Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

Design, Construction and Evaluation of Switch-Controlled Intruder Security Alarm System

Agu, Paul Maduabuchi
University of Greater Manchester, Bolton, United Kingdom
Department of Robotics, Autonomous Systems and Telecommunication

Chukwu Victor Omoke
Ebonyi State University, Abakaliki Nigeria
Department of Agricultural Economics, Management and Extension

Ugbor-Aku Mercy Eberechi
Ebonyi State University, Abakaliki Nigeria
Department of Technology and Vocational Education

Nwozaku Basil Odinaka
University of Greater Manchester, Bolton United Kingdom
Department of Data Analytics and Technologies

ABSTRACT
This study is on the Design, Construction and Evaluation of a switch-controlled Intruder Security Alarm System. The study adopted Research and Development (R and D) Design. The benefits of this study were that this project work can be installed and used in residential houses and offices for detection of intruders into the offices when the user is away. The casing of the project was done with 6cm x 9cmblack pattress box. The researcher used tools and machines such as multimeter, screwdriver, plier, soldering iron, razor blade, veroboard, and soldering iron stand. The main components used include I.C (NE555), Transistor (BC547), Capacitor (10uf and 0.01uf), 12volts Battery, Resistors (10k, 1k, 470ohms), switches (push-pull burglar switch and single throw switch), Variable resistor (10k), and an alarm speaker/buzzer. The principal findings were that the cost of building this project was low, simple, easy to operate and maintain, the project was effective because when subjected to voltage of 9-12volts for one week, during testing, it worked perfectly well without breaking down. Some recommendations were that; institutions of learning, Government agencies, ministries, private companies and individuals should procure this security intruder alarm system as many as they can and mount them strategically in their offices, workshops, laboratories where there is a high risk of intrusion; Finally, government should equip youths with construction skills in electrical/electronic technology for mass construction of security alarm devices to replace the high costly imported intruder security alarm in the market.

***Keywords*: Intruder Alarm, Security, Switch-Control, Electronic System**

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

TABLE OF CONTENTS

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

CHAPTER ONE
INTRODUCTION

Background of the study

Intruder security alarms have been designed to protect lives and properties in the last few decades. According to Gee (2016) intruder security alarm was in the hands of guards who manually provided surveillance both during the days and nights in earlier days, but it was not full proof as it was only normal for them to have momentary lapses of concentration. The guard was also susceptible to sleep at times due to excess workload and thief may intrude into the building. It was then that intruder security alarm system based upon electronic circuits were developed which proved to be highly reliable and were appreciated by the people as they were relieved from constant monitoring of their offices, homes, cars and industry.

An intruder security alarm system may be defined as a component or element of a physical protection system. The ultimate objective of a physical protection system is to prevent the accomplishment of overt or covert malevolent actions. Typical objectives are to prevent sabotage of critical equipment, theft of assets or information and protection of people. The physical protection system must accomplish its objectives by either deterrence or a combination of detection, delay, response (Garcia, 2001, p. 54) and recovery. Intruder alarm systems achieve two components of a physical protection system, as a deterrent and through adversary detection. Deterrence can be achieved through signage advising of the protection of premises by the intruder alarm system and by the prominent display of external warning devices, such as sirens and strobe lights.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

In addition to the system itself, Harvelson (2013) verified that security intruder alarms systems are often coupled with a monitoring service. In the event of an alarm, the premises control unit contacts a central monitoring station. Operators at the station see the signal and take appropriate action, such as contacting property owners, notifying police, or dispatching private security forces. Such signals may be transmitted via dedicated alarm circuits, telephone lines, or the internet. According to the researcher, this intruder alarm system uses a timing circuit, as tone generator and amplifier to obtain a maximum audible sound. The NE555 times the circuits and also generates a tone and this tone is sent to transistor which amplifies the tone generated through a loudspeaker or buzzer. The reset button is used to reset or open circuit the system back to its initial stage with other components such as transistors, capacitors, variable resistors and LED. The system is powered with 12v power supply voltage.

An intruder security alarm according to Adeniran (2010) can be defined as a system designed to detect intrusion-unauthorized entry-into a building or other area. Intruder security alarms are used in residential, commercial, industrial, institutions and military properties for protection against theft or property damage, as well as personal protection against intruders (Weber, 2000). The researcher further stated that intruder security alarms in residential areas show a correlation with decreased theft. He further stated that, intruder security alarms likewise helps to protect offices and their contents and prisons also use security systems for control of inmates. Intrusion security alarm systems may also be combined with closed-circuit television surveillance (CCTV) systems to automatically record the activities of intruders, and may interface to access control systems for electrically locked doors (Coupe and Kaur, 2005). To them, the Systems range from small, self-contained noisemakers, to complicated, multirally systems with computer monitoring and control. It may even include two-way system which allows communication between the panel and the monitoring station.

Depending upon the application, Jose and Thomas (2008) stated that the intruder security alarm output may be local, remote or a combination. Local security alarms do not include monitoring, though may include indoor and/or outdoor sounders (e.g. motorized bell or electronic siren) and lights (e.g. strobe light) which may be useful for signaling an evacuation notice for people during unexpected person's intrusion, or where one hopes to scare off an amateur burglar quickly. However, with the widespread use of intruder security alarm systems (especially in offices), false alarms are very frequent, and many urbanites tend to ignore alarms rather than investigating, let alone contacting the necessary authorities (Jose and Thomas, 2008). In short, there may be no response at all. In rural areas where nobody may hear the fire bell or burglar siren, lights or sounds may not make much difference, as the nearest emergency responders may arrive too late to avoid losses. The alarm monitoring includes not only the switch-controlled sensor, but also the communication transmitter itself. Therefore, the type of intruder security alarm system employed in this project work is the switch-controlled intruder security alarm system. More typical systems incorporate an analog cellular communication unit that will contact the central station (or some other location) via the Switch-controlled Network and raise the alarm, either with a synthesized voice or increasingly via an encoded message string that the central station decodes.

In the context of this study, the type of sensor employed for detection of intrusion into offices is a switch-controlled sensor. A switch is an electro-mechanical device used for turning ON and OFF an electrical system. Switches can be of many types ranging from simple push-pull switch, toggle switch, single throw, double throw to a more complex burglar switch, which is used for this design. Many security alarm panels are equipped with a backup communication path for use when the primary circuit is not functioning.

According to Sampson (2011) the most basic intruder security alarm consists of one or more sensors to detect intruders, and an alerting device to indicate the intrusion. However, he further stated that a typical intruder security alarm employs the following components: Alarm Control Panel (ACP) which is the brain of the system, it reads sensor inputs, tracks arm/disarm status, and signals intrusions. In modern systems, this is typically one or more computer circuit boards inside a metal enclosure, along with a power supply; a sensors device which detect intrusions. Sensors usually switch, may be placed at the perimeter of the protected area, within it, or both. Sensors can detect intruders by a variety of methods, such as monitoring doors and windows for opening, or by monitoring unoccupied interiors for motions, sound, vibration, or other disturbances; An alerting device which indicates an alarm condition. Most commonly, these are bells, sirens, and/or flashing lights. Alerting devices serve the dual purpose of warning occupants of intrusion and potentially scaring off burglars. These devices may also be used to warn occupants of a fire, smoke or incessant intrusion condition; a small keypad device, typically wall-mounted which function as the human-machine interface to the system. In addition to buttons, keypads typically feature indicator lights, a small multi-character display, or both. The interconnections between components may consist of direct wiring to the control unit, or wireless links with local power supplies automated intruder alarm.

Finally, the design and construction of this switch-controlled intruder security alarm system prepare learners for careers that are based on manual or practical activities in electrical-electronics. It is designed to develop skills especially in practical work, such as that which involves design and construction in electrical/electronics. Therefore, the design and construction of this project work give the researcher the skills to "live, learn and work as a productive citizen in a global society."

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

STATEMENT OF THE PROBLEMS

It is imperative to know that several security companies have developed and come up with a security alarm system that act automatically by detecting the presence of an intruder and equally sounding an alarm that will inform the vicinity of the menace. But it is quite unfortunate that those existing intruder alarm systems in the market are too complex in terms of its design and structure. Since the systems are too complex, they need regular preventive maintenance to be carried out to make sure that the systems operate well and last longer.

Another problem of this study was to design, construct and evaluate a switch-controlled intruder security alarm system that will be easy to operate and equally carryout maintenance work on, affordable by both the rich and average Nigerians for safety purposes. Finally, the problem of this study is to design an alarm system which helps to limit the criminality in the society by sounding a danger alarm that will reduce drastically the rate at which intruders break into private properties by scaring them away once the alarm is triggered on. This security intruder alarm system will be installed and used in the office, homes and industries for security purposes.

PURPOSE OF THE STUDY

The main purpose of this study is to design, construct and evaluate a switch-controlled intruder security alarm system. Specifically, the study tends to:

1. Design a market competitive portable switch-controlled intruder security alarm circuit that is locally sourced, inexpensive, easy to construct and operate.
2. Construct an intruder security alarm system to be used for security purposes in technology and vocational education, faculty of education.
3. Carry out performance evaluation of a portable switch-controlled intruder security alarm circuit so designed.
4. Identify the constraints in the design and construction of the intruder security alarm system.

SIGNIFICANCE OF THE STUDY

The benefits to be derived from this work are enormous. Therefore, the findings of this study will be beneficial to schools, students, industries, individuals and the general public for detection of intrusion into their residence. The findings of this project work will be beneficial to schools, that is, institutions of learning for protection of their office document which is open to assessment by both staff and students by sounding an alarm whenever an intruder burgle into the office. Schools can also use this system as an improvised material for teaching and learning of courses related directly or indirectly to electrical/electronics. Also, to students, the result of this project work will avail them the opportunity to understand and also learn the principles and processes involved in electronic system and design, how to construct and assemble an electronics circuit, the functions of components used and acquisition of soldering and electronics skills. The students on acquiring this skill can go a long way in producing this product in mass and sell them to sustain him/her self even after graduation.

