DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FEDERAL UNIVERSITY OYE-EKITI.

DESIGN AND CONSTRUCTION OF A LIGHT ACTIVATED SWITCH

BY

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SEPTEMBER 2016

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IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF BACHELOR OF ENGINEERING DEGREE (BEng. ELECTRICAL AND ELECTRONICS ENGINEERING)

SEPTEMBER 2016

DECLARATION

I Arogundade Shina Fatai hereby declare that this project work carried out is the result of my personal effort and has not been submitted elsewhere for this purpose. All sources of information are duly acknowledged by means of references.

17/october/2016

AROGUNDADE SHINA FATAI **DATE**

(EEE/11/0385)

CERTIFICATION

This project work titled "light activated switch" by Arogundade Shina Fatai, meets the requirements for the award of Bachelor of Engineering (B.Eng.) degree in Electrical and Electronics Engineering Department, Federal University Oye-Ekiti.

18/10/2016

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I want to thank God almighty for His infinite mercies and for guiding me during the course of my study as well as the period of this project. His name forever be praised.

I am indeed most grateful to my parents and the entire members of the Arogundade's family for their support, morally financially and spiritually. I want to say a very big thank you to all of them.

I want to show my profound gratitude to the Department of Electrical and Electronics Engineering for its support throughout my stay. I also want to show my appreciation to my supervisor Engr. Babarinde for his patience, time taken to go through my manuscript and correction when necessary am eternally grateful sir. My profound gratitude goes to all the lecturers of the Department of Electrical and Electronics Engineering.

I want to appreciate all my friends who in one way or the other contributed to the success of this project. God bless you all.

DEDICATION

This thesis is dedicated to Almighty God who spared my life till this moment to see me through my degree program in good condition.

Also to my beloved parents Alhaji. & Mrs. J.A Arogundade for their love, care and encouragement, also for their financial and moral support given to me. Not forgetting other members of my family who in one way or the other have contributed positively towards the success of my academic pursuit.

ABSTRACT

This project presents a light activated switch for switching on and off electrical appliances using light dependent resistor (LDR) for its operation. The light dependent resistor changes or varies resistance with change in the intensity of light hitting its surface, this in turn is passed through a comparator to determine if the light intensity can be said to be day through the resistance entering the comparator. It can however be programmed to act as a light activated switch or as a dark activated switch. In the case of this project, it is working as a light activated switch. It is to turn on automatically when there are rays from the sun and it's to turn off automatically when it is dark. As such, power wastage or accidental fire outbreak can be avoided. Thus, the overall aim of the project is achieved.

In furtherance to this research, future works on improving the work is advised. This includes making the LDR more or less reactive to sunlight. So far, the project also turns on and off from direct rays from other sources of light. Carrying out advanced research to avoid this is also recommended.

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ABBREVIATIONS

1. LDR- Light Dependent Resistor
2. LED- Light Emitting Diode
3. IC- Integrated Circuit
4. AC- Alternating Current
5. DC- Direct Current
6. TTL- Transistor-Transistor Logic
7. VCC- Collector Supply Voltage
8. CMOS- Complementary Metal Oxide Semiconductor
9. OP-AMP- Operational Amplifier
10. DTL- Diode- Transistor Logic

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CHAPTER ONE

INTRODUCTION

1.1 PREAMBLE

A Light Activated Switch is a simple electrical project circuit by which we can switch on and off the electrical load appliances like lights, fans, coolers, air conditioners, street lights, etc., automatically based on the day-light intensity instead of manually operating the switches. By using this method, manpower can be reduced to a great extent.

1.2 PROJECT MOTIVATION

The present power and economy crisis has a negative effect on Nigerians coupled with the fact that there is power wastage as more appliances are left powered than are necessary. The reason for this design is to cut down this excesses by automating the switching. This in turn will save cost and power used over a period of time and more efficiency is achieved.

1.3 SCOPE OF THE PROJECT

The scope of this project work took into consideration the hardware design of an automatic light activated switch using a light dependent resistor (LDR) to control this regulation. The use of a timer is also introduced to avoid accidental switching.

1.4 PROBLEM DEFINITION AND METHODOLOGY

Over the years, due to the failings of electricity generation, hazards associated with power generation, and the inconvenience of light switching; the use of light activated switches are being introduced to minimize human impacts with lightning and switching systems. Also, in Federal university Oye-Ekiti the impact of humans on switching of appliances has really increased the wastage incurred by the institution. With light activated switch this wastage can be effectively manage and reduced.

In design and construction of this project, acquiring components was a herculean task as vendors are far off and a lot of traveling had to be done. Eventually, with the construction of this project doors are being opened for vendors to come and vie their business in this part of the world.

Finally, the steps followed in achieving this project include

1. Designing the circuit to be implemented
2. Constructing and testing the circuit on breadboard
3. Coupling and setting up the entire model

1.5 AIM

This project is aimed at the design and construction of light activated switch using light dependent resistor. Also, finding out ways of implementing it to cut down power wastages and cost.

1.6 PROJECT OUTLINE

This project is broken down into five (5) chapters as follows: chapter one contains the introduction to the whole project; chapter two explains the theoretical background of the process of implementing the project. Chapter three gives an analysis of the hardware design of light activated switch; chapter four comprises of the construction and testing of the whole system. Chapter five concludes the whole project giving limitations as well as recommendations for subsequent projects.

CHAPTER TWO

THEORETICAL BACKGROUND

2.1 INTRODUCTION

This chapter gives an insight into the various components used in the construction of this project. The various components used in constructing the light activated switch has a major role to play as the specific roles cannot be overemphasized.

2.2 LITERATURE REVIEW

Light activated switch is important in operating appliances and equipment in our environment today as opposed to the conventional switching on and off of appliances. This is because of a lot of power wastage caused by human errors and omissions.

[2], in his project was able to design and construct a battery operated light trap in for of a light activated switch. This he used for collecting mosquitoes in remote locations during the day. However, this device was limited because of the limitations of battery. Over the years, light activated switch has been improved upon as a lot of technology have been put in place ranging from solar powered lamps which is from a renewable energy source to energy from power grid.

