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# Development and installation of a 1.5kVA solar-powered inverter system for a mini ICT centre

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**Abstract**
Operation of an Information and Communication Technology (ICT) centre relies heavily on the availability of regular power supply. Renewable energy sources such as solar power have been identified as a potential solution to shortage in power generation especially in developing countries, Electricity supply does not meet the demands of users and many rural communities remain without access to the national grid, while those connected to the national grid experience epileptic power supply. Moreover, the desire for an alternative power supply has induced a rapid growth in the number of solar power inverter building across the globe, this study presents the design and implementation of 1500VA solar inverter to cater for the electricity need of a mini ICT centre. Key components of the power supply system include photovoltaic cell, the oscillator circuit of the inverter consists of an SG3524 integrated circuit and two NPN transistor drivers powered directly by a 12V battery through a switch and two sets of IRF740 MOSFET.

**Keywords:** inverter, household energy need, IRF740, ICT, information technology

## Introduction

In recent times, the internet plays a significant part in the lives of all people. There are numerous internet services accessible to meet the needs of customers (Nama & Despa, 2016) [19]. As of 2020, 46.6 percent of the Nigerian population had access to the internet (Johnson, 2021).Hence, there are Information and Communication Technology (ICT) centres created to cater for the ICT needs of the populace such as tertiary education students. The availability of a consistent power supply is critical to the operation of an information and communication technology (ICT) center. The grossly insufficient or completely unavailable electricity in many communities within the country is a problem. This problem varies from the shortage in power generation to limited grid expansion. Almost 33% of the world population lives without usable electrical power according to Oyedun, Onyechekwa and Ezenwora (2011). In Nigeria, electricity demand far exceeds supply; hence many rural communities remain without access to the national grid, while those connected experience epileptic and frustrating power supply.

In view of the foregoing, some who intend to set up ICT centre have to factor the addition cost of purchasing and running fossil fuel power generators. Apart from increasing the cost of operation, this mode of power generation contribute to greenhouse gases in the atmosphere, with detrimental consequences to the climate. Presently, Graves (2019) [10] estimates that the ICT sector generated for 2.5 percent of total greenhouse gas emissions in 2010. By 2040, if nothing is done, the share will be 14 percent.

Solar energy is the most sought after source of energy. Therefore, concerning the worldwide trend of green energy, solar technology has become one of the most promising energy resources. The solar cell transforms the light energy into electric energy. It represents a source with good energy density and high theoretical efficiency.

From an electrical point of view, the solar cell is considered as a voltage source, this source is nevertheless imperfect, and therefore it is necessary to insert an inverter between the solar cell and the network in other to obtain the alternating electric source (Oyedun *et al.* 2011).

The desire for alternative and clean energy has induced a rapid growth in the number of solar power building across the globe. The environmental impact of electricity generation, particularly the greenhouse effect is also another important reason for exploring photovoltaics as an alternative source of electricity.

The main aim of this write-up is to outline the development of a 1.5kVA solar powered inverter system capable of powering a mini ICT centre.

### Literature review

The photovoltaic (PV) module is the generator required for the conversion of solar energy to electrical energy. PV module generates direct current, which cannot be used directly by many home appliances, as a result of this there is need for an inverter which is an electrical device that converts direct current (DC) to alternating current (AC); the converted AC can be at any required voltage and frequency with the use of appropriate transformers, switching and control circuits. A solar inverter is the major electronic component required in a solar power system. Nigeria is a tropical country that is blessed with abundant sunshine and since solar energy is gotten from sunlight radiation to the earth surface. The energy from the sun is captured using the PV (photovoltaic) panels. The solar power system consists of an arrangement of several components, including a solar panel to absorb and convert sunlight into electricity, a solar inverter to change the electric current from DC to AC. The solar power system is of two types namely; stand-alone (off-grid) and grid-connected.

A literature search showed that several authors have written papers on the inverter systems and ways of improving their performance. According to Tianze *et al.*, 2011 [26] using an anti-charge diode to control the charging and discharging of the solar inverter through the solar cell matrix, when the solar cell matrix does not generate electricity or appear short circuit fault in the raining days and night results in an improvement of the operation of the charge controller. Ali *et al.*, 2016 posited that, the solar photovoltaic contribution to energy services in remote villages in Nigeria was still very low in spite of various governmental interventions. A solar inverter can be improved by using solar energy based on sine wave inverter (Varsha & Zope, 2017, Hassan *et al.* 2015) [2, 14].

