**DESIGN AND CONSTRUCTION OF A RECHARGEABLE VARIABLE POWER SUPPLY (1 to 30 volt)**

**BY**

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**(ET/EE/HND/21/006)**

**A PROJECT REPORT SUBMITTED IN PARTIAL FULFILMENT**

**OF THE REQUEMENT FOR THE AWARD OF HIGHER NATIONAL DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING**

**DEPERTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING**

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**SEPTEMBER, 2023**

# DEDICATION

This project entirely dedicated to the almighty God for his infinite mercy and love in my life and for giving me the wisdom to carry out this research work successfully without much stress and to my lovely parent.

# DECLARATION

I hereby declare that the project work entitled **“Design and Construction of a Rechargeable Variable Power Supply (1 To 30 Volt)”** was written by me **PAUL USako.** It is my record of work; The work has not been presented or submitted elsewhere for consideration of degree/diploma/certificate award. All references made to published literatures have been duly acknowledged.

Signature…………………………….. Date………………………………..

**PAUL USako**

(ET/EE/HND/21/006)

# CERTIFICATION

This is to certify that this project work **“Design and Construction of a Rechargeable Variable Power Supply (1 To 30 Volt)”** presented by PAUL Usako has been written in accordance with regulations governing the preparation and presentation of projects in the Federal polytechnic Mubi and meets the requirements for the award of Higher National Diploma in Electrical and Electronics Engineering Technology.

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**PAUL Usako**

(ET/EE/HND/21/006)

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**Alh. Aminu Ya’u**

(Project Supervisor)

# APPROVAL

This project report entitled **“Design and Construction of a Rechargeable Variable Power Supply (1 To 30 Volt)”** presented by **PAUL Usako** was submitted to the Department of Electrical and Electronics Engineering Technology and has been accepted as partial fulfilment of the requirement for the award of Higher National Diploma in Electrical and Electronics Engineering Technology. Federal polytechnic, Mubi.

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E**ngr. Fache Vincent**

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# ACKNOWLEDGMENTS

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# ABSTRACT

*In a world increasingly reliant on electronic devices and systems, a stable and versatile power supply is fundamental for research, development, testing, and maintenance of electronic components and circuits. The project, "Design and Construction of a Rechargeable Variable Power Supply (1 to 30 Volts)," addresses the critical need for a portable, adjustable, and rechargeable power source. Traditional fixed-voltage power supplies have limitations in providing the flexibility required for diverse electronic projects. A variable power supply is an essential tool for engineers, hobbyists, and students, enabling them to tailor voltage output to specific requirements. Additionally, mobility and rechargeability enhance its utility, allowing experimentation and testing in various settings. This project focuses on the design and construction of a compact and rechargeable variable power supply that can deliver a range of voltages from 1 to 30 volts. The design employs an efficient voltage regulator circuit to ensure a stable and adjustable output voltage. Lithium-ion battery technology is integrated for portability and convenience. Safety features such as overcurrent protection and voltage monitoring are incorporated for user security. The project delivers a functional and reliable rechargeable variable power supply with a voltage range of 1 to 30 volts. Users can precisely set the desired voltage output for their electronic experiments and projects. The lithium-ion battery provides mobility and eliminates the need for a constant external power source. Safety mechanisms prevent damage to connected devices and ensure user safety during operation. The "Design and Construction of a Rechargeable Variable Power Supply (1 to 30 Volts)" project successfully addresses the need for a portable and adjustable power source in the electronics field. The system's versatility, rechargeability, and safety features make it an invaluable tool for electronics enthusiasts, professionals, and students alike. The project's completion underscores the significance of accessible and user-friendly power supply solutions in advancing electronic innovation.*

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# Chapter one

# INTRODUCTION

## 1.1 Background of the Study

Development in the field of electronic have provided different technological approach used for upgrading and improving the standard DC voltages, communication instrumentation control etc. electronics perhaps more than any other field of technology, has enjoyed an explosive development. Generally, in electronics all electrical instrument and circuit require a source of direct current (DC) power before they operates, it Is either from a battery or a AC source (Hoftman, 2013).

