MOSFET TECHNOLOGY BASED MICRO INVERTER

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Abstract: Design a low cost inverter circuit using MOSFET's motivated by the growing demand due to frequent power shortages. The circuit constructed from resistors, capacitors, and N-channel MOSFETs. It works in 3stages: Astable Multivibrator, Oscillatory circuit, and Step up of the voltage. Higher voltage rating can be achieved by enhancing the stage of oscillation. This is cheap, clean, very conductive, sailent in operation and very reliable source of power supply. Inverter can be used with DC battery as an alternative source of energy source in case of power failures and energy crisis.

Keywords:

MOSFET	Metal Oxide Semiconductor Field Effect Transistor
AC	Alternating Current
PVC	Photo-Voltaic Cells
DC	Direct Current
PWM	Pulse-Width Modulation

I.INTRODUCTION

This project emphasis on DC to AC power inverters aimed at inexpensively transforming a DC power source into a high voltage AC output comparable to a power that would be accessible at an electrical wall outlet. Inverters are used in many applications where low voltage DC sources such as batteries, solar panels or fuel cells must be converted, so that devices can runoff of AC power.

Low voltage DC conversion is completed in two stages. The first being the conversion of the low voltage DC power to a high voltage DC source and consequently converting the high voltage DC source to an AC wave form using pulse-width modulation then using a transformer to boost the voltage to 240V. This project is concentrated on second method and specifically transforming a low

DC source into an AC output.

This can reduce family spending on energy utilization because of its non-fuel consumption, low price and maintenance cost as compared to other source of power supplies within local market and international. In addition for large scale power production the study can be incorporated with solar energy to provide energy to very distant and rural communities particularly in our part of the world where these alternative source of energy are abundant.

In addition power inverter is an electrical appliance that can be used with DC source as an alternative source of energy supply in the event of power failures and energy crisis. It is cheap, clean, very contusive and silent when in operation and very reliable source of power supply as to generator. Modern research and technologies has shown that inverter is the cheapest source of energy.

This development seeks the use inverter with DC source and the standard are safety precaution governing the using of appliances for constant operation and safety of electrical and electronic appliances.

In the world today, there are currently two forms of electrical power transmission; DC and AC with each having its own advantages and disadvantages. DC power is simply the application of a steady constant voltage across a circuit resulting in a constant current. A battery is the most common source of DC transmission as current flows from one end of a circuit to the other. Most digital circuitry today is run off of DC power as it carries the ability to provide either a constant high or low voltage enabling digital logic to process code execution.

Power loss can be derived from electrical current squared and the resistance of transmission line. When the voltage is increased, the current decrease and concurrently the power loss decreases exponentially therefore high voltage transmission reduce power losses. For this reasoning electricity was generated at power stations and delivered to homes and businesses through AC power. AC, unlike DC oscillates between two voltage values at specified frequency and it's ever changing current and voltages makes it easy step up or step down the voltage. For high voltage and long distance transmission situations all that is needed is a transformer. The transformer made long distance electrical transmission possible using AC power supply.

Inverter and Applications

Power inverters are devices which can convert electrical energy of a DC form into that of AC. They come in all kind of shapes and sizes from low power functions such as powering a car radio to that of backing up a home in case of power outage. Inverters can come in many different varieties, differing in price, power efficiency and purpose. The purpose of a DC/AC power inverter is typically to take DC power supplied by a battery, such as a 12V car battery and transform it into a 240V AC power source generating at 50Hz, emulating the power available at an ordinary household electrical outlet. 600W Pure Sine Wave Inverter .Power inverters are used today for many tasks like powering appliances in a car such as cell phones, radios and TVs. They also come in handy for consumers who own camping vehicles, boats and at construction sites where electric grid may not be accessible.

The modified and pure sine wave power inverters differs in their outputs providing varying levels of efficiency and distortion that can affect electronic devices in different ways. The modified sine wave inverter provides a cheap and easy solution to powering devices that need AC power. It does have some drawbacks as not all devices work properly on a modified sine wave, products such as computers and medical equipment are not resistant to the distortion of the signal and must be run off of a pure sine wave power source.

