DESIGN AND CONSTRUCTION OF AN AUTOMATIC SECURITY LIGHTS CONTROL SYSTEM WITH OPEN CIRCUIT DETECTOR

BY

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MAT. NO: 2003/15467EE

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA

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A PROJECT REPORT SUBMITTED TO THE DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING, SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF ENGINEERING (B. ENG.) HONS DEGREE IN ELECTRICAL AND COMPUTER ENGINEERING, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA

NOVEMBER, 2008

DEDICATION

This project is first and foremost dedicated to Almighty ALLAH for his mercies, blessings and compassions, making my lifelong dream a reality. I also dedicate this work to my lovely parents Mall and Mrs. E. Sadiq, for their unfailing supports and Hajiya Oyinjimoh (Sokoto), for her sacrifices.

DECLARATION

I, Sadiq Abdulrazaq Adeiza, declare that this work was done by me and has never been presented elsewhere for the award of a degree.

I also hereby relinquish the copyright to the Federal University of Technology, Minna.

SADIQ A. ADEIZA	Mr. O. AGBACHI
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7th NOV, 2008	7/11/'08.
Signature and Date	Signature and Date
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Signature and Date	Signature and Date

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ABSTRACT

Security light is essential to the safety of any society and so, should be devoid of human intervention as errors are usually associated with human involvement in switching operations. So, this project work involves the application of the light department resistor (LDR) technology to sense darkness and light and of course to automatically initiate the switching process of security lights in our homes and offices without human intervention. An open circuit detector which helps to alert occupants (by switching on an alarm and LED used as indicator) whenever a security light / bulb is bad or removed, is incorporated into the design to ensure close monitoring of the security light even while you are asleep.

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CHAPTER ONE

1.0 GENERAL INTRODUCTION

1.1 INTRODUCTION

Security of lives and property is no doubt an essential ingredient of socio-economic development of any society and so, should be enhanced. The unavailability and poor usage of security lights in our homes, offices and companies from my observation, have threatened the security of people and homes and the entire society, as men of the underworld more often than not, perpetrate evil under the cover of darkness. I observed also that some homes for instance, do not have security lights while others who have, often forget to switch them on at night. Some people even traveled out on holidays and would not leave their security lights ON (during the day and at night) because of rising electricity bills.

It is obvious from the aforementioned observations that there are problems (in form of human errors) associated with switching operations (e.g. switching ON / OFF of security light). The problems need to be checked to ensure the security of lives and property in our society. In this regard, I came up with an idea on "The Design and Construction of an Automatic Security Lights Control System with Open Circuit Detector." A device that will automatically switch on lights at night and off at dawn without human involvement, and most essentially, the device alerts you by switching Off an emergency light (LED) and Alarm when the bulbs of the security lights is / are removed or bad (i.e. when there is an open circuit). The system will also provide a means of automatically controlling up to three (3) different lighting bulbs depending on ambient light conditions, by using a light dependent resistance that would convert the ambient sunlight level into a logical output.

This device has been achieved through a combination of past works that have been achieved by other researchers into one piece, such devices are:

1. Light activated switch, which automatically switches on lights or alarm by the action of a Light Dependent Resistor, which initiates the switching process.
2. Automatic Street Light Control System, which automatically switches on and off street lights.
3. Light Operated Domestic Alarm, which automatically switches on an alarm by the action of a Light Dependent Resistor.

Thus, all these ideas have been incorporated into one.

The construction of this device has been made easy by virtue of the growth and advancement in electronics technology. The invention of miniaturized components, such as Integrated Circuit (ICs), semiconductors devices like the Light Dependent Resistor (LDR) and others (like relay) which operates on a low voltage to control a heavy load current with high reliability. All these have really helped to ease the work. The aforementioned discrete components have almost replaced or faced out bulky power components like switch gears, contactors etc. used in switching operations in the past, these bulky components run on large current, they are less reliable and highly prone to electrical hazards. They also occupy much space.

1.2 AIMS AND OBJECTIVES

This project is aimed at designing constructing an Automatic Security Lights Control System with Open Circuit Detector.

This project research work has the following objectives:

1. To ensure safety of lives and property in our society by ensuring that the security lights are on at the right time.
2. To save occupants of a home and office the trouble of having to switch on the security lights whether they are at home or not and when they forget to switch off the lights as scheduled.
3. To alert occupants through a LED and alarm whenever there is an emergency (i.e. when the bulbs is bad, broken or removed).
4. To reduce power consumption, as occupants do not have to keep the security lights on all day and all night (for 24 hours) while they are away on holidays.
5. To develop an inexpensive system that is affordable to many people.

1.3 SCOPE AND LIMITATION

This project work is achieved through the combination of a Light Dependent Resistor (LDR), Retriggerable monostable, resistors, transistors, timer, and relays, and will automatically switch on security lights for homes and offices. The limitation encountered in this work includes the unavailability of exact values of components like transistors and resistors and buzzer. So, close values were used in this work. Also, the cost of the components used, since they were not bought in bulk for mass production / construction, is much. So, mass production of this device which involves buying components in bulk, is expected to be cheaper and more affordable to people.

CHAPTER TWO

2.0 LITERATURE REVIEW

Scientists who say there are just three basic necessities of life might have made an ignorant mistake. If not, why are you feeding, sheltering and watering a life that is not secured? This is where security of life comes to mind as the fourth necessity.

Security is the act that provides safety, freedom from danger and axiety. It can also be seen as the precautions taken to protect lives and properties. Fear of uncertainties tortures the cerebrum, once it dominates the brain, the way forward seems sad and without hope. This could be as a result of overshooting of adrenalin, which causes dullness of the brain, stroke and eventually might lead to death. Freedom is the presence of food, shelter and water nurtures life in a faculty of emotionally relaxed, repressive environment. Without this, life turns to an untimely two ways (ON – OFF) switch which is triggered once, then packs – off].

2.1 HOME SECURITY DEVICES

Security Lighting is no doubt essential to the safety of lives and properties of the people and of course an essential ingredient of socioeconomic development of a society.

There has been renewed focus on home security and that has led to the design of security devices that protect against burglaries, protecting earthly possessions and lives from criminal intentions by bad people. When home alarms first came out, home security devices were narrowed to door and window contacts and under the carpet pads.

New ideas have added many new things that expanded the options for people to more adequately protect their families. Since the primary focus of the use of home security devices is to physically protect access to the house and prevent illegal access from happening. The first video home security system was invented. It was patented on December 2, 1969 to Merie Bro [2], Motion detectors with infrared and glass shatter detectors can all be connected to a home alarm system to trigger an alarm if illegal entry is attempted. Light activated switch can be connected to security lights and open circuit detectors to automatically switch on security lights and also alarts the occupants when the lights are bad. Automatic dialing systems are home security devices too, being utilized to notify the authorities in the event of a break – in or other similar events [2].

Many home security devices lately developed are products of alarm and security lights manufacturers consulting with former criminals concerning their ability to gain entry into a locked and secured premises. [2].

2.2 AUTOMATIC CONTROL

The history of control systems technology reaches back to Greek antiquity. It covers areas from time keeping to transportation, from prime movers to prime numbers, and from pure mathematics to business and profit.

The impact of automatic control on our daily life is ubiquitous. Our homes are replate with automatic controls. They govern ovens, furnaces, water heaters, air conditioners, humidifiers, watches, video and audio equipment, garage door openers, water softeners, refrigerators, washers and dryers. In our automobiles, engine temperature, air / fuel ration, sparks advance, cruise control and automatic transmission operations were all designed and built incorporating automatic controls. Our factories and processing plants could not function without automatic controls [3].

Control systems could be classified as either closed or open. The former is self correcting in that a measurement of the output variable is fed back and compared with the command input variable. Hence, in this system, output is measured and used to alter the control inputs applied to the plant / device under control. If output measurements are not utilized in determining the plant input then, the plant is said to be under open loop control. The closed loopcontrol system is employed in this project work [4].

Automatic control as it is employed in so many aforementioned areas of our daily lives is aimed at putting paid to human errors associated with manual controls. The Automatic Security Light Control System shares this common objectives.

2.3 HISTORICAL BACKGROUND

Until the seventeenth century London had no organization which ensured the security of its inhabitants against crime. Only then were 1000 watchmen recruited; each was paid less than a shilling at night. These watchmen, who were known as 'Charlies' after King Charles II, were usually completely unsuitable for their duties, both physically and mentally; if Henry Fielding, the magistrate and author, is to be believed. It was not until Sir Robert Peel was appointed Home security in 1822 that further action was taken to prevent crime. After six years in office, he managed to convince the House of Commons committee to recommend the formation of a police force.

The initial purpose of the police was the prevention rather than the detection of an offender, but this latter duty soon became a major occupation, and the problem of prevention and protection was only partly solved [5].

