DESIGN AND CONSTRUCTION OF A LIGHT-SENSITIVE SECURITY ALARM SYSTEM.

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(2005 / 22094EE)

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DESIGN AND CONSTRUCTION OF A LIGHT - SENSITIVE SECURITY ALARM SYSTEM

BY

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NOVEMBER, 2010

DEDICATION

This project is dedicated to Almighty Allah (SWT) our sustenance, to my parent and sibling and all those that contributed to the success of my education.

DECLARATION

I, Salako Murtala Adetunji declare that this work was done by me and has never been presented elsewhere for the award of a degree. I hereby relinquish the copyright to the Federal University of Technology, Minna.

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ABSTRACT

In this project, therefore the design, construction and testing of a security alarm system is presented. In other parts of the world a lot of research has been done in this area and a lot more are still going. The sensor pad which is light dependent in this system is mounted at the presence of persons and set on the necessary alarm to alert the occupant of the house.

The system is to protect human beings and their belongings from being taken away. This makes themselves secured and thus make the system reliable. The main parts of the security alarm system are the power supply unit, the light sensor unit, transistor switch unit, the monostable multivibrator and alarm unit. This system is capable of raising an alarm when someone is at the entrance into the building. As a person comes to the entrance of the building, the sensor pad (i.e transducer) placed at the door detects that particular person as he blocks the rays of light falling on it, the signal from the sensor pad is fed to the monostable multivibrator and it will be set to a high and once it is set, the transistor will be switched on and subsequently activates the relay whose output is fed to the buzzer. This produces an audio sound that remains "ON" until it for a specified time that is being set to.

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CHAPTER ONE

1.0 INTRODUCTION

Light is one of the key elements to a safe home. Entryways must be lighted to welcome visitors and reassure homeowners who would answer the door. Walkways, grounds, exterior doorways, and garages need light for safety and security. Hallways, bathrooms, and stairs are all safer when lighted at night. Using sensors and timers helps owners respond to these needs for home security and safety. Many studies have shown the effectiveness of outdoor lighting in the prevention of home break-ins. Efficient lighting will deter burglars, since it forces them to expose themselves at the time of committing a crime. A well lit premise makes it clear to burglars that they should go and seek a different, less exposed target.

This project deals with the design and construction of a security alarm system. Security which is defined as the act that provides safety, freedom from danger an anxiety. In a large society like Nigeria where rate of crime is increasing day in, day out, its use cannot be overemphasized. It becomes very important to device a means that can monitor what is happening in our environment most especially our home, office whenever one is around, sleeping or absent.

Talking about security, a lot of companies, communities and countries have invested much into it, but this project proves much more important because of the way robbery is been attempted and perfectly carried out. At this time, it impossible that your home, business is under surveillance by professional robbers and a date is set for the job. This could occur during the day, at night, or when one is around or has traveled. Though there are different types of security devices ranging from common padlock and key to the sophisticated electronics system. There are many ways by which the presence of an uninvited person or even an intruder can be detected.

This security alarm system is a project that is carried out for the security of life, vital items that need to be moved or moving from its position. It is used to produce a sound that serves as a warning of danger or insecurity.

These fascinating results emphasize the power of a simple tactic, such as lighting, as an effective crime deterrent.

The need for security has become imperative for our nation today because of high rate of crime. There has been a high demand for a reliable security system that serves as monitor for unauthorized people.

Before now, security was provided through padlocks, door locks and other means but they have been found to be unreliable due to numerous duplicate keys and what is called "master keys" that can make it easy to unlock any door or padlock.

It has been observed that the use of these security guards alone has not been sufficient to curb theft and burglary in our houses and offices. This is because as human beings, so

many factors can make a guard to sleep on duty thereby making way for unauthorized person to enter such premises but with the use of the alarm system, any intruder is immediately noticed when the alarm is set "ON" and he or she is subsequently apprehended. In the case of burglary proofs; it has also been observed that an intruder can come in with sophisticated chemicals that melt the iron bars thereby gaining entry into the building. These have necessitated the design of the light sensitive security alarm for homes and offices.

The design of the light sensitive security alarm is simple and the components used for the construction are relatively cheap. Also, its performance is alright and generally reliable. It is also easy to install.

1.1 Aims and Objectives.

The aim of this project is to design and construct a light sensitive security alarm which provides a reliable security alarm for our homes, offices, and other places with valuable assets.

1.2 Methodology

For the design of light dependent security alarm system, modular approach was employed. This security alarm consists of five (5) units. Each unit performs various functions in the device. But it basically centered around 555 IC timer. The light sensor unit indicates the power supplies as well as the particular where the visitor or intruder would be at a particular point in time. The monostable mutivibrator unit supplies the

required signal to activate the relay which is the switch that activates the alarm unit and gives out audio sound.

1.3 Scope of Work.

This project work involves the design and construction of a security alarm system to be used in a building using delay circuit.

1.4 Project Outline.

The project write up was arranged in the following format, chapter one comprises of introduction, aim/objectives, methodology, scope of work and the project outline. literature review and the various types of alarm systems makes up chapter two, Chapter three comprises details of components used, construction of the light dependant alarm system, and soldering techniques. In chapter four, the main construction, testing and casing were carried out, while Chapter five comprises the conclusion and recommendation.

CHAPTER TWO

2.0 LITERATURE REVIEW

Scientists who said 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 anxiety. It can also be seen as the precautions taken to protect lives and properties. Fear of uncertainty tortures the cerebrum, once it dominates the brain, the way forward seems sad and without hope. This could be as 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 [1]

Security systems fall into two main categories; those concerned with fire and those concerned with protection against theft of property or information.

2.1 Historical Background

History: - until the seventeenth century London had no organization which ensured the security of its inhabitants against crime. Only then were 1000 watchman recruited; each was paid less than a shilling at night. These watchman, who were known as 'Charles' 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 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. [2]

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, television, current monitored wiring, magnetic recorder, pressure pads, vibration sensors, heat sensors, capacity sensors, microphones and many types of switches. [11]

In 1874, L.H.Mc Collough invented the first mercantile alarm system. The first alarm system utilized a single zone of protection that extended around the perimeter of the facility. The zone was nothing more than an electrical circuit that allowed current to constantly flow from one end to the other. When a door was opened, or a window was broken, the flow of electricity would be interrupted and the panel would cause an alarm.