[3], was able to design and construct a switch to power security light in FUNAAB. This automatically becomes activated and deactivated with the intensity of light hitting the light dependent resistor. This is aimed at reducing theft in the late hours of the night when people leave for home.

Moreover, the major component of light activated switch is the light dependent resistor and this component find application in a lot of fields ranging from automatic light circuit, simple fire alarm circuit, light activated switch circuit, automatic led emergency light, even in medicine.

This project work also uses the light dependent resistor to complete the light activated switch. The circuit contains a transformer and a rectifier because it is designed to convert input AC to DC for its use. Also, other components such as comparator, astable multivibrator, and flip-flop are also used. Although, there is an additional component which is the timer to cause delays and avoid accidental switching since the whole aim of the circuit is to avoid wastages.

2.3 LIGHT DEPENDENT RESISTOR (LDR)

A LDR is a light controlled variable resistor in which the resistance increases or decreases with increasing or decreasing light intensity. The resistance of certain semiconductors such as cadmium sulphide decreases as the intensity of the light falling on them increase [4]. The effect is due to the energy of the light setting free electrons from donor atoms in the semiconductor, so increasing its conductivity, i.e. reducing its resistance. A popular LDR is the ORP12; there is a 'window' over the grid-like metal structure to allow light to fall on a thin layer of cadmium sulphide. Its resistance varies from 10MΩ in the dark to 1KΩ or so in daylight. Figure 2.1 shows the schematic diagram and the symbol of a light dependent resistor.

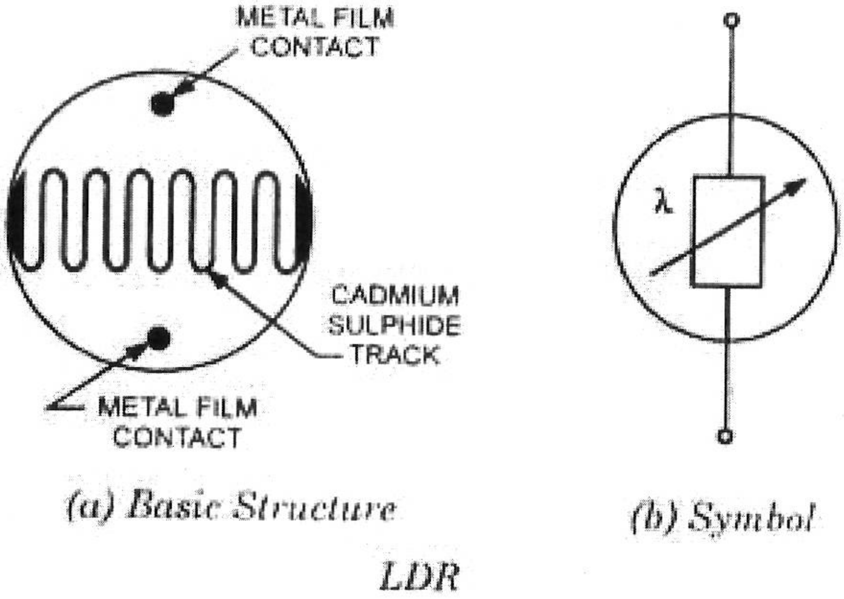

Figure 2.1 [1] Light Dependent Resistor

2.4 LIGHT-EMITTING DIODE (LED)

A LED consists of a junction diode made from the semi-conducting compound gallium arsenide phosphide. It emits light when forward biased the colour depending on the composition and impurity content of the compound. At present red, yellow and green LEDs are available. When a p-n junction diode is forward biased, electrons move across the junction from the n-type side to the p-type side where they recombine with holes near the junction. The same occurs with holes going across the junction from p-type side. Every recombination results in the release of certain amount of energy, causing, in most semiconductors, a temperature rise. In gallium arsenide phosphide some of the energy is emitted as light which gets out of the LED because the junction is formed very close to the surface of the material, this is shown in figure 2.2. A LED does not come on when reverse biased and if the bias is 5v or more it may be damaged.

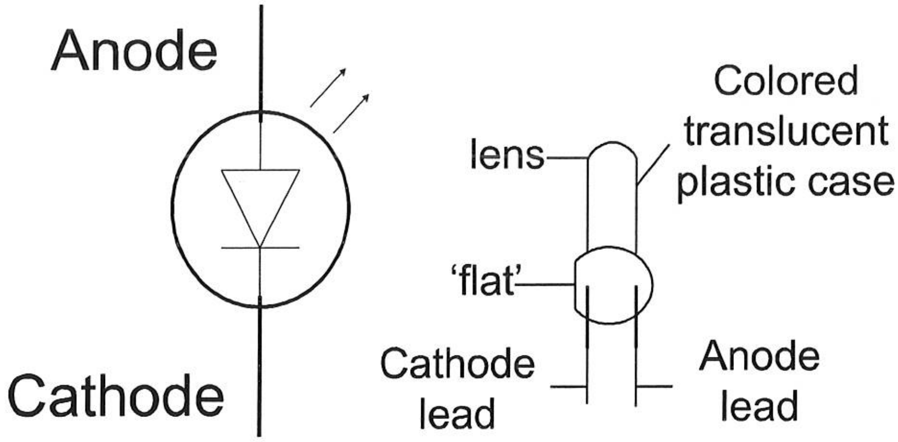

Figure 2.2 Light Emitting Diode

2.5 IC TIMERS

The emanation of IC timers eliminated a wide range of mechanical and electromechanical timing devices. It also helped in the generation of clock and oscillator circuits. Timing circuits are those, which will provide an output change after a predetermined time interval. This is, of course, the action of the monostable multivibrator, which will give time delay after a fraction of a second to several minutes quite accurately. The most popular of the present IC, which is available in an eight, pin dual in line package in both bipolar and CMOS form, this is shown in figure 2.3. The 555 timer is a relatively stable IC capable of being operated as an accurate bistable, monostable or astable multivibrators. The timer comprises of 23 transistors, 2diodes and 16 resistors in its internal circuitry.

The operation of the 555 timer is further defining the functions of all the pins. The details regarding connection to be made to pins are as follows.