### Description of key concepts

### An inverter

An Inverter is an electronic device capable of transforming a (DC) current into an AC source at a given voltage and frequency. The inverter can be used in connection with the following:

Fuel cells based power generation, uninterrupted power supply (UPS) to the speed controllers of electric motors. They are also used in stand-alone photovoltaic systems for powering electrical devices of isolated houses, mountain huts, camper vans and boats, and are also used in grid-connected photovoltaic systems to enter the current produced by the plant directly into the power grid distribution.

### Charge Controller

The charge controller is a battery regulator that limits the rate at which electric current is added or drawn from electric batteries. It prevents overcharging and may protect against over-voltage, which can reduce battery performance or lifespan.

### Types of solar power system

### Stand-Alone (Off-Grid) System

This is an electricity generation system from solar that is composed of the PV (photovoltaic) panels that capture energy from sunlight. The panels must be enough to cover the power needed. It uses a charge controller to have a suitable DC to charge the battery, to ensure the use of the energy produced in the absence of sunlight and a battery bank for storage until energy needed by the load. It produces a fine DC to the inverter for conversion to AC. A stand-alone system is mainly used in rural areas of developing countries. They are also used in powering Telecommunication towers, water pumps and street light uses, which can be considered as a social benefit for this type of systems.

Although there was a price reduction of the PV panels cost and the inverters involved, the batteries cost is the main concern in off-grid (stand-alone) systems that it stays expensive especially if the energy stored in terms of kilowatts or megawatts, the required battery size increases. Moreover, the batteries are required to be replaced in approximately every ten years, which constitute more investments in the application of off-grid systems (Osman, 2017). A stand-alone system is shown in Figure 1.

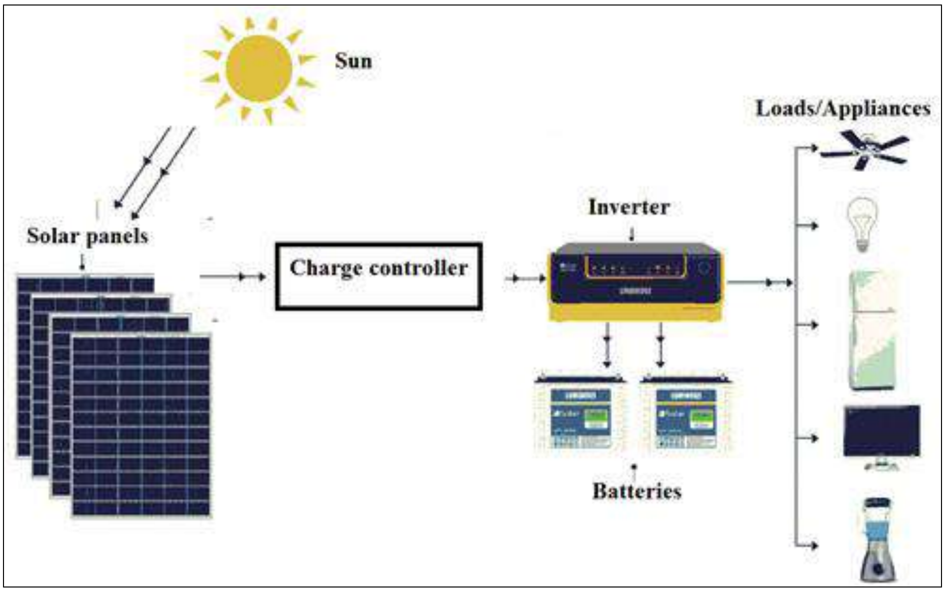


**Fig 1:** Off-grid system, sourced from (Loomsolar, 2019) [18] with some adaptation

**Grid-Connected System**

This is the simplest and cost-effective PV design is the "Grid-Tied" also sometimes called (utility-interactive) system. The solar system composed of PV solar panels, inverter, and load as in stand-alone systems but the difference is that the inverter used in this system called "Grid-tied inverter" and it is a power electronic device which converts the direct current into the alternating current. (GTI) is a special inverter that can synchronize voltage and frequency with the main grid parameters. It does not battery storage to store the energy, it is consumed immediately and the excess power transferred to the grid which can consider as battery storage virtual battery without the need for maintenance regularly in every decade. The grid is used to store power for further use at night and during cloudy days or can be sold to the utility company with a net metering technique that considers a power meter to measure the power in both directions from the grid to the appliances and vice versa which result in the reduction of the electricity bill. Moreover, it does not require any rewiring which reduces the installation cost (Osman, 2017). Figure 2 shows a block diagram of the grid-connected system.