In 1883, George Lush Pearson applied for a patent for his invention which could alarm by means of electric communication. This was initially a revolving lamp on the exterior of the protected premises or the use of bells. It was not, however, until about 1923 that intruder alarms became generally available. Since that time equipment has been designed, this uses the principles of ultrasonic, microwaves, infrared light, current monitored wiring, magnetic recorders, pressure pads, vibration sensors, microphones, heat sensors, capacity sensors, and many types of switches [5].

2.4 THEORETICAL BACKGROUND

In view of the wide variety of equipment now available, the designer of a comprehensive system to guard against intruders must take into consideration where equipment will operate and how it will be operated before selecting the methods to be used.

Variably, alarm systems are designed to provide some audible or visible warming to security staff, whether they are police or private security companies. Manpower, an important part of any security system and the majority of systems for stores, factories and buildings still rely on the store detective, commissionaire or patrolling guard. Where such systems are used, the security of the premises begins by ensuring that selection of the staff for such positions allows only people of the highest integrity to be appointed.

Today all major security organization, provide uniform guards who are fully trained and organized in eithermilitary or police manner. These companies also use guard dogs and have available armour vans for the transportation of money and valuables. Radio communication with headquarters is common and when on duty within premises, the management usually extend to these guards the right to search and question staff.

Security companies guarantee the regular patrolling of premises by guard by using equipment which requires the guard to operate it with special keys at predetermined periods throughout his watch.

CHAPTER THREE

3.0 DESIGN AND IMPLEMENTATION

The system was designed around:

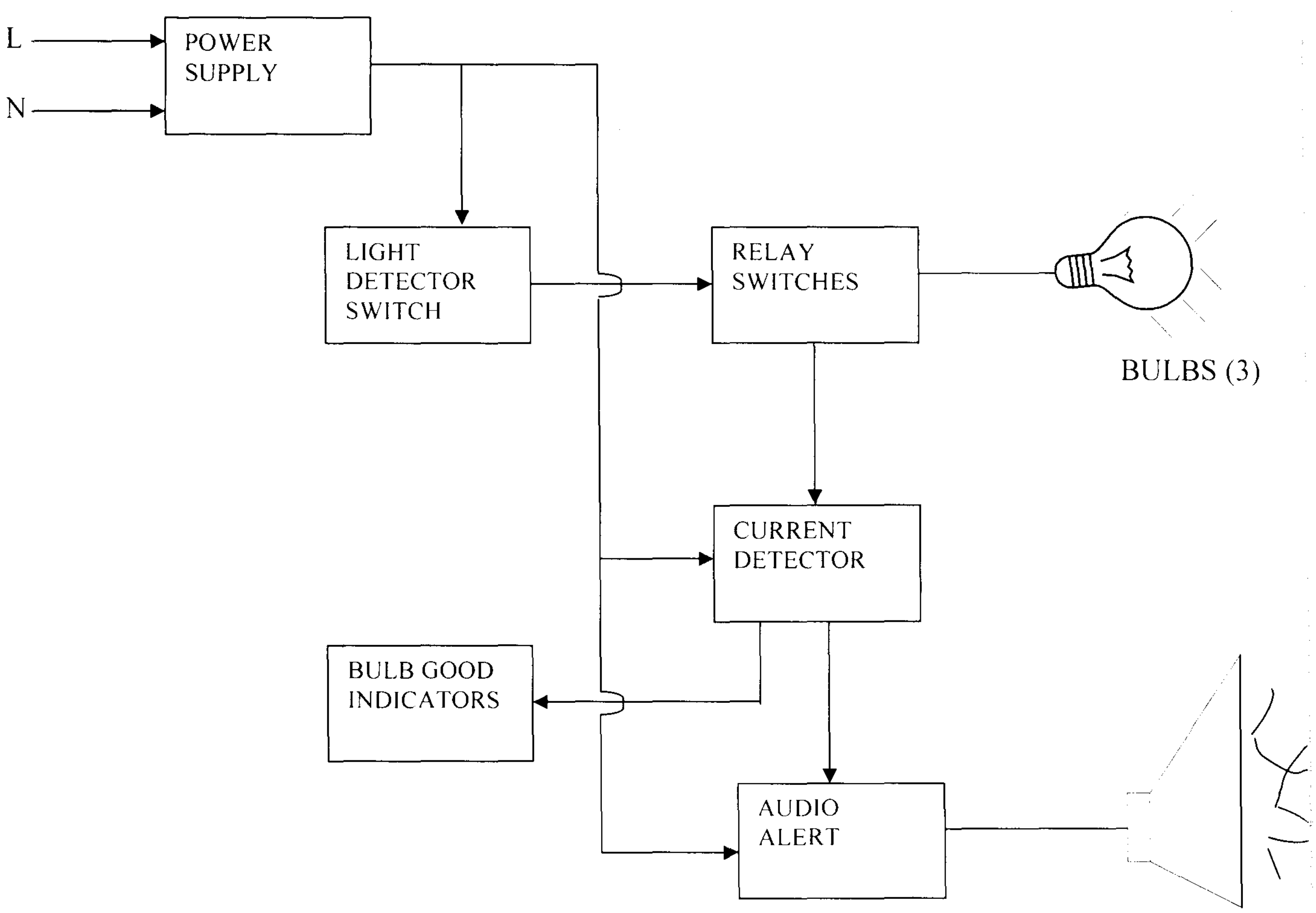
i. A 6 – volt power supply;

ii. A light detector / AC power switch;

iii. 3 – way current monitoring system;

iv. Bulbs failure detector / audible alert generator.

3.1 BLOCK DIAGRAM



3.2 POWER SUPPLY:

To ensure system's operational reliability down to low voltages, a low – voltage circuit was deemed necessary, prompting the utilization of a low – voltage D.C supply. A 6 – volt operational voltage was used.

The 6 – volts was derived from a 12 V – 0.5A step down transformer wired to a full – wave bridge rectifier as shown in fig. 3.0 below:

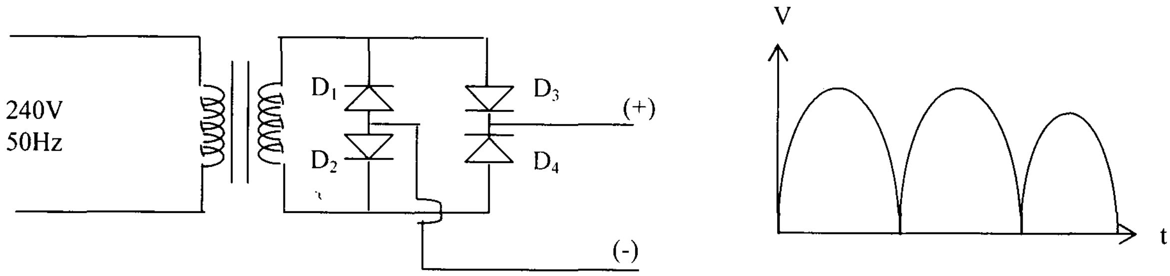


Fig. 3.0 Full – wave bridge rectifier

The pulsating DC output voltage has an amplitude :

$$V_{DC} = \left((V_{rms} \times \sqrt{2}) - 1.4 \right) V$$

Vrms = root mean square secondary voltage;

$\sqrt{2}$ = rms to – peak scaling dactor;

1.4 = two – diode forward voltage drop in adjacent diode of the bridge rectifier.

For a 12 V rms transformer;

$$VDC = \left((12 \times \sqrt{2}) - 1.4 \right) V = 15.5V$$

The voltage, though unidirectional in current, has very little practical utilization except for battery charging applications etc. This is one to the very large amount of AC ripple voltage superimposed on the DC output.

To reduce the AC ripple, a form of storage device that alternative charges and discharges was required. A capacitor serves this function effectively. During the 'Peak' times of the DC voltage, the capacitor charged to the peak applied DC voltage. During the 'trough' times, of the D.C. supply, the capacitor discharges into the load once the source DC voltage is lesser than Vc (capacitor voltage).

The value of capacitance required is determined by:

(i) The maximum allowable ripple voltage on the DC

(ii) The maximum load current

(iii) The form of rectifier used (half – wave or full – wave).

The value of capacitance is calculated from:

$$Q = CV$$

$$Q = It$$

$$CV = It$$

taking differential on the LHS sides:

$$C\,\Delta V = It$$

$$\therefore \quad \Delta V = \frac{It}{C}$$

$$C = \frac{It}{\Delta V} \qquad \text{———— } 1.0$$

I = system current drains is maximum

When;

(i) The three relays are energized;

(ii) The alarm is On.

The above are in addition to the normal operational current drawn by the system. With the three relays energized, the current drawn is; $3\left(\frac{6}{100}\right) = 180$ mA

which is the relays current.