Pin 1: This is the ground pin and should be connected to the negative side of the supply voltage.

Pin 2: This is the trigger input. A negative going voltage pulse applied to this pin when falling below 1/3Vcc causes the comparator output to change state. The output level then switches from LOW to HIGH. The trigger pulse must be of shorter duration than the time interval set by the external CR network otherwise the output remains high until trigger input is driven high again.

Pin 3: This is the output pin and is capable of sinking or sourcing a load requiring up to 200mV and can drive TTL circuits. The output voltage available is approximately −1.7V.

Pin 4: This is the reset pin and is used to reset the flip-flop that controls the state of output pin 3. Reset is activated with a voltage level of between 0V and 0.4V and forces the output low regardless of the state of the other flip-flop inputs. If reset is not required, then pin 4 should be connected to same point as pin 8 to prevent accidental resetting.

Pin 5: This is the control voltage input. A voltage applied to this pin allows the timing variations independently of the external timing network. Control voltage may be varied from between 45 to 90 of the Vcc value in monostable mode. In astable mode the variation is from 1.7 to the full value of supply voltage. This pin is connected to the internal voltage divider so that the voltage measurement from here to ground should read 2/3 of the voltage applied to pin 8. If this pin is not used it should be bypassed to ground, typically use a 10nF capacitor. This helps to maintain immunity from noise. The CMOS Ics for most applications will not require the controlled voltage to be decoupled and it should be left unconnected.

Pin 6: This is the threshold input. It resets the flip-flop and hence drives the output low if the applied voltage rises above two-third of the voltage applied to pin 8. Additionally, a current of minimum value 0.1 A must be supplied to this pin since this determines the maximum value of resistance that can be connected between the positive side of the supply and this pin. For a 15V supply the maximum value of resistance is 20M.

Pin 7: This is the discharge pin. It is connected to the collector of an npn transistor while the emitter is grounded. Thus when the transistor is turned on, pin 7 is effectively grounded. Usually the external timing capacitor is connected between pin 7 and ground and is thus discharged when the transistor goes on.

Pin 8: This is the power supply pin and is connected to the positive of the supply. The voltage applied may vary from 4.5V to 16V although devices, which operate up to 18V, are available.

Its functional diagram is shown below;

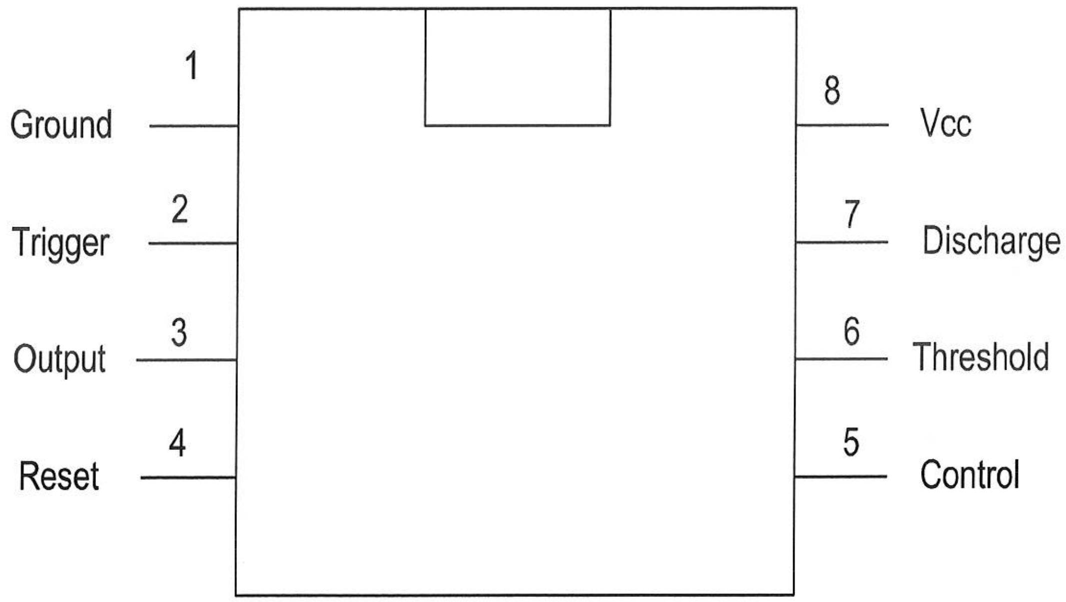

Figure 2.3 Timer Pin Configuration

2.6 SEQUENTIAL LOGIC CONTROL

This stage comprises of a D-type flop-flop (7474). The sequential logic control is more or less a decision making circuit. The decision whether the conversation should be recorded or not is done in this stage. The D flip-flop is the main branch of the decision making circuit. Decision to enable recording is attained by triggering the flip-flop to set mode when the phone rings, once the phone rings the flip-flop gives a HIGH which goes to the input of the AND gate. The DATA is held at the output (of the flip flop) until the system is reset manually from S1. As already mentioned this is just an enabling signal and is shown in figure 2.4.

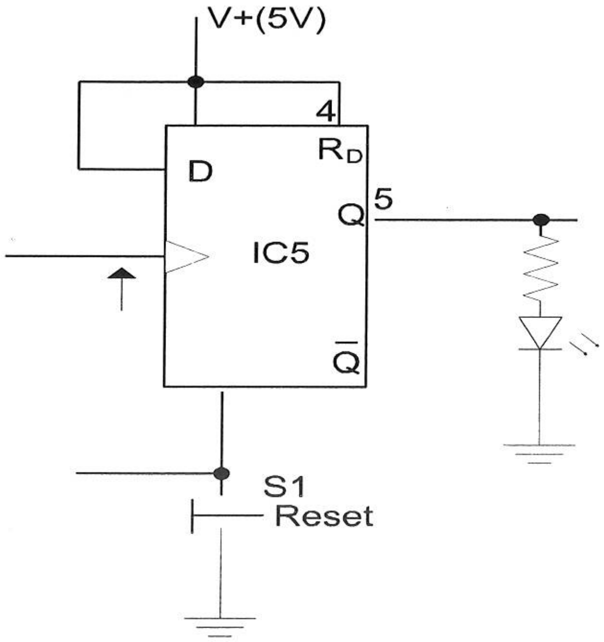

Figure 2.4 D Flip Flop Stage

2.7 POWER SUPPLY STAGE (+5 & +12V).

All stages in the project uses +5V except the oscillator which uses +12V. The power supply stage is a linear power supply type and involves in step down transformer, filter capacitor, and voltage regulators, to give the various voltage levels. The rectifier is designed with four diodes to form a full wave bridge network. C_1 is the filter capacitor and C_1 is inversely proportional to the ripple gradient of the power supply. Figure 2.5 shows the schematic diagram of the power supply stage.

