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Power Saving Smart Inverter

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Abstract- **Inverters are nothing but they serve as a backup power when electricity is shut down. This project focuses on DC to AC power inverters, which aims to efficiently transform a DC power source to a AC source, by minimizing some amount of transformer no load losses. The proposed system can save the energy by having a concept of no load shutdown.**

This project describes the nullification of no load losses in the transformer. The no-load loss is nullified with the help of continuity tester, which check whether the load is connected or not. Which means in the inverter mode, when no load is detected the system will cut off the inverter supply automatically. When the inverter is in off mode and if the user switches on any of the connected load, the system will identify the user requirement and will switch on the inverter automatically.

1. INTRODUCTION

An ideal transformer is the one which is 100% efficient. This means that the power supplied at the input terminal should be exactly equal to the power supplied at the output terminal, since efficiency can only be 100% if the output power is equal to the input power with zero energy losses. But in reality, nothing in this universe is ever ideal. Similarly, since the output power of a transformer is never exactly equal to the input power, due a number of electrical losses inside the core and windings of the transformer, so we never get to see a 100% efficient transformer.

Transformer is a static device, i.e. we do not get to see any movements in its parts, so no mechanical losses exist in the transformer and only electrical losses are observed. There are two primary types of electrical losses in the transformer, they are copper loss and iron loss. Other than these, some small amount of power losses in the form of 'stray losses' are also observed, which are produced due to the leakage of magnetic flux. No load loss is the loss in a transformer that is excited at rated voltage and frequency, but without a load connected to the secondary. No-load losses include core loss, dielectric loss, and copper loss in the winding due to exciting current.

2. METHODOLOGY

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. Typically, it encompasses concepts such as paradigm, theoretical model, phases, quantitative and qualitative techniques. Methodology is also a general research strategy that outlines the way in which research is to be undertaken and among other things, identifies the methods to be used in it.

2.1 WORKING OF THE SMART INVERTER

The basic operation of this inverter is to shut down when power is off and no load is connected to the system. When power is in on condition the inverter works normally, simultaneously charging the battery. When power goes off the micro controller AT89S52 checks for the load by the help of continuity tester and LDR circuit which is connected in series with the junction box, if the load is connected then the micro controller activates the inverter by the help of relay and if the load is not present then micro controller doesn't perform any task. If the load is removed all of a sudden when the inverter is in on condition then the current sensor doesn't sense any pulse hence no input will be fed to micro controller hence the inverter will be made off by deactivating the relay. Hence by this way the micro controller controls the inverter during load and no load condition.

Sl.NO	Main	Inverter	Load demand	Output
Case 1	ON	OFF	ON	ON
Case 2	OFF	OFF	OFF	OFF
Case 3	OFF	ON	ON	ON
Case 4	OFF	OFF	ON(constant load)	OFF
Case 5	OFF	ON	ON(constant load/night mode)	ON

Table 2.1: Different modes of working of the inverter

The different modes of working of the inverter is explained in the table 2.1, from this table we can understand the each cases and how the inverter behave according to the mains supply and load.

The following figure represents the block diagram of the smart inverter:

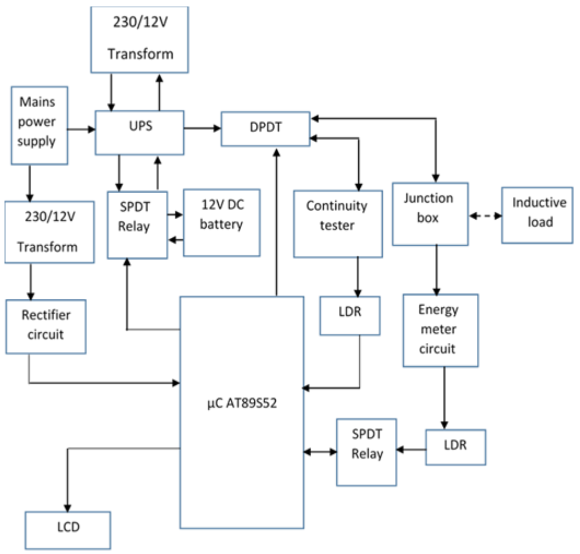

Fig.2.1: Block diagram of power saving smart inverter

The Fig.2.1 represents connections between different components and the microcontroller and also how the microcontroller are used to control the different relay and other components in this project.

3. CONSTITUENT ELEMENTS

An electronic component is any basic discrete device or physical entity in an electronic system used to affect electrons or their associated fields. Electronic components are mostly industrial products, available in a singular form and are not be confused with electrical elements, which are conceptual abstractions representing idealized electronic components. Electronic components have number of electrical terminals or leads .These leads connect to create an electronic circuit with a particular function.

3.1 REGULATED POWER SUPPLY

A regulated power supply is an embedded circuit, it converts unregulated AC into a constant DC. With the help of rectifier, it converts AC supply into DC. Its function is to supply a stable voltage (or less often current), to a circuit of device that must be operated within certain power supply limits.