Secondly, the findings of this project work will be beneficial to both government and private industries for the security of their residence, properties and self. The findings of this project work will also be beneficial to individual Nigerians in their respective homes and offices for security purposes; by this it will be mounted strategically in their respective homes and offices so as to help curtail the danger of intruders by sounding an early alarm in an attempted menace.

Finally, the findings of this study will be beneficial to the general public by functioning as electronics watch dog against illegal intrusion and as such serves as a major security alarm used in residential, commercial, industrial, and military properties for protection against burglary (theft) or property damage, and as well as personal protection against intruders**.** The Nigerian Prisons Services also uses intruder security alarm system for controlling of the prison inmates to ensure that the inmates do not escape at will.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

RESEARCH QUESTIONS

In the design, construction and evaluation of this switch-controlled intruder security alarm circuit, the following questions were answered based on the purpose of the study:

1. What is the market competitiveness of this portable switch-controlled intruder security alarm circuit that is locally sourced, inexpensive, easy to construct and operate?
2. What are the procedures involved in the construction of an intruder security alarm system to be used for security purposes in technology and vocational education, faculty of education?
3. What is the performance evaluation of this portable switch-controlled intruder security alarm circuit so designed?
4. What are the constraints involved in the design and construction of the intruder security alarm system?

SCOPE OF THE STUDY

The scope of this study is delimited to the design and construction of switch-controlled intruder security alarm system to be used in technology and vocational education department, faculty of education. This work also covers the use of solid-state electronic components alongside popular active and passive electronic component like, capacitors, resistors, integrated circuits, LEDs, alarm buzzers etc to solve the problem of locally or manually designed intruder security alarm system. It also covers the areas of electronics system design and construction.

LIMITATIONS OF THE STUDY

A good number of challenges faced the researcher in coming up with the design and construction of this switch-controlled intruder security alarm system.
Therefore, the obvious limitations of this project work are as follows:

- The unavailability of some of the basic required components in the local markets within Abakaliki metropolis such as the NE555 Timer I.C, the burglar switch and the alarm speaker.
- Components are scarce and expensive when found.
- Another major constraint of this project was the difficulty of the researcher in sourcing for materials for this project work.
- Finally, the limitation of this project work is the unavailability of electricity to type and also solder the components during construction.

CHAPTER TWO

LITERATURE REVIEW

This chapter deals with the review of related literature. The review of related literature for this project work is organized under the following sub-headings:

- Conceptual Framework
  - Concept of intruder security alarm system
  - Design and Construction of Electronics Circuit
  - Components used in the construction of the Intruder security Alarm System
  - Constraints to the design and construction of intruder security alarm system
- Review of Empirical works
- Summary of Reviewed related works

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

CONCEPT OF INTRUDER SECURITY ALARM SYSTEM

Intruder security system is critical for individuals and organizations of all sizes for the protection of their properties and self against intruders. Gee (2016) defined Security as the state of being or feeling secure; freedom from fear, anxiety, danger, doubt, etc. it is a state or sense of safety, certainty and tranquility. The Researcher also defined security as the state of being free from adverse situations, the likes of fire, theft and terrorism, and among others. He however stated that, security is one of the essential issues, so when we have best security, we can improve all our needs and our country for the better.

In the context of this study, Adeniran (2010) defined an intruder security alarm as an active protection system designed to detect the presence of an intruder (thief) by monitoring the environment through the use of a detective devices. Also, Chenebert and Breckon (2011) defined intruder security alarm as a device that detects and warns people through audio appliances when emergencies are present. The intruder alarm sounders can be set to certain frequencies and different tones including low, medium and high, depending on the manufacturer of the device (Chenebert and Breckon, 2011). However, an intruder security alarm sounders can sound a two-tone siren, pulse tone siren, yowl tone siren, warble tone siren, mechanical siren or electronic siren.

An intruder security alarm system is either automatic or manually activated depending on the components used (Adeniran, 2010). An intruder security alarm system is said to be automatic when it senses the presence of an intruder or burglar by its switch or heat detector and sounds an alarm on its own. On the other hand, an intruder alarm system is said to be manually activated when it uses pull stations of which someone has to trigger the sound on presence of a thief so that people will come for the apprehension of the thief in the building. This study however, will focus on security alarm system, as it will design and construct a switch-controlled intruder security alarm system that activates automatically on attempted breaks into the building.

The design and construction of an intruder security alarm is the putting together of parts of an alarm system using components and lines to form an integrated object capable of sounding an alarm to the vicinity on detection of intrusion. The design and construction of this intruder security alarm system is such that the intruder alarm system uses electronic components to achieve the alarm sound, these components are integrated circuit (IC), resistors, capacitors, light emitting diodes, push burglar switch, battery and speaker (buzzer) which when combined together, gives an alarm system that can be used in houses, offices and even in commercial company for intrusion detection. The integrated circuit times the circuits and also generates a tone and this tone is sent to transistor which amplifies the tone generated through a loud speaker or buzzer.

The purpose of an intruder security alarms system is to detect an attempted intrusion or unauthorized entry into a building, room and site or secure installation and trigger a response to alert the vicinity of the menace. A well-fitted and maintained intruder security alarms can make organizations and individuals less likely to become victims of burglary, vandalism and other forms of attack. There are two major types of intruder security alarms systems, which include the wired and the wireless intruder alarm system, with selection depending on personal preference, location, building size, level of protection required, monitoring, and method of response and so on.

The procedures involved in the construction of this intruder security alarm system includes; drawing of the appropriate circuit diagram; listing of the required components according to the circuit diagram, simulating and designing the components layout, bending of the components according to the veroboard components layout, securing of the components to the veroboard in line with the veroboard layout, soldering of the components on the veroboard and cutting-off the protruding parts, testing for the functionality of the system and finally, packaging the system into its casing.

DESIGN AND CONSTRUCTION OF ELECTRONICS CIRCUIT

DESIGN OF AN ELECTRONICS CIRCUIT

Design according to Kumaragamage (2011) is the creation of a plan or convention for the construction of an object, system or measurable human interaction as in architectural blue print, engineering drawings, business processes, circuit diagrams and patterns. He further defined design as to convince or fashion in the mind, invent, and to formulate a plan. One of the design models in electronics is the Cycle design model. The cyclic design model has strategies in a specified order but which can be repeated through various iterations. The cycle design model however, is adopted for this project due to its merits which include and not limited to the following:

- It is interactive in nature in that the design can check list with his aims and objectives at any stage of the design.
- Error are easily detected and eliminated as soon as they occur
- It has a specified order which can be followed without making unnecessary error methods of constructing

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

Therefore, to design any electrical and electronic circuit, either analog or digital, the electrical engineers need to be able to predict the voltages and currents at all places within the circuit (Theraja, 1998). Linear circuits, that is, circuits wherein the outputs are linearly dependent on the inputs, can be analyzed by hand using complex analysis. Before the invention of digital circuits, all individual transistors, diodes, resistors, capacitors, and inductors were discrete in nature and are analogue.

Analogue electronic circuits are those in which current or voltage varies with time to correspond to the information being represented. Diodes, capacitors, resistors, transistors and wires are the major components of an analog circuit. In analog circuits, electrical signals take the continuous value, and these circuits are represented in schematic diagrams, where wires are represented by lines and each component is represented by unique symbols. Every analog circuitry has series or parallel or both circuits (Theraja, 1998).

Digital electronic circuit takes the electrical signals in the form of discrete values. The data are represented in the form of zeros and ones. Digital circuits extensively use transistors, interconnected to give, create logic gates that provide the function of Boolean logic. Transistors are interconnected to provide the positive feedback as used in latches and flip-flops. Therefore digital circuits can provide both logic and memory, enabling them to perform computations.

CONSTRUCTING AN ELECTRONIC CIRCUIT

Construction is an imperative aspect of a design process. Construction is a general term meaning the art and science of forming objects, system, or organization. Put simply, construction connotes putting together of parts to form an integrated object. In the context of this study, construction simply means the doing of the electronic plan designed. Electronics can be defined as a branch of science that deals with the study of flow and control of electrons (electricity), their behaviours, and effects in vacuum, gas and in semi-conductors and the device using such electrons under the influence of applied electric and magnetic phenomenon. It is the science of controlling electrical energy, energy in which electrons have a fundamental role. Electronics deals with electrical circuits that involve both active and passive electrical components such as resistors, capacitors, diodes, transistors and integrated circuits associated technologies. The different methods of constructing electronic circuit according to Clarke in Theraja (1998) are:

The Printed Circuit Boards (PCB): Clarke (2005) stated that a printed circuit board is the method of circuit construction done by drawing the schematic into PCB design software. The tracks and holes are drawn according to the schematic. The advantage of this method is that the final circuit is the same as the schematic. This makes it easier to debug if your circuit doesn't work. Also, soldering a printed circuit board is much quicker because every component has a dedicated position on the board. For high performance digital circuit, with many thousands of pins, multi-layer PCBs (at least 4 layers) printed circuit board is the preferred choice. This allow two layers to be mounted with supply and ground connection each having a whole layers. The result is excellence noise characteristics and relatively easy and compact routing, which is usually done automatically.

Surface mount technology: This construction method utilizes the technology of micro-chip with smaller components on both sides of the Printed Circuit Board. According to Clark in Theraja (1998) this method has even led to greater possibilities in automation, reducing labour cost and increase production rates. Also in this type of electronic design, the components are usually mounted and soldered on top of the veroboard or the printed circuit board rather than making holes for the components to enter during construction. Here the soldering is done on the surface of the board. Tracing of faults on a surface mounted components are usually simple and easy, but the soldering required more technical skill in doing since bridging of components leads is possible.