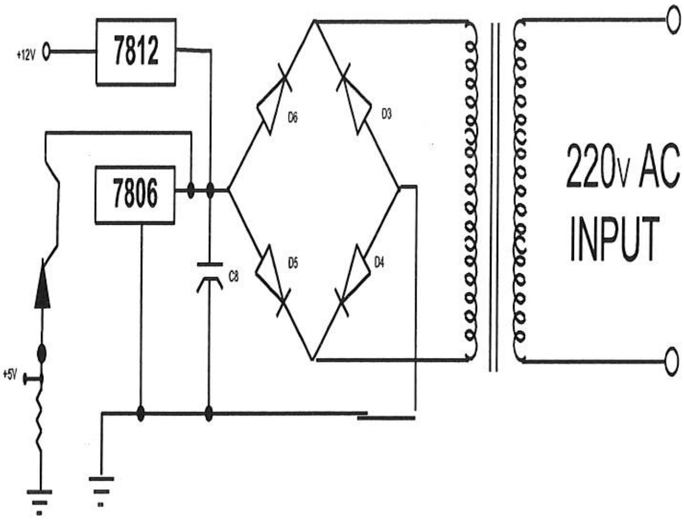

Figure 2.5 Power Supply Stage

2.8 RELAYS

A relay is a switch worked by an electromagnet. It is useful if we want a small current in one circuit to control another circuit containing a device such as a lamp or electric motor which requires large current, or if we wish several different switch contacts to be operated simultaneously. The controlling current flows through the coil, the soft iron core is magnetized and attracts the L-shaped soft iron armature. This rock on its pivot and opens, closes or changes over as shown in figure 2.6. The current needed to operate a relay is called the *pull-in* current and the *dropout* current is the current in the coil when the relay just stops working [5].

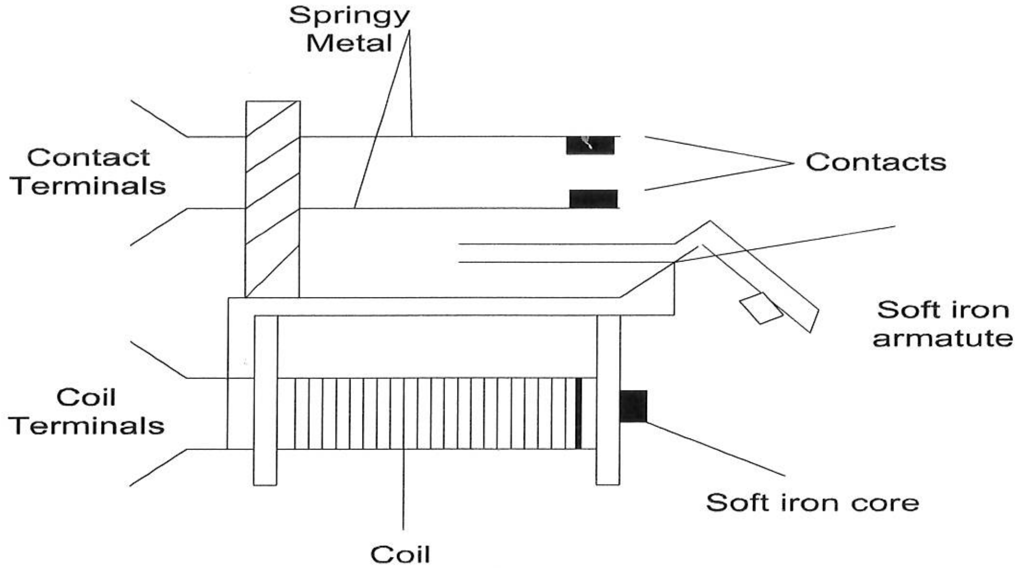

Figure 2.6 Schematic Diagram of a Relay

2.9 COMPARATOR

An operational amplifier is a differential amplifier with an extremely high open voltage gain. Negative feedback circuits are employed in op-amps to control the gain when precise gain values are needed. The comparator is an operational amplifier without a feedback. Hence, it is controlled by the open loop voltage gain [4]. The circuit diagram is shown in figure 2.7

The op-amp was originally developed for use with analog computers but now they find place in almost all aspect of electronics. The op-amp has the following ideal characteristics;

- Infinite voltage gain
- Infinite input impedance
- Infinite bandwidth.

In practice however there are deviations from ideal conditions due to manufacturing processes and other physical conditions the various components might be subjected to which make up the op-amps. Below show the actual characteristics of μA741 op-amp.

Voltage gain – 106dB (numerical gain = 2000000.0)

Input impedance – 1MΩ

Output impedance – 7500Ω

Bandwidth – up to 1MHz

The voltage gain and bandwidth are two parameters that must be critically looked at for successfully application of this device. More information about the parameters could be gotten from IC date sheets.

Vout = A_0 Vin

Where A_0 = open loop voltage gain.

And Vin = $V^+ - V^-$

Due to the very high A_0, Vout will tend to saturate upon any difference in input. Other op-amp circuits include, inverting and non – inverters amplifiers, summing amplifiers, unity gain buffers etc.