II.MATERIALS

Resistor (1k, 18k, 100Ohms),Capacitor, Diodes, Zener diode, Switch, Integrated Circuit ,Transformer (220V)
Astable multivibrator ,Two NPN Transistors, Light Emitting Diode
Circuit board and crocodile clips. ,Transformer (220V)

2.1 Multivibrator:

Multivibrators are a class of electronic switching devices which depend on their operation or regenerating. They are also called relaxation oscillators hence generate non-sinusoidal waveforms by gradually charging a resistor.

2.2 Astable multivibrator:

Astable multivibrators are multivibrators that have two quansistable states with time intervals determine by external components. It operates continuously to provide rectangular waveform with particular values of pulse repetitive frequencies and its operating frequency is set to 50Hz.

2.3 Light Emitting Diodes (LEDs):

The Light Emitting Diodes (LED_s) is a forward biased P-N junction which emits visible light when energized. The colour of light emitted depends on the material and for example, emits infrared radiation or invisible light, emits red or green light and emit red or yellow radiation or amber light. To choose LEDs for a particular application, one or more of the following points have to be considered; wavelength of light emitted the required input power efficiency, turn-on and turn-off time of the switching devices, circuit construction, light intensity, brightness, among others. The uses of LEDs include. They are also used in image sensing circuits. LEDs are used for numeric displays in hand-held portals.

2.4 Resistors:

Resistors are used in the circuits to limit current, set bias levels, control gain in switching components, fixing time constant, impedance matching and loading, voltage division and sometimes heat generation. Resistors used in the circuit (1k, 18k, 100 ohms)

2.5 Capacitor:

The capacitor in figure 10 is use in the circuit to store charges as element of frequency selectivity circuits and filters for coupling AC signals from one circuit to another and for shunting unwanted signals to ground (decoupling).

2.6 NPN – Transistors:

The transistor is used as a detector or a switch. The operation of the transistor in the control circuit of the power inverter consists of current in the high resistance direction through one collector via the low-resistance direction in the emitter and the base or ohmic contact.

2.7 Transformer:

Transformer is an electrical device that is used to either step down or step-up alternating voltage. It consists of a primary coil connected to the input power supply, and a secondary coil connected to the load. The transformer used in this project is 12V centre tapped connected to the circuit to produce an output voltage of 220V. For this project the transformer is used as step-up transformer in the circuit.

2.8 Battery:

There are primary and secondary batteries. Secondary batteries use renewable power systems where as primary batteries allow the chemical process that provide the electrical energy to occur once and then it is discharged.

III.METHOD

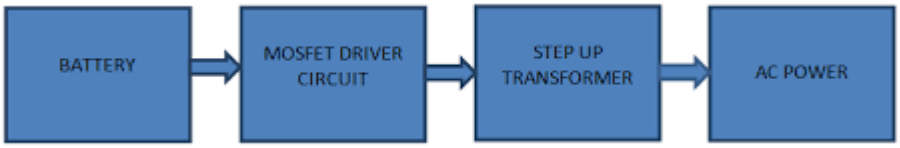

Fig 3.1 Block Diagram Of Inverter

The various components were carefully selected; and the end connections of the components were cleaned with sand paper. Transistor Q_1 was inserted into a heat sink where its collector is connected to the negative s terminal of the capacitor C_1, and the positive end connection or terminal of the same capacitor is connected to resistor R4.The output of resistor R_4 was connected to the transistor Q_2 then, the collector of the transistor Q_2 was also connected to the negative end connection of the capacitor C_2 and the positive end connection of the capacitor C_2 was connected to resistor R_3. The output of R_3 was connected to the base of transistor Q1, and then the emitter of both transistors was grounded. The output of both transistors was connected to the primary side of the transformer. The centre tapped of the transformer was looped to the input voltage as well as the negative end connection of the diodes (D1, D2). The positive terminal of diode D_2 was connected to one of the terminals of resistor R_1 and the other terminal to the output of transistor Q_1. Also the positive terminal of diode D_1 was connected to one side of Resistor R3 terminal and the other side of the terminal to the output of transistor Q_2. The two resistors (R_3, R_4) were connected to the input source which looped the centre tapped transformer and finally the 24VAC output voltage can be taken from the secondary side of the transformer.