The panel would utilize a McCollough transmitter to send a type of code to the local police or monitoring facility. The McCollough transmitter was a wind-up device that was connected to a dedicated copper circuit. When the alarm was triggered, the McCollough

transmitter would unwind and send a series of pulses along the dedicated copper wire. The signal is best compared to a type of morse code or telegraph signal. After the alarm goes off, the McCollough transmitter would need to be rewound so that it was ready to send the next alarm. The McCollough Receiver would tap out holes in stripes of paper. An alarm dispatcher would compare the holes with a list to pinpoint where the alarm had occurred. The earliest McCollough transmitter was utilized for fire alarm pull stations. Alarm panel have come a long way since the days of the McCollough transmitter, but as a testament to the technology inverted by McCollough, some of the most secure alarm transmission methods available today utilize a very similar technology. [2]

In year 2000, a project by Abodunrin Olufunmilayo Samson; An Intruder Detector was designed in Electrical Department of Federal University of Technology Minna, using Darlington amplifiers as a comparator and switch. The designer does not consider that pyroelectric devices apply the effect that arise because of polarization with temperature and may occur in several ways.

In 2010, a project by Suleiman Oladimeji another designer in Physics Department of Federal University of Technology Minna, designed a light sensitive security alarm system without timing unit and backup, so the system was not made to sound for a specific period of time before going off.

This project electronic security system is quite unique as it successfully overcome the short coming of the previous project, were transistors were used as comparator and switch.

2.2 Theoretical Background

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

Variably, alarm systems are designed to provide some audible or visible warning to security staff, whether they are police, firemen or private security companies. Manpower, an important part of any security system and the majority of systems for stores, factories and building 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 either military or police manner. These companies also use guard dogs and have available amour 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 guards by using equipment which requires the guard to operate it with special keys at predetermined periods throughout his watch. Such equipment produces coded tapes which are analyzed daily and reports are sent to the customer. [10]

Store security: - In stores, the use of television mirrors and loop alarms are common in order to observe shoppers from a central area to prevent the removal of the display items. The experienced store detective however is still invaluable for observing the habits of potential shoplifters and for checking the honesty of the shop assistants. A common practice used by store detectives is a 'test' purchasing assignment', this is carried out by two operatives working as a team. Both go to the same cash desk with items for purchase, both notes the cash register totals before and after a particular purchase and close attention is paid to all until procedures. If any suspicious is observed, positive identification of the cashier and details of the event can be collaborated.

Equipment has also been designed which requires a metal tag to be attached to each saleable item. When the customer pays for goods, the assistant removes the tag with a special tool. If the customer tries to take the goods from the shop with the remaining on the goods, equipment placed at the exits of the shop detects the tag through the disturbance of the magnetic field. Such equipment, however, can cause embarrassment if the shop assistant has forgotten to remove the tag or other items on the customer which affects the apparatus. [2]

2.3 Types of Alarm System

There are different types of alarm systems some of these are:

- Fire alarm system
- Burglar alarm system
- Car alarm system

- Emergency alarm system

2.3.1 Fire Alarm System

An automatic fire alarm system is designed to detect the unwanted presence of fire by monitoring environmental changes associated with combustion. In general, a fire alarm system is classified as automatic, manually activated or both automatic and manual. The fire alarm systems can be used to notify people so as to evacuate from a building in the event of a fire outbreak or other emergency, to summon emergency services, and to prepare the structure and associated system to control the spread of the fire and smoke. [3]

2.3.2 Burglary Alarm System

During the recession of the 1930s, demand for telephone equipment fell dramatically. To keep the production plants running, Ericsson broadened its product range. And broad was definitely the word. If anything could be manufactured with existing equipment and personnel, Ericsson was interested in trying it. There were many examples of unusual products that bore the Ericsson name during this time. [4]

The photo-electric burglar alarm: In 1934, F von Meissner published an article in Ericsson Review that Ericsson had developed. The introduction to the article contained the following enthusiastic description: "The new Ericsson burglar-alarm system with photo-electric cells is described below. At the present stage of technical development it constitutes the best automatic protection against burglary for apartments or whole buildings. Banks, offices where money or other valuables are kept, museums, libraries, shops - especially jewelers - factories, private houses with extensive grounds, etc. are by

the Ericsson photo-electric system provided with a means of protection against burglary that even the most scientific burglar is incapable of avoiding or rendering harmless."

This for the time very modern system worked as follows. A small projector cast a ray of light on a light-sensitive cell, which in turn was connected to a power circuit. The cell carried current to the circuit only as long as it was subject to light. If the ray of light was broken, if even for a moment, the current stopped flowing and an alarm sounded. A filter could also be used to make the ray of light invisible. [5]

The need for full security in our society cannot be over emphasized not only because lives are important to the growth and development of the society and nation, but also because properties and valuables are needed to be able to achieve this development. No doubt, burglars and thieves pose a great threat to the security lives and properties as they burgle and steal away valuables of innocent citizens sometimes at gun-point. Oweing to this fact, the burglary alarm system(s) become imperative to prevent some, if not all cases of burglary. Also important are burglary proofs installed in houses, offices, buildings, to name but a few.