According to Theraja and Theraja (2008) opines that most of electronic devices ad circuit require a d.c source for their operation. Dry cells and battery are one form of d.c source. Those type of dc source voltages are low; they need frequent replacement and are expensive as compared to conventional d.c. power supply (Adeite & Osemelikilali, 1996).

A power supplies have a power input which receives energy from the energy source. and a power output that delivers energy to the load. Most power supply the power input and output consist of electrical connectors or hardware circuit connection (John, 2020). The circuit mainly compose of the input transformer which will be used to transform the incoming line voltage down to the required level for the power supply, the power supply rectifier covert the AC voltage to DC voltage either halfwave or full wave, the addition of a reservoir capacitor here fills In the troughs in the wave form, enabling the next stage of power supply to operate, large value and capacitor are to be used in this stage (Robert & Louis 2004). The voltage adjuster of the power supply takes the smoothed voltage and use a variable integrated circuit (IC) and potentiometer to provide a variable regulated output virtually regardless of the output current and any minor fluctuation in the input level (Study, 2014).

## 1.2 Statement of the Problem

1. Unavailability of public power supply
2. Need of different voltage in many areas of application such as lab technician work
3. Avoidance of the use of many measuring instrument.

## 1.3 Aim and Objectives

The aim is to construct a variable power supply to provide the required power load using an AC supply at the input and variable regulated power from 1 to 24v at the output terminal and display the value on screen, by earning the voltage adjuster known as potentiometer, it allows analog control and power supply output for maximum versatility and other objectives to be achieved are:

1. To observe the output to meet the requirement.
2. To use the device for more than one purpose power supply and USB.
3. To use less costly components and portability.

## 1.4 Significance of the Study

This project if completed will make it possible for researchers to have power supply to run different devices of higher or low value.

The project does not require any external measuring device such as multimeter and others because the quantity obtained is being displayed on the screen.

The project can be used in basic electricity laboratory and other laboratory where different D.C. voltage is required for practical.

The project can be used in electronic workshop by technician for repairs and maintenance of electronic devices

## 1.5 Scope and Limitation

The scope of the study is conversion of A.C. voltage to D.C. voltage to be displayed and it is limited to 1.5 to 30 volt.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Review of Related Literature

Thomas Edison invented direct current in the late 1870s and in 1920s crude device were first developed to serve as battery eliminators to power radios in both commercial and consumer market. The market for separate power supplies rise around 1929, where most radios manufactured include a built-in power supply. The need for standalone power supply remained relative from 1930 to 1940 (Charles, 2021). In the early 1950s and early 1960s power supply produced adopting may-Amp technology satisfy the application at this time vibrators converts and an automobile 12volt high voltage D.C. by mechanically switching (Paul, 2022).

Thermion (vacuum tube) diodes and solid state (semiconductor) diodes were developed separately, at approximately the same time, in the early 1900s, as radio receiver detectors. Until the 1950s vacuum tube diodes were more often used in radios because semiconductor alternatives (Cat’s Whiskers) were less stable, and because most receiving sets would have vacuum tubes for amplification that could easily have diodes included in the tube (for example the 12SQ7 double-diode triode), and vacuum tube rectifiers and gas-filled rectifiers handled some high voltage/high current rectification tasks beyond the capabilities of semiconductor diodes (such as selenium rectifiers) available at the time.

Battery-base, battery-linear and linear power supply those that the most common once (Green, 1995).

James Winshart (1903), constructed a DC power supply using 100kso and 50kso resistor which can be expected to obtain 3volts at the output but due to the resistance of the DC resistor used cannot be able to obtain that result instead he got 1.2volts, he used discharge and made no effort in retrying to solve the problem.