Modest normal operational current of 100mA was taken, totalling of 280mA.

For the 6V (7806) regulator used, the minimum DC input voltage needed to maintain regulation is 8V. On a 15.5V DC input, this translates to an AC ripple voltage of 7.5V peak – peak. For a full – wave bridge rectifier, the frequency of the output DC voltage is twice that of the input AC. Thus, on a 50Hz live frequency, the output DC has a ripple frequency of 100Hz.

Using equation (1), the minimum value of capacitance needed is

$$C = \frac{0.28 \times \frac{1}{100}}{7.5} = \frac{2.8 \times 10^{-3}}{7.5}$$

$$C = 373\ \mu F$$

This gives the minimum value of the smoothing capacitance needed on power line.

A 6 – fold increasement in capacitance was used to allow for system reliability in the worst cases.

Thus, a 2200 μF capacitance was used. The smoothened DC was feed into a 6 – volt regulator to produce a ripple – free 6V DC system working voltage.

3.3 LIGHT DETECTOR AND AC POWER SWITCH

A reliable means of detecting presence or absence of ambient light was needed. An LDR (Light Dependent Resistor) was used to convert charge in light level to resistance, which when combined with a resistor in a potential divider network generated the required control signal.

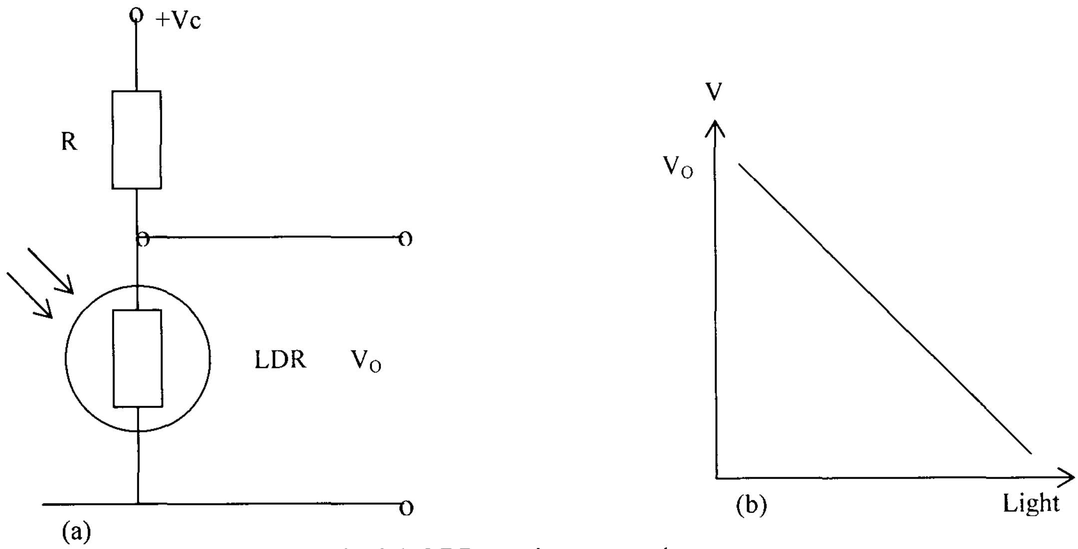


Fig. 3.1 LDR – resistor network

Fig. 3.1 (a), shows a typical LDR – resistor network and 3.1 (b), is a typical plot of the response of the network with respect to light intensity.

To ensure snap – action switching, hysterisis was incomporated in the switching circuit. This was realized using an NE 555 Schmitt trigger.

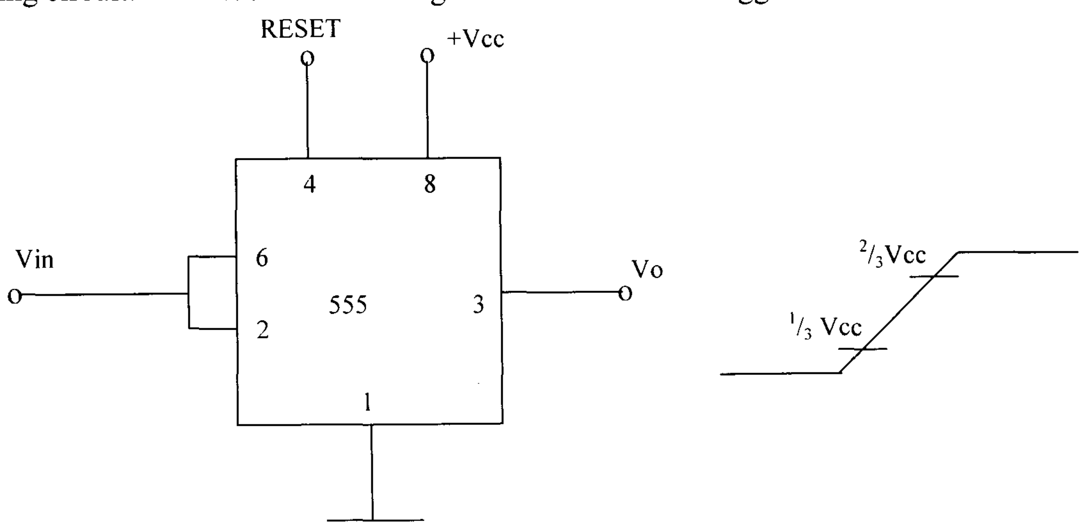


Fig. 3.2 555 Schmitt Trigger

For a 555 used as aschmitt trigger, the upper and lower switches points are fixed at $^2/_3$ and $^1/_3$ Vcc respectively (Vcc is power supply to Pin 8). With the device wired as shown in fig. 3.2, the output voltage, Vo, is high for all values of Vin lesser than $^2/_3$ Vcc. When Vin is greater than $^2/_3$ Vcc, Vo switches low and remains low even though Vin falls below $^2/_3$ Vcc. When Vin falls below $^1/_3$ Vcc, Vo switches high again and follows the same steps as outlined above.

An important note about the characteristics of a Schmitt trigger is that it 'shapes' or converts signals that do not obey established logic levels into logic level signals. For example, directly connecting the network of fig. 3.1 (a) to a logical input on a gate will result in Oscillation and instability. However, with a schmitt trigger interposed between the network and the digital part, a logic level interfacing is effected between the non-logic level output of fig. 3.1 and any connected gate. To keep operational current low, it was decided to sink current during relaying switching instead of sourcing current through the schmitt trigger.

The 555 was wired as shown below:

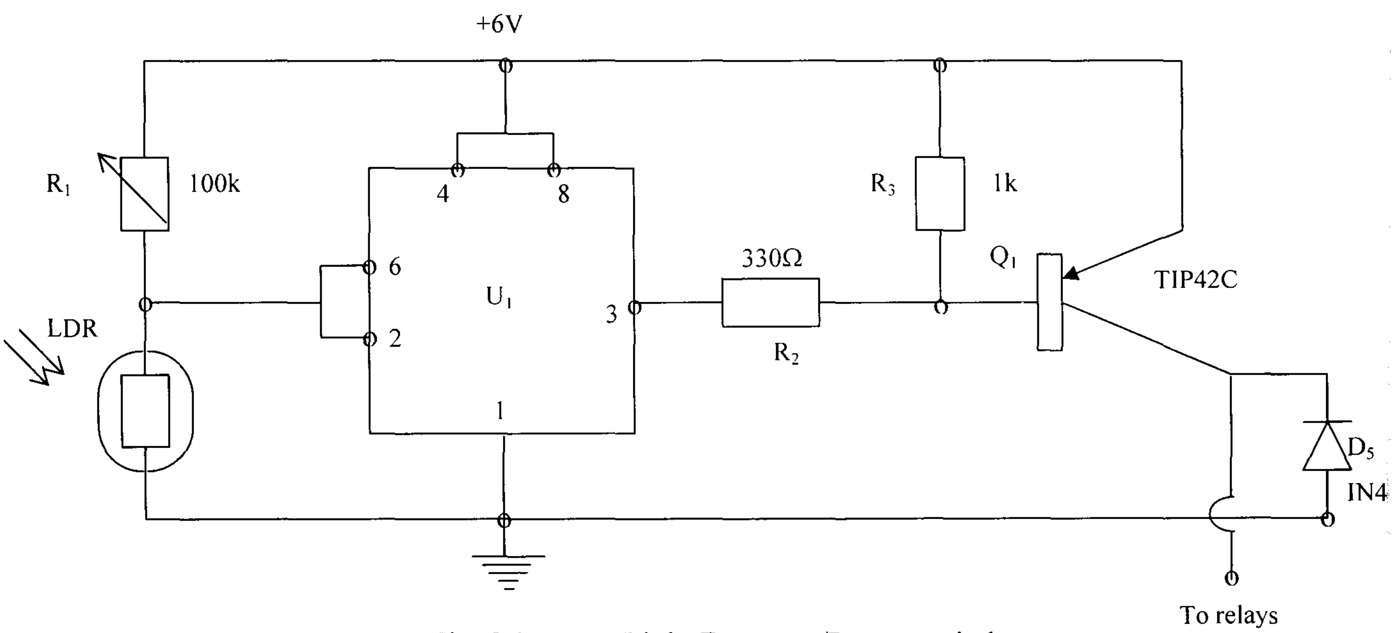


Fig. 3.3. Light Detector /Power switch

R_1 is a sensitivity adjustment potetiometer that allows the light level at which the system switches to be adjusted. It was chosen to have about the same resistance as the LDR in subdued light.