Burglary alarm systems is used to alert before hand any forth coming cases of theft and this will create time for persons or owners of such valuables to prevent the occurrence(s).[6]

2.3.4 Car Alarm System

Burglars do not only burgle houses or buildings, they also snatch cars on road sides, at parking places, building front, offices and even at sales points. What the car alarm system does is that it helps to prevent the cases of car thefts. [7]

2.3.5 Emergency Alarm System

Emergency by definition is any thing that needs an urgent attention or solution. Emergency alarm systems are systems that help to prevent any eventuality which may include fire-out-break, car snatching, parson, burgling a building or even road accident that will need the attention of medical personnel's to save the lives of victims. In this, the ambulance which serves as the emergency alarm system for the injured is used to rush victims to hospitals. [8]

2.4 Light Dependent Security Alarm System

The circuit detects sudden shadow falling on the light sensor and sounds the alarm. When this happens the circuit will not respond to gradual changes in brightness to avoid false alarms. The alarm sounds for only a short term to prevent the battery running flat. The normal lighting can be used, but the circuit will work best if a beam of light is arranged to fall on the light sensor creating a barrier between the sensor and the beam of light cause the alarm to sound. The light sensor is an LDR (light dependent resistor). This has a low resistance in bright light a high resistance in dim light.

The light sensitivity of the circuit can be adjusted by varying the loop preset. The length of alarm can be varied from 15seconds to 30seconds even more using the 1MΩ presentable resistor. An alkaline PP3 9V battery is used for the power supply, the battery last for about 6 months.

The transistor BC 557 or equivalent is used as a switch to triggered the monostable multivibrator IC, the time delay for the alarm can be set using the 1MΩ variable resistor presentable resistor.

A power switch S_1 is position in such a way when you enter inside the room you disable the alarm before making barrier between the light and the sensor the switch or situated close to the door inside the room, while the sensor and the light are fixed at the opposite to each other so that the light beams can be about 3feet away from the door.

The design is cheap, economical and easy to implement compared to other types of alarm systems.

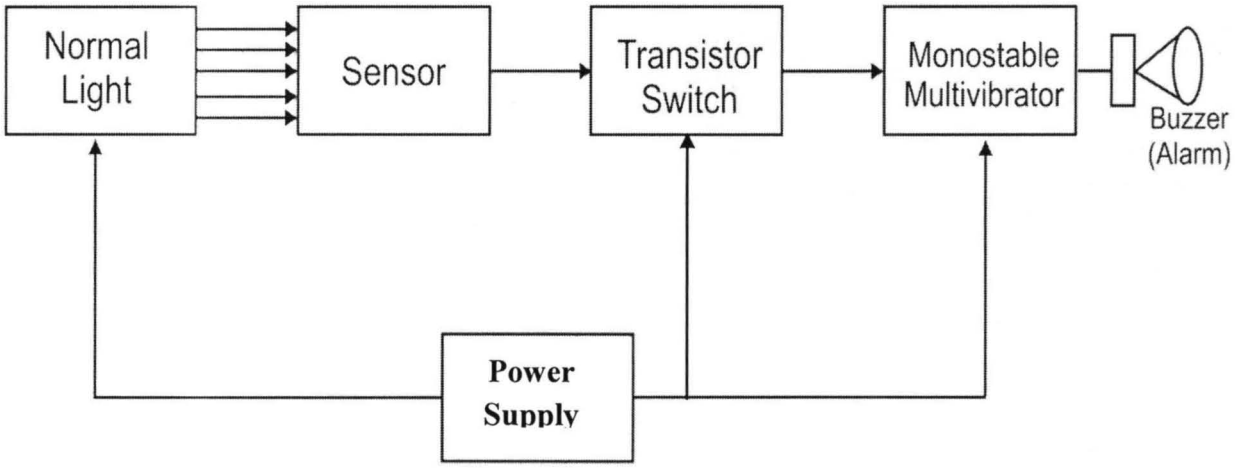

Fig 2.1: Block Diagram of Light Sensitive Security Alarm

2.5 Principle of Operation

This system is capable of raising an alarm when someone is at a particular door or into a building. When a person is at a door, a sensor pad (i.e transducer) placed on the door or entrance detects that particular person when he blocks the ray of light falling on it, the signal from the sensor pad is fed to monostable multivibrator and then it will be set to high, and once it is set, the transistor will be switched on and subsequently activates the

relay whose output is fed to the buzzer. This produces an audio sound that remains "ON" until it is reset using the button or switched off. This alerts the occupant that there is either a caller or an intruder at the entrance.

2.6 Economic Importance

The components used in the construction of light sensitive security alarm system are relatively cheap and the entire system is easy to install. Also, because of the effectiveness of most of these alarm systems, they are gaining popularity in this era.

CHAPTER THREE

3.0 CONSTRUCTION OF THE LIGHT DEPENDANT SECURITY ALARM

3.1 Introduction

The components used for the construction of the light sensitive alarm system were first installed on a bread board and tested. When it worked on the bread board, it was then transferred to the vero board where they were properly soldered. These analyses were required to make the correct choice of component values for effective performance.

3.2 Power Supply Stage

The power supply unit is made up of a step down transformer which steps down the available mains voltage to lower voltage value, a bridge rectifier circuit, a capacitor and a voltage regulator which keeps the output d.c voltage at a constant value. [5]

A simple AC powered linear power supply usually uses a transformer to convert the voltage from the wall outlet (mains) to a different, usually a lower voltage. If it is used to produce DC a rectifier circuit is employed either as a single chip, an array of diodes sometimes called a diode bridge or Bridge Rectifier, both for full wave rectification or a single diode yielding a half wave (pulsating) output. More elaborate configurations rectify the AC voltage at first to pulsating DC. Then a capacitor smoothes out part the pulses giving a type of DC voltage. The smaller pulses remaining are known as ripple. Because of a full wave rectification they occur at twice the mains frequency (in USA it's 60Hz doubled to 120Hz – or the UK, its 50Hz, doubled to 100Hz).

Finally, depending on the requirement of the load, a linear regulator may be used to reduce the ripple sometimes also allowing for adjustment of the output to the desired but lower voltage. [3]

3.2.1 The Step down Transformer

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled wires. A changing current in the first circuit (the primary) creates a changing magnetic field; in turns, this magnetic field induces a changing voltage in the second circuit (the secondary). By adding a load to the secondary circuit, one can make current flow in the transformer, thus transferring energy from one circuit to the other.

