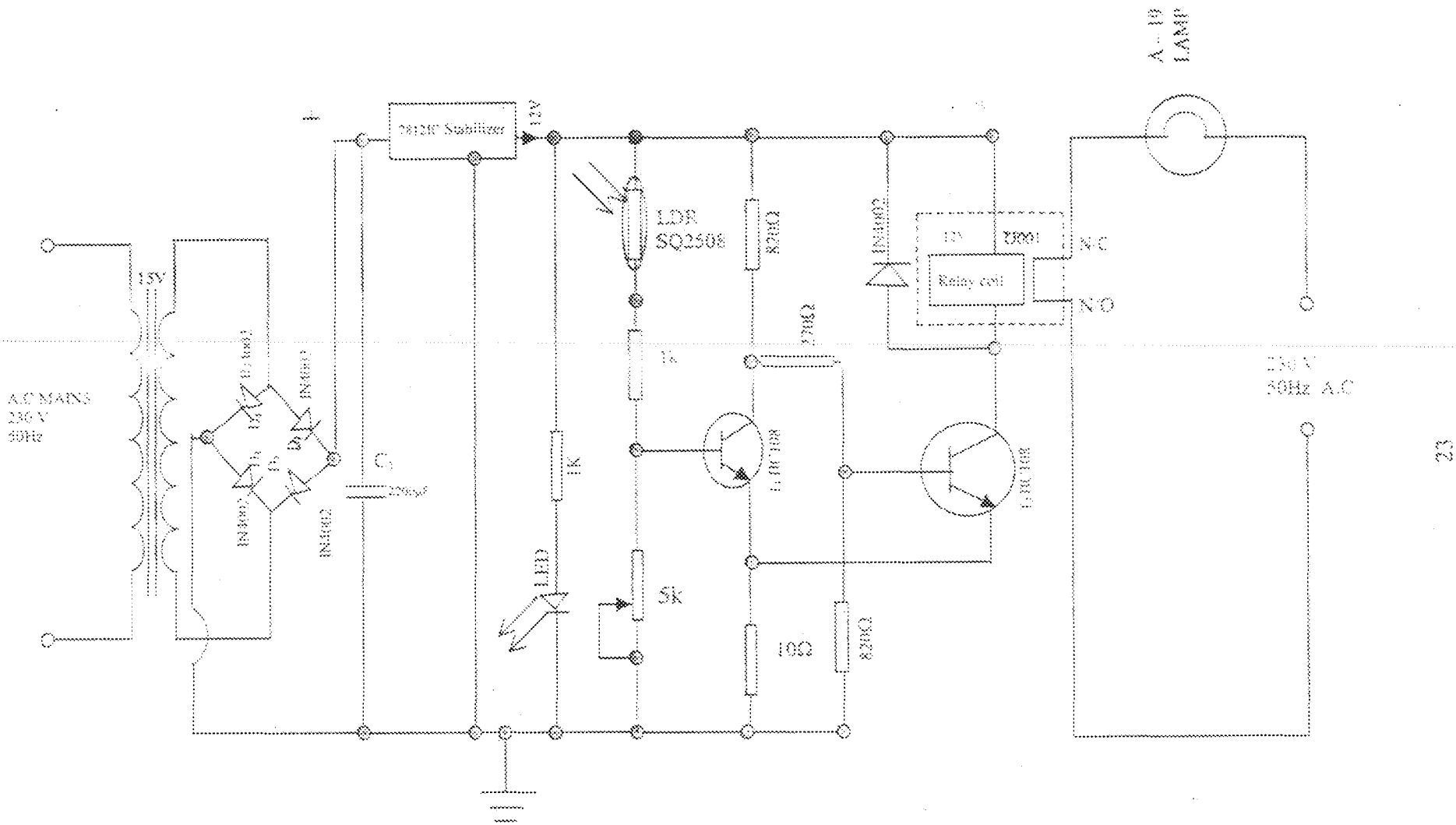


FIG. 3:8:2b. The Complete Circuit diagram of the burglar deterrent using the light dependent resistor (LDR)

CHAPTER FOUR

4.0 CONSTRUCTION, TESTING, RESULTS AND DISCUSSION OF RESULTS

4.1 CONSTRUCTION

In line with the aims and objectives (see section 1.3) of this project work, the physical construction of the circuit is the next step after an extensive perusal of previous and related works on this subject matter along with the necessary theories from which this design was made possible.

However, this design was carried out with the aid of some electrical and electronics tools which are briefly described below: -

Breadboard: – Another name for it is the prototype board. – this is a perforated board measuring approximately 6.5cm x 17.5cm on which electronic components are mounted to allow for a preliminary evaluation of any circuit. The prototype board construction starts with the Circuit diagram.

Soldering Iron: – An electrical tool, having a heated tip for melting solder. The type used here is the 25W, 230 V chisel tip type.

Vero board: – This is another perforated board on which the previously prototype electrical electronics circuit is finally mounted after ascertaining that is has measured favourably with the aims and objectives for which it is met to serve.

Sniper : This tool was used for removing excess soldering lead from the board after soldering.