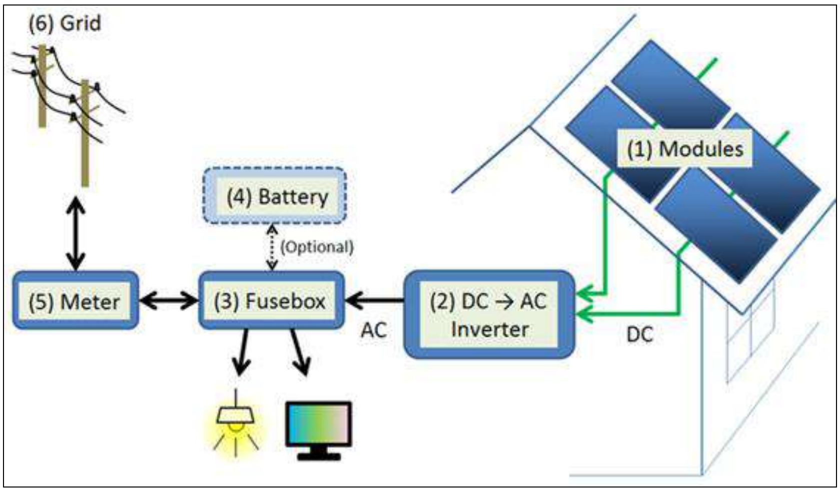


**Fig 2:** A Grid type connection sourced from Egdefix Kits (2019) [7]

**Solar Panels**

This is a collection of solar cells designed to absorb the sun's ray as a source of energy for generating electricity or heating. It is also a device that can convert light directly into electricity. There are two generations of solar panels namely:

a. First-generation – Solar panels use monocrystalline or polycrystalline silicon (output of 15%).
b. Second-generation – Solar panels consist of solar cells made of amorphous silicon. This name also applies to solar panels based on other materials that have appeared on the market more recently:
   1. CIS (copper-indium-selenium)
   2. CIS (copper-indium-gallium-selenium)
   3. CDT (cadmium telluride)

The particular feature of this second generation is that it uses thin semiconductor layers ("thin-film"). This explains why these panels are less expensive and more aesthetic but also has a lower output from 5 to 11% (GreenMatch, 2019) [11].

**a. Mono-crystalline solar panels:** This is the most efficient and expensive solar panels made with Mono-crystalline cells. These solar cells use very pure silicon and involve a complicated crystal growth process and the solar panel has one of the highest efficiency rates with the newest ones reaching above 20%. Mono-crystalline panels have a high power output, occupy less space, and last long (GreenMatch, 2019) [11].

**b. Polycrystalline solar panels:** Often called multi-crystalline Solar panels, they are made with Polycrystalline cells and are a little less expensive & slightly less efficient than Mono-crystalline cells because the cells are not grown in single crystals but in a large block of many crystals. They are made by melting raw silicon, which is a faster and cheaper process than that used for mono-crystalline panels (GreenMatch, 2019) [11].

**c. Amorphous solar panels:** These are not crystals, but a thin layer of silicon deposited on a base material such as metal or glass to create the solar panel. These Amorphous solar panels are much cheaper, but their energy efficiency is also much less, as a result, more square footage is required to produce the same amount of power as the Monocrystalline or Polycrystalline type of solar panel.

**Types of solar panel array mountings**

***Fixed*:** This is the simplest and least expensive type of solar panel mounting system, it will be completely stationary. The solar panels should always face the sun direction. A typical fixed type of solar panel mounting is shown in Figure 3.

**Fig 3:** A fixed type of solar panel mounting sourced (Greentumble, 2019) [12].

**Shade Structures:** solar panels can also be mounted as shade structures where the solar panels can provide shade instead of patio covers. The support structure for the shading systems can be normal systems as the weight of a standard PV array is between 3 and 5 pounds. The panels are mounted at an angle steeper than normal patio covers; the support structures may require additional strengthening.

