Pure Sine Wave Inverter

Introduction: This project is the designing and implementation of 24V to 115, 125, 400Hz SPWM inverter to convert the direct current to alternating current. Such as what can be continuous from a standard wall outlet. There are generally three types of the inverter in general purpose: modified sine wave, pure sine wave, and square wave. Considering the power output capability, efficiency and harmonics pure sine wave inverter is the best quality among these three types of the inverter. The main goal of this project is generating a pure sine wave. In this design, the inverter converts the low voltage 24V DC power to 115V DC source of high voltage. It also converts high DC source into AC waveform identical to sine wave using PWM generated by microcontroller. The crux of this research work is the use of an economical and advanced 16-bit PIC microcontroller to generate the popular SPWM with very high carrier frequency (in order of kHz) to control the inverter circuit. The high frequency pulses of SPWM results in smoothed filtration of inverter output into pure sine wave by using small sized capacitors and inductors as a filter. This inverter circuit provides a pure sine wave of 400Hz frequency with low harmonic distortion. The simulation is done by MATLAB/SIMULINK software in the beginning step. Finally, it's implemented and tested in real time basis.

Aim:
In this project, we will work on:

- 24V to 115V 125W, 400Hz Sine wave inverter.
- Output Step down upto 50V using potentiometer.
- Constant Output
- PCB, Gerber, BOM, Schematic, Simulation, Prototype

Hardware Used:

1. Buck IC with one input (5V-30V) with fixed two output 5V and 12/24V (depends on MOSFET which we want as input voltage)
2. PIC18F microcontroller
3. MOSFET driver
4. MOSFET
5. Transformer
6. Active Passive components
7. PCB
8. Load

Software Used: In this project, we have to work on many phases and all phases simulated by different software.

1. PWM from Proteus
2. MATLAB/Simulink for testing circuit simulation
3. Eagle for schematic design

4. PCB Design in eagle
5. Gerber in eagle
6. BOM in excel
7. MBLAB X IDE

Working and Block Diagram:

In the below block diagram the battery is used as input, where we are using 24V battery. We need 5V to operate microcontroller, 12V DC to MOSFETs driver and MOSFET. So, we need a converter circuit. **According to the requirement, the output should be constant no matter the battery input voltage is. So, we will be using a IC which is deliver 2 output, which is 5V and 12V and this is fix output.**

There is many conventional method to generate sine wave and make a inverter. But, because of leakage, heatup, high drop and much space cover, we will be using digital way to get the sine wave. That is sine wave from microcontroller. We can also get it from 555 timer as well, but for advancement in future, I have used PIC microcontroller.

The SPWM is generated from microcontroller which is of 400Hz frequency. We will generate 2 SPWM which input to the H Bridge to get the result. As seen in the below, we will get SPWM from microcontroller as this,

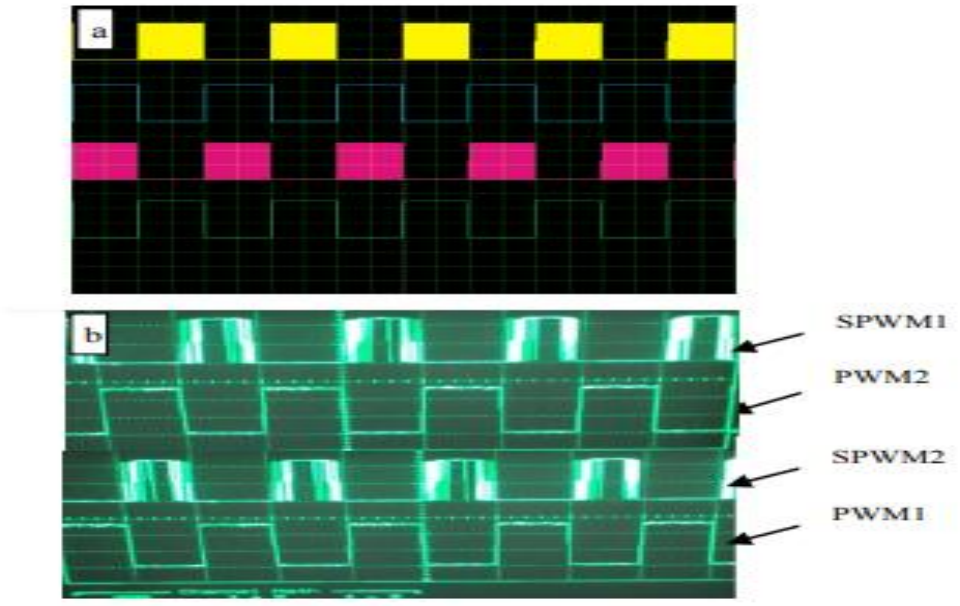


Fig.8 illustrates microcontroller signal waveform generated by simulation at (a) and by experimental at (b).

So, to make it sinusoid with negative cycle as well, we will use H-Bridge to get the result.