The Strip Board or Vero board construction: In this construction method, Clarke (2005) stated that the components are firmly secured into the holes on the veroboard and are soldered at the back of the board. This is the method beloved of hobbyists because it produces a reasonably neat and robust result for minimum cost (Clarke, 2005). Here components are laid on a strip board also known as the veroboard. This method however, utilize a board which one of its sides is covered with copper separated into tracts 2.54mm apart with interval of 2.54mm. This is the method that was adopted because of the following advantages

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

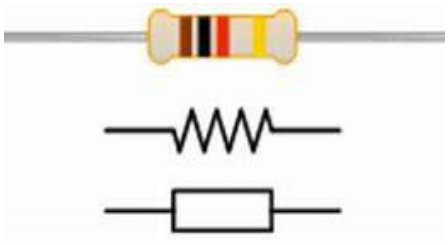
- It gives a good means of soldering components permanently to the board.
- It can be used to build a complex circuit.
- It is easy to construct, even learners can build circuits on strip board.

The method involved four stages which includes; cutting the strip board to size, planning a strip board layout, placing components and soldering and cutting strip board tracks.

COMPONENTS USED IN THE CONSTRUCTION OF THE INTRUDER SECURITY ALARM SYSTEM

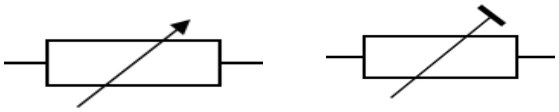
The electronic components used in the construction of this switched controlled intruder security alarm system are reviewed in this segment.

Resistor: Resistor can be defined as a passive two-terminal electronic component that opposes the flow of current in a circuit. It is an electronic component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. Resistors are used in this project work to limit the amount of current to be taken by the integrated circuit (IC) and the LED. The values of resistors used in the project work include: 10kohms variable resistor, 1kohms, 10kohms, and 470 ohms. Figure 1; The diagram of a resistor is shown below:



Variable resistor: A variable resistor is a resistor of which the electric resistance value can be adjusted. A variable resistor is in essence an electro-mechanical transducer and normally works by sliding a contact (wiper) over a resistive element. When a variable resistor is used as a potential divider by using 3 terminals it is called a potentiometer. When only two terminals are used, it functions as a variable resistance and is called a rheostat. Electronically controlled variable resistors exist, which can be controlled electronically instead of by mechanical action. These resistors are called digital potentiometers. In this project work, the variable resistor used is 10kohms variable resistors.

Figure 2: Symbols of variable resistor



Capacitor: Capacitor is a passive two-terminal electronic component that stores potential energy in an electric field in form of electrical charges. The effect of a capacitor is known as capacitance. A capacitor was originally called condenser. There are different types of capacitors namely: electrolytic capacitor, ceramic capacitor, mica capacitor, paper capacitor etc. and the type of capacitor depends upon the type of dielectric used in producing it. A 10uf, 1uf, 0.01uf and 330uf electrolytic capacitors were used in the circuit design.

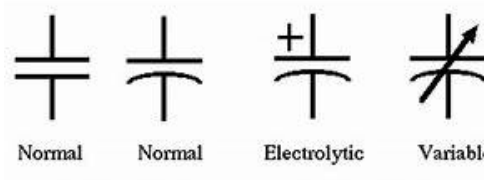
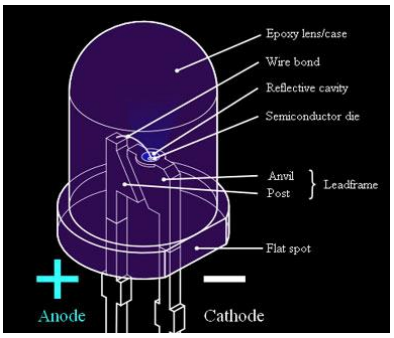


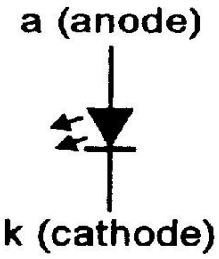
Figure 3: The diagram a capacitor is shown below:

Published by :
http://www.ijert.org

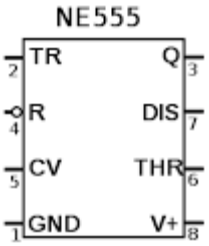
International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

Light emitting diode indicator (LED): A light-emitting diode is a two-lead semiconductor component use as a light source. It is a p-n junction diode that emits light when current is passed through it or when activated. When suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. A red and green LED was used in this project. Figure 4: The diagram of LED is shown below:

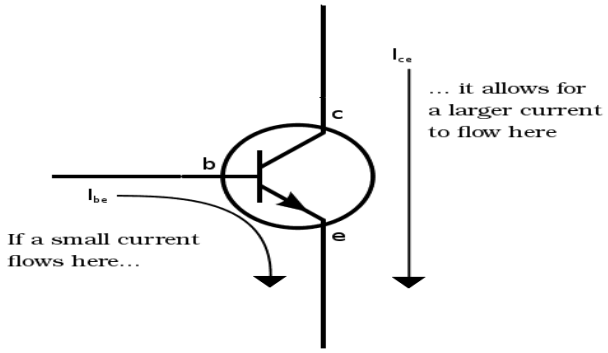




Integrated circuits (IC): An integrated circuit is a community of different electronic components usually transistors assembled together to perform a certain useful function. Integrated circuit also called chips can be of different sizes and shapes depending on the manufacturer. We have different scales of I.C integrations; ranging from the small scale to a very large scale. Integrated Circuits may have hundreds to thousands of components integrated on a small chip which may be digital, analog or hybrid (integration of both analog and digital).The family of Integrated Circuit used in the construction this intruder security alarm system is NE555 timer I.C. Figure 5: The diagram of NE555 timer I.C is shown below:



Transistor: A transistor is a three-terminal semiconductor electronic component/device which allows small amount of current into it and increases it to give a higher amount of current. It is made up of a P-N junction capable performing both switching and amplification operations. To every transistor, it is made up of three terminals such as the base, collector and the emitter for bipolar and the gate, drain and source for the unipolar transistors. The transistor used in this project work is BC547 NPN transistor. Figure 6: The diagram of BC547 NPN transistor is shown below:



Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

Switch: A switch is a mechanical device used for turning ON and turning OFF an electronic circuit. Switches are of different types and sizes depending on it applications. It is often used in an electronic circuit for making and breaking contacts. Figure 7: A push-pull switch is used for this project and it is shown below:

Alarm Speaker (Buzzer): A speaker is an electronic component designed to give a sound when a desired current carrying audio signal is supplied to it. A speaker is an electromagnetic device which converts electrical energy to sound energy. Speakers are rated in ohms based on their bass resistance. Speaker in this project work is designed to make an alarm when an intruder burgles into the office. A 4ohms, 5watts buzzer is employed for this project work. Figure 8: The diagram of Buzzer is shown below:

CONSTRAINTS TO THE DESIGN AND CONSTRUCTION OF INTRUDER SECURITY ALARM SYSTEM

When designing a prototype for any new electrical/electronics projects or innovating existing ones, electrical/electronics designers are often mandated to design them under certain constraints to ensure that a satisfactory quality of the final products is achieved. Constraints are impediments, challenges or hindrances to the design and implementation of any system. Constraint is a limitation to the requirements or conditions under which a design and construction should be implemented. In electronics product design and construction, constraints affect everything from the size to the features, functionality to the performance of the final products and these constraints are largely dependents on the available technology, time and budget. Therefore, the constraints to the design and construction of this intruder security alarm system according to the researcher include the following:

- Difficulty in meeting size and value of components: In terms of designing within the stipulated size and value constraints, integrated circuits (I.C) are the most difficult components to work with. Others include the passive components. Passive components are circuit elements that do not generate energy themselves, but only store it or dissipate it. Examples of such passive components are resistors, capacitors, transistors etc. passive components are the fundamental building blocks of electronic circuit (intruder security alarm circuit inclusive) and no design is feasible without utilizing a number of them. However, in the designing and construction of this intruder security alarm system using passive components poses a challenge for the constructor due to the sizes of their package which in turn affect the overall performance of the system.
- Difficulty in meeting power constraints: Power was the most challenging design and construction constraints to meet. Low power consumption is the hallmark of modern electronic design. Therefore, trying to achieve a low power intruder security alarm system was one of the major constraint the researcher faced in the design and construction of this portable intruder security alarm system.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

- Difficulty in meeting performance constraints: Performance constraint is the most difficult constraint in the design and construction of any electrical/electronics system. The performance of a design is largely dependent on components selection and configuration. However, it is one of the constraint to the design and construction of this intruder security alarm system, since the target of the researcher is to come up with a well-sounding alarm system capable of informing the vicinity the presence of an intrusion.

In summary, the success or failure of a design depends on how it performs during the testing phase in relation to expectation. Therefore, designing and constructing an optimal electronic system involves creating a design that is not only cost-effective but well within the performance constraints.

REVIEW OF RELATED EMPIRICAL WORKS

The following empirical works were reviewed to guide the study;

Loughnane (2001), worked on design and construction of an autonomous mobile security device. He adopted the Research and Development (R and D) using the linear design model as his design approach. Here, he portrayed different design strategies, which was done once and in a fixed manner. He used components such as resistors, variable resistors, capacitors, timer I.C, LED, counters and 4volts battery. His work however, is related to this project because it sought to design and construct a security system. However, the only difference between this present work and Loughnane (2001) work is that the former sought to design and construct an mobile security device that uses a 4 volts battery as its source of supply while this present work sought to design, construct and carry out performance evaluation of a portable switch-controlled intruder security alarm system that uses a 9 volts battery as its source with high alarming output.