Wires: – These are tiny telecommunication wires and are insulated in nature used in connecting the various junctions/components that constituted the complete circuit together.

Heat sink: – These are tools used to absorbed excessive heat that might have damage the soldered components. The miniature crowcrowdile clips were employed during the process of carrying out this work.

4.1.2 CONSTRUCTION DETAILS

The prototype module of the burglar deterrent using the light dependent resistor was constructed using the circuit diagram of fig. 3:8:2b.

After ensuring that the prototype, which was initially mounted on the breadboard, measured favourably with the set aims and objectives of this project, I thereafter transferred each component to the Vero board for permanent soldering.

The size of the Vero board used was arrived at after a careful consideration of the numbers of components to be mounted on it and the amount of space they are likely to occupy. I cross checked and examined each components against it's individual specification before connection in order to avoid circuit faults (open-circuit and short circuit).

During soldering I made sure that the components were properly positioned and older bridge as well as dry joints (blob formed due to insufficient heating of the track) were avoided.

The finished model is a wooden box measuring 19.70cm x 11.70cm high housing the complete circuit of the system Fig 4.1.2. The height of the box is 10.70cm, with all the necessary outlets as shown in Fig 4:1:2 below.

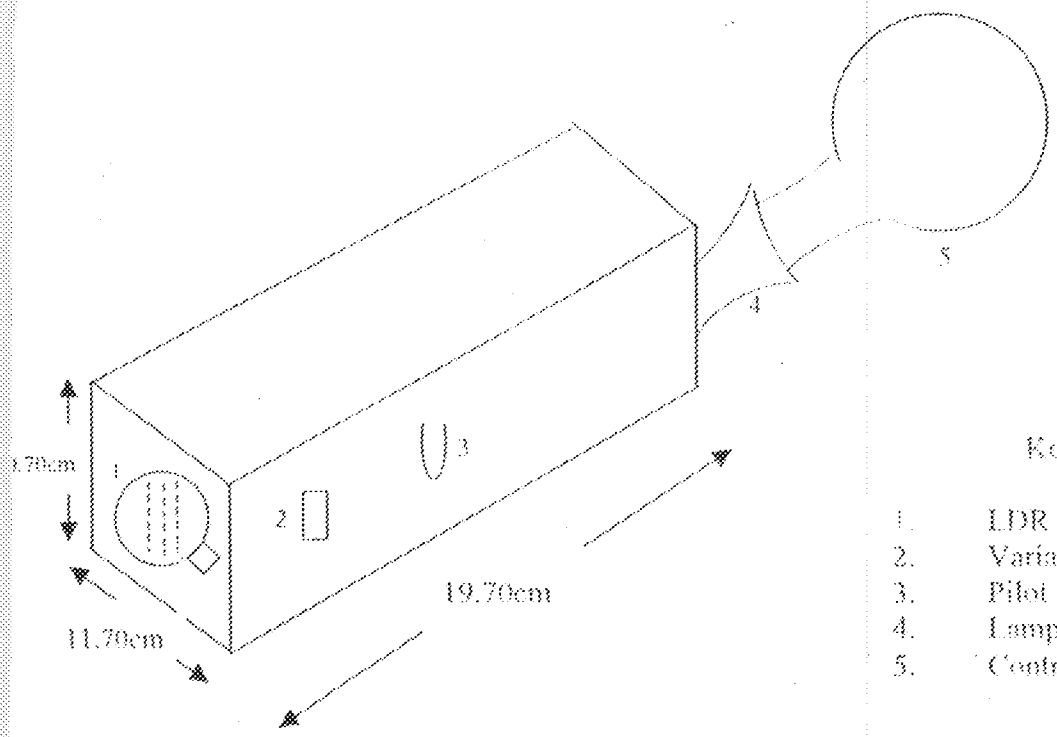


Fig. 4:1:2 Burglar Deterrent using LDR, module

4.2 TEST AND RESULTS

After construction comes the testing of the constructed prototype module of Fig 4.1.2 to demonstrate the workability of the design. The results obtained were recorded and stated below:

4.2.1 POWER SUPPLY TEST AND RESULT

The pilot lamp came up when the system was powered from a 230 V source to indicate that the power pack phase is functioning as expected, hence, power is being fed to the control phase of the circuit.

4.2.2 CONTROL AND CONTROLLED TEST WITH RESULTS

With the power pack dully ON, I tested the circuit at night; it worked perfectly. Inside my room at night with my fluorescent lamp OFF, the controlled or output phase of this project work (the

lamp) came up (i.e. begins to light). Immediately I switched the fluorescent ON, the controlled lamp went OFF.

Further, I extended the connections of the LDR (NO2508) outside at night and the controlled lamp remained ON till the next morning before it went OFF when it was still daybreak. These results shows that both the control and the controlled/output phase are functioning as expected; hence, the circuit as a whole is working perfectly well.

