DESIGN AND CONSTRUCTION OF A DC TO AC POWER INVERTER SYSTEM

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SUPERVISED BY ……

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DEDICATION

This work is dedicated to God almighty

CERTIFICATION

This is to certify that the project **titled "Design and construction of a DC to AC power inverter system"** carried out by Ekpede Ebikewenimo Mien, Nelson Ayibabaraemi Joseph, Victor Godwin Edugo, and Godgift Onyemechi Joseph has been read and approved for the Award of National Diploma In Electrical /Electronic Engineering Technology Of Bayelsa State Polytechnic, Aleibiri, Bayelsa State. Nigeria.

Project supervisor …….

Name Signature and Date

Head of Department ……

Name Signature and Date

External examiner……

Name Signature and Date

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We would like to thank God Almighty for his grace, our Lecturers for giving us the knowledge and advice to finish this project with ease and also to our loving parents who are always there for financial support and they were the ones who showered us with encouragement in other for us to really do our best on this project without these people this project wouldn't be successful or possible.

ABSTRACT

This project is titled the design and construction of a DC to AC power inverter system. It is designed to meet up with the power demand in the offices and in homes in the absence of power supply from the national supply authority, National Grid. In order words the device / item serves as a substitute for National Grid which almost monopolies the power supply to people.

It is designed in such a way that it will take up 12v DC from battery and inverts it to an output of 220v, 50HZ AC. It makes no noise during operation and no hazardous carbon monoxide is generated in the surrounding.

This is a feature that makes it safe to use anywhere when compared to generator. Also, the circuit is capable of charging the battery (i.e 12v source) when the power from the supply authority is on. This greatly reduces the cost of operation of the system.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF THE PROJECT

A power inverter is a device that converts DC power (also known as direct current), to standard AC power (alternating current). Inverters are used to operate electrical equipment from the power produced by a car or boat battery or renewable energy sources, like solar panels or wind turbines. DC power is what batteries store, while AC power is what most electrical appliances need to run so an inverter is necessary to convert the power into a usable form. For example, when a cell phone is plugged into a car cigarette lighter to recharge, it supplies DC power; this must be converted to the required AC power by a power inverter to charge the phone.

In modified sine wave, The waveform in commercially available modified-sine-wave inverters is a square wave with a pause before the polarity transition, which only needs to cycle through a three-position switch that outputs forward, off, and reverse output at the pre-determined frequency. The peak voltage to RMS voltage does not maintain the same relationship as for a sine wave. The DC bus voltage may be actively regulated or the "on" and "off" times can be modified to maintain the same RMS value output up to the DC bus voltage to compensate for DC bus voltage variation.

The ratio of on to off time can be adjusted to vary the RMS voltage while maintaining a constant frequency with a technique called PWM. Harmonic spectrum in the output depends on the width of the pulses and the modulation frequency. When operating induction motors, voltage harmonics is not of great

concern, however harmonic distortion in the current waveform introduces additional heating, and can produce pulsating torques.

Most AC motors will run on MSW inverters with an efficiency reduction of about 20% due to the harmonic content.

1.2 PROBLEM STATEMENT

This particular device can only be powered with 12v battery and can comfortably use for light appliance not for appliances with heating element such as electric iron or electric water.

1.3 AIM OF THE PROJECT

The aim of this project is to design and construct a power inverter system that converts DC – AC.

1.4 OBJECTIVE OF THE PROJECT

The objective of this project is to design and construct a modified sine wave inverter which is rated 1.5KW which can be powered from the source of 12V battery.

1.5 SIGNIFICANCE OF THE PROJECT

With these device, electrical appliances can be powered with 12v DC from battery and inverts it to an output of 220v, 50HZ AC.

It makes no noise during operation and no hazardous carbon monoxide is generated in the surrounding.

The battery can be recharged when it is been used up using ac source or solar panel.

1.6 SCOPE OF THE PROJECT

A power inverter is a power conversion device. It converts conversion device. It converts fixed direct current (DC) voltage to frequency sinusoidal alternating current (AC) voltage output

Power inverters are used to power and control the speed, torque, acceleration, deceleration and direction of the motion.

The use of inverter has become prevalent in wide range of industrial applications from motion control applications to ventilation systems waste water processing facilities to marching areas and many others.

Through power inverters offer lower operating costs and higher efficiency, they are not without their problems.

CHAPTER 2

LITERATURE REVIEW

2.1 HISTORICAL BACKGROUND OF WORK

David Prince probably coined the term inverter. It is unlikely that any living person can now establish with certainty that Prince (or anyone else) was the originator of this commonly used engineering term. However in 1925 Prince did publish an article in the GE Review (vol.28, no.10, p.676-81) cited "The Inverter". His article contains nearly all important elements required by modern inverters and is the earliest such publication to use that term in the open literature. Prince explained that an inverter is used to convert direct current into single or poly phase alternating current. The article explains how: "the author took the rectifier circuit and inverted it, turning in direct current at one end and drawing out alternating current at the other". Subsequent development of the inverter is discussed as are rectifier devices.

