Department of Electrical & Electronic Engineering

Project Report

Course No. : EEE-4154
Course title : Power System II Lab
Name of the project : Solar based Power Supply System

Date of Submission : 26/09/2024

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Section : B2C2
Year : 4th
Semester : 1st

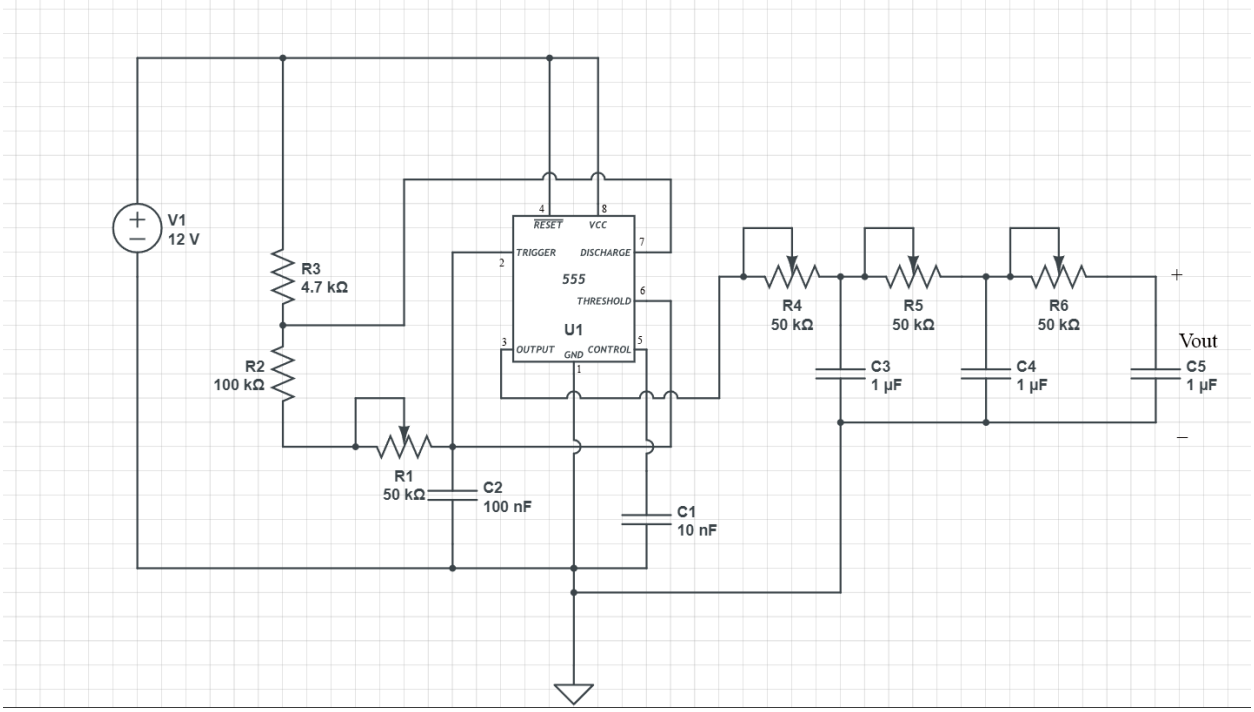
Objective:

The project's goal is to use a solar panel to store solar energy in batteries, which will later be used to power our intended load. In loads, we often utilize a sinusoidal 50 Hz signal frequency. Thus, we used an inverter circuit (which includes a 555 timer) to convert the battery's DC voltage to AC voltage, and a filter network circuit to change the AC output from square wave to sinewave. The purpose of this circuit is to give solar power to our everyday ac loads.

