Ahsanullah University of Science & Technology

Department of Electrical and Electronic Engineering

Project

Course No : EEE-4228

Course Title : Power Electronics

Project Title : Single Phase Sine Wave Inverter Using Arduino

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Group : 02

Submitted by

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Abstract:

The main goal of this project is to produce a Laboratory Variable DC Power Supply. A variable DC power supply is a device where we can easily change the output voltage and also supply enough current to the load. The voltage is regulated irrespective of load & line variation Every power supply has an input or supply power that it converts to meet the demand from the electrical load using various methods. Even if the load demand current or supply power varies, power supplies are said to be regulated when the output voltage or current is kept constant. To achieve this goal, we will implement and design a complete full circuit. This is a typical laboratory dc supply which can supply up to 50V & maximum current rating is 30 A.

Types of Inverter:

According to the Type of Load :

- Single-phase Inverter
- Three-phase Inverter

1) single-phase inverter :

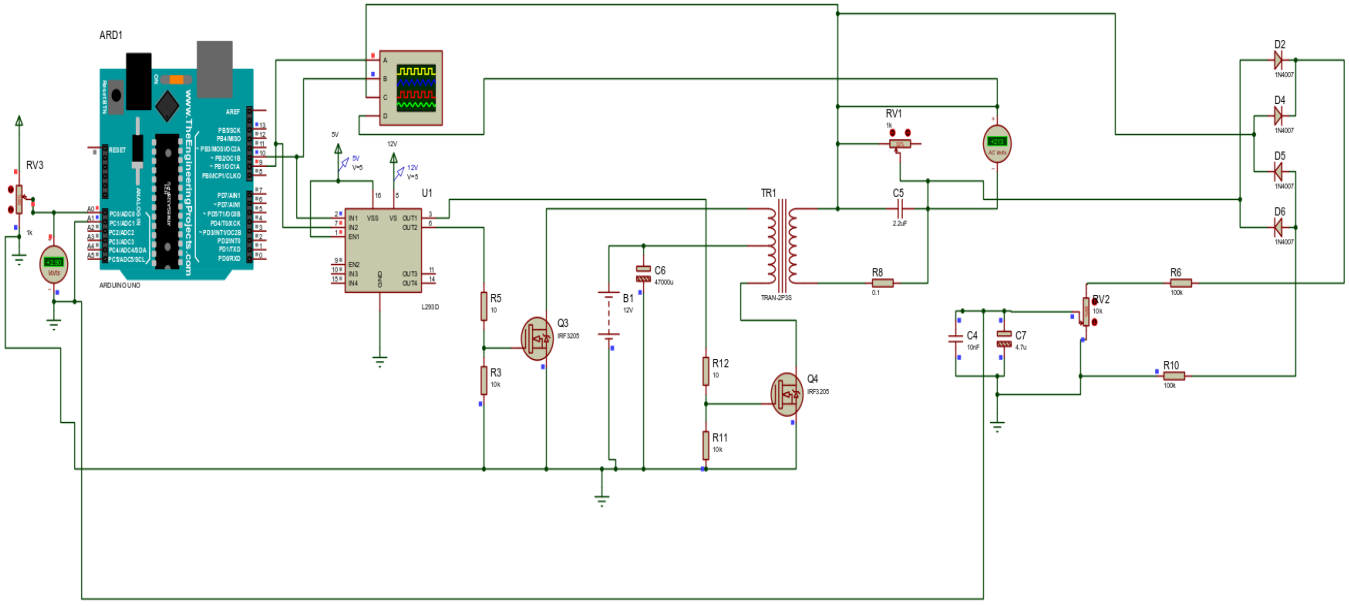
Generally, residential and commercial load uses single phase power. The single-phase inverter is used for this type of application. The single-phase inverter is further divided into two parts;