The secondary induced voltage Vs is called scaled from the primary Vp by a factor ideally equal to the ratio of the number of turns of wire in their respective windings:

$$V_S/V_P = N_S/N_P \quad \text{..... (1)}$$

By appropriate selection of the numbers of turns, a transformer thus allows an alternating voltage to be stepped up – by making NS more than NP – or stepped down, by making it less.

The transformer is based on two principles: first, that an electric current can produce a magnetic field (electromagnetism) and second, that a changing magnetic field within a coil of wire induces a voltage across the ends of the coil (electromagnetic induction). By

changing the field; since the secondary coil is wrapped around the same magnetic field, a voltage is induced across the secondary. [6]

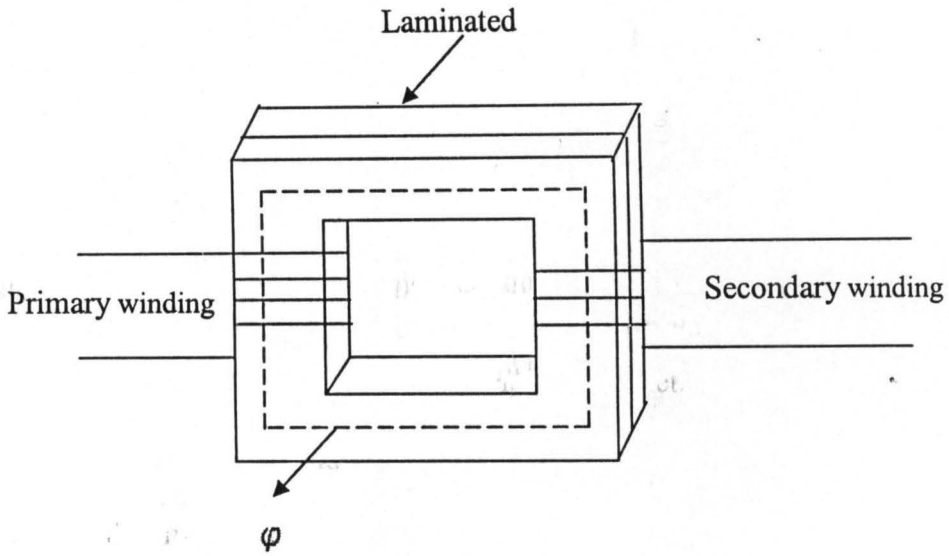

Fig.3.1 An ideal step-down transformer showing magnetic flux in the core

A current passing through the primary coil creates a magnetic field. The primary and secondary coils are wrapped around a core of very high magnetic permeability, such as iron; this ensures that most of the magnetic field lines produced by the primary current are within the iron and pass through the secondary coil as well as the primary coil. [6]

3.2.2 Ideal Power Equation

If the secondary coil is attached to a load that allows current to flow, electrical power is transmitted from the primary circuit to the secondary circuit. Ideally, the transformer is perfectly efficient; all the incoming energy is transformed from the primary circuit to the magnetic field and hence to the secondary circuit. If this condition is met, the incoming electric power must equal the outgoing power

P incoming = IPVP = P outgoing = ISVS ..... (2)

Giving the ideal transformer equation

Thus, if the voltage is stepped up (VS > VP), then the current is stepped down (IS < VP) by the same factor. In practice, most transformers are very efficient (see above), so that this formula is a good approximation. The impedance in one circuit is transformed by the square of the turns ratio.

3.2.3 Full Wave Bridge Rectification

The dc level obtained from a sinusoidal input can be improved 100% using a process called full wave rectification.

A rectifier is an electrical device that converts alternating current to direct current, a process known as rectification. Rectifiers are used as components of power supplies and as detectors of radio signals. Rectifiers may be made of solid state diodes, vacuum tube diodes mercury are valves, and other components.

Full-wave rectification converts both polarities of the input waveform to DC (direct current), and is more efficient. However, in a circuit with a non-center tapped transformer, four diodes are required instead of the one needed for half-wave rectification. This is due to each output polarity requiring two rectifiers each, for example, one for when AC terminal 'X' is positive and one for when AC terminal 'Y' is positive. The other DC output requires exactly the same, resulting in four individual junctions (see semiconductors, diode). Four rectifiers arranged this way are called a diode bridge or bridge rectifier:

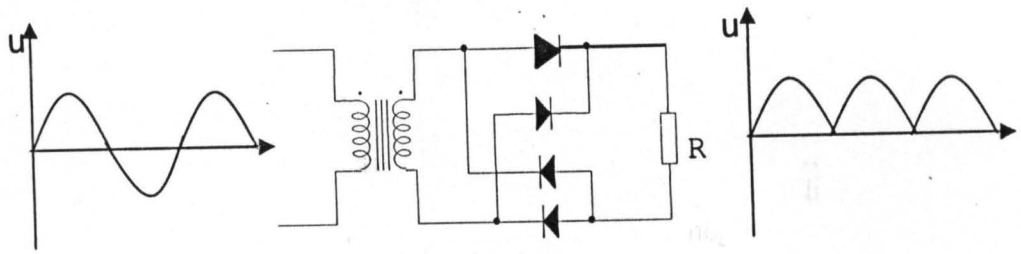

Fig. 3.2: Full wave rectifier waveform

A full-wave rectifier converts the whole of the input waveform to one of constant polarity (positive or negative) at its output by reversing the negative (or positive) portions of the alternating current waveform. The positive (or negative) portions thus combine with the reversed negative (or positive) portions to produce an entirely positive (or negative) voltage/current waveform.

For single-phase AC, if the transformer is center-tapped, then two diodes back-to-back (i.e anode-to-anode or cathode-to-cathode) from a full-wave rectifier. [6]

3.2.4 Capacitor Filter

While half-wave and full-wave rectification suffices to deliver a form of DC output, neither produces constant-voltage DC. In other to produce steady DC from a rectified AC supply, a smoothing circuit, sometimes called a filter, is required. In its simplest form this can be what is known as a reservoir capacitor, Filter capacitor or smoothing capacitor, placed at the DC output of the rectifier. There will still remain an amount of AC ripple voltage where the voltage is not completely smoothed.