### 2.2.2 Variable Power Supply Using 25volts AC Transformer

Benjamin Mike (2009), He constructed a DC power supply using 25volt transformer, He was expecting to get 12 volts at the output but instead he got 7.5volt DC at the output. The resistance of the voltage selector and other hardware used in the construction drain the voltage. Due to this problem encounter by Benjamin, He again constructed the same device but using only to voltage sector, with this he obtained 9volt at the output. But he was able to achieve the required voltage at the output.

### 2.2.3 Linear Power DC Power Supply

Adebayo (2018), constructed a linear power supply using half wave rectification in his construction the AC voltage is being rectified using one diode. This type of rectifier only allows one half-cycle of an AC voltage to DC voltage. This half wave rectifier is nothing more than a single PN junction diode connected in series to the load resistor that allows electric to flow in only one direction. This type of power supply is unregulated, the DC terminal is affected significantly by the amount of load, this is the major setbacks to this type of power supply as the loads draws more current the terminal voltage becomes less.

### 2.2.4 Stabilize Variable power Supply (1 to 6volt DC)

Adedayo Adelakum (2014), the main purpose of this work is to construct a stabilize variable power supply unit with a voltage range of 1 to 6volts and also study the regulating characteristics of a constructed power supply unit to a certain load and line regulation so as to determine its stability by comparing it to a standard power supply unit to power load (Rheostat of 126ohm 0.5A) the major component used include transistor regulator the output measurement showed that the power supply was functional and the measured value gave minimal variation from the standard value. This type of power supply is used where low voltage is required from 1 to 6volt DC

### 2.2.5 Construction of 1 to 15volt Power Supply

Naman Saini (2020), construction of 1 to 15volt power supply, here the main working principle of this project is full of wave rectification which is done by bridge configuration, using 4 diode and those rectifies the output of the step-down transformer which step down the 220volt AC to 12volt AC, in this circuit two capacitor c1and c2are used to get constant input to the regulator of 12volt. Moreover, it also helps to reduce the sharp peaks in the output a 2200uf and 470uf capacitors are used to reduce the noise and ripples produced by the regulator so that the regulator output has less ripples. The main task of this circuit is to get variable output and for this a pair of voltage divider resistor variable resistor of 1kso and 5kso to increase the output of the regulator and in which resistance is varied so by increasing or decreasing the value of the resistor the output voltage of the regulator will also change accordingly and 1 to 15volt is obtained at the output terminal.

### 2.2.6 DC Power Supply Using Lm7815

Amadi (2010) constructed as 15volt DC power supply using I.C Lm7815 in his work a step-down transformer of 15volt was used and a bridge rectification using four diodes to rectify the AC voltage while a smoothing capacitor of 1000uf 25volt was used. The regulating I.C Lm7815 has three terminal pin1 pin2 and pin3. Pin1 is the DC input terminal while pin2 is the ground terminal of the integrated circuit which is connected to a bias resistor and a ziner diode to the ground and the pin3 is the voltage output terminal to the load an output couplay capacitor is connected across the positive and negative terminal of the output. The voltage at the output can be measured using multi meter, the main drawback of this work was that the power supply is not variable and there is no display on the system.

### 2.2.7 DC Power Supply Using BJT Series

Nilhoit (2007) constructed a variable power supply 1.5 to 9volt DC using bipolar junction transistors series, the construction was made with 12volt AC transformer to step-down the voltage to require value full wave rectification using four diodes, a series of ten capacitors is connected in series at a resistor, across the work six BJT transistors are connected according to the design of the hardware component. The voltage appears at the output in different steps. The major setback of this type o power supply is that the voltage is obtained at different terminals.

