An Iot Enabled Smart Inverter Using SPWM

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Abstract - An IOT is fast becoming a hot topic of conversation and vendors are quickly adding IOT enabled devices to their product ranges. Being closely connected to the future of solar, the internet of things and the emerging technologies surrounding hyper connectivity are determining the future of power management. As the use of the renewable energy source as the solar energy, eco-friendly power generator. Since the smart inverter is that new generation of inverter is indeed work with wirelessly. Inverters and routers are commonly found in most households applications in today's life. However this work we discuss the implementation of a IOT enabled smart inverter i.e. a solar charged inverter that uses Wi-Fi technology to engage a two way communication with the user, and informing the user of both, the battery voltage of the inverter as well as utilization time of the loads which the user chooses to run. Moreover, the wireless control of loads is implemented to ease efficient utilization of energy also increase human comfort.

Key Words: Smart Inverter, Power Management, ARDUINO UNO, IoT, Wi-Fi Technology, Wireless Control

1. INTRODUCTION

Different types of users in society like industries, houses and the government, all are dependent on the power for its reliability. During emergencies like floods, storms, equipment failure etc. which results long power cut then energy storage comes in near. Increasing in population also one of the cause of power shortage and important power cuts. But in recent there is advances in technologies in inverter which becomes smarter than previous.

In smart inverter it is doing by that consumers monitor its status remotely. The main focus of this research paper is to monitor battery of inverters, utilization time of load, load control by wirelessly and to decide the priority of load according to consumers.

By this work, objectives are as follows:

1. To create an interactive IOT enabled smart inverter which is charged by battery and can display the existing battery voltage at any point in time.
2. To allow the user to then decide which crucial loads to run in the event of a power failure and key in his preferences onto the provided GUI mobile application.
3. To allow the user to control the selected loads wirelessly, through a GUI such as mobile application.
4. To then display to the user as to how long he can run the chosen loads simultaneously or individually.
5. To reducing the harmonics, reliability of supply.

1.1 Inverters

An inverter is basically a device that converts electrical energy of DC form into that of AC. The purpose of DC-AC inverter is to take DC power from a battery source and converts it to AC. For example the household inverter receives DC supply from 12V or 24V battery and then inverter converts it to 240V AC with a desirable frequency of 50Hz or 60Hz. These DC-AC inverters have been widely used for industrial applications such as uninterruptible power

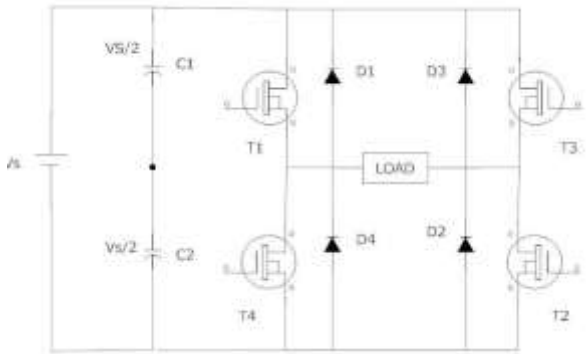

Fig-1 : Circuit Diagram Of 1-phase Full Bridge Inverter

supply (UPS), AC motor drives. The DC-AC inverters usually operate on Pulse Width Modulation (PWM) technique. The PWM is a very advance and useful technique in which width of the Gate pulses are controlled by various mechanisms. In a conventional inverter the output voltage changes according to the changes in the load. To nullify this effect of the changing loads, the PWM inverter correct the output voltage by changing the width of the pulses and the output AC depends on the switching frequency and pulse width which is adjusted according to the value of the load connected at the output so as to provide constant rated output.

1.2 Internet of Things(IoT)

This is the concept of basically connecting any device with an on and off switch to the Internet (and/or to each other). This includes everything from cell phones, coffee makers, washing machines, headphones, lamps, wearable devices and almost anything else you can think of. This also applies to components of machines, for example a jet engine of an airplane or the drill of an oil rig. As I mentioned, if it has an on and off switch then chances are it can be a part of the IoT. The analyst firm Gartner says that by 2020 there will be over 26 billion connected devices... That's a lot of connections (some even estimate this number to be much higher, over 100 billion). The IoT is a giant network of connected "things" (which also includes people). The relationship will be between people-people, people-things, and things-things.

2. COMPARISON

Inverters which are used years ago operated by remotely or wire communication which consume high energy. In this smart inverter, there are high frequency is selected and hence the size of smart inverter also reduces.

Smart inverter operates by mobile application which is wirelessly communication. There also possible of switching of load, automatic cut on/off using application.

It also indicates is inverter running or not. In mobile, it shows the running duration of load. Smart inverter manage the priority of load. Because use of high frequency circuit size of inverter, weight of inverter reduces. And cost also reduces.

Table-1 : features of PWM and SPWM techniques for inverter

Features	PWM	SPWM
Power consumption	High	Less
Efficiency	Less	High
Switching losses	High	Less
Reliability of output	Less	High
Harmonics	High	Low

By above table, it proves that SPWM techniques are reliable for inverter.

3. Block Diagram

The block diagram represents the lay out of components of our project on an IoT enabled smart inverter. In this, battery gives supply to inverter which is connected with relay for protection purpose. The controller which is used here is Arduino Uno by that the control of inverter and control of load is done also.