**Tracking:** This Solar panel when mounted follows the path of the sun during the day to maximize the solar radiation that the solar panels receive. A single-axis tracker tracks the sun east to west and a two-axis tracker tracks the daily east to west movement of the sun and the seasonal declination movement of the sun.
The electrical power output of a solar power system is influenced by (DKA solar centre, 2018, Sunmetrix 2019):

**Temperature:** The output of a solar panel decreases as temperature increases. High ambient temperature limits the amount of electricity panel produce. Solar panels also generate their heat as they produce electricity.

**Coordinates of the Location:** Due to the earth's spherical shape, the solar rays have more intensity around the equatorial regions. As it moves further away from the equator, the intensity decreases as the solar rays are distributed around a larger geographical region.

**Aerosols:** Aerosols are small particles that float in the atmosphere. By absorbing or diffracting solar radiation, they can act as a filter and decrease the level of solar radiating reaching the surface.

**Elevation:** The distance that solar rays have to travel through the atmosphere is less at higher altitudes. Therefore, there is less atmospheric absorption, and consequently, more solar radiation as the elevation increases.

**Solar charge controller**

A solar charge controller is essentially a voltage or current controller for charging the battery and preventing overcharging of the battery. It permits the solar systems to work optimally by running higher voltage in the wires from the solar panels to the charge controller, power dissipation in the wires is diminished fundamentally. The reverse power flow can also be controlled using solar charge controllers. When there is no power coming from the solar panels, it can detect this and open the circuit separating the solar panels from the battery devices, stopping the reverse current flow. There are different types of charge controller to select from. They include: the Pulse-Width Modulation (PWM) and the Maximum Power Point Tracking (MPPT) types.

**Available batteries for the solar powered electricity system**

The battery is a two-terminal device that provides DC supply to the inverter section when the AC mains is not available. This DC is then converted into 220V AC supply and output at the inverter output socket. It is pertinent to state that lead-acid batteries used in automobiles are very good for this purpose as they provide good quality power for a long duration and can be recharged once the power stored in them are consumed. The backup time provided by the inverter depends on the battery type and its current capacity. Various types of solar battery include (Doityourself, 2017) [6]:

**Lead-Acid Batteries:** A lead acid battery, often known as a sealed battery, comes in a variety of sizes and single-cell traction batteries. Sealed batteries are great since they do not require any maintenance. They are, nevertheless, more expensive than other forms of solar batteries. Furthermore, the charging is more precise.

**OGIVE batteries:** OGIVE solar batteries have a flat plate design and are semi-sealed. With OGIVE batteries, there is a reduced release of hydrogen during charging which reduces the amount of ventilation needed.

**Deep Cycle Batteries:** Deep cycle batteries resemble a car battery, but their plate construction is different. Their storage capacity ranges from 60 AH to120 AH at 12 volts. Deep cycle batteries have a longer life span and can cope well with constant charge and discharge.

**Nickel Cadmium Batteries**: Nickel-cadmium batteries they are batteries constructed with alkaline in which the positive active material is nickel-oxide and the negative contains cadmium. These batteries are very expensive and expensive to dispose of because cadmium is considered the very hazardous and non-standard voltage and charging curves may make it difficult to use some (Northern Arizona Wind and Sun Technology, 2019) [20].

**Components of Information Communication Technology**

According to Asafe 2014 [3]: “Information technology (IT) is the application of computers and telecommunications equipment to store, retrieve, transmit and manipulate data, often in the context of a business or other enterprise. The term is commonly used as a synonym for computers and computer networks, but it also encompasses other information distribution technologies such as television and telephones. Several industries are associated with information technology, such as computer hardware, software, electronics, semiconductors, internet, telecom equipment, e-commerce and computer services”. The components necessary to operate and maintain enterprise IT environments are known as information technology (IT) infrastructure. IT infrastructure can be housed in a cloud computing system or on-site at a company's location. Hardware, software, networking components, an operating system (OS), and data storage are examples of these components, which are all used to supply IT services and solutions. IT infrastructure products are available as downloadable software applications that run on top of current IT resources. These components relies much on electricity to function.