Sizing of the capacitor represents a rectifier a tradeoff. For a given load, a larger capacitor will reduce ripple but will cost more and will create higher peak currents in the transformer secondary and in the supply feeding it. In extreme cases where many rectifiers are loaded onto a power distribution circuit, it may prove difficult for the power distribution authority to maintain a correctly shaped sinusoidal voltage curve.

For a given tolerable ripple the required capacitor size is proportional to the load and inversely proportional to the supply frequency are generally outside the control of the designer of the rectifier system but the number of peaks per input cycle can be affected by the choice of rectifier design. [7]

A half-wave rectifier will only give one peak per cycle and for this and other reasons is only used in very small power supplies. A full wave rectifier achieves two peaks per cycle and this is the best that can be done with single-phase input. For three-phase inputs a three-phase bridge will give six peaks per cycle and even higher numbers of peaks can achieved by using transformer networks placed before the rectifier to convert to a higher phase order.

To further reduce this ripple, a capacitor-input filter can be used. This complements the reservoir capacitor with a choke and a second filter capacitor, so that a steadier DC output can be obtained across the terminals of the filter capacitor. The choke presents a high impedance to the ripple current.

If the DC load is very demanding of a smooth supply voltage, a voltage regulator will be used either instead of or in addition to the capacitor-input filter, both to remove the last of the ripple and to deal with variations in supply and load characteristics.

A capacitor is an electrical/electronic device that can store energy in the electric field between a pair of conductors (called"plates"). The process of storing energy in the capacitor is known as "charging", and involves electric charges of equal magnitude, but opposite polarity, building up on each plate.

Capacitors are often used in electrical circuit and electronic circuits as energy-storage devices.

They can also be used in differentiate between high-frequency and low-frequency signals. This property makes them useful in electronic filters. Capacitor consists of two conductive electrodes, or plates, separated by a dielectric.

3.2.5 Capacitance

The capacitor's capacitance (C) is a measure of the amount of charge (Q) stored on each plate for a given potential difference or voltage (V) which appears between the plates:

$$C = {}^{Q}/_{V} \qquad \text{.....} \qquad (3)$$

In SI units, a capacitor has a capacitance of one farad when one coulomb of charge is stored due to one volt applied potential difference across the plates. Since the farad is a very large unit, values of capacitors are usually expressed in microfarads (μF), nanofarads (nF), or picofarads (pF).

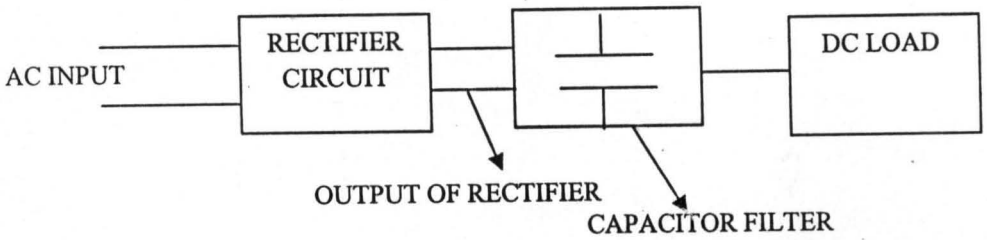

Fig.3.3: Simple capacitor filter

Fig. 3.5 shows the resulting wave form after the filter capacitor is connected at the rectifier output.

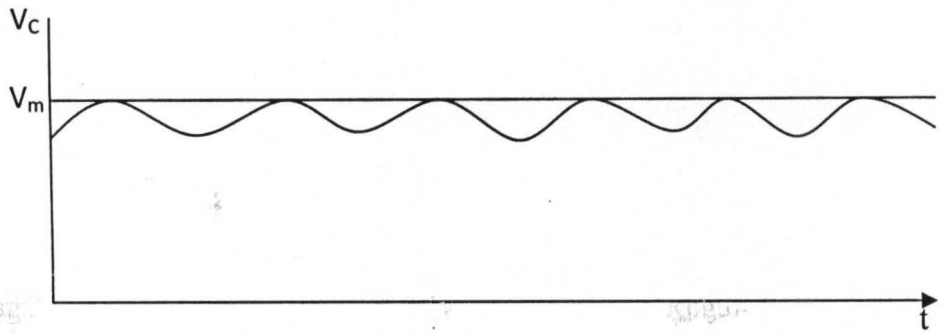

Fig. 3.4: The output waveform after connecting the capacitor

3.2.6 The IC Voltage Regulator

Voltage regulators comprise a class of widely used ICs. Regulator IC units contains the circuitry for reference source, comparators, control devices and overload protection all in single IC. Although the internal construction of the IC is somewhat different from that of the discrete components circuits, the external operation is much the same. A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level. It may use an electromechanical mechanism, or passive or active electronic

components. Depending on the design, it may be used to regulate one or more AC or DC voltages.

With the exception of shunt regulators, all modern electronic voltage regulators operate by comparing the actual output voltage to some internal fixed reference voltage. Any difference is amplified and used to control the regulation element. This forms a negative feedback serve control loop. If the output voltage is too low, the regulation element is commanded to produce a higher voltage. For some regulators if the output voltage too high, the regulation element is commanded to produce a lower voltage; however, many just stop sourcing current and depend on the current draw of whatever it is driving to pull the voltage back down. In this way, the output voltage is held roughly constant. The control loop must be carefully designed to produce the desired tradeoff between stability and speed of response. [3]