The function of the comparator is to compare two voltages and give an output, which tell if they are equal or unequal. The comparator stage in this circuit is used to senses when the battery is fully charged. A reference voltage of 1.2V is applied to the non- inverting input of the comparator, generated by the drop across D_1 and D_2. When the charging voltage is impressed on the battery, it drops and increases exponentially as the battery charges. When the battery is charged the voltage on the battery rises to the charging voltage (i.e. 14.4V)

VR_1 will be adjusted such that at 14.4V a drop of1.2V will be at the inverting input of the comparator. This will set the comparator at the threshold of switching and any further charging will increase this voltage which will consequently cause the output of the comparator to go high which will now switch a thyristor circuit.

$$Vout = A_0 \, Vin$$

Where A_0 = open loop voltage gain.

And $Vin = V^+ - V^-$

Vout will drop to V+ for the slightest positive difference in voltage since A0 is often very large (in order of 20000).

As the V^- tends to go above V, the drop across V_{R1} tend to exceed V^-, hence the output drop to V+, and switches a thyristor circuit which control a relay that cut off the charger.

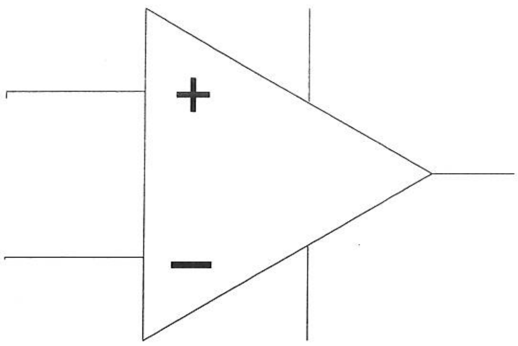

Figure 2.7 Circuit Diagram of a Comparator

2.10 TRANSISTOR

Transistors are active components used basically as amplifiers and switches. The two main types of transistors are:

The bipolar transistors whose operation depends on the flow of both minority and majority carriers, and the unipolar or field effect transistors (called FETs) in which current is due to majority carriers only (either electrons or holes). The transistor as a switch operates in class

A mode. In this mode of bias, the circuit is designed such that current flows without any signal present.

The value of bias current is either increased or decreased about its mean value by the input signal (if operated as an amplifier) or ON and OFF by the input signal if operated as a switch. This is shown in figure 2.8 below

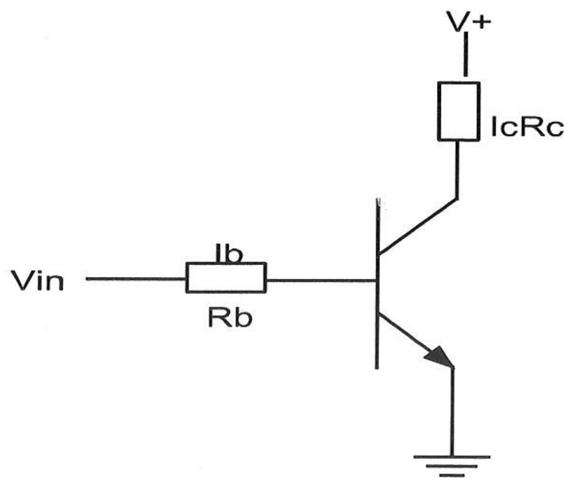

Figure 2.8 Circuit Diagram of a Transistor

CHAPTER THREE

HARDWARE DESIGN

3.1 INTRODUCTION

In this chapter, we would be considering the hardware structure of the entire project which gives detailed explanation of the function of the devices and components used. Also, the choice of some of the devices. This chapter would entail the block diagram, operation of the whole circuit and why the selection of some of the components.

3.2 FUNDAMENTAL BLOCK DIAGRAM

The block diagram of the circuit is a block of drawings that expresses different segments of the stages involved for the circuit to be functional. The various segments involved in this circuit includes: the power supply, light sensor segment, the logic control segment, switching timer segment and the load. The diagram is shown in the figure 3.1 below.

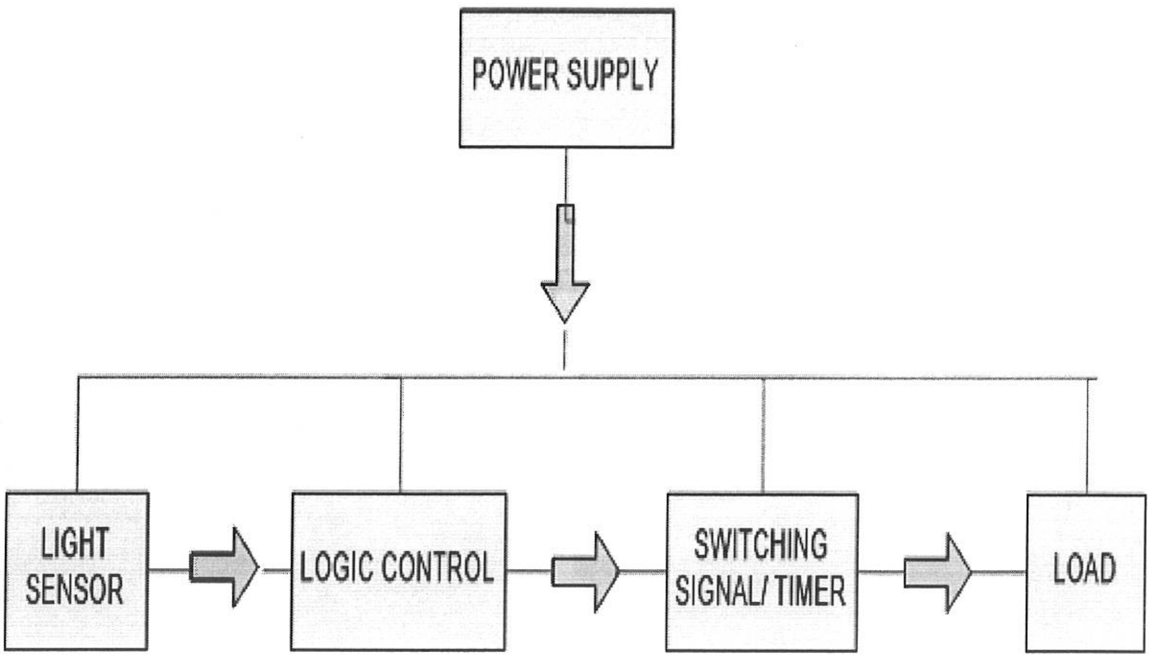

Figure 3.1 Generalized Block Diagram

3.3 PRINCIPLE OF DESIGN AND OPERATION

This project is about switching on and off power supply using light intensity (rays from the sun) driving/Powering a load.