**Design of the Solar Powered Inverter System**

The block diagram of the solar-powered system is shown below. It consists of a panel 200W, 12V Solar panels that are wired in parallel; it is wired in such a way that the positive terminal is connected to the positive terminal and negative terminal being connected to the negative terminal. The charge controller is rated 12V 20A, this means we can connect up to 20A of solar panel output current to this controller. The battery rated 100AH /12V is connected to produce a current of 100A per hour. The inverter constructed for this project is 1.5KVA inverter converting the 12V Dc from the battery into 220Ac

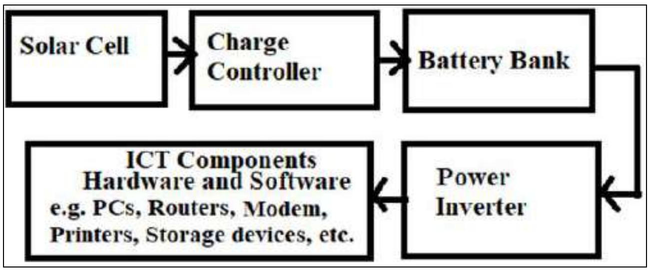


**Fig 4:** Block diagram of the Solar Power Inverter system for the ICT

**Development of the inverter**

**Oscillator Stage**

The oscillator circuit consists of an SG3524 integrated circuit and two NPN transistor drivers. The circuit is directly powered by the 12V battery through a switch (inverter switch). A light-emitting diode (LED) power indicator shows the presence of current flow in the circuit. The regulator operates at a frequency programmed by the timing resistor and a capacitor. The oscillator controls the frequency of SG3524. The circuit is shown in Figure 5.The LED used is rated 2.3V 10 mA with a resistance of 1000 Ω.

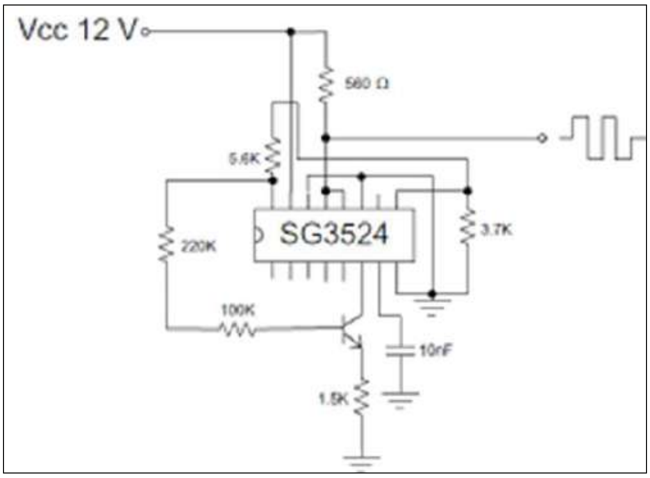


**Fig 5:** The SG3524 circuit. (Sourced Oladeji and Ladodun 2012)

Table 1 contains the technical specification of the SG3524.

**Table 1:** The Specification of SG35245

| Components | Rating |
|---|---|
| Collector output current | 100mA |
| Reference output Current | 50mA |
| Voltage | 40V |
| Temperature | 0-70$^0$ C |
| Power | 1000Mw |
| Frequency | 20KHz |

Pins 1 and 2 are adjusted to a similar voltage of 2.5 V. R1, R2, R3 and R4 are rated 10 KΩ each. R1/R2 and R3/R4 form potential dividers that apply regulated 2.5 V to both pins 1 and 2. Pin 3 is not connected. Pins 4 and 5 are grounded. R5 and C1 determine the operating frequency of the oscillator. The design frequency is 50 Hz (for normal AC mains of 220-240 V). Choosing C1 to be 0.1µF, R5 is obtained as 236 KΩ (STMicroelectronics, 2000).

**Capacitor Selection**

Two types of capacitors are popular in switched-capacitor (SC) DC-AC converter applications integrated capacitors and external ceramic capacitors. The integrated capacitors are convenient for low power applications as they help create an ultra-compact final product. However, due to the higher power level in the project, ceramic capacitors were chosen. The selection of capacitors depends on both the capacitance and the output ripple current. Unlike other multilevel inverter topologies, such as flying capacitor multilevel inverters, in which the capacitor for the various levels have to be calculated separately, the multilevel capacitor (MC) converter is modular in nature and allows for the use of capacitors of the same value in each module. The electrolytic capacitor used in each module is rated 1µF, 300V while the output capacitor is rated 1000µF, 300V. The reason for choosing an output capacitor of large capacitance value was to achieve a smooth Constant DC voltage desired to be fed to the inverter stage.