Block diagram regulated power supply is shown below:

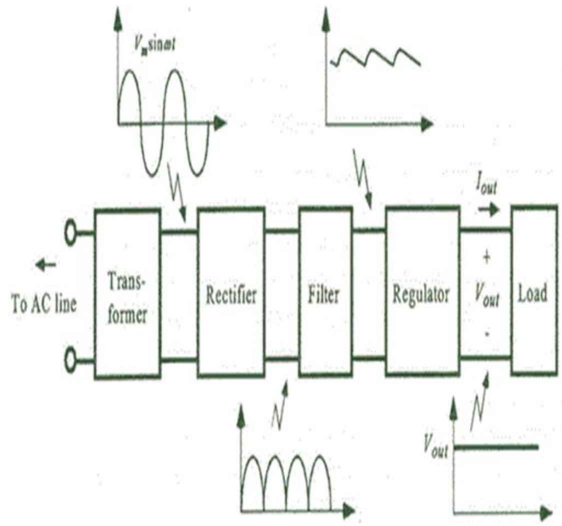

Fig.3.1: Block diagram of regulated power supply

3.2 DPDT (DOUBLE POLE DOUBLE THROW) RELAY

DPDT stands for double pole double throw relay. Relay is an electromagnetic device used to separate two circuits electrically and connect them magnetically. They are often used to interface an electronic circuit, which works at a low voltage to an electrical circuit which works at a high voltage. Relays are available in different configuration of operating voltages like 6V, 9V, 12V, 24V etc.

There are two sections input and output. The input section consists of a coil with two pins which are connected to the ground and the input signal. The output section consists of contactors which connect or disconnect mechanically. The output section consists of six contactors with two sets. Each set has three changeover contacts, namely, normally open (NO), normally closed (NC) and common (COM). When no supply is given the COM is connected to NC. When the operating voltage is applied the relay coil gets energized and the COM changes contact to NO.

DPDT relay can be used to power either one device/appliance or another. While SPDT relay can only switch the output circuit between on and off states; a DPDT relay can also be used to change the polarity at the terminals of a device connected at output. For example, to drive a DC motor in both clockwise and anticlockwise directions, following connections can be done. Pins 2 & 7 can be provided with Vcc (9V for motor) and ground, respectively. The first motor terminal can be connected to pins 3 & 4 while the other terminal to pins 5 & 6. In case no input signal is given, the motor would rotate in one direction (say clockwise, depending upon the connection of its terminals). When an input signal is provided, the contactors change their positions, resulting in the anticlockwise rotation of motor.

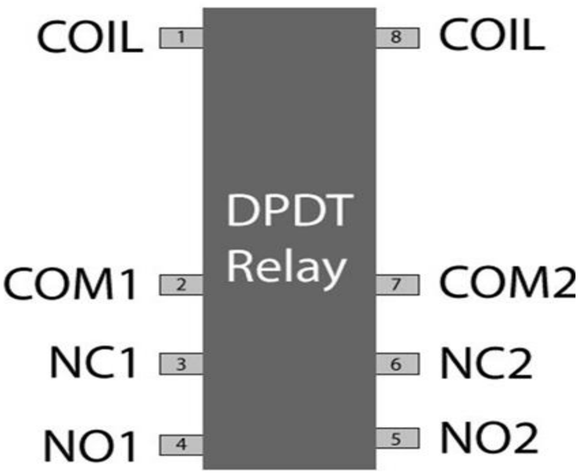

Fig.3.2: Pin diagram of DPDT relay

3.3 UNINTERRUPTED POWER SUPPLY (UPS)

The full form of the UPS is an uninterruptible power source or uninterruptible power supply. It is an electrical device, gives emergency power to various loads when the input power typically fails. A UPS fluctuates from an emergency power system in that it will deliver near-instantaneous safety from i/p power interruptions by providing energy stored in batteries, super capacitors. The run time of battery for most UPS is relatively short but enough to start a standby power source. The main purpose of a UPS is to provide a protection to the equipment's like computers, electrical equipment, computer and data centers when there is a power disruption. This device keeps a computer running for a few minutes after a power disruption and protects the data in the computer. In present days, there are various types of UPS systems coming with software component that enables you to automobile backup in case there is no power disruption when you are away from the computer.

The circuit diagram of the UPS is shown below, which shows how the batteries in the equipment's control during a power disruption. The input voltage of the primary winding of the transformer (TR1) is 240V. The secondary winding of the transformer (TR2) can be raised up to 15V if the value is at least 12V running 2 amps. The fuse is used to give the protection to the owl circuit from the short circuits. The electricity presence will cause the led1 to glow. Glows will set off upon power disruption and the battery of the UPS will take over. This circuit is designed to provide a more flexible pattern where it can be modified by using different batteries and regulators to offer regulated & unregulated voltages. Using two 12V batteries in series and a positive input of 7815 regulators, we can control a 15Volts supply.