R_2 sinks current through the 555, to turn on Q_1, a PNP device.

The relay current = 180 mA = 0.18A life of Q_1(typical) $\approx$ 40, $I_c = 0.18A$,

but $I_c = \beta I_\beta$

$$\therefore \quad I_\beta = \frac{I_c}{\beta} = \frac{0.18A}{40} = 4.5mA$$

$$R_2 = R_b = \frac{V_E - V_{CE}}{I_\beta}$$

$$V_E = 6V, \quad V_{CE} = 1.4V$$

$$\therefore \quad R_2 = \frac{6 - 1.4}{0.0045} = 1022\Omega$$

To ensure saturation of Q_1 and prevent V_{CE} Ic dissipation, R_2 was made smaller.

R_3 pulls the base of Q_1 to + 6V, forcing it off when pin 3 of U_1 is high (6V)

D_5 is a free wheeling diode to protect Q_1 against destructive inductive back – emf generated when the relays are turned off. The three relays for turning On or Off the bulbs are shown wired as below in fig. 3.4.

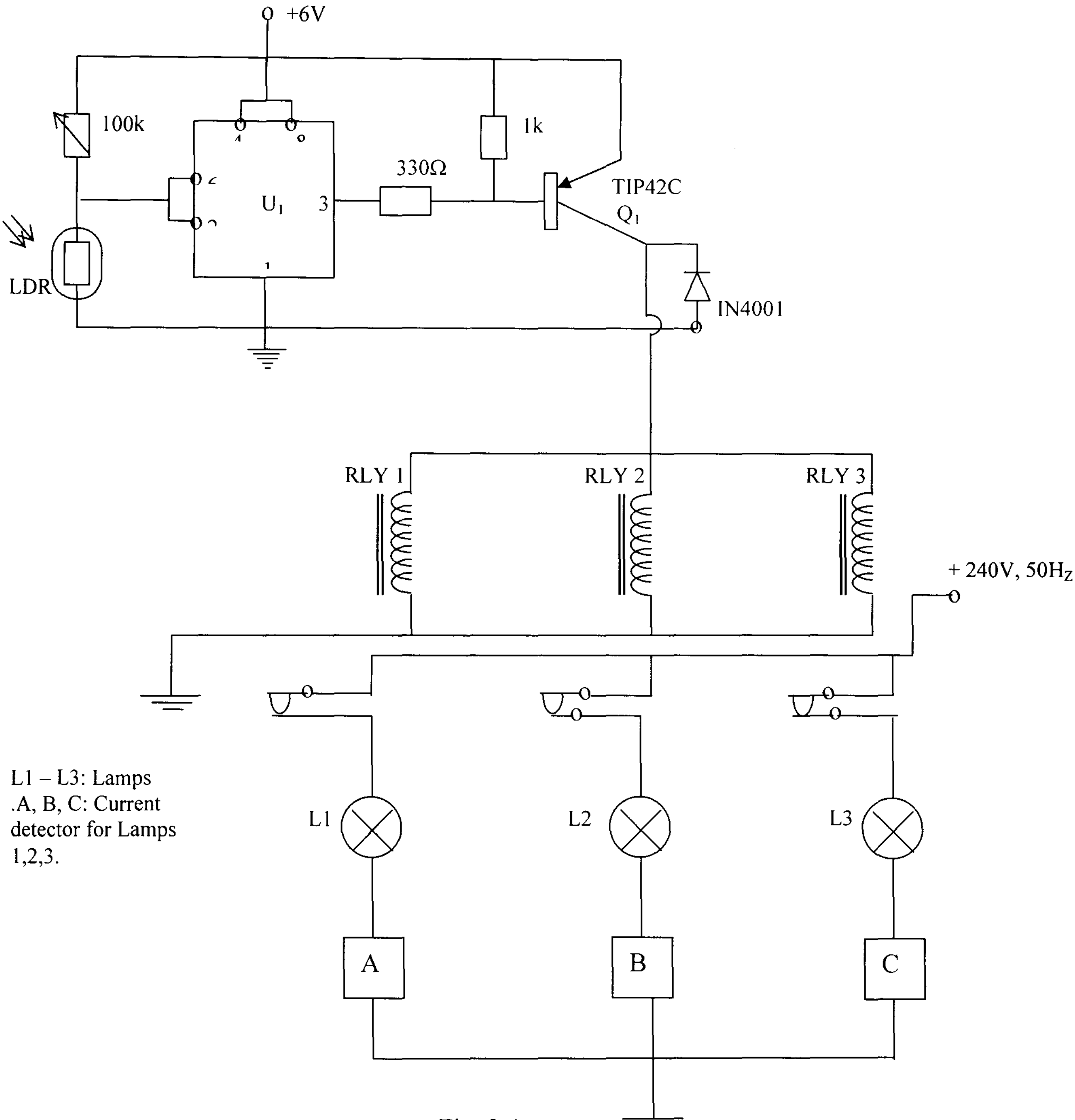


Fig. 3.4

When ambient light level falls below a minimum, at U_1's the voltage on pin 6,2 rises high enough above the $^2/_3$ Vcc threshold, forcing pin 3 low, forward – biasing Q_1 when then source current into the relays, energizing them and causing their contracts to close.

3.4 3 – WAY CURRENT MONITORING SUBSYSTEM

For feedback (i.e. a closed – loop operation), the bulbs were monitored for current flow through them. This was done by inserting a calculated value of resistance in series with each bulbs, causing a voltage to be developed across the ends of the resistors.

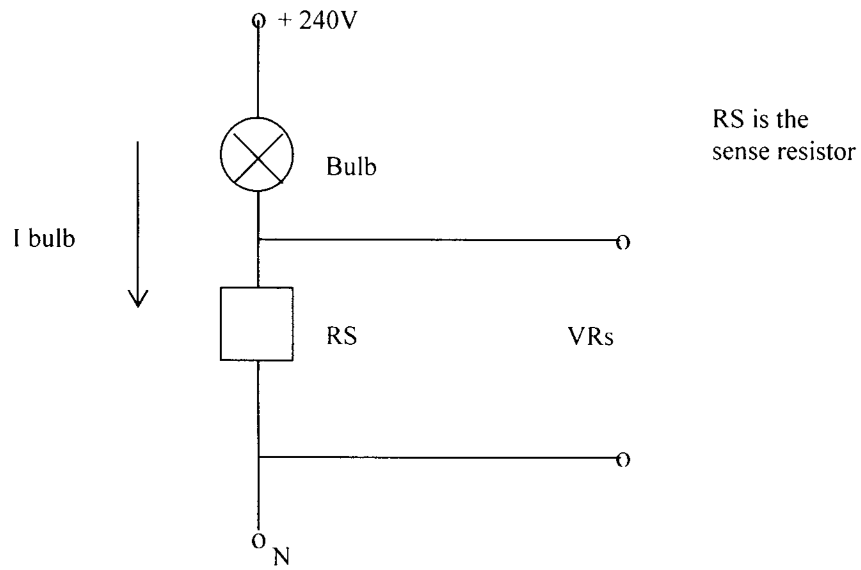


Fig. 2.5 Current flow detector

$$\therefore \quad I\ bulb = \frac{240}{R\ bulb + Rs}$$

Since Rs < < < R bulb, it can be assumed that minimal voltage is developed across Rs.

Choosing circuit values for a 40 watt bulb on 240V a.c.

$$I\ bulb = \frac{40}{240} = 0.1667A.$$

A minimum value of 0.7V is needed across Rs to turn on the associated transistor.

Calculating:

$$R_s = V/_I = 0.7/_{0.1667} = 4.2\Omega$$

To enable detection on:

i. Low live voltage; and

ii. High resistance (low – voltage bulbs).