**Switching Stage**

The selection of metal oxide semi-conduction transistor (MOSFET) was determined by the current requirements and the voltage ratings as well as closely comparing their radio data system RDS (on), power dissipation and switching characteristics. Lower voltages ratings and higher current capabilities tend to drive down the conduction losses through reduced RDS (on) values. Also, the device must be rated above the maximum output voltage of the converter. This MOSFET is 10A, 400V and 125W. The MOSFETs is connected to the primary winding of the inverter transformer, when these MOSFETs receive the Metal oxide semiconductor (MOS) drive signal from the driver section, they start switching on/off at the speed of 50Hz, this switching of MOSFETs starts an alternating current with frequency of 50Hz at the primary winding of the inverter transformer and the inverter transformer step it up to 220v AC. This is being sent to the output socket through a changeover relay. Number of MOSFETs can be determined by knowing MOSFETs the power rating, current and voltage that is intended for use. The wattage of the rated inverter by dividing the watt of the inverter over the MOSFETs watt was taken into consideration i.e.IRF740 has 125W, for a 1.5kVA inverter the required number of MOSFETs will be;

$$Numbers \cdot of \cdot mosfets = \frac{1500}{125} = 12$$

The required number of MOSFETs used in this construction will be 12 for the switching stage.
Table 2 shows the datasheet of the IRF740 MOSFET used.

**Table 2:** The specification of the MOSFET

| Parameter | Rating |
|---|---|
| Temperature | 100$^0$ C |
| Voltage | 400V |
| Current | 10A |
| Power | 125W |

**The battery charger**

When the inverter section receives AC mains supply, it stops operation while the charger section in the inverter starts its operation. In this mode, the inverter transformer works as a step-down-down transformer and output 12V at its secondary winding. During the charging, MOSFET transistors at the output section work as rectifier with the drain working as the cathode while the source works as the anode. The center-tapping of the transformer receives a positive supply and the MOSFET source 'S' receives a negative supply from the battery. The center-tapping is connected to the positive terminal of the battery and the MOSFET source S is connected to the negative terminal with a shunt resistance. Thus, when the inverter receives AC mains supply inverter transformer and MOSFET together work as a charger to charge the battery.

**Relay Switch**
A relay is a mechanical switch that uses low electrical power to control a high one. It is a switch that is operated by magnetic force. The inverter has the facility to alternate between mains and battery such that when there is supply from power holding companies, the two batteries will be charged and the moment the mains supply is off, the inverter will invert the Dc supply from the battery to storage.

**The Load**
The load profile of the mini ICT centre is show in Table 3.

**Table 3:** Load profile of the mini ICT centre

| Items | Estimated Power Rating Per Unit | Units | Power Consumption |
|---|---|---|---|
| Computer unit | 100W | 3 | 300W |
| Printer | 500W | 1 | 500W |
| Miscellaneous components/accessories | Lot | | 300W |

The load is rated 1500VA. The power factor of a watt to VA inverters is approximately 0.8. Therefore the power output is obtained as 1500×0.8 = 1200W.

**Design of the Transformer**
A centre-tapped step-up transformer was used. The step-up transformer is specially designed for the project. It is slightly rated above 1.5kVA to withstand power surge and the primary coil is powered by a 12V battery source. The process of conversion of DC to AC is based on the phenomenon of Electromagnetic induction.
Electromagnetic induction is the generation of Electric potential difference in a conductor when it is exposed to a varying magnetic field. A system with two coils and a DC is passed through one of the coils (primary coil) that coil with DC act along to the magnetic since Electric current produces the magnetic field.
If the direction of the current is reversed frequently, the alternating magnetic field will induce AC in the secondary coil. Moreover, the secondary coil is designed concerning the maximum current [4.8A] expected to flow through the load. The two coils are usually constructed with a ratio that is determined by the intended voltages across them using the mathematical relationship between the coils of the step-up transformer.

$$\frac{V_p}{V_S} = \frac{I_s}{I_p} = \frac{N_p}{N_S}$$

Where $V_p$ = voltage across the primary coil = 12V
$V_S$ = voltage across the secondary coil 240V
$I_s$ = current across the secondary coil 6.8A
$I_p$ = current across the primary coil
$N_S$ = number of turns of the secondary coil usually 30
$N_p$ = number of turns of the primary coil