The project has a power supply section that houses a transformer which steps down the input voltage and a rectifier which converts alternating current to direct current for use in the complete circuit. After noise must have been removed by the capacitor, there are two voltage regulators to convert voltages to 5v and 12v respectively. The circuit has a light dependent resistor (LDR) whose resistivity increases or decreases with the intensity of light (sun rays) hitting it. The light dependent resistor is connected to a comparator which compares resistances and then to a timer which acts as a monostable multivibrator which determines the state of the circuit. This in turn is connected to a flip flop which has a memory and keeps track of the past state of the circuit for changes. The circuit also has a 555 timer which times the circuit for five (5) seconds before switching on or off to avoid accidental switching. The circuit operates a load of not more than 1KW power.

3.4 DESIGN CALCULATIONS

This is the calculation of how the values of some of the components used were reached.

3.4.1 CALCULATION OF BASE RESISTANCE

Given that Rc = 400Ω (Relay coil resistance)

$V^+ = 12V$ (regulated voltage from the power supply stage)

$V_{BE} = 0.6V$ (silicon)

$V_{CE} = 0V$ (when transistor is switched)

$V_{in} = 5V$ (from the AND gate output)

$H_{fe} = 300$ (from data sheet for BC337)

since,

$V^+ = I_c R_c + V_{CE}$ .... (3.1)

$V_{in} = I_B R_B + V_{BE}$ .... (3.2)

$\frac{I_C}{I_B} = h_{fe}$ .... (3.3)

$R_b = \frac{V_{in} - V_{BE}}{I_B}$ .... (3.4)

Where,

I_C = collector current

I_B = base current

V_{in} = input voltage

V_t = supply voltage

V_{CE} = collector-emitter voltage

H_{fe} = current gain.

From 3.1, 12 $= I_C R_C + V_{CE}$

12 = Ic (400) + 0

and, I_C = 30mA

From 3.3, I_B = 30mA/300

= 100uA

From 3.2, 5= 100uAR_B + 0.6

R_B = 4.4/100uA

= 44KΩ

= 47K (preferred value).

3.4.2 ASTABLE DESIGN CALCULATION

$t_1 = 1.1C(R_1 + R_2)$ seconds (where t_1 = ON time)

$t_2 = 0.693CR_2$ seconds (where t_2 is the OFF time)

Since $F = \frac{1}{T}$

& $T = t_1 + t_2$

$F = \frac{1}{ln2c(R_1+2R_2)}$ seconds

$$F = \frac{1.44}{R_1+2R_2)C} \quad \text{... ......(3.5)}$$

Letting R_1 = 10K and C = 10μF for F=5Hz (for the modulating astable)

Substituting the values into equation 3.5, gives

R_2 =9.4K

=10k preferred value.

For F=1KHz, letting R_1=47K and C=10nF (for the tone generator stage)

Substituting values to equation 1 gives R_2=48.5KΩ

A variable resistor of 100K was however used for V_{R1}.

3.4.3 OVERALL SPECIFICATIONS

- INPUT VOLTAGE → 240VAC
- OUTPUT VOLTAGE → 9-0-9VAC
- SUPPLY VOLTAGE → 5VDC/ 12VDC

- CURRENT→ 500mA
- FREQUENCY → 50Hz

However, a host of other resistors were used to oppose the flow of current, thereby protecting the circuit from getting damaged. Also, some capacitors were used to filter out the noise caused in the circuit by passing voltage over some components.

CHAPTER FOUR

SYSTEM CONSTRUCTION AND TESTING

4.1 CONSTRUCTION

In implementing any electronics circuit, a circuit diagram is first obtained after which all components and materials needed for the circuit project are made available. The components are then connected on a breadboard which provides a temporary platform to construct a circuit and make sure that the circuit is operational as desired before it is transferred and soldered on the permanent platform for the construction. The system layout that makes up this project is shown in figure 4.1 below.

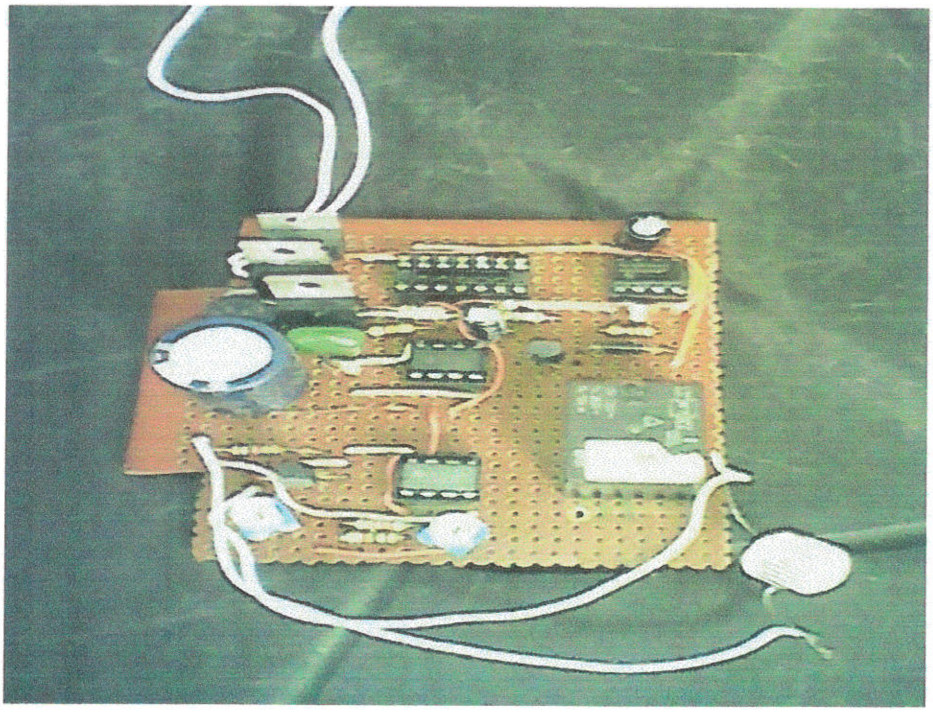

Figure 4.1 System Layout

4.2 TESTING

The testing of the project was first done on a bread board whereby all the components used for the project were affixed into the breadboard as it is on the circuit diagram. Usually it is expected not to work on the first attempt and so each connection terminal is checked carefully to make sure that they are all fitted in perfectly on the breadboard.