2.2 REVIEW OF DIFFERENT TYPES OF INVERTER

2.2.1 Digital Inverters

Binary communication consists of ones and zeros. A digital inverter is a basic building block of many binary devices. It simply takes a zero or one as input and returns a one or zero, respectively, as output.

2.2.2 Modified Sine Wave

Inverters convert DC power (steady positive voltage) to AC power (voltage that alternates positive and negative as a sine wave). They do this by rapidly flipping the DC power, positive to negative and back again. However, the resulting

waveform usually comes out box-shaped. rather than a smooth sine wave curve, which is why some inverters are called “modified” sine wave inverters.

2.2.3 Pure Sine Wave

“Pure” sine wave inverters implement complicated and expensive technology to produce a smooth sine wave output. The smooth power provided is better suited to higher-end electrical appliances than is the output from a modified sine wave inverter.

2.3 REVIEW OF INVERTER CAPACITY.

The power backup solutions are popularly known as Power inverter or inverter in India. Choosing the right inverter and battery are the critical decision factors in building the right power backup solution. In this article, we discuss in choosing the right type of battery and right capacity or size. Try the Inverter selector to choose right inverter by answering simple questions without reading any buying guide.

The three main components of the power backup solution are

Power grid to charge battery

Inverter battery to store DC current

Inverter

Inverter buying guide

Power grid is default and electricity connection at your home. The power from the power grid recharge the battery. At the event of power cut the battery DC current needs to be converted to AC current with the help of Inverter. But in general the total power backup solution is called as inverter in India. We discuss the inverter and battery buying guides in two different sections as elaborately as possible.

CHAPTER 3

3.1 CIRCUIT DIAGRAM

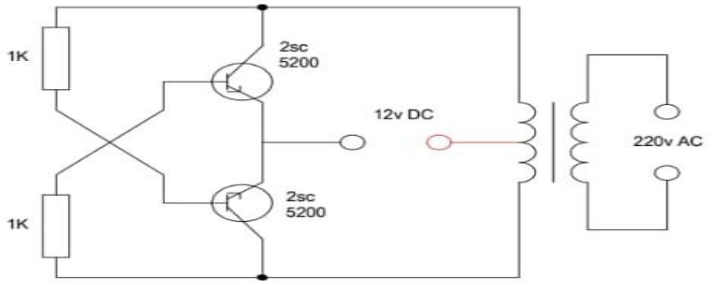

Fig 3.1

3.2 MATERIALS AND METHODS

Description of components used

3.2.1 Battery: The power input for the inverter circuit is from the 12V rechargeable battery. When 12V rechargeable battery supply is fed to the control circuit through the relay, then the input power to the circuit will be ON. The transistor(TR3) from the circuit with the Light Emitting Diode (LED) display whether the power from the rechargeable battery to the relax is pass through to circuit or not. If the power is passing through the circuit, the zener diode of 5.1V will apply to turn on the transistor CRR3 and then pass through and turn ON the lamp

3.2.2. Capacitor: A capacitor is an electronic component that stores and releases electricity in a circuit. It also passes alternating current without passing direct current. A capacitor is an indispensible part of electronic equipment and is thus almost invariably used in an electronic circuit. In a power inverter, a DC link capacitor is placed in parallel with the input to minimize the effects of voltage

variations as the load changes. The DC link capacitor also provides a low-impedance path for ripple currents generated by power switching circuits.

3.2.3. Adoptable Box: Plastic Adaptable Boxes are found in various electrical applications including enclosing wiring junctions as well as terminating lengths of cable using the adaptable junction box in conjunction with Armoured Cable Glands. It can also be used for surface mounting, within ceilings and underneath flooring in domestic and commercial buildings alike. Top Quality Wiska boxes come with connectors built inside to made your outside connections even easier. Depending on size, they can also be used to hold sockets and switches, giving them further protection and security. All the adaptable boxes we stock and supply are made from a hard-wearing, quality plastic that can withstand chemicals and mechanical damage alike. Its used in this project as a frame , packaging material for the inverter components.

3.2.4. Wire/Cables: A wire is a long thin piece of metal that is used to fasten things or to carry electric current. ... If you wire something such as a building or piece of equipment, you put wires inside it so that electricity or signals can pass into or through it.

3.2.5. Switch: In electrical engineering, a switch is an electrical component that can disconnect or connect the conducting path in an electrical circuit, interrupting the electric current or diverting it from one conductor to another.

3.2.6 Socket: Electrical sockets or outlets allow us to plug in appliances to attach them to the electrical grid and provide power for them to run. ... There are socket testers you can buy to make sure the polarity and power to a socket is what it should be.