### 2.2.8. DC voltage multiplier

Simon (2011) constructed a voltage multiplier this type of D.C voltage the D.C output is greater than the A.C input the circuit is constructed using several IN 400l diode connected in series the A.C main source live terminal is connected to positive terminal of the capacitor which the negative terminal of the capacitor is connected to cathode terminal of the diode D1 and D1 is connected to D2 and D2 is connected to D3+……….. which the neutral terminal of the A.C. source is connected to the anode of D1 which is connected to C2, in this circuit 12 diode is connected in series which 12 capacitors of same value. D.C voltage multiplier are required in application when is necessary or high voltage is required with low current as for electron acceleration purpose in cathode ray tube this type of D.C power supply is not suitable for low voltage application.

2.2.9 a Basu *et al.* (2002), have introduce power quality improvement techniques and solution the problems can be viewed as the difference between the quality power supplied and the quality of the power required for reliable operation of the load equipment using this viewpoint the quality problem can be resolved in to one of this three ways listed as follow

1. Reducing the power supply disturbance
2. Improving the load equipment immunity to disturbance
3. Inserting correct equipment between the electrical supply and the sensitive load

### 2.2.10 Theraja B. L. and Thereja A. K. (2005), three phase D.C. power supply

In this construction the D.C. rectifier of a 3-phase supply with help of a diode along with a smoothing circuit. The three diodes are connected to the three phase of star-connection secondary of a 3-phase transformer. Neutral point N of the secondary the negative terminal for the rectified output and is earthed.

### 2.2.11 Uchenna (2010) Demonstration of variable D.C. power supply.

The demonstration of D.C. power supply work by Uchenna is a construction of stabilized power supply unit with a voltage range from 1 – 20 volts D.C. with a low output impedance, he studied the characteristics of a constructed power unit which he ascertained the load and line regulation. The test and analysis were carried out using the constructed power supply unit to power a load. In this construction an external measuring device is required to determine the quantity of the output magnitude, he used both analog and digital meter during his test due to the fact that there is a slide variation between the two meter used the analog meter showed 18.6 volt D.C. while the digital meter showed 20 volt D.C. the casing of the device is metal and in square shape.

### 2.2.12 The Rechargeable variable power supply

The main working of this project is full wave rectification which is done by the bridge configuration where we are using 4 diodes which rectifies the output of the step down transformer also, using a voltage regulator that gives variable output, the rechargeable Lithium batteries are used to store D.C. voltage and to be recharged by the D.C. voltage from the source. The circuit comprises of charging circuit and switching circuit that switch the main variable source and the power bank source. The circuit provides constant variable power supply. The rechargeable power supply comprises of variable circuit, charging circuit, switching circuit and display at the output.

**CHAPTER THREE**

## 3.1 Material and Method

The material for the project are both active and passive electronic component. Most of the component used for this project are available, and the analog to digital converter is a module which will be connected to the constructed circuit.

3.1.1 List of Component

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Name** | **Value** | **Quantity** |
| 1 | Analog to Digital Converter | DT830D | 1 |
| 2 | Transformer step down | 240 50Hz 24 or 30V 3000 MA | 1 |
| 3 | Diode | IN 4001 | 6 |
| 4 | Capacitor | 2200uf 50V | 1 |
| 5 | Capacitor | 10uf 63V | 1 |
| 6 | Capacitor | 0.1uf | 1 |
| 7 | capacitor | 470uf 50V | 1 |
| 8 | Variable resistor | 10Kso | 1 |
| 9 | Resistor | 2.2kso 1watt | 1 |
| 10 | I.C | LM317 | 1 |
| 11 | Resistor | 1ks0 | 1 |
| 12 | LED | Red | 1 |
| 13 | Vero board | Copper lines | 1 |
| 14 | Connectors | Many | Many |
| 15 | Relay |  | 2 |
| 16 | I.C. | LM7805 | 1 |
| 17 | I.C. | LM7809 | 1 |
| 18 | Battery | Litium | 8 |

## 3.2 Circuit Block Diagram

Regulator

Charging/batteries

Display

Switching circuit

Rectifier

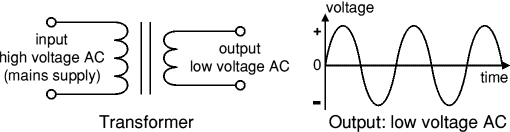
Filter

Transform

220/50Hz

*Figure 3.1: Circuit Block Diagram*

### 3.2.1 Transformer





*Figure 3.2: Transformer*

A Transformer is an equipment used either for raising or lowering the voltage of an ac supply with a corresponding decrease and increase in current. It essentially consists of two windings primary and secondary.

