Ahsanullah University of Science and Technology

Department of Electrical and Electronic Engineering Lab

Project

Course No : EEE 4154

Course Name : Power System II Lab

Submitted By:

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Group : 01

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Dept : EEE

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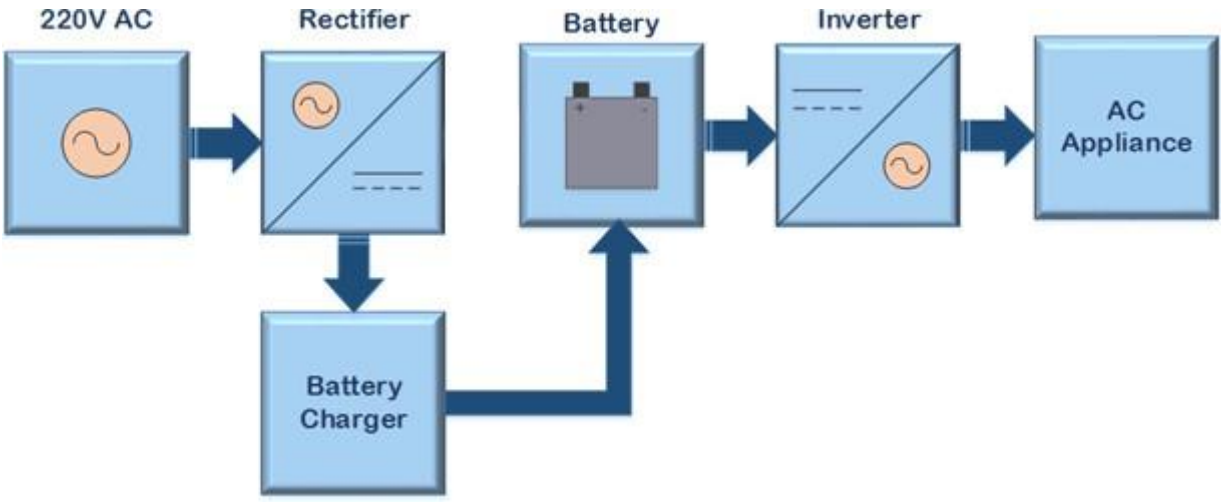
Project name:

Miniature uninterruptible power supply (UPS)

Project Summary:

Uninterruptible power supplies, or UPSs, are inverters created to deliver continuous AC mains power to a connected load without even the slightest interruption, regardless of unforeseen power fluctuations or brownouts.