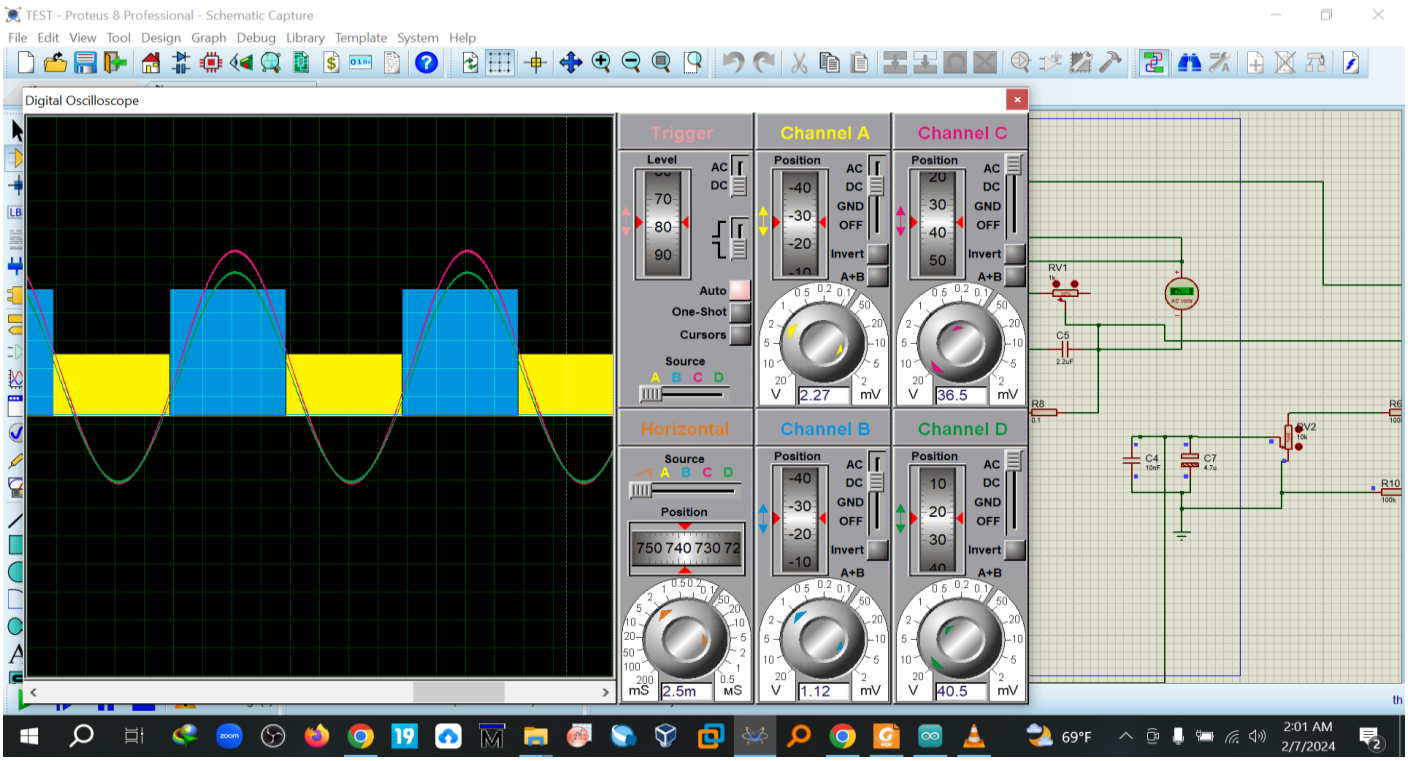
- Single Phase Half-bridge Inverter
- Single Phase Full-bridge Inverter

Components:

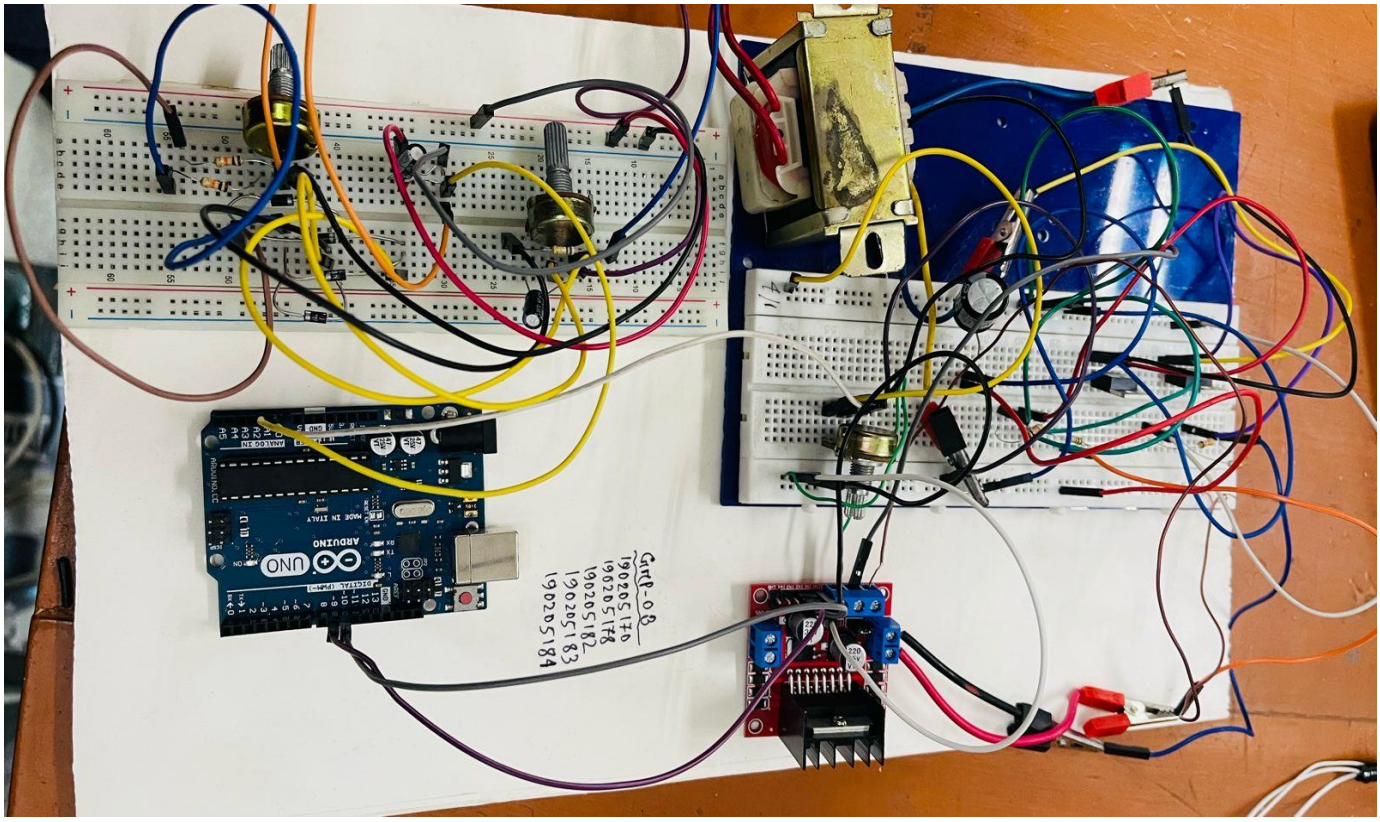
- ✓ Arduino UNO
- ✓ MOSFET – IRF3205
- ✓ Voltage Generator
- ✓ Capacitors
- ✓ Step up transformer
- ✓ Diodes
- ✓ H bridge module
- ✓ Resistances,POT