N1 = no. of turns in primary coil

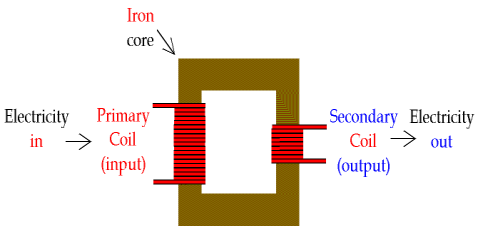
N2 = no. of turns in secondary coil

N1< N2 = Step-up transformer

N1> N2 = Step-down transformer

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC.

Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230v) to safer low voltage.



*Figure 3.3: Transformers and their symbol*

The input coil is called the primary and the output coil is called the secondary. There is no electrical connection between the two coils, instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core.

Transformers waste very little power so the power out is (almost) equal to the power in. Note that as voltage is stepped down current is stepped up.

The ratio of the number of turns on each coil, called the turn’s ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.

### 3.2.2 Rectifier

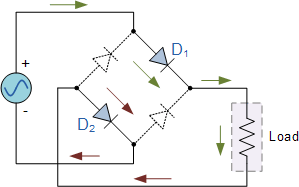
There are several ways of connecting diodes to make a rectifier to convert AC to DC. The [bridge rectifier](http://www.kpsec.freeuk.com/powersup.htm#bridgerectifier) is the most important and it produces full-wave varying DC. A full-wave rectifier can also be made from just two diodes if a centre-tap transformer is used, but this method is rarely used now that diodes are cheaper. A [single diode](http://www.kpsec.freeuk.com/powersup.htm#singlediode) can be used as a rectifier but it only uses the positive (+) parts of the AC wave to produce half-wave varying DC.

### 3.2.3 Bridge Rectifier

A bridge rectifier can be made using four individual diodes, but it is also available in special packages containing the four diodes required. It is called a full-wave rectifier because it uses all the AC wave (both positive and negative sections).

**The Positive Half-cycle**. During the positive half cycle of the supply,

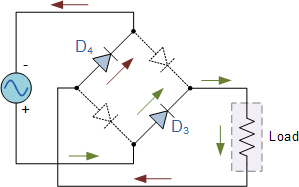
diodes D1 and D2 conduct in series while diodes D3 and D4 are reverse biased and the current flows through the load as shown below.



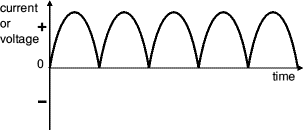
Output of Transformer

*Figure 3.4: Positive Half cycle*

The Negative Half-cycle During the negative half cycle of the supply, diodes D3 and D4 conduct in series, but diodes D1 and D2 switch “OFF” as they are now reverse biased. The current flowing through the load is the same direction as before.



Output of



*Figure 3.5: Resultant wave form*

Hence, we can say that the bridge wave rectifier give the pulsating DC voltage which are not suitable for electronics circuit.

### 3.2.4 Smoothing (Filter)

Smoothing is performed by a large value [electrolytic capacitor](http://www.kpsec.freeuk.com/components/capac.htm#polarised) connected across the DC supply to act as a reservoir, supplying current to the output when the varying DC voltage from the rectifier is falling. The diagram shows the unsmoothed varying DC (dotted line) and the smoothed DC (solid line). The capacitor charges quickly near the peak of the varying DC, and then discharges as it supplies current to the output.