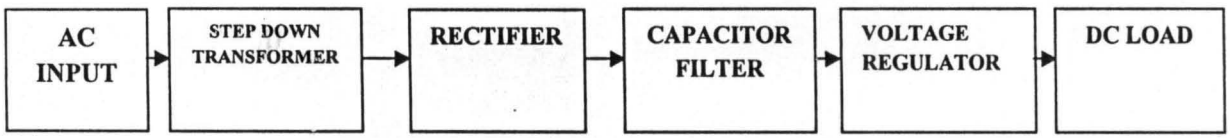

Fig. 3.5 Block diagram of a complete power supply unit

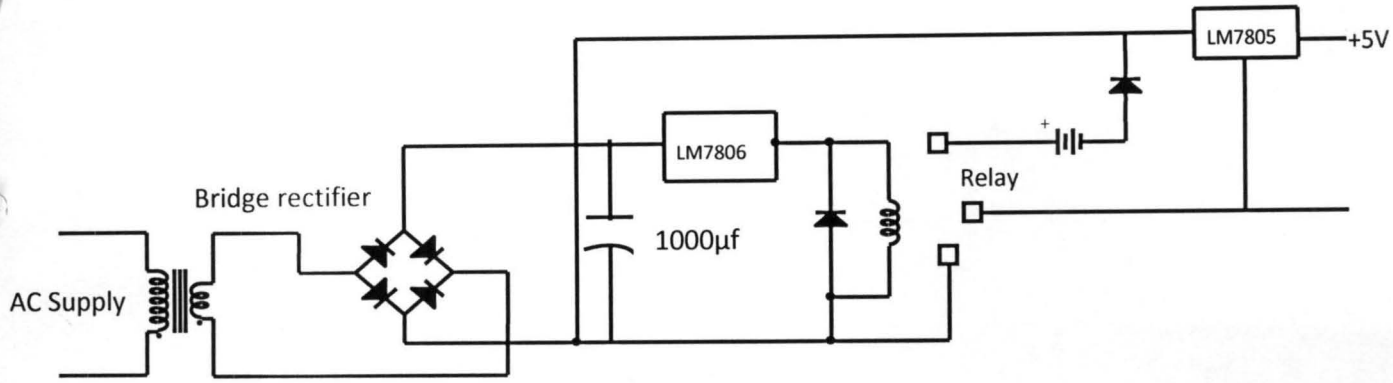

Fig. 3.6: Complete Power Supply Unit

3.3 Light Sensing Unit

3.3.1 The Light Dependent Resistor (LDR)

The light sensor is LDR (Light Dependent Resistor). This has a low resistance in bright light and a high resistance in dim light. Figure 3.8 below shows the sensor as a detector. The light sensor is connected in series with a variable resistor of 10kΩ as shown in the diagram below which is used in series with any variable resistor.

The light sensitivity of the circuit can be adjusted by varying the l0kΩ preset.

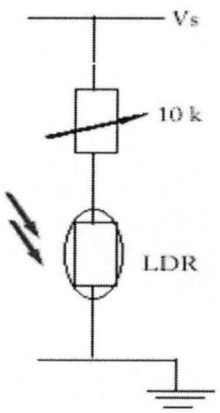

Fig. 3.7 The sensor as a detector

From the voltage regulator to LDR and its output to a transistor

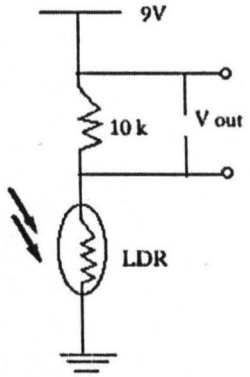

Fig.3.8 Analysis of the sensor

For the voltage divider network

$R_{LDR} = 10, R_1 = 10K, V_{CC} = 9$ V (for light)

$$V_{OUT} = \frac{R_1}{R_{LDR} + R_1} \times V_{CC} \quad \text{..... (4)}$$

$$V_{OUT} = \frac{10}{10 + 10} \times 9$$

$$= \frac{10}{20} \times 9$$

$$V_{OUT} = 4.5V$$

$For\ Dark, R_{LDR} = 0.1k$

$$V_{OUT} = \frac{10}{0.1 + 10} \times 9$$

$$= \frac{10}{10.1} \times 9$$

$$V_{OUT} = 8.91V$$

3.4 Transistor

A transistor is a semi conductor device commonly used as current amplifier or as an electrically controlled switch. The transistor is the fundamental building block of the circuitry that governs the operation of computers, cellular phones and all other electronics.

Transistors are divided into two main categories which are the Bipolar Junction Transistors (BJTS) and the Field-effect Transistors (FETS).

A bipolar junction transistor (BJTS) is a three terminal device named emitter, base and collector. There are two types of bipolar junction transistors; NPN and PNP

The figure below shows the symbol of an NPN transistor.

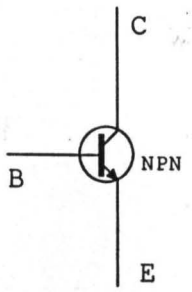

Fig.3.9. NPN transistor

Where B is the base, E is the emitter and C is the collector.

3.4.1 Resistor

A resistor is a two terminal electronic component that resists electric current by producing a voltage drop across its terminals in accordance with Ohm's law; R=V/I. The electrical resistance is equal to the voltage drop across the resistor divided by the current through it. Resistors are used as a part of electrical networks in electronic circuits.

3.4.2 Variable Resistor

Variable resistors consist of a resistance track with connections at both ends and a wiper which moves along the track as you turn the spindle. The track may be made of carbon, ceramic (ceramic and metal mixture) or a coil of wire (for low resistances).

Variable resistors may be used as a rheostat with two connections (the wiper and just one end of the track) or as a potentiometer with all three connection in use. Miniature versions called presets are made for setting up circuit which will not require further adjustment.

3.4.3 Integrated Circuits (IC)

The 555 IC timer is an IC whose output is in form of a square wave. The 555 timer is an 8-pin IC. The layout of the 555 timer used in this project is shown below.

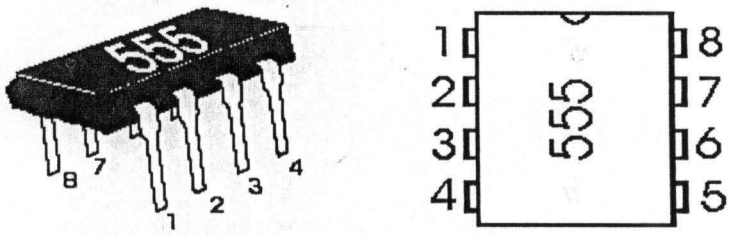

Fig 3.10 schematic diagram of 555 timers

- **Pin 1** is the ground or common terminal to which the negative pole of the power supply is connected.