Using the above equation

$$\frac{V_p}{V_S} = \frac{I_s}{I_p}$$

$$\frac{12}{220} = \frac{6.8}{I_P}$$

$$I_P = \frac{1496}{12} = 125A$$

Conventionally the primary turns of low power [solar] inverter is usually 30, hence the number of turn in the secondary coil is

$$\frac{6.8}{125} = \frac{30}{N_P}$$

$$N_P = \frac{3750}{6.8} = 551 Turns$$

**Sizing of the panel and battery bank**
With the assumption that the mini ICT centre will operate from 8:00 am to 4:00 pm at a 1200w, that is 1200 *8 = 9600 WH. We assume a 24V system. Why not 12V? We choose 24Vbecause 24V has a better efficiency and then, the current draw is minimal. So using a 24V for energy demand of 9600WH equals 400AH. This corresponds to four units of 200AH batteries.
To estimate the amount of solar panels needed. We estimate the solar system that will generate 9600wh in 5hrs. Five hours is the average insolation time for Nigeria. Bearing in mind that there will be losses. This loss is estimated at 35%. Loss due to wires, cables and weather (sunlight itself causes degradation). Adding 35% to 9600WH as the energy that should be generated daily. That is 12960WH. Thus, the panels should be able to generate 12960WH per day to ensure we have 9600wh guaranteed. 12600WH / 5hrs of sun is 2592W, approximately 2600W. However, for practical purpose, 2500W is chosen because we can easily make use of 10 units of 250W panels in designing the system.

## Circuit diagram of the solar inverter system

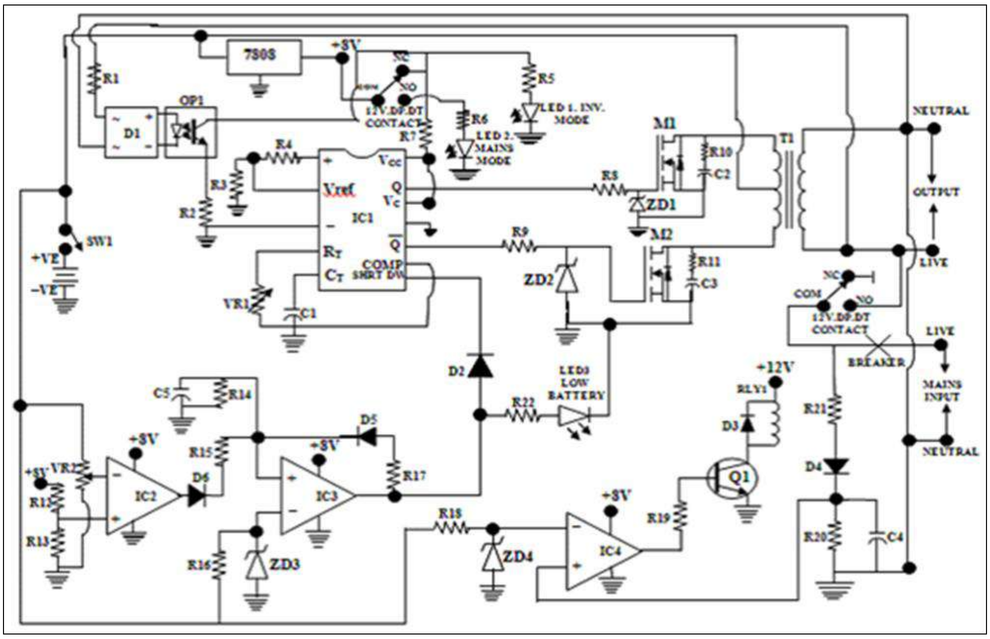


**Fig 6:** Circuit diagram of the power inverter system. (Sourced from Onyechekwa, 2015).

The inverter operates by performing two functions, firstly it converts the incoming Dc from the feed battery to Ac using a pair of powerful MOSFETS. Then, it steps up the resulting AC into equivalent mains voltage with a corresponding frequency 50Hz. DC to AC period of oscillation is 20ms. The 12 MOSFETs are divided into two pairs of 6 components each. One pair acts as positive and the other pair acts as negative. Each pair switches for 10ms positive and negative. When the 12VDc from the charge controller enters into the MOSFETs, the MOSFETs begin to alternate between the positive and negative path, producing a kind of pulse width output. The continuous switching action by the MOSFETs produces an Ac voltage of pure sine wave which is then fed to the primary windings of the step-up transformer and 240V is obtained at the secondary winding. This is tapped out through the socket.