Smoothing is not perfect due to the capacitor voltage falling a little as it discharges, giving a small ripple voltage. For many circuits a ripple which is 10% of the supply voltage is satisfactory and the equation below gives the required value for the smoothing capacitor. A larger capacitor will give less ripple. The capacitor value must be doubled when smoothing half-wave DC

So, in this we concluded that the pulsating DC voltage is applied to the smoothing capacitor. This smoothing capacitor reduces the pulsations in the rectifier DC output voltage.

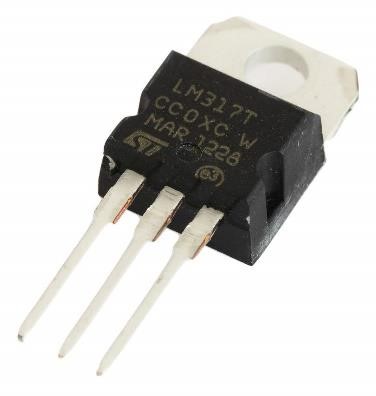
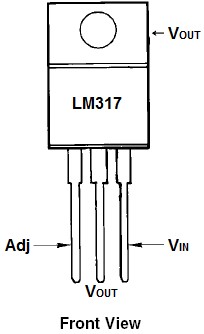
Output from the full wave bridge rectifier is fed to a LM317 regulator IC LM317 provides varied voltage from 1.2V to 35V. Reference voltage of 1.25 V is maintained at 220 Ohm Resistor.

The LM317 Voltage Regulator is a 3-terminal [adjustable voltage regulator](http://www.learningaboutelectronics.com/Articles/What-is-an-adjustable-voltage-regulator) which can supply an output voltage adjustable from 1.2V to 35V. It can supply more than 1.5A of load current to a load.

### 3.2.5 LM317 Pinout

The LM317 Voltage Regulator has 3 pins. Below is the pinout:

LM317



*Figure 3.6: LM317 Pinout*

Looking from the front of the voltage regulator, the first pin (on the left) is the Adjustable Pin, the middle is Vout, and the last pin(on the right) is VIN.

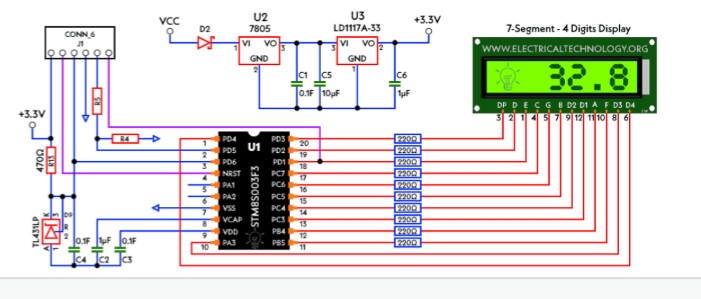
**VIN -** VIN is the pin which receives the incoming voltage which is to be regulated down to a specified voltage. For example, the input voltage pin can be fed 12V, which the regulator will regulate down to 10V. The input pin receives the incoming, unregulated voltage.

**Adjustable -** The Adjustable pin (Adj) is the pin which allows for adjustable voltage output. To adjust output, we swap out resistor R2 value for a different resistance. This creates adjustable voltages.

**Vout**: Vout is the pin which outputs the regulated voltage. For example, the LM317 may receive 12V as the input and output a constant 10V as output.

### 3.2.6 Display Unit

The display unit is a module consisting of microchip and other components. This circuit convert the analogue signal to digital signal and display the value being measured in digital form (Numeral). The major advantage of this system is the reading of the value being displayed is easy and accurate unlike analogue display.