Elue (2007), worked on design and construction of a door alarm system. He however, adopted the learning by design model as his design approach under Research and Development (R and D) Research Design. He used components such as resistors, capacitors, op-amp., and transistors. The circuit was powered using 9volts non rechargeable battery. He asked questions like 'will the device be easy to operate by even the layman and 'will the cost of building the circuit be low?' His work is related to this present project, because both sought to design and construct an alarm system. However, the only difference between this present work and Elue (2007) project work is that, the former sought to design and construct a door alarm system using a non-rechargeable 9 volts battery while this present work sought to design, construct and evaluate a portable switch-controlled intruder security alarm system that uses a rechargeable 9 volts battery for office use.

Finally, Onele (2006) worked on Design, construction and performance evaluation of the modules for teaching superposition, Maxwell's mesh and Thevenin's theorems. In his research, he adopted the cyclic design model as his design approach under Research and Development Design. Here, he portrayed several design strategies in a specified order, where it was done through various iterations until the desired design was achieved. This design method was however, adopted by the researcher. Onele (2006)'s work is purely related to this present project work because both deals with design and construction and have implication in the teaching and learning. However, the predominant difference between his project and this present work is that, his work is only implied in the teaching of electrical and electronics theorems while this present project work deals with the actual design, construction and evaluation of a switch-controlled intruder security alarm used in offices for protection of the people and residence against incessant intrusion.

SUMMARY OF THE REVIEWED RELATED LITERATURE

The review of literature relating to the design, construction and evaluation of a switch-controlled intruder security alarm system revealed that, the Research and Development (R and D) as adopted by the researcher was most appropriate and as such was chosen for this work because of its ability to provide feedback on the whole process of the design. The components used in the design and construction of this intruder security alarm system include resistors (variable and fixed), capacitors, timer I.C, transistor, LEDs, 9volts battery, switch and speaker (buzzer).

Also, the construction method adopted was the through hole construction method, due to its availability and simplicity to use. The review also revealed that the type of sensor switch used in this project was a push-pull switch because of its high probability of switching after installation. Empirical works from scholars and theory according to George ohms were reviewed to guide the study since it majored in electronic circuit. From the empirical works reviewed, the study revealed that the existing security alarm systems in the market are too complex in terms of their design and structure. Since the systems are too complex, they need regular preventive maintenance to be carried out to make sure that the

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

systems operate well. Also, the cost of maintaining the existing systems is expensive. Therefore, this study tends to cover the gap by designing, constructing and evaluating a low-cost portable switch-controlled intruder security alarm system that is cost effective in terms of price and affordable by the entire Nigerian populace for safety of their residence, easy to operate and of course carryout maintenance work on.

CHAPTER THREE
MATERIALS AND METHOD

This chapter presents the methods adopted for the design and construction of switch-controlled intruder security alarm system to be used in Faculty of Education, with the following sub-heading:

- Design of the study
- Choice and selection of materials
- Tools and materials used
- Functional design
- Science and Calculation of the Design
- Construction Procedure
- Assembly of the component
- Precautions to be observed in the construction procedure

DESIGN OF THE STUDY

The type of design adopted for this research project was Research and Development (R and D) design. Research and Development according to Uzoagulu (1998), refers to the work conducted for the innovation, introduction, and improvement of products and procedures. He further stated that it is a series of investigative activities carried out to improve already existing products and procedures or to lead to the development of new products. Research and Development aims to create new technology or information that can improve the effectiveness of products or make the production of that product more efficient. The Researcher defined Research and Development as the type of research design that involves several repetitions before arriving at the desired or intended product. He further stated that research and development involve activity-oriented research in which design of a product is conceived and the construction carried out to bring the development of a new product. Research and development designs are mostly adopted for practical purposes in engineering and technology.

CHOICE AND SELECTION OF MATERIALS

The materials and components used in this project were chosen based on their colour coding, the rating, value and the role they play in the circuit. Their mechanical properties were also considered when choosing the materials and components. However, the components and materials used in this project and their amount are presented in the table below:

Table 1: Bill of engineering measurement and Evaluation (BEME) of a switch-controlled intruder security alarm system

Items	**material and components**	**Quantity**	**Rate**	**Amount (₦)**
1.	Resistors-1kΩ, 10kΩ, 470Ω, 47Ω	6	30	180
2.	Capacitos-0.01uf, 10uf	2	100	200
3.	Transistor - BC547	1	200	200
4	9volts battery	1	200	200
5.	Soldering lead	1 yard	100	100
6.	Switches-Sw1 and Sw2	2	150	300
7	I.C NE555 timer	1	200	200
8.	LED - Green and Red	2	50	100
9.	Vero Board – Dotted	1	150	150
10.	Jumper Wire	1 yard	100	100
11.	4Ω speaker/Buzzer	1	500	500
12.	Casing and cover- 6cm x 9cm	1	1000	1000
13.	Miscellaneous			2000
	Grand Total			**₦ 5,230**

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

TOOLS AND MATERIALS USED

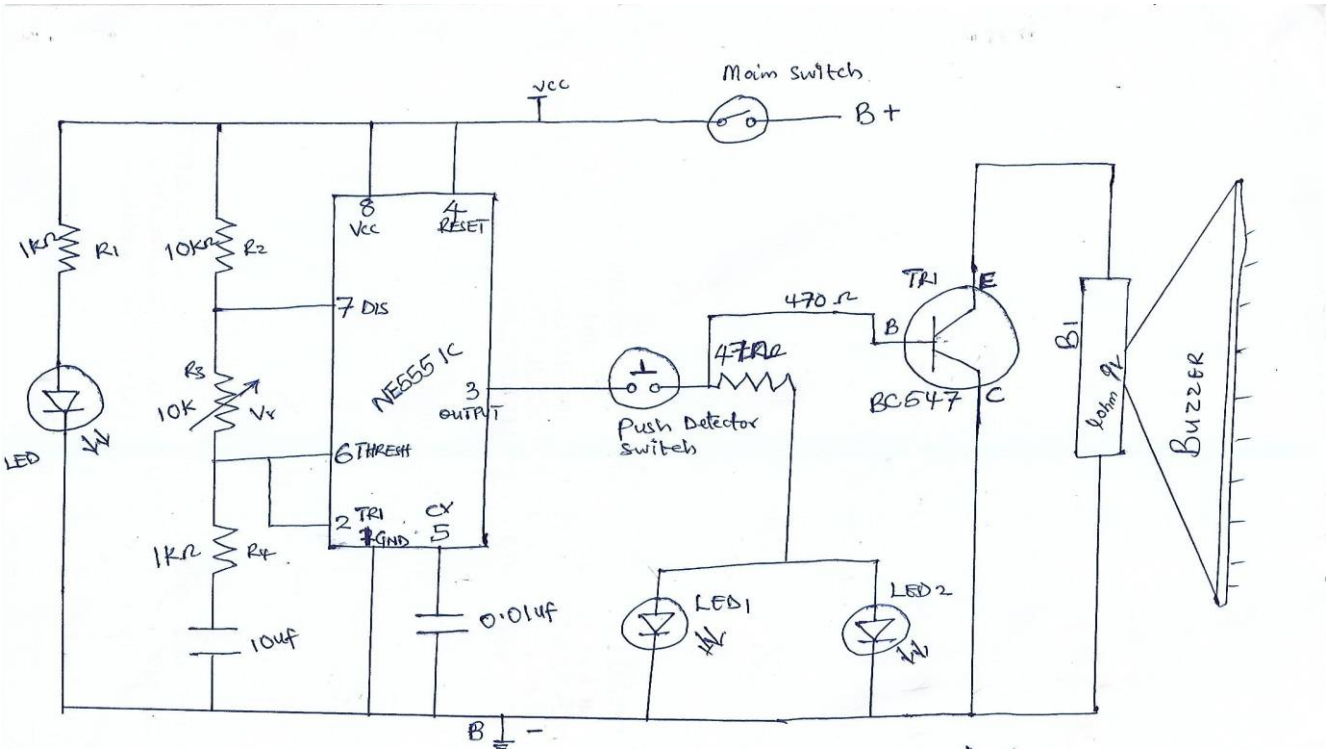
The major tools and material used in carrying out this project include:

- Digital multimeter: a digital multimeter is used for measuring the values of components and testing for continuity or functionality of an electronic circuit. A digital multimeter is best chosen because it displays the exact values of components for easy understanding.
- Soldering iron: it is used for soldering the components on the veroboard. Soldering iron is usually plugged to an AC mains supply to generate heat for soldering.
- Solder lead: it is used for soldering the lead of components during soldering. It is made up of solder with lead and this as its contents.
- Soldering stand: it is used for holding and keeping the soldering iron at a place during when the soldering iron is not in use.
- Side cutter: it is used for cutting long component leads or terminals.
- Sand paper: it is used for cleaning the surface of a veroboard, and casing in order to ensure smooth contacts.
- Plier (long-nose): it is used for bending and holding electronic components.
- Razor Blade: it is used for stripping cables.
- Screwdriver (flat and star): this is used for driving in and out of screws during the circuit assembling.
- Measuring tape: it is used for measuring the distance between where each component should be placed.
- Pencil: the pencil is used for marking out the positions of each component on the veroboard and the casing.
- Double pattress box: the casing of the circuit was formed using the PVC plastic adoptable box.
- Super glue: it is used for holding the speaker to the casing during construction.

FUNCTIONAL DESIGN

This functional design presented the schematic diagram of this project as designed by the researcher and also how the circuit works. The researcher went through various research to come up with the final schematic diagram. However,

Figure 9 is the schematic diagram of this project work, and it is presented below:



Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

SCHEMATIC DIAGRAM OF A SWITCH-CONTROLLED INTRUDER SECURITY ALARM SYSTEM.