4.3 DISCUSSION OF RESULTS

The results obtained from each test is hereby enumerated for emphasis. First is that from the power pack when powered from a 230 V mains, the pilot lamp came up (i.e. was ON). This indicates that the right magnitude of voltage (15 V) is being supplied to the control phase of the circuit. Next is the result from the control phase; if the sensor (LDR) is in a darkened environment it therefore causes the relay in the circuit to make contact or close contact to complete the circuit for the controlled phase. Otherwise causes the relay to open the controlled phase circuit. Conversely is the controlled phase; with our sensor (LDR) in darkness and the relay closed, the lamp which is the indicator of the controlled phase or output phase came up (i.e. was ON), showing that the controlled phase as well as the control phase all gave a positive results hence the lamp lighting. The lamp will remain in this state as the light dependent resistor (LDR) remains in the darkened environment. This implies that when the LDR is exposed to a lighted or brighter environment which naturally will come up in the early hours of the following morning, it will therefore cause the relay to loose contacts and the lamp will automatically go OFF, hence these results will discourage any burglar theft who may want to encroach into any apartment with this all important electrical electronics gadget duely mounted on it.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

Knowledge would not worth investing on, if it's dividends could not be made to transform (and in some cases eliminate) the inconveniences of mankind (e.g. darkness) into his convenience. In fact, this is what engineering entails. That is, using the knowledge or know-how of science to find solution(s) (convenience) to mankind's problems (inconvenience). This project is indeed one of such solutions.

As could be seen from the forgoing, the purpose of this design has been achieved since the test carried out shows that the constructed work adequately meets the stated aims and objectives of this work.

In the design, consideration was given to operational characteristics, cost effectiveness and area/period or conditions of operation.

Material selection to ensure high sensitivity, durability and efficiency was also given appropriate attention.

Conclusively, in simple terms, I could confidentially say that my stated aims and objectives (section 1.3) have been adequately addressed.

5.2 RECOMMENDATIONS

Safety at home and its environs is very important to man as the food he eats in or the water he drinks. This has made him to be keeping pets like dogs and parrots with the aim of either to wad off intruders especially during the odd hours of the day or to inform him of such intruders before

they get close. It is also the consciousness of safety that has also made man to employ the services of security agents especially for night operations/surveillance.

Nevertheless, non of the above mentioned safety measures is cost effective to man since he has to provide for their shelter, welfare, feeding and other related expenses which are inevitable for their efficient services to be delivered for the benefit of man.

On the contrary, if safety at home and its environs (especially during the dark hours of the day) at minimum cost is to be considered by man, than the burglar deterrent using the light dependent resistor must be considered.

Nevertheless, in spite of the efficient use to which this designed circuit hereby serves, there is still room for further work on it to achieve its total completeness. It could be redesigned exclusively for domestic use only to handle both security lights, indoor light and to simultaneously close some window curtains when it trips ON the light at night and on the other hand opens the curtains when it trips OFF light at daylight if not the break of dawn.

Finally, it is worthy to recommend here that my successor should try to see how a single phase AC or DC motor could be incorporated into this design to take care of the opening and closing of the curtains.

REFERENCES:

1. PUCKERING, R.D., and BROUGH, S., *"Electronics for electrical installation"* Blackwell scientific publication, 1992, pp. 24, 39, 53 and 178.
2. SHARMA, M.C., *"Batteries chargers and Emergency Lights"* BPB Publications, 1993, pp. 58 – 60, 80 – 81.
3. JOHN MORRIS, C., *"Applied Electronics"* Paston Press Ltd, London, 1997, pp. 25 – 33, 78 – 81, 84 – 85 and pp. 127.
4. ABDULLAHI, M.D., *"Lecture note on electrical services design"* pp. 46, 49, 70 – 72.
5. MAZDA, F.F., *"Electronic instruments and measurement techniques"* Cambridge University Press 1987, pp. 48
6. MILLER, H.A., *"practical Wiring volume 2(in SI Units)"* Pergamon Press Ltd., 1976, pp. 72- 75.
7. RICHTER, H.P., and SCHWAN, W.C., *"Practical Electrical Wiring"*, 14th edition, mcraw – hill book company, 1987, pp. 255 – 257.
8. COOPER, W.D., and HELFRICK, A.D., *"Electronic instrumentation and measurement techniques"* – 3rd edition, Prentice Hall incorporation, London, 1995, pp. 384, 388 – 390.

APPENDIX A

LIST OF SYMBOLS

LDR	Light Dependent Resistor.
A.C	Alternating current
D	Diode
R	Resistors in ohms
C	Capacitors in farad
V	Voltage in Volts
X_C	Capacitive reactance in ohms
f	Frequency in Hertz
X_L	Inductive reactance in ohms
P	Power in watt
I	Current in Ampere
PIV	Peak inverse voltage in volts
LED	Light emitting diode

APPENDIX B

LIST OF MATERIALS

Parts	Quality
15 V transformer	1
Full bridge rectifier IC	1
12 V regulator IC	1
2200μF Capacitor	1
5 k variable resistor	1
LDR (SQ2508)	1
BC 108 transistor	2
IN 4002 diode	1
12 V relay (100Ω)	1
Lamp bulb	1
Lamp holder	1
LED (red)	1
220μF Capacitor	1
7mH inductor	1
1K resistor	2
820Ω resistor	2
270Ω resistor	1
10Ω resistor	1

APPENDIX C

LIST OF FIGURES