3.2.7. How to choose a right inverter battery

Step 1: Identify Your Power Requirements. Do not get baffled by the word 'Identify'. ...

Step 2: Check the VA Rating of the Inverter. ...

VA = Power Requirement/Power Factor. ...

Step 3: Get an Appropriate Battery for the Inverter.

3.3 CONSTRUCTION

AC electrical power supply can be used in most electronic devices. It will be difficult to use these devices when power goes off. This problem can be solved by the use of an inverter. The function of inverter is to change DC input voltage to a symmetrical AC output voltage of desired magnitude and frequency. There are various kind of watt in the inverter according to P=VI. Watt is dependent on the current. The traditional inverter have transformer within them that synchronizes the voltage of the charging source and appliances. The transformer is used to step up the generated voltage to the voltage required for use in appliances. There are various types of inverters, and they are classified according to the No. of the phases. Use of power of semiconductor devices, communication principles and output waveforms. We will first look single phase inverter. Secondly, we will discuss voltage source inverter(VSI) and current source inverter(CSI).Inverters are used for different industrial applications including the speed control of induction and synchronous motors, induction heating, aircraft power supplies, uninterruptible power supplies(UPS) and high voltage DC transmission. Town and countries which have no sufficient light use inverters. So, we study inverter and then we can

know electrical and electronic knowledge. But here, we made use of battery and capacitors as two main active components.

3.4 PRINCIPAL OPERATION OF THE INVERTER.

An inverter is an electrical device, and it is capable of changing a DC current to an AC current at a given frequency as well as voltage. For instance, if we want to provide power supply to home appliances then it will use 230V AC. In some cases, when the AC power is not available then power supply can be provided to the home appliances through a 12V inverter. Inverters are applicable for PV systems to provide the supply to the electrical devices in mountain huts, isolated houses, boats, camper vans, etc. The working of an inverter is, that it converts DC to AC, and these devices never generate any kind of power because the power is generated by the DC source. In some situations like when the DC voltage is low then we cannot use the low DC voltage in a home appliance. So due to this reason, an inverter can be used whenever we utilize solar power panel.

CHAPTER 4

DESIGN ANALYSIS AND CONSTRUCTION

4.1 SYSTEM DESIGN PARAMETERS

This chapter expanciate on each stage of the constructed work seen in chapter (3) which deals with gathering of various materials for each stage.

The material was assembled with the aid of circuit diagram. The case of the inverter is built with plyboard of high thickness.

Since the project work deals with the construction of inverter, the various steps/procedures on how this was achieves would be discussed under this chapter which includes;

1. Dimensioning
2. Creation of holes for the fittings
3. Connection of the parameters.

4.2 DIMENSIONING: is the process of measuring either the area or the volume that an object occupies. It can be seen as the method of calculating capacity for the storage, handling, transporting and invoicing of goods. But in this project just the plyboard that was dimensioned because of the material used, and equally the capacity and safety of the materials was considered during dimensioning. The purpose of dimensioning is to provide a clear and complete set of dimensions that will permit only one interpretation needed to construct the path ways that will follow guidelines during dimensioning such as:

(a) Accuracy (b) neatness

4.3 CREATION OF HOLES: holes were created in order to file in the components like the output source and load. Drilling machine was used to create the hole on both sides of the plyboard. This is done to maintain neatness.

SPECIFICATIONS

Plywood = 0.986m thickness

Battery = 12 volts

Capacitor = 2.5uf 450 volts

Cable = 1.5mm flexible wire

Table 4 bill of engineering measurement and evaluation (BEME)

05/12/2021

S/N	MATERIAL USED	QTY	UNIT PRICE (₦)	TOTAL PRICE (₦)
1.	Plyboard	30cmx 4	3000	3000
2.	Wire	4 yards	100	400
3.	Screw nails	10	10	100
4.	13 amp socket	1	400	400
5.	Lampholder	1	150	150
6.	Battery (12v)	1	10000	10000
7.	Capacitor	3	1500	4500
8.	Miscellaneous		4000	4000
	TOTAL			22,550

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 CONCLUSION

This section of the project report forms the concluding part of the project report and takes a look at some problems entertained during the progressive construction of the system.

The basic objective of this project were partially realized, the inverter is more environmentally friendly, easy to operate and required very little maintenance compared to generator of any kind

Though this project is efficient and reliable, but it has some limitations.

1. It drains faster because of the capacitors involved
2. It can only be used for less than 240volts as proposed

5.2 RECOMMENDATION

After the completion of this project work, the following recommendation are necessary to achieve a higher and more efficient inverter

1. More research work should be done on the area of the energy source in windmill and solar
2. Electrolytic capacitor with higher specification should be use to get actual and more efficient reliable inverter