For wirelessly control for load (i.e. IoT) a mobile application is used for which we required internet or wi-fi enabled computer. This is also control by Arduino.

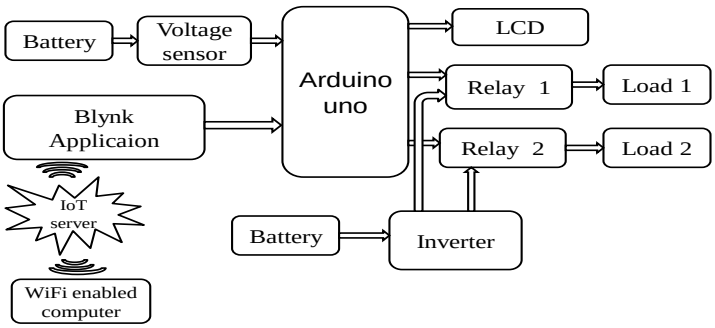

Fig-2 : Block Diagram

4. HARDWARE IMPLEMENTATION

Fig-3 Screenshot of Hardware

In hardware as shown in figure 3, 9 V battery supply to the first inverter in which is high frequency inverter gives 20 Khz. In high frequency Output of inverter gives to the step up transformer which output voltage is 140 V is supplies to voltage doubler circuit.

In both inverters the gate signal is applied by opto-couplers that signals are control by Arduino uno.

Voltage doubler circuit gives 280 V and then it supplies to the main inverter of project.

Now its ready to connect single phase supply. Relay is connected to the load which sense the fault and by IoT application it can be ON OFF automatically.

In mobile application, how much load is consumed, condition of load and load rating can be seen.

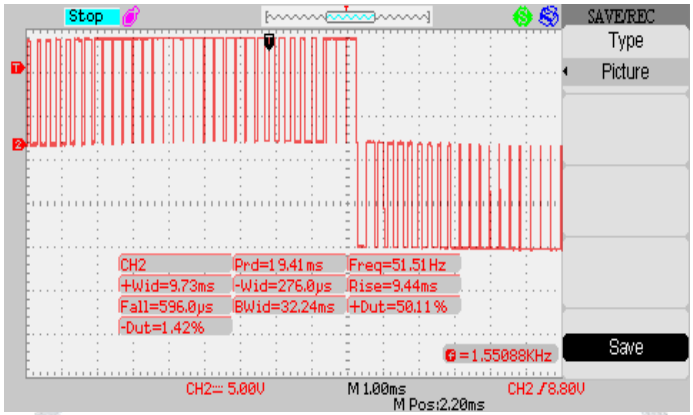

Fig-4 Output signal of Inverter

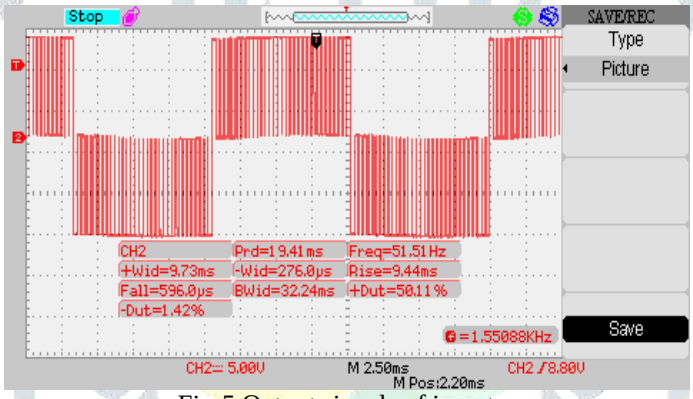

Fig-5 Output signals of inverter

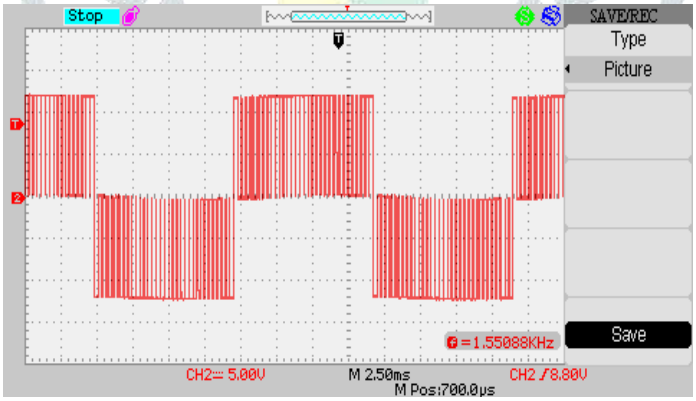

Fig-6 Signals of switching frequency

Above figures shows the waveform of main inverter of MOSFET in which SPWM waveform are used which reduces harmonics.

5. CONCLUSIONS

By implementing this an IOT enabled smart inverter which functionalities as the bidirectional communication with the user. At time of power cut the user can wirelessly control he loads on his priorities. This prototype gives insight into working of a self sufficient and reliable system for the home automation and monitoring the power consumption of household appliances.

FUTURE SCOPE

As in this we inverter extended by using solar panel instead of battery . Instead of using the Blynk application we can also use the ESP8266 module in which the cable is not used.

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