A 5 – fold increasment in value of resistance was chosen, and a 22Ω current sensing resistance was used with a 240V, 40W bulbs.

$$P = VI$$

$$I = 0.1667A$$

Then, the bulb resistance is calculated thus;

$$P = I^2R$$

$$40 = (0.1666)^2 \text{ x } R$$

$$\therefore \quad R\text{ bulb} = \frac{40}{(0.16667)^2} = 1440\Omega$$

with a 22Ω series resistance,

$$1\text{ bulb} = \frac{240}{1462} = 0.16416A$$

$$\therefore \quad I\text{ bulb} = IRS.$$

The voltage, VRS, developed across Rs;

$$V_{RS} = Rs \text{ x } I_{RS} = 3.6V.$$

This value of voltage is generated across the two ends of the current sensing resistor by virtue of the current through them. This voltage is rectified using half – wave rectifier and fed into a three – input NAND gate as shown in Fig. 3.6.

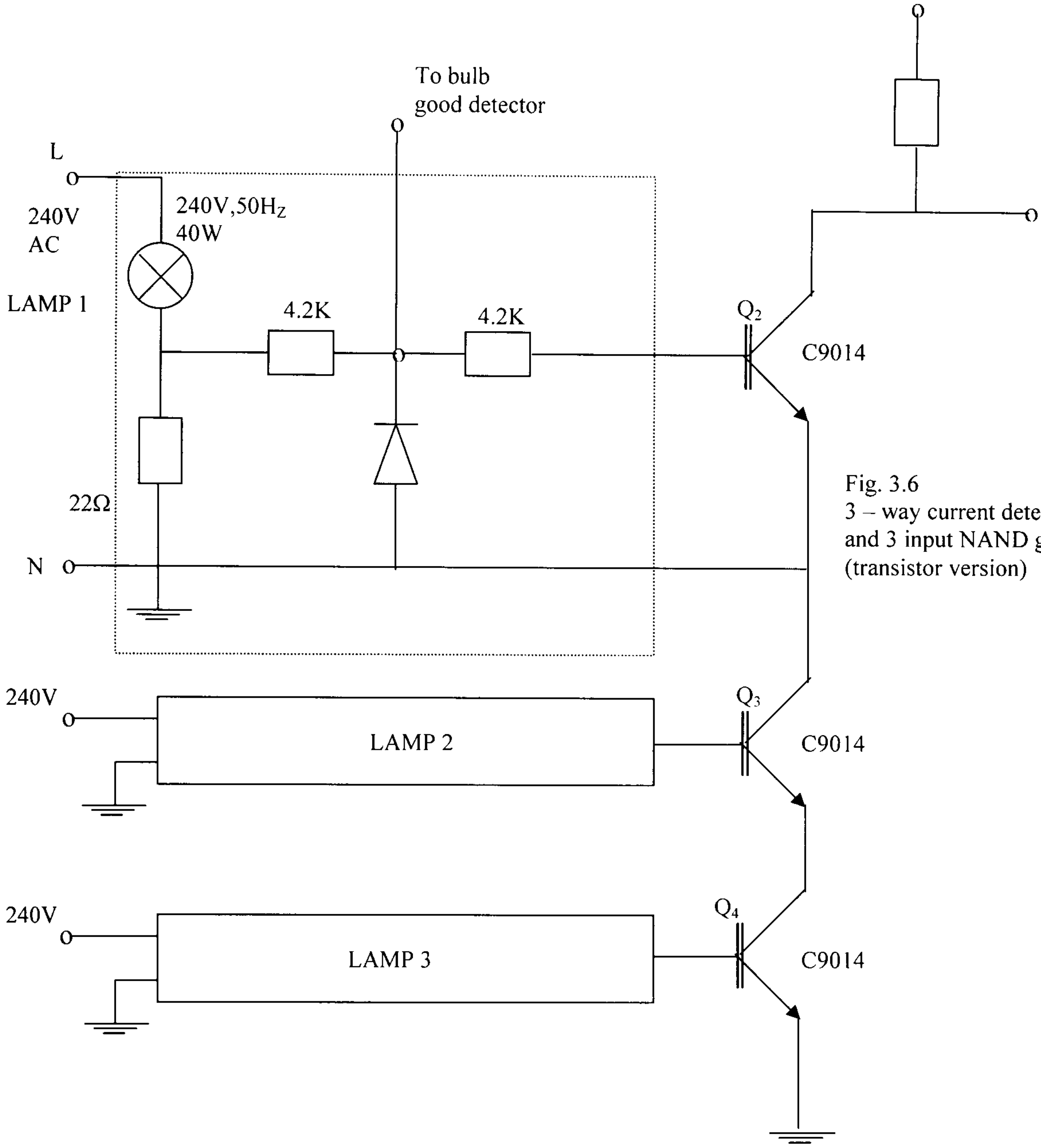


Fig. 3.6
3 – way current detector and 3 input NAND gate (transistor version)

Q2, Q3 and Q4 form a 3 input N AND gate as shown by the table below:

Q_2	Q_3	Q_4	OUTPUT
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

O = OFF

1 = ON

The output at collector of Q_2 is a series of pulses at 50Hz (Live frequency)

3.5 HALF WAVE RECTIFIER

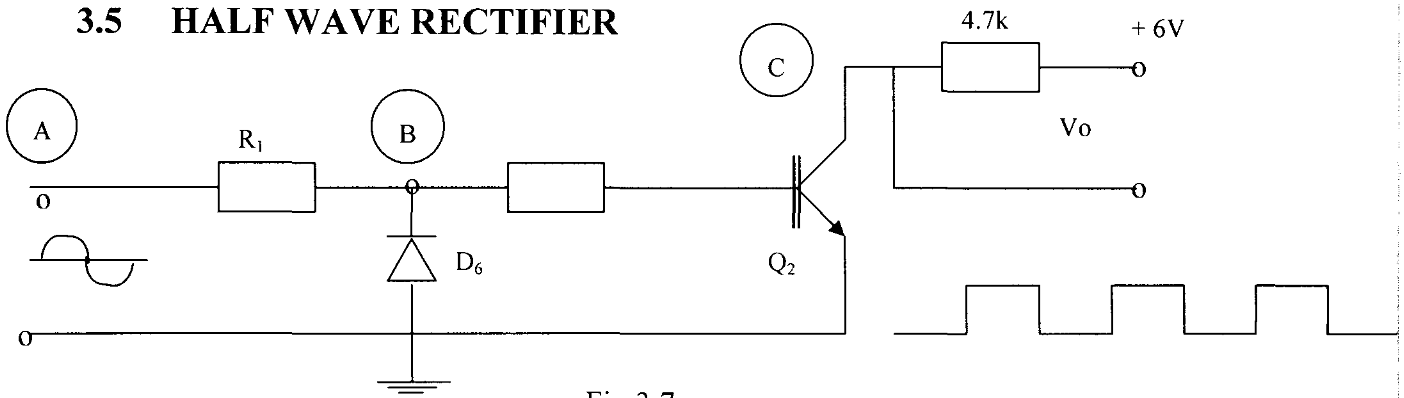


Fig 3.7

Figure 3.7 is a representative circuit of the current detector.

When a sinusoidal AC voltage is input into the system, D_6 is forward – biased every half-cycle, providing an alternate path for the negative half cycle, passing on only the positive half cycle wave form. The output is shown below.

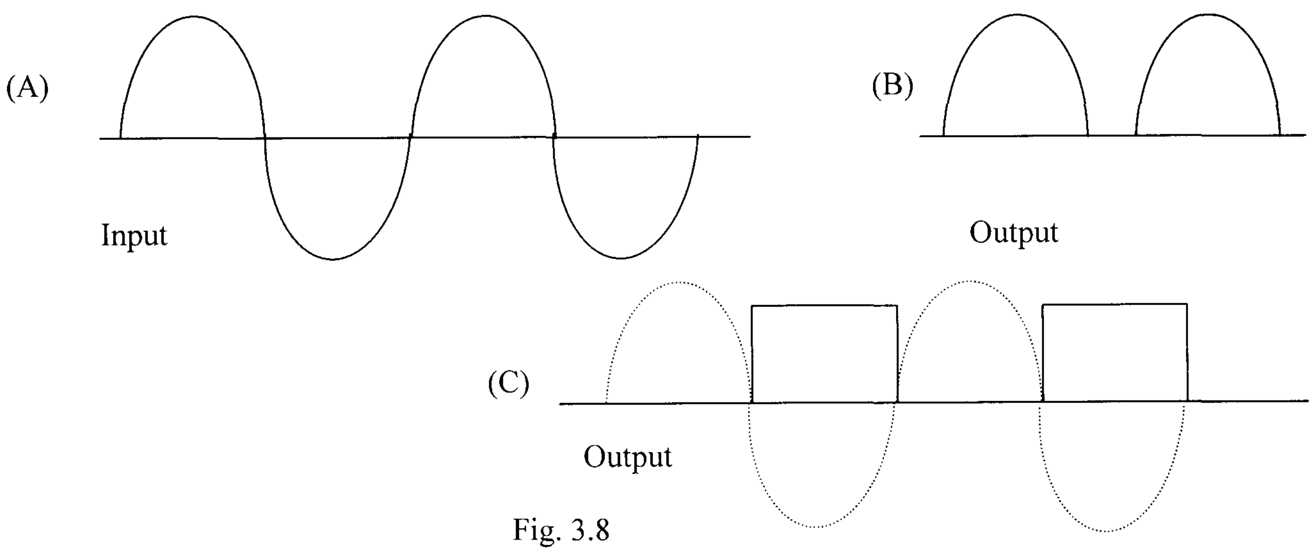


Fig. 3.8

The positive half cycles cause the transistor to saturate, producing a zero volt DC output at the collector, generating the kind of waveform shown in fig 3.8 (c)

3.6 AUDIBLE ALARM GENERATOR

The waveform of the fig 3.8 (c) is fed into the three – in NAND gate whose output was wired to the trigger input of a CD4098 retriggerable monostable. When all three bulbs are in place and working, i.e. no bulb burn out, the monostable is continuously triggered, silencing the audible alarm.