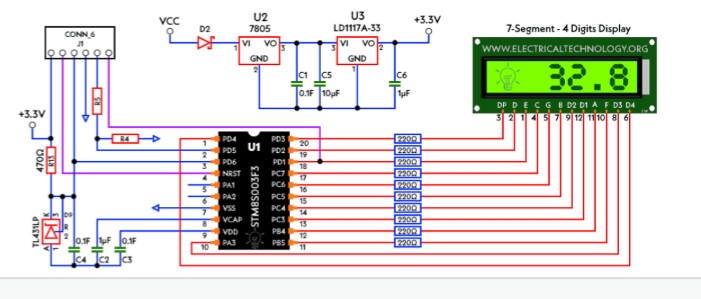
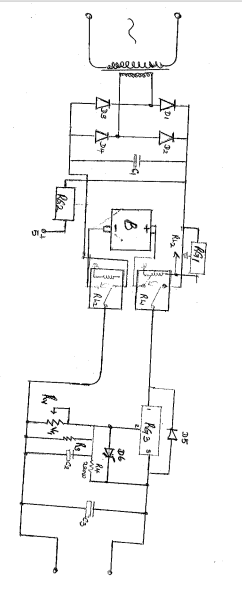


*Figure 3.7: Display unit*

### 3.2.7 Battery

The battery was used in this design to serve as power backup in the absence of domestic power supply. The switching circuit switch it automatically and if the power is restored it will switch back vice versa.

## 3.3 Circuit Diagram



*Figure 3.8: Circuit Diagram*

## 3.4 Design Analysis

Calculation 1

For bridge rectification the drop across diode is 2x0.7 = 1.4v assuming drop in transformer coil to be 0.7v minimum input voltage required by regulator 15v giving the total of 9.70v

=

= 6.7v

1de = 1000mA

Full wave rectifier

Vdc=

15 =

Vm =

Vm==23.565

Vm= 23.57

Vrms= 0.707x23.57

= 16.663=16.7

1dc = 1000mA

2. to calculate the choice of diode

Vm = 23.57v, 2x23.57 = 47.14

Piv = 47.14

To calculate the value of capacitor (filter stage)

R1 = = = 1500

Ripple factor = = 0.1

C = =

C = 1000

For filter capacitor 1000uf was selected, the higher the capacitance the better the result.

**Calculation 2**

Calculation of variable voltage output using 12Kso and 10Kso variable resistor for regulator Lm338

Vaut = Vref

Where R =

R3 = 12Kso

Rv = 10Kso Vr

R4 = 22050 =0.22

Vaut = 1.25

= 1.25 = 125 [1+24.8]

Vaut max = 32.25v

Vmini out Vref Rv = 0

Vminimum Rv 10Kso to 0Kso Now Rv = 0Kso

Vautmin = 1.25 [1+0] = 1.25 \* 1+ 1.25

## 3.5 Method

The design and construction of digital variable power supply was made using necessary procedure. The components were mounted on bread board to test whether its working perfectly and later transferred to the Vero board to form a closed circuit, the component are connected to one another and linked in a stage to a complete circuit in accordance to the circuit diagram, the arrangement and the connection of those component that can not be mounted on a board and addition of some connections to aid the functions ability of the circuit were included. After the components have been laid on the Vero board it was checked and rechecked for faulty replacement, then with point tip and a good soldering iron lead, the connection of the components were soldered on to the Vero board carefully. After soldering process, the board was carefully examined so that there will be no bridge of lines or components during the soldering process and to check for partial contact, some of the necessary tools used during the method implementation are

1. Multimeter
2. Soldering iron
3. Soldering lead
4. Pair of small cutter etc.

## 3.6 Circuit operation

The 220volt A.C. coming from the power cord is fed to the transformer via the on-off switch and the 500mA fuse. The 40volt (approximately) from the transformer goes to the bridge rectifier where it is converted from A.C. to D.C. volt. The IN 4001 was used for the bridge (rectification) for converting the pulsation D.C. output from the rectifier via the 100µf capacitor and fed to input of the adjustable LM338 regulator. The output of this voltage from 1 to 40volt via the pin 2 and the 10K potentiometer p1, the large value of the capacitor C1, make good low ripple output voltage. The work of this regulator is to compare the output voltage to an internal reference and control the output voltage so that it remains constant. The IC also provides a method of adjusting the output voltage to the level required by using the potentiometer. Internally the regulator uses a diode to provide a fixed reference voltage of Ov across the external Resistor R1 and the potentiometer P1 increase the resistance voltage across it due to the current from the regulator plus current from R2 its voltage increase. D1 is a general purpose 1N4001 diode is used as a feedback blocker steer any current that might come from the diode under power around the regulator to prevent the regulator from being damaged.