Equipments:

- Solar Panel
- 12V battery
- Resistors
- Capacitors
- Cables and Connectors
- Breadboards
- Charging module
- 555 Timer

Circuit diagram:



Working principle:

1. The 12V dc battery is charged by the solar panel by using charging module.
2. The 555 timer on this circuit operates in astable mode to generate a continuous square wave output.
3. R1 preset is used to adjust the frequency of the square wave.
4. C1(10nF) capacitor is connected between pin 5 (Control Voltage) and ground to stabilize the voltage.
5. C2(100nF) capacitor is connected to pins 6 (Threshold) and 2 (Trigger) to control the charging and discharging cycle.
6. R2 (100kΩ) and R3 (4.7kΩ) resistance work with C1 and C2 to set the timing characteristics of the 555 timer.
7. The square wave output from the 555 timer is generated in pin3
8. The output of the timer is connected to the filter network which consists of R4, R5, R6 (50kΩ each) resistors that act as series resistors in the filter stages and C3, C4, C5 (1µF each) capacitors that smooth out the square wave output to produce a more stable AC sinusoidal voltage at the output. The filtering network reduces the high-frequency components, resulting in a waveshape with rounded transitions and reduced ripple, approaching a more sinusoidal form.
9. The voltage across C5 capacitor is the final output of this circuit which is AC and sinusoidal and adjusted to 50Hz for in general load usage.

10. We can further step up the output voltage using transformer or other methods according to different loads.

Applications:

1. The most common applications are in battery-powered mobile and marine vehicles.
2. uninterruptible power supplies (UPS)
3. renewable energy generation systems.
4. stationary battery banks.

Future Development:

The future development of inverters is likely to focus on several key areas:

1.Efficiency Improvements: Advancements in materials and design, such as silicon carbide (SiC) and gallium nitride (GaN), will enhance efficiency and reduce energy losses.

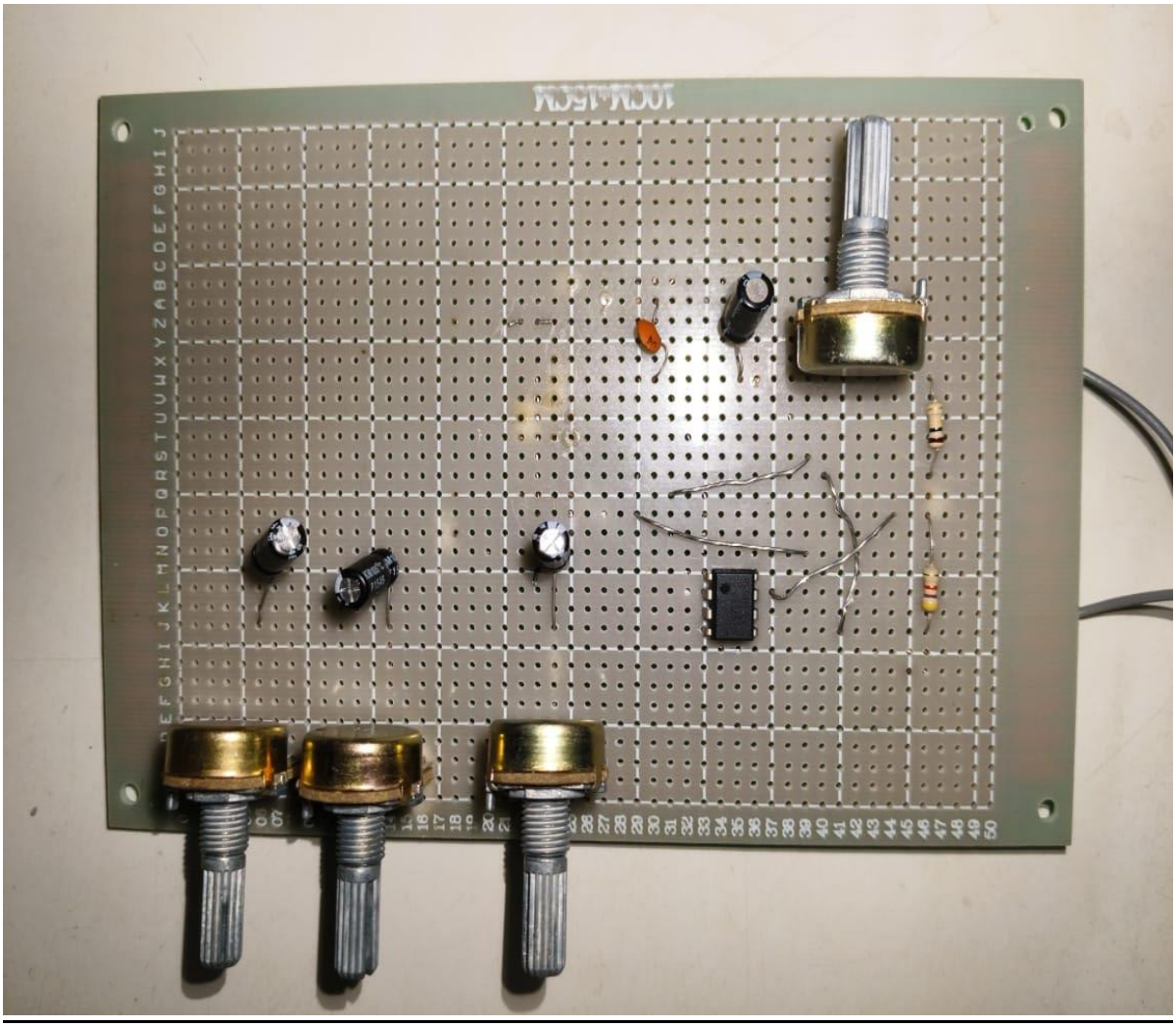
2.Smart Inverters: Integration with smart grid technology will allow inverters to communicate with the grid, optimizing energy distribution and supporting renewable energy sources.