Also, another testing is done when the components have all been soldered on the permanent casing, at this point the working principle of the project can be fully tested and further corrections can be made if need be. The testing phase is shown in figure 4.2 below

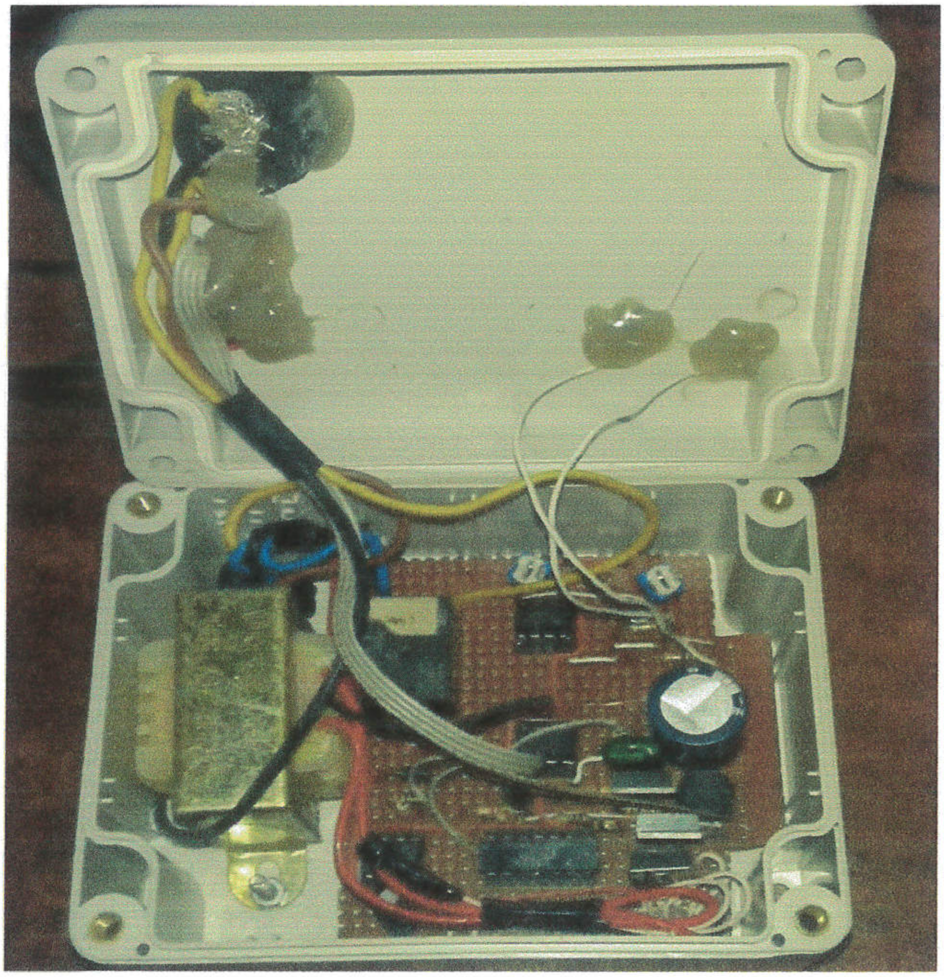

Figure 4.2 Testing Of the Project

4.3 DESIGNING STAGES AND PROCEDURES

In achieving such a project as this, it is recommended to take into consideration some steps and procedures to be followed. The steps taken for this project are explained further below;

4.3.1 STAGE ONE

The circuit is thought out and designed using a simulator software, it is then tested for errors and corrections are made. After this, we are ready to move to the next stage.

4.3.2 STAGE TWO

The components are then soldered on a Vero board (the power components, the logic control components and the switching components) following the circuit diagram simulated. At this stage the LED are then added as well as the LDR connected to the main circuit. They are joined with a lot of care to avoid breaks or errors. Then, testing is carried out.

4.3.3 STAGE THREE

Finally, the main circuit id then housed in a cubic containment as required tapping out the LEDs, LDR and power supply. The final testing is done at this stage to ascertain the work done. After this the project is ready. At this stage, also an external load can be added to check the output description.

4.4 APPLICATIONS

The Light activated switch is popular in street lighting systems. However, it can be programmed to achieve the following purposes;

- For automatic outdoor lighting or garden lighting at home.
- For automatic switching of street lights.
- For switching the hoardings on and off automatically.
- For self-switching operation of displaying title hoardings of companies.
- As a light detector circuit.
- As a dark activated switch.
- For controlling appliances in offices to avoid wastage.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

This chapter contains the conclusive part of the project, the limitations of the project and the recommendation for further work to be carried out on the project.

5.2 CONCLUSION

The idea of automating switching on and off electrical appliances using light activated switch has been achieved. As the system is setup to be completely automated using a light dependent resistor. This in turn will reduce cost due to wastage as well as the need for security men leaving there place of primary assignment. Also, this will help cut down the likelihood of fire outbreak due to negligence on the part of some staff. The light activated switch is a simple circuit that can be properly utilized and if possible made in bulk to cover large areas. The project works simply with the use of a renewable source of energy which is sunlight. Albeit, sunlight is a common source which makes the use of light activated switch quite interesting. Therefore, the major objective of the undertaken project was achieved.

5.3 LIMITATIONS

Upon the completion of this project, I realised some limitations which are discussed below.

i. The light dependent resistor is not limited to the sun; it can also be triggered by rays of light from an electric bulb. As such the switch is not only triggered by the sun, it can also be triggered by an electric bulb.

ii. Due to the effect of light on the design, placing the design appropriately also becomes an issue. This is owed to the fact that if placed wrongly the whole aim is defeated.

iii. Components used in the course of the project cannot also be found in Ikole. Albeit, a lot of travelling has to be done.