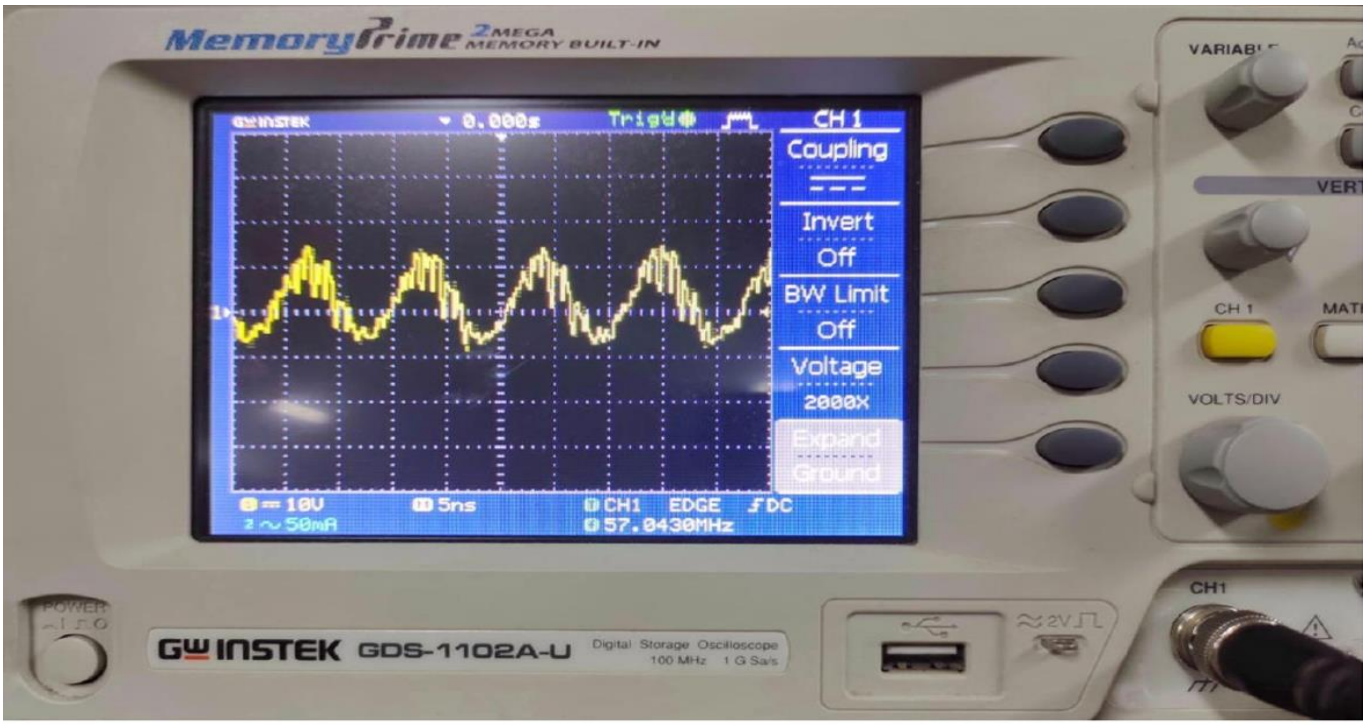
Circuit Diagram:





Practical Setup:





Working Principle:

Inverter is defined as an Electrical device which converts the Direct current source into the Alternating current source. The main source of electrical power is the battery which is a DC source. The DC output of the battery is bucked or boosted according to the requirement and then converted into AC using a DC-AC inverter. The function of an inverter is to change a dc input voltage to a symmetric ac output voltage of desired magnitude and frequency. The output voltage waveforms of ideal inverters should be sinusoidal. However, the waveforms of practical inverters are non-sinusoidal and contain certain harmonics. The input of the inverter is a fixed DC voltage which is nominally obtained from the batteries and the output of the inverter is generally a fixed or a variable frequency Alternating voltage, the AC voltage magnitude is also variable. A Single-phase inverter converts a DC input into an AC output. In three phase inverter circuit process the three single phase inverters put across the same DC source. The pole voltages in a three phase inverter are equal to the pole voltages in a single phase half bridge inverter. Three phase inverters can be operated into two different types of modes of conduction, i.e. 120 degree conduction mode and 180 degree conduction mode