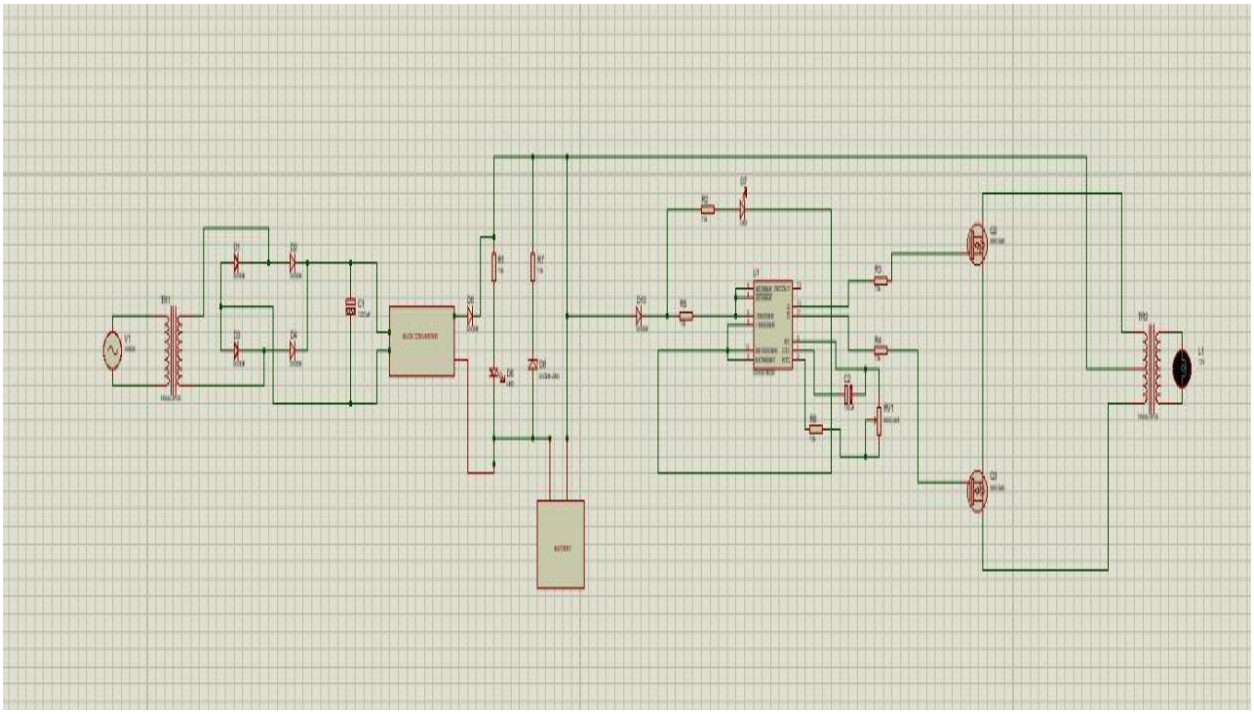


Equipment List:

- 220v to 9*2v 600Ma Transformer
- L7808CV voltage regulator 8v
- Buck Converter LM2596
- Fixed Resistors (R1, R2,R3,R4)=1KΩ

- Variable Resistor (VR)=50KΩ
- Electrolytic Capacitor 570µF
- MOSFETs (BR50N06)
- IC CD4047
- Battery 12V (4V LEAD ACID BATTERY CONNECTED IN SERIES)
- 91L16 AC voltmeter
- 1N4007 diode

Circuit diagram:



Physical View:

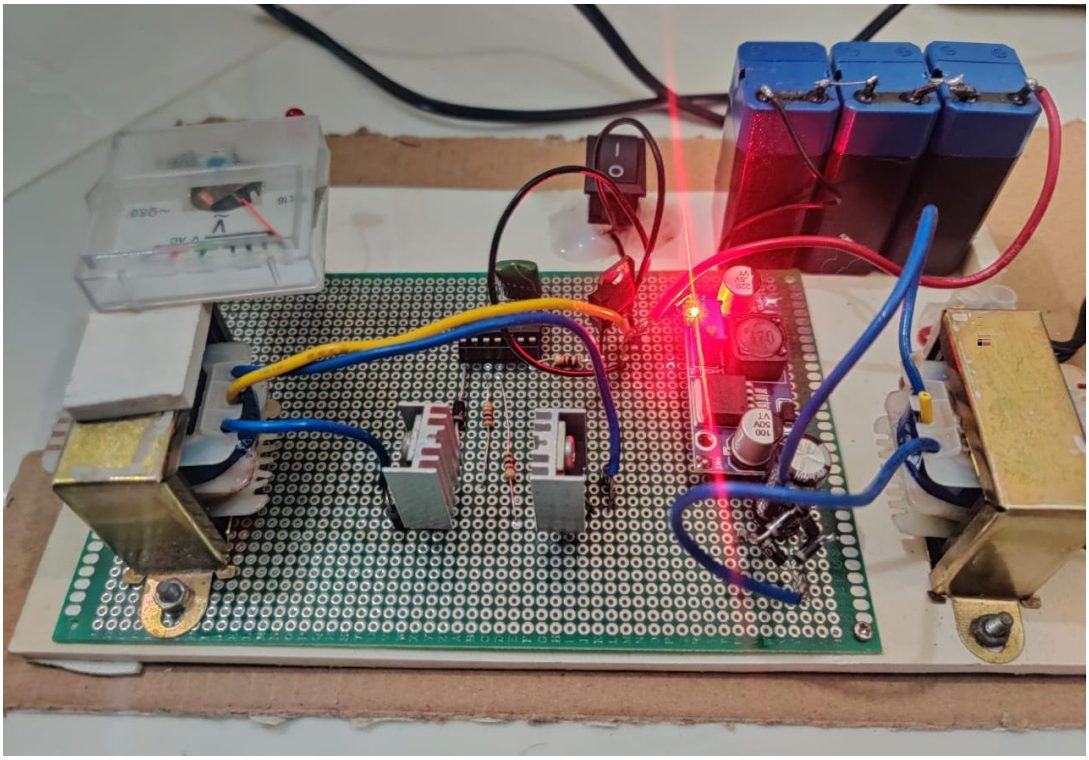


Figure 01: when AC on

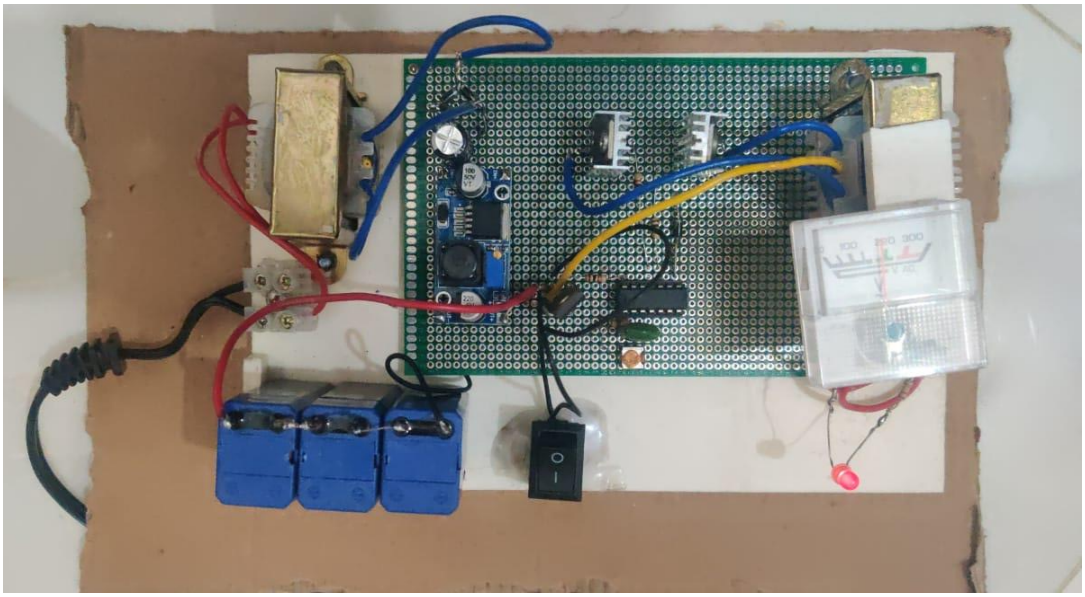


Figure 02: When AC off, UPS on

Working Principle:

1. A step-down transformer is an electrical tool that lowers the voltage of an alternating current (AC) power source. In this context, we employ a step-down transformer to decrease the voltage, as in the subsequent step, we utilize a rectifier to transform AC into DC.

2. In the subsequent step, we employed a full-wave rectifier to change the AC voltage into DC voltage. A full-wave rectifier is characterized by its ability to transform the entire alternating current cycle into pulsating direct current. We opted for full-wave bridge rectifiers due to their cost-effectiveness, lightweight nature, and high efficiency. These rectifiers consist of four diodes arranged in a closed-loop configuration, ensuring an effective conversion of alternating current (AC) into direct current (DC). In this setup, the resulting output frequency is twice that of the initial input frequency.

3. In our next stage, we implemented a buck converter, which is employed to reduce the voltage from the provided input to attain the desired output. The term "buck" in buck converter signifies that the inductor consistently opposes or counters the input voltage. This device is a type of DC-DC converter. In this context, the buck converter is utilized to regulate the voltage, specifically because a 12-volt lead acid battery is in use. To prevent potential damage to the battery due to excessive voltage, the buck converter is incorporated into the system.