The diagram as shown above consists of a 9volts D.C battery that can be recharged. Alternative source used in the project work is a transformer and a four diodes 1N4007 connected in a bridge form to convert the input alternating current to a direct current, a capacitor of 1000uf/25v to filter the pulsating direct current. The circuit is made up of a resistor of 1kilo ohms connected in series to a capacitor of 10uf to provide a threshold for the I.C and for stabilizing the I.C against excess current. A variable resistor of 10kohms connected to the NE555 timer I.C for increasing and decreasing the sound output. The LEDs are connected from the lead that connects both the I.C output and the BC547 transistor supplying the buzzer. A resistor of 1kohms is connected in series to a LED to indicate the presence of power supply. For the buzzer, it is connected through the emitter and collector of the BC547 transistor in series with capacitor of 0.01uf which is being regulated by the timer I.C.

SCIENCE AND CALCULATION OF THE DESIGN

The calculations involved in the design of this project work are analyzed as follows:

Supply voltage, V =9v

Vrms =9V

Considering Resistor, R1, using ohm's law, where V=IR

Current, I through the Resistor, I =V/R

Where, V=9V, R=1000Ω

Hence, I = 9/1000= 0.009A

Also considered LED, in series to R1

Resistance in LED, R = $\frac{Vs-VLED}{I\ LED}$

Where, Vs=supply voltage =9V

V Led=3V (standard for red LED) andI Led =10mA (standard for Red LED)

Therefore, RLED i.e. LED Resistance =

$$\frac{9-3}{10 \times 10^{-3}} = \frac{6 \times 10^{3}}{10}$$

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

Red Led $= \frac{6000}{10} = 600\Omega$

Analyzing the capacitance, C1=0.01uf $=0.01 \times 10^{-6}$f

Quantity of charge stored, Q =CV But, C=0.01×10^{-6}f, V =9v

Q=$0.01 \times 10^{-6} \times 9$

Q=$0.01 \times 9 \times 10^{-6}$=9.10C

Notes VAC =VDC =9v

Power consumed, P=IV=0.09x9=0.81Watts

CONSTRUCTION PROCEDURE

The following steps were used in the construction of the switch-controlled intruder security alarm system:

Step 1: The circuit diagrams for the work were drawn which showsin detail how the inter connections between components in the board will be made and followed. This circuit diagram helped the researcher to know the different modules in the intruder security alarm so designed.

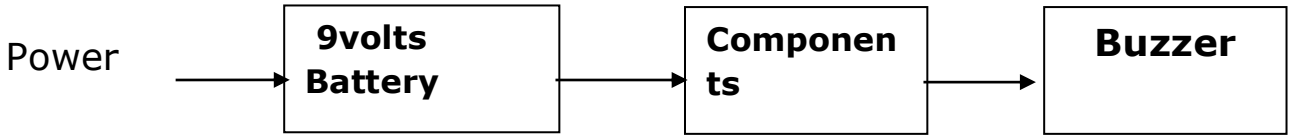
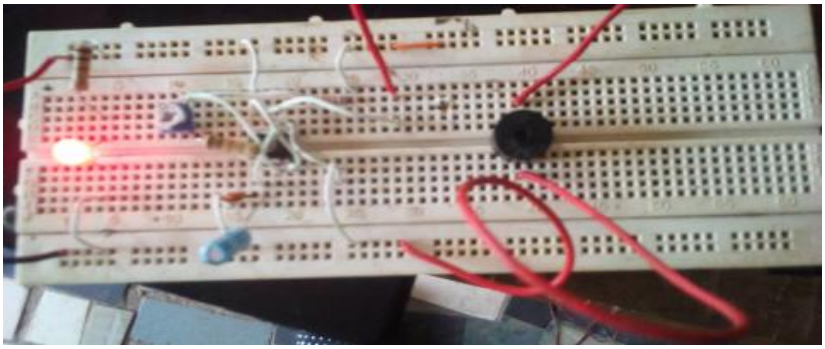


Figure 10: Block Diagram of intruder security alarm system

Step 2: The circuit designed was studied to know how the components were going to be placed. The components were also measured using a digital multimeter. The aim of this measure was to know if the values of each component were in keeping with the proposed components used in the circuit design. Another purpose of the measurement was to indicate faulty components so as to make away with them.

Step 3: The circuit diagram was simulated using a Breadboard or a project board. Here, the components were placed as of the circuit diagram in the breadboard. This was done by arranging the component as of the circuit diagram on the breadboard to test the functionality and the effectiveness of the circuit so designed to ensure neatness when the components are transferred permanently to the veroboard.

Figure 11: The circuit layout is shown below:



International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

Step 4: A veroboard or strip board components layout was produced as according to the circuit.

Step 5: The components were laid as of the drawing in the veroboard components layout and jumper wire placed where necessary on the veroboard.

Step 6: Connecting wires were used to connect the speaker/buzzer, LEDs, switch and the battery to the veroboard.

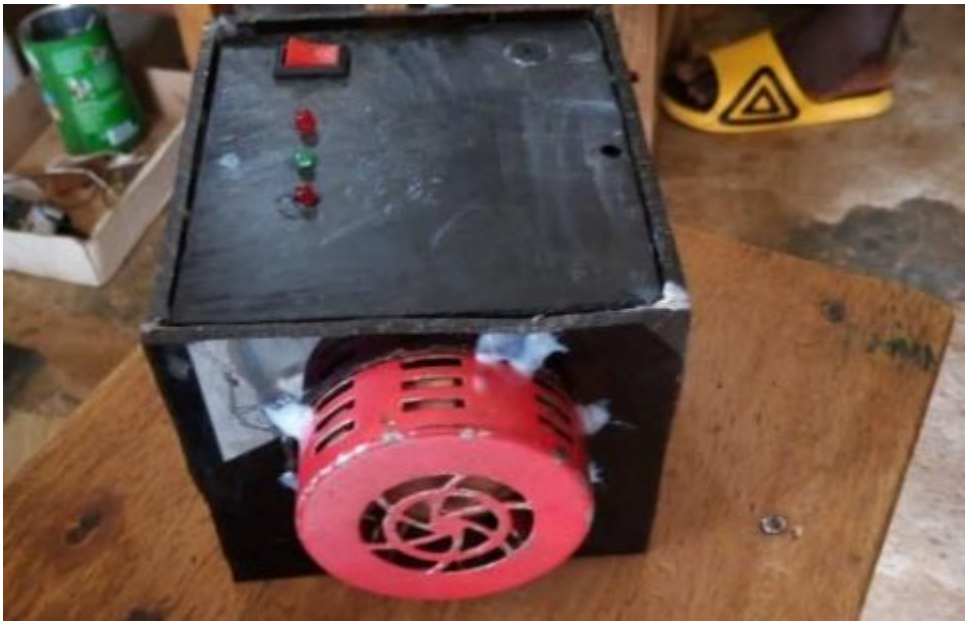
Step 7: After the arrangement of the components according to the veroboard components layout, the next thing done was to solder the components' lead to the veroboard so that they will be firmly held to the veroboard. This was done by using a soldering iron and a solder wire to hold the lead of the components firm to the veroboard.

Step 8: Excess protruding parts beyond the solder were trimmed and the testing of the tracks was carried out.

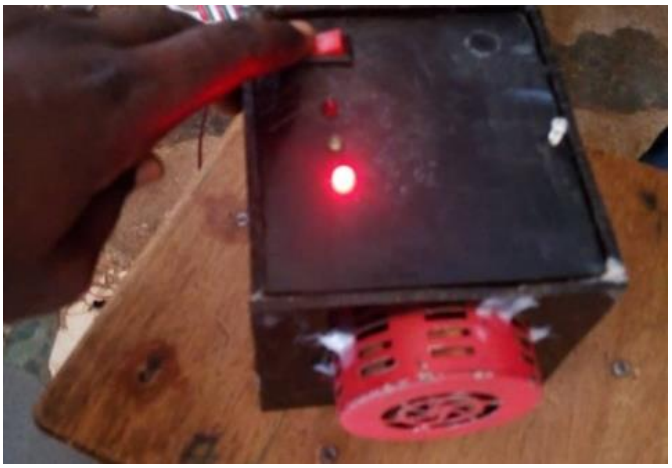
Step 9: The component soldered to the veroboard were tested to ensure it gave what was intended and to avoid bridging of any of the components and to ensure its workability. This was done by using a digital multimeter to test the continuity of all the components and how they flowed to each other in the veroboard.

Step 10: The veroboard was then transferred to the casing of the intruder security alarm system. The casing comprises of 6cm x 9cm blackpattress box.

A pencil and a meter rule were used to mark out where the veroboard, switch, speaker/buzzer and the LEDS were to be placed. The holes for switches, speaker and the LEDs were made.
After this, the cover of the box was used to cover the intruder security alarm system and two screw nails of 1cm each were however, used to hold the cover to the box and then submitted to the supervisor. **Figure 12:** The complete system is shown below:



International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025



ASSEMBLY OF THE COMPONENTS

The assembling of the component had several steps. However, the detailed steps are presented below:
Step 1: Drawing of the block diagram. This drawing helped the researcher to know the different units in the intruder security alarm system so designed.
Step 2: The components to be assembled were measured using a digital multimeter. The aim of this measurement was to know if the values of each component were in keeping with the proposed component's value so used in the circuit design. Another purpose of the measurement was to indicate faulty components so as to correct them immediately before using them.
Step 3: Simulation of the circuit using a breadboard was carried out. This was done by arranging the component as of the circuit diagram on the breadboard. This was done to test the functionality of the circuit so designed to ensure neatness when the component is transferred permanently to the veroboard.
Step 4: The veroboard component layout of the circuit was produced. This is a drawing that showed how components were going to be placed on the veroboard.
Step 5: The components were then arranged on the veroboard as according to the veroboard components layout drawn and was soldered to the veroboard. This was done by using a soldering iron and a solder wire.
Step 6: The component so soldered to the veroboard was tested to ensure it gave what was intended and to avoid bridging of any of the components by using a digital multimeter to test the continuity of all the components and how they flowed to each other in the veroboard.
Step 7: The veroboard was then transferred to the casing which comprises of 6cm x 9cm black pattress adoptable box and was finally tested for functionality.