- **Pin 2** is the trigger input to the inverting terminal of the lower comparator. The trigger input is initially set at above $1/3V_{cc}$. Triggering is accomplished by taking the input from above to below $1/3V_{cc}$. When a negative-going trigger pulse is applied, the threshold of the comparator is exceeded, thereby setting the control flip flop to drive the output HIGH. The triggering pulse must be of short duration compared with the timing cycle determined by the external RC components. Input pulses longer than the output pulse should be shortened by differentiation to produce a negative-going spike. The trigger input has high input impedance, about 2 MΩ.

- **Pin 3** is the output terminal connected to the collector of an npn transistor, the emitter of which goes to ground. The transistor is switched ON (output LOW) or switched OFF (output HIGH) by the control flip flop (or latch). The output can sink or source about 100mA.

- **Pin 6** is the threshold input, the non inverting input of the upper comparator used to reset the flip flop, which causes the output to go LOW. Resetting is accomplished by taking this terminal from below to above $2/3V_{cc}$, provided the trigger input is greater than 1/3 V_{cc}, otherwise the trigger input will override the threshold input and hold the output HIGH. The threshold input impedance is high, about 10MΩ.

- **Pin 7** is connected to the open collector of an npn transistor, the emitter of which goes to ground. When the transistor is turned on, pin 7 is effectively shortened to ground (as is the output), facilitating the discharge of the external (timing) capacitor to almost 0 V.

- **Pin 8** is connected to the positive supply terminal

3.4.4 Relay

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have double throw (changeover) switch contacts as shown in the diagram.

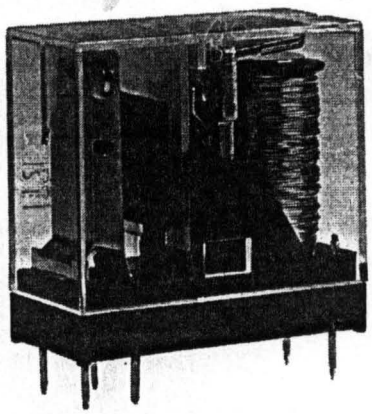

Fig 3.11 shows the diagram of a relay

3.5 Monostable Multivibrator

The 555 IC is a versatile timer IC that generates stable timing period from a few microseconds to hundreds of seconds via a simple RC-network and it gives good output waveform (with typical rise and fall times of 100nS)

When used in a "monostable" mode, its output can be pulse width modulated (PWM) and when in the "Astable" mode, it can be subjected to frequency sweep control or to frequency modulation (FM) or pulse-position modulation (PPM).

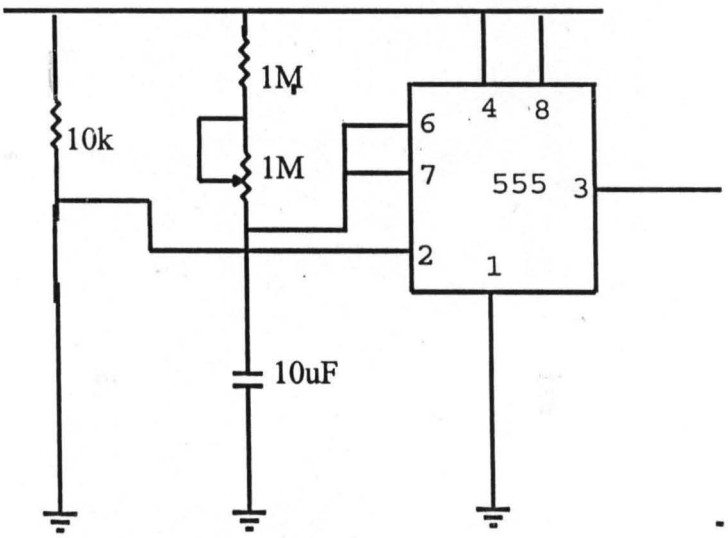

Fig. 3.12 Circuit diagram of the 555 IC monostable multivibrator

3.5.1 Operation of the IC

The timing period is triggered (started) when the trigger input (555 pin 2) is less than 1/3 Vs. This makes the output light ($+V_s$) and the capacitor C_1 to start charging through resistor R_1.

Once the time period has started further trigger pulses are ignored. There should input (555 pin 6) monitors the voltage across C_1 and when this reaches 2/3 Vs the time period is over and the output becomes low. At the same time discharge (555 pin 7) is connected OV, discharging the capacitor ready for the next trigger.

The reset input (555 pin 4) overrides all other inputs and the timing may be connected at any time by converting reset to OV. This instantly makes the output low and discharges the capacitor.

3.5.6 Calculation

Time period, T for the above circuit diagram

$T = 1.1 \times R_1 \times C_1$ ..... (5)

But R_1 is in series with 1MΩ

R_1 at maximum

$T = 1.1 \times (1x10^6 + 1 \times 10^6) \times 10 \times 10^{-6} = 22secs$

R_1 at min

$T = 1.1 \times (1 \times 10^6 \times 10 \times 10^{-6})$

$T = 11secs$

If the reset function is not required the reset pin should be connected to $+V_s$.

3.6 Light Beam.

The light used for this project is a laser light in order to have a composed beam that can be directed to the sensor.

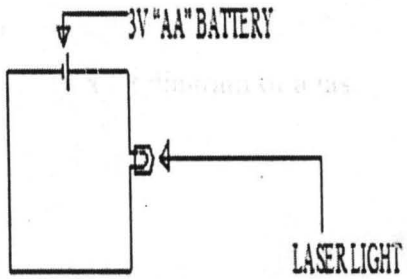

Fig.3.13 Circuit diagram of a laser light.