Once a bulb failure is discovered, an input to the NAND gate goes low, forcing its output high, preventing further checkup of the monostable and turning on the sounder after about one second (1s) delay.

Monostable is a circuit that produces an output pulse of specified width for an input trigger pulse.

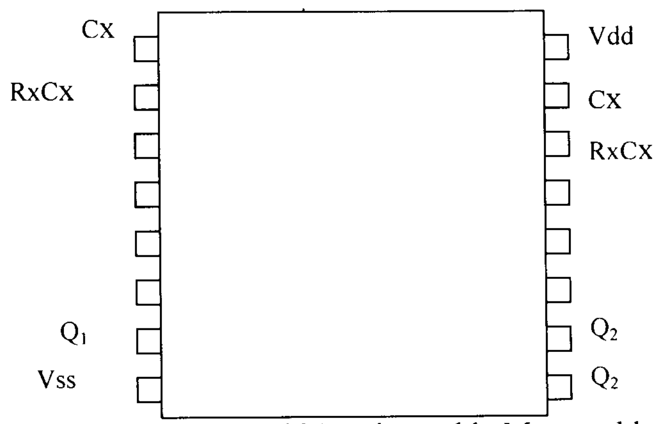


Fig. 3.9 CD4098 Retriggerable Monostable

A monostable is a device that produces a pulse with width duration proportional to the values of the analog timing components.

Monostables commonly employ R – C components for timing. A monostable can be either retriggerable or non-retriggerable, though a retriggerable monostable can be converted to a non – retriggerable type by modifying the wiring.

The CD4098 is a dual retriggerable monostable with both a positive edge triggering and a negative edge triggering. SO, long pulses are applied to the selected trigger input, the monostable does not time out (Assuming the period of the trigger pulses is shorter than the pulse duration).

However, if the trigger pulses disappear, the monostable generates one timeout delay and reverts to its inactive state, i.e. Q = 0, Q = 1.

The CD4098 has the following electrical specifications:

V_{DD}: 18V max

Rmax: 100KΩ

Cmax: 100μF

The Q output was connected to an NPN transistor whose collector load was an audio sounder as shown below:

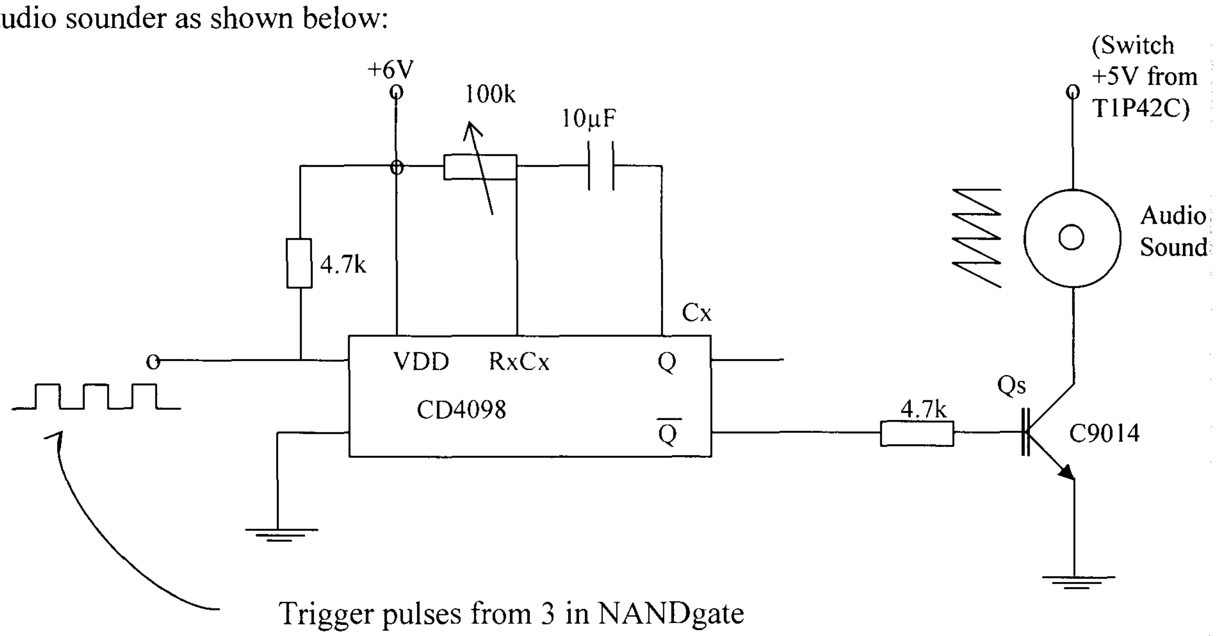


Fig. 3.10

As long as the trigger pulses appear at the negative edge trigger input, Q is held high, Q is low, and Qs is OFF, the alarm does not sound.

However, if the trigger pulses disappear, Q remains high only for a period of time given by:

T = $[0.5R_TC_T]$ seconds, after which it switches low, and Q switches high , turning on Qs and since the other end of the sounder is already at + 6V at the instant of the TIP42 coming ON, the alarm sounds. The audible alert remains ON as long as bulb failure detected.

3.7 LAMP GOOD INDICATORS

The LED indicators were used to indicate bulb failure. Individual LED is ON so long failure is not detected in the asociated bulb, and turns off when failure is detected, providing a very simple visual means of detecting where the problems lies. The LEDs were run off 6V via current – limiting resistors calculated from:

$$Rs = \frac{Vcc - V_{LED}}{I_{LED}}$$

The allowable range of I_{LED} (for red LED = 5mA – 20mA, continous operation). Choosing 12.5mA operating current;

$$R = \frac{6 - 1.7}{0.0125} = 344\Omega$$

:. The nearest resistance value of 330Ω was used.

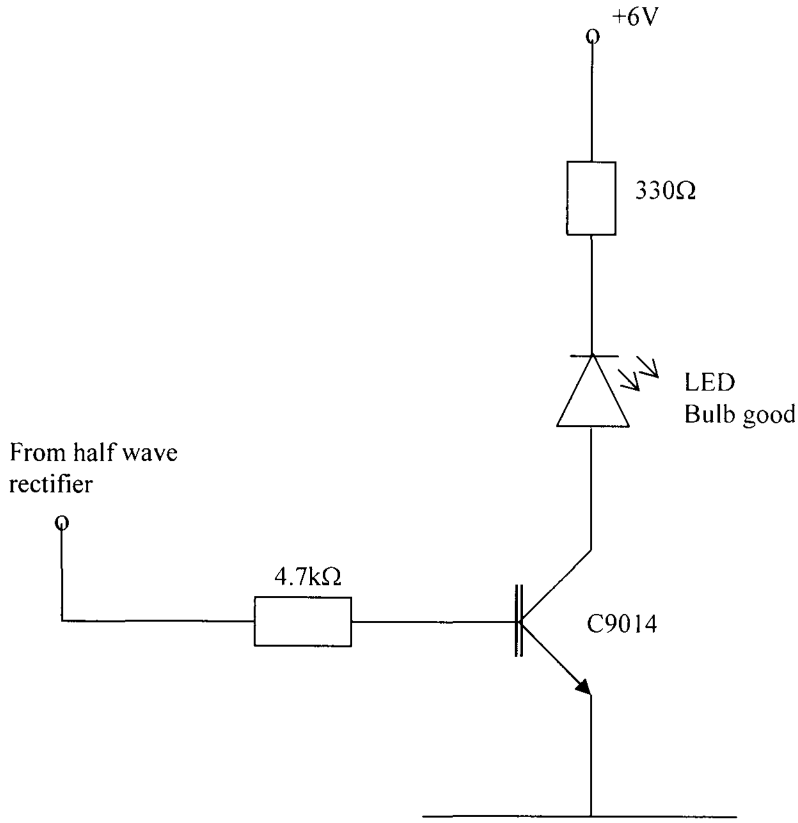


Fig. 3.11

A base resistance of 4.7kΩ was used.