IV. RESUT AND ANALYSIS

4.1 Circuit Operation:

The circuit operation would be easy to understand if it is remembered that due to feedback (i) when Q_1 is ON, Q_2 is OFF and (ii) when Q_2 is ON, Q_1 is OFF. When the power is switched on by closing S, one of the transistors will start conducting before the other does (or slightly faster than the other) it is so because characteristics of no two seemingly similar transistors can be exactly alike. Supposes that Q_1 starts conducting before Q_2 does, a feedback system is such that Q_1 will be very rapidly driven to saturation and Q_2 to cut-off.

Since Q_1 is in saturation, whole of Vcc drops across $R_{L1.}$ Hence, V_{C1} =0 and point A is at zero or ground potential. Since Q_2 is cut-off that is, it conducts no current, there is no drop across R_{L2} hence point B is at V_{cc}. Since A is at OV, C2 starts to charge through R_2 towards V_{CC}. When voltage across C_2 rises sufficiently (that is more than (O.7V), it biases Q_2 in the forward direction so that it starts conducting and is soon driven to saturation.V_{C2} decreases and becomes almost zero when Q_2 gets saturated. The potential of point B decreases from V_{CC} to almost 0V.This potential decrease (negative swing) is applied to the base of Q_1 through $C_{1.}$ Consequently, Q_1 is pulled out of saturation and is soon driven to cut-off. Since, now, point B is at 0V, C_1 starts charging throughR_1 towards the target voltage V_{cc}.When voltage of C_1increases sufficiently, Q1 becomes forward biased and starts conducting. In this way, the whole cycle is repeated. It is seen that the circuit alternates between a state in which Q_1 is ON and Q_2 is OFF and vice versa. The time in each state depends on RC values. Since each transistor is driven alternately into saturation and cut-off the voltage waveform at either collector (point A and B in peak amplitude equal to V_{cc})

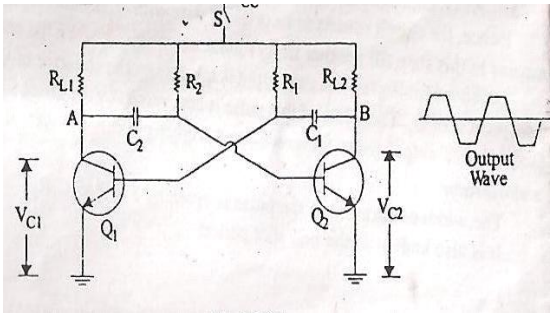

Fig 4.1: circuit Diagram

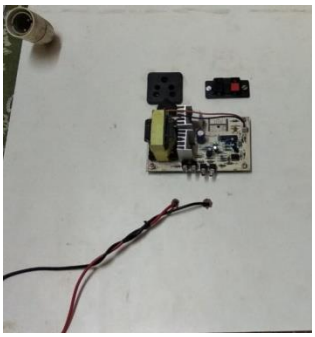

Fig4.2 Prototype Model

4.2 Switching times:

It can be proved that off-time for Q_1, is $T_1 = 0.69R_1C_1$and that for Q_2 is $T_2 = 0.69R_2C_2$Hence total time-period of the wave is, $T= T_1 + T_2=0.69 (R_1C_1+R_2C_2)$If R1 = R_2=R and $C_1=C_2$=C that is the two stages are symmetrical, then T=1.38 RC

RECOMMENDATIONS

After careful collection, observation and analysis of data gathered from the research, it is recommended that; More research should be made into power inverter systems design as a more cost-effective means of electric power generation in our part of the world due to adverse climatic change which poses threat to the already available power supplies and care should also be taken in the installation, maintenance and usage of power inverter systems, extreme caution should be taken when handling batteries and electrolyte and final, for the constant unavailability of electronic components in the market, the School of Engineering should study

research proposals of students and made available the basic components for each academic year, the Electrical and Electronic Engineering Department should also put up a state of the art electrical and electronic laboratories to enable students to undertake their final projects and also have first hand information and usage of modern tools or gadgets.

CONCLUSION

In conclusion, the inverter was able to convert an input voltage of 12V DC source into an output voltage of 220V AC power supply and a frequency of 50Hz and it can now be use to power electrical appliances rated 200W depending on the capacity of the battery and can also reduce family spending on energy utilization because of its non-fuel consumption, low price and maintenance cost as compared to the other sources of power supply in the market but it cannot be used on three-phase machines, domestic appliances with voltages above 240V and below 220V, and devices with 60Hz frequency.

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