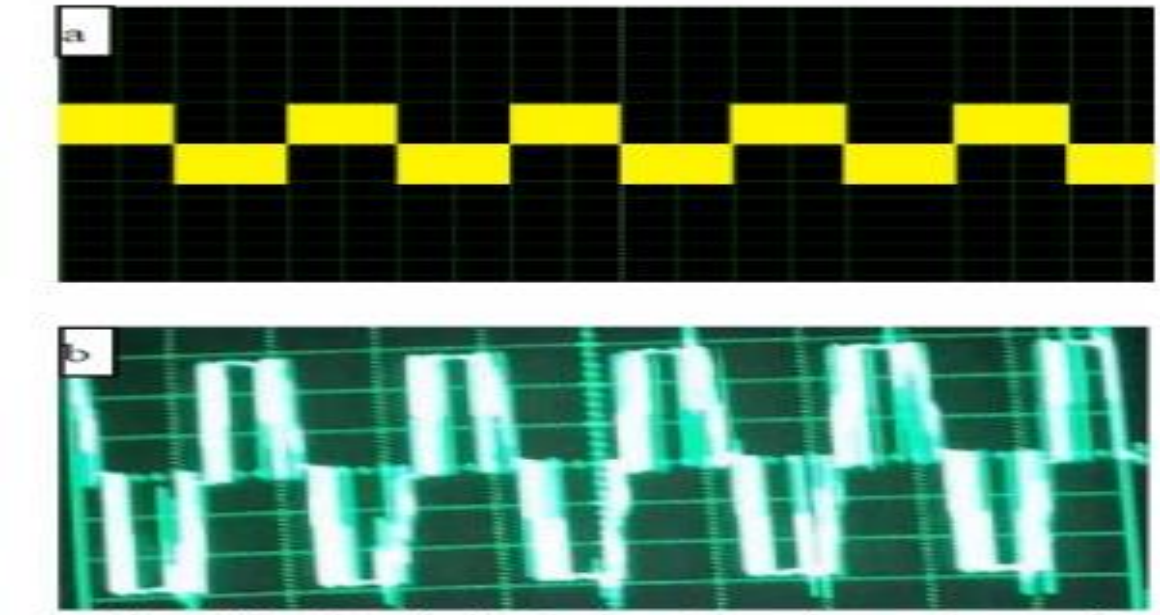
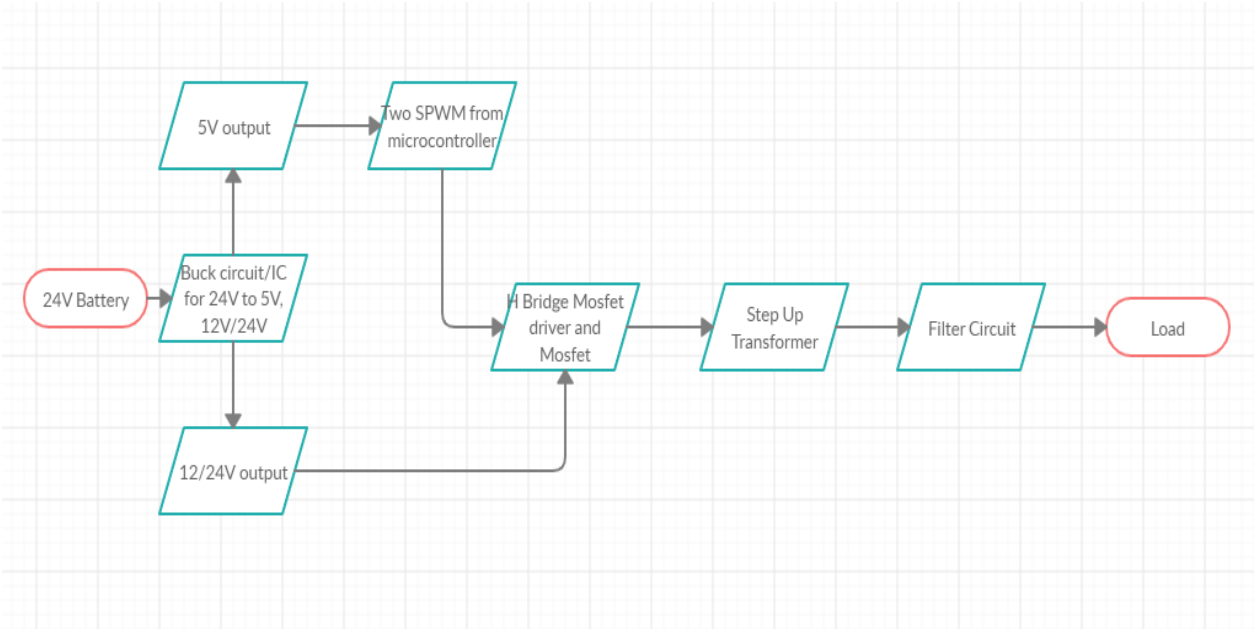


Fig.9 The signal simulation (a) and experimental signal results (b) of output waveform of full bridge single phase inverter.

Now, using RC filter we will get the the desired smooth AC output. This is than step up via transformer where we feed input 24V and get the output as 115V.

Full Block Diagram:



Future Scope:

1. **You can add solar as input as well.**
2. **You can add LCD to review the voltage and current.**
3. **You can also make a IoT inverter.**