This value was derived from:

$$V_{CE} = Vcc - I_C R_C$$

$$Ic = \beta I_\beta$$

$$Ib = \frac{Vb - Vbe}{Rb}$$

For a 12.5mA continuous collector current at a β of 200 for the C9014, is

$$I_\beta = \frac{12.5 \times 10^{-3}}{200} = 6.25 \times 10^{-5} A$$

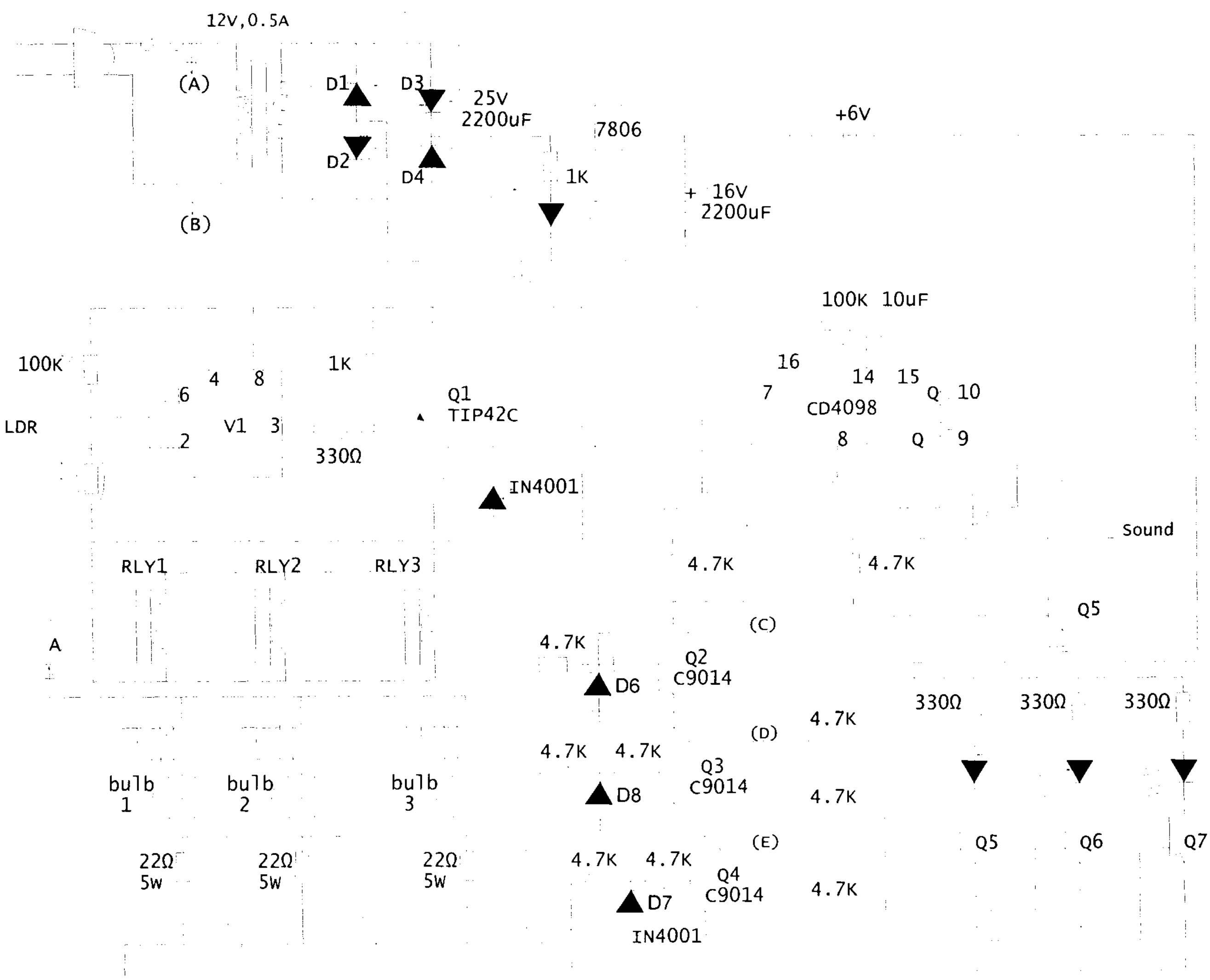
$$R_\beta = \frac{Vb}{I_\beta} \quad ; \quad V_\beta = \text{half – wave rectifier output.}$$

On normal 240V supply, V_β, the voltage across the 22Ω current sensive resistors is about 3.6V RMS.

$$R_B = \left(\frac{3.6 - 0.65}{6.25 \times 10^{-5}}\right)\Omega = \frac{2.95}{6.25} \times 10^5$$

$$\therefore \quad R_B \simeq 47k\Omega.$$

To allow for saturation of the C9014 driver transistor, a 10 – fold overdrive was implemented by reducing R_B to 4.7kΩ.



CIRCUIT DIAGRAM

CHAPTER FOUR

4.0 DEVICE CONSTRUCTION AND DISCUSSION OF RESULTS

4.1 CIRCUIT CONSTRUCTION

The circuit was first constructed on a breadboard to ascertain that it was working properly and subsequently transferred to a vero board. Highly insulated transformer coil wires were used to link the components in the circuit. Soldering iron and lead was used to fix the components firmly and correctly on the vero board. Digital meter was used to test the workability of each component before commencement of construction. It was also used to troubleshoot and test voltages and currents at each point in the circuit.

Also, pliers, culters, lead sucker, screwdriver, razor blade, ruler, pen and wires/cables were the tools employed during the course of the work. Figure 4.1 shows the diagram of the constructed circuit on vero board.

4.2 CONSTRUCTION OF CASING

A cuboids shaped casing was used. The choice of material for the casing was based on cost, availability, and overall size, weight and physical appearance of the casing. A "paper tiles" material was used for the casing.

Length used = 16.5cm, Breath = 11.5cm, Height = 5.3cm. Figure 4.2 shows the diagram and dimensions of the casing. Super glue was used in holding the paper tiles together to form the casing in which the circuit is housed.

4.3 DEVICE TESTING

Having constructed the circuit, the contacts of the relays were connected to bulbs (220v, 60w) x 3. As the light dependent resistor (LDR) was exposed to light, the normally open (NO) relays contact failed to close hence, the bulbs remained off. However, when the LDR was covered with the hand or when placed in a dark room, the normally open contacts of the relays closed and the bulb came on. Also, the power LED (Yellow) came on as the power source supplied to the device was left on for about 5 hours to confirm its reliability.

When the bulb was removed, while the device was still working normally, the emergency LED (RED) turned off (indicating the particular bulb that removed) and Alarm (buzzer) came on, indicating an emergency.

4.4 DISCUSSION OF RESULTS

The device was tested and confirmed to be working properly. From the test, we could see that the LDR acts as a light sensitive device that initiates the whole working process of the device. The 220v, 60w bulbs was just used as model; high – pressure sodium lamps should be used in security lighting because of their high luminous efficiency. The sensor (LDR) should be placed in a secured place where stray light or shadow would not reach it thereby causing false / wrong switching of the device.

The number of open circuit detector circuits incorporated into the device is determined by the number of lights to be used in security lighting. This implies that, if you need more than three security lights for instance, you will incorporate more than three (with respect to the numbers of security light) open circuit Detectors in the device, i.e. one open circuit Detector for each security light. It should be also noted that, when there is no alternating current (a.c) power source (e.g. when PHCN seizes electricity) the device would not work at all, not even in darkness.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

My dream of designing and constructing an "Automatic security lights control system with open Circuit Detector" has finally come true. This project work is indeed very interesting and educative, although energy sapping and time consuming. It involved the switching on and off of security lights automatically at dusk and dawn respectively using a light dependent resistor to initiate the switching process. An open circuit detector incorporated into this work helps to alert users of a broken or bad bulb / security light. The device have been tested and certified to be working fine.

I should be more fulfilled if every individual and organisations contribute their own quota towards the security of the society. One way of doing this is to ensure that this security device is gotten and proper usage ensured. Let us all make the society a secured place to live in!

5.2 RECOMMENDATIONS

This project was carried out based on the theoretical knowledge I was given and practical applications of those theories.

Firstly, this work has some limitations so; further improvement can be carried out on it. For instance, a more sensitive light dependent resistor (LDR) may be used for a more effective switching process.

A buzzer of very low resistance may be used for a louder sound output. Also, the open circuit detector circuit may be incorporated into other projects where break in continuity of a current path (or an open circuit) is to be detected.

Lastly, I recommend that the management of Federal University of Technology, Minna should embrace this project and use the device at the various security light points installed in the campus (both Bosso and Gidan Kwanu), to avoid the afforementioned human errors associated with manual switching.