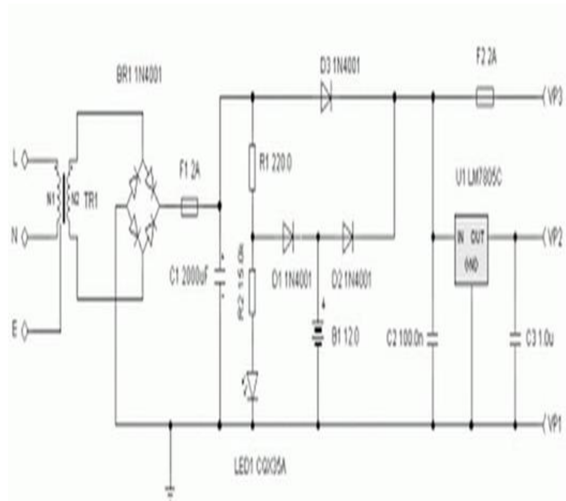

Fig.3.3: Uninterrupted power supply circuit diagram

3.4 MICROCONTROLLER 8051 – AT89S52

8051 is the name of a big family of Microcontrollers. The device which we use in our project is 'AT89S52' which is a typical 8051 Microcontroller manufactured by Atmel. A simpler architecture can be represented as below. The 89S52 has 4 different ports, each one having 8 Input/output lines providing a total of 32 I/O lines. Those ports can be used to output DATA and orders do other devices, or to read the state of a sensor, or a switch. Most of the ports of the 89S52 have 'dual function' meaning that they can be used for two different functions.

The first one is to perform input/output operations and the second one is used to implement special features of the Microcontroller like counting external pulses, interrupting the execution of the program according to external events, performing serial data transfer or connecting the chip to a computer to update the software. Each port has 8 pins, and will be treated from the software point of view as an 8-bit variable called 'register', each bit being connected to a different Input/output pin.

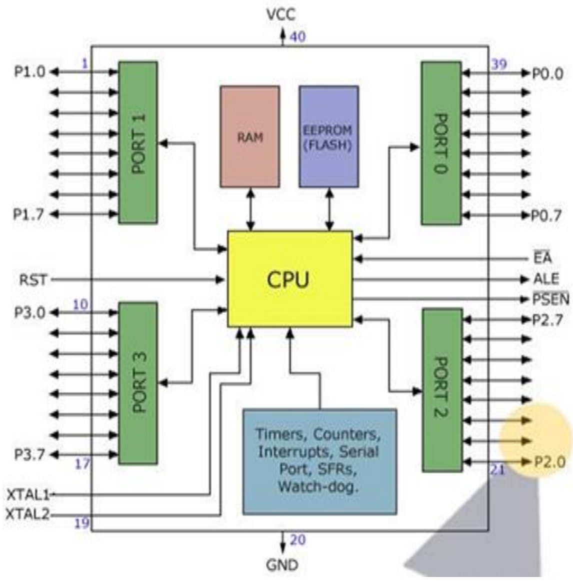

Fig.3.4: Block diagram of microcontroller 8051

3.5 CONTINUITY TESTER

A continuity tester can tell you whether electricity can flow through a cord. Electricity needs a continuous path or circuit in order to flow. It's like a two-lane road from point A to point B and back. If one or both lanes are blocked, traffic in this case, electricity–stops. A continuity tester is useful for checking cords and wires to make sure they can conduct electricity.

A continuity tester is an item of electrical test equipment used to determine if an electrical path can be established between two points that is if an electrical circuit can be made. The circuit under test is completely de-energized prior to connecting the apparatus. The tester consists of an indicator in series with a source of electrical power - normally a battery, terminating in two test leads. If a complete circuit is established between the test-leads, the indicator is activated. The indicator may be an electric light or a buzzer. This led to the term "buzzing out a circuit" (which means to test for continuity) Audible continuity buzzers or beepers are built into some models of millimeter, and the continuity setting is normally shared with the ohmmeter setting.

Fig.3.5: Continuity tester

A popular design has the tester combined with a standard flashlight. A phone connector or jack plug in the rear of the unit permits a set of test leads to be plugged in effecting a quick conversion between the two applications. For situations where continuity testing must be done on high resistance circuits, or where delicate conductors and sensitive components that might be damaged by excessive current are present, a low voltage, low current device must be used. These typically use an op-amp and watch batteries to drive an LED as an indicator. These testers can be exquisitely sensitive; for example, they will indicate if the test points are taken by both hands.

There are times when a simple continuity test fails to reveal the problem. For example, vibration-induced problems in automobile wiring can be extremely difficult to detect because a short or open is not maintained long enough for a standard tester to respond. In these applications a latching continuity tester is used. A more complex device, it detects intermittent opens and shorts as well as steady-state conditions. These devices contain a fast acting electronic switch (generally a Schmitt trigger) forming a gated a stable which detects and locks (latches) the indicator on an intermittent condition with duration of less than a millisecond.

4. CONCLUSION

The main goal of the project is that, it mainly focuses on DC to AC power inverters, which aim to efficiently transform a DC power source to a high voltage AC sources, by minimizing some amount of transformer losses. The proposed system can save the energy by having a concept of “no load shutdown”. This smart concept of “no load shutdown” and also auto detection of load switching can save transformer losses. As the discharging time is decreased, the battery life will increase.

Getting access to the information required especially online was a great challenge as many local companies do not have functional websites and many other obstacles came along the way like learning new software like embedded C.

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