## 3.7 Casing

The successful implementation of this work would not be completed without a casing for it of which would protect the system from human and environmental hazards like direct sun rays and moisture, over the years, wooden or metallic casing were used for the project but careful analysis showed that metallic casing are better than the wooden type with modern technology developing in doping material, a more durable light and thermoplastic in nature is employed, this does not conduct electricity or electric charges. The plastic case was made for the project, the top view has the display unit and the variable resistor knob, the power supply cable is placed at the side. The casing is in rectangular shape.

# CHAPTER FOUR

# TESTING, RESULT AND DISCUSSION

## 4.1 Testing

The major component implemented in the project was subjected to test at the end of the implementation during the test value of component were varied and verify by the potentiometer in order to see the expected range of acceptable unit by unit is substituted within the model in a way to stress it capability of operating correctly in several manners. In order to be satisfy and see it normal application. The following test were carried out.

1. Its performance characteristics of major circuits such as transformer, rectifier, smoothening.
2. To ascertain whether the board has flow following the short or open circuit.
3. To ascertain the stable or condition of the device.

Having been satisfied with the test of the project leads to a favourable outcome result. The required output voltage was achieved.

## 4.2 Result

The result obtained during the test is stated at the table below:

Table 4.1: Result

|  |  |  |  |
| --- | --- | --- | --- |
| **S/N** | **TEST** | **RESULT** | **COMMENT** |
| 1 | A.C. Main input to transformer | 220volt A.C. | Input to transformer |
| 2 | Rectifier input | 30volt A.C. | Transformer output to rectification |
| 3 | Rectifier output | 32volt D.C. | Rectification output to the terminal of capacitor C1 |
| 4 | Regulator input | 30volt D.C. | Input to regulator to be varied |
| 5 | Variable D.C. voltage 1 to 30 | 1 to 30 | D.C. variable at the output terminal |

## 4.3 Discussion

The design and construction of a rechargeable Digital D.C. variable power and the main working principle of this is a full wave rectification which is done by bridge configuration which has its input from the step down transformer, the circuit used C1 and C2 in order to have a constant input to the regulator. The main task is to get variable output and for this a pair of voltage divider resistor was used by increasing or decreasing the value of that resistor, the output voltage of the regulator will also change accordingly. The test was carried out t ascertain the working principle and the desired voltage required at the output terminal was achieved from 1 to 40volt D.C. the battery serves as a power bank which provide the required 30 volt D.C. to the circuit in the absence of domestic power supply.

# CHAPTER FIVE

# SUMMARY, CONCLUSION AND RECOMMENDATIONS

## 5.1 Summary

The rechargeable variable D.C. power supply utilizes a battery and 220volt A.C. supply which is stepped down by the step-down transformer. The output of the transformer is feed to the bridge rectifier circuit the capacitor do the smoothing of the voltage which is rectified by the bridge rectifier after the smoothing the regulator takes the input from Vin pin the Vadj pin is connected to the potentiometer with a resistor and grounded and the regulated voltage output is on Vout pin with protective diode. The output voltage is connected to the output terminal and the digital display via a switching circuit.

## 5.2 Conclusion

The aim of the project is to make the student adopt the theories told in class and put them into practical realization for the benefit of mankind. The circuit was implemented and tested; the output voltage as expected was achieved.

## 5.3 Recommendations

The project implementation has its limitation which are technical specification and finance.

The government through project related corporate bodies should help or finance department to provide some of the project materials.

Some project implemented should be kept and used in schools in various field of its application.

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