PRECAUTIONS OBSERVED IN THE CONSTRUCTION PROCEDURE

The following precautions were observed in the construction procedures:

i. The circuit diagram was properly studied to avoid using inappropriate components that were not in line with the design.
ii. The veroboard components layout was made to ensure the components are neatly placed and arranged before simulating the circuit on a breadboard.
iii. The components were tested to ensure that they are in good working condition before they are soldered to the veroboard.
iv. The soldering iron was allowed to heat very well and then placed at an angle of 45^0 to ensure proper soldering and firm grip of the components.
v. The soldering iron was placed on its stand to avoid coming in contact with other inflammable things that may lead to fire outbreak.
vi. Gloves and laboratory coat were worn to ensure safety while working.

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

CHAPTER FOUR
PRESENTATION AND ANALYSIS

This chapter presented the stages involved in the analysis of the constructed switch-controlled intruder security alarm system. The chapter is, however, arranged in the following sub-headings:

- Discussion of findings
- Presentation
- Skill Requirements
- Maintenance Guidelines

DISCUSSION OF FINDINGS

In this segment, the research questions were answered. Therefore, in the design, construction and evaluation of this switch-controlled intruder security alarm system, the following questions were answered based on the research questions:

Research Question One: What is the market competitiveness of this portable switch-controlled intruder security alarm circuit that is locally sourced, inexpensive, easy to construct and operate?
The market competitiveness of this intruder security alarm system was such that the project was simple, inexpensive and durable compared to other ones sold at the market. The cost of selling this project work was ₦6, 000 compared to foreign ones sold at ₦ 10,000.00 and above in the market. Therefore, since this work is cost effective people should go for the ones that is cheaper, simple and durable and can do the same work much better than those foreign ones and even more effectively. It is easily accessible and maintained since the feature can be well understood. Finally, since locally available materials were used in this construction and it was considered effective, it is imperative to note that, mass production of this security alarm system will tend to reduce the demand of those foreign or imported ones in the market since this local one can do the same work perfectly and is as well cheaper in terms of cost of purchase.

Research Question Two: What are the procedures involved in the construction of an intruder security alarm system to be used for security purposes?
The construction of this switch-controlled intruder security alarm system was done in such a way that, first, the circuit diagrams for the work were drawn which showed how the inter connections between components in the board will be made and followed. The circuit was studied to know the values, ratings of each component, their functions and how the components were going to be placed. The circuit diagram was simulated, each version tested, and the components layout produced using a Breadboard to see if it works before transferring it to the veroboard. Here, the components were placed as it is in the circuit diagram in a breadboard to test the effectiveness of the circuit. Connecting wires were used to connect the light emitting diodes, switch, and other components and the output wire to the veroboard. After connecting each component to the veroboard, the soldering was carried out. Excess protruding parts beyond the solder were trimmed and the testing of the tracks was carried out. This testing was carried out to ensure its workability. The veroboard was finally transferred to its casing which comprise of 6cm x 9cm black casing. The final testing was made to ensure everything was in place and the circuit was functioning effectively before submission.

Research Question Three: What is the performance evaluation of this portable switch-controlled intruder security alarm circuit so designed?
A series of performance test was conducted. The project passed the entire tests, and it is ready for use. For the purpose of this study, the following performance tests were carried out:

Preliminary testing: Preliminary testing is the first preventive testing used to determine if the project will work or not. This area is performed before power is applied to the project in order to detect errors that could cause serious problem should the wrong voltages and current be allowed to reach critical components. Result: During the preliminary testing of this intruder security alarm system, a bread or project board is used to replicate the circuit. Here the components were placed as it is in the circuit diagram and a 12volts battery is used to supply to the circuit to know if it works. From the result, it was observed that the circuit is implementable and as such has passed the preliminary test. Once the project passes all preliminary tests, the next test is;

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

Operational test: In this operational test, power is applied for the first time and basic project functioning is determined if all appears well at this point, operational testing is done. If there is a problem, for example the voltage is not reaching the alarm speaker or it is malfunctioning, the project must undergo the trouble shooting stage.

Result: The result of this test proved that when power is applied for the first time and basic project functioning determined, the voltage was able to reach the alarm speaker without any malfunctioning.

Troubleshooting: Trouble shooting is done to determine what is wrong, why it is wrong and what to do about it. There the cause of the problem is identified and corrected and the final performance testing is done again.

Final Result: This final performance test result is used to determine if the project will work whenever it is supposed to be used. With the performance test result of this switch-controlled intruder security alarm system, the work is subjected to harsh and extreme condition. Therefore, the result of the performance testing of this intruder security alarm was that when this project work was subjected to extreme direct current voltage of 12v for about one week, it worked perfectly well without breaking down.

Research Question Four: What are the constraints involved in the design and construction of the intruder security alarm system?

The constraints to the design, construction and evaluation of this intruder security alarm system are as follows:

i. Difficulty in meeting size and value of components: In terms of designing within the stipulated size and value constraints, integrated circuits (I.C) are the most difficult components to work with. Others include the passive components. Passive components are circuit elements that do not generate energy themselves, but only store it or dissipate it. Examples of such passive components are resistors, capacitors, transistors etc. passive components are the fundamental building blocks of electronic circuit (intruder security alarm circuit inclusive) and no design is feasible without utilizing a number of them. However, in the designing and construction of this intruder security alarm system using passive components poses a challenge for the constructor due to the sizes of their package which in turn affect the overall performance of the system.
ii. Difficulty in meeting power constraints: Power was the most challenging design and construction constraints to meet. Low power consumption is the hallmark of modern electronic design. Therefore, trying to achieve a low power intruder security alarm system was one of the major constraint the researcher faced in the design and construction of this portable intruder security alarm system.
iii. Difficulty in meeting performance constraints: Performance constraint is the most difficult constraint in the design and construction of any electrical/electronics system. The performance of a design is largely dependent on components selection and configuration. However, it is one of the constraint to the design and construction of this intruder security alarm system, since the target of the researcher is to come up with a well-sounding alarm system capable of informing the vicinity the presence of an intrusion.

In summary, the success or failure of a design depends on how it performs during the testing phase in relation to expectation. Therefore, designing and constructing an optimal electronic system involves creating a design that is not only cost-effective but well within the performance constraints.

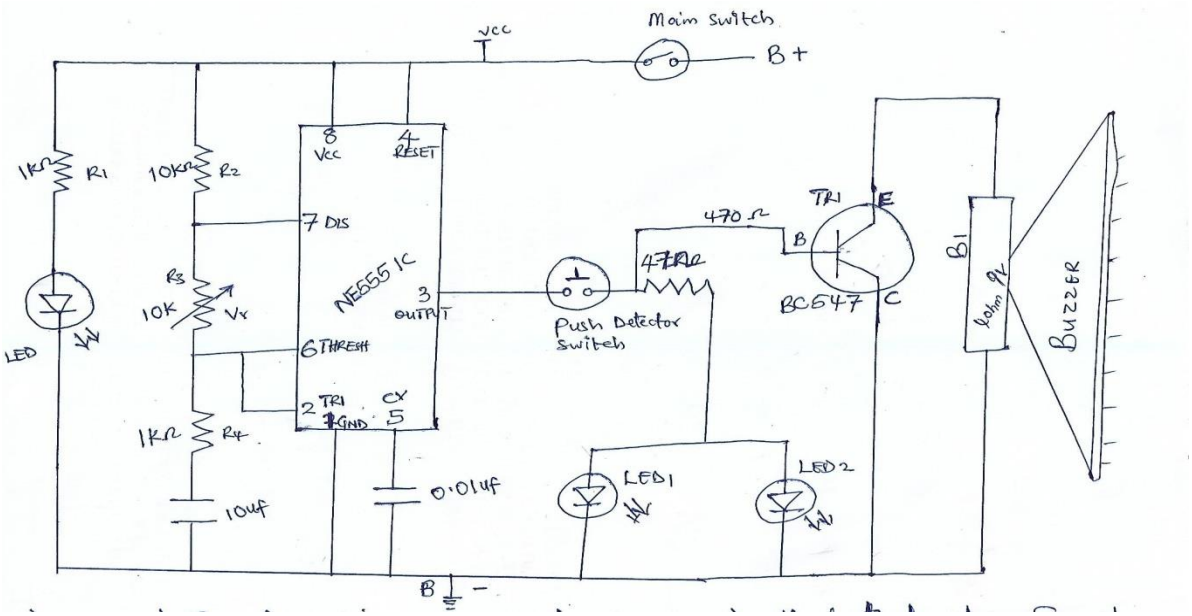
PRESENTATION

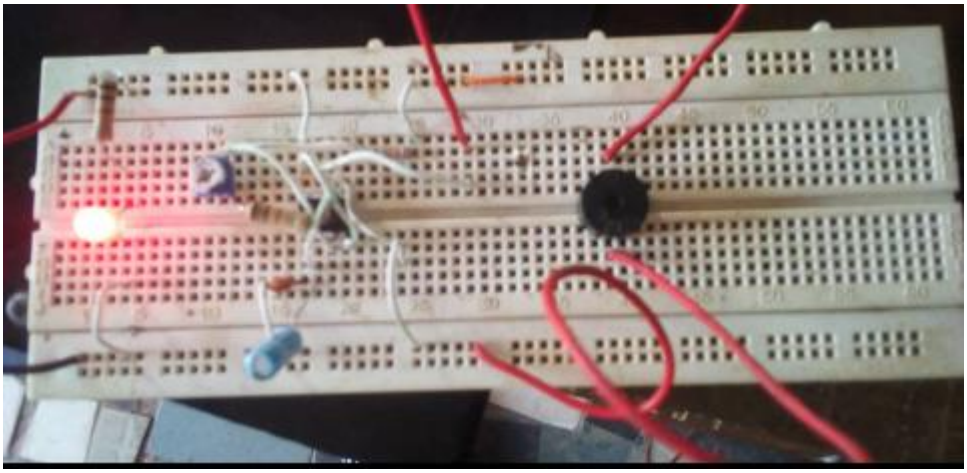
This segment presents the working principles of the switch-controlled intruder security alarm system so constructed.