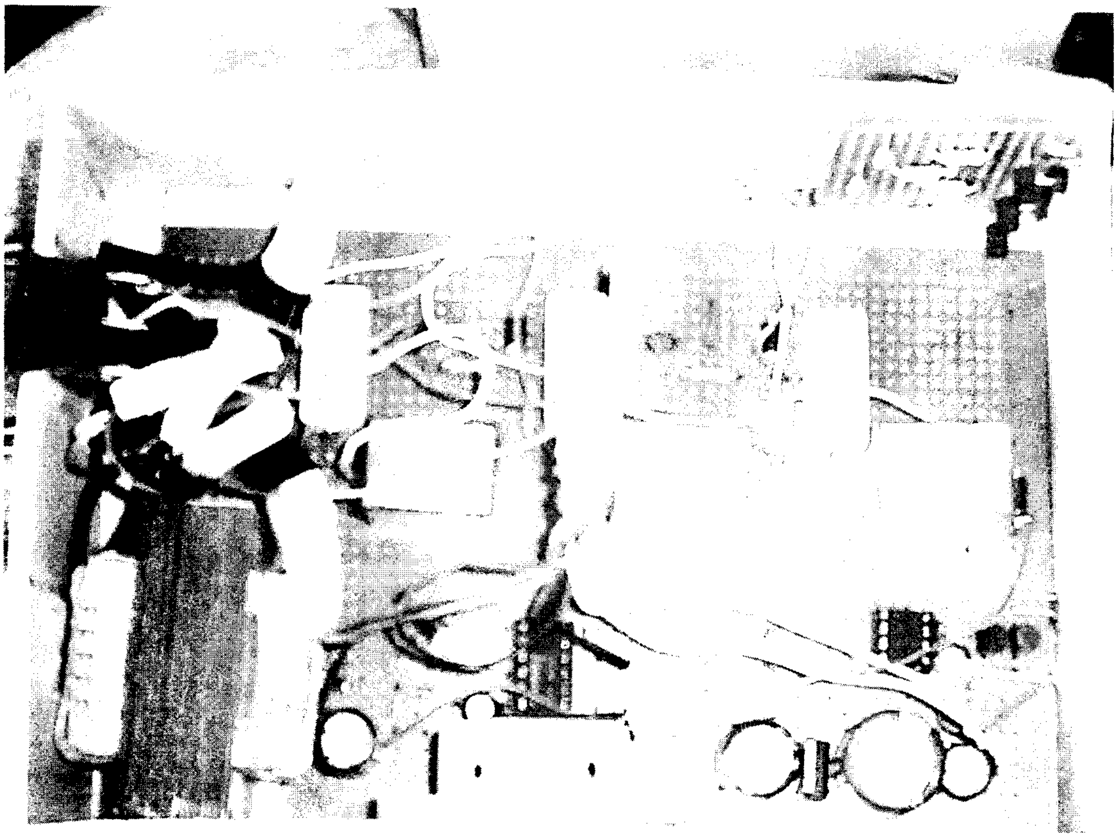


Fig. 4.1

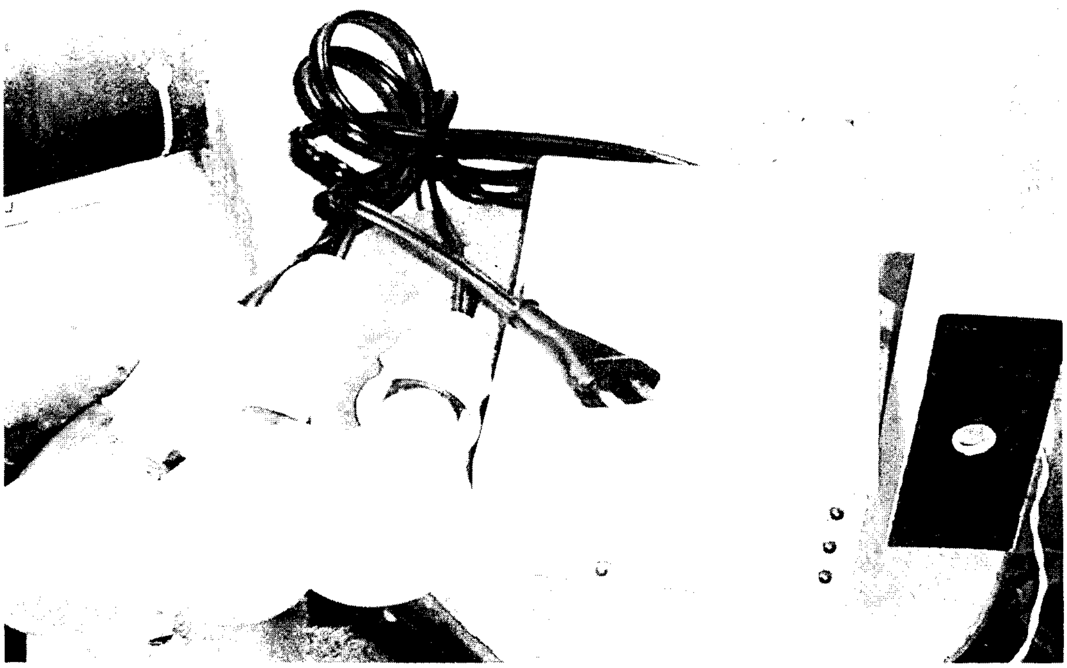


Fig. 4.2

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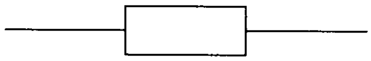
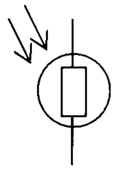
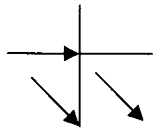
APPENDIX



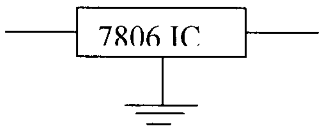
Carbon Resistor



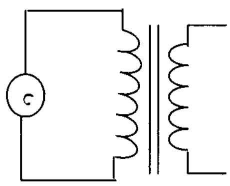
Light Dependent Resistor (Photo resistor)



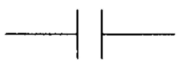
Light Emitting Diode (LED)



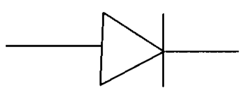
6Vdc Voltage Regulator



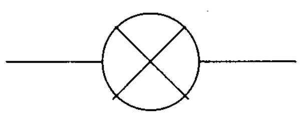
Step down Transformer



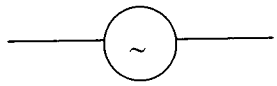
Capacitor



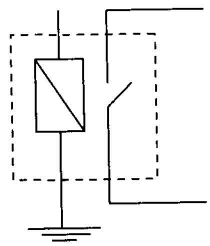
Diode



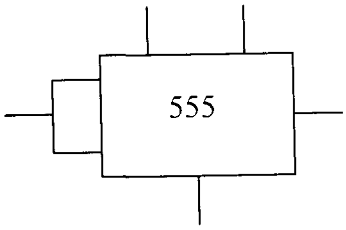
Lamp



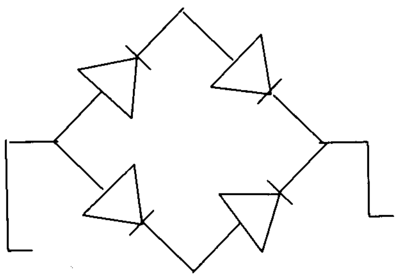
Alternating Current (a.c) source



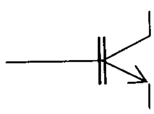
Normally Open (NO) relay



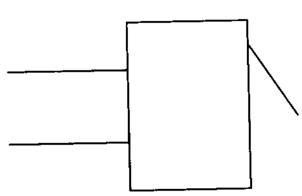
555 Schmitt Trigger



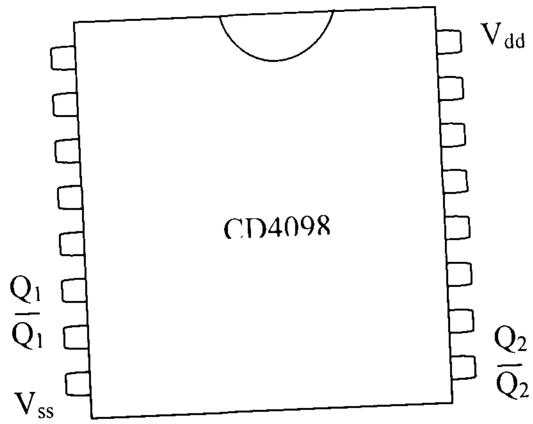
Bridge Rectifier



Transistor



Buzzer



Retriggerable Monostable