3.Miniaturization: Smaller, lighter inverters will become more common, enabling easier installation and integration into various applications, including residential and electric vehicles.

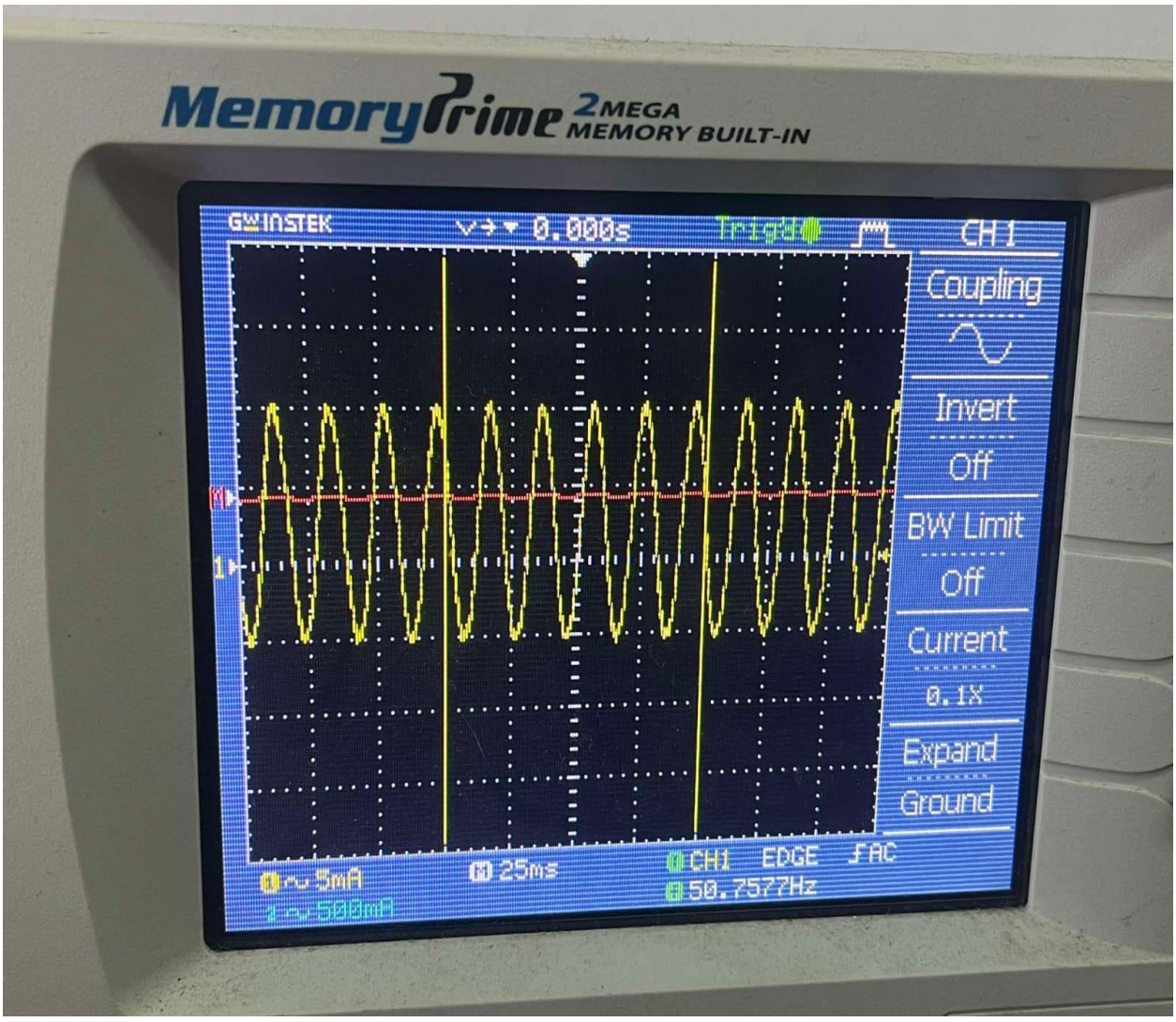
Breakdown of costing:

Solar Panel-- 440 Tk.
12V battery--600 Tk.
Resistors-- Each 3 Tk.
Capacitors-- Each 5 Tk.
Cables and Connectors--Total 200 Tk.
Breadboards --350 Tk
Charging module --100 TK
555 Timer --120 Tk
Potentiometer--4 piece 200 TK.

Circuit:



OUTPUT:


MemoryPrime 2MEGA MEMORY BUILT-IN
GW INSTEK
0.000s
Trig'd
CH1
Coupling
Invert
Off
BW Limit
Off
Current
0.1X
Expand
Ground
CH1 EDGE AC
50.7577Hz
25ms

Individual Contribution:

1. Student ID: 20200205125
Contribution of the project: Draw Circuit Diagram.

2. Student ID: 20200205128
Contribution of the project: Lab report writing and collecting equipment.

3. Student ID: 20200205169
Contribution of the project: working principle and soldering the circuit.

4. Student ID: 20200205171
Contribution of the project: Circuit setup and soldering the circuit.

5. Student ID: 20200205172
Contribution of the project: circuit setup.

6. Student ID: 20200205173
Contribution of the project: Applications and setup circuit.

Discussion: This project which consists of an inverter circuit using 555 timer IC and RC filtering network demonstrates a fundamental approach to power conversion and signal processing. The circuit generates a square wave, adjustable via a potentiometer, which is then smoothed by a filtering network to produce a more stable AC-like output. This simple, cost-effective design serves as an excellent educational tool and can be scaled up for more advanced applications. It has potential future uses in renewable energy systems where DC power needs to be converted to AC. However, it also has limitations such as lower efficiency, limited power output, and less precise waveform quality compared to more complex inverters. Despite these drawbacks, the project provides valuable insights that can be used to develop more sophisticated and efficient inverters with advanced components and technologies for higher power and quality requirements.