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

Figure 13: Working principle of the switch-controlled intruder security Alarm System





From the circuit diagram above, the supply voltage used in the design, construction and evaluation of this switch-controlled intruder security alarm system was a 9volts battery and the battery used was connected through a switch to the ground (negative). The switch helps user to have control over the system by putting it ON and OFF at any time. Also, LED1 which is connected through a 1kilo ohms Resistor (Rl) serves as an Indicator to show the presence of power supply through the circuit.

The circuit works in such a way that, when the system is ON, the LED comes ON and vice versa. Here, the Integrated Circuits (I.C) in this project were configured in Astable mode. I.C, which was the switch detector stage had pull-switch (S1), Variable Resistor (RV1), Resistors (R2, R3 & R4) and Capacitors (Cl& C2) connected to it. Also, LED2 and LED3 (Red and Green Colours) were connected through the Output pin (Pin3) of the I.C and a Resistor (R3) is used to produce a suitable amount of current going into the LED2 and LED3. Similarly, BC547 transistor was connected to pin3 of the I.C through Resistor (R4). The emitter of BC547 transistor was connected to the buzzer and the collector connected to pin l and pin 5 of the I.C which was the Sound Module. The positive and negative of the Speaker/buzzer (SP1) was connected through the collector and emitter as supplied by the Output pin (Pin3) of the IC.

However, this project senses the presence of an intruder through the pull-switch that is connected to the door. So, on making contact, then it gives a signal. The signal is given through the Output pin (Pin3) of IC and the BC547 transistor, where the three LEDs will come ON and the BC547 will switch pin l of the IC to the ground making the sound (Siren) to be heard. The capacitors used in this project acted as filters to remove ripples so that we can have a square wave.

Also, the Sound (Siren effect) coming out from the project can be adjusted through Variable Resistor (RV2) in the Sound Module.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

PERFORMANCE TEST AND TEST RESULT

A series of performance test was conducted. The project passed the entire tests, and it is ready for use. For the purpose of this study, the following performance tests were carried out:

Preliminary testing: Preliminary testing is the first preventive testing used to determine if the project will work or not. This area is performed before power is applied to the project in order to detect errors that could cause serious problem should the wrong voltages and current be allowed to reach critical components.

Result: During the preliminary testing of this intruder security alarm system, a bread or project board is used to replicate the circuit. Here the components were placed as it is in the circuit diagram and a 12volts battery is used to supply to the circuit to know if it works. From the result, it was observed that the circuit is implementable and as such has passed the preliminary test. Once the project passes all preliminary tests, the next test is;

Operational test: In this operational test, power is applied for the first time and basic project functioning is determined if all appears well at this point, operational testing is done. If there is a problem, for example the voltage is not reaching the alarm speaker or it is malfunctioning, the project must undergo the trouble shooting stage.

Result: The result of this test proved that when power is applied for the first time and basic project functioning determined, the voltage was able to reach the alarm speaker without any malfunctioning.

Troubleshooting: Trouble shooting is done to determine what is wrong, why it is wrong and what to do about it. There the cause of the problem is identified and corrected and the final performance testing is done again.

Final Result: This final performance test result is used to determine if the project will work whenever it is supposed to be used. With the performance test result of this switch-controlled intruder security alarm system, the work is subjected to harsh and extreme condition. Therefore, the result of the performance testing of this intruder security alarm was that when this project work was subjected to extreme direct current voltage of 12v for about one week, it worked perfectly well without breaking down.

SKILL REQUIREMENTS

The skills required in designing and constructing this switch-controlled intruder security alarm system were majorly Electronic-Electrical skills. However, other skills include; Electronic Design skills gotten from electronic system and design; Electronics calculation skills gotten from circuit theorem and Analysis; soldering skills gotten from basic electronics; casing design skills gotten from Engineering Drawing and AutoCAD; and finally, Electronics construction skills gotten from electronic system Design.

MAINTENANCE GUIDELINES

The maintenance guidelines for this project are presented thus:

1. The intruder security alarm system should be kept in areas free from dust. Also, it should be kept in areas free from vibrations to avoid making the components to break and as such causing partial contact.
2. The security intruder alarm system should be dusted regularly either on a weekly or monthly interval.
3. The intruder security alarm should be kept out of reach of unauthorized user to avoid sounding a false alarm when switched to its set position.
4. The alarm system should be mounted on ceilings and equally on Walls 10meters above the ground and should be hidden to avoid intelligent criminals from locating and switching off the system before operation.
5. The battery in the security intruder alarm should be changed on monthly interval.
6. A certified technician should be called to carryout installation, repair and maintenance work on the intruder security alarm system whenever the system got spoilt.

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter presents the summary of the findings, conclusion and recommendations.

- Summary
- Principal findings
- Conclusion
- Recommendations
- Suggestions for further studies

SUMMARY

The study is on design, construction and evaluation of this switch-controlled intruder security alarm system. The study adopted Research and Development (R and D) design. The construction, however, was carried out on a Veroboard while the casing of the project was done with black pattress box (6cm x 9cm) and a cover. The project was tested using the push-pull burglar switch to ensure it works perfectly. Also, the effectiveness of this project was tested by putting ON the system for three hours without any interruption and the system worked perfectly well without breaking down.
The materials used in the design and construction of this intruder security alarm system include resistors, capacitor, speaker/buzzer, transistors, I.Cs, variable resistors, diodes, switches, LEDs, veroboard, jumper wire, black pattress casing box. The procedures used during the construction are as follows: first, the circuit diagram was drawn, the components required were listed and tested, the components were checked against the veroboard size and secured on the veroboard. The components were soldered and some protruding parts cut off. Finally, the circuit was tested to ensure its workability and then the circuit was assembled into the casing.
Finally, the advantage of this locally made intruder security alarm system is that it is cheap in the cost of production due to the purchase of the components within our locality, simple in terms of its design, easy to operate and carry out maintenance work on.

PRINCIPAL FINDINGS

Based on the research questions answered, the following principal findings were made:

1. From research question one, it was found that this switch-controlled intruder security alarm system was simple, inexpensive and durable compared to other imported or foreign ones sold at the market. Therefore, the cost of selling this project work was N 6,000 compared to imported ones at the market sold at N 10,000 and above. Therefore, since this work is cost effective people tend to go for the ones that is cheaper, simple and can do the same work as those imported ones and even more effectively. It is easy to construct and maintain since the feature can be well understood.
2. From research question two, it was found that locally available components and materials were used in this construction such as resistor, capacitors, integrated circuit, light emitting diodes, alarm speaker, battery, connecting wires, switch, veroboard, super glues, soldering lead, black plastic board, and screws and it was considered effective. The procedures were drawing the circuit diagram, listing out the required components, testing the components, simulating the components according to the layout, securing the components to the veroboard, soldering the components, and testing for functionality. Therefore, the mass production of this intruder security alarm system will tend to reduce the demand of those foreign or imported ones since this local one can do the same work perfectly.
3. From research question three, the result of the performance testing of this switch-controlled intruder security alarm system revealed that the project work is effective in operation and also, when this project work was subjected to extreme direct current voltages of 9 volts during the performance testing for about one week and it worked perfectly well without breaking down.
4. Finally, from research question four, it was found that constraints such as difficulty in meeting size and value of components, difficulty in meeting power constraints, and difficulty in meeting performance constraints were observed and the successful construction and testing of this project has demonstrated that more of this foreign alarm system can be properly replicated, designed and modernized to reduce size and cost of purchase, thereby encouraging the use of local ones like this so constructed switch-controlled intruder security alarm system.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

CONCLUSION

Based on the findings of this project, the following conclusions were drawn:
The intruder security alarm system was effective because when kept ON for three good hours, it worked perfectly well without breaking down. Also, the cost of building the project was low, which figuratively was N5,230 and this was in keeping with the researcher's problem of wanting to design and construct a low-cost intruder security alarm system that is cheap and affordable by the average Nigerian for safety. Furthermore, the project was simple in terms of its design, easy to operate and carry out maintenance work on. Thus, the gap of the research being covered and it is simple but has effective alarm circuit which can reset its self after a time. It has normally closed and normally open triggers which make this door as a switch so as to triggers. It uses a NE555 timer so that alarm will reset itself after a certain amount of time. The time varies according to the resistor and capacitor been used in the circuit. The alarm has a switch, which we can replace with a key switch to make it more secure and can change the trigger to other top of the door or window too. The alarm uses a transistor and a capacitor, which is connected to a siren (buzzer) but it can be replaced with speaker. The circuit is running off 9volts but can range from 6-12volts.

RECOMMENDATIONS

Based on the findings of the work, the following recommendations are hereby made:

- All institutions of learning should procure this intruder security alarm system as many as they can and mount them strategically in their offices and most especially their workshops, laboratories where there is a high risk of intrusion.
- All government's ministries, establishments and Departments, private companies, industries should procure this intruder security alarm system and mount them strategically in their offices, power houses and workshops.
- Government should train youths/students in electrical/ electronic construction so as to introduce intruder security alarm system that can be automated, that is the security alarm that contains a LCD and a counter for detecting how many people entering the building.
- Due to its cost effectiveness and ease of operation and maintenance, individuals should procure this project and mount them strategically in their homes for safety.
- Government and schools should equip youths/students with construction skills in the field of electrical/electronic technology for construction of security alarm systems.