4. In this setup, a Zener diode functions as a safeguard against surges

5. Subsequently, an inverter (DC-AC) is assembled utilizing the IC 4047. The CD4047 Integrated Circuit is set up as an astable multivibrator, producing the required frequency and duty cycle for the inverter's functioning. The intentional phase difference between the two oscillating outputs is designed, and the oscillation frequency is regulated by the 50K variable resistor.

6. Following this step, we utilized two MOSFETs, specifically the BR50N06 MOSFETs, for voltage amplification. The BR50N06 is a high-current N-channel MOSFET with the capability to switch currents up to 50A and handle voltages of 60V. We selected this MOSFET type due to its N-channel configuration, considered advantageous over P-channel MOSFETs for certain applications

7. Finally, a step-up transformer was incorporated to achieve the desired output voltage of 220V.

Difference between UPS & IPS:

1. Usually, in UPS, the current is supplied directly from the main. This current is converted from AC to DC and is continuously used to charge the battery. The charged battery then supplies power through sine wave inverter, where DC is converted back to AC, and we receive power on our PC. The output power remains in DC, so the frequency is constant.

2. On the other hand, in IPS, the current directly goes to the inverter from the main power supply. This main supply is simultaneously used to charge the battery and provide power output. IPS has a sensor and relay mechanism that constantly checks if power is coming from the main. Whenever the main power is off, it triggers charging from the battery.

3. Generally, in UPS, it takes around 3 to 8 milliseconds for power to transition from the main to the battery. This is a very short time, and there is no reaction time in the materials used. Conversely, IPS takes about 500 milliseconds.

4. The power in UPS is typically 2 kVA. On the other hand, IPS usually has a power of about 16 kVA or more, and it operates in 3 phases.

5. In UPS, there is automated voltage regulation, and it is usually set to 220V. In contrast, in IPS, the voltage is the same as the main voltage.

Importance of UPS:

1. Crucial for Performance:
    - Reliable power supply is essential for optimizing performance in various applications.
2. Preventing Data Loss:
    - Ensures data integrity and prevents loss by providing continuous power during outages.
3. Backup Power with UPS:
    - A UPS system acts as a backup power source during electrical outages.
4. Continuous Operation:
    - Ensures uninterrupted operation of critical equipment and systems.
5. Data Protection:
    - Safeguards against disruptions that could lead to data corruption or loss.
6. Enhancing Equipment Reliability:
    - Contributes to the overall reliability of equipment and systems.
7. Optimizing System Availability:
    - Maximizes the availability of critical systems and services.
8. Mitigating Downtime:
    - Minimizes downtime by seamlessly transitioning to backup power.
9. Critical for Various Applications:
    - Applicable across diverse sectors such as IT, healthcare,

manufacturing, and more.

10. Business Continuity:
    - Facilitates business continuity by preventing disruptions in essential operations.
11. Protection Against Voltage Fluctuations:
    - Guards against voltage fluctuations that can damage electronic equipment.
12. Increased Resilience:
    - Adds resilience to the overall infrastructure, especially in areas with unreliable power grids.

Charging time:

Battery Capacity: 3000mAh (milliampere-hour) = 3Ah (ampere-hour)

Charging Current: 600mA (milliampere) = 0.6A (ampere)

Voltage: 9V (Volts)

Charging time (in hours) = Battery capacity (Ah) / Charging current (A)

Charging time = 3Ah / 0.6A = **5 hours**

Improvement:

Due to frequent and disruptive load shedding, our daily routines are being disrupted. To address this issue, we are working on building a UPS. Our UPS incorporates a rectifier, buck converter, IC CD407, MOSFETs, a Zener diode, and various other components. While we have achieved an output of approximately 220V in our project, there is a need for further enhancement, particularly in optimizing the frequency.

Conclusion :

Due to frequent and disruptive load shedding, our daily routines are being disrupted. To address this issue, we are working on building a UPS. Our UPS incorporates a rectifier, buck converter, IC CD407, MOSFETs, a Zener diode, and various other components. While we have achieved an output of approximately 220V in our project, there is a need for further enhancement, particularly in optimizing the frequency.