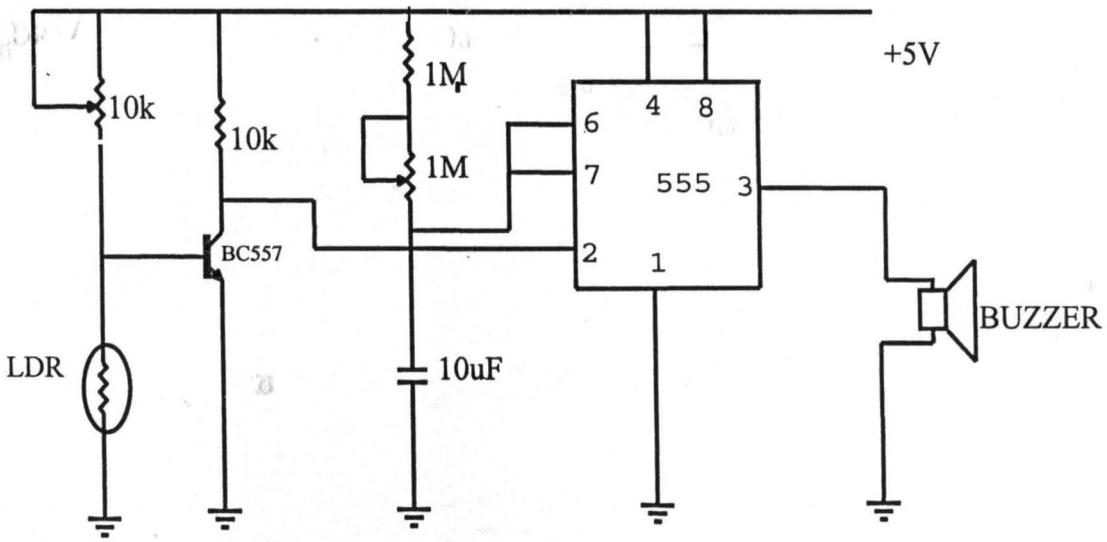

Fig. 3.14.The circuit diagram of light sensitive security alarm

CHAPTER FOUR

4.0 CONSTRUCTION AND TESTING

4.1 Construction

Construction is the process of putting the various component of the current together on a vero board, in constructing the system of all the various units that made up system were followed in an orderly manner. This stating point was the power supply unit, timer unit LDR (light dependant resistor), transistor, Resistor, capacitor, ON /OFF switch and lastly laser light unit. All the stages involved in this project were initially tested on a bread board before soldering. All the stages worked properly both on the bread board and the vero board as well. The individual components of the circuit were carefully picked and their rating carefully calculated before assembling them together.

4.2 Casing

The light sensor security alarm circuit board was enclosed in a small rectangular wooden box with an opening door which the box stands as the room.

Fig. 4.1 below shows the wooding box 12cm x 6cm x 4cm. The sensor is fitted 2cm away from the door and 2inch above the floor in opposite to each other with the light.

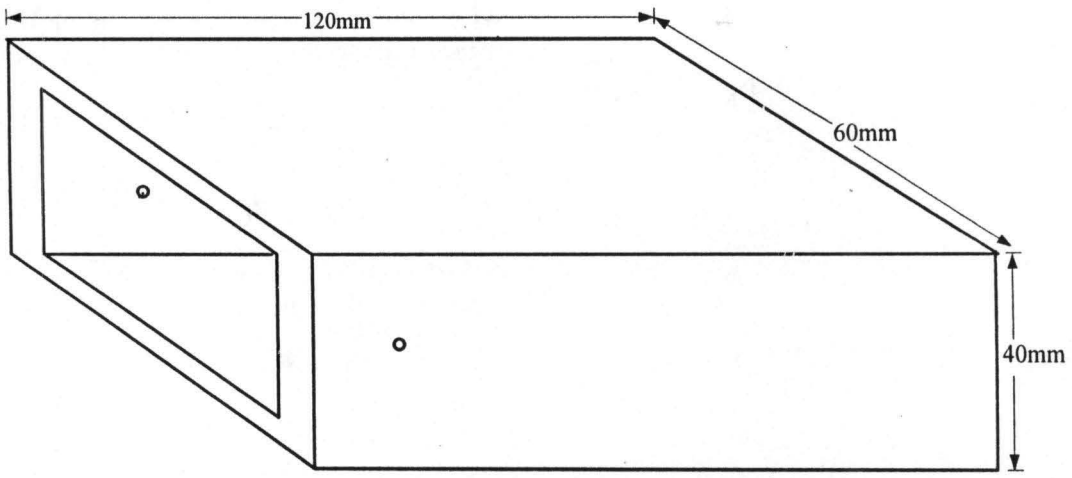

Fig. 4.1 The plastic box

4.3 Testing

On the completion of the construction a thorough test was carried and on the circuit to make sure that all components were done appropriately and there was continuity in wires used. This is to say that the circuit was made free from wrong connections as these may lead to the bridging of components before it is powered.

There are test carried out after the circuit has been proved in order to confirm the working condition of the system visual and equipment test constitute test ran in order to ascertain a proper working condition of the circuit. The former relate to test done before power was connected to the circuit while the later relates to test done where power was connected to the circuit.

4.4 Results

The following results were obtained on completion and testing of the security system. The light sensor alarm circuit was tested and found working properly. Problems encountered include setting of the monostable time providing appropriate soldering for the sensor. And the time for the alarm to sound is 15-30seconds.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

The aim and objective of this project work was achieved - to construct a light dependent security alarm. The system provides an excellent protection against theft and burglar. It is different from other alarm systems, because it is cheap and easy to implement.

5.1 Recommendation

The irregularities in power supply from the power holding company (PHCN) could affect the performance of the light sensitive security alarm. Therefore, it is recommended that the system be provided with another source of power supply, probably a 9V d.c battery. It is advised that, the cables connecting the alarm system be hidden inside the walls of the building (conduit). Also, it is recommended that provision of alarm system be included in the electrical design of every house, industry and office.

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