SUGGESTIONS FOR FURTHER STUDIES

Research should be carried out on the following:

1. Design, construction and performance testing of an automatic heat sensor security alarm system.
2. Design and construction of Liquid Crystal Display (LCD) siren security alarm circuit.
3. Construction of automatic fire detector security alarm system.

Declaration Section

Availability of Data and Materials

Not Applicable

Funding

Not Applicable

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

ACKNOWLEDGEMENT

The Researcher's thanks go to some authors whose work helped in the realization of this work, Elue, P. (2007), Adeniran, O. O. (2010). Onele, N. O. (2006), etc. He is grateful. He thanks his supervisor, Dr. C. E. Ogwa for his patience, and sound academic input during the course of this project work, May God bless and reward him abundantly. He wish to also thank other lecturers in Technology and Vocational Education in the person of Prof. P.A. Nwobasi, Prof. P.N. Opara, Assoc. Prof. J. E. Ogbu, Dr. N.O. Onele, Dr. E.N. Elom, Dr. J.U. Ndem, Dr. S.O. Eze, Dr. B.O. Egbe, Engr. C. Edu and Arch. Mrs. V. Imakwu for some of their correction during this project work, He is grateful. He thanks specially his good friend Paul for his assistance in the actual construction of this project work. Thank you for this favour.

REFERENCES

Adeniran, O. O. (2010). A Technical Report on Industrial Training on security alarm which tookplace at Aitek Network Systems Limited, Ikeja, Lagos. Unpublished Technical Report Paper submitted to the Department of Electrical/Electronic Engineering, University of Ibadan. Retrieved from www.ui.edu.ng. 28thMay, 2021.

Chenebert, A. and Breckon, T. P. (2011). "A Non-temporal Texture Driven Approach to Real-time Fire Detection Alarm. International Conference on Image Processing. IEEE.pp.1781-1784.

Coupe, T. and Kaur, S. (2005). The Roles of Alarms and CCTV in detecting non- residential burglary. Security Journal, 18(2): Pg. 53–72.Cross-Reference Google Scholar.

Elue, P. (2007). Design and Construction of a Door Alarm System. Unpublished B.Sc. Thesis. Department of Electrical/Electronic Engineering. Madonna University, Elele. Rivers State.

Garcia, M. L. (2001:54). The Design and Evaluation of Physical Protection Systems. Burlington, VA: Butterworth-Heinemann. Google Scholar.

Gee, D. (2016).Rethinking Security: A discussion paper, (PDF version) Ammerdown Group. Retrieved from https:www.rethinkingsecurity.org.uk. 20thMay, 2021.

Harvelson, C. (2013). Audio Verification Equals More Apprehensions, E-H Publishing, Retrieved on May 17, 2021.
José, C. and Thomas, L. (2008). Wireless data acquisition system using Bluetooth technology for infrasonic records. Journal of Engineering and Computing. **7** (2): 18-21.
Kumaragamage, D. Y. (2011). Design Manual Volume 1. Retrieved from www.engineersgarage.online.com. May 12, 2021.

Loughnane, D. J. (2001). Design and Construction of an Autonomous Mobile Security Device. Unpublished M.Sc. Thesis, Department of Physics and Electronics Engineering. University of Waikato.

Onele, O. N. (2006). Design, Construction and Performance Evaluation of the Modules for Teaching Superposition, Maxwell's Mesh and Thevenin's Theorems. Unpublished HND Thesis. Department of Education (Technical). Kaduna Polytechnic, Kaduna.

Sampson, R. (2011). False Burglar Alarms 2nd Edition (PDF version). US Department of Justice/Office of Community Oriented Policing Services, ISBN 978-1-932582-04-8, archived from the original (PDF).

Uzoagulu, A.E. (1998). Practical guide to writing Research project reports in Tertiary institutions. Enugu: John Jacob's classic publishers Ltd. Enugu.

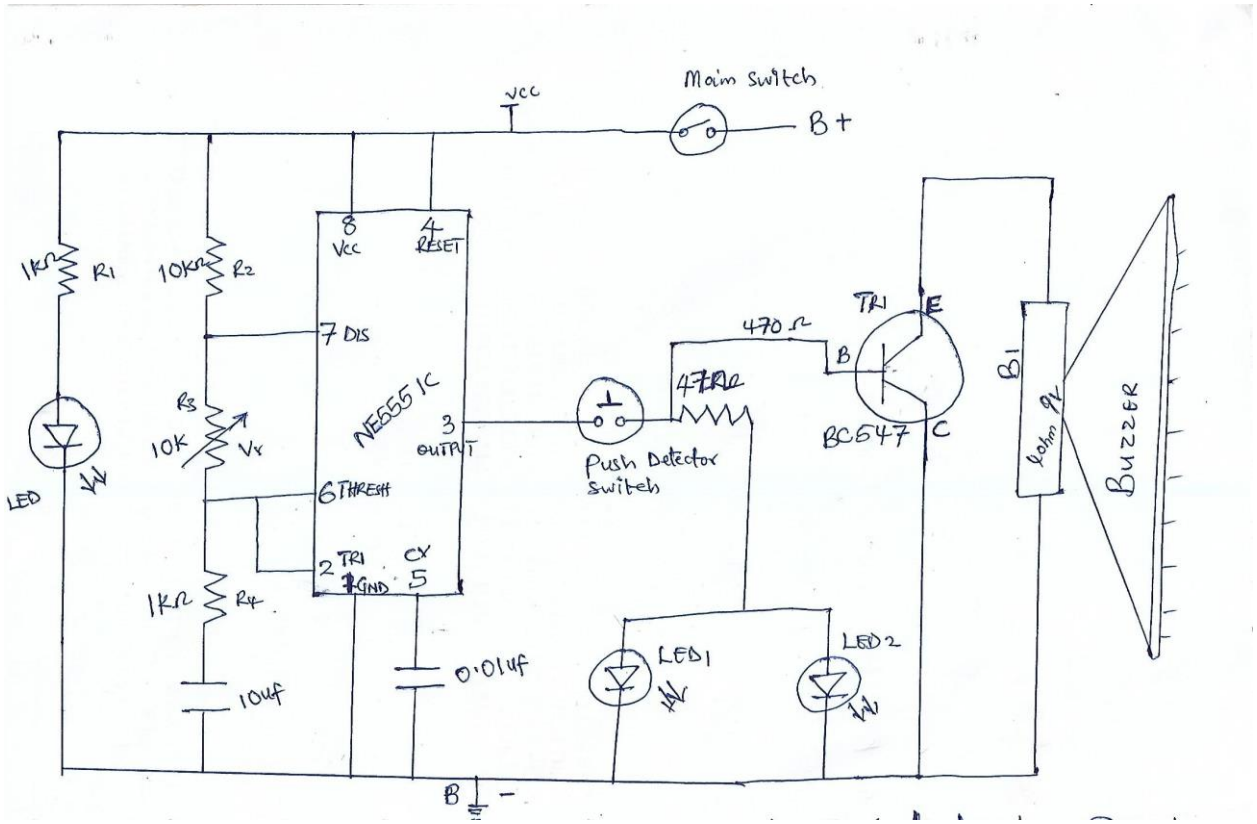
Walker, P. (2000). Electronic Security Systems. Cambridge, UK: University Press.

Weber, T. L. (2000). Alarm Systems and Theft Protection (2nd Ed.). Stoneham, MA: Butterworth Press Ltd.

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

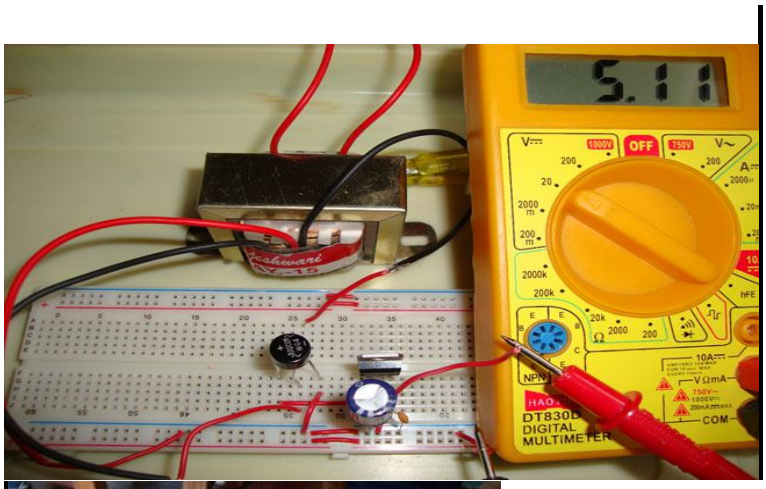
Appendices



Circuit diagram of a switch-controlled intruder security alarm system

Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025



Bill of engineering measurement and Evaluation (BEME) of a switch-controlled intruder security alarm system

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 14 Issue 09, September - 2025

Items	material and components	Quantity	Rate	Amount (₦)
1.	Resistors-1kΩ, 10kΩ, 470Ω, 47Ω	6	30	180
2.	Capacitos-0.01uf, 10uf	2	100	200
3.	Transistor - BC547	1	200	200
4	9volts battery	1	200	200
5.	Soldering lead	1 yard	100	100
6.	Switches-Sw1 and Sw2	2	150	300
7	I.C NE555 timer	1	200	200
8.	LED - Green and Red	2	50	100
9.	Vero Board – Dotted	1	150	150
10.	Jumper Wire	1 yard	100	100
11.	4Ω speaker/Buzzer	1	500	500
12.	Casing and cover- 6cm x 9cm	1	1000	1000
13.	Miscellaneous			2000
	Grand Total			**₦ 5,230**