5.4 RECOMMENDATIONS

Although, the main objective of the project was thus achieved, it is subject to further improvement.

i. It will be a better equipment if a solar power supply could be incorporated to the overall design so as to make power available at all times and to complement one another,

ii. Sensors could also be provided to increase the credibility of the circuit since for now direct rays of light from bulb could also trigger the switch. As such, the whole design could be improved upon.

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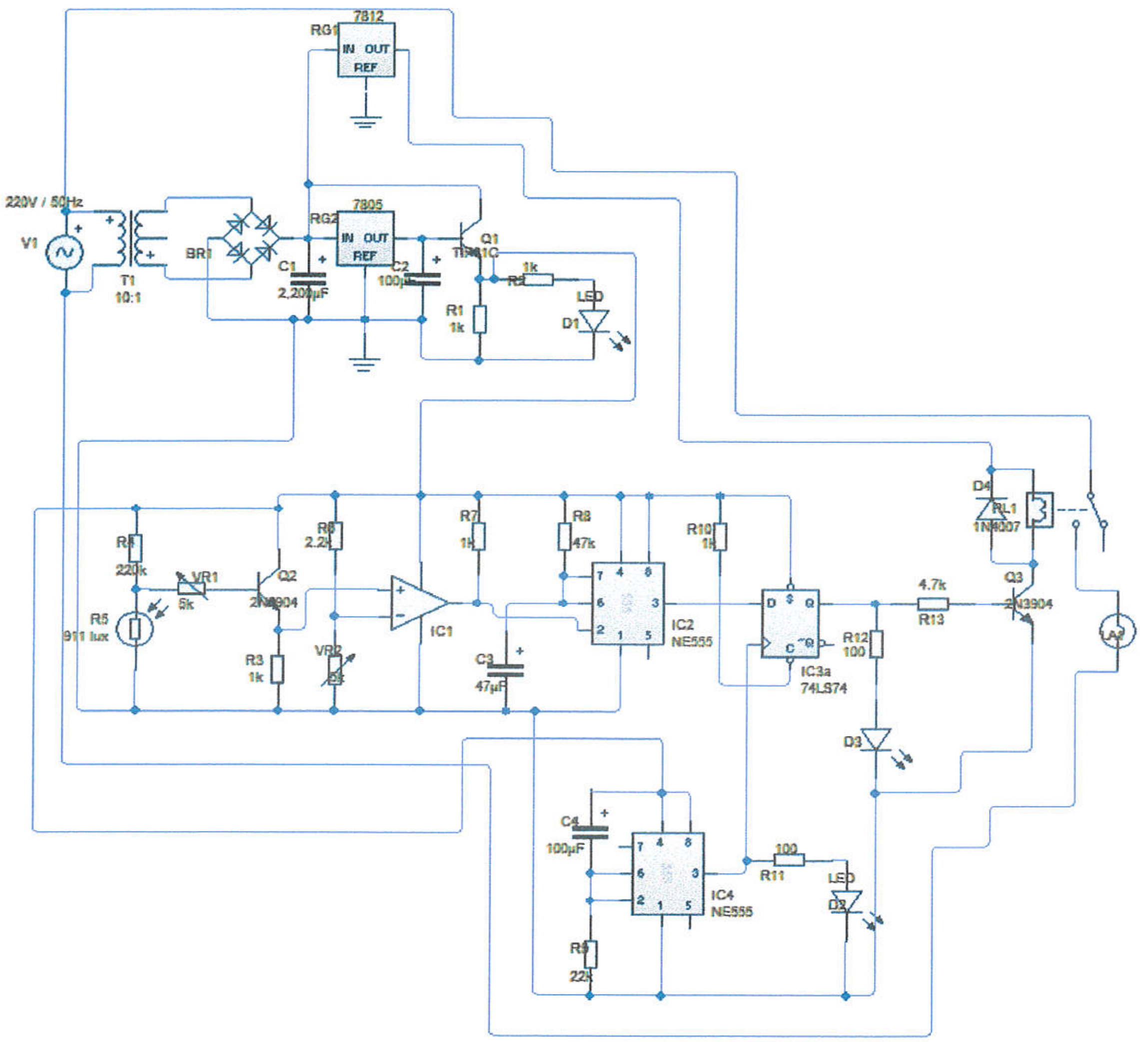
APPENDICES

APPENDIX I

IMAGE OF THE COMPLETE PROJECT

APPENDIX II

COMPLETE CIRCUIT DIAGRAM



APPENDIX III

COST EVALUATION OF THE WHOLE PROJECT

S/NO	COMPONENT/ITEM	QUANTITY	AMOUNT (=N=)	TOTAL AMOUNT
1	9-0-9vac, 300mA	1	500	500
2	wo4 bridge rectifier 1Amp	1	150	150
3	7805	1	80	80
4	TIP41C	1	80	80
5	Voltage Regulator 7812	1	80	80
6	Op Amp LM393	1	100	100
7	NE555	2	200	400
8	2N3904	2	100	200
9	IN4007	1	10	10
10	Relay 12vdc,10amp	1	100	100
11	LED 3mm	3	30	90
12	LDR	1	100	100
13	1kohms	5	10	50
14	220kohms	1	10	10
15	5k pre-set	2	10	20
16	2k2 ohms	1	10	10
17	47k ohms	1	10	10
18	22k ohms	1	10	10
19	100 ohms	2	10	20
20	4k7 ohms	1	10	10
21	47uf	1	15	15
22	100uf	1	15	15
23	100nf	1	10	10
24	7474	1	150	150
25	illuminating rocker switch	1	200	200
26	Casing	1	1800	1800
27	terminal block	1	50	50
28	mains cable	1	150	150
29	2,200uf	1	100	100
30	Vero board	1	100	100
31	connecting wire	1	100	100
32	8pins IC socket	3	15	45
33	14pins IC socket	1	20	20
	GRAND TOTAL			4785