Arduino Code:

```
#include <TimerOne.h>

#define potinput A0

#define feedbackinput A1

#define outA 9

#define outB 10

int f_pwm = 20000;

int f_sin = 50;

float sinus[200];

float phi = 3.14;
```

```
int flag = 0;
int sample = 0, samples = 0;
int potinputval;
int feedbackinputval;
int A;
int max_power = 800;
float invert = 0.0;
int total_sample;
int phase = 0, x = 0;
void setup() {
 total_sample = round((((1000000. / f_sin) / (1000000. / f_pwm)) / 2.));
 for (int sudut = 0; sudut < total_sample; sudut++) {
  float rad = sudut * (180. / total_sample) * phi / 180;
  sinus[sudut] = sin(rad);
 }
 float t_pwm = (1000000. / f_pwm);
 delay(1000);
 pinMode(potinput, INPUT);
 pinMode(feedbackinput, INPUT);
 pinMode(LED_BUILTIN, OUTPUT);
 A = 0;
 Timer1.initialize(t_pwm);
 Timer1.attachInterrupt(generate_sinus);
 Timer1.pwm(outA, (sinus[samples] * A));
 Timer1.pwm(outB, (sinus[samples] * A));
}
void loop() {
 potinputval = analogRead(potinput);
 feedbackinputval = analogRead(feedbackinput);
 while (feedbackinputval < potinput) {
  if (A >= max_power) {
```

```
    potinputval = analogRead(potinput);
    feedbackinputval = analogRead(feedbackinput);
   } else {
    A = A + 1;
   }
  }
  potinputval = analogRead(potinput);
  feedbackinputval = analogRead(feedbackinput);
  while (feedbackinputval > potinputval) {
   if (A == 0) {
    potinputval = analogRead(potinput);
    feedbackinputval = analogRead(feedbackinput);
   } else {
    A = A - 1;
    potinputval = analogRead(potinput);
    feedbackinputval = analogRead(feedbackinput);
   }
  }
}
void generate_sinus() {
 generate();
}
void generate() {
 if (sample >= total_sample && flag == 1) {
  flag = 0;
  sample = 1;
 }
 if (sample >= total_sample && flag == 0) {
  flag = 1;
  sample = 1;
 }
```

```
 sample++;
 if (flag == 0) {
   Timer1.pwm(outA, (sinus[sample] * A));
   Timer1.pwm(outB, 0);
 }
 if (flag == 1) {
   Timer1.pwm(outA, 0);
   Timer1.pwm(outB, (sinus[sample] * A));
 }
}
```

Application:

- Railways
- industrial control,
- communication and exchange vehicles.
- civil offices.
- industrial and agricultural fields.
- military medical fields.
- transportation.
- Regulation range of output voltage
- Stability Degree
- Ripple Voltage control
- Overcurrent Protection

Why should I use this type of inverter?

The pure sine wave inverter does not have the problem of electromagnetic pollution in the power grid, and the output is the same pure sine wave alternating current as of the mains. It has stronger load capacity, can carry the inductive load and any type of general-purpose AC load, has low noise with inductive load, and has no effect on the performance and life of the load.

In contemporary times, we now need a large amount of power supply, and the convenience brought to us by pure sine wave inverters is obvious. Pure sine wave inverters are also used in transportation systems, small passenger cars, cars, RVs, large trucks, motor trains, trains, airplanes and other transportation vehicles. Generally, the above types of transportation equipment are the operation of DC power. With the improvement of our quality of life, users can pick up some AC loads to meet our new needs when choosing equipment. These all require the conversion of direct current to the alternating current through an inverter. The direct supply of these devices has also brought us some convenience .Protection devices make us safer when using electricity. Pure sine wave inverter not only brings convenience to current conversion but also brings us different protection measures, such as over-voltage protection, overload protection, over- current protection, over-temperature protection, short circuit protection, positive and negative protection

Conclusion:

The result revealed that the inverter design was successful and the objectives were also achieved. The inverter produced a pure sine wave and had no challenges operating under load. The feedback network from the pulse width modulator kept the output voltage constant at maximum and minimum input voltage.