### Implementation and Results
### Implementation Stage
### Steps Taken During the Construction

- The first step we took during the construction process was the designing of the inverter casing, shown in Figure 8 (metal casing of gauge 12 was chosen) having a length of 30cm and width of 15cm. The metal was bent into shape and size suitable to accommodate the circuit and to allow ventilation and improve the heat sink. And we proceeded to learn the theoretical part behind inverter and the working principles.

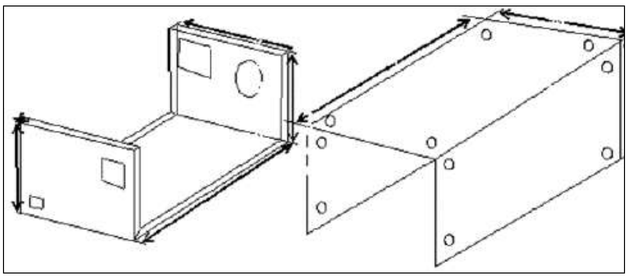

**Fig 8:** The inverter casing

- The next step that followed was the construction of a step-up transformer which is slightly rated above 1.5kVA to withstand power surge. We wound the transformer primary and secondary windings respectively, for the primary winding we used twenty (20) gauge wire while the secondary winding we used 14 gauge, this is because the system is hybrid charging with both solar and the power holding companies. Cardboard was used for the former of the transformer to provide shape for the wire to wound around it.

- The oscillating stage, shown in Figure 9 was designed using SG3524 which brings out modified sine wave through the inverter ON\OFF switch. The MOSFET was tested with the use of multi-tester to check the condition of the component before using. Twelve MOSFETs were connected in series. Capacitors (both polarized and non-polarized capacitors) were used for this stage likewise resistors, relay and Zener diode with valves of 4.6v.

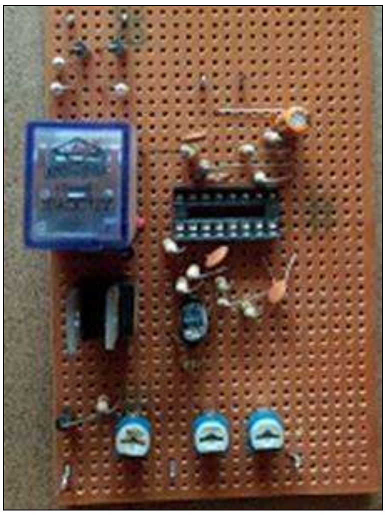

**Fig 9:** Constructed oscillation stage

- The switching stage was constructed using six (6) field-effect transistors which were connected in parallel. Aluminium was divided to hold the MOSFET and it will absorb the heat generated by the MOSFET. The MOSFET consist of three terminals namely; Gate, Drain and Source. The gate terminal was interconnected with the source and drain terminals and the gate terminals were connected with a shunt resistor; the Gate terminal was connected with to the secondary side of the transformer.
- Construction of a protective device, the AC input to this device was fused with 5A fuse to protect the transformer as well as the rectifying circuit in case of overvoltage and high current.
- Indicator lights were connected in front of the inverter, a red light shows that the inverter is charging, the green light indicates that the inverter is discharging and the yellow light shows that the inverter is delaying.
- Construction of switch, which is used to energize the inverter

After all these component and materials were gathered together, we proceed to the connection of various sections and stages involved in the inverter circuit.

The finished work is shown below in Figure 10 and other components were bought i.e. the solar module (panel), deep cycle battery and the charge controller.

**Fig 10:** Internal circuitry of the power inverter

## Conclusion

A 1.5kVA power inverter was designed and constructed to complement the power supply, utility provider for a mini ICT centre. Various tests were carried out and the result obtained showed that the inverter system achieved its aims and objectives. Despite the achievement of this project, further work is possible to increase the efficiency of the inverter while reducing the cost. These include. Pulse width modulation using micro-controller could be implemented to produce a pure sinusoidal output instead